United States Patent

[11] 3,628,977

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[54] **MULTILAYER TAPE FOR COATING INTAGLIO DEPRESSIONS AND PROCESS FOR USING SAME**
10 Claims, 4 Drawing Figs.

[52] **U.S. Cl.** ..... **117/11,** 101/401.1, 117/36.3, 117/36.4, 117/76 F, 117/138.8 F
[51] **Int. Cl.** **B32b 27/08,** B41c 7/02
[50] **Field of Search** ..... 117/76 F, 36.4, 36.1, 36.3, 3, 11, 3.1; 101/32, 369, 401.1; 161/DIG. 3, 406, 400

[56] **References Cited**

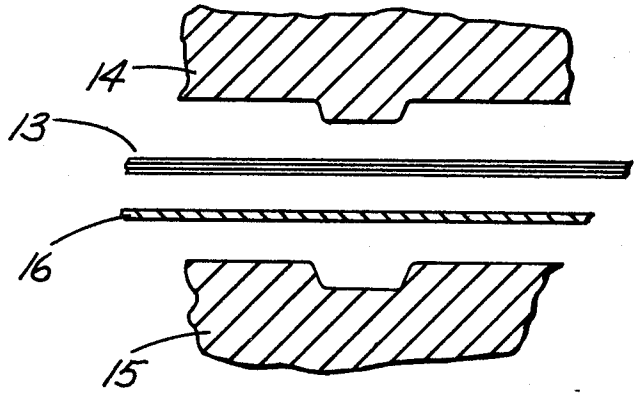
UNITED STATES PATENTS

3,037,879	6/1962	Newman et al.	117/36.1
3,245,344	4/1966	Owen	117/36.1 X
3,301,703	1/1967	Owen	117/36.1 X
3,306,718	2/1967	Chapin	117/76 F
3,481,761	12/1969	Newman et al.	117/36.4

Primary Examiner—William D. Martin
Assistant Examiner—Ralph Husack
Attorneys—Russell L. Root and Ray S. Pyle

ABSTRACT: An improved multilayer tape is provided for coating or cavity tipping the intaglio depressions of a printing plate or the like as they are formed as from a punch and die embossing operation. The sandwich tape construction combines the best properties of strength, hardness, elasticity, resistance to heat and rupture, and the like, by judiciously combining different resins as layers, each resinous layer furnishing certain of the desirable properties to a degree desired while, however, inherently lacking others. The tape as an overall, complete unit satisfactorily meets all physical demands during use.

The carrier layer has a tensile strength of at least 10,000 p.s.i., the intermediate layer is a polyolefin having a tensile strength less than 10,000 p.s.i. and the outer layer is a fragmentable organic resin matrix containing a coloring pigment.



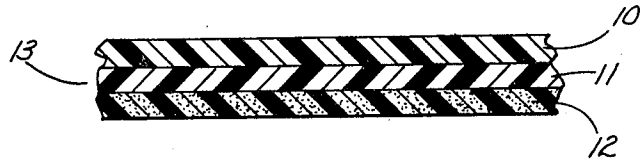


Fig. 1

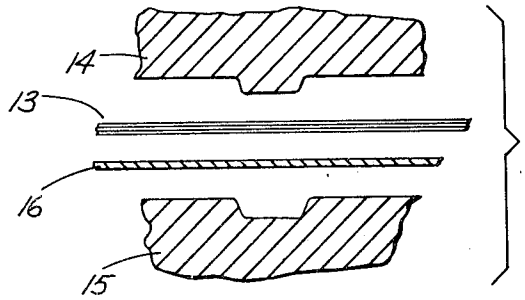


Fig. 2

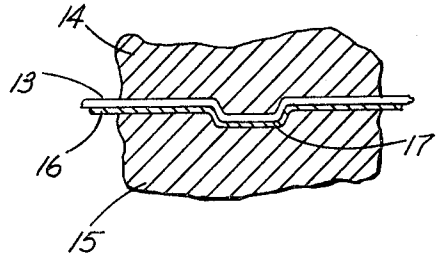


Fig. 3

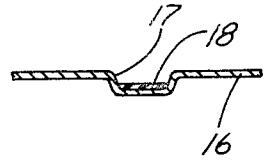


Fig. 4

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MULTILAYER TAPE FOR COATING INTAGLIO DEPRESSIONS AND PROCESS FOR USING SAME

