

- [54] **EMBOSSING TAPE**
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[73] Assignee: **Dymo Industries, Inc.**, San Francisco, Calif.
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[21] Appl. No.: **410,724**

3,542,630 11/1970 Pfiffner 161/6
3,808,180 4/1974 Owens 260/885

FOREIGN PATENTS OR APPLICATIONS

2,092,389 1/1972 France

Primary Examiner—George F. Lesmes
Assistant Examiner—Ellis P. Robinson

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428/520; 428/908; 428/913
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[58] **Field of Search**..... 161/DIG. 3, 406 T, 413,
161/254, 256, 406, 116, 165, 6; 156/220,
209; 40/2 R, 136; 264/293; 260/885

[56] **References Cited**

UNITED STATES PATENTS

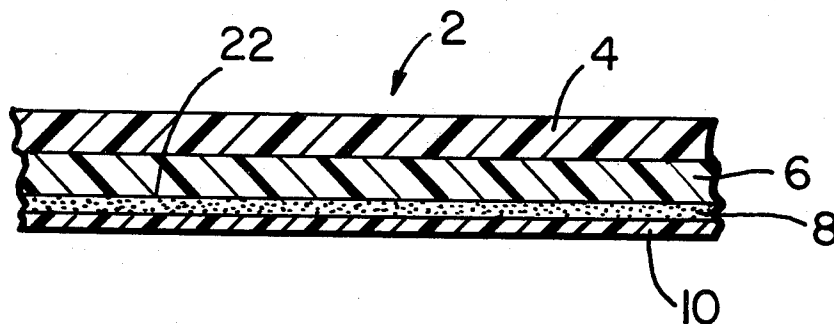
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| 2,925,625 | 2/1960 | Souza..... | 161/125 |
| 3,036,945 | 5/1962 | Souza..... | 161/406 |
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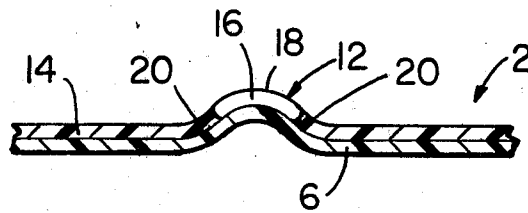
[57] **ABSTRACT**

An embossing machine tape is provided employing a film of a stress whitening, substantially transparent elastomer-modified methyl methacrylate polymer, normally employed in combination with a non-stress whitening, opaque, normally colored, polymer film backing. In usual applications, an adhesive coating is applied to the backing and protected by a releasable liner.

The stress whitening film provides sharply delineated symbols without fracture, when embossed, and substantially free of ghosts in the usual embodiment.

16 Claims, 5 Drawing Figures

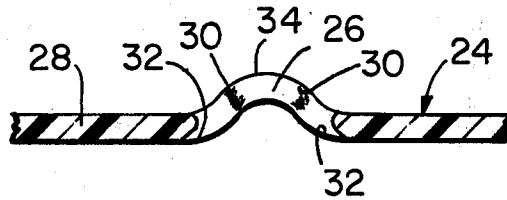




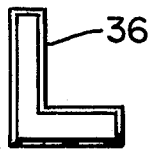
FIG_1



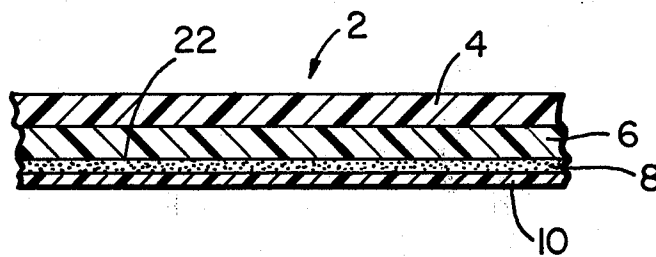
FIG_2



FIG_3
(PRIOR ART)



FIG_4
(PRIOR ART)



FIG_5

EMBOSSING TAPE

BACKGROUND OF THE INVENTION

1. Field of the Invention

Embossing tapes find wide use. In the fabrication of many embossing tapes, a stress whitening film is employed with a darkened background. By stress whitening it is intended to mean the characteristic of a material that changes color and/or opacity, when subjected to cold flow. In stress whitening materials, the yield point occurs at a low degree of elongation.

