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COATING COMPOSITION CONTAINING POLYETHYLENE AND WAX AND PAPER COATED THEREWITH

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My invention relates to a surface coating composition for paper, and more particularly to a wax-type coating composition containing a relatively high percentage of micro-crystalline wax (also known as amorphous or petroleum wax), the characteristics of which are modified by incorporation of polyethylene therewith to render the wax suitable for such coating.

Crystalline paraffin wax is commonly employed as a surface coating on certain kinds and grades of readily flexible wrapping paper for rendering the paper moisture resistant and also to provide a means whereby edge portions of the paper may be "heat sealed" together over the object wrapped by adhesion of adjacent overlapping wax coatings upon application of heat. In the manufacture of such wax coated paper, the paper may be wound in rolls or stacked in layers after the wax coating has been applied and has hardened. Consequently, it is necessary that the wax composition be of such character that the coating will not stick to adjacent layers in the roll or stack under the pressure to which the layers, particularly the inner-most layers of the roll or lower layers of the stack, are subjected. Otherwise, as the paper is unrolled or removed from the stack, portions of the coating may be torn loose or become marred, rendering such portions of the paper unsatisfactory for use. This sticking is generally designated in the trade as "blocking."

It is, therefore, seen that besides characteristics which may render a wax suitable for providing a moisture resistant and good seal coating, it must be sufficiently tough and hard to obviate blocking, and at the same time be sufficiently flexible to permit winding of the paper in a roll and wrapping thereof over the object to be wrapped without cracking. Paraffin wax or essentially paraffin wax compositions satisfy these conditions and are hence widely used as coatings of the character described.

Micro-crystalline wax, which as perivously stated is sometimes designated as amorphous or petroleum wax, is highly desirable as a coating material for the purpose described since the coating thereof has greater flexibility, adherence to the paper, and better sealing qualities. However, heretofore it could not be used commercially as a surface coating because it would block in the roll or stack of the paper. Micro-crystalline wax finds its source in petrolatum which is a jelly-like substance formed from high boiling point petroleum derivatives and comprises a mixture of waxy compounds, petroleum residue, and oil.

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The higher melting waxes separated from petrolatum are what is known as micro-crystalline wax. Micro-crystalline wax is to be distinguished from paraffin wax which is derived from more volatile and lighter fractions in the distillation of petroleum and is markedly crystalline and brittle compared to micro-crystalline wax which is non-brittle.

I have found that micro-crystalline wax can be adapted as a coating material for paper by blending it with polyethylene with which it is entirely compatible in a wide range of proportions, and which improves the toughness and hardness of the resultant composition compared to the micro-crystalline wax alone, and prevents blocking in the roll or stack of paper so coated which would otherwise occur as a result of the micro-crystalline wax.

Also, the polyethylene imparts improved gloss characteristics to the resultant coating which is desirable from the viewpoint of appearance; and the coating comprising micro-crystalline wax and polyethylene possesses better flexibility and sealing qualities compared to essentially paraffin wax coatings. The micro-crystalline wax-polyethylene composition may be used alone as the coating or may be incorporated in a relatively wide range of proportions, depending on the effect desired, with other common waxes employed as coatings for paper, in which the micro-crystalline wax constitutes a substantial proportion of the coating to impart thereto the desirable characteristics of such wax.

Thus, my invention, has as its objects, among others, the provision of an improved coating composition for paper comprising a substantial proportion of micro-crystalline wax modified by polyethylene which will provide desirable properties to the coating, especially for flexible wrapping paper, and yet will not block in the roll or stack of the paper, and which can be coated on the paper by conventional wax applying equipment. Other objects of my invention will become apparent from a perusal of the following more detailed description.

Polyethylene, as is disclosed in U. S. Patent No. 2,153,553, is produced by condensation of ethylene at high pressures and temperatures. It is thermo-plastic at temperatures above approximately 130° C., and is quite tough although relatively in elastic. Its polymers vary widely in molecular weight; and for any given quantity of micro-crystalline wax, the characteristics of the resultant composition will vary with the molceular weight of the polymer employed. When too high

a molecular weight is used, it is more difficult to combine the polyethylene with the wax and high viscosity of the resultant composition is obtained before enough polyethylene can be incorporated to obtain the desired result. Too low a molecular weight results in too soft a mixture. For most purposes, polyethylene polymers having molecular weights of about 3,000 to 15,000 are most suitable for my purposes, although this range is not particularly critical and molecular weights outside of this range can be employed.

