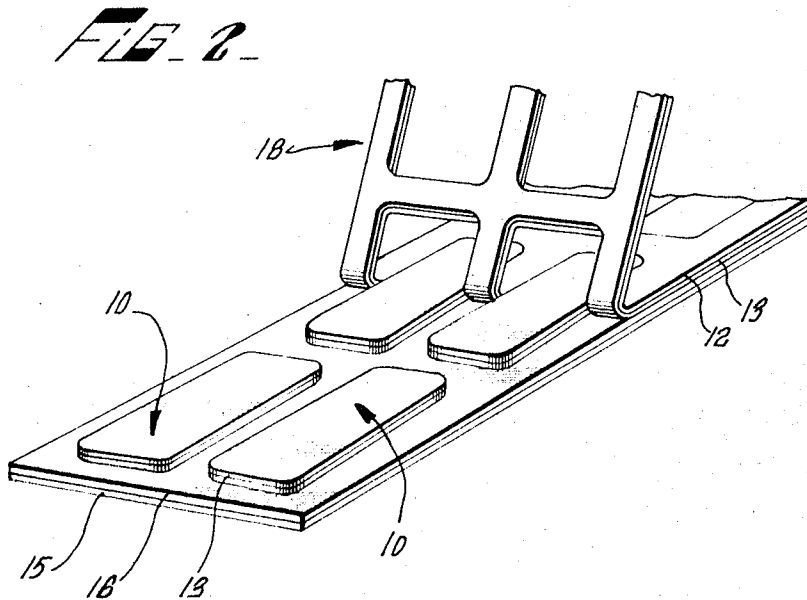
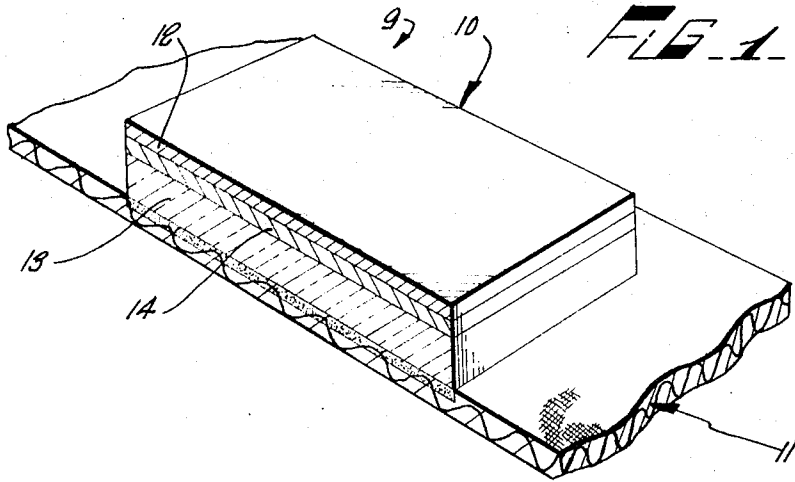


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SELF-CONTAINED, SOLVENT RETAINING PRESSURE-SENSITIVE
ADHESIVE PRODUCT
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3,464,883 SELF-CONTAINED, SOLVENT-RETAINING, PRESSURE-SENSITIVE ADHESIVE PRODUCT

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ABSTRACT OF THE DISCLOSURE

A self-adhesive product in which a layer of pressure-sensitive adhesive is disposed between a face layer and a release liner and is preferentially adhered to the face layer, and in which the adhesive has dispersed and retained therein a quantity of solvent for the adhesive in an amount which approaches but is less than that required to render the adhesive flowable laterally of the face layer and which is sufficient to maintain the adhesive in a tacky and substantially wet state.

This invention relates to adhesives. More particularly, it relates to pressure-sensitive adhesives having utility in pressure-sensitive labels, for example.

