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COLD PROCESS TRANSFER COATING
COMPOSITIONS

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This invention relates to cold process transfer coating compositions for paper or similar base material, and has to do more particularly with a cold process transfer "spot" coating composition which is applied to a selected area or areas on the reverse or rear side of the paper or other base for reproducing marks or characters which are to be typed or written on the face or front side of the paper.

Transfer coating compositions which, heretofore, have been generally used are thermoplastic, and heated to a molten condition before being applied as a coating, or are rendered liquid by the use of a solvent for application and then set or dried by vaporizing the solvent. Thermoplastic transfer coating compositions require heaters for liquifying them immediately before their application as a coating, and also require cooling devices to set the coating as quickly as possible after it is applied. Those coating compositions which are liquified, in commercial practice, by a solvent require heaters to evaporate the solvent immediately after the coating has been applied so that the coated sheets may be superimposed without offset.

In practice, transfer "spot" coatings are printed on selected areas of a paper base. With both the thermoplastic and solvent activated types of coating compositions, the special heaters, and in some cases coolers, must be attached to the printing machine, for unless the coating is promptly set between printing operations of the machine, it will offset onto the face or front side of the next printed sheet. Thus in both of these methods special apparatus is required, and much control needs to be exercised in having the coating composition applied under proper conditions. It will, also, be appreciated that obnoxious fumes and odors are given off in both of the above methods, and that they are objectionable and disagreeable for working conditions as well as being fire hazards.

Some transfer compositions have been compounded for "spot" transfer coating without the use of special heating or cooling apparatus. However, such compositions have not proved satisfactory because they are either too hard or too soft. Those which are too hard do not spread well as a coating and do not transfer well after being applied. Those which are too soft do not set to a non-fluid condition, and thereby penetrate the paper unduly and are subject to offset that causes smudging or smearing of the uncoated side of the sheet when a number of sheets are superimposed in being handled and stacked. Even the thermoplastic or heat liquified coating

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compositions and those liquified by solvents, are not entirely free from these objections since they require careful control in being applied to the sheet and dried. However, the hot process compositions have been the least objectionable, and, therefore, have been used more generally even though requiring special apparatus for their application to the paper.

A principal object of the invention is to provide a transfer coating composition which can be spread in a film coating with conventional coating apparatus and which will set, without special treatment, sufficiently rapidly to avoid smudge or offset.

More specifically, an object of the invention is to provide a cold process transfer coating composition which, at normal room temperatures, is in solid form and resistant to free flow but sufficiently soft to be spread in a film layer, and readily becomes free flowing under the mechanical manipulation to which it is subjected in being applied as a transfer coating on paper.

Another object of the invention is to provide a normally solid cold process transfer coating composition which is changed to a liquid by the mechanical manipulation to which it is subjected in being applied to the paper as a film coating, and will revert to its normal solid form and be resistant to free flow when not disturbed by mechanical manipulation.

Another object of the invention is to provide a cold process transfer coating composition which is adhesive to the paper but does not unduly penetrate the same.

Another object of the invention is to provide a cold process transfer coating composition which sets to either a thixotropic gel or solid solution and does not objectionally penetrate the paper base to which said coating is applied.

Another object of the invention is to provide a transfer coating composition which can be changed from a normally solid form to a liquid and which will revert from a liquid to its normally solid form as a result of conditions to which it is subjected in being applied as a coating, thereby obviating the need of special and additional means for liquifying and/or solidifying the compositions in the coating operation.

Further objects, and objects relating to details of the composition and application of the composition as a transfer coating, will definitely appear from the detail description of the invention.

