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COATED SHEET AND METHOD OF PREPARING SAME

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This is a continuation in part of my copending application Serial No. 260,234, filed March 6, 1939, entitled Coated or impregnated copy sheets and method and composition for the preparation.

The invention relates to improvements in coated sheets and to methods of preparing the same. More particularly the invention relates to coated or impregnated copy sheets adapted to receive and retain color impressions having high color intensity and good fade resistance by contacting the coated surface of the copy sheet with a hectograph copy mass or master copy sheet having a design on its surface formed of a water or alcohol soluble dye.

In hectograph and spirit process copy papers, the copy strength is closely related to the porosity of the paper surface. Papers with a high porous coating show the highest copy strength. However, fade resistance of such copy papers has heretofore not been satisfactory. While the addition of mordanting agents such as bentonite has increased the fade resistance of such papers, the copy strength has not been entirely satisfactory.

The reason for the lack of copy strength of papers coated with bentonite and like water swellable mordants or fade resistance agents lies in the fact that such fade resistance agents swell and form continuous or semi-continuous coatings which interfere with the porosity of the sheet. Thus, if a sufficient amount of water swellable mordant is incorporated to give a satisfactory fade resistance, the porosity will be insufficient to give high copy strength.

I have discovered that if the water swellable mordant is intermixed with another substance which prevents swelling, then the porosity of the sheet will not be impaired by inclusion of even very large amounts of the mordant. In coatings of this type, extremely high copy strength and extremely high fade resistance may be combined.

Suitable ingredients for preventing the swelling of bentonite and like swellable mordants in water are the electrolytes. Suitable electrolytes include the wetting agents which dissociate into ions when dissolved in water, such as the —SO_3H and —SO_4H type of wetting agents, as well as the more common electrolytes such as sodium chloride, ammonium chloride, potassium phosphate, and the like.

In some instances, I prefer to use volatile electrolytes such as ammonium carbonate. These volatile electrolytes evaporate when the paper dries and thus will not remain in the paper. This precludes any possibility of unfavorable effects on gelatin masses that otherwise might be caused by such an electrolyte.

The optimum concentrations of the electrolyte used and of the bentonite, beidellite, or other water swellable mordant largely depend upon the mode of application of the liquid coating solution. If it is desired to apply the composition to the sheet by means of tub sizing, I prefer to use a suspension of about 10% bentonite or other water swellable clay in 2 to 4% water solution of electrolyte such as sodium chloride or ammonium carbonate.

In a 4% electrolyte solution, the swelling of the bentonite is substantially inhibited. In a 2% solution some swelling takes place which, however, may be desirable when it is endeavored to secure a more lasting and permanent bond between the bentonite particles and the paper.

Instead of applying the coating solution by a tub sizing operation, it is sometimes preferable to apply the composition in a coating machine, or by means of a doctor knife. In such instances it is desirable to use a composition of much higher concentration than is used for tub sizing. For example, a suspension of 50% bentonite in a solution of 10% ammonium carbonate, sodium chloride or the like in water is highly suitable for this mode of application. After the application of the electrolyte solution containing the mordant to the paper, whether it be tub sizing, machine sizing or coating, the copy sheet coated with the solution is dried and then may be calendered to improve the surface and increase the uniformity of distribution of the mordant or anti-fading agent.

The preparation of the coating composition of electrolyte and water swellable mordant is an important part of this invention. The water swellable mordant such as bentonite is added to the aqueous solution of electrolyte anti-swelling agent. In the case of a liquid electrolyte, the bentonite may be slowly added to the water free liquid electrolyte and then water slowly incorporated. In any event, the electrolyte is added to the water before the major proportion of the bentonite is added to the water. For example, if sulfonated castor oil is added to water first and the bentonite added subsequently, there may be obtained a composition comprising 20% sulfonated castor oil, 12% bentonite, and 68% water, which is in the form of an easy pourable liquid highly suitable for sizing paper to produce copy paper of more brilliant copy strength and very good fade resistance. However, if the bentonite is added to the water first and the sulfonated

castor oil subsequently, the same composition is almost a solid gel entirely unsuitable as a coating composition.

To more clearly set forth the practice in accordance with the invention and to more specifically point out the nature of the product and process contemplated thereby, several specific, illustrative examples are hereinafter set forth, it being understood that these examples illustrate several embodiments which have given satisfactory results and are not intended to restrict the invention thereto.

Example I

	Parts by weight
Bentonite	12
Sulphonated castor oil	20
Water	68

This composition is made by adding the bentonite to the aqueous solution of sulfonated castor oil. It was applied to uncoated insurance cards by brushing thereon. Copies taken by the hectograph process on these cards were much brighter than copies similarly taken on any untreated cards and also were of good fade resistance.

Example II

	Parts by weight
Mahogany soap (sulfonated naphthenic acid from petroleum)	10
Bentonite	5
Water	90

This composition is thoroughly mixed with or without heat and applied to a paper surface by any known means.

