May 16, 1961 J. E. SMITH 2,984,342

HEAT SEALABLE LABEL ROLL AND METHOD OF MAKING THE SAME

Filed Nov. 24, 1958

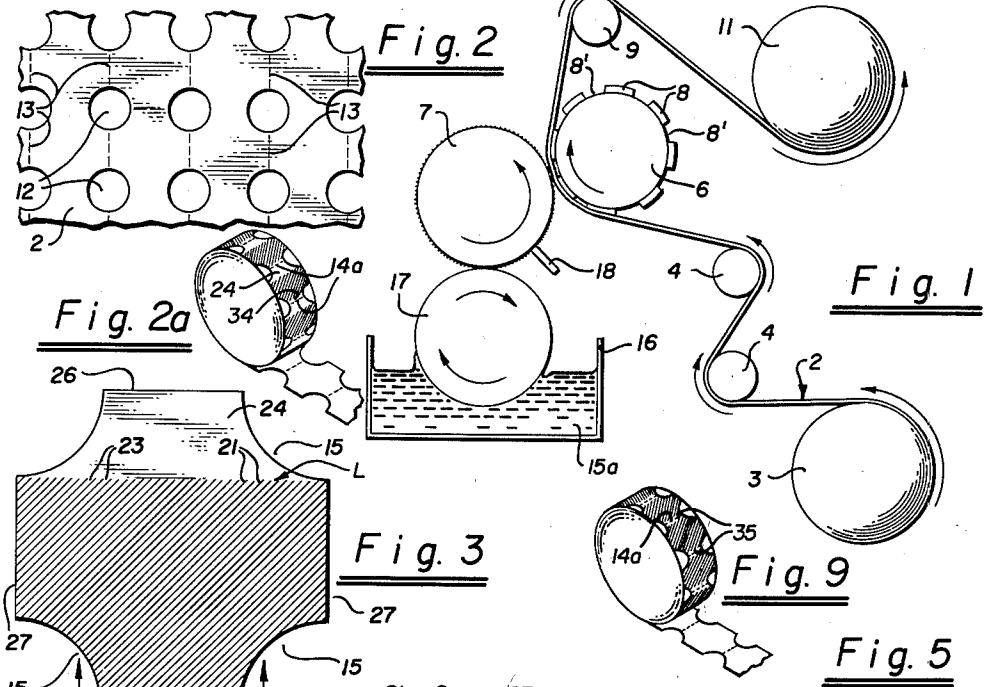


Fig. 1

Fig. 2

Fig. 2a

Fig. 3

Fig. 9

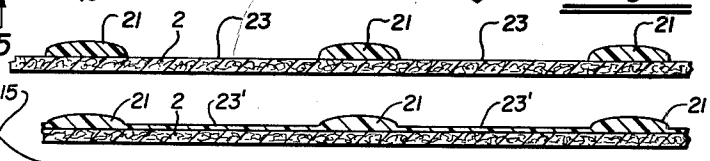


Fig. 5

Fig. 6

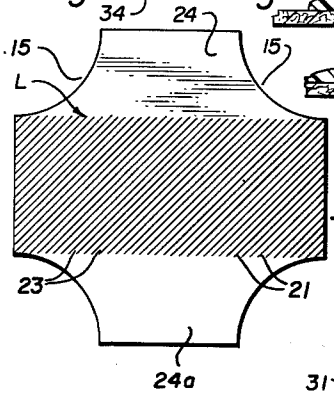


Fig. 4

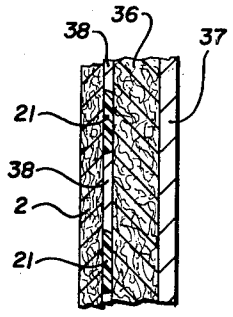


Fig. 8

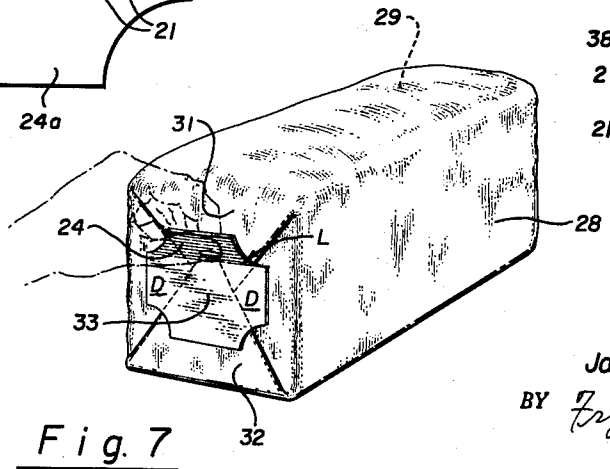


Fig. 7

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HEAT SEALABLE LABEL ROLL AND METHOD OF MAKING THE SAME

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11 Claims. (Cl. 206—59)

This invention relates to labels of flexible sheet material having a heat sealable thermoplastic coating thereon adapting the label to be sealed by heat and pressure to objects. In an advantageous embodiment, the principal substance of the coating is polyethylene which enables the label to be heat sealed to polyethylene film, as well as to other materials, such as paper, waxed paper, wax coated glassine, cellophane (regenerated cellulose) and metal foil, such as aluminum. Such composition, sheet material coated therewith and laminated products are described and claimed in assignee's copending application, Serial No. 772,523, filed November 7, 1958, by James E. Smith, the applicant hereof, and Christopher C. Mazura; the method of application are disclosed and generically claimed in assignee's copending application, by the same inventors, Serial No. 772,573, filed November 7, 1958.