Many surfaces, especially the surfaces of fabrics, are difficult to label with existing pressure-sensitive adhesive labels because the contact area between the adhesive of the label and the surface to be labeled is small in relation to the area of the label. This is especially true with fabric because the fabric has an inherently fuzzy or rough surface. Existing pressure-sensitive adhesive labels include an adhesive which is intentionally provided in an essentially dry state and which in most instances forms a poor bond with fabrics because the adhesive cannot adequately wet the fabric when the label is applied. Existing labels are made to be applied to a wide variety of adherend surfaces, principally hard and non-absorptive surfaces, and thus existing labels uniformly include an essentially dry adhesive. Such surfaces as are provided by fabrics, therefore, normally are labeled either by heat-activated adhesive labels, by sewn-on labels, or by printing directly upon the surface. These labeling techniques, however, are not always desired either because of their high cost in the case of sewn-on labels, or particularly in sheer garments, because of their adverse effect upon the appearance of the fabric substrate in the cases of heat-activated and direct printed labels.

This invention provides a novel pressure-sensitive adhesive product. The product has great utility in conjunction with adhesive labels for use on fabrics and the like. The label bonds securely, permanently if desired, to the fabric to which it is applied without adversely affecting the appearance of the fabric. The label has a good shelf-life and is low in cost. The label may be applied by automatic labeling machinery, if desired. As shown below, however, the adhesive product provided by this invention has myriad other uses; adhesive labels for fabrics are described in detail below for the purposes of illustration and example because such an embodiment of the invention particularly demonstrates the novelty and usefulness of the invention.

Generally speaking, this invention provides a pressure-sensitive adhesive product. The adhesive product includes a face layer of sheet material. A layer of pressure-sensitive adhesive is adhered to one side of the face layer. A quantity of solvent for the adhesive is dispersed in the adhesive layer. The solvent is present in the adhesive in an amount sufficient to cause the adhesive to be in a highly tacky and basically wet state yet insufficient to cause the

adhesive to flow laterally of the face layer. A release liner is releasably adhered to the side of the adhesive layer opposite from the face layer.

The face layer may be fabricated of some sheet material bearing label indicia and thereby provide a pressure-sensitive adhesive label. The label may be applied to a fabric adherend surface by removing the release liner from the adhesive and engaging the exposed adhesive to the adherend surface. The adhesive, because of the solvent dispersed therein, is sufficiently pliable that it thoroughly wets the adjacent surface of the sorptive fabric. As the solvent is absorbed into the fabric and evaporated from the adhesive, the adhesive sets to provide a secure bond to the fabric.

The face layer may include an anchor coating to render the face layer both impervious to the solvent and its vapors and securely adherable to the adhesive. Also, the release liner may include a release coating to render the release liner both impervious to the solvent and its vapors and readily releasable from the adhesive.

The above-mentioned and other features of this invention are more fully set forth in the following detailed description of the invention, which description is presented in conjunction with the accompanying drawing, wherein:

FIG. 1 is a perspective cross-sectional elevation view of an adhesive product according to this invention fabricated as a label and applied to a layer of fabric; and

FIG. 2 is a perspective view of a step in the manufacture of the label shown in FIG. 1.

FIG. 1 shows an adhesive product 9 defining a label 10 applied to a fabric layer 11. The label, as applied to the fabric, includes a face layer 12, which may have its obverse or exposed surface printed as desired, adhered to the fabric by a layer of adhesive 13 prepared so as to be pressure sensitive. The adhesive is applied to the face layer over the entire areal extent of the reverse side of the face layer; the reverse side of the face layer is the side disposed toward the fabric. Label 10 includes an anchor coat 14 of material to which the adhesive bonds securely. The anchor coat is disposed between the face layer and the adhesive and, as a practical matter, is a portion of the face layer. Accordingly, the adhesive is securely and permanently adhered to the reverse side of the face layer.

At the time that the label is applied to fabric 11, the adhesive has uniformly dispersed therein a quantity of solvent for the adhesive. The solvent is present in the adhesive in an amount sufficient to cause the adhesive to be tacky, but the solvent is not present in an amount sufficient to give the adhesive that degree of liquidity which would allow the adhesive to flow laterally of the face layer.