With respect to the micro-crystalline wax, there are various commercial grades available and these vary in hardness and melting point. It is desirable that the higher melting point and harder grades of the wax be employed, but again this is not particularly critical because desired characteristics can be obtained for any given polyethylene by variation in the proportions of the wax to the polyethylene. My preferred melting point range for the micro-crystalline wax is about 140° F. to about 160° F., although this range may be extended from about 120° F. to about 170° F. As to hardness, I prefer a range of about 10 to about 35, needle point penetration at 77° F.—ASTM–D–5–25. My preferred commercial micro-crystalline wax has a melting point of about 150° F. to 152° F. and a needle point penetration on the basis referred to above of about 20 to 22.

My micro-crystalline wax composition for the purpose related may consist of only the micro-crystalline wax modified by the polyethylene in which case the preferred proportions may vary from about 3 to about 9 parts by weight of micro-crystalline wax to about 1 part by weight of polyethylene, or expressed in percent about 90% to about 75% by weight of the wax and about 10% to about 25% by weight of polyethylene. Various common additives in suitable proportions may be incorporated in the composition to enhance toughness, flexibility and bonding strength of the resultant coating. The viscosity of the mix is generally increased by such additives. Therefore, the maximum amount that should be incorporated depends on how viscous a mix can be handled by the coating equipment used. For practical purposes, the amount should not be much over about 30% by weight of the total weight of the composition. For example, copolymers of polystyrene and polyisobutylene, and also polyisobutylene alone may be employed for this purpose. The micro-crystalline wax usually imparts splendid adhesion of the coating to the paper. However, should the coating require modifiers to improve adhesion to the paper, sufficient amounts of the usual tackifiers such as ester gums and glycerol esters of hydrogenated rosin ("Staybelite") may be incorporated therein.

As can be noted from various typical formulae set forth in the following table, some of the micro-crystalline wax can be replaced by other waxes such as paraffin wax to vary the physical properties of the resultant coating, but in all cases, the composition contains sufficient of the micro-crystalline wax modified by a sufficient amount of the polyethylene to provide the desired effects of the micro-crystalline wax but yet impart sufficient hardness and toughness thereto by the polyethylene to obviate blocking. In all these compositions, the total quantity of waxes (both micro-crystalline and paraffin waxes) preferably constitutes at least about 75% by weight of the composition, and the polyethylene not more than about 25% by weight, while the proportion of micro-crystalline wax to polyethylene is preferably within the range of about 3 to 9 parts by weight of the former to about 1 part by weight of the latter.

The following table presents representative specific formulae which I have found satisfactory and in which the micro-crystalline wax is of the preferred melting point range of about 140° F. to about 160° F., and the preferred hardness of about 20 to 22 needle point penetration at 77° F.—ASTM–D–5–25. The polyethylene is of the preferred molecular weight of between 3,000 to 15,000; and the paraffin wax where employed has a melting point of about 130° F. to about 160° F. The proportions are in parts and percent by weight. Example 2 is preferred.

	Example 1	Example 2	Example 3	Example 4	Example 5
Micro-crystalline wax	85	60	55	65	30
Polyethylene	15	10	10	10	5
Paraffin Wax		30	25	20	65
Copolymer of Styrene and Polyisobutylene (Standard Oil N. J. S–50)			10		
Polyisobutylene				5	

In the examples, except Example 5, the micro-crystalline wax constitutes over 50% by weight of the composition; and in Example 5, paraffin wax is the predominant wax, but the relatively smaller amount of micro-crystalline wax therein imparts to the composition enhancement in adherence to the paper, flexibility and sealing strength. However, in all the compositions, the micro-crystalline wax comprises a substantial proportion, and is considerably in excess with respect to the polyethylene, varying preferably from about 5½ to about 6½ parts by weight of the micro-crystalline wax to about 1 part by weight of polyethylene.

Any suitable method may be employed for compounding the ingredients of the various compositions as all the ingredients are entirely compatible and solid solutions of the polyethylene and wax can be readily effected. A convenient method is to melt the wax to a temperature at which the polyethylene will dissolve therein when introduced in finely divided form, and stirring until the polyethylene is thoroughly dissolved. As low a temperature as possible should be employed, so as to avoid decomposition, preferably about 220° F. If paraffin wax is included, this can be done by adding it in relatively large pieces if so desired at any stage of the mixing procedure as it will melt and mix readily. The additives may also be added to the molten micro-crystalline wax in the same manner as the polyethylene.