BACKGROUND OF THE INVENTION

The present invention relates to a tape used to coat or color the embossed depressions or cavities of a printing plate or the like as the depressions are formed, so that the resulting embossed pattern may be more easily read; and, more particularly, to such a tape having improved physical characteristics that adapt it for use under severe physical treatment.

One well-known form of business machine used for printing repetitive data, such as periodic mailing lists, premium notices, invoices, and the like, is one in which relatively small printing plates are used. Each plate is embossed individually with various-type characters providing such data as may be desired, such as a name and mailing address. These plates are passed in sequence through the machine to a printing station where each printing plate transfers an impression of its embossed characters or other indicia through an inked ribbon or the like to a receiving surface, such as an index card, invoice statement, envelope, etc. The printing plates are formed from relatively thin sheet metal or a wear-resistant plastic and are used over again repeatedly for printing records of high quality without concern as to the accuracy of the printed data or deterioration of the embossed characters.

It often is necessary to refer visually to such printing plates to insure a correct plate has been selected, to check pertinent data, or for still other purposes. Since the characters, numbers, or other indicia are usually embossed on the printing plates to appear in reverse reading form, that is, in reverse order in relief on one side and in usual reading order in intaglio on the other side, it is customary to refer to the intaglio faces of the embossed plates to obtain an easy, direct reading as one would normally read an imprinted message.

The embossing operation which produces the characters on printing plates results in the production of what are generally termed highlights and shadows in the intaglio faces of such characters. These highlights and shadows make it difficult to read the embossed data on the printing plates when it is desired to do so for purposes of verification, for checking changes made, or for still other purposes.

U.S. Pat. Nos. 3,245,344 and 3,301,703, both issued to Owen and assigned to the assignee of the present application, describe one technique for coloring intaglio depressions so that they may be easily seen. The technique includes depositing a pigment coating substantially on the bottom of an embossed intaglio character simultaneously with its formation. This is accomplished by interposing between a punch and die of an embossing machine a strip of plastic bearing a pigment layer on a side which faces toward the die member. When the punch and die are brought into registry to form the embossed character, the plastic strip forms into the cavity causing a corresponding portion or section of the pigment coating to be offset into the resultant intaglio character. A plastic film is used to avoid breaking or punching of the strip by the embossing punch and die movement.

While such a film has been satisfactory for many applications, in some embossing machines, which use printing plates of the type herein described, a plastic strip, such as is described in U.S. Pat. Nos. 3,245,344 and 3,301,703, is subjected to much more severe treatment. For instance, the film must travel a much more arduous and tortuous path in reaching the embossing station. Accordingly, some prior films tended to break under the greater stresses and strains.

On the other hand, use of a tougher, harder plastic film to support a pigment during embossment is also unsatisfactory. While such a film of harder, stronger plastic high in tensile strength normally transmits a pigmented layer through an embossing machine without breaking, it is unsuited for other operations attendant the embossing operation. For instance, a tougher, harder film incompletely fills the intaglio cavity with pigment, and the pigment transfer is less effective. Also, such a tougher film tends to wrinkle and score the plastic plate during embossing, leaving lines radiating away from the cavity. Further, the stronger plastics that might otherwise be used do not have the ability to release readily an ink or pigment as desired during the embossing operation. If attempts are made to soften the coatings as by the addition of a plasticizer, the ink tends to run and print in the background of a plate.

It would, therefore, advance the art to provide a film of the type described that was sufficiently strong to resist physical forces attendant its use with a printing machine and that still possessed sufficient softness, extensibility, and elasticity suitably to fill completely an intaglio cavity during embossing with facile release of a coloring pigment or ink.

