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COPYING PAPER AND METHOD OF MANUFACTURE

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Fig. 1

COPYING PAPER COATING

10 To 50 Parts Polyvinyl Chloride Plastisol Dispersion Resin Selected From Marvinol VR 50; Geon 121; Opalon 410; Exon 654; Vinylite QYNV

10 To 20 Parts Non-Volatile Plasticizer Selected From Dioctyl Phthalates And Other Phthalates; Tricresyl And Trioctyl Phosphates; Adipates; Azelates; Sebacate Esters; Castor Oil; Tetrahydrofufuryl Oleate; Sperm Oil; Butyl Stearate; Methyl Acetyl Ricinoleate; Mobilsol L.

5 To 75 Parts Colorant Such As Calco Oil Blue ZA Dissolved In Mineral Oil; Dye Formulation With Oleic Acid As Solvent; Iron Blues; Peacock Blues; Alkali Blues; Rubine Reds; Molybdate Oranges Ground In Mineral Oil; Alkali Blue Flushed In Mineral Oil.

10 To 50 Parts Miscible Non-Volatile Diluent Color Carrier, (In Volume As Great As The Plasticizer) Selected From Commercial Oleic Acid, Mineral Oils Of Paraffinic Or Naphthenic Origin

Fig. 2

PROCESS OF COATING COPYING PAPER

1. Prepare Coating Composition In Accordance With Fig. 1
2. Coating Is Thoroughly Stirred, Or Ground In An Suitable Mill If Containing Solid Particles.
3. Coating One Mill Thick Is Applied At Room Temperature To The Sub-Strate On Knife-Coating Equipment, Such As Used In Conventional Carbon Paper Manufacture.
4. With Certain Pigments, Particularly Alkali Blues, Apply Dry Steam To Coating For An Instant Immediately After Coating And Before Fusing
5. Knife-Coating Equipment Includes Electrical Heating Elements, And Coating Is Heated To Over 300°F And Perferably 350°F For Approximately 5 Seconds As Paper Travels Through Machine.

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COPYING PAPER AND METHOD OF MANUFACTURE

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2 Claims. (Cl. 117—36)

This invention relates to a copying paper and method of manufacture, and has for its purpose to produce copying papers provided with coatings of plastisols made with high molecular weight polyvinyl chloride dispersion resins which are liquid at room temperature, sufficiently low in viscosity to coat on paper, and which fuse to a firm, non-tacky film when heated.

Conventional carbon papers are introduced with coatings including wax while coatings made according to my invention from plastisol dispersion resins contain no wax, and have the characteristics of longer wear and less tack than carbon papers made with wax.

Copying papers made with plastisol dispersion resins have been found to withstand heat better than papers coated with wax compositions, have no melting tendencies, and can be manufactured more economically, since no heat is required while grinding the inks or during coating of the paper. The coating can be applied in liquid form at room temperature and does not require heating before coating.

A plastisol dispersion resin coating is more flexible than wax-based coatings, with less likelihood of flaking off, and can be coated on cheaper paper bases with no deleterious effects. Lower cost in manufacture is possible because the cost of the dispersion resin and plasticizer is approximately half the cost of the wax and oil required in wax coating compositions generally used in making conventional carbon papers.

In general, my invention consists in a substrate having on at least one surface a coating composition which includes a dispersion resin such as used in making a plastisol, a plasticizer, a non-plasticizing non-volatile diluent color carrier, and coloring matter, affording a mixture which at room temperature has a low viscosity permitting coating on paper, and which when heated fuses to form a firm, hard non-tacky film on the substrate.

In the drawings:

Fig. 1 is a flow-sheet view of a copying paper coating produced in accordance with a preferred embodiment of the invention, and

Fig. 2 is a flow-sheet view of a process of coating copying paper in accordance with the invention.

The plasticizer which is non-volatile acts as a solvent for the resin at the processing temperature, and the non-volatile diluent is a color carrier which acts to hold the color and exude the color when pressure is applied. The diluent is not firmly bound to the resin as is the plasticizer, and does not act as a solvent for the resin. The diluent would not function alone as a solvent for the resin, whereas the plasticizer is compatible with the resin and functions as an effective solvent. The diluent functions mainly to hold the color and to squeeze out the color when pressure is applied.

A wide variety of dispersion resins, plasticizers, non-plasticizing non-volatile diluent color carriers, and colorants can be used, and examination of copying papers produced according to the invention leads to the conclusion that the film covering the substrate has a spongy

structure formed by a skeleton of a polyvinyl chloride or a polyvinyl chloride-acetate copolymer resin. The interstices of the spongy skeleton are filled with color contained in the non-plasticizing non-volatile diluent color carrier, and when pressure is applied to the paper by pencil, typewriter, or otherwise, for making a copy, a small amount of the color carrying non-plasticizing diluent is squeezed out and makes a legible mark.

Many papers, particularly those adapted for carbon papers, have been found satisfactory as substrates for the coating composition, which preferably consists of from 10 to 50 parts plastisol dispersion resin, 10 to 20 parts plasticizer or mixture of plasticizers, 5 to 75 parts colorant, and 10 to 50 parts non-plasticizing non-volatile diluent color carrier.