The coating is particularly applicable to flexible porous base sheets of a cellulosic character, such as paper, to be applied as sealing labels, over the folds of wrappers about articles, such as bread wrappers. United States Patents Nos. 2,228,785, dated January 14, 1941, and 2,348,687 and 2,348,688, both dated May 9, 1944, disclose compositions of this character which contain essentially wax as the principal ingredient. To decrease striking through or in other words penetration of the wax into the porous or pervious base sheet, a film forming agent is incorporated, such as rubber, This film forming agent renders the wax more cohesive and gel-like in character. Although these types of compositions have been employed for laminating the base sheet to waxed paper and cellophane wrappers, they offer only marginal adhesion to polyolefin, particularly polyethylene film which with the advent of this invention is now being employed as wrappers for articles, such as bread.

Furthermore, these essentially wax coating compositions present problems in their application to the base sheet by means of knurled rolls of the rotogravure type because of their stringy character when applied by hot melt application at their usual hot melt coating temperature of about 250° F. If such temperature is raised to the point where stringing is obviated, the coatings penetrate or strike into a porous base sheet. Also, their set up time becomes relatively long, i.e. they remain flowable for a relatively long time. As a result, the formation of individual discrete coating portions which should normally be formed by knurled roll application is impaired.

The instant invention has as its objects, among others, the provision of an improved label and label roll, and method of manufacturing the same, in which a flexible base sheet of material is desirably coated with an improved heat sealable coating composition for overcoming the foregoing problems; the composition being of such character as to enable the coating to be applied over separated areas of a parent label sheet so as to form pull tap portions on individual labels cut from the sheet or transversely extending areas free of the coating both of which allow individual label sections to be cut from a parent label roll without build-up of coating on cutting equipment; the composition of the coating also being such that when applied to the base sheet, the resultant coated sheet can be heat sealed to polyethylene, as well as to other materials, such as waxed paper, metal foil or cellophone. Furthermore, the characteristics of the coating enable it to be applied to the base sheet by hot melt application and by means of a knurled applicator roll of the rotogravure type to form the coating as discrete projections which obviate blocking in the label roll and also provide many advantages pointed out hereinafter.

In the drawings which illustrate knurled applicator roll application of the composition and form of labels:

Fig. 1 is a schematic side elevational view of a conventional type of hot melt coating applying apparatus, in which the knurled applicator roll of the invention is embodied;

Fig. 2 is a fragmentary plan view of a parent sheet of label material, illustrating the manner in which it is provided with cut out portions to form individual conventionally shaped labels with corner notches;

Fig. 2*a* is an isometric view of an embodiment of a label roll from which individual labels may be cut;

Fig. 3 is a plan view of the coated face of a label illustrating the coating applied thereto in a pattern arrangement providing a pull tab band;

Fig. 4 is a view similar to Fig. 3 illustrating the coating applied in a pattern providing two pull tab bands;

Fig. 5 is an enlarged fragmentary sectional view illustrating the type of tooth-like anchoring projections which results from application of the coating of the instant invention to a base sheet of material; the plane of the section being indicated by line 5—5 in Fig. 3;

Fig. 6 is a view similar to Fig. 5 illustrating such anchoring projections, as part of a continuous coating on the base sheet;

Fig. 7 is an isometric view illustrating an article, such as bread, wrapped and end sealed by a label having the laminating coating of this invention;

Fig. 8 is an enlarged fragmentary sectional view illustrating the manner in which the tooth-like anchoring projections on the base sheet penetrate a wax coating on a wax coated sheet to enable direct lamination to such sheet;

Fig. 9 is a view similar to Fig. 2*a* illustrating another embodiment of the label roll.

The heat sealable adhesive of this invention may be of any suitable type, desirably essentially resinous, which has a fast set up time, so that it will congeal quickly to a firm-solid flexible mass rendering it capable of application to a sheet in the form of discrete teeth or projections which will not materially coalesce or run together. As a result, the teeth provide irregularities which preclude blocking when a sheet of the coated material is wound in a roll. In a most advantageous embodiment of the invention, the adhesive has polyethylene as its principal agent, modified with any suitable additive compatible with polyethylene and which is capable of reducing the viscosity and melting point of the resultant composition compared to the polyethylene alone, and also of increasing tackiness of the composition in the region of its melting point but at the same time not materially decrease the set up time of the composition, namely, the time that it takes for the product to congeal to a relatively non-flowable substantially firm solid mass that will not run, thus enabling application to a base sheet by a knurled roll for producing discrete projections on the surface of the base sheet.

The composition of the advantageous embodiment should contain at least 50% by weight polyethylene of the desirable type described later, as this is the essential ingredient which provides for the quick set up time and insures secure adhesion to polyolefin film such as poly-

ethylene, and also provides desirable viscosity characteristics for hot melt application. As much as 95% by weight of this polyethylene may be employed in the composition.

The properties of the polyethylene should be such that it quickly congeals to a self-sustaining film when coated from molten state onto a base sheet, so that it will not materially penetrate or strike through a base sheet, such as paper, which is of a porous or permeable character. Also, the polyethylene should remain tacky over a relatively wide temperature range of about plus or minus 25° F. at its melting point so that it will impart good adhesion when heated to about its melting point, and which is of sufficiently low viscosity when melted so that it can be handled and applied by conventional hot melt coating equipment. Polyethylenes most suitable for the purpose are those of relatively low molecular weight in the range of about 4,000 to 6,500 (Staudinger method) which are formed by catalytic polymerization of ethylene under high pressure because such polyethylenes possess superior self-sustaining film forming properties with good adhesive characteristics and yet can be applied by hot melt application.