SUMMARY OF THE INVENTION

In accordance with the present invention, a multilayer tape is provided which as an integral unit affords the diverse and even conflicting and opposing physical properties needed, as described, for use with a pigment-containing film in an embossing operation or the like, so as to coat or color at least the bottom surface of an intaglio depression.

In one form, the present tape comprises three, essentially all organic layers of film-forming resinous polymers. These layers or coats include a carrier layer and an intermediate layer which in conjunction with each other support a pigment-containing layer. The resinous polymer of the carrier layer has a relatively high-tensile strength of at least 10,000 p.s.i. and is relatively hard, substantially nonextensible, heat and rupture-resistant. Polyester resins are preferred for this purpose and especially polyethylene terephthalate. The resinous polymer of the intermediate layer is more extensible and softer than the resinous polymer of the carrier layer, sensitive to organic solvents, and has a tensile strength less than 10,000 p.s.i. The intermediate layer should be pigment-receptive and pigment-releasable. Polyethylene is preferred as the intermediate layer. The middle layer is important since it permits use of the tape in many diverse applications. The resin or matrix of the pigment-containing layer should be fragmentable and effective to release sections thereof to a receiving surface that are generally commensurate with areas of pressure applied thereagainst, so that the pigment covers and coats-corresponding areas in an intaglio depression. Polyvinyl resins are preferred for the matrix layer.

BRIEF DESCRIPTION OF THE DRAWING

The accompanying drawing illustrates one form of the present tape and its manner of use wherein:

FIG. 1 is a fragmentary, greatly enlarged cross section of the present tape and shows three superposed layers;

FIG. 2 is a schematic, sectional view and illustrates the relative positions of a punch, present tape, printing plate, and die prior to embossing;

FIG. 3 is a schematic, sectional view similar to FIG. 2 and shows the parts of that figure when brought together in registry as by an embossing operation; and

FIG. 4 is a fragmentary section of an embossed printing plate having an intaglio depression coated or tipped by means of the present tape.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring more particularly to the resinous polymers of the three layers of the present tape, the carrier layer is designed to bear the brunt of the destructive forces tending to break and tear the composite tape as it changes its direction several times in traveling to an embossing machine and/or during the punching operation of the embossing step itself. The carrier layer should have a tensile strength of at least 10,000 p.s.i. and also be hard, tough, substantially nonextensible, and heat and rupture resistant. Resinous polymers useful for this purpose are polyurethanes, polyamides, and polyesters, especially if crosslinked.

By the term "polyurethane" is meant a film-forming polymer in which the repeating unit is a urethane linkage.

Polyurethanes are commonly formed by interreacting a diisocyanate and a reactant containing at least one hydroxyl group. By the term "polyamide" is meant a film-forming polymer in which the repeating unit is an amide linkage. Polyamides such as nylon are usually formed by interreacting polybasic acids and polyfunctional amines. By the term "polyesters" is meant a film-forming polymer in which the repeating unit is an ester linkage. Polyesters are normally prepared by interreacting a polybasic acid and a polyhydric alcohol. Polyesters are preferred for the carrier layer, especially unsaturated polyesters cross linked by vinyl-containing agents such as styrene. However, an especially useful polyester is polyethylene terephthalate. In addition, polypropylene which has been biaxially oriented may also be used as the carrier layer.

The resinous polymer of the intermediate layer has less strength than that of the carrier layer (such as less than 10,000 p.s.i.) and is purposefully softer, stretchable, and organic solvent-sensitive. This is to enable the polymer to deform under the embossing pressure and completely fill the intaglio cavity. The organic solvent-sensitivity provides a rule-of-thumb to indicate a suitable molecular weight and/or softness of the resin which renders it satisfactory for use as an intermediate layer. As an example, at least 1 percent by weight of the resins, hereinafter indicated as useful for the intermediate layer, is soluble in toluene. The relative softer, organic solvent-sensitive nature of the intermediate resin is also important with respect to receiving the pigment or ink of the pigment-containing layer hereinafter described. Equally important, the polymer of the intermediate layer must affect a ready release of the pigment without smearing when the embossing occurs. Although the intermediate layer does not normally break in use, it can happen on occasion. Yet, the uniqueness of the present tape is such that, backed by the stronger carrier tape, the breaking of the intermediate layer does not interfere with the use of the tape. In any other type of tape for the purpose indicated, such breakage would render it useless.