Example III

	Parts by weight
Beidellite	100
Water	200
Calcium chloride	4

This composition was applied to sulfite bond paper of high rag content by brushing thereon. Copies taken by the hectograph process on the coated copy paper so produced were much brighter than copies similarly taken on untreated copy paper and had good fade resistance.

In addition to the wetting agent type of electrolytes given in Examples 1, 2 and 3, coating compositions may be made with ordinary electrolytes. The examples given below illustrate coating compositions containing such electrolytes which are suitable for application to paper to give copy sheets of high fade resistance and good copy strength.

(A) Five grams of sodium chloride are completely dissolved in 100 cc. water. Ten grams of bentonite are then added with agitation.

(B) One gram of ammonium sulfate is completely dissolved in 100 cc. of water. Ten grams of bentonite are then added with agitation.

(C) Two grams of bentonite are allowed to swell completely in 100 cc. water. Four grams of sodium chloride are then added, followed by 50 cc. of water. Finally ten grams of bentonite are added with agitation.

(D) 4 grams of alum are dissolved in 100 cc. water. 27 parts of bentonite are added with agitation.

These suspensions are applied to paper preferably by means of a "tub-sizing" bath, although it is understood that any other suitable means of application may be employed.

(E) 4 grams of calcium chloride are dissolved in 100 cc. water. 50 grams of bentonite are added with agitation.

This suspension is applied to paper preferably by means of a doctor knife or on the calender stock, although it is realized that other suitable means may be employed.

Obviously, other ingredients known to prior art may be included, such as binding agents (e. g., starch, casein, and the like), when compounded so as not to interfere objectionably with the porosity or other desirable physical characteristics of the coating; antiseptics such as phenol, benzoic acid or the like; pigments, such as titanium oxide or the like; fillers, such as calcium carbonate, china clay and the like, et cetera.

The copy sheets of this invention are particularly adapted for use in a hectograph type duplicating process. In this process an original or master copy sheet is prepared by typing on a sheet of ordinary typewriting paper using an ink of water or alcohol soluble dye such as methyl violet. The surface of the sheet containing the typewritten matter in the form of a configuration of the dye is contacted with a moistened gelatinous hectograph mass, the dye and configuration being largely transferred thereto in reverse. Copies are then made by applying the copy sheet of this invention to the hectograph mass, each sheet receiving a proportion of the dye to form a copy of the writing on the master sheet.

Likewise the copy sheets may advantageously be used in the so-called spirit reproduction process. In this process my coated copy sheets are moistened with a volatile solvent such as alcohol and contacted with a master copy sheet having printed thereon a mirror reverse image of the matter to be reproduced.

The copy sheets of this invention are also useful in stencil duplication. In this process the master copy sheet is a stenciled sheet made by typing or writing through one of the common coated stencil sheets known to the art. Copies are made from this stenciled sheet by inking through the openings of the sheet onto the copy sheet of this invention. Enhanced brightness of copies is obtained.

In accordance with the present invention, the water and alcohol soluble dyes may be advantageously employed in the transfer processes, and increased water resistance and increased fastness to light with good copy strength or color intensity may be secured in the copies. Thus the water and alcohol soluble dyes such as methyl violet, crystal violet, fuchsines, magentas, anthraquinones, chrysoidine and the like; the water and alcohol soluble aniline dyes, such as aniline blue, Victoria blue and orange, Nile blue and the like, the water and alcohol soluble azo dyes, such as Congo red, Bismarck brown, and the like, may be advantageously used in these processes and copies may be secured of greatly increased fastness to light and good copy strength.

While there have been shown and described certain embodiments of the invention, it is to be understood that it is capable of many modifications. Changes, therefore, may be made without departing from the spirit and scope of the invention as described in the appended claims, in which it is the intention to claim all novelty inherent in the invention as broadly as possible, in view of the prior art.

The term "electrolyte" as used in this specification and claims means any substance which dissociates into two or more ions to a great or

small extent when dissolved in water. Solutions of electrolyte thus conduct the electric current and are decomposed by it.

I claim:

1. A sheet adapted to receive and retain color impressions of increased fastness to light and high color intensity by contact with a configuration of an aqueous or alcohol soluble dye susceptible to fading in light, comprising a flexible base sheet having distributed over the contact surface a composition comprising a water swellable clay in a substantially unswollen condition, said copy sheet being characterized by greater porosity than a sheet coated with said water swellable clay in the swollen condition, and the particles of clay on said copy sheet being substantially larger than the particles produced by drying a coating containing water swollen clay.

2. A sheet adapted to receive and retain color impressions of increased fastness to light and high color intensity by contact with a configuration of an aqueous or alcohol soluble dye susceptible to fading in light, comprising a flexible base sheet having distributed over the contact surface a composition comprising a water swellable clay in a substantially unswollen condition and an electrolyte, said copy sheet being characterized by greater porosity than a sheet coated with a water swellable clay in the absence of an electrolyte.

