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R. G. SHEPHERD, JR

2,990,311

HEAT TRANSFER

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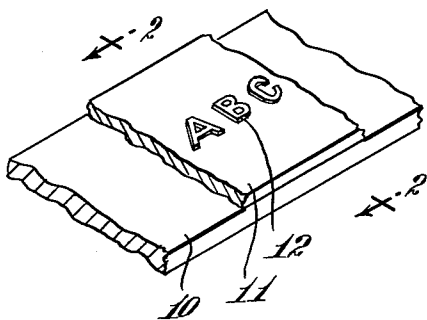


Fig. 1

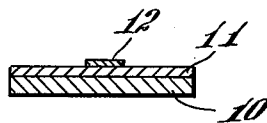


Fig. 2

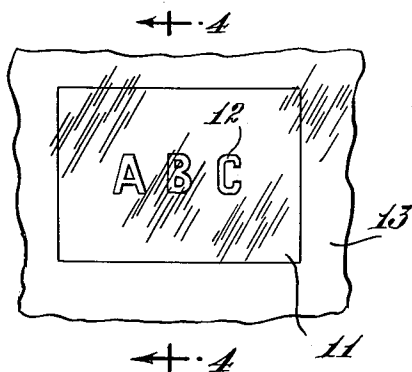


Fig. 3

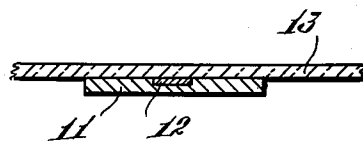


Fig. 4

Inventor
Ridley G. Shepherd Jr.
by G. P. Potts, Cushman & Grover
Attys

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HEAT TRANSFER

Ridgley G. Shepherd, Jr., Weston, Mass., assignor to
Dennison Manufacturing Company, Framingham,
Mass., a corporation of Massachusetts
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This invention relates to the art of heat transfer and particularly to heat transfers for applying labels and designs to thin, impervious films.

In many packaging operations involving packaging film such as transparent plastic sheets it is desired to apply identifying labels or decorative designs to the finished package. This has heretofore been accomplished by preprinting the film or by applying separate paper labels. Preprinting is normally accomplished by processes such as flexography, rotogravure or silk screen which require elaborate and expensive equipment. Packaging concerns normally have this printing done by outside contractors which procedure is expensive and requires the maintenance of expensive inventories. Further, in packaging foodstuffs, conventional printing cannot usually be tolerated immediately prior to packaging because of the danger of food contamination by fresh ink odors. Where a variety of goods are packaged it is often more expedient and less expensive to use unprinted film and to label by affixing separate paper labels. In many instances these paper labels do not present as attractive an appearance as the more expensive printed film. In addition such labels have a tendency to cause wrinkles and to fray and curl at the edges and to come loose.

Heat transfer compositions heretofore disclosed for marking purposes have been defective in one or more respects which has limited or prevented their use for labeling impervious film. These prior compositions can be classified under two general types: (1) those in which a heat responsive image, or image-forming coating lies directly on a backing or temporary carrier, and (2) those in which the image is printed on a heat-responsive transfer coating which lies on a backing.

Heat transfer processes falling under the first category, referred to above, include roll leaf marking whereby a heated printing plate causes a pigmented coating to transfer opposite areas where heat and pressure are applied. This process does not permit fine detailed printing, is not applicable to half tone reproduction and is expensive and unwieldy for multi-color printing. Other compositions falling under the first category include special thermoplastic ink images deposited on a carrier paper. These products are commonly used for decorating porous receiving surfaces such as textile and wood and either distort when used in conjunction with impermeable receiving surfaces or are of limited utility for fine detailed work due to the heavy ink layers required. Further, they have a tendency to only partially transfer and leave part of the image on the backing. Generally these image materials are not amenable to application on conventional printing equipment. Due to the absence of a protective transfer layer, all of the processes falling under this first category are sensitive to abrasions and cannot be used for underside labeling of films for food packaging because of the danger of contamination.

