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3,516,904

HEAT TRANSFER DECALCOMANIA FOR APPLICATION TO PLASTIC BOTTLES MADE FROM A LAMINATE OF A POLYAMIDE ADHESIVE, A PRINTED LAYER, AND A WAX LIKE HEAT RELEASE LAYER

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No Drawing. Filed Apr. 7, 1966, Ser. No. 540,855

Int. Cl. B32b 27/30, 27/34

U.S. Cl. 161-227

7 Claims

ABSTRACT OF THE DISCLOSURE

A four-layer heat transfer decalcomania label for plastic bottles is provided, carried, prior to transfer, by a paper backing. The label includes a wax-like heat-release layer, a primer and protective coating, a design print which may be of several individual layers, and an overprint adhesive layer. After transfer, a permanent label is obtained which is resistant to scraping, abrasion, weathering, and the action of solvents and detergents.

The present invention relates to a heat transfer decalcomania and, more particularly, to a heat transfer label and its method of application to a plastic container.

The art of heat transfer decalcomania is an ancient one. Thus the patent to McKerrow No. 1,030,908 discloses a heat transfer label having a paper backing, a transfer layer of resin or wax, and a design of printing and color upon the transfer layer. However, the heat transfer layers of McKerrow (note also McKerrow et al. No. 1,161,711) and those who followed, as exemplified by Rosenfeld No. 1,331,581; Hentschel No. 1,882,593; Humphner No. 2,219,071 and Von Hofe No. 2,667,003, have not been entirely successful for a number of reasons, particularly when transferred and applied to plastic containers.

In more recent years a number of other heat transfer labels systems have been devised. Thus, the Shepherd Pat. No. 2,862,832 shows a heat transfer decalcomania having only three layers and this decalcomania is indicated to be inexpensive compared with those of the prior art. It has now been found, however, that a three layer heat transfer decalcomania is not commercially satisfactory, particularly when transferred to plastic containers, such as polyethylene bottles, and used as labels thereon, which labels are subject to the action of scraping, abrasion, weathering and the action of various solvents including detergents.

The labels of the prior art have proven to be not entirely satisfactory in that they often fail to pass the simple "cellophane-tape" test for adhesion (where conventional cellophane adhesive tape such as "Scotch" tape is placed against the transferred layer and then pulled off; if the cellophane tape partially delaminates the transferred layer from its substrate, the coating or laminate has failed the test). These labels have also failed to provide adequate chemical protection against such items as common household liquid detergents.

It is therefore an object of the present invention to obviate and/or alleviate the deficiencies of the prior art, such as indicated above.

It is another object of the present invention to provide a new and improved heat transfer decalcomania particularly applicable for transfer to plastic containers for use as labels thereon.

It is another object of the present invention to provide a highly accurate, yet highly resistant label for plastic containers.

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It is another object of the present invention to provide a method of heat transferring labels.

It is another object of the present invention to provide a label which is consistent, relatively inexpensive, highly accurate and resistant to external forces.

These and other objects along with the nature and advantages of the present invention will be more apparent from the following detailed description.

In accordance with the present invention, an essentially five layer heat-transfer decalcomania label is provided having a temporary backing or carrier; a heat release layer disposed along the upper surface of the temporary backing; a primer and protective coating disposed upon the upper surface of the heat release layer; a design print which may include a number of layers disposed upon the upper surface of the primer layer; and an overprint adhesive layer.

The heat transfer decalcomania will thus be stratified as shown in Chart I.

ADHESIVE

PRINT

PRIMER

RELEASE LAYER

CARRIER

(Chart I)

Upon transfer, the label in accordance with the present invention provides lasting adhesion to the surface to which it is applied along with improved chemical and scuff resistance, as opposed to the heat transfer labels of the prior art which often fail to pass the simple "cellophane-tape" adhesion test and also fail to provide chemical protection against such items as common household liquid detergents.

The temporary backing or carrier for the present label may comprise any suitable material such as plastic film or metal foil. However, both from a standpoint of expense and ease of handling it has been found most desirable to use paper as the carrier. Such paper may be common natural kraft paper or any other type of paper. The paper carrier requires no special sizing or coating although coated or sized paper may be used if desired. One material found particularly useful is super-calendered natural kraft paper.

The heat release layer must be a wax-like material which is capable of softening or melting substantially during heat transfer so as to permit the temporary backing to separate from the remainder of the label. In addition, such material, whether it be a blend or a homogeneous material, must be capable of receiving the primer coat without having such primer sink into or be absorbed by the heat transfer material and without causing any migration, puddling or crawling of the primer on the heat release material.

