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MODIFIED PARAFFIN WAX GREASE RESISTANT COATING COMPOSITION AND PAPERBOARD COATED THEREWITH

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This invention relates to a grease resistant coating composition which is essentially of paraffin wax but which is modified by incorporation therein of minor amounts of a solid polyethylene polymer and microcrystalline wax; the composition being particularly adapted for the surface coating of paperboard to be employed as cartons for the packaging of grease-containing food products, such as butter, oleomargine, bacon, and lard.

Paperboard cartons of this character have heretofore been coated with paraffin wax, but this wax alone is far from satisfactory as far as grease resistance is concerned. Grease, which includes fatty or oily substances, penetrates the paraffin wax coating readily, particularly in hot weather, causing unsightly stains on the carton, and also off odors due to development of rancidity of the oil in contact with the paper fibers.

Summarizing this invention, it has been found that polyethylene, when incorporated with the paraffin wax, will increase grease resistance of the composition markedly, even with relatively small amounts of polyethylene added; but when the polyethylene is employed alone as an additive to the paraffin wax, the problem of so-called "scuffing" occurs. This scuffing is a flaking off of portions of the coating, which is caused because of the relative incompatability of polyethylene in paraffin wax. When the amount of polyethylene exceeds approximately 1% by weight of the total weight of the composition, the scuffing effect becomes excessive, and is consequently objectionable not only in handling the packaged product but also in setting up the coated cut paperboard in the form of cartons in conventional carton setting-up machinery wherein the cartons glide against metal parts at a rapid speed.

Microcrystalline wax when added even in relatively small amounts to the paraffin wax-polyethylene blend counteracts the scuffing effect of the polyethylene. However, when used alone with paraffin wax or in too great a quantity with the polyethylene and paraffin wax, it creates another problem, namely, "frictional drag" which interferes with smooth feeding of the coated carton blanks in the previously mentioned carton setting-up machines, and can cause various other mechanical problems preventing smooth operation of packaging machinery. This "frictional drag" however in the three component composition of this invention, is counteracted by the presence of the polyethylene. Thus, the scuffing effect of the polyethylene is counteracted by the microcrystalline wax and the frictional drag of the microcrystalline wax is counteracted by the polyethylene.

When microcrystalline wax is employed alone with paraffin wax, it enhances somewhat grease resistance of such blends compared to paraffin wax alone; and in the three component blend of paraffin wax, microcrystalline wax and polyethylene, the microcrystalline also enhances grease resistance and has the synergistic effect of making the entire blend more cohesive and the polyethylene more effective.

The composition of this invention comprises a major proportion of paraffin wax modified with minor amounts

of polyethylene and microcrystalline wax to enhance grease resistance, and at the same time provide a balanced composition in which the previously described scuffing and drag problems are minimized. Also, the microcrystalline wax has the previously mentioned synergistic effect. Furthermore, without much sacrifice of grease resistance, the microcrystalline wax because of its grease resistance and synergistic properties in the composition, permits smaller quantities of the more expensive polyethylene to be employed, thus making for economy.

In greater detail, the polyethylene can be any solid polymer of ethylene. The molecular weight thereof is not particularly critical but if too high it will cause viscosity problems in the final composition. If the molecular weight is too low, the polyethylene will be essentially paraffinic in character. A suitable molecular weight range is from approximately 3,000 to 29,000 (Staudinger method), and preferably approximately 7,000 to 15,000. Grease resistance is not materially enhanced with increase in molecular weight of the polyethylene; and for ease of handling without creation of a composition too viscous, polyethylene with an average molecular weight of 12,000 is preferably employed.

The paraffin wax can be any of the usual paraffin waxes employed as coating material for paperboard. The higher the melting point of the wax, the less modifier generally required; and the lower the melting point of the paraffin wax, the slicker the composition is; slickness, or lack of frictional drag being desirable in the carton setting-up machinery. For best results, the melting point of the paraffin wax should be in the range of 130° to 165° F. (A. M. P.—American melting point), and preferably a melting point of 130° to 135° F. (A. M. P.).

With respect to the melting point of the microcrystalline wax, this is quite critical because if the melting point is too low, such wax will impart too much frictional drag to the composition. Hence, for a paperboard coating composition of the type described wherein heat sealing properties of the coating are not desired, the microcrystalline wax should be of the high melting point grade; and relatively hard. The melting point should be at least about 180° F. (A. M. P.); the higher the better. In this connection, the higher the melting point of the microcrystalline wax, the harder the wax is. A preferred hardness range is about 2 to 10, needle point penetration at 77° F. (A. S. T. M. D–5–25) and preferably about 2 to 7 with a melting point of approximately 190° F. to 195° F. (A. M. P.)