Certain of the above deficiencies have been overcome by using heat transfer processes of the second general category wherein a heat responsive transfer layer is provided. Thus finely detailed, multi-colored images can be printed on the transfer layer by conventional processes. The resulting print, which is usually thin and very delicate, is protected from distortion during transfer by the strong transfer film. The presence of the transfer film insures the complete transfer of the image. After trans-

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fer to the receiving surface the printed image is laminated between the receiving surface and the transfer layer and thus is protected from abrasion and chemical attack. Compositions of this type have found use for applying a continuous decoration to fabrics and films. However, none of the compositions heretofore disclosed have been applicable for low cost, high speed, mechanical label application since they do not exhibit the property known as "sharp breakaway," wherein only selected portions of the printed transfer layer are sharply transferred opposite area where heat and pressure are applied. This lack of sharp breakaway property in previously disclosed compositions can be attributed to the film strength of the high polymers in the transfer coating, which causes a ragged outline at the border of application of heat and pressure. This difficulty can be overcome by applying the transfer coating in discrete areas of label size but this constitutes a complicated coating process and requires careful printing registration which increases the cost materially. Sharp breakaway properties are a necessity for high speed label applications where the area of the label is less than the area of the receiving surface.

A further disadvantage of heat transfers heretofore disclosed under the second category is the relatively high activation temperature required to effect adhesion to the receiving surface. Attempts have been made to correct this by the application of separate adhesive layers over the printing as in the case of heat transfer decalcomanias. This also increases cost, requires special coating equipment and does not permit the application of last minute price and code information.

It is accordingly one object of the present invention to provide an inexpensive process and materials to apply high quality, printed transfers to film only opposite those areas where heat and moderate pressure are applied. Another object is to provide a process and materials for labeling impervious film which combines the attractiveness of preprinted film with the low cost and flexibility of separate paper labels. Still another object is to provide for the last minute addition of prices and code designations. Further objects are to provide a process and materials for labeling impervious film which requires relatively simple equipment, which permits simple machine application, which will not cause wrinkles in the film, which lowers the thermal activation temperature, which puts the label in optical contact with the transparent film and utilizes the glossy surface of the film to present an attractive appearance and to present an abrasion resistant and tamperproof label, and which provides a method for labeling and decorating flexible and extensible film.

Other objects and advantages will be apparent from the following disclosure.

According to the present invention the above objects are achieved by providing a heat transfer which comprises a backing coated with a transfer layer and a design printed on the transfer layer by ordinary commercial methods. The transfer layer comprises a uniform mixture of a crystalline wax and a synthetic, thermoplastic, film-forming, resin wherein each ingredient is present to the extent of at least 15% of their combined weights. The resins preferred for the present invention are synthetic, linear, polymeric, principally organic, thermoplastic, substantially water-insoluble, and which have a second-order transition temperature below approximately 60° C. while the preferred waxes have a melting point between about 50° C. and 110° C. and a penetrometer value (ASTM D5-52) below about 15 when tested with 100 grams weight for 5 seconds at 25° C.

In a particular aspect the compatibility of the resin and wax is controlled through selection and ratios of ingredients to give heat transfers of either the hot peel

or the cold peel type. A cold peel transfer is one wherein the transfer layer carrying a design will adhere to the receiving surface when hot but will only release and transfer by peeling away the backing after the transfer has cooled. A hot peel transfer is a transfer wherein the transfer will adhere and release from the backing only immediately after application while the transfer is still hot. In both types, resins and waxes are selected which are mutually incompatible or insoluble at temperatures below the melting temperature of the wax such that the molten wax, upon cooling, will crystallize separately and distinctly from the resin. Hot peel transfers are provided by selecting resins and waxes which are also incompatible or of low mutual solubility at temperatures above the melting point of the wax. Cold peel transfers are provided by selecting resins and waxes which are substantially incompatible at temperatures above the melting temperature of the wax. Each of these types are useful for particular purposes as hereinafter set forth.