Polyethylenes above this desirable molecular weight range and up to about 14,000 molecular weight may be used but are not as suitable because they require extensive modification by incorporation of additives to impart the desired properties to the composition. Polyethylenes below the desirable range are generally of the type that are formed by thermal degradation of higher molecular weight ethylene polymers. Although more brittle and lower in adhesive bond, they may be modified by additives to promote flexibility and adhesion. The following table sets forth ranges in important properties of the desirable type of polyethylene:

TABLE I

Properties of polyethylene—range

Melting point	200° F. to 220° F.
Molecular weight	1,500 to 14,000
Viscosity at 300° F. (cps.)	600 to 7,000
Density	0.905 to 0.930

In the foregoing table, and in all other subsequent tables and examples unless otherwise specified, the melting point (M.P.) is determined by the minimum rate of temperature change method (A.S.T.M., D–87–42). The molecular weight (M.W.) by the Staudinger method, the viscosity (V.) in centipoises (cps.) at 300° F. by the Brookfield Synchro-lectric viscosimeter at a spindle speed of one (1) revolution per minute, and the density (D.) by any customary method for determining specific gravity. Typical polyethylenes that have been found most suitable and their properties, are about:

TABLE II

Properties of typical polyethylenes

	M.P., °F.	M.W.	D.	V., cps.
Epolene C	208	4,500–5,000	0.907	2,000
Bakelite DYLT	215	12,000	0.910	5,000
Tenite 812	215	10,000	0.910	4,000

Epolene C and Tenite 812 are manufactured by Eastman Chemical Products, Inc. of Kingsport, Tennessee, and Bakelite DYLT by Bakelite Corp. of New York, New York. Epolene C has been found to give best results because of superior adhesive and desirable viscosity characteristics, and is consequently preferred.

Various additives or combinations thereof, desirably non-waxes compatible with polyethylene are blended therewith to provide a suitable resultant composition that can be applied by the so-called hot melt method wherein the composition is maintained in molten state in a coating pan, and applied to the base sheet by applicator roll. Additives that will reduce the viscosity and melting point and increase the tackiness of the resultant composition compared to the polyethylene alone, are employed. Examples of these types of additives that impart all three of such properties are polyterpenes, rosin, rosin derivatives, polyamides and methylated hydrocarbon resins. In some instances, if increase in tackiness is more than desired, antiblocking agents, such as hydrogenated fats and oils and fatty acid amides may be incorporated in the blend. The latter additives also have the property of reducing melting point and viscosity. Certain types of additives, such as alpha-methyl styrene polymers and polybutenes are good tackifiers and may be incorporated in the blend if desired.

Although paraffin, microcrystalline and synthetic waxes will blend with polyethylene and reduce the viscosity and melting point of the blend compared to polyethylene alone, they are not desirable because they cause serious reduction in the heat seal bond strength to polyethylene film and cellophane. As little as 5% by weight wax in the formulation will cause poor seal development to polyethylene film and cellophane. Also, the resistance of waxes to oxidation is poor at the higher temperatures of 265° F. to 350° F. required for hot melt application of the essentially polyethylene blend hereof compared to lower temperatures for essentially wax compositions. This leads to objectionable color and odor development if a substantial amount of wax is in the formulation. Therefore, it is advantageous to omit wax from the formulation, but if it is employed for viscosity and melting point reducing purposes, it should not constitute more than about 2% by weight of the blend.

The amounts and varieties of particular additives compatible with the polyethylene so that they can be homogeneously blended therewith to impart the desired properties to the resultant composition, may be varied considerably as will be apparent to those skilled in the art. However, as previously mentioned, the blend should contain at least 50% by weight of the polyethylene to impart bonding strength to the composition, provide a non-penetrating coating on porous base material, provide quick set up time, and to provide for satisfactory heat seal bonding to polyethylene film or other polyethylene surfaces.

Particular additives most suitable and which have been found to produce best results are Hydrofol Glyceride T57N by Archer Daniels Midland Company, Minneapolis, Minnesta; Oronite Polybutene No. 24, by Oronite Chemical Company, San Francisco, California; Staybellite Ester No. 10 by Hercules Powder Company, Wilmington, Delaware; Piccopale No. 85, by Pennsylvania Industrial Chemical Company of Clairton, Pennsylvania; Versamid 100 by General Mills, Inc., of Minneapolis, Minnesota; Piccolyte S–115L by Pennsylvania Industrial Chemical Company; and Piccolyte S–10 also by Pennsylvania Industrial Chemical Company.

Hydrofol Glyceride T57N is composed of triglyceryl esters of fatty acids of which stearic acid is the major component. It is produced by the hydrogenation of best quality animal fat. It has a melting point in the range of 141–149° F., a maximum acid number of 0.5, a saponification number of 193–196, a maximum iodine number of 1 and a specific gravity of 0.846. It serves the purposes of an anti-blocking agent, and of reducing the viscosity and melting point of the blend compared with the polyethylene alone.

Oronite Polybutene No. 24 serves primarily as a tackifier. It is composed of polymers of polybutenes obtained by the catalytic polymerization of normal and branched chain butenes. It has a molecular weight range of 800 to 1500 and is a liquid at normal temperatures. It should be employed in relatively small amounts, not over 5.0% by weight of the blend, as it may present blocking problems if in too great a quantity.

