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HEAT-SEALABLE LABEL

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This invention relates to labels which can be attached to objects by means of heat and/or pressure.

Our invention relates generally to labels, bands, strips and the like made from any suitable sheet materials coated with a heat-sealable composition which can be activated when subjected to heat and/or pressure to permit the label to be adhered to any desired surface or object and which will remain firmly adhered under usual conditions.

Our invention is adapted particularly for making heat-sealable labels used for sealing the folded ends of bread packaged in usual wrapping materials, such as waxed paper, Cellophane (regenerated cellulose) and the like. For such use the label must meet the following qualifications:

1. The label coating material must form a strong bond between the label and the waxed paper, Cellophane or other wrapping material.

2. When subjected to sealing temperatures the label coating should not strike through or soak into label or the wrapping sheet and should not cause discoloration of the outer surface of the label.

3. The label should not slip on the end of the package during application.

4. The seal should not loosen or become weak under normal conditions of use for the packaged product.

5. The label coating should not squeeze out around the edges of the label to cause sticking between the heating elements of the wrapping machine and the package.

6. The label composition should be sufficiently hard to prevent pressure-sealing of the labels during manufacture and handling.

7. The label coating should be non-toxic and should be free of objectionable odor at sealing temperatures.

Heretofore, labels have been manufactured with a thermo-plastic coating containing a film-forming material, such as rubber, mixed with paraffin wax, as disclosed in United States Patent No. 2,054,112. The sealing property of such labels depends upon the film-forming properties of the rubber. When we attempted to use a coating of microcrystalline wax without a film-forming ingredient for heat-sealing purposes, we found certain inherent disadvantages which could not be overcome. For example, if the base sheet was made of porous paper, the wax would strike through the sheet when the labels were heat-sealed, thereby causing undesirable staining and discoloration. During application, such coated labels also have a tendency to slip on the package because the viscosity of the molten wax is too low.

We have overcome these difficulties by utilizing a novel label coating composition which comprises essentially microcrystalline wax and a water-insoluble metallic soap of the higher fatty acids, such as the stearate, palmitate of oleate of aluminum, in amounts ranging from about 4% to 20% by weight of the wax used, and having a minimum viscosity of 10,000 cps. at 250° F. (The viscosity measurements, referred to herein, are determined in centipoises by means of the Brookfield Synchro-lectric viscosimeter using a spindle speed of 1 R. P. M.) Viscosity as measured by this instrument is defined as the ratio of shear stress to rate of shear. If this ratio is constant for various rates of shear, the material being tested is said to have Newtonian viscosity; if the ratio decreases as the rate of shear is increased, the material is said to be thixotropic. The wax and the metallic soap are compounded under carefully controlled conditions to form a viscous, homogeneous gel which is then conditioned so as to make it suitable for coating on the label base sheet.

In preparing our label coating compositions it is important to select the proper wax since there are many types of waxes, differing greatly in their properties. Our compositions require the use of the so-called microcrystalline waxes. These waxes are generally found in high boiling or residual fractions of petroleum oils. The waxes in these fractions are commonly removed by centrifuging the solvents or by cold settling from solvents, or they may be filtered out in the presence of certain well-known solvents. These waxes may be processed further by recrystallizing to alter their properties.

Microcrystalline waxes differ greatly in their properties. We prefer to use waxes having a drop melting point from about 130° F. to about 180° F. and having needle penetrations from about 10 to 60 at 77° F. The drop melting point referred to herein is determined in accordance with American Society for Testing Materials standard method D127–30 and the needle penetration in accordance with standard method D5–25. The selection of waxes within these specifications will depend upon the character of the thermoplastic coating desired on our labels and their particular use.

It is also important to select the proper metallic soap for preparing our compositions. We find it desirable to use the metallic soap which

will produce the maximum viscosity in our composition for a given amount of metallic soap used. We have found the commercial grades of aluminum stearate suitable for compounding with our selected microcrystalline wax. Technical aluminum distearate having the following specifications is satisfactory: not less than 7.5% Al_2O_3, 6 to 9% free fatty acids, not more than 1% water, and not more than 1% water-soluble salts.