Relative to proportions, the presence of any amount of polyethylene in the three component composition will enhance grease resistance, the degree of grease resistance being a function of the amount of polyethylene employed but to avoid too great a viscosity, the amount of polyethylene should not exceed approximately 20% by weight of the total weight of the three component composition. With relatively high amounts of polyethylene in the composition the viscosity of the composition renders it relatively hard to handle with present commercial equipment for coating paperboard although such coating can be readily applied by hand or by special hot melt coating equipment. With present commercial equipment for coating paperboard, the amount of polyethylene should not exceed approximately 3% by weight of the total weight of the composition; and to obtain the desired minimum degree of grease resistance, and also counteraction against the frictional drag effects of the microcrystalline wax, the polyethylene should be present in a sufficient amount, namely, at least about 1% by weight of the total weight of the composition.

With about 1% or more by weight of polyethylene in the composition, the previously mentioned scuffing effect is imparted to the composition which is overcome by in-

corporation of the microcrystalline wax even in a minor amount irrespective of the amount of polyethylene within the range noted, but if too much microcrystalline wax is used, then no matter what the quantity of polyethylene may be, the objectionable drag effect will exist. To avoid the drag effect, the maximum amount of microcrystalline wax should not exceed 10% by weight of the total weight of microcrystalline wax and paraffin wax, irrespective of the amount of polyethylene in the composition within the range noted; and the amount of microcrystalline wax should be sufficient to counteract the scuffing effect of the polyethylene, namely, at least about 1% by weight of the total amount of microcrystalline wax and paraffin wax. In other words, the amount of paraffin wax should be at least 9 parts by weight to 1 part by weight of the microcrystalline wax; and of the total amount of waxes, the microcrystalline wax should be at least about 1% by weight to overcome the scuffing effect of the polyethylene. Thus, the composition may vary in the following range of proportions, in parts and percent by weight.

Total amount of paraffin wax and microcrystalline wax	99–80
in which:	
Paraffin wax	99–90
Microcrystalline wax	1–10
	100–100
Polyethylene	1–20
	100–100

Within this range, there will of course be variations in the specific non-scuffing and non-frictional drag characteristics of various specific formulations but they will all have enhanced grease resistant properties compared to paraffin wax alone, at which this invention aims primarily. The grease resistant effects imparted to the paraffin wax by the polyethylene and by the microcrystalline wax are depicted by the following table in which the formulations are in parts and percent by weight, and each the average of ten determinations.

	Paraffin Wax, Percent	Polyethylene, Percent	Microcrystalline Wax, Percent	Turpentine Penetration Time, Seconds
1	100	0	0	50
2	99	1	0	500
3	97	3	0	1,440
4	94	6	0	2,060
5	97	1.5	1.5	1,240
6	94	3	3	1,790
7	94	0	6	840

The paraffin had a melting point of 130° to 135° F. (A. M. P.), the polyethylene an average molecular weight of 12,000 (Staudinger method); and the microcrystalline wax a melting point of 190° to 195° F. (A. M. P.). The turpentine penetration test for grease resistance is the standard A. S. T. M. test D–722–45, adopted 1945, page 938, A. S. T. M. Standards, 1949, part 4. It is essentially a test to determine the time it takes turpentine to penetrate the coating, the faster the penetration time, the less the grease resistance.

Compositions 3 and 4 had bad flaking; composition 7 had bad frictional drag; while compositions 5 and 6 were substantially non-flaking and offered substantially no frictional drag in the carton setting-up machinery. Comparison of compositions 4, 6 and 7 establish that by reducing in half, the amount of the relatively expensive polyethylene in composition 4, and substituting the microcrystalline wax therefor as in composition 6, very little sacrifice in grease resistance occurs.

Composition 6 is preferred formulation presently employed as a coating for oleomargarine cartons. Other

typical formulations in parts and percent by weight are as follows:

	Paraffin Wax, Percent	Polyethylene, Percent	Microcrystalline Wax, Percent	Turpentine Penetration Time, Seconds
8	92	3	5	2,420
9	96	1	3	860
10	82	10	8	12,040

In all these compositions, the paraffin wax melting point is 130° to 135° F. (A. M. P.) except in composition 9 in which the paraffin wax melting point is 143° to 150° F. (A. M. P.). The microcrystalline wax in all compositions has a melting point of 190° to 195° F. (A. M. P.), and the polyethylene an average molecular weight of 12,000 (Staudinger method). Composition 8 has substantially no flaking, and offers substantially no frictional drag in the carton setting-up machinery, and for oleomargarine cartons is equally satisfactory to composition 6 but is more expensive because of the increased amount of microcrystalline wax. Where superior grease resistance is desired, such as in hot climates, it is preferable to composition 6. Composition 9 is a low cost product adapted as an oleomargarine or butter carton coating for relatively cool localities. Composition 10 has high grease resistance and is comparatively expensive. It is adapted for a lard carton coating because of the greasy character of this product. Both of compositions 9 and 10 also have good non-flaking and non-frictional drag properties.