Where an adhesive product according to this invention is fabricated as a label for fabrics, it is preferred that either the face layer per se or the combination of the face layer and anchor coat 14 be impervious to the solvent in the adhesive layer and to vapors of the solvent. Alternately or conjointly, the assembled label may be kept in a package fabricated of material impervious to the solvent and its vapors during the period between fabrication of the label and application of the label to a sheet of fabric. Accordingly, the tacky consistency of the adhesive is maintained during the period between fabrication of the label and the time when the label is applied to fabric layer 11. When the label is applied to the fabric layer, the adhesive wets the adjacent surface of the fabric, as shown in FIG. 1. When the solvent later evaporates from the adhesive through the fabric, and also through the face layer in the case of a label having a face layer pervious to the solvent and its vapors, a secure bond between the adhesive and the fabric is produced. The resultant bond has a strength not previously attain-

able with previously known pressure-sensitive adhesive labels.

FIG. 2 illustrates a stage in the manufacture of label 10. The label may be fabricated according to the following exemplary process which is described at this point so that the novel characteristics of the label itself may be more readily discerned.

A continuous web of release liner or backing material 15 is used as the foundation upon which the label is built. The release liner for label 10 has an obverse or upper side which preferably is both impervious to the adhesive solvent and its vapors and readily releasable from the adhesive. In the event the material from which the release liner web is fabricated does not possess both these characteristics, the upper side of the release liner web is first given a coating 16 of a release material which imparts to the web one or the other or both of these characteristics. As a practical matter, the release coating, when provided, is a portion of the release liner. After release coating 16 has dried upon the release liner proper, a film of adhesive 13 is flowed over the upper surface of the release liner across the entire extent of the release liner. The adhesive, which may or may not be tacky in its fully dried condition, is mixed with one or more compatible solvents to render the adhesive flowable prior to the time the adhesive is applied to the release liner. After the adhesive has been applied to the release liner, the adhesive is partially dried by evaporating from the adhesive a portion of the solvent dispersed in the adhesive. Complete drying of the adhesive is carefully avoided; solvent evaporation is discontinued when the adhesive has substantially the same degree of tackiness as the degree of tackiness desired at the time the label is to be applied to a particular adherend surface. Therefore, a controlled amount of solvent is retained in dispersion in the adhesive layer. The amount of solvent retained is insufficient to cause excessive oozing or bleeding when the finished label is stored in roll form. Also, the amount of solvent retained is insufficient to permit the adhesive to string-out during the die-cutting and matrix stripping steps described below.

After the adhesive has been partially dried by driving out sufficient solvent to leave the adhesive with the proper amount of solvent dispersed therein, a sheet of face layer material 12 is applied to the exposed surface of the adhesive. The face layer is applied as a strip of material having a width equal to the width of the release liner. The face layer may have its reverse surface (i.e., lower surface) pretreated, for the reason set forth above, with a coating of anchor material 14 at the time the face layer is applied to the adhesive.

It will be understood, however, that the procedure described above may be reversed without departing from the scope of this invention. The adhesive film may be applied to the reverse side of the face layer and thereafter the backing material, with or without a release coating applied thereto, as desired, may be applied to the exposed surface of the adhesive film following controlled partial drying of the adhesive to the degree of tackiness desired.

After the face layer, the solvent-containing adhesive and the backing or release liner have been laminated together, the resultant laminated strip may be wound in roll form, if desired, to await printing and die cutting. On the other hand, the laminated strip may then be passed directly to a printing press wherein selected areas of the obverse side of the face material are printed with the data which is to appear upon each finished label. The printed laminate is then introduced into a die cutting machine wherein the face layer and the adhesive layer, but not release liner 15 or release coating 16, are cut into the desired finished label shapes as shown in FIG. 2. The die cutting procedure forms a matrix 18 of scrap face coating and adhesive laminate which is stripped away from the release liner as shown in FIG. 2. The result is a plurality

of individual labels 10 carried at spaced locations by the release liner. The labels may be packaged in this form so that later, at any time desired, a label may be stripped from the release liner and applied to a suitable substrate, such as fabric 11.