Our coating compositions may be prepared as hot-melt or as solvent type, depending upon the equipment which will be used to coat the base sheet materials. Our hot-melt compositions are prepared by melting the wax, adding the aluminum stearate and dispersing it mechanically in the wax, gradually heating and stirring the mixture until an elastic gel of maximum viscosity and thixotropic characteristics is formed, and then conditioning the gel, by heating and/or mixing, so that it is in suitable condition for spreading on sheet materials for forming continuous, smooth, flexible coatings. It is important to control carefully the compounding conditions, such as temperature, time and character of mixing in order to produce the desired condition and viscosity in the final coating composition.

The following is a typical procedure in preparing a 2,000 pound batch of our coating composition, containing 92% by weight of microcrystalline wax (M. P. 145–7° F., needle penetration 23 at 77° F.) and 8% by weight of technical aluminum stearate. The wax (1840 lbs.) is melted in a steam-jacketed Baker Perkins mixer and heated to about 180° F., at which temperature the wax has a viscosity of about 15–20 cps. The powdered technical aluminum distearate (160 lbs.) is then added slowly and the mixture agitated for from one-half to one hour at 180° F. until all the aluminum stearate has been dispersed uniformly in the wax. At this stage the mixture has a low viscosity and is milky in appearance. It is important to effect a good dispersion of the aluminum stearate in the molten wax by mechanical agitation so that any agglomerates of aluminum stearate are broken up into small particles. If this precaution is not taken large lumps of aluminum stearate will form later during the subsequent compounding procedure, making it very difficult to effect a smooth dispersion of the aluminum stearate.

The temperature of the mixture is then raised to about 235 to 250° F., with agitation, whereupon the viscous elastic gel (viscosity about 100,000 to 150,000 cps. at 250° F.) is formed. This gel appears to be a colloidal dispersion of the aluminum stearate in the wax and it exhibits thixotropic properties. This gel is not suitable for our purposes since it will produce a rough, uneven coating under ordinary commercial operating conditions. The gel is then conditioned further by heating to about 250–260° F., and mixing at this temperature for about six hours, during which time it is transformed to a less thixotropic condition approaching the Newtonian condition, until the rheological properties of the composition render it suitable for smooth coating. The composition (having a viscosity of about 25,000 to 50,000 cps. at 250° F.) is now in suitable condition for forming smooth, flexible, continuous coatings on sheet materials. This composition and the method of compounding same are fully disclosed in copending application Serial No. 467,466, filed November 30, 1942.

Our hot-melt coating compositions, prepared as previously described, may be applied to any desired base sheet materials from which the labels are to be made. The coating is applied to the sheet in any suitable thickness by spreading with a hot roll, doctor blade or other suitable means, keeping the composition molten and causing it to adhere to the sheet material and to form upon cooling a smooth, uniform, heat-sealable, flexible, water-proof coating which will not substantially penetrate or strike through the sheet. The coated sheet is then passed over a chilled roll to congeal the coating. It is advantageous to dust our coatings with starch, talc, or other inert powdered materials to avoid blocking (that is, the tendency of coated sheet materials to stick together) and to facilitate use and handling of our coated sheets. We may use coatings on our labels as low as 10 lbs. per ream and as high as 80 lbs. (per ream—24 x 36—480). For example, with a 35-lb. sulphite paper base sheet a 20-lb. coating is satisfactory for our labels. The base sheet may be printed with any desired designs or indicia prior to coating and may thereafter be cut into individual labels or into a series of labels in roll form.

Our compositions can be coated on pervious or impervious base sheet materials, including paper (such as bond, wrapping, glassine and vegetable parchment) fiberboard, fabrics, metal foil, leather, and films of regenerated cellulose, cellulose acetate, ethyl cellulose, rubber hydrochloride and the like.

It is important to control the final viscosity of our composition, when applied to porous base sheet materials, to prevent the compositions from penetrating or striking through the sheet. The minimum viscosity of our composition must therefore be adjusted for each type of base sheet, since penetration is dependent upon the structure, porosity, density and character of the fibers of the sheet. In general, we have found it advantageous to coat porous sheet materials, such as paper, with compositions having a viscosity not less than 10,000 cps. at 250° F. in order to prevent undesirable penetration of the sheet. We adjust the viscosity of our compositions for producing smooth coatings depending upon the character of the base sheet material to be coated, the coating equipment used, and the ultimate use of the coated labels.