All the compositions can be readily prepared in a conventional manner by melting the paraffin wax and the microcrystalline wax, and then dissolving the polyethylene in the resultant molten mixture of waxes maintained at a temperature of about 210° F. by stirring the molten mixture thoroughly and constantly while the polyethylene is gradually added, and continuing the stirring until all the polyethylene is dissolved in the molten wax mixture.

The resultant compositions can be applied by conventional wax applying equipment for the coating of paperboard, in which the composition is maintained in molten state in a tank at a temperature of about 200° F., and the board is passed through a series of felt covered wax applying rollers which collect and apply the wax. If the composition is of relatively high viscosity such as composition 10 because of the relatively high content of polyethylene and the relatively low content of microcrystalline wax compared to the polyethylene, special high temperature handling equipment for the hot melt method of application, should be employed to handle the composition for application thereof. The amount of coating applied to the paperboard is the same as for wax coatings, namely, about 4 to 7 lbs. per thousand square feet of board (both sides).

I claim:

1. A modified paraffin wax grease resistant coating composition for paperboard or the like comprising a major proportion of paraffin wax and minor proportions of solid polyethylene and microcrystalline wax having a melting point of at least about 180° F., the total amount of said paraffin wax and said microcrystalline wax in said composition comprising at least about 80% by weight of the total weight of the composition, the paraffin wax being present in an amount constituting at least about 90% by weight of the total amount of said microcrystalline wax and said paraffin wax, the microcrystalline wax being present in an amount sufficient to counteract the scuffing effect of said polyethylene but not exceeding about 10% by weight of the total amount of said microcrystalline wax and said paraffin wax, and the polyethylene being present in an amount sufficient to counteract the frictional drag effect of said microcrystalline wax.

2. A modified paraffin wax grease resistant coating composition for paperboard or the like comprising a major

proportion of paraffin wax and minor proportions of solid polyethylene and microcrystalline wax having a melting point of at least about 180° F., the total amount of said paraffin wax and said microcrystalline wax in said composition comprising at least about 80% by weight of the total weight of the composition, the paraffin wax being present in an amount constituting at least about 90% by weight of the total amount of said microcrystalline wax and said paraffin wax, the microcrystalline wax being present in an amount sufficient to counteract the scuffing effect of said polyethylene but not exceeding about 10% by weight of the total amount of said microcrystalline wax and said paraffin wax, and the amount of polyethylene not exceeding about 20% by weight of the composition.

3. A modified paraffin wax grease resistant coating composition for paperboard or the like comprising a major proportion of paraffin wax and minor proportions of solid polyethylene and microcrystalline wax having a melting point of at least about 180° F., the amount of polyethylene being approximately 1% to 20% by weight of the total weight of the composition, the total amount of said paraffin wax and said microcrystalline wax in said composition comprising at least about 80% by weight of the total weight of the composition, the amount of paraffin wax being about 90% to 99% by weight of the total amount of said microcrystalline wax and said paraffin wax, and the amount of microcrystalline wax being approximately 1% to 10% by weight of the total amount of microcrystalline wax and paraffin wax.

4. A modified paraffin wax grease resistant coating composition for paperboard or the like comprising a major proportion of paraffin wax and minor proportions of solid polyethylene and microcrystalline wax having a melting point of at least about 180° F., the amount of paraffin wax constituting about 94% by weight of the composition, and the balance about 3% by weight of each of said polyethylene and said microcrystalline wax.

5. A modified paraffin wax grease resistant coating composition for paperboard or the like comprising a major proportion of paraffin wax and minor proportions of solid polyethylene and microcrystalline wax having a melting point of at least about 180° F., the amount of paraffin wax constituting about 92% by weight of the composition, and the balance about 5% by weight of microcrystalline wax and about 3% by weight of polyethylene.

6. A modified paraffin wax grease resistant coating composition for paperboard or the like comprising a major proportion of paraffin wax and minor proportions of solid polyethylene and microcrystalline wax having a melting point of at least about 180° F., the amount of paraffin wax constituting about 96% by weight of the composition and the balance about 3% by weight of microcrystalline wax, and about 1% by weight of polyethylene.