In embossing, it is desirable that the alpha-numeric symbol becomes entirely opaque and white, so as to clearly stand out and be legible. The embossed symbol should not fracture which destroys legibility and creates an unacceptable appearance, should be free of ghosting, which is unsightly and affects legibility, and be able to retain the sharp characteristics for long periods of time under varying conditions.

To some degree, the stress whitening and fracturing of the symbols is associated. The stressing of the polymeric film by cold flow elongation, results in changes in the physical characteristics of the polymer, which makes the film susceptible to fracture. It is desirable to find an embossing tape which provides a high degree of stress whitening or opacity, while being substantially free of fracturing on embossing. Also, any film used for an embossing tape should be easily processed and fabricated, readily adhere to a base film, and be stable or stabilizable to heat and light, so as to retain its characteristics for long periods of time.

2. Description of the Prior Art

U.S. Pat. Nos. 2,925,625; 2,996,822; 3,036,945 and 3,542,630 disclose a variety of embossing sheets and tapes.

U.S. Pat. Nos. 2,599,359; 3,073,734; 3,447,997; 3,562,088; 3,600,268 and 3,623,944 disclose a variety of film laminates having a variety of functions, particularly as adhesive tapes.

SUMMARY OF THE INVENTION

Novel embossable plastic assemblies are provided having a thin film of a stress whitening, substantially transparent and haze free elastomer-modified poly(methyl methacrylate) adhered to a non-stress whitening, opaque polymeric backing. Either the backing is colored, or a pigmented film is introduced behind the backing away from the stress whitening film. Normally, an adhesive coating is then applied to the backing and protected by a releasable liner.

The resulting film provides sharply defined alpha-numeric symbols, substantially free or free of ghosting, without rupture upon embossing. Furthermore, the film is stable for long periods of time without substantial loss of the stress whitening, despite normal variations in temperature.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an enlarged side elevational view, in section, through an embossed section in a tape constructed in accordance with the present invention;

FIG. 2 is a plan view of a letter embossed into a tape constructed in accordance with the present invention;

FIGS. 3 and 4 are similar to FIGS. 1 and 2, but illustrate the construction of prior art tapes and the appearance of a letter, together with a ghost image, embossed onto a prior art tape; and,

FIG. 5 is an enlarged side elevational view, in section, through a composite multilayered tape constructed in accordance with the present invention.

DESCRIPTION OF THE SPECIFIC EMBODIMENTS

The composite assembly of this invention comprises a stress whitening film, optionally a pigmented layer, if the backing is clear or white, a backing layer, preferably pigmented, an adhesive coating and a protective strip. The assembly can be in large sheets, tapes of from about one-fourth to three-fourths inch in width, and the like. The assembly can vary widely in thickness generally being at least about 8 mils in thickness and usually not exceeding 50 mils in thickness, more usually being in the range of about 8 to 20 mils in thickness. The particular thickness is a function of the embossing die with which the tape or film is to be used.

The base or stress whitening sheet will normally be of from about 2 to 6 mils in thickness, more usually in the range of about 3 to 4 mils in thickness. The tensile elongation of the film material when tested in accordance with ASTM D-638 (0.25 in. specimen, 0.2 inches per minute) will have an elongation at break of at least about 25 percent, more usually at least about 40 percent and generally not exceeding about 80 percent, more usually not exceeding about 70 percent. The Izod Impact Strength (ASTM D-256) notched for a one-eighth inch specimen at 25°C will usually be in excess of 1.0 ft.lb/inch of notch, usually in excess of 1.5 and usually not exceeding about 2.1. Haze (ASTM D-1003) will generally be less than 10 percent for a 0.125 inch thick specimen.

The polymer has a major amount of a methyl methacrylate polymer and a minor but sufficient amount of an elastomeric interpolymers, usually at least 10 weight percent, and generally not exceeding 40 weight percent of the total composition, usually from 15 to 35 weight percent of the total composition.

The methyl methacrylate polymer may have from about 0 to 20 monomer percent of another monomer, usually an alkyl acrylate wherein the alkyl group is of from 1 to 6 carbon atoms, more usually of from 2 to 5 carbon atoms. The polymers will usually have a viscosity average molecular weight in the range of about 75,000 to about 250,000, more usually of about 100,000 to 200,000. The methyl methacrylate polymer may be bonded to the elastomer modifier or the elastomer modifier may be a mixture with the methyl methacrylate polymer.