My invention comprises a cold process transfer composition which needs no special apparatus for its application as a coating. It is normally solid and resistant to free flowing although suf-

ficiently soft to be readily and evenly spread, is free flowing under ordinary conditions of being applied as a coating to paper, is adherent to but does not unduly penetrate the paper, and subsequently reverts to a solid condition, following application as a coating, so as not to offset or smear. It is normally, at ambient temperatures from 20 to 35° C., in solid form but soft enough to be readily spread in a thin coating. The coating composition is normally a soft thixotropic gel or solid solution and is not free flowing. While there may be a distinction between a thixotropic gel and a solid solution, the difference is not easily ascertainable where one of the components is a liquid. Thus the term "thixotropic gel" will be used broadly in reference to the novel composition here disclosed and without regard to any distinction between it and a solid solution. It refers to a composition having the character of being solid when not disturbed by mechanical manipulation and liquid when so disturbed. By a thixotropic gel, I mean a composition which exists as a gel but changes to a liquid state (free flowing under the influence of gravity) upon mechanical manipulation, such as stirring, shaking or compressing. It reverts to a solid gel when at rest and not subjected to mechanical manipulation. A gel is a semi-rigid mass consisting of two or more phases, one of which is a liquid, to produce a mass which maintains a definite shape against the pull of gravity, and thus displays some rigidity and cohesion.

When the composition is disturbed by mechanical manipulation, such as that to which it is subjected in being applied as a coating on a sheet, it becomes liquid and free flowing to adhere evenly to the paper without unduly penetrating same. After the coating composition is applied to the paper and the mechanical manipulation of the coating operation is discontinued, the coating composition reverts to its normally solid form so as not to smudge and offset.

A transfer composition embodying my invention comprises a non-drying liquid oil, a solid wax and a pigment and/or dye, these being combined in such proportions that the composition is normally a thixotropic gel or solid solution which is soft and spreadable but not free flowing. The proportions of the oil and wax vary, depending upon the hardness of the wax and the viscosity of the oil. However, the ratio of the oil to the wax for obtaining a composition of this novel character can be determined by the hereinafter described formula which correlates the proportions of the oil and wax in relation to the melting point of the wax and the viscosity of the oil. The oil comprises about 48 to 80%, by weight, of the composition, and preferably from about 50 to 70%.

The oil is preferably of the type obtained in refining crude petroleum and is that fraction within a distillate range, generally known and referred to as cylinder stock or lubrication oil. The lubrication oil is the heavy distillate in the range between fuel oil and petroleum grease, the latter being a semi-solid combination petroleum product and a soap, or a mixture of soaps. Lubrication oils include those which are indicated as of high, medium and low viscosity, and ordinarily are refined to remove sludge therefrom.

Other liquid non-drying oils, such as vegetable oils and animal oils are also suitable. The oils include those designated in the trade by their S. A. E. viscosity, ranging from 10 to 250, and those lighter liquid oils which have a viscosity

less than 10 but whose viscosity is not designated in the trade. These lighter oils are spindle oils and the like, and are generally designated and classified in the trade under names which do not specify the viscosity of the oil. However, such oils are suitable, and their viscosities can be ascertained for determining the proper proportion to be used with the wax component in the present invention. Oils above a viscosity of S. A. E. No. 250 are too hard and stiff to provide a composition which can be rendered free flowing and, therefore, are not suitable in the present invention. A larger proportion of wax or one of harder character is required for lighter oil or oil of lower viscosity, whereas a smaller proportion of wax or one of softer character is required for heavier oils or oils having a higher viscosity. It is essential that the oil be liquid, and liquid oil of any viscosity is suitable if same is non-drying. The oil should be non-drying and one which is and remains liquid and free flowing without channeling at normal temperatures from 15 to 35° C. Those oils, such as linseed oil, and the like, which oxidize and irreversibly "set" by chemical action to solids or semi-solids are not suitable for the oil component in the composition embodying the present invention, but may be added in small quantities with the non-drying oil without impairing the character of the composition.

The wax may be any of the natural solid waxes such as spermacetti, paraffin, yellow or white beeswax, carnauba, montan and the like. Synthetic waxes are also suitable where they approximate substantially the natural waxes by a mixture of their principal components. All synthetic waxes do not, however, duplicate or even approximate the components of the natural waxes, and thus their suitability in the present invention is dependent upon their approximation with the principal components of the natural waxes.

