June 23, 1970 J. J. KLINKER, JR., ET AL 3,516,842

HEAT TRANSFER LABEL

Filed April 27, 1966

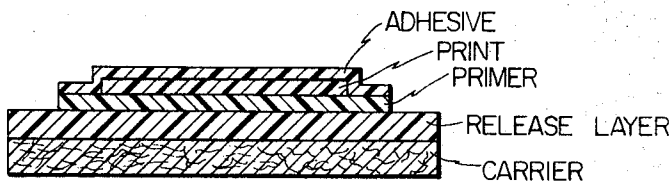


FIG. 1

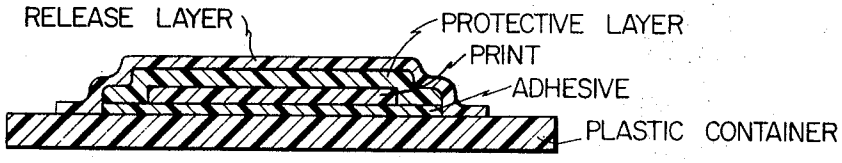


FIG. 2

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HEAT TRANSFER LABEL

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U.S. Cl. 117—3.4 12 Claims

ABSTRACT OF THE DISCLOSURE

A four-layer heat transfer decalcomania carried by a natural kraft backing and transferable to a plastic bottle is provided. The label includes a wax-like heat-release layer of a low-molecular weight polyethylene wax having a saponification number between 15 and 23, an unoxidized wax having a corona treated surface, or a blend of 20–40% ethylene-vinyl acetate copolymer and 80–60% paraffin wax having a melting point of 150–155° F.

The present invention relates to a heat transfer decalcomania and, more particularly, to a heat transfer label particularly suited for 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 the 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. In addition, certain of the prior art transfer labels use, as heat release layers, highly oxidized aliphatic waxes which are expensive to use and manufacture.

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.

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

It is another object of the present invention to provide a label which is very inexpensive in relation to the transfer labels of the prior art.

It is another object of the present invention to provide a label which includes a variety of different types of ink systems.

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 similar to that set forth in the copending application of Klinker, Ser. No. 540,855 filed Apr. 7, 1966, is provided having an inexpensive temporary backing or carrier; a more inexpensive 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 of different types of inks 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 FIG. 1.

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 whereas the heat transfer labels of the prior art 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. While the labels of the prior art have used unsized paper, results were not always satisfactory due to release layer "strike-through" unless the paper was either sized or super-calendered. However, the paper carrier of the present invention requires no special sizing or coating, although coated or sized paper may be used if desired. One material found particularly useful is an expensive machine-glazed kraft paper.

An improvement of the present invention resides in the heat release layer which must generally 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. The release layer materials used in accordance with the present invention are also not absorbed by common machine-glazed kraft paper thereby permitting such paper to be used as the carrier.

In particular, the wax-like release layer of the present invention may take the form of any one of three following general embodiments:

(I) The release layer may comprise an only slightly oxidized, low molecular weight polyethylene wax. As an example, a polyethylene wax has been developed having a M.W. of 1400, a softening point of 103° C., a penetration hardness of 4.0, an acid number of 11.0, a saponification number of only 20, and a viscosity at 250° C. of 225 centipoises. In general, the saponification number may lie between 15 and 23. Such a wax is much less

expensive than the more highly oxidized waxes and in addition, does not "strike-through" or become absorbed by common machine-glazed kraft paper.

(II) The release layer may comprise an unoxidized hard wax of common and conventional properties having a penetration hardness of about 1–10 and a softening point of about 80–120° C., which wax after deposition on the temporary carrier has been subjected to corona discharge. Such waxes include certain polyethylene waxes (e.g. "Epolene N") and some Fischer-Tropsch waxes (e.g. "FT Wax 200"), montan wax, ouricury wax, sterone wax, carnauba wax, certain paraffin waxes, certain microcrystalline waxes, etc.

(III) The release layer may comprise a blend of ethylene-vinyl acetate (EVA) copolymer (e.g. Elvax resin) and paraffin wax. The blend preferably comprises 70% paraffin wax and 30% EVA copolymer although the EVA may comprise from 20–40% of the blend. Various grades of EVA are effective, regardless of the melt index and molecular weight. The paraffin wax preferred is one with a melting point of about 150–155° F.

The heat release layer is preferably coated on the backing paper at the rate of about 6 lbs. per ream of paper. Thus, if the carrier paper consists of 30 lbs. machine-glazed kraft paper having a thickness of about 2.2 mils, the thickness of the heat release layer will be about 0.5 mils or about ¼ of the thickness of the paper backing.

The release wax 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 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 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 may be either or both the conventional nitrocellulose and polyamide type inks.

As a particular aspect of the invention, it has been found that it is particularly advantageous in that the printing is much easier to control if the two different ink types are deposited in alternate layers. This has been found to reduce the picking and drying problems since the solvent systems for the two ink types are different.

After the design print has been deposited on the primer coating, an overprint adhesive layer is then 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 the apparatus described in Bliss Pat. 3,434,-902.

