

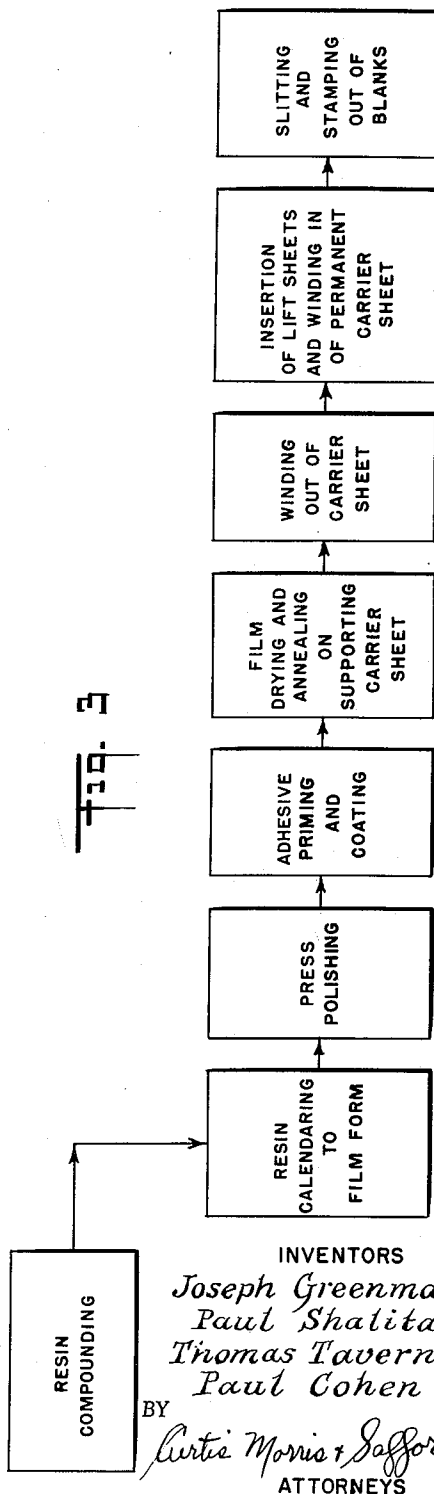
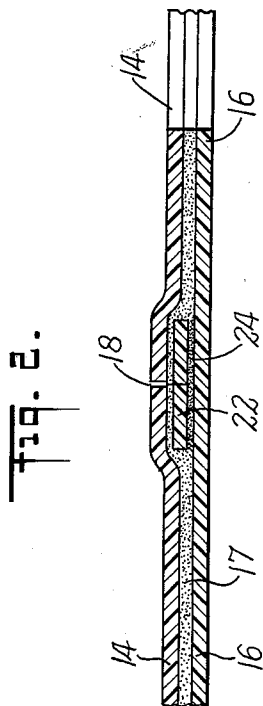
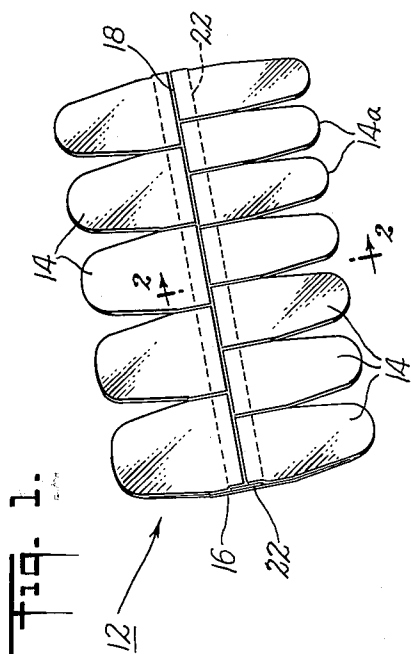
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NAIL COVERINGS AND METHODS OF MAKING SAME

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2,979,061

NAIL COVERINGS AND METHODS OF MAKING SAME

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This invention relates to plastic articles useful in providing decorative coverings for human fingernails and toenails as well as to methods of making such articles. Articles of this general nature are described in United States Patent 2,688,331 to Bogoslowsky; however as this specification proceeds it will be apparent that embodiments of the present invention are significantly different from the articles described in the said patent.