Staybellite Ester No. 10, is a pale hard synthetic resin

consisting of glycerol esters of hydrogenated rosin. It has an acid number of 10, a melting point of 176° to 190° F., and a specific gravity of about 1.07 at 25° C. It serves as a tackifier, and viscosity and melting point reducing agent.

Piccopale No. 85 is essentially a hard hydrocarbon resin, which serves as a viscosity and melting point reducing agent, and as a tackifier. It is produced by the polymerization of unsaturates derived from the deep cracking of petroleum, and may be classed as a methylated paraffin having an average molecular weight of approximately 1100 and a melting point of 200° F.

Versamid 100 is a polyamide resin produced by condensation of dimerized and trimerized unsaturated fatty acids of vegetable oils with ethylene diamine. It is a viscosity and melting point reducing agent, as well as a tackifier. It is liquid at normal temperatures.

Piccolyte S–10 and S–115L also serve all three purposes. They are polyterpene resins derived from hydrocarbon residues of petroleum refining operation. Piccolyte S–115L has a melting point of 239° F. ±6° F., a molecular weight of 1,200, a density at 60° F. of 0.980, a refractive index at 68° F. of 1.535 and acid and saponification numbers substantially zero. With respect to Piccolyte S–10, it is similar in properties but has a much lesser melting point of about 50° F. ±6° F. Because of its relatively low melting point, it is a marked tackifier; and if employed in the composition, it should be in relatively small amounts, and desirably be used in conjunction with an additive having good anti-blocking properties.

Rosin may also be employed as an additive with good effects for the purpose of imparting tack, and lowering viscosity and melting point. However, it tends to discolor at the hot melt application temperature range of 265° F. to 350° F., and consequently is not desirable if appearance of the final product is important.

As previously mentioned, the additive agents may be employed in widely varying amounts with the essentially polyethylene blend containing at least 50% by weight polyethylene. In this connection, for hot-melt application, the polyethylene compatible additives should be incorporated with the polyethylene to impart the following properties to the resultant blend.

TABLE III

Properties of polyethylene-additive blend—range

Melting point	180° to 205° F.
Viscosity at 300° F. (cps.)	500 to 2,500

With these melting point and viscosity ranges, the heat sealable polyethylene coating blend can be applied to the base sheet by hot melt application, while the blend is maintained at the aforementioned desirable temperature of between 265° F. to 350° F. After application to the base sheet, the properties of the blend imparted thereto by the large amount of polyethylene therein, will enable it to set up under atmospheric conditions to a congealed firm but yet flexible, moisture resistant and substantially non-blocking mass (substantially non-stickable to other stacked sheets or in a roll) in less than one second. At the same time there will be substantially no penetration or striking through of the composition into a porous cellulosic base sheet, such as paper. Also, the blend can be applied by means of a knurled applicator roll without substantial coalescence after such application, to thus form discrete tooth-like anchoring projections on the base sheet which are important for reasons explained later. However, if desired, the blend may be applied as a continuous coating over the base sheet.

The 265° F. to 350° F. hot melt application temperature is desirable. If the temperature is much below 265° F., clean coating application may be impeded because of increase in coating viscosity. Should the coating composition be much above 350° F., it may become degraded by excessive heat. Also, its viscosity may be reduced to the extent that it might penetrate a porous base sheet, such as paper to such degree as to require excess coating application.

The following are examples of particular formulations in percent by weight of the substances. Example I has been found to produce best results and is preferred.

	Ex. 1	Ex. 2	Ex. 3	Ex. 4
Epolene C (polyethylene)	80.0	80.0		
Tenite 812 (polyethylene)				60.0
Bakelite DYLT (polyethylene)			55.0	
Piccolyte S–115L (polyterpene—viscosity and melting point reducer, and tackifier)	20.0		5.0	7.0
Piccolyte S–10 (polyterpene—viscosity and melting point reducer, and tackifier)			15.0	13.0
Hydrofol Glyceride T57N (hydrogenated animal fat—viscosity and melting point reducer, and anti-blocking agent)			25.0	20.0
Rosin (viscosity and melting point reducer, and tackifier)		20.0		
	100.0	100.0	100.0	100.0

In Example 2, the rosin is ordinarily wood rosin having substantially the following properties:

Melting point, ° F.	169
Acid number	166
Saponification number	172
Specific rotation, degrees	+13
Refractive index	1.5453
Density at 20° C.	1.067

It is to be noted that in Example 2, rosin is substituted in equal amount for the Piccolyte S–115L of Example 1. The resultant polyethylene rosin blend is almost as good as the composition of Example 1, but the composition of Example 1 is more desirable.

The formulations of the foregoing examples have the following approximate melting points and viscosities:

TABLE IV

Properties of particular polyethylene-additive blends

	M. P., ° F.	Viscosity, cps.
Example 1	194	1,200
Example 2	189	1,000
Example 3	185	2,000
Example 4	189	1,600

In Example 1, it is to be noted that the melting point of the resultant composition is less than that of the polyethylene and the additive incorporated therein. This is believed due to an eutectic-like effect.

With respect to all examples, the viscosity of the blend is reduced compared to the polyethylene alone, thus facilitating hot-melt knurled roll application. Furthermore, the melting point is reduced which is important when the coating is applied to a base sheet of material adapted to be laminated by heat sealing to polyethylene film. This is so because polyethylene film is relatively fragile and can be easily damaged by too high a heat sealing temperature. The melting point of polyethylene film presently widely employed for wrapping is about 225° F., and can be readily damaged if the heat sealable laminant melts at a temperature too close to 225° F. because within about 20° F. of its melting point, the film becomes soft and is subject to pin hole formations under heat seal pressure. Thus, the reduced melting point of the polyethylene laminating blend, provides a margin of safety and allows such heat sealing without impairment of the film. Desirably, for laminating to polyethylene film, the melting point of the polyethylene laminating blend should be at least 20° F. less than the melting point of the film.