We have found that our coating compositions on 35-lb. sulphite paper labels, having a minimum viscosity of 10,000 cps. at 250° F., are satisfactory for use in the standard bread-wrapping equipment for applying labels to bread packages wrapped in waxed paper or Cellophane. However, we prefer to use coating compositions with a viscosity of 25,000 cps. at 250° F., or higher, as we have found that coatings of high viscosity prevent slippage and penetration.

For each coating composition of wax and aluminum stearate there is a critical temperature below which, on mixing, the composition "granulates," that is, it becomes non-homogeneous and is not in suitable condition for smooth coating. Below this temperature the ingredients of the composition become incompatible and free wax tends to separate out. This granulation temperature for our hot-melt compositions may range from about 175–220° F. Above this temperature our compositions appear to be homogeneous gels.

In order to permit coating of our hot-melt compositions on sheet materials at temperatures below the critical granulation temperature we have found it desirable to add to our composition

a granulation-inhibitor, such as ester gum (glycerol esters of rosin) or Amberol ST-137 (unmodified phenol-formaldehyde resin). The ester gum assists also in more rapid conditioning of our compositions. Increasing amounts of ester gum appear to increase the solubility or dispersion of the aluminum stearate in the wax. Depending upon the amount added, the addition of ester gum will lower the granulation temperature of a given composition, and if sufficient ester gum is used granulation and wax separation are prevented entirely when the composition is cooled to its solidification point. Addition of ester gum also results in lowering the viscosity of the composition. As the amount of ester gum is increased the viscosity of the composition is decreased. We have also found that ester gum having a high peroxide number causes more rapid decrease in viscosity. Continued heating of our prepared coating compositions, containing ester gum, lowers the viscosity much more rapidly than in the case of compositions containing no ester gum. The addition of ester gum enables us to coat our compositions at lower temperatures than would be possible otherwise. In this way undesirable shrinkage, dehydration and embrittlement of the sheet materials are avoided.

The following table illustrates the effect of increasing amounts of ester gum in lowering the viscosity and the granulation temperature of a composition containing microcrystalline wax (M. P. 145–7° F.) and 8% aluminum distearate.

Table

No.	Ester gum, per cent by wt.	Aluminum stearate, per cent by wt.	Microcrystalline wax, per cent by wt.	Granulation temp., ° F.	Viscosity cps. at 250° F.
1	0	8	92	220	150,000
2	1	8	91	213	127,000
3	3	8	89	198	67,000
4	5	8	87	180	39,000
5	10	8	82	(1)	25,000
6	15	8	77	(1)	18,000
7	20	8	72	(1)	12,000

[1] No granulation.

Ester gum, in amounts up to about 20% by weight of the coating composition, prevents the separation of free wax and the attendant staining, when the labels are heat-sealed. Compositions Nos. 5, 6 and 7 given in the table are especially suitable for coating heat-sealable labels. For coating porous label base sheets, such as paper, we prefer to use coating compositions containing microcrystalline wax, about 4 to 10% by weight aluminum stearate, and about 3 to 10% by weight of ester gum.

The character of our label coatings may be modified by the addition of other ingredients to our coating composition. For instance, if our coated labels are to be employed in machine packaging, where the coated surface of the label encounters moving mechanical parts, it is desirable to harden the coating by increasing the amount of aluminum stearate or by adding other suitable ingredients, such as paraffin wax, solid hydrogenated oils, opal wax (hydrogenated castor oil), or other hard waxes. If our labels are to be subjected to low temperatures after sealing and it is desirable to maintain flexibility of the labels, we may add other ingredients, such as rubber, isobutylene polymers, petrolatum or mineral oils. Similarly, if the labels are to be subjected to high temperatures after sealing, other ingredients such as high melting waxes may be added. The adhesiveness and character of the final seal can also be controlled by modifying our composition suitably.

We may also add materials such as tetramethyl thiuramdisulphide, Santovar A (alkylated polyhydroxy phenol) and hydroquinone, to inhibit aging and embrittlement of the label coating. If desired, suitable pigments, dyes and fillers may also be added.

The term "label" as used in the appended claims is intended to include labels, bands, tapes, seals, and the like.