An elastomer modifier is provided for combination with the methacrylate polymer. The polymers may be cross linked or mechanically mixed. The elastomer modifier is conveniently an acrylate polymer having one or more of other monomers. Usually, the acrylate will be present in at least about 50 monomer percent and normally not exceeding about 70 monomer percent. The acrylate is an alkyl acrylate of from 1 to 6 carbon atoms, more usually of from 1 to 4 carbon atoms. Small amounts, generally from about 0.1 to 2 monomer percent are added of cross linking monomers that is, monomers which have two active non-conjugated (with each other) double bonds. Illustrative cross linking monomers include alkylene diacrylates, allyl methacrylate, and the like. The remainder of the monomers will be derived from aromatic addition monomers, such as styrene, alkyl methacrylates (alkyl of from 1 to 4 carbon atoms) and hydrophilic addition

monomers, such as hydroxyalkyl, alkoxyalkyl, or alkylthiooxyalkyl (alkyl of from 2 to 4 carbon atoms) acrylates and methacrylates, vinyl pyrrolidone, acrylonitrile, and the like. Of particular interest are the hydroxyalkyl methacrylates and acrylates. The individual monomers will normally be present in from 0.1 to 15 monomer percent, with styrene present in from about 5 to 15 monomer percent and the other monomers in from about 0.1 to 5 monomer percent.

The above polymers are illustrated in French Patent No. 71/07305, filed Dec. 27, 1971 French Pat. No. 2,092,389. Elastomer modified methacrylates are commercially available from Rohm and Haas Co., West Philadelphia, Pa., under the trade designation DR-42 and from American Cyanamid Co., New York, N.Y., under the trade designation XT-375.

In accordance with this invention, the base film is normally and preferably adhered to a rigid plastic backing. Conveniently, the plastic backing can be any of a wide variety of suitable plastics to which the methacrylate polymer readily adheres, which are reasonably stable to light and heat, have a similar coefficient of expansion to the methacrylate polymer, and provide the desired degree of mechanical strength, while still being embossable, so as to retain the desired structure after being embossed with a die. Among the various polymers which may be used are such addition polymers as polyvinyl chloride, copolymers of vinyl chloride and vinylidene chloride, copolymers of vinyl chloride and vinyl acetate, polypropylene, and the like. The backing will commonly be of a thickness of about 2 to 6 mils, usually 2 to 4 mils.

If desired, a colored coating may be introduced behind the backing where the backing is transparent. The coating will vary from a fraction of a mil to 1 mil in thickness and can be applied according to conventional means, such as spraying, brushing, or the like. The coating provides a colored background which is aesthetically pleasing, and enhances the legibility and clarity of the embossed symbol. Conveniently, a paint binder such as Union Carbide's VYHH may be employed. Preferably, and alternatively, the backing is colored with one of a wide variety of dyes and pigments, particularly those providing red, brown, green or blue coloration. The dye may be a soluble or insoluble dye as described in U.S. Pat. No. 2,925,625, column 4, the disclosure of which is incorporated herein by reference.

The base and backing may be joined together by having the two compositions coextruded as sheets and calendered, by laminating, or other techniques well known in the art.

In a preferred embodiment, the base and backing are annealed at a temperature at or above 200°F, after the joining of the two films.

To the exposed surface of the backing, an adhesive layer is applied by conventional means. Various adhesives may be used, such as those described in U.S. Pat. No. 2,953,475 and U.S. Pat. No. 3,036,945. See particularly column 3 of the latter.

Finally, a protective layer is placed over the adhesive layer. The protective layer may be any of a wide variety of easily removable films, such as a metal film, e.g. aluminum, a plastic film, e.g. polyethylene, fabric, e.g. celulosic, or the like. The thickness of the protective layer will be at least about 2 mils, generally not exceeding

about 10 mils, and usually in the range of about 4 to 8 mils.

Turning now to consideration of the drawings. Referring to FIGS. 1, 2 and 5, embossing tape 2 constructed in accordance with the present invention comprises a clear transparent or translucent methacrylate base 4, backing 6 adhered or affixed to the base, an adhesive coating 8 and a protective strip 10, that can be peeled off the adhesive to expose the latter for adhering the tape to a support surface. (For the purpose of this specification and the claims, the terms "clear," "transparent" and "translucent" are used interchangeably, and the term "transparent" is intended to include the others). The base 4 is constructed of an elastomer modified methacrylate. Backing 6 is a non-stress whitening rigid plastic, which is pigmented unless a colored coating is provided at the back of the backing. The base and backing are affixed to each other by a bonding agent, heat sealing, coextrusion, and the like.