The manner of blending the polyethylene with the compatible additive, is readily effected because of the character of the desirable type of polyethylene. All that need be done is to heat the components in a conventional blending tank jacketed for application of a heating fluid therein, such as hot oil, and which is provided with a mechanical mixer for mildly stirring or agitating the blend. The composition is raised to an elevated temperature which is maintained until a homogeneous solution is obtained which can be determined visually. A desirable temperature is in the range of the hot melt temperature application, namely, about 265° F. to 350° F., preferably about 325° F. At such temperature, complete blending of about 350 lbs. of material can be effected in about 4 hours. However, the temperature and time of stirring are not critical.

Referring to Fig. 1 of the drawings, the parent base sheet 2 of the flexible label material, is continuously unwound from a supply roll 3 in a conventional manner, passes over guide rolls 4 and between back-up roll 6 and knurled applicator coating roll 7 of metal, such as steel. For applying the coating in a pattern which forms uncoated transversely extending band portions on the label for a purpose described later, the back-up roll is covered with spaced apart transversely extending sections 8 of resilient covering material, such as rubber, which provide uncovered sections 8' therebetween. However, if the coating is to be applied to base sheet 2 without providing the uncoated band portions, then the resilient covering about back-up roll 6 will be continuous, as is disclosed in the aforementioned copending application, Serial No. 772,573, filed November 7, 1958.

From the back-up roll, the base sheet passes over guide roll 9 to wind up mechanism which winds the sheet into a roll 11. The direction of rotation of the rolls is indicated by the direction arrows. In the conventional manner of making end labels provided with corner notches which are widely employed for sealing the end folds of wrappers about articles, such as bread, the coated parent sheet is continuously unwound from coated roll 11 which is formed of a relatively wide parent sheet, and while being so unwound, it is punched or otherwise cut out in the usual manner to provide circular apertures or cutout portions 12 spaced apart equal distances in equally spaced apart longitudinally and horizontally extending rows, as is illustrated in Fig. 2. The thus punched sheet is next wound in another relatively wide roll which is subsequently sliced transversely to the axis of the roll all the way through by conventional cutting discs along parallel planes indicated by the broken longitudinal lines 13 in Fig. 2, to provide a plurality of individual relatively narrow end label rolls equal in width to the spacing between adjacent through cuts at 13. Figs. 2*a* and 9 illustrate such individual end label rolls, each of which has sections which are adapted to be cut from the roll for providing individual labels.

The individual end labels are formed by suitable cutting means. The location of the cuts when they are made, is indicated by the broken transversely extending lines 14*a* in Fig. 2*a*, such cuts being made through the label sheet as it is unwound from the label roll. Thus, if the parent sheet is provided with apertures 12, the individual labels are formed with notched arcuate edge corners 15, as is illustrated in Figs. 3 and 4. In this connection, in commercial operations for sealing the end folds of bread wrappers illustrated in Fig. 7, the labels are automatically cut from the sheet as it is unwound from the parent label roll, and are automatically applied and heat sealed to the wrapper end folds by well known bread wrapping and end label applying equipment, such as is disclosed in United States patents to Weida 2,349,317, dated May 23, 1944, and to Pohl 2,409,065, dated October 8, 1946.

The end labels need not be formed with the notched corners 15. They may be rectangular in shape or any other suitable shape. If the notched corners are omitted, then the formation of apertures 12 is omitted, and the narrow end label rolls may be formed directly by slicing through roll 11 after it is completely wound. As is well known in the art, the base sheet 2 for bread wrapper end labels is desirably of cellulosic sheet material, such as paper. Usually, the labels are of about 35 lbs. per ream of good grade sulphite paper.

Applicator roll 7 is desirably of the rotogravure type formed with a plurality of spaced apart grooves as is disclosed in detail in the aforementioned copending application, Serial No. 772,573, filed November 7, 1958. As is explained in such application, the grooves are formed in the periphery of roll 7 in any suitable manner such as by etching but preferably by machining; and as is illustrated by the coating pattern in Figs. 3 and 4, the grooves run obliquely and parallel from one end of the roll to the opposite end, the ends of the grooves being closed by flange portions which are not machined out of the roll. Although grooves that apply an oblique pattern are preferably employed, it is to be understood that the knurling of the roll may be of any suitable pattern. For example, the knurling may be such as to apply a grid-like criss-cross pattern to the parent label sheet or a dotted pattern. This is not particularly critical.

The grooves are of relatively small dimensions, in the order of several thousandths of an inch, to form tooth-like anchoring projections which provide irregularities on one surface of the base sheet. Because of the fast set up time of the heat sealable coating, these projections lay on the sheet without substantially penetrating the same.

The preferred type of hot melt composition from which the coating is applied to the base sheet 2, is maintained in a molten liquid mass 15*a* at a desirable temperature of about 300° F., in a conventional coating pan 16 heated in a well known manner by suitable means. A pick-up roll 17 also cooperates with knurled applicator roll 7, and continuously rotates through mass 15*a* to pick-up the material from the pan and apply it to the knurled roll. In case the labels are to bear printed matter, the uncoated surface of base sheet 2 is printed before application of the coating to the opposite surface, with desired legends, such as trademarks, special designs, or price of the object to which the label is to be attached. Such printing is indicated by the letters D in Fig. 7.