While a number of materials are suitable, including various waxes described in the prior art (note above), it has been found that a low molecular weight, partially oxidized polyethylene is particularly suitable for use as the heat release layer. The low molecular weight partially oxidized polyethylene preferably has a molecular weight of between 1000 and 1800, a softening point of about 80-120° C., a penetration hardness of about 2.5-5.5, an acid number of about 10-20 and a viscosity at 125° C. of about 170-210 centipoises.

The heat release layer is preferably coated on the backing paper at the rate of about 5-7 lbs. per ream of

paper. Thus, if the carrier paper consists of 30 lb. supercalendered natural kraft paper having a thickness of about 1.7 mils, the thickness of the heat release layer will be about 0.4 mil or about $\frac{1}{4}$ of the thickness of the paper backing.

The release layer coated backing paper is then print coated with the primer and protective coating. This coating is preferably a wax-free vinyl acrylic lacquer or varnish. Such a material is easily printed over the polyethylene release layer and in addition forms a good base for the printing of the ink design.

The primer and protective coating may be applied to the release layer by the gravure process and is preferably applied in such a manner so that its printed area is larger than that of the print to follow. This layer serves two functions in that it provides a primer and foundation for the design print and prevents the inks in the design from migrating or striking into the release layer during the label formation; in addition, it provides chemical and scuff resistance for the label after it has been transferred.

The design print is coated directly on the primer coating in a manner dependent upon the exact nature of the design. Thus, the inks utilized in the design print may vary from one to six colors depending upon the label and these separate inks are generally coated or printed in separate steps. The inks used are the conventional chlorinated rubber resin type inks.

After the design print has been deposited on the primer coating, an overprint adhesive layer is applied on top of the design print. The adhesive layer comprises a polyamide and is preferably applied as a lacquer solution. The adhesive layer is applied in such a manner that its printed area is larger than that of the design print. The purpose of the adhesive layer is to provide adhesion for the label when it is transferred to the labeling surface.

The heat transfer label is utilized by bringing the overprint adhesive layer in contact with the surface to be labeled, e.g. a plastic container. While the label and the container are in contact, transfer is accomplished by applying heat and pressure, preferably to the back of the temporary carrier. Apparatus for carrying out the transfer may vary considerably from the use of a simple electric iron to the apparatus described in the Von Hofe Pat. No. 2,667,003 or to the apparatus described in the copending Bliss application Ser. No. 473,290, filed July 20, 1965, now Pat. No. 3,434,902. If desired, it is an advantage to carry out the labeling procedure described in the copending Peppler application Ser. No. 519,964 filed Jan. 11, 1966, now abandoned.

As heat and pressure are applied to the uncoated side of the temporary backing so as to press the adhesive layer against the plastic container, the heat release layer will melt or soften and the adhesive overprint will bond to the labeling surface of the container. After a short period of time the paper backing is then removed leaving the adhesive overprint, the design print, the protective coating, and a portion of the heat release layer strongly attached to the plastic container in a manner shown in Chart II.

RELEASE LAYER
PROTECTIVE LAYER
PRINT
ADHESIVE
PLASTIC CONTAINER

(Chart II)

On the transfer it is found that usually about 50% of the heat release layer will be released from the temporary backing.

As heat is applied to the paper carrier two things happen: First the wax coating begins to melt and releases itself from the paper carrier; secondly, the adhesive layer begins to soften and becomes thermoplastic. As the label

is released from the temporary carrier the adhesive coat bonds to the labeling surface.

When the transfer has been completed the permanent label comprises four layers as seen by Chart II. The adhesive coat, previously the uppermost layer in Chart I, now becomes the bottom layer through which the label is bonded to the labeling surface, e.g. the plastic surface of the container. Immediately above the adhesive is the decorative print layer. Above the print layer and affording chemical and scuff resistance thereto is the protective layer, previously the primer. A portion of the release coating becomes the uppermost layer and this serves to provide added chemical and scuff protection.

The present invention may be more clearly understood by reference to the following examples, it being understood that such examples are illustrative only and are not to be considered limiting of the invention.

EXAMPLE I

A carrier paper made of 30# white machine-glazed kraft paper (secured from Thilmany Paper Company) is coated with a wax type, partially oxidized polyethylene (Epolene E-14, Eastman Chemical Products Inc.) having a molecular weight of about 1400, a softening point of 101° C., a penetration hardness of about 3.5 and an acid number of about 14. The coating on the backing paper is applied at the rate of 10 lbs. per ream.