The adhesive layer 8 is coated onto the exposed backing and protected by protective strip 10.

The tape is provided of a thickness and width in relation to the embossing machine to which it is intended. It enters the embossing machine longitudinally and letters, symbols and the like are sequentially embossed on the tape at spaced intervals. By deforming the tape, by raising tape portions or sections 12 above the flat remainder of the tape, as illustrated in FIG. 1, the raised section is stressed beyond the yield point of the stress whitening methyl methacrylate film. A stress whitened area 16 extends a relatively short distance to either side of an imaginary central line of raised section 12, that terminates well short of the flat tape remainder 14.

Maximum stresses in the base appear in the vicinity of its convex exterior curvature 18. Substantially no stress whitening is experienced in the area of the concave exterior surfaces 20 of the base. This lesser stressed area can result in stress whitening, creating a ghosting or halo effect, in embossing tapes which do not follow the teaching of this invention. In the subject embossing tape, the stress whitened area is limited to the immediate vicinity of the imaginary center of raised section 12, thus leading to a sharply defined, stress whitened symbol, such as the letter "L" illustrated in FIG. 2.

As an alternative to pigmenting the backing a coating of an ink or paint 22 may be placed away from the base 4 on the backing 6. A letter embossed on the tape 2 has a background, color and appearance supplied by the paint 22 and stress whitening solely from the base 4.

Referring briefly to FIGS. 3 and 4, for purposes of illustration, there is shown an embossing tape constructed in accordance with the prior art. Such prior art tape comprises a layer 24 of the stress whitening material such as polyvinyl chloride, a suitable adhesive and a protective strip (not shown in the drawings). Upon embossing of this prior art tape, a stress whitened area 26 is formed which extends from an imaginary center line of the raised section to a flat remainder 28 of the tape. As compared to the tape of the present invention, the stress whitened area extends substantially further away from the imaginary center line. In the transitional area 30, between concave and convex tape portions 32 and 34 respectively, only limited stress whitening takes place, leaving dark areas 30. The stress whitening which occurs at the concave portion 32 creates an unsightly and undesirable ghost or halo 36. Consequently,

a letter, such as letter "L" as shown in FIG. 4, embossed on prior art tape, has a peripheral secondary or ghost image 36, which distracts from its appearance.

In a letter embossed on tape constructed in accordance with the subject invention, such ghost images do not form, because the stress whitened area 16 terminates at about the transition between the convex and concave surface portions of the raised section and because the lower portion of the tape (which is the portion that stress whitens the furthest away from the center line in the prior art tape) does not stress whiten at all.

Although normally the base 4 is transparent, so that the colored backing can be viewed through the base and provide the desired background color of the tape, in some situations it may be desirable to color the base 4. Any coloring should be consistent with the coloring of the backing, and should not be detrimental to the stress whitening characteristic of the base.

In accordance with the subject invention, larger letters can be achieved with greater stroke width, without letter fracture, and clarity and legibility is enhanced by the absence of ghosting. The white resulting is a sharper, clearer white than previously attained with earlier tapes.

The following examples are offered by way of illustration and not by way of limitation.

EXAMPLE I

An 0.004 inch thick base was constructed from Rohm and Haas DR-42 elastomer-modified-poly(methyl methacrylate). An 0.002 inch layer of a pigmented, non-stress whitening rigid vinyl (PVC) backing was affixed to the base. The backing was adhesive coated and the adhesive was protected by an 0.006 inch polyethylene release liner.

The thus constructed tape, when embossed, showed sharp embossing outlines free of ghost images.

EXAMPLE II

A backing constructed of an 0.004 inch non-stress whitening rigid vinyl was affixed to the same base as the one used in Example I. The resulting tape showed clear, sharply defined embossings free of ghost images.

EXAMPLE III

An 0.004 inch thick backing of pigmented Marbon's Cyclocac CG-ABS compound was affixed to the same base as was used in Example I. As in Example I, embossings on the tape were clear, sharply defined and free of ghost images.

EXAMPLE IV

An 0.004 inch thick backing constructed of pigmented Dow Chemical Styron 470 high impact polystyrene resin was affixed to the same base as was used in Example I. Embossings on the tape were again clear, sharply defined and without ghost images.