A conventional so-called doctor blade 18 cooperates with knurled applicator roll 7 and is adjustable with reference to the periphery of the roll to aid in controlling the quantity of coating applied. Applicator roll 7 is driven by any suitable means so that its periphery travels at the same speed as base sheet 2 which is about 150 ft. per minute in commercial practice.

As a result of the aforementioned characteristics of the preferred type of coating by virtue of its relatively large polyethylene content, it will not materially coalesce but will form on the base sheet tooth-like, discrete solid anchoring projections 21 which lay on the surface of the base sheet and remain substantially intact thereon without substantial penetration therein. With the doctor blade 18 in intimate wiping contact with the periphery of knurled roll 7, these projections are separated by substantially uncoated valleys 23, thus forming a discontinuous coating on the base sheet. However, a thin film 23' of the coating may be applied to the base sheet in the valleys 23 between the anchoring projections 21, by adjusting the doctor blade in suitable spaced relationship with respect to the periphery of roll.

Employing a knurled roll having grooves of the dimensions indicated in said copending application, Serial No. 772,573, filed November 7, 1958, and with doctor blade 18 in slight frictional contact with the knurled roll, the projections will average about 0.002 inch in height, about 0.012 inch in width at the base, and be spaced apart about 0.035 inch between their centers. Under a magnifying

glass, a slight running of a very minor character may be seen from the sides of the bases of anchoring projections 21. However, this running does not fill up valleys 23.

Although the set-up time of the composition to a solid mass is less than one second, it is desirable under atmospheric air drying in commercial plant operations to allow a residence time of about six seconds between the time of application of the coating to the base sheet, and the time the coated sheet is wound in roll 11. This provides a margin of safety insuring that the coating has set up to a solid that will not block in the roll. Such residence time can be materially shortened by cooling the coated base sheet by blasts of cool air before it is wound in the roll, or by running the sheet over a conventional chilled calendar roll (not shown) located between wind-up roll 11 and guide roll 9, with its uncoated face engaging the chilled roll.

The characteristics of the coating composition are such that no dusting powder, such as starch, need be applied thereto after application to the base sheet, in order to preclude blocking when it is wound in roll 11. In this connection, the knurled application, capable with the composition of the invention, is a decided advantage in minimizing blocking when the coated base sheet is wound in roll 11 because the projecting anchoring teeth 21 provide irregularities on the coated surface, with the result that in comparison to a smooth continuous coating there is considerably less surface to surface contact of the coating presented to the opposite surface of the base sheet which is free of the coating. This is especially important should the coating be applied in the valleys between the teeth 21, as illustrated in Fig. 6.

Another important advantage of the knurled application permitted by the composition, is that it reduces materially the amount required for application per unit area of the base sheet which is important when it is considered that polyethylene is relatively expensive. It is to be understood, however, that if the advantages of knurled application are not desired, the composition may be applied as a smooth coating on the base sheet in which event a smooth surfaced applicator roll would be employed instead of the knurled roll.

The amount of coating to be applied to the base sheet may vary widely depending upon the type of material to which labels subsequently formed therefrom are to be laminated by heat sealing. With discontinuous knurled roll application, the range will usually be from 3 to 12 lbs. per ream (3000 square ft.) of base sheet. For application to commercial polyethylene film, 4 to 5 lbs. of the coating per 3000 square ft. has been found to be best. For wax coated paper, 7 to 12 lbs. is preferable, and desirably 8 lbs. per 3000 square ft. For adherence to cellophane, a suitable range is 5 to 9 lbs. per 3000 square ft. and desirably 6 lbs. The reason for the lower amount when the base sheet is to be laminated to polyethylene film is that the less material to be thermoplastically fused to such film by heat sealing under pressure, the less chance there is of damaging the film which is very thin.

Referring to Figs. 1 and 3, it will be noted that in one embodiment of application of the coating, the spacing between resilient sections 8 on the back-up roll 6, is such as to leave the base sheet free of coating along relatively wide transversely extending spaced areas because the coating only becomes applied to the sheet in cooperation with the pressure effected by the resilient sections 8. The resultant label with its flexible heat sealable coating adhesively bonded thereto, will thus be uncoated along a strip 24 extending adjacent an edge 26 and between opposite edges 27 of the label. This provides an unsecured band forming a free pull tab for facilitating removal of the label after it has been heat sealed to an object. In the Fig. 4 embodiment, another free band 24*a* is similarly provided. With two pull tabs, one above the other, the label can be pulled from an object in either one of opposite directions.

In this connection, it will be noted from Fig. 7 that the wrapper 28 about bread loaf 29 is conventionally wrapped with its upper fold 31 underlying the outermost lower fold 32, and that the central region 33 of the label is heat sealed over the folds. The one pull tab modification of Fig. 3 provides a greater sealing area to the wrapper, and is hence preferred. As indicated in Fig. 7, the label is desirably adhered to the wrapper end folds with the junction line L between the pull tab 24 or 24*a* and the coated area, below the top end of the outermost fold 32. This enables ready pulling of this fold downwardly upon downward pull of the pull tab, to thus facilitate opening of the wrapper.

In addition to serving as a pull tab, the uncoated areas 24 or 24*a* provide another important advantage. In the label roll, these transversely extending uncoated areas enable the label sheet to be cut through such areas by cutting means on the bread wrapping equipment to preclude build-up of the coating thereon, thus precluding fouling of the cutting means. Such fouling which occurs because of frequent passage of a cutting knife through coated areas of the thermoplastic adhesive, otherwise necessitates stopping of the machine for cleaning of the same.