Conventionally, human nails are brush coated with lacquers, either clear or colored, dispersed in volatile solvents. However the operation of coating the nails is slow and tedious, the lacquers tend to break and crack thus exposing the fingernail; furthermore the consistency and quality of a given bottle of nail lacquer deteriorates rapidly once the bottle has been opened.

The object of the present invention is to overcome the difficulties and disadvantages of known articles and methods of coating nails and to provide an article which may be applied to nails by an inexperienced user rapidly, efficiently and at modest cost. It is a further object of the invention to provide fingernail blanks which will adhere tenaciously to the nails of the user for extended periods of time, which are non-allergenic, which are highly decorative, which are easily and simply removable and which can be made rapidly and precisely in commercially feasible operations. Other objects of the invention will be apparent as the specification proceeds.

In accordance with the invention there is provided a thin, highly flexible, abrasion resistant fingernail blank completely coated on one side with a high adhesive strength, non-allergenic, pressure-sensitive adhesive, which is highly tacky, highly cohesive, resistant both to heat and to cold flow and which has a high shear strength. The adhesive side of the blank is attached to a supporting carrier sheet which is of a type that readily releases the adhesive without adhesive offsetting or transfer and without distortion of the thin fingernail or toenail blank.

Perhaps the features of the invention can best be appreciated and described by referring to specific embodiments thereof and the accompanying drawings wherein:

Figure 1 is a perspective view of a nail blank according to the invention,

Figure 2 is a cross-sectional view taken along the line 2-2 of Figure 1, and

Figure 3 is a diagrammatic flow sheet of a method of making the blank shown in Figure 1.

More particularly in Figure 1 there is shown a nail blank assembly 12 which is comprised of a plurality of thin flexible sheets or nail members 14, the outer edges 14a of which conform to the contours of the inner portions of each of the human nails. The sheets 14 are supported by a carrier sheet 16 which is flexible, but may be less flexible than the nail blanks 14. The assembly 12 is slit or cut along the center line 18 so that one-half of the assembly provides 7 separate nails members and the other provides 5 members in accordance with the structure set forth in the co-pending application of Paul Cohen, Serial No. 672,310, filed July 16, 1957.

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Referring to Figure 2 it will be seen that slit or cut 18 in members 14 does not extend through carrier sheet 16. As shown, members 14 are coated on the underside with pressure-sensitive adhesive 17 for their entire width. Narrow lift sheets 22 of flexible material such as triacetate underlie members 14 along each side of the center slit line 18; sheets 22 are held in place on their upper sides by the pressure-sensitive adhesive layer 17 and on their lower sides by the separate, light tack pressure-sensitive adhesive 24. This arrangement, as will be pointed out below, provides blanks which are readily removable by the user and which may be manufactured in a practical and efficient manner.

Figure 3 illustrates diagrammatically a method of producing fingernail blanks according to one aspect of the invention. First, a 95%-5% vinyl chloride-polyvinyl acetate copolymer resin is mixed with suitable stabilizers, anti-oxidants, pigment dispersion aids, fillers, color pigments and plasticizers. For example, a 95-5 vinyl chloride resin is mixed in the proportions of about 100 parts by weight of resin and 35 parts by weight of a non-migrating resinous plasticizer such as the polymeric ester resin sold by Bakelite Division of Union Carbide Corporation, New York, New York, under its designation of Flexol R 2H; other similar plasticizers may also be used such as the polymeric esters of a low molecular weight glycol and a dibasic acid such as sebacic acid made and sold by Rohm and Haas, Philadelphia, Pennsylvania under its designations Paraplex G-25, G-40, G-50 or G-60. In other instances monomeric plasticizers such as tricresyl phosphate or dioctyl phthalate or the like may be substituted in part for the wholly resinous plasticizers indicated above. The resin is to be used so that the elasticity of the compounded vinyl film is between about 125% to about 300%. Thereafter the compounded resin is calendared to a sheet form or film of at least 2½ mils to 5½ mils thickness, and preferably 4½ mils thickness. The calendared film is formed so that one side is dull or matte in finish, this side later receiving the pressure-sensitive adhesive layer 17. The opposite side of the elastic film is made highly glossy by calendaring and press polishing (while the film is at elevated temperature) on polished rolls, or, alternatively is printed with a vinyl ink to achieve considerable gloss. Also, pearlescent, iridescent or design effects may be achieved by suitable printing on the film.