The present invention may be better understood by reference to the accompanying drawing in which

FIG. 1 is an isometric view of the heat transfer of the present invention;

FIG. 2 is a cross-section on the line 2—2 of FIG. 1;

FIG. 3 is an isometric view of the present transfer after it has been affixed to the packaging film; and

FIG. 4 is a cross-section on the line 4—4 of FIG. 3.

In accordance with the present invention a backing sheet 10 is coated with a transfer coating 11, specially prepared as set forth below. The exposed surface of the transfer layer is then printed with the desired label or design 12. The transfer coating is printed by any of the commercial methods used for printing paper. Thus the design 12 may be of any type or color or combination thereof available in the graphic arts, yielding to great variety of designs at minimum cost on existing equipment.

The design 12 is affixed to the packaging film 13 by placing the design side of the heat transfer against the film and applying heat and moderate pressure. The backing sheet 10 is then stripped away leaving the design 12 and the transfer layer 11 firmly attached to the film. Thus the design 12 is permanently sandwiched between the film 13 and the transfer layer 11. This is advantageous since the glossy surface of the film enhances the attractiveness of the design and any food contained in the packaging film is protected by the transfer layer 11 from contamination with design materials of questionable toxicity.

The boundaries of the transfer film are defined by the outline of the application of the heat which can be accomplished by means of an iron or other heated surface. Thus the design can be of any configuration desired by the use of a suitably shaped heating surface. The area heated will transfer completely while the adjacent unheated areas will remain attached to the backing and a sharp line of separation is achieved. The heat is preferably applied in a rolling motion to preclude the formation of bubbles and air pockets. The heating surface can be applied either to the backing or to the back of the receiving surface. Where the receiving surface is thin film, lower heating temperatures are possible where the heat is applied through the back of the film.

Any suitable material may be used as the backing which serves merely as a mechanical support. Paper is preferred for economic reasons and is quite satisfactory. The backing should be relatively non-adhesive to the transfer layer to allow preferential adherence to the receiving surface. Some papers are sufficiently smooth to serve without further treatment while others may be rendered satisfactory by the use of sizings. Emulsions of waxes and low molecular weight polyethylene have been found to be particularly suitable for the present invention. Examples are set forth below as release papers A, B, C and D.

RELEASE PAPER A

Nine lbs. of Duroxon H-110, an emulsifiable hard Fischer-Tropsch wax, melting above 90° C., sold by Dura Commodities Corp., is melted and mixed with 2.4 lbs. of morpholine. The mixture is poured into 51 lbs. of boiling water and cooled with agitation. The resulting emulsion is coated on a 26 lb. (20 x 25—500) super calendered sulfite paper with an air knife coating machine to give a release paper carrying a 1 to 1.5 lbs. per ream (20 x 25—500) coating of wax.

RELEASE PAPER B

Two parts of stearic acid, 3 parts of triethanolamine and 10 parts of AC-Polyethylene-629 (Semet-Solvay Co.) an oxidized, emulsifiable grade of low molecular weight polyethylene, are melted at 95–100° C., then poured into 40 parts of boiling water and chilled with agitation. The resulting emulsion is coated on a 26 lb. (20 x 25—500) supercalendered sulfite paper under conditions to give a coating weight of 1–2 lbs. per ream (20 x 25—500).

RELEASE PAPER C

Two parts of stearic acid, 3 parts of triethanolamine, and 10 parts of Cardis 320 (Warwick Wax Co.), an oxidized, emulsifiable microcrystalline wax, are melted at 95–100° C., then poured into 40 parts of boiling water and chilled with agitation. The resulting emulsion is applied to a 26 lb. (20 x 25—500) supercalendered sulfite paper to give a coating weight of 1–2 lbs. per ream (20 x 25—500).

RELEASE PAPER D

Release paper D consists of a commercial stock comprising a 30 lb. kraft paper coated with a ½ mil layer of polyethylene. This paper can be obtained from the International Paper Co., New York, N.Y.