7. A modified paraffin wax grease resistant coating composition for paperboard or the like comprising a major proportion of paraffin wax and minor proportions of solid polyethylene and microcrystalline wax having a melting point of at least about 180° F., the amount of paraffin wax constituting about 82% by weight of the composition, and the balance about 8% by weight of microcrystalline wax and about 10% by weight of polyethylene.

8. A paperboard carton adapted to be set up in setting up machinery and adapted to package grease containing products, said carton having a substantially non-flaking modified paraffin wax grease resistant surface coating composition offering substantially no frictional drag in said machinery, and comprising a major proportion of paraffin wax and minor proportions of polyethylene and microcrystalline wax having a melting point of at least about 180° F., the total amount of said paraffin wax and said microcrystalline wax in said composition comprising at least about 80% by weight of the total weight of the

composition, the paraffin wax being present in an amount constituting at least about 90% by weight of the total amount of said microcrystalline wax and said paraffin wax, the microcrystalline wax being present in an amount sufficient to counteract the scuffing effect of said polyethylene but not exceeding about 10% by weight of the total amount of said microcrystalline wax and said paraffin wax, and the polyethylene having a molecular weight of approximately 3,000 to 29,000 and being present in an amount sufficient to counteract the frictional drag effect of said microcrystalline wax.

9. A paperboard carton adapted to be set up in setting up machinery and adapted to package grease-containing products, said carton having a surface coating defined by claim 4.

10. A paper board carton adapted to be set up in setting up machinery and adapted to package grease-containing products, said carton having a surface coating defined by claim 5.

11. A paperboard carton adapted to be set up in setting up machinery and adapted to package grease-containing products, said carton having a surface coating defined by claim 6.

12. A paperboard carton adapted to be set up in setting up machinery and adapted to package grease-containing products, said carton having a surface coating defined by claim 7.

13. A modified paraffin wax grease resistant coating composition for paperboard or the like comprising paraffin wax, polyethylene and microcrystalline wax having a melting point of at least about 180° F., the total amount of said paraffin wax and said microcrystalline wax in said composition comprising at least about 80% by weight of the total weight of the composition, the amount of paraffin wax being about 90% to 99% by weight of the total amount of said microcrystalline wax and said paraffin wax, the amount of microcrystalline wax being about 1% to 10% by weight of the total amount of the paraffin wax and the microcrystalline wax to counteract the scuffing effect of said polyethylene, and the polyethylene having a molecular weight of approximately 3,000 to 29,000 and being present in a minor amount with respect to the total amount of the paraffin wax and the microcrystalline wax to counteract the frictional drag effect of said microcrystalline wax but not exceeding about 20% by weight of the total weight of the composition.

14. A paperboard carton adapted to be set up in setting up machinery and adapted to package grease containing products, said carton having a substantially non-flaking modified paraffin wax grease resistant surface coating offering substantially no frictional drag in said machinery, said coating comprising paraffin wax, solid polyethylene and microcrystalline wax having a melting point of at least about 180° F., the total amount of said paraffin wax and said microcrystalline wax in said composition comprising at least about 80% by weight of the total weight of the composition, the amount of paraffin wax being about 90% to 99% by weight of the total amount of said microcrystalline wax and said paraffin wax, the amount of microcrystalline wax being about 1% to 10% by weight of the total amount of the paraffin wax and the microcrystalline wax to counteract the scuffing effect of said polyethylene, and the polyethylene being present in a minnor amount with respect to the total amount of the paraffin wax and the microcrystalline wax to counteract the frictional drag effect of said microcrystalline wax but not exceeding about 20% by weight of the total weight of the composition.

15. A modified paraffin wax grease resistant coating composition for paperboard or the like comprising a major proportion of paraffin wax and minor proportions of polyethylene and microcrystalline wax, said paraffin wax having a melting point range of approximately 130° F. to 165° F., the polyethylene having a molecular weight of approximately 3,000 to 29,000, and said microcrystal-

line wax having a melting point of at least about 180° F., the total amount of said paraffin wax and said microcrystalline wax constituting about 80% to 99% by weight of the total weight of the composition, the paraffin wax constituting about 90% to 99% by weight of the total weight of paraffin wax and microcrystalline wax, the microcrystalline wax constituting approximately 1% to 10% by weight of the total weight of paraffin wax and microcrystalline wax, and the polyethylene constituting approximately 1% to 20% by weight of the total weight of the composition.

16. A paperboard carton adapted to be set up in setting up machinery and adapted to package grease containing products, said carton having a surface coating defined by claim 15.

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