In press polishing the vinyl film it is first passed over heaters so that the film temperature is raised to about 160°-180° F.; next it is passed between the nip of two rolls, one being rubber coated and the other a heated, highly polished finish roll, preferably chromium plated. It is to be noted that a highly glossy film (described below) is simultaneously passed between the nip of the polishing rollers and in direct contact with the chrome surfaced roller. While smooth cellophane, polyester film or metal foils may be used, advantageously 2 mil thick cellulose acetate film, which is fairly stiff, is used. This acetate film serves to convey the vinyl film (which is quite distortable, especially when heated) and also to impart a gloss of about 90 on a standard glossometer to the vinyl film by direct contact thereto.

In accordance with a presently preferred procedure, by a separate operation polyethylene films (which are to serve as carrier sheets in the finished product) are similarly press polished so that the polyethylene carrier sheets are given a highly glossy surface on one side and a more or less matte finish on the opposite side. The glossy side of the polyethylene sheets will be the underside of the finished product and will serve to minimize adhesion between separate blanks while adjacent to one another. In this aspect of the invention the acetate car-

rier sheet may be wound out and the polyethylene film carrier wound in after press polishing. Alternatively, the acetate carrier may be used to convey the polished vinyl film through the subsequent steps of priming and coating.

It is to be noted that the compounded polyvinyl chloride-acetate film described is highly flexible, water resistant and abrasion resistant. It is also glossy and may be compounded in a wide variety of attractive colors. In some instances other films may be used such as polyethylene which, however, is somewhat deficient compared to vinyl films in that the polyethylene films have less abrasion resistance, less elastic recovery and may tend to curl and lift off a woman's fingernail. Similarly, cellulose acetate, metal foils, the polyester film known as mylar and laminates of those materials with one another or with vinyl film or cellophane may be used. In each instance such films or laminates will be stiffer and less flexible than the vinyl films, which is less desirable. However, polyethylene films and mylar films do not require plasticizing and in this respect are advantageous.

In compounding the various films for the nail sheets 14, the use of lead or arsenical compounds or similar allergenic materials is to be avoided.

Continuing now with the description of the vinyl film specified above, it is next prime coated on the dull or matte surface by use of a doctor knife blade, or squeeze or nip rolls or by transfer printing. The primer composition is applied either as an aqueous emulsion or dispersed in a solvent, the viscosity and amount of primer coated on the film being adjusted so that a wet film only $\frac{1}{4}$ to $\frac{1}{2}$ mil is coated on the film. The primer is then air dried at about 180° F. The composition of the primer is significant. The following compositions achieve excellent results and avoid offsetting with the high tack, high cohesive strength adhesives which are to be used.

Primer Example 1

	Parts by Weight	Total Solids, Percent
Butadiene-acrylonitrile elastomer, as aqueous emulsion	37.5	38
High styrene-butadiene polymer, as aqueous emulsion (e.g. 70% styrene-30% butadiene polymer)	12.5	34
Neoprene Latex (e.g. 842A of du Pont), i.e. a chloroprene from E. I. du Pont de Nemours, Wilmington, Delaware	40.0	39
Aqueous emulsion of pentaerythritol esters of hydrogenated rosin	150.0	40

The above aqueous emulsions are mixed slowly while stirring to avoid breaking of the mixed emulsions.

Primer Example 2

	Parts by Weight	Total Solids, Percent
Heptane	50	
Polyacrylate resin in mineral thinner (e.g. an acrylate resin such as Acryloid F10, a synthetic polymerized acrylic acid ester available from Rohm and Haas, Philadelphia, Pa.)	100	40

After the primed vinyl film has been dried, the underside of the composite acetate-vinyl film is coated with a pressure-sensitive adhesive release coat, referred to as a low adhesion coating, which acts to repel a pressure-sensitive adhesive. Such a low adhesion coating may be made of a copolymer of vinyl stearate and acrylic acid or of a copolymer of vinyl acetate and an unsaturated dicarboxylic acid. The low adhesion coating is applied as a solution in an organic solvent and then air dried.