EXAMPLE V

A base constructed of an 0.004 inch thick UV-Stabilized American Cyanamid XT-375 elastomer modified poly(methyl methacrylate) was affixed to an 0.002 inch thick pigmented layer of rigid vinyl which, in turn, received an adhesive coat and a polyethylene release liner. Embossings on this tape were again clear, sharply defined, and without ghost images.

EXAMPLE VI

The American Cyanamid XT-375 base was combined with the same backings as was the Rohm and Haas DR-42 liner. In addition, both the Rohm and Haas DR-42 and the American Cyanamid XT-375 bases were combined with the various liners listed in Examples I-IV but a coat of paint was applied to the side of the backing attached to the base and no pigmentation was used in the backing. In all instances, the embossings on the tape were clear, sharply defined and free of ghost images.

In accordance with this invention, novel embossing tapes are provided which provide excellent stability for long periods of time to temperatures and light which are encountered in storage and use. When exposed to weathering under severe conditions, the tape was found to retain the desirable embossing characteristics for long periods of time. The embossing tapes provide clear, sharply defined characters undistorted by ghosting and without letter fracture. In addition, the stress whitening obtained is very opaque and bright, so as to provide enhanced clarity and legibility, further enhancing the desired characteristics of the embossing tape.

Although the foregoing invention has been described in some detail by way of illustration and example for purposes of clarity of understanding, it will be obvious that certain changes and modifications may be practiced within the scope of the appended claims.

What is claimed is:

1. An embossable sheet material comprising a rigid non-stress whitening plastic backing film and a base sheet of at least about 2mils in thickness of a stress-whitening elastomer modified poly(methyl methacrylate), having a tensile elongation of from about 25 to 80 percent of elongation at break and wherein said elastomeric modifier is bonded or mixed with said poly(methyl methacrylate) and said elastomeric modifier is an acrylate polymer having at least about 50 monomer percent of an alkyl acrylate, and said alkyl group is of from about 1 to 6 carbon atoms.

2. A sheet material according to claim 1, including a backing adhered to said base sheet of a non-stress whitening rigid plastic material of a thickness of from about 2 to 6 mils.

3. A sheet material according to claim 2, having an adhesive layer adhered to the exposed surface of said backing and a protective layer.

4. A sheet material according to claim 2, wherein said base sheet is transparent and said backing is opaque and pigmented.

5. A sheet material according to claim 2, wherein said backing is comprised of polyvinyl chloride.

6. An embossing tape for use in machines of the type impressing onto the tape alpha-numeric symbols comprising:

a transparent stress-whitening elastomer modified poly(methyl methacrylate) film of from about 2 to 6 mils thickness, having a tensile elongation at break of from about 25 to 80 percent said elastomeric modifier is an acrylate polymer having at least about 50 monomer percent of an alkyl acrylate, and said alkyl group is of from 1 to 6 carbon atoms, a rigid non-stress whitening plastic film affixed to said base;

an adhesive coating affixed to the exposed side of said rigid plastic film; and

- a protective film adhered to said adhesive coating.
7. A tape according to claim 6, wherein said rigid plastic material is polyvinyl chloride.
8. A tape according to claim 6, wherein said rigid plastic material is pigmented and is opaque.
9. A tape according to claim 6 wherein the total thickness of said tape is from 8 to 20 mils.
10. An embossing tape for use in machines of the type impressing onto the tape alpha-numeric symbols comprising:
- a transparent stress-whitening elastomer modified poly(methyl methacrylate) having an acrylate polymer having at least about 50 monomer percent of an alkyl acrylate, and said alkyl group is of from about 1 to 6 carbon atoms as said elastomer modifier, and having a tensile elongation at break of from 25 to 80 percent;
 - a backing film of a non-stress whitening rigid plastic;

- an adhesive coating on the exposed side of said coating; and
- a protective film adhered to said adhesive.
11. A tape according to claim 10 having a total thickness of from about 6 to 20 mils.
12. A tape according to claim 10, wherein said backing is polyvinyl chloride.
13. A tape according to claim 10, wherein said backing is polypropylene.
14. A tape according to claim 10, wherein said acrylate polymer is cross linked to said poly(methyl methacrylate).
15. A sheet material according to claim 2, having a pigmented coating on said backing.
16. A tape according to claim 6, having a pigmented coating on said rigid plastic film.

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