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 FIG. 2.

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 transfer coating begins to melt and releases itself from the paper carrier; and second, the adhesive layer begins to soften and becomes thermoplastic to bond to the labeling surface. Then the label is released from the carrier paper.

When the transfer has been completed the label comprises four permanent layers as seen by FIG. 2. The adhesive coat, previously the uppermost layer in FIG. 1, 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 as 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 slightly oxidized (saponifiaction number of about 20) wax type polyethylene having a molecular weight of about 1400, a softening point of 103° C., a penetration hardness of about 4.0, an acid number of about 11 and a viscosity of 250° C. of 225 centipoises. The coating on the backing paper is at the rate of 6 lbs. per ream.

The wax coating backing paper is then print coated with a protective coating using regular varnish etch cylinder having a depth of 32–40 microns—150 line screen—15–20 wall with a wax-free vinyl acrylic lacquer (98E2053b, Frederick H. Levey Co., Inc.).

The design print is then printed over the vinyl acrylic layer using alternate layers of Type "C" (nitrocellulose) and Type "D" (polyamide) inks.

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 the adhesive 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 release layer comprises an un-

oxidized polyethylene wax having a molecular weight of about 1400, a ring and ball softening point of about 102° C., a penetration hardness of about 4.4 and a viscosity at 125° C. of about 190 centipoises. Immediately after deposition of the release layer, the coated carrier paper is passed beneath a conora discharge unit to provide the wax with a coated receptive surface.

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.

EXAMPLE III

The procedure of Example I is carried out except that the release layer comprises a blend of 70% paraffin wax having a melting point 150–155° F. (Sun Oil Co., Grade 5512) and 30% EVA copolymer (Du Pont, Elvax 400).

The labels are found to print and to transfer in a highly satisfactory manner. The resultant products adhere tenaciously and are resistant to both abrasions 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.

What is claimed is:

1. In a heat transfer decalcomania label comprising a temporary backing for said label, a wax-like heat-release layer on said backing having a melting point of from 80–120° C. and a penetration hardness of 1–10, a wax-free vinyl acrylic primer and protective layer on said heat-release layer, a design print on said primer layer, and a polyamide overprint adhesive layer on said print layer, the improvement wherein said heat-release layer comprises a low-molecular weight polyethylene wax having a saponification number between 15 and 23.

2. A label in accordance with claim **1** wherein said temporary backing comprises machine-glazed kraft paper.

3. A label in accordance with claim **1** wherein said print layer comprises a plurality of separate layers of alternating nitrocellulose and polyamide inks.

4. A label in accordance with claim **1** wherein said temporary backing comprises common natural kraft.

5. A label in accordance with claim **1** wherein the area of said wax-free vinyl acrylic primer and protective layer and said polyamide overprint adhesive layer are greater than the area of said intermediate design print.

6. A label in accordance with claim **1** wherein said wax-like heat-release layer has a thickness of about 0.5 mil.

7. In a heat transfer decalcomania label comprising a temporary backing for said label, a wax-like heat-release layer on said backing having a melting point of from 80–120° C. and a penetration hardness of 1–10, a wax-free vinyl acrylic primer and protective layer on said heat-release layer, a design print on said primer layer, and a polyamide overprint adhesive layer on said print layer, the imrpovement wherein said heat-release layer comprises a blend of an effective quantity of ethylene-vinyl acetate copolymer and paraffin wax.

8. A label in accordance with claim **7**, wherein said print layer comprises a plurality of separate layers of alternating nitrocellulose and polyamide inks.

9. A label in accordance with claim **7**, wherein said temporary backing comprises common natural kraft.

10. A label in accordance with claim **7**, wherein said wax-like heat-release layer has a thickness of about 0.5 mil.

11. A label in accordance with claim **7** wherein said heat-release layer comprises said blend of ethylene-vinyl acetate copolymer and paraffin including 20–40% of said copolymer and 80–60% of said paraffin wax.

12. A label in accordance with claim **11** wherein said paraffin wax has a melting point of 150–155° F.

References Cited

UNITED STATES PATENTS

2,648,097	8/1953	Kritchever.	
2,670,555	3/1954	Bostwick et al.	117—3.4 XR
2,746,877	5/1956	Matthes	117—3.4 XR
2,862,832	12/1958	Shepherd	117—15 XR
2,894,139	7/1959	Magruder et al.	117—138.8
2,935,418	5/1960	Berthold et al.	117—93.1 XR
2,970,076	1/1961	Porth	156—240 XR
3,007,829	11/1961	Akkeron	117—3.2 X
3,014,828	12/1961	Reese	156—240 X
3,060,023	10/1962	Burg et al.	117—3.4 XR
3,067,054	12/1962	Reese	117—3.4
3,245,857	4/1966	Rutledge	215—7 XR
3,355,348	11/1967	Lamar	117—76 X

FOREIGN PATENTS

715,914	9/1954	Great Britain.

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U.S. Cl. X.R.

117—45; 161—406