When the single pull tab modification of Fig. 3 is employed, the label sheet as it is unwound from its roll is registered with the cutting knife in the wrapping machine, so that the knife passes through each uncoated area 24 in spaced but closely adjacent relationship to the coated area on the next adjacent label section, to thus leave an uncoated area 34 of a short length at the end of each label opposite the pull tab. A suitable length of uncoated portion 34 is about ⅛ inch. This insures that the knife will not pass through the coating. In this connection, the customary size of a bread label, disregarding the notched corners, is about 2¾ inches square. A suitable pull tab length is about ⅝ inch.

It is of such advantage to avoid fouling of the cutting means as the individual label sections are cut from the label roll, that if the labels are not to be formed with pull tabs 24 or 24*a*, it is desirable to leave short uncoated transversely extending spaced apart areas on the label sheet through which the knife can pass without passing through the coating. Such areas 35 are shown in the embodiment of Fig. 9. A suitable length of areas 35 is about ¼ inch although this is not critical. In forming the individual labels, the label sheet is cut centrally of each area 35 along line 14*a*, to thus leave short uncoated ends of about ⅛ inch in length at each end of each individual label. When areas 35 are provided on the label sheet, the spacing of resilient sections 8 on back-up roll 6 are arranged in complementary spaced relationship.

As previously mentioned, the melting point of the desirable flexible heat sealable adhesive composition bonded to the label is less than the melting point of conventional commercial polyethylene film now on the market, such polyethylene film usually having a minimum melting point of about 225° F. This is important, for example, when the coated label is employed to seal the end folds of a polyethylene wrapper film employed for wrapping an object, such as bread. This is so because in the machine wrapping of such bread in a widely used type of conventional bread wrapping apparatus wherein the end label is heat sealed over the end folds of the wrappers, the label is not heated before it is applied to the end folds. Normally, the end folds are first preheated to a temperature below the melting point of the polyethylene laminating coating on the base sheet.

As a result, when the peaks of coating anchoring teeth 21 are applied to the polyethylene film, they will become sufficiently tacky because of the heat transferred thereto from the film, to adhere to such film without substantial slipping. Subsequently, when pressure and heating means embodied in the machine are applied to the end label

initially adhered to the folds, with heat applied to the label to soften the coating at about its melting point and desirably at least 20° F. less than melting point of the polyethylene film, the label will adhere firmly to the polyethylene wrapper without damaging or in other words impairing the wraper. Such adherence is enhanced by the teeth 21 which present minimum surface contact with the polyethylene film thus effecting ready fusion with the film.

The tooth adherence is also true for anchoring to the various lacquer films, such as nitrocellulose and polyvinylidine chloride (Saran) films, conventionally employed on cellophane. Furthermore, with reference to polyethylene film, metal foil and lacquer coated cellophane, even through the end folds of the wrapper may not be initially preheated, the peaks of the teeth have sufficient frictional tack at room temperature to cling to these materials (polyethylene film, metal foil and cellophane) upon application of the normal wrapping machine pressure which applies the end label to the end folds. Upon subsequent application of heat and pressure, the labels become heat sealed to the folds.

An additional important advantage of the anchoring teeth projections 21 resulting from knurled roll application of the heat sealable coating, is that they also enhance firm heat sealing directly to base sheets that are wax coated, for example, conventional wax coated paper bread wrappers, even though essentially polyethylene heat sealing compositions do not adhere as well to the wax of wax coated sheets as they do to polyethylene, lacquer coated cellophane, metal foil such as aluminum, and paper fiber. This is because under heat and pressure the teeth can readily bite through or penetrate a thin wax coating on the base sheet, so as to adhere directly to the base itself. Such effect is illustrated in Fig. 8 which illustrates a conventional paper bread wrapper 36 usually of about 25 lbs. per ream sulfite paper and having essentially wax coated surfaces 37 and 38.

When base sheet 2 with anchoring teeth 21 is heat sealed over wax coating 38, by heat and pressure, for example, by the usual means embodied in the aforementioned conventional bread wrapping equipment, the teeth will penetrate the molten wax and the peaks thereof will come into direct contact with the underlying paper 36 to which it will adhere with a tenacious bond. Even if the heat sealable composition is applied as a smooth continuous coating to the base sheet 2, adherence to porous wax coated base sheets can be effected by imparting sufficient pressure and heat to the wax to drive the wax into the sheet upon which it is coated.

With respect to heat sealing to lacquer coated cellophane and other material, such as metal foil, there is no particular problem except that the polyethylene additive incorporated in the desirable type of composition, should impart sufficient tackiness to the laminating coating at the melting point of the coating composition. From the preceding, it is seen that the laminating coating composition on the label provides the important advantage of being heat sealable to polyethylene as well as other materials.

In this respect, the preferred coating composition on the label is very tacky and viscous in the region of its melting point because of its high polyethylene content and the tackifier therein. It remains in this tacky and viscous condition at the high temperatures of the sealing plates in conventional bread wrapping equipment. Therefore, the coating has high frictional drag and shear resistance. This is so even if the composition is applied as a smooth coating on the label. Because of such properties, lateral slippage of the label with reference to the end folds of non-wax coated bread wrappers such as cellophane, metal foil or polyethylene, is minimized thereby insuring accurate positioning or centering of the end label over the end folds by the wrapping machine which applies the label to the end folds by movement thereof in a direction transverse to the plane of the end folds and while the bread is moving. The wax of wax coated wrappers, which is in heated molten state when the label is applied by the wrapping machine, creates slip but with the anchoring teeth or projections of this invention, such slippage is minimized with wax coated wrappers. During the heat sealing, the projecting anchoring teeth 21 do not coalesce under the heat and pressure, although there is some lateral flow.