Liquid waxes are not suitable alone in the invention, but a small proportion of liquid wax may be advantageously included with the solid wax to improve the quality of the oil and wax transfer coating composition in being mechanically drawn out into thin strands or threads. This quality of a transfer coating composition is referred to in the art as "fiber length," and this quality of having "fiber length" or capability of being drawn out into thin strands of threads is necessary for the successful feeding of the coating composition through a series of rollers or other mechanisms which carry same to the forms for its transfer to the surface or surfaces to be "spot" printed. Inclusion of a small quantity of liquid wax, with the solid wax, is advantageous where the solid wax is of the harder kind, so that the quality of "fiber length" of the composition is not impaired.

The concentration of the oil and wax components in the composition is such that the wax is partially and incompletely dissolved in the oil, and is dispersed therein with the oil forming one phase and the wax forming the other phase of the dispersion. The wax and the oil form either a thixotropic gel or solid solution which is normally sufficiently soft to be easily spread in a film coating but is not free flowing, and does not offset and smear under normal conditions. The composition has the character of a solid when at rest and not disturbed by mechanical manipulation, whereas it has the character of a liquid when disturbed by mechanical manipulation. Otherwise

stated, the physical character of the composition is characterized by the wax phase of the dispersion when at rest and by the oil phase of the dispersion when disturbed.

The proportion of the wax comprises about 2 to 35%, preferably about 7 to 25%, by weight, of the composition. A less viscous oil requires more wax or wax of a harder character. Ordinarily the proportion of the oil predominates the combined proportions of the wax and coloring material but with oils of low viscosity, the wax component may exceed that of the oil.

The coloring material may be one which is or is not in solution in the composition, or a combination of the two types. The coloring material is preferably wholly or mainly a solid pigment which is not in solution in the composition as it gives more body to the composition and functions to make same more resistant to penetration in the paper. The solid pigment is filtered out of any part of the vehicle which tends to penetrate the paper, whereas coloring material which is in solution has a tendency to follow any portion of oil which penetrates the paper. This is commonly referred to as "bleeding." Any coloring pigment may be used. Where the coloring material, such as a dyestuff, is of a type to be in solution in the composition, some finely divided inert solid insoluble filler is preferably included, even though such filler may be colorless and not a pigment. Diatomaceous earth, bentonite, talc and the like are suitable for this purpose. Such inert fillers help to localize the coating on the surface of the paper and prevent "bleeding" of the dye into the paper. Conventional pigments may be used for the coloring material, such as carbon black, lampblack, metal oxides, lakes, toners and the like. Carbon black is preferred as it is ordinarily, more finely divided and therefore, a smaller amount can be used for obtaining proper pigmentation. Where a soluble dyestuff is used, a suitable acid, such as oleic acid or the like, is included in sufficient amount to dissolve the dyestuff and disperse same through the composition. The coloring material is not necessarily of the kind that renders the transfer composition visible to the naked eye, and may be one which is ordinarily considered colorless but is fluorescent, and thereby renders the composition fluorescent so that it will glow under ultra-violet light and be visible. Thus the term "coloring material" is used broadly to refer to a dyestuff, pigment or the like, irrespective of whether or not the material may, of itself, be colored or colorless.

If soluble coloring material be alone used, same may range from 1 to 20%, by weight, depending upon the type of the dye. A solid pigment is used in proportion, by weight, up to about 45%, preferably about 15 to 35%, if used alone. Enough pigment should be included to give the desired density of color or pigmentation to the composition, and this can ordinarily be obtained with about 15 to 35% of solid pigment. It is desirable to use the least amount of coloring material which is necessary for proper pigmentation. An amount of solid pigment in excess of 45% renders the composition too thick for spreading, and impairs its characteristic of being rendered liquid by mechanical manipulation. Where both soluble and insoluble coloring materials are used in the composition, they may be in any proportion in respect to each other, and their combined amounts will be in any proportion not in excess of 45%, and preferably not in excess of 35%.