The subsequent step is to apply by knife coating, or other coating methods, a highly tacky, highly cohesive, heat resistant, low cold flow, non-allergenic, rapid adher-

ence, pressure-sensitive adhesive (hereinafter referred to as a hyperpressure-sensitive adhesive) to the primed side of the vinyl film. Inasmuch as the fingernail blanks are to be decorative, adhesive oozing to the extent found in conventional pressure-sensitive adhesive tapes is quite disadvantageous; also the blanks are to withstand the user's washing her hands in hot dishwater containing strong detergents and other materials. Thus a tackiness of about 80-100 ounces per inch width (measured by a draw down adhesion test on a standard stainless steel test panel) is needed in contrast to the typical 50-60 or so ounces of tack in a conventional pressure-sensitive adhesive used on cellophane tape.

Examples of usable hyperpressure-sensitive adhesives 15 having the requisite characteristics for the objects of this invention are given below.

Adhesive Example I

Ingredient:	Parts by weight
20 Natural rubber (pale crepe)	97.1
Butadiene-styrene synthetic rubber (GR-S 1011)	97.1
Anti-oxidant	5.8
Pentaerythritol ester of hydrogenated rosin	125
25 Thermoplastic terpene resin (M.P. 85° C. app.)	92.6
Heptane	150
Hexane	60

30 The amount of solvents in the above adhesive example may be varied to yield a total solids content of approximately 25%.

Adhesive Example II

Ingredient:	Parts by weight
35 Natural rubber (pale crepe)	137
Silica reinforcing pigment	39.2
Zinc oxide pigment	27.5
Anti-oxidant	4.1
40 Pentaerythritol ester of hydrogenated rosin	168
Plasticizer (e.g. low molecular weight polyisobutylene)	14
Vulcanizing agent (e.g. sulfur containing phenolic resin such as Vultac #3, from Sharples Chemical Co., Philadelphia, Pa.)	4
45 Hexane	90
Heptane	30

50 In the preceding adhesive composition the rubber, pigment and anti-oxidant components are first dispersed in about 75 gallons of the hexane-heptane solvent; to this is added the remaining ingredients which have been pre-dispersed in a hexane-heptane solvent. The total solids content is maintained at about 36%, yielding a viscosity of between 40,000 and 50,000 centipoises.

Adhesive Example III

Ingredient:	Parts by weight
60 High molecular weight polyvinyl ethyl ether (as 25% solution in heptane)	222
Low molecular weight polyvinyl ethyl ether	16.7
Hard, brittle polymerized rosin (M.P. app. 208°-217° F.)	16.7
65 Soft diethylene glycol ester of hydrogenated rosin	5.6
Brittle, hard, low acid number (M.P. 100° C. app.) resinified alpha pinene	16.7

70 Upon completion of the adhesive coating step, the laminated sheet of acetate carrier and adhesive coated vinyl film is next dried, avoiding temperatures which will curl or wrinkle the flexible vinyl film. It is noted that a significant amount of shrinkage of the calendared film occurs in the drying steps, thus minimizing shrinkage in the final fingernail blanks and insuring freedom from

substantial distortion after cutting of the blanks or while on the user's fingers.

After completion of the adhesive coating and drying steps, the acetate carrier sheet is wound out (for re-use if desired) and lift sheets 22, bearing a mildly tacky pressure-sensitive adhesive 24 are inserted at pre-determined distances across the width of the vinyl sheet. Such lift sheets are advantageously made of a white pigmented sheet of cellulose triacetate, approximately 1 mil thick; such lift sheets facilitate the removal of an individual blank 14 by the user.

In a presently preferred procedure, 12 lift sheets each ¼" wide are adhesively attached to the vinyl film per 30" of width of the film. It is of importance that the attachment of the lift sheets be accomplished shortly before slitting because of the shrinkage of the film in the prior steps and because of the difficulty in winding up the film precisely. Otherwise stated, the film may tend to creep due to shrinkage and transport of the film, so that the lift sheets, if attached prematurely, will "walk" and not remain precisely aligned, as is needed in the subsequent slitting.

Upon attachment of the lift sheets, they are promptly slit down the center thereof and thereupon the permanent carrier sheets (preferably of press-polished polyethylene film as heretofore described) are wound into the film. Next the laminated sheet comprised of vinyl film, lift sheets and carrier sheets is slit into small size rolls (e.g. about 6"-7" wide) which are next die cut into the 12 blank pads shown in Figure 1, at which point they are ready for packaging in the form sold to the user.