3. A sheet adapted to receive and retain color impressions of increased fastness to light and high color intensity by contact with a configuration of an aqueous or alcohol soluble dye susceptible to fading in light, comprising a flexible base sheet having distributed over the contact surface a composition comprising bentonite and an electrolyte, said copy sheet being characterized by greater porosity than a sheet coated with bentonite in the absence of an electrolyte.

4. A sheet adapted to receive and retain color impressions of increased fastness to light and high color intensity by contact with a configuration of an aqueous or alcohol soluble dye susceptible to fading in light, comprising a flexible base sheet having distributed over the contact surface a composition comprising bentonite and a wetting agent type of electrolyte.

5. A sheet adapted to receive and retain color impressions of increased fastness to light and high color intensity by contact with a configuration of an aqueous or alcohol soluble dye susceptible to fading in light, comprising a flexible base sheet having distributed over the contact surface a composition comprising bentonite and sulphonated castor oil.

6. A sheet adapted to receive and retain color impressions of increased fastness to light and high color intensity by contact with a configuration of an aqueous or alcohol soluble dye susceptible to fading in light, comprising a flexible base sheet having distributed over the contact surface a composition comprising bentonite and sulphonated naphthenic acid.

7. A sheet adapted to receive and retain color impressions of increased fastness to light and high color intensity by contact with a configuration of an aqueous or alcohol soluble dye susceptible to fading in light, comprising a flexible base sheet having distributed over the contact surface a discontinuous coating comprising bentonite in a substantially unswollen condition.

8. A flexible porous sheet coated with a composition comprising a water swellable clay and an electrolyte, and having a design thereon formed of a dye which is normally subject to fading in sunlight.

9. A paper sheet coated with a composition comprising bentonite and an electrolyte, and having a design thereon formed of a water and alcohol soluble dye.

10. The method of making sheets adapted to receive and retain color impressions of high color intensity and good fade resistance which comprises admixing a water swellable clay with an electrolyte and water in such a manner that said water swellable clay is not contacted with water free of electrolyte, to form a liquid coating composition, coating a paper sheet with said composition and evaporating the water from said liquid coating composition on the sheet to give a copy sheet having the clay distributed thereon.

11. The method of making sheets adapted to receive and retain color impressions of high color intensity and good fade resistance which comprises admixing bentonite with an electrolyte and water in such a manner that said bentonite is not contacted with water free of electrolyte, to form a liquid coating composition, coating a paper sheet with said composition and evaporating the water from said liquid coating composition on the sheet to give a copy sheet having the bentonite distributed thereon.

12. The method of making sheets adapted to receive and retain color impressions of high color intensity and good fade resistance which comprises admixing bentonite with an electrolyte wetting agent without allowing water free of electrolyte to contact said bentonite, to form a liquid coating composition, coating a paper sheet with said composition and evaporating the water from said liquid coating composition on the sheet to give a copy sheet having the bentonite uniformly distributed thereon.

13. The method of making sheets adapted to receive and retain color impressions of high color intensity and good fade resistance which comprises admixing bentonite with sulphonated castor oil and water in such a manner that said bentonite is not contacted with water free of electrolyte, to form a liquid coating composition, coating a paper sheet with said composition and evaporating the water from said liquid coating composition on the sheet to give a copy sheet having the bentonite distributed thereon.

14. The method of making sheets adapted to receive and retain color impressions of high color intensity and good fade resistance which comprises admixing bentonite with a water soluble salt and water in such a manner that said bentonite is not contacted with water free of electrolyte, to form a liquid coating composition, coating a paper sheet with said composition and evaporating the water from said liquid coating composition on the sheet to give a copy sheet having the bentonite uniformly distributed thereon.

15. The method of making sheets adapted to receive and retain color impressions of high color intensity and good fade resistance which comprises admixing bentonite with volatile electrolyte and water in such a manner that said bentonite is not contacted with water free of electrolyte, to form a liquid coating composition, coating a paper sheet with said composition and drying the sheet to evaporate the water and the volatile electrolyte to give a copy sheet having a bentonite uniformly distributed thereon.

16. The method of making sheets adapted to receive and retain color impressions of high color

intensity and good fade resistance which comprises admixing bentonite with ammonium carbonate and water in such a manner that said bentonite is not contacted with water free of electrolyte, to form a liquid coating composition, coating a paper sheet with said composition and drying the sheet to evaporate the water and the ammonium carbonate to give a copy sheet having bentonite distributed thereon.

17. A copy sheet coated with a composition comprising bentonite in a substantially unswollen condition and having a design thereon formed of a water and alcohol soluble dye, said design being characterized by high copy strength combined with high fade resistance, and said coated sheet being of greater porosity than a sheet coated with said bentonite in a swollen condition.

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