The transfer layer comprises a uniform mixture of a crystalline wax and a synthetic, thermoplastic, film-forming resin. The ratio may vary between 85% by weight of resin to 15% wax and 15% resin to 85% wax depending on the specific wax and resin selected. Sufficient resin should be used to provide adhesion and freedom from distortion while sufficient wax should be used to provide a lowered activation temperature and sharp breakaway at the boundary of the heat application. Breakaway properties can be visually determined while adhesion will generally be satisfactory if the label is not removed when pressure sensitive tape is adhered thereto and stripped off.

The resin and wax comprising the transfer layer should be uniformly mixed and be substantially incompatible, that is, exhibit low mutual solubility at temperatures below the melting point of the wax. Above this temperature compatibility of the resin and wax is controlled through selection of the types and ratios of ingredients to give transfers of either the "hot peel" or the "cold peel" type.

Mixtures of resin and wax possessing substantial compatibility above the melting point of the wax will exhibit "cold peel" properties. The term "cold peel" indicates that the release backing can be removed after the transfer has been accomplished and after the system has cooled. Such transfers are useful for semiautomatic application and in double labeling where the release paper can serve as a temporary top label for premium offers or coupon use.

Mixtures of wax and resin which exhibit low compatibility at temperatures above the melting point of the wax possess "hot peel" characteristics, that is, the release backing can be removed immediately after transfer while the transfer coating is still hot. Such transfers are particularly useful for high speed machine application. The breakaway properties of these transfers are believed to be due to the gelled discontinuity of the resin component due to the presence of the wax.

Compatibility properties of various resin-wax combinations can be evaluated in a number of ways. Combinations incompatible above the melting point of the wax show little tendency above such temperature to swell or solvate and are gelatinous and cloudy, while compatible combinations swell or solvate, soften, become fluid and non-gelatinous and, if unpigmented, are transparent.

Preferably the resins utilized in the transfer layer are synthetic polymers which are principally organic, linear, thermoplastic, film forming, substantially water-insoluble and which have second-order transition temperatures below 60° C. The term "thermoplastic" is used in the conventional sense of being essentially solvent-soluble, softened by heat, and to involve only a minor amount or no cross-linkage. As used herein the preferred limit of cross-linking is defined in Example V below. The term "linear" limits the preferred polymers to polymers of monofunctional addition-type monomers and difunctional condensation-type polymers and suitably compounded ester and ether derivatives of cellulose. As illustrated in the examples below, the transfer layer can incorporate emulsifying agents, plasticizers and other modifying materials without adverse effect.

Second order transition temperature is used herein to indicate the temperature range of a few degrees at which the properties of rigidity, the coefficient of thermal expansion, the heat capacity, the dielectric constant, and others, change markedly. Polymer systems are preferred for this invention which have second order transition temperatures below about 60° C. Many pure polymers having such transition temperatures above 60° C. can be rendered suitable by plasticization and copolymerization techniques which reduce the resultant transition temperature to 60° C. or below and this invention includes such modifications. Example VIII sets forth, by example, the preferred upper limit of second order transition temperatures.

Synthetic resins which are preferred for the present invention include polyvinyl acetate, polyethyl acrylate, polymethyl acrylate, polyethyl methacrylate, polypropyl methacrylate, polybutyl methacrylate, styrene-butadiene, acrylonitrile-butadiene, polychloroprene rubbers, polyvinyl butyral, ethyl cellulose, and polyvinyl acetate-vinyl stearate copolymer.

The wax component should be a material which derives its crystallinity mainly from the presence of long hydrocarbon chains and should melt over a relatively narrow range between the temperatures of about 50° C. to 110° C. Its penetrometer value (ASTM D5-52) when tested with 100 grams for 5 seconds at 25° C. should be below about 15. Waxes suitable for the present invention include beeswax, candelilla wax, carnauba wax, hydrogenated castor oil, montan wax, paraffin wax, low molecular weight polyethylene, oxidized microcrystalline wax, and hard wax or derivatives thereof obtained from the Fischer-Tropsch synthesis.