The coated backing paper is then print coated with a protective layer using regular varnish etch cylinder 32 microns-150 line screen—15-20 wall with a wax-free vinyl acrylic lacquer (RO-120.2, Frederick H. Levey Co., Inc.).

The design print is then printed over the vinyl acrylic layer using red and blue Parlon ink (Hercules Powder Company), a chlorinated rubber resin ink.

Over the ink, as an overprint, there is then coated an adhesive layer comprising a solution of thermoplastic polyamide resin in lacquer form.

A decalcomania, formed as above, is then passed in face-to-face contact with a polyethylene bottle, the surface of which has been treated to render it more print receptive in a conventional manner, such as by flame contact or corona discharge. Heat and pressure are applied to the temporary backing to effect pressing of adhesion layer against the polyethylene. As the heat is applied, the polyethylene layer softens sufficiently to permit removal of the temporary backing. Simultaneously the adhesive overprint bonds to the polyethylene surface of the bottle. The temporary backing is stripped from the label with about half of the release layer remaining with the temporary backing and about half remaining with the label.

After cooling, the bottles so coated are tested to determine the adherence of the label thereto. The label is found to adhere tenaciously and to be abrasive resistant and also highly resistant to chemical action.

EXAMPLE II

The procedure of Example I is carried out with the following distinctions. The carrier paper is 30# supercalendered natural kraft. The partially oxidized, low molecular weight polyethylene of the release layer has a molecular weight of about 1400, a ring and ball softening point of about 102° C., a penetration hardness of about 4.4, an acid number of about 14 and a viscosity at 125° C. of about 190 centipoises. The print layer comprises six distinct colors applied as separate layers.

Decalcomanias of the above type are found to print and to transfer in a highly satisfactory manner. The resultant products are found to be tenaciously adhered and to be highly resistant to both abrasion and chemicals.

It will be obvious to those skilled in the art that various changes may be made without departing from the scope of the invention and therefore the invention is not limited

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to what is described in the specification but only as indicated in the appended claims.

What is claimed is:

1. A heat-transfer decalcomania label for application to a plastic bottle comprising:
 - a temporary backing and carrier for said label;
 - a heat release layer disposed along the upper surface of said temporary backing, said heat release layer comprising a wax-like material of a low molecular weight polyethylene having a softening point of about 80–120° C. and adapted to melt during transfer, a penetration hardness of about 1.5 to 10 and which is capable of receiving thereon a wax-free vinyl acrylic varnish without migration, puddling or crawling;
 - a permanent primer and protective coating disposed on the upper surface of said heat release layer, said primer and protective coating comprising a wax-free vinyl acrylic varnish;
 - a permanent design print disposed on the upper surface of said primer coating, said design comprising at least one layer of decorative ink and having an area less than the area of said primer and protective layer; and
 - a permanent overprint polyamide adhesive layer disposed upon said design print and extending over an area larger than said design print, said adhesive layer comprising a polyamide resin.
2. A label in accordance with claim 1 wherein said temporary backing and carrier comprises paper.
3. A label in accordance with claim 2 wherein said paper is kraft paper of about 30 lbs./ream having a thickness of about 1.7 mils and wherein said heat release layer has a thickness of about ¼ the thickness of said paper backing.
4. A label in accordance with claim 1 wherein said heat release layer comprises partially oxidized polyethyl-

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ene having a M.W. of about 1000–1800, a penetration hardness of about 2.5–5.5, an acid number of about 10–20, and a viscosity at 125° C. of about 170–210 centipoises.

5. A label in accordance with claim 4 wherein said polyethylene heat release layer has a M.W. of about 1400, a softening point of about 100° C., an acid number of about 14 and a viscosity at 125° C. of about 190.
6. A label in accordance with claim 1 wherein said ink of said design print comprises a chlorinated rubber.
7. A plastic container having the heat bonded label of claim 1 thereon, comprising:
 - a thermoplastic wall;
 - the overprint adhesive of claim 1 adhesively bonded to the outside of said thermoplastic wall;
 - the design print of claim 1 disposed upon said adhesive;
 - the protective coating of claim 1 disposed upon said design print; and
 - a thin layer of a portion of said heat release layer of claim 1 disposed upon said protective layer.

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U.S. Cl. X.R.

156—230, 234; 161—235, 252, 253, 254, 406, 413