The amount of insoluble coloring material is decreased as the amount of soluble coloring matter is increased.

The amount of solid coloring material used depends also on its fineness. With equal amounts, by weight, of two or more solid coloring materials, that which is more finely divided will present a greater surface area or areas to be covered by the oil and wax vehicle, and thus will be more effective than coarser material in coloring the composition. Accordingly, a less proportion of more finely divided solid material can be used, other things being the same, and be as effective as a larger proportion of coarser material. Carbon black, for example, is ordinarily more finely divided than any of the other above mentioned solid colored materials, and therefore, is preferred as less of it need be used.

Some preferred specific examples, embodying my invention, are given below, these including transfer compositions with solid pigments, soluble pigments, or a mixture of the two:

Solid pigments

	Per cent
1. Pale yellow paraffin oil, S. A. E. 10	60
Yellow beeswax	20
Carbon black	20
2. Lard oil, S. A. E. 10 (preferably 1 to 5% free fatty acids)	68.2
Yellow beeswax	11.3
Carbon black	20.5
3. Mineral oil, S. A. E. 50	69.9
Yellow beeswax	11.1
Carbon black	19
4. Mineral oil, S. A. E. 40	71.3
Yellow beeswax	11.2
Carbon black	17.5
5. Mineral oil, S. A. E. 40	60
Yellow beeswax	20
Fast violet No. 7001 (solid lake pigment)	20
6. Mineral oil, S. A. E. 250	72
Yellow beeswax	8
Carbon black	20
7. Mineral oil, S. A. E. 60	60.5
Yellow beeswax	8.7
Lampblack	30.8
8. Mineral oil, S. A. E. No. 140	52.8
Anthracene (solid fluorescent pigment)	26.5
White beeswax	13.2
Flexo Wax C (synthetic wax manufactured by Glyco Products Co.)	7.5

Soluble pigments

	Per cent
9. Mineral oil, S. A. E. 30	37.5
Yellow beeswax	12.5
Oleic acid	12.5
Crystal violet dye	12.5
Talc (inert filler)	25.0
10. Mineral oil, S. A. E. 50	36.0
Yellow beeswax	12.0
Oleic acid	12.0
Methyl violet dye	12.0
Talc (inert filler)	28.0

Mixed solid and soluble pigments

	Per cent
11. Mineral oil, S. A. E. No. 140	42.3
Lampblack	28.8
Yellow beeswax	9.6
Oleic acid	11.5
Dye, Ciba Oil-Soluble Black, G. C. G.	7.8

In those compositions in which soluble dyes are used, it may be noted that the ratio of the oil and wax components is about the same as in those in which solid coloring material is used, although the amounts of each are decreased. This fact shows still further that it is the ratio of oil to wax components in the composition which is critical. In the above Examples 9 and 10, the oleic acid is a fatty acid and may be considered as a part of the oil fraction or the liquid phase of the vehicle.

The foregoing examples are preferred compositions, embodying this invention, and are representative of those in which soluble and insoluble solid pigments are each used alone, or in combination. The proportion of pigment present in the composition, below a certain maximum, is not critical in respect to the novel character of the oil and wax vehicle, same being adapted to be used in a wide range. The only limitation is that the pigment be not used, where same is insoluble, in such large proportion as to impair the spreadability of the coating composition. The soluble coloring material is more diffuse than the insoluble material and is not filtered from the portion of the vehicle which permeates the paper. It is for this reason that a soluble dye should be used in a limited amount and preferably with some inert solid filling material which would tend to prevent the color from "bleeding" into the paper. The dye would coat the particles of the inert filler. The critical factor is in the proportions of the oil and wax components in the dispersion vehicle in which the coloring matter is dispersed. The proportions of the oil and wax should be within definite limits, depending upon the melting point of the wax and the viscosity of the oil, to provide a normally soft, spreadable thixotropic gel or solid solution that is normally resistant to free flow but is free flowing when subjected to mechanical manipulation. The dispersion has the liquid oil and solid wax phases so proportioned or balanced that the composition normally, when at rest, is caused by the wax to be solid, and when disturbed is caused by the oil to be liquid.