The invention may better be understood by reference to the following examples which illustrate the preparation of transfer layer coatings. Unless otherwise indicated, all parts and percentages are by weight:

Example I

An emulsion of hydrogenated castor oil, M.P. 86° C., penetration 2 (100 g., 5 sec., 25° C.) is prepared as follows: 30 parts of hydrogenated castor oil, 70 parts of water and 2 parts of Duponol D paste (E. I. du Pont de Nemours & Co.), an emulsifying agent consisting of the sodium salt of unsaturated long-chain alcohol sulfate, are brought to a boil and passed through a tightly set homogenizer. The emulsion is then chilled with agitation. The final transfer coat emulsion is prepared by blending 30 parts of the hydrogenated castor oil emulsion with 10 parts of Rhoplex B-60-K, a 46% flexible acrylic polymer emulsion sold by Rohm & Haas Co.

Example II

A transfer coat emulsion is prepared by blending 8.5 parts of Geon 251 (B. F. Goodrich Co.) a 51-55% emulsion of a hard polyvinyl chloride resin, 5 parts of Vultex PX-20-A (General Latex & Chemical Co.) a 30-35% emulsion of a copolymer of 55% butadiene and 45% acrylonitrile, 12 parts of a 33.3% ball-milled, aqueous dispersion of diphenyl phthalate stabilized with 0.5% ammonium caseinate, 18 parts of Castorwax emulsion 284.3 (Lukon, Inc.), a 30% hydrogenated castor oil emulsion and 10 parts of R.B.H. Titanium Dioxide Dispersion 223E57.

Example III

Ten parts of a 50% solids polyvinyl acetate-vinyl stearate copolymer (Air Reduction Chemical Co.) and 20 parts of a proprietary hydrogenated castor oil emulsion (Lukon Emulsion 284.3) are mixed and coated on Release Paper "A."

Example IV

Ten parts of Resyn 12KO3 a vinyl acetate copolymer (National Adhesive Div. of National Starch Products, Inc.), 10 parts of R.B.H. Titanium Dioxide Dispersion 223E57 and 30 parts of the hydrogenated castor oil emulsion described in Example I are blended and applied to Release Paper "C."

Example V

Ten parts of Vultex PX-20-A (General Latex & Chemical Co.) a 30-35% emulsion of a copolymer of 55% butadiene and 45% acrylonitrile and 30 parts of a proprietary 30% hydrogenated castor oil emulsion (Lukon Emulsion 284.3) are mixed and coated on Release Paper "A."

Example VI

Ten parts of Vinylite XYHM (Bakelite Corp.), a medium viscosity polyvinyl butyral and 30 parts of Duroxon C-60-A (Dura Commodities Corp.), a hard, oxidized Fischer-Tropsch wax are dissolved in hot butanol and applied to Release Paper "D."

Example VIII

Ten parts of dry solid polymer obtained by drying Rhoplex B-60-K emulsion (a 46% flexible acrylic polymer emulsion sold by Rohm & Haas Co., Philadelphia, Pennsylvania) and 15 parts carnauba wax, M.P. 83-86° C., penetration of 1 (100 grams, 5 seconds, 25° C.) were dissolved in 90 parts methyl ethyl ketone with warming.

Example VIII

Fifteen parts of montan wax, M.P. 70-85° C., penetration (100 g., 5 sec. 25° C.) of 9-10, and 10 parts of the dry polymer from Rhoplex B-60-K Rohm & Haas) are dissolved in 90 parts of warm methyl ethyl ketone and applied to Release Paper "D."