It is of importance that the adhesion of the thin distortable fingernail blank to the permanent release sheet be comparatively low. As noted above the hyperpressure-sensitive adhesives used exhibit tackiness to standard stainless steel panels of the order of 80 ounces per inch. At the same time the vinyl film, as applied to the user's fingernails is a thin, elastic film with minimum internal stresses so that creep or curl on the fingernails is avoided. In removing the blanks from the release or carrier sheet, it is important that the act of removal not distort the film so that undue stresses are set up in the film. To accomplish this we have found that the adhesion of the hyperpressure-sensitive adhesives to the permanent carrier sheet 16 is to be less than 25 ounces per inch and preferably less than 15 ounces per inch.

In another form of the invention, a flexible vinyl film is used which however is processed differently from the embodiment described above. In this procedure, a high molecular weight polyvinyl chloride-acetate resin is dispersed in an organosol containing about 20-40% methyl isobutyl ketone or other volatile solvent for vinyl resins. To the organosol are added plasticizers, color pigments, stabilizers and anti-oxidants similar in kind and quantity to those used in making the calendared film described above. The organosol is then flowed onto a carrier sheet adapted for forming the organosol into a cast vinyl film and then conveying the cast film through the subsequent operations.

The carrier sheet used with organosols differs from that used in making calendared film. Preferably there is used a dense, glossy surfaced paper such as 55 to 90 pound machine finished or glazed kraft paper, although plastic sheets and the like may be used provided the surfaces thereof are sufficiently glossy to impart to the vinyl film the required lustre. Such carrier sheet is first processed on each side to perform separate functions. To one side of the carrier sheet there is applied a vinyl release coating which is to impart lustre to the film and also to permit its removal, without substantial distortion, when the film is ultimately removed from the carrier. The opposite side of the carrier sheet is coated with a pressure-sensitive adhesive release coat, of the type described below.

The adhesive release coating applied to the carrier

sheet is comprised of a combination of a tough thermosetting resin, an alkyd resin to facilitate the continuity (or film forming ability) of the coating and wax-like materials which are repellent to pressure-sensitive adhesives—all dissolved in suitable solvents. Excellent results have been attained by the use of a composition containing approximately 15% waxy amides derived from fatty acid such as Armid C and Armid 8 from Armour and Co., Chicago, Illinois, which are essentially derived from C₁₀ and C₉ fatty acids respectively, 12½% alkyd resin, 11½% thermosetting urea-formaldehyde resin, ½% n-butyl phosphoric acid and the balance a mixed solvent of isopropanol and methyl isobutyl ketone (there being about 7 parts isopropanol to 1 part of ketone).

The organosol is cast onto the vinyl release coating side of the coated carrier sheet and the solvent evaporated from the organosol so that a dried vinyl film of about 4½ mils thickness is formed. Thereupon the vinyl film on its carrier is coated first with a primer as described above, dried and then adhesive coated with a hyperpressure-sensitive adhesive in accordance with the foregoing examples.

After drying of the adhesive coating, the paper carrier sheet is wound out, lift sheets attached as described in the use of calendared film (i.e. with mild pressure-sensitive adhesives of less than 10 ounces tack), initial slitting conducted and the permanent carrier sheet wound in. As indicated heretofore the permanent carrier sheet may be polyethylene, glassine or parchment paper or paper coated with silicone, alkyd urea, and the like which will enable the fingernail blank to be removed from the permanent carrier sheet with minimum distortion and wherein adhesive to carrier adherence is less than 25 ounces per inch. After application of the permanent carrier sheet, the composite sheet is die cut into the form shown in Figure 1.

Having now particularly described embodiments of our invention what is claimed is:

1. A fingernail blank which comprises a first sheet of thin flexible extensible sheet of a copolymer of vinyl chloride and vinyl acetate highly plasticized with a non-exuding plasticizer, said first sheet being pre-cut to form a plurality of members adapted to conform to the curvature of the cuticles of human fingernails, each of said members having adhesively attached to the underside of its innermost edge a lift sheet, said first sheet being highly glossy on one side thereof, the opposite side of said first sheet being covered with a hyperpressure-sensitive adhesive composition, the tackiness of said adhesive to a standard panel being at least 80 ounces per inch, said first sheet being supported by a relatively stiffer carrier release sheet in direct contact with said adhesive, the adherence of said adhesive to said carrier sheet being less than 25 ounces per inch.