While more or less oil may be used in the composition, the solid wax is combined in such proportion that it is partially and incompletely dissolved in the oil, and sufficiently dominates or influences the physical character of the composition under certain conditions, thereby causing the dispersion normally to set to a thixotropic gel or solid solution and be resistant to free flow. However, when the composition is subjected to mechanical manipulation, such as pressure, stirring and squeezing, by and between the applicator, fountain, or form rolls, and by and between said rolls and the paper being coated in the coating operation, the oil dominates or influences the physical character of the composition so that it is rendered liquid and free flowing without the use of any other means. Following the coating operation and the cessation or release of the mechanical manipulation of the coating operation, the coating sets to a relatively soft, solid condition and does not offset or smear.

From the foregoing description, it is apparent that a cold process coating composition embodying my invention is not only well suited for transfer but is normally solid to be resistant to offset and smear before being used for transfer. It also has better aging qualities due to minimum absorption of the vehicle by the paper. Moreover, in being applied as a transfer coating, the com-

position conforms itself, under conditions of application, to the necessary physical forms for being applied as a coating and subsequent to its application.

I am aware that there may be considerable variation in compounding a composition embodying my invention, without departing from the spirit thereof, and therefore, I claim my invention broadly as indicated by the appended claims.

Having thus described my invention, what I claim as new and useful and desire to secure by Letters Patent, is:

1. A cold process transfer coating composition comprising a solid wax and non-drying liquid oil, having a coloring matter dispersed therein, the oil having a viscosity not in excess of 250 comprising about 48 to 80% of the composition, by weight, and the wax comprising about 2 to 35%, by weight, of the composition, said composition normally being in the form of a spreadable thixotropic gel in which the wax is incompletely dissolved in the oil, and which is resistant to free flowing at ordinary room temperatures of about 20 to 35° C. but is capable of becoming free flowing when subjected to mechanical manipulation and of reverting to said soft, solid gel when free from mechanical manipulation.

2. A cold process transfer coating composition comprising a solid wax and non-drying oil having a coloring matter dispersed therein, the oil having a viscosity not in excess of 250 comprising about 48 to 80%, by weight, of the composition and the wax comprising about 7 to 25%, by weight, of the composition, said composition normally being in the form of a soft, spreadable thixotropic gel in which the wax is incompletely dissolved in the oil, and which is resistant to free flowing at ordinary room temperatures of about 20 to 35° C. but is capable of becoming free flowing when subjected to mechanical manipulation and reverting to said soft, solid gel when released from mechanical manipulation.

3. A cold process transfer coating composition comprising a solid wax and non-drying liquid oil, having a coloring matter dispersed therein, the oil having a viscosity not in excess of 250 comprising about 50 to 70% of the composition, by weight, and the wax comprising about 2 to 35%, by weight, of the composition, said composition normally being in the form of a spreadable thixotropic gel in which the wax is incompletely dissolved in the oil, and which is resistant to free flowing at ordinary room temperatures of about 20 to 35° C. but is capable of becoming free flowing when subjected to mechanical manipulation and of reverting to said soft, solid gel when free from mechanical manipulation.

4. A cold process transfer coating composition comprising a solid wax and non-drying liquid oil, having a coloring matter dispersed therein, the oil having a viscosity not in excess of 250 comprising about 50 to 70% of the composition, by weight, and the wax comprising about 7 to 25%, by weight, of the composition, said composition normally being in the form of a spreadable thixotropic gel in which the wax is incompletely dissolved in the oil, and which is resistant to free flowing at ordinary room temperatures of about 20 to 35° C. but is capable of becoming free flowing when subjected to mechanical manipulation and of reverting to said soft, solid gel when free from mechanical manipulation.

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