It is to be understood that many modifications and changes may be made within the spirit of our invention, which are intended to be included broadly within the scope of the following claims.

We claim:

1. A heat-sealable label having a base of porous sheet material coated with a composition comprising a major proportion by weight of microcrystalline wax, about 4 to about 10% by weight of an aluminum soap of a higher fatty acid and about 3 to about 10% by weight of ester gum, said composition having been transformed from a thixotropic gel of maximum viscosity to a less thixotropic condition approaching the Newtonian condition as determined by a Brookfield Synchro-lectric viscosimeter at 250° F., and being in a homogeneous, spreadable, rheological state for forming uniformly smooth, non-penetrating, adherent, flexible coatings.

2. A heat-sealable label having a base of paper coated with a composition comprising a major proportion by weight of microcrystalline wax, about 4 to about 10% by weight of an aluminum soap of a higher fatty acid and about 3 to about 10% by weight of ester gum, said composition having been transformed from a thixotropic gel of maximum viscosity to a less thixotropic condition approaching the Newtonian condition as determined by a Brookfield Synchro-lectric viscosimeter at 250° F., and being in a homogeneous, spreadable, rheological state for forming uniformly smooth, non-penetrating, adherent, flexible coatings.

3. A heat-sealable label having a base of porous sheet material coated with a composition comprising a major porportion by weight of microcrystalline wax, about 4 to about 10% by weight of an aluminum soap of a higher fatty acid and about 3 to about 10% by weight of ester gum, said composition having been transformed from a thixotropic gel of maximum viscosity to a less thixotropic condition approaching the Newtonian condition as determined by a Brookfield Synchro-lectric viscosimeter at 250° F., said composition having a viscosity not less than 10,000 cps. at 250° F. and being in a homogeneous, spreadable, rheological state for forming uniformly smooth, non-penetrating, adherent, flexible coatings when applied to said base sheet.

4. A heat-sealable label having a base of paper coated with a composition comprising a major proportion by weight of microcrystalline wax, about 4 to about 10% by weight of an aluminum soap of a higher fatty acid and about 3 to about 10% by weight of ester gum, said composition having been transformed from a thixotropic gel of maximum viscosity to a less thixotropic condition approaching the Newtonian condition as determined by a Brookfield Synchro-lectric viscosimeter at 250° F., said composition having a

viscosity of about 25,000 cps. at 250° F. and being in a homogeneous, spreadable, rheological state for forming uniformly smooth, non-penetrating, adherent, flexible coatings when applied to said base sheet.

5. A heat-sealable label having a base of paper basis weight 10 to 80 pounds (per ream 24 x 36—480) coated with a composition comprising a major proportion by weight of microcrystalline wax, about 4 to about 10% by weight of an aluminum soap of a higher fatty acid and about 3 to about 10% by weight of ester gum, said composition having been transformed from a thixotropic gel of maximum viscosity to a less thixotropic condition approaching a Newtonian condition as determined by a Brookfield Synchro-lectric viscosimeter at 250° F., said composition having a viscosity not less than 10,000 cps. at 250° F. and being in a homogeneous, spreadable, rheological state for forming uniformly smooth, non-penetrating, adherent, flexible coatings when applied to said base sheet.

6. A heat-sealable label having a base of porous sheet material coated with a composition comprising a major proportion by weight of microcrystalline wax, about 4 to about 10% by weight of aluminum stearate and about 3 to about 10% by weight of ester gum, said composition having been transformed from a thixotropic gel of maximum viscosity to a less thixotropic condition approaching the Newtonian condition as determined by a Brookfield Synchro-lectric viscosimeter at 250° F., and being in a homogeneous, spreadable, rheological state for forming uniformly smooth, non-penetrating, adherent, flexible coatings.

7. A heat-sealable label having a base of sheet material coated with a composition comprising a major proportion by weight of microcrystalline wax, about 4 to about 10% by weight of an aluminum soap of a higher fatty acid and about 3 to about 10% by weight of ester gum, said composition having been transformed from a thixotropic gel of maximum viscosity to a less thixotropic condition approaching the Newtonian condition as determined by a Brookfield Synchro-lectric viscosimeter at 250° F., and being in a homogeneous, spreadable, rheological state for forming uniformly smooth, non-penetrating, adherent, flexible coatings.

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