The face layer may be any material desired including, by way of example rather than limitation, paper, fabric (either woven or non-woven), plastic film, metal foil, or a laminate of any of these materials. As noted above, the face layer per se may be either pervious to the solvent dispersed in adhesive 13 or to vapors of the solvent, or it may be such that the adhesive does not adhere readily to it, or it may have both of these characteristics. In such event, an anchor coating of a suitable lacquer or the like, inert to the adhesive and the solvent, is applied to the reverse side of the face layer to render the face layer impervious to the solvent, unless the finished label is to be packaged in a container impervious to the solvent and its vapors, and readily adherable to the adhesive. If desired, particularly where the face layer material is porous, the face layer may be thoroughly impregnated by the anchor coat. Further, the anchor coating, where it impregnates the face layer, may be used to condition the obverse surface of the face layer to readily receive printing.

The release liner also may be of any desired material including, again only by way of example, paper, fabric, a plastic film, or a laminate of any of these or other materials. Where the release liner is not impervious to the solvent and its vapors or is not readily releasable from the adhesive, a release coating of a suitable lacquer or the like, inert to the adhesive and the solvent, is applied at least to the obverse side of the release liner to impart either or both of these characteristics to the release liner. Where, however, the finished label is to be contained in a package impervious to the solvent and its vapors, the release liner need not be impervious.

Preferably a mixture of solvents for the adhesive is used in fabricating label 10. To provide the liquid or semi-liquid solvent-adhesive mixture which is flowed onto the release liner web, the adhesive is mixed with a solvent of low volatility and a solvent of high volatility. The more volatile solvent is driven from the adhesive after the adhesive is applied to the release liner but before the face layer is adhered to the adhesive layer. The less volatile solvent remains in the adhesive until the label is applied to an article to be labeled; thereafter, this residual solvent evaporates so that the adhesive bonds tightly to the article. The less volatile solvent may be selected for chemical reaction with, or attack of the material to be labeled, thus providing an exceptionally strong bond, as where the label is to be permanently affixed to a synthetic fabric. Regardless of the specific solvents used, they must be compatible both with each other and with the adhesive. A solvent is compatible with the adhesive when it does not react with the adhesive, or bleed out of the adhesive, or otherwise act in a manner to disturb the dispersion of the solvent in the adhesive.

The adhesive used in label 10 may or may not be a tacky, pressure-sensitive adhesive. If it is not, it is rendered pressure sensitive in the label by the residual solvent dispersed in the adhesive. The adhesive may be principally an elastomer such as, for example, natural rubber, styrene-butadiene rubber, neoprene rubber, chlorosulfonated polyethylene, a polyester or polyether urethane elastomer, butadiene-acrylonitrile rubber, butyl rubber, ethylene-propylene copolymers or vulcanizable ethylene-propylene terpolymers, stereoregulated isoprene or butadiene rubbers, or combinations of these elastomeric materials with each other or with other rubbers. Further, the adhesive may be any one or more of the above-listed elastomeric materials in combination with compatible tackifying resins, plasticizers, fillers, vulcanizing agents, accelerators or antioxidants; the nature of the additives which may be used with a given elastomeric material or

combination thereof are known in the art and form no part of this invention. For example, with a polyester resin such as "Multranil 176" distributed by Mobay Chemical Co., a suitable high volatility solvent may be acetone, methyl ethyl ketone, or ethyl acetate; a suitable low volatility solvent may be ethylene glycol monoethyl ether acetate, butyl carbitol (diethylene glycol N-butylether), or diethylene glycol ethyl ether. Alternatively, the adhesive may be an acrylic polymer or copolymer, a vinyl ether polymer or some other natural or synthetic polymer or copolymer. Suitable solvents of various volatilities are known for each of the above-mentioned materials and thus are not listed herein.