2. A fingernail blank according to claim 1 wherein said hyperpressure-sensitive adhesive is comprised of a tackifying resin and a tackifiable rubbery elastomer, the ratio of resin to elastomer being between about 1.1:1 and 1.3 to 1.

3. A fingernail blank according to claim 1 wherein an adhesive primer coating lies between said first sheet and said adhesive, said primer having a high specific attraction to hydrophobic films.

4. A fingernail blank according to claim 3 wherein said primer is comprised of tackifiable synthetic rubbery elastomers mixed with a tackifying esterified resin, the ratio of said resin to said elastomers being about 2:1.

5. A fingernail blank according to claim 3 wherein said primer is comprised of a polyacrylate resin.

6. The method of making a fingernail blank which comprises supporting a thin flexible glossy film on a relatively stiffer carrier sheet, thereafter successively applying and drying an adhesive priming coat and a hyperpressure-sensitive adhesive coating to one side of said

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film, removing said carrier sheet, next applying lift sheets at pre-determined spaced intervals to the adhesive coated side of said film, next applying a permanent carrier sheet to said adhesive coated side of said film, the side of said permanent carrier sheet in contact with said adhesive being weakly attractive to said adhesive, and thereafter slitting and cutting said composite sheet and film to provide a plurality of members adapted to conform to the curvature of the cuticle portions of fingernails.

7. The method of making a fingernail blank which comprises casting a polyvinyl organosol onto a glossy supporting sheet, said glossy supporting sheet being coated on the side thereof in contact with said organosol with a vinyl release coating and being coated on the opposite side with a pressure-sensitive adhesive release coating, next drying said organosol to produce a thin flexible extensible vinyl film on said supporting sheet, next applying an adhesive primer to said film, drying said primer, applying a hyperpressure-sensitive adhesive to the primed side of said film, drying said adhesive, next winding out said supporting sheet and winding in a permanent carrier sheet, the side of said permanent carrier in contact with said adhesive being weakly attractive to said adhesive, and thereafter slitting and cutting said composite sheet and film to provide a plurality of members adapted to conform to the curvature of the cuticle portions of fingernails.

8. A fingernail blank which comprises a first sheet of thin flexible material having a glossy surface on one side and being coated on the opposite side with a hyperpressure-sensitive adhesive, said sheet being pre-cut to provide a plurality of members adapted to be applied to human fingernails, each of said members having adhesively attached to the underside of its innermost edge a lift sheet, and a carrier release sheet contacting the adhesive coated side of the first sheet, said hyperpressure-sensitive adhesive having a tackiness to a standard panel of at least 80 ounces per inch, and an adherence to said carrier sheet of less than 25 ounces per inch.

9. A fingernail blank which comprises a first sheet of thin flexible extensible resilient material having a glossy

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surface on one side and being coated on the opposite side with a hyperpressure-sensitive adhesive, said sheet being pre-cut to provide a plurality of members adapted to be applied to human fingernails, each of said members having adhesively attached to the underside of its innermost edge a lift sheet having on the underside thereof a mildly tacky pressure-sensitive adhesive, and a carrier release sheet supporting said first sheet, said hyperpressure-sensitive adhesive on said first sheet and said mildly tacky pressure-sensitive adhesive on said lift sheet being in contact with said carrier release sheet, said hyperpressure-sensitive adhesive having a tackiness to a standard panel of at least 80 ounces per inch, and an adherence to said carrier release sheet of less than 25 ounces per inch.

10. A fingernail blank according to claim 9 wherein said resilient material is comprised of a plasticized copolymer of vinyl chloride and vinyl acetate.

11. A fingernail blank according to claim 9 wherein said carrier release sheet is comprised of polyethylene.

12. The method according to claim 6 with the additional step of coating said lift sheets on the underside thereof in contact with the carrier sheet with a mildly tacky pressure-sensitive adhesive before applying said lift sheets at predetermined spaced intervals to the adhesive coated side of said film.

13. Method according to claim 6 with the additional steps of calendaring said film by heating and then press polishing said film and, while hot, pressure contacting said film to a glassy carrier sheet such as cellulose acetate.

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