The above transfer coatings are applied to the release paper backing to give a dry coating weight of from 3 to 7 pounds per ream (20 x 25-600) of release paper which yields a dry coating from 0.4 to 1.0 mil in thickness. The paper can be coated with conventional paper coating machinery as an emulsion, a solvent solution, or as a hot melt. Emulsion application is generally more satisfactory and for this purpose, the components should be in a fine state of subdivision.

The adhesion of the transfer layer of the present invention is derived largely from the polymeric component which should therefore be selected to show specific adhesion for the film to be decorated. For example polyvinyl acetate, polyacrylates and Buna N rubbers possess specific adhesion to moistureproof cellophane and polybutyl methacrylate possesses adhesion for vinyl film and rubber hydrochloride.

Printing on the transfer coating can be accomplished by conventional processes such as letterpress printing, rotogravure and flexography. Most commercial inks are

satisfactory for this purpose although commercial inks used to print directly on film of the type to be transfer decorated is preferred. The following formulation of well known ingredients is given as a typical example of a letterpress ink useful for heat transfer labeling heat-sealable cellophane and cellulose acetate film:

	Lbs.
Phloxine toner -----	4.0
Lithol Red -----	3.5
Red Lake C -----	2.0
Synthetic varnish -----	40.0
Cobalt lineoleate -----	1.0

Since many commercial inks do not exhibit the desirable sharp breakway characteristics of the transfer layer, the designs should be arranged such that the edges of the heating surface register with uninked portions of the transfer layer.

As a specific procedure the following example is given. The release coating of Example I above is coated on "Release Paper A" to give a dry transfer coating of from 4 to 5 pounds per ream (20 x 25—500). The coated side is then printed with a glossy oil ink from a natural letterpress plate. After the ink has dried a section of the transfer coating carrying the ink image is transferred to heat-sealable, moistureproof cellophane by rolling the two stocks, with moderate pressure, over a hot plate at 175° C. The release paper is immediately stripped away leaving a transfer only at the area where heat and pressure were applied. This coating also exhibits specific adhesion to cellulose acetate film and kraft paper.

A particular advantage of the present invention is that it allows simple, rapid, economical machine operation. Most packaging machines handling transparent films are so constructed that the film, usually in roll form, is fed optionally past a label applicator to a wrapping or bag forming station. The transfers according to the present invention are fed to the labeling machine which would have provision for imprinting prices, code numbers, etc., on the composite sheet prior to transfer. Since transfer occurs only at the area where heat and pressure are applied, close alignment is not required.

While the primary purpose of this invention is to provide a heat transfer and a method of applying a design (including printing or art work or both) to packaging film, the heat transfers provided herein will transfer advantageously to other material and surfaces such as wood, paper, ceramics, plastics, metals, glass and the like and such use is included within its scope. It is also obvious that the transfer layer in this invention may be transparent or may be dyed or pigmented to any desired color, may be applied as a discontinuous layer only in the shape and position of the desired label to permit easy hand operation where this is desirable. Further it is obvious that, where desirable, the design can be applied to the outer surface of packaging film or other objects in which case the transfer layer will be unpigmented to permit the design to be legible therethrough.

It should be understood that the present disclosure is for the purpose of illustration only and that the invention includes all modifications and equivalents which fall within the scope of the appended claims.

I claim:

1. A heat transfer for applying a printed design to thin impervious film which comprises a backing and transfer layer thereon, said transfer layer comprising a uniform mixture of a crystalline wax and a synthetic, thermoplastic, film-forming resin wherein each ingredient is present to the extent of at least 15% of their combined weights, said film-forming resin constituting the major resinous ingredient in said layer, said resin and wax being substantially incompatible at temperatures below the melting point of the wax, said layer being receptive to printing, strongly adherent to the receiving film, non-blocking and having the property of sharp break-away at the boundary

of heat application, whereby substantially the whole of said layer within said boundary may be transferred with a sharp outline and without substantial distortion.

2. A heat transfer according to claim 1, wherein said mixture of resin and wax are substantially incompatible at temperatures both below and above the melting point of the wax.