By way of example, a label 10 in accord with the foregoing has been made by coating a glassine paper release liner web with a continuous release coating of cured silicone material; the silicone coating enhances the character of the glassine paper as a barrier to solvent vapors. An acrylate ester copolymer, specifically Rohm & Haas "Acryloid K-7003," was dissolved in a mixture of methyl ethyl ketone, toluene and methyl alcohol and was coated upon the treated release liner. The adhesive was then partially dried. For this adhesive formulation the solvent content of the partially dried adhesive may be from 20% to 80%, but a solvent content of 20% to 50% is preferred. A face layer of polished cotton and polyester film laminate was then adhered to the partially dried adhesive. After the label assembly was die-cut, individual labels were applied to cotton and other fabrics and the residual solvents dispersed in the adhesive allowed to evaporate. Excellent bonds of the label face layers to the fabrics were obtained in each case. The same polymer applied after complete drying of any residual solvents therein showed very poor adhesion to each of the fabrics tested.

Another suitable label in accord with this invention may be made according to the above-described procedure using an adhesive-solvent mixture comprised of Shell Chemical Co. S-1011 butadiene-styrene rubber dissolved in hexane as a high volatility solvent and Stoddard solvent as a low volatility solvent.

The amount of solvent retained in the adhesive layer may vary depending upon the nature of the adhesive and the nature of the solvent in each case. Pressure-sensitive adhesive formulations other than those described above as examples may contain as little as 10% retained solvent. Accordingly, adhesive products according to this invention contain from 10% to 80% retained solvent in the adhesive layer of the product.

The foregoing description, for the purposes of example and illustration, relates to a label for fabrics as an embodiment of this invention. It is noted therein that the face layer and the release liner or backing of the label preferably are impervious to the adhesive solvent and to vapors of the solvent. This preference is related to the nature of the packaging provided for the finished label. Where the adhesive solvent and its vapors are sealed into the adhesive layer of the product by impervious face and backing layers, the packaging for the product may be inexpensive and need not be air-tight. In some cases, however, as shown below, it is desirable that the face layer be pervious to the solvent and its vapors; in such cases the adhesive product, following fabrication, is placed in a snug-fitting sealed package fabricated of material which is impervious to the solvent and its vapors. Any solvent vapors which may escape from the adhesive layer of the product into the package are so small in quantity as to be negligible.

Where the face layer of product 9 is impervious to the solvent and its vapors, the product can be used successfully on rough, porous surfaces and the like where the solvent can evaporate from the adhesive layer through the adherend material. Such a product can also be used successfully on rough, non-porous surfaces such as are provided by crinkle-finish paints and rough metal castings

where the solvent vapors can escape from the adhesive layer laterally of the applied product along the minute crevices and valleys in such surfaces. Also, such a product can be used on smooth, porous surfaces, such as wood and paper surfaces, where the solvent vapors are either absorbed into the adherend material or pass through the adherend. Moreover, adhesive products having solvent impervious face layers may be used on smooth, non-porous adherend surfaces when the adherend material is compatible with the solvent retained in the adhesive layer; for example, where the retained solvent is also a solvent for the adherend material, be it plastic, rubber or the like, the solvent attacks and is absorbed into the adherend material and the adhesive product is bonded to the adherend material.

If it is desired that the adhesive product be applied to a smooth solvent-resistant adherend surface, the face layer of the adhesive product is pervious to the solvent and its vapors so that the solvent may evaporate from the adhesive layer through the face layer after the product has been applied to the adherend surface.