Because of the non-blocking of the label in the roll which is enhanced by the projections of the coating, the label sheet can be unwound from the roll evenly and without back lashing at the relatively high speed at which the wrapping machine unwinds the label sheet from the label roll, cuts it into consecutive label sections and applies them to the end folds. This cooperates in facilitating centering of the label because if substantial sticking (blocking) should occur as the label sheet is unwound from the roll and cut, not only may tearing of the sheet occur but the individual sections would not be cut and applied evenly.

The invention has found wide application for the coating of end label sheets, to be sealed to the folded ends of bread wrappers which have heretofore been of cellophane or waxed paper. However, by virtue of the preferred type of coating composition, application to polyethylene film wrappers can be employed. Although labels of the type described are usually provided with printed matter including insignia or designs, it is to be understood that the term "label" as employed herein includes such article irrespective of whether it does or does not have such printed matter thereon.

Although the essentially polyethylene heat sealable coating of the type described is desirable for the reasons previously explained, it is apparent that the physical advantages of the toothed flexible coating desirably effected by knurled roll application, and the application of the coating on the individual label sections in the label roll in a pattern having uncoated areas for the reasons explained, are applicable to other types of heat sealable label coatings.

I claim:

1. A bread wrapper label roll of a continuous flexible paper sheet having adjacent sections adapted to be cut into individual labels for application to overlapped end folds of wrappers about bread loaves, and a heat sealable, thermoplastic coating on only one surface thereof consisting essentially of a homogeneous blend of at least 50% by weight polyethylene and the remainder essentially additive material imparting to the coating decrease in melting point and viscosity, and increase in tackiness at about its melting point, compared to such properties of the polyethylene alone, said coating being solid and flexible under atmospheric conditions and extending over the areas of said surface of the sheet which will be disposed along marginal edges of said overlapped folds when the respective label sections are positioned over said overlapped folds for heat sealing thereto by heat and pressure, the opposite surface of said sheet being free of said heat sealable coating, said coating being also in the form of discrete projections providing irregularities in the order of several thousandths of an inch in height presenting reduced area of contact with the opposite surface of said sheet in the roll compared to a smooth continuous coating in contact with said opposite surface, whereby to obviate blocking in the roll as the sheet is unwound from said roll and simultaneously cut into individual labels while cut labels are being heat sealed to such folds, each of the label sections having a cut out portion.

2. A label roll of a continuous flexible sheet having adjacent sections adapted to be cut into individual labels for application to overlapped folds of wrappers around articles, and having a heat sealable, flexible, solid thermoplastic coating on one surface thereof, said coating extending over the areas of said surface of the sheet which

will be disposed along marginal edges of said overlapped folds when the respective label sections are positioned over said overlapped folds for heat sealing the same thereto by heat and pressure, the opposite surface of said sheet being free of said heat sealable coating, said coating being in the form of discrete projections providing small irregularities in the order of several thousandths of an inch in height so as to present reduced area of contact with said opposite surface of said sheet in the roll compared to a smooth continuous coating in contact with said opposite surface, whereby to obviate blocking in the roll as the sheet is unwound and simultaneously cut into individual labels.

3. The label roll defined in claim 2, wherein said thermoplastic coating consists essentially of a homogeneous blend of at least 50% by weight of polyethylene and the balance thereof consisting essentially of additive material imparting to the coating of a decrease in melting point and viscosity, and an increase in tackiness at about its melting point compared to such properties of the polyethylene alone.

4. A label roll as defined in claim 3, wherein each of the sections of said sheet has a pull tab for removal of the label from its heat sealed position on said overlapped folds.

5. A label roll as defined in claim 2, wherein the sections of said sheet are separated by transversely extending areas on the coated surface which are also free of said coating to enable the sheet to be cut through such areas by cutting means without build-up of said coating on the cutting means.

6. A label roll as defined in claim 5, wherein said transversely extending areas are of a length sufficient to provide a pull tab on the individual labels.

7. A label roll as defined in claim 5, wherein the side edges of said transversely extending areas are notched.

8. The method of manufacturing a label roll of flexible sheet material having adjacent sections thereof adapted to be cut into individual labels for application to overlapped folds of wrappers around articles, said method comprising continuously applying to one surface of said sheet material a hot melt appliable, heat sealable, thermoplastic coating composition which is solid and flexible under atmospheric conditions, said coating composition being applied so as to extend over the areas of said surface of the sheet which will be disposed along marginal edges of said overlapped folds when label sections cut from said roll are positioned over said overlapped folds for heat sealing the same thereto by heat and pressure, said areas of said coating being applied in the form of discrete projections providing small irregularities in the order of several thousandths of an inch in height so as to present reduced area of contact with said opposite surface of said sheet in the roll compared to a smooth continuous coating in contact with said opposite surface, and continuously winding the said coated sheet into a roll after solidification of the thus applied coating.

9. The method of claim 8, wherein the said coating composition is applied to said sheet in molten state by a knurled applicator roll.

10. The method of claim 8, wherein the said coating is applied to said sheet in sections separated by transversely extending areas free of said coating, whereby the sheet can be cut through such areas by cutting means on a label applying machine for forming individual labels as the sheet is being unwound from said roll without build-up of said coating on said cutting means.

11. The method of claim 8, wherein the said flexible sheet material is a relatively wide sheet, and the unwound roll is subsequently cut into a plurality of relatively narrow individual label rolls.

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