Various polyvinyl chloride and polyvinyl chloride-acetate copolymer resins of high molecular weight have been used, and those preferred are polyvinyl chloride resins known as "stir-in" dispersion resins, such as Marvinol VR–50 sold by the Naugatuck Chemical Division of U.S. Rubber Co., Naugatuck, Conn.; Geon 121 sold by B. F. Goodrich Chemical Co., Cleveland, Ohio; Opalon 410 sold by Monsanto Chemical Co., Plastics Division, Springfield, Mass.; Exon 654 sold by Firestone Tire and Rubber Co., Pottstown, Pa.; and Vinylite QYNV sold by Bakelite Company, Division of Union Carbide & Carbon Corporation, 30 East 42nd St., New York 17, N.Y.

Polyvinyl chloride-acetate copolymer resins such as Pliovic AO sold by Goodyear Tire & Rubber Co., Akron 16, Ohio, and Vinylite VYNV sold by Bakelite Company, supra, can also be used, although they show a tendency to develop somewhat higher viscosity when dispersed in the plasticizer.

Primary plasticizers which have been used successfully are dioctyl phthalate and other phthalates, tricresyl and trioctyl phosphates, adipates, azelates, and sebacate esters. Secondary plasticizers which have been utilized in varying limited amounts are castor oil, tetrahydrofurfuryl oleate, sperm oil, butyl stearate, methyl acetyl ricinoleate, and Mobilsol L sold by Socony-Mobil Company, New York City.

For the non-plasticizing non-volatile diluent, which must not be deleterious to the composition or affect the color, commercial oleic acid and various mineral oils of paraffinic, or naphthenic origin have been successfully used and any liquid can be used that is a poor plasticizer for the dispersion resin present, does not injuriously affect the composition or color, and which acts as a carrier for the color and effectively exudes the color from the coating when pressure is applied to the paper.

The colorant may be either a pigment that is compatible with the plasticizer and dispersion resin, or a dye, and satisfactory results have been obtained with such dyes as Calco Oil Blue ZA dissolved in mineral oil, sold by American Cyanamid Co., New York city, N.Y., and #9743 black paste sold by Paul Uhlich & Co., Inc., New York city, N.Y., which is a dye formulation with oleic acid as a solvent. Pigments that have been successfully used include those classed as iron blues, peacock blues, alkali blues, rubine reds, and molybdate oranges, ground in mineral oil as a carrier, and alkali blue already flushed in mineral oil and sold by various manufacturers.

The dispersion resin is in powder form and when all the ingredients of the composition except the dispersion resin are liquids, the coating can be prepared by thorough stirring. In other cases the solid particles are ground in on three-roller mills, or otherwise.

If desirable, small amounts of surface-active agents and resin-degradation inhibitors can be added to the

composition, but are not indispensable, and a small amount of perchlorethylene can be added to serve as a diluent and lower the viscosity of the coating.

A coating approximately one mil thick is applied at room temperature to the substrate on knife-coating equipment such as used in the manufacture of conventional carbon paper to which are added electrical heating elements which heat the coating on the paper to over 300° F. and preferably to approximately 350° F. for a period of approximately 5 seconds as the paper travels through the machine. Such heating fuses the resin particles into a continuous spongy film, and when certain pigments, particularly alkali blues are used, the depth of the color impression can be increased and a dull appearance and seeming porous surface imparted to the coating by exposing the coating to dry steam for an instant immediately atfer coating and before fusing. This seems to expedite transfer of the color dispersion onto the copy paper when pressure is applied.

As an example of a coating composition prepared in accordance with the invention, I have employed the following: 30 parts by weight of a plastisol dispersion resin, namely Exon 654 sold by Firestone Tire and Rubber Co., Plastics Division, Pottstown, Pa.; 15 parts by weight of a plasticizer namely Flexol A–26 (di (2-ethyl hexyl) adipate) sold by Union Carbide Chemicals Co., Division of Union Carbide & Carbon Corp, South Charleston, West Virginia; and 35 parts by weight of Flushed Alkali Blue, 7–MB–258, which includes mineral oil as a carrier, and is sold by Standard Ultramarine Co., Huntington, West Virginia, this colorant containing 40% alkali blue and 60% mineral oil.

It is essential in carrying out the process and producing a satisfactory copying paper that the mineral oil, or non-volatile non-plasticizing diluent color carrier be present in an amount by volume substantially at least as great as the plasticizer. This relationship is deemed preferable, although the diluent may be greater in volume than the plasticizer. When a dye is employed, the diluent

dissolves the dye, and when a pigment is used, the diluent merely disperses the pigment.

For a surface active agent, polyethylene glycol–200 monolaurate, purchased from Glyco Products Co., Inc., New York, N.Y., can be used.

Copying paper made in accordance with the invention has in actual use produced as many as one hundred legible copies from the same coated area, and there was no evidence of tackiness, which is of tremendous advantage particularly in the use of copying paper made into rolls for use in autographic register machines.

While the invention has been described in reference to certain materials and proportions, it is not necessarily limited to the specific ingredients and procedure herein set forth, and this application is intended to cover such substitutions, modifications, changes, or deparatures as come within the purposes of the invention or the scope of the following claims.

I claim:

1. The method of producing a copying paper consisting in coating a substrate on at least one surface with a color transfer composition including from 10 to 50 parts by weight of a polyvinyl chloride plastisol dispersion resin, from 10 to 20 parts by weight of a non-volatile plasticizer for said resin, from 5 to 75 parts by weight of a colorant, and from 10 to 50 parts by weight of a non-volatile, non-plasticizing oily diluent color carrier in a volume at least as great as the volume of plasticizer, and which acts to exude color from the coating when pressure is applied, and heating the composition to approximately 350° F. for at least approximately 5 seconds.

2. A copying paper produced by the process defined in claim 1.

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