All the compositions of the character related require no special applicators; and consequently they can be coated on the paper by conventional wax coating equipment. The amount necessary to coat the paper for proper coverage, so as to obtain good protective properties, gloss and self-sealing may vary considerably with the type of paper and the use to which it is put. For very smooth surfaced paper, such as glassine, as little as 2 pounds and as much as 10 pounds per ream of 3,000 sq. ft. (coated both sides) may be employed. For well finished sulphites, the amount may vary from 10 to 15 pounds per ream (both sides). For coarser papers, it may reach 20 to 25 pounds per ream (both sides).

I claim:

1. A wax paper coating composition comprising about 60 parts by weight of micro-crystalline wax, about 10 parts by weight of a solid polyeth-

ylene polymer, and about 30 parts by weight of paraffin wax.

2. A wax paper coating composition comprising a solid solution of micro-crystalline wax, paraffin wax, and a minor proportion of about 5% to 10% by weight of a solid polyethylene polymer; the total quantity of the micro-crystalline wax and the paraffin wax constituting at least 75% by weight of the composition and the paraffin wax constituting at least 20% by weight of the composition; and the quantity by weight of micro-crystalline wax being at least three and not more than nine times the quantity by weight of the polyethylene.

3. A wax paper coating composition comprising a solid solution of micro-crystalline wax having a melting point of about 140° F. to 160° F., paraffin wax having a melting point of about 130° F. to 160° F., and a minor proportion of about 5% to 10% by weight of a solid polyethylene polymer; the total quantity of the micro-crystalline wax and the paraffin wax constituting at least 75% by weight of the composition in the ratio of 13:4 to 6:13 parts by weight of micro-crystalline was to paraffin wax; and the quantity by weight of micro-crystalline wax being at least three and not more than nine times the quantity by weight of the polyethylene.

4. Paper having a coating comprising micro-crystalline wax, paraffin wax, and a minor proportion of about 5% to 10% by weight of a solid polyethylene polymer sufficient to minimize blocking that would be otherwise caused by the micro-crystalline wax; the total quantity of the micro-crystalline wax and the paraffin wax constituting at least 75% by weight of the composition and the paraffin wax constituting at least 20% by weight of the composition; and the quantity by weight of micro-crystalline wax being at least three and not more than nine times the quantity by weight of the polyethylene.

5. A composition as set forth in claim 2 in which the ratio of waxes is 13:4 to 6:13 parts by weight of micro-crystalline wax to paraffin wax.

6. A composition as set forth in claim 2 in which the ratio of waxes is from 2:1 to 1:2.

7. Paper as set forth in claim 4 in which the ratio of waxes is 13:4 to 6:13 parts by weight of microcrystalline wax to paraffin wax.

8. Paper as set forth in claim 4 in which the ratio of waxes is from 2:1 to 1:2 by weight.

9. A wax paper coating composition comprising about 30 parts by weight of micro-crystalline wax, 5 parts by weight of a solid polyethylene polymer, and 65 parts by weight of paraffin wax.

10. A wax paper coating composition comprising about 65 parts by weight of micro-crystalline wax, 10 parts by weight of a solid polyethylene polymer, 20 parts by weight of paraffin wax, and 5 parts by weight of a solid polyisobutylene polymer.

11. A composition of matter comprising solid polyethylene in an amount of 10% by weight of the composition and the balance a mixture of about equal parts by weight of paraffin wax and micro-crystalline wax.

12. A wax paper coating composition comprising micro-crystalline wax, paraffin wax, and a minor proportion sufficient to prevent blocking but not exceeding 10% by weight of polyethylene having a molecular weight of at least about 3000; the total quantity of the micro-crystalline wax and the paraffin wax constituting at least 75% by weight of the composition, and the paraffin wax constituting at least 20% by weight of the composition, and the quantity by weight of micro-crystalline wax being at least 3 and not more than 9 times the quantity by weight of the polyethylene.

13. Paper having a coating comprising micro-crystalline wax, paraffin wax, and a minor proportion sufficient to prevent blocking but not exceeding 10% by weight of polyethylene having a molecular weight of at least about 3000; the total quantity of the micro-crystalline wax and the paraffin wax constituting at least 75% by weight of the composition, and the paraffin wax constituting at least 20% by weight of the composition, and the quantity by weight of micro-crystalline wax being at least 3 and not more than 9 times the quantity by weight of the polyethylene

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