It was also noted above in the description of label 10 that the face layer is either inherently such that adhesive 13 readily adheres to it, or is given such a characteristic by anchor coating 14. This invention also contemplates an adhesive product wherein the face layer is releasable from the adhesive layer of the product, but to a lesser extent than the release liner or backing layer 15 is releasable from the adhesive layer. In other words, this invention contemplates and encompasses an adhesive product having a face layer, backing layer, and a solvent-retaining pressure-sensitive adhesive layer sandwiched therebetween, wherein the face and backing layers are releasable from the adhesive layer, but the backing layer is more readily releasable than the face layer. Such an adhesive product is useful for providing a pressure-sensitive coating on an article to be applied to another article. For example, it may be desired to apply a block of wood to a metal surface, or vice versa. The more readily releasable backing layer is stripped from the adhesive product and applied to the desired area of the block of wood which should have a porous surface. As the adhesive is applied to the wood, the solvent retained in the adhesive layer begins to be absorbed into the wood such that the adhesion of the adhesive layer to the wood becomes greater than the adhesion of the adhesive layer to the face layer. Before the solvent is fully absorbed from the adhesive layer into the wood, the face layer is stripped away from the adhesive layer and the block of wood applied to the metal. Continued absorption of the solvent from the adhesive layer into the wood produces the desired adhesion of the wood to the metal via the adhesive layer. It will be apparent that such a product can be used to adhere other three dimensional or two dimensional articles to desired adherend surfaces; all that is required is that either the surface of the article or the adherend surface be such as to absorb the solvent from the adhesive or permit the solvent vapors to escape laterally from the adhesive layer.

The foregoing description has been presented merely by way of example to describe what is presently considered to be the best mode of practicing the invention. Workers skilled in the art to which the invention relates will readily appreciate that other materials than those specifically mentioned may be used in an adhesive product like that described, and thus the invention is not limited to the listed materials. Similarly, methods other than the method described may be used to make the novel product without departing from the scope of the invention. In short, the foregoing description is not to be considered as limiting this invention.

What is claimed is:

1. An adhesive product comprising a face layer of sheet material, a layer of pressure-sensitive adhesive adhered to one side of the face layer, the adhesive layer having dispersed and retained therein a quantity of solvent for

said adhesive in an amount approaching but less than that required to render the adhesive flowable laterally of the face layer and sufficient to maintain the adhesive in a tacky and substantially wet state, said solvent being present in said adhesive in an amount of about 10% to 80% by weight, and a release line of sheet material releasably adhered to the side of the adhesive layer opposite from the face layer.

2. An adhesive product according to claim 1 wherein the adhesive layer is securely adhered to the face layer.

3. An adhesive product according to claim 1 wherein the adhesive layer is releasably adhered to the face layer and has a greater adhesive affinity for the face layer than for the release liner so that the release liner may be stripped from the adhesive layer without causing the adhesive layer to separate from the face layer.

4. An adhesive product according to claim 1 wherein at least the side of the release liner disposed toward the adhesive layer is substantially impervious to the solvent and vapors thereof.

5. An adhesive product according to claim 1 wherein the adhesive layer is securely adhered to the face layer over substantially the entire areal extent of said one side thereof, the release liner is releasably adhered to the entire areal extent of the side of the adhesive layer opposite from the face layer, and at least the side of the release liner disposed toward the adhesive layer is impervious to the solvent and vapors thereof.

6. An adhesive product according to claim 5 wherein the solvent is present in the adhesive in an amount of about 20% to 50% by weight.

7. An adhesive label for fabrics and the like comprising a face layer of sheet material, a layer of pressure-sensitive adhesive securely adhered to the face layer over substantially the entire areal extent of one side thereof, the adhesive layer having dispersed therein a volatile solvent for said adhesive, the solvent being present in the adhesive

in a quantity sufficient to place the adhesive in a tacky and substantially wet state thereby to cause the adhesive to effectively wet a fabric to which the adhesive may ultimately be applied, such quantity being insufficient to render the adhesive flowable laterally of the face layer and such quantity being in an amount of about 10% to 80% by weight, a coating of a material substantially impervious to said solvent and vapors thereof and to which the adhesive securely adheres disposed over the one side of the face layer, a release liner engaged with the side of the adhesive layer opposite from the face layer over the entire areal extent of the adhesive layer, and a coating of a material releasably adherable to the adhesive and impervious to the solvent and its vapors carried by the side of the release liner disposed toward the adhesive layer.

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