3. A heat transfer according to claim 1 wherein the resin in the transfer layer is a synthetic, linear, polymeric material which is principally organic, thermoplastic, substantially water-insoluble and which has a second-order transition temperature below approximately 60° C.

4. A heat transfer according to claim 1 wherein the crystalline wax in the transfer layer has a melting point between about 50° C. and 110° C. and a penetrometer value below about 15 when tested with 100 grams weight for 5 seconds at 25° C.

5. A heat transfer according to claim 1 wherein the transfer layer comprises a plastic resin selected from the group of polyvinyl acetate, polyethyl acrylate, polymethyl acrylate, polyethyl methacrylate, polypropyl methacrylate, polybutyl methacrylate, styrene-butadiene, acrylonitrile-butadiene, polychloroprene rubbers, polyvinyl butyral, ethyl cellulose, and polyvinyl acetate-vinyl stearate copolymer and crystalline wax selected from the group of beeswax, candelilla wax, carnauba wax, hydrogenated castor oil, montan wax, paraffin wax, low molecular weight polyethylene, oxidized micro-crystalline wax, and hard wax and derivatives therefrom obtained from the Fischer-Tropsch synthesis.

6. A heat transfer according to claim 1 wherein the transfer layer comprises a uniform mixture of flexible acrylic resin and hydrogenated castor oil.

7. A heat transfer according to claim 1 wherein the transfer layer comprises a uniform mixture of polyvinyl acetate resin and hydrogenated castor oil.

8. A heat transfer according to claim 1 wherein the transfer layer comprises a uniform mixture of polyvinyl acetate-vinyl stearate copolymer and hydrogenated castor oil.

9. A heat transfer according to claim 1 wherein the transfer layer comprises a uniform mixture of polyvinyl butyral resin and a hard, oxidized wax derived from the Fischer-Tropsch synthesis.

10. A heat transfer according to claim 1 wherein the transfer layer comprises a uniform mixture of acrylic resin and carnauba wax.

11. A heat transfer of the cold peel type for applying a printed design to thin, impervious film which comprises a backing and a transfer layer thereon, said transfer layer comprising a uniform mixture of crystalline wax and a synthetic, thermoplastic, film-forming resin wherein each ingredient is present to the extent of at least 15% of their combined weights, said mixture of resin and wax being incompatible below the melting temperature of the wax and substantially compatible above this temperature, said layer having the property of sharp breakaway at the boundary of heat application, whereby the area of said layer within said boundary may be transferred with a sharp outline and without substantial distortion.

12. The method of applying a printed design to a receiving surface which comprises coating a backing with a transfer layer comprising a uniform mixture of a crystalline wax and a synthetic, thermoplastic, film-forming resin wherein each ingredient is present to the extent of at least 15% of their combined weights, said film-forming resin constituting the major resinous ingredient in said layer, said resin and wax being substantially incompatible at temperatures below the melting point of the wax, printing a design on the exposed surface of said transfer layer and transferring said design, together with a supporting film constituting substantially the full thickness of a predetermined area of said transfer layer which is less than the whole area of said layer, to the receiving surface by applying heat and pressure to said predetermined area

to effect transfer of that area with a sharp outline and without substantial distortion.

13. The method of applying a printed design according to claim 12, wherein said design is applied to thin impervious film.

14. A heat transfer for applying a printed design to thin-impervious film which comprises a backing having a wax-like sizing, a transfer layer on said backing, and a printed design on said transfer layer, said transfer layer comprising a uniform mixture of a crystalline wax and a synthetic, thermoplastic, film-forming resin wherein each ingredient is present to the extent of at least 15% of their combined weight, said film-forming resin constituting the major resinous ingredient in said layer, said resin and wax being substantially incompatible at temperatures below the melting point of the wax, said layer being receptive to printing, non-blocking, strongly adherent to the receiving film, and having the property of

sharp break-away at the boundary of heat application, whereby substantially the whole of said layer within said boundary may be transferred with a sharp outline and without substantial distortion.

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