The number of resinous polymers that satisfy the important functions of the polymer of the intermediate layer is surprisingly small. Polypropylene may be used, preferably an unoriented form because it is then softer and more flexible. However, polyethylene is preferred as the intermediate layer, and especially polyethylene of a coating grade having an average molecular weight within the range of about 2,000 to 25,000. However, polyethylene alone, that is without a carrier-backed support, is unsatisfactory. Polyethylene alone, and for that matter unoriented polypropylene as well, tends to stick to plastic printing plates, stretches easily with resultant breakage, and punches out poorly over metal plates.

In addition to the coloring pigment, usually carbon black, the pigment-containing layer comprises a matrix of a film-forming resinous polymer and several optically employed additives. The matrix polymer may be a polyacrylic or a polyvinyl resin. By the term "polyacrylic" is meant the film-forming polymerization products of esters of acrylic acid and methacrylic acid, such as polymethyl methacrylate. By the term "polyvinyl" is meant the film-forming resins obtained by polymerizing compounds containing the vinyl radical, such as polyvinyl chloride, polyvinyl acetate, polyvinylidene chloride, polyvinyl alcohol, polyvinyl butyral, and copolymers thereof.

Certain additives enhance the performance of the pigment-containing layer but are not essential. For example, known plasticizers, stabilizers, extenders, and the like, may be incorporated into the matrix resin to modify its properties. Additionally, an alkyd resin such as glyceryl phthalate may be used to increase the adhesion of the pigment to a metal plate during embossing. Also, an oil like mineral or vegetable oil is usually incorporated in effective amounts as a nondrying vehicle for the pigment. Iron oxide is also conventionally used as an abrasive for the embossed plate, especially a metal plate, to scar and pock the intaglio depression during driving of the pigment into the depression by the embossing punch.

Referring next to the preparation and use of the present tape, a carrier layer **10** (FIG. 1) is initially obtained in strip form. A coating grade of the resinous polymer of the intermediate layer is then solubilized by a conventional organic solvent, such as toluene, to form for example about a 7 percent by weight solution of the resin. The use of a high-sheer mixer may facilitate the solubilization of this polymer. The dissolved resin is then applied as a continuous coating over the carrier layer **10** by any conventional technique, such as by rod coating. The solvent evaporates to leave a layer **11**. Alternately, the resinous polymer of the intermediate layer may be applied as a hot melt over the carrier layer **10**.

In any case, the intermediate layer **11** is self-bonding to the carrier layer **10** throughout its continuous surface. This prevents inadvertent lateral displacement of the carrier and intermediate layers with respect to each other and contributes as well to realizing a combination of the best properties of the resins of layers **10** and **11**.

The ingredients of the pigment-containing layer are suitably mixed together as by a ball mill in a liquid organic medium such as nitropropane. The admixture or dispersion is then spread over the intermediate layer **11**, and the organic liquid medium removed as by evaporation to leave a third continuous layer **12** bonded to the intermediate layer **11** throughout their interface. Preferably the intermediate layer **11** is more adherent to the carrier layer **10** than to the pigment-containing layer **12**, so that while layer **12** is suitably adhered to layer **11**, there is yet a facile release of sections of the pigment-containing layer **12** during an embossing operation.

Thicknesses of the layers are not critical. As a rule, the carrier layer has a thickness of about 0.5 mil to about 1.0 mil. The intermediate layer is applied over the carrier layer in an amount of about 0.3 to about 0.5 pound per ream, a ream being taken as 300,000 square inches. And the matrix layer is applied over the intermediate layer in an amount of about 1.0 to about 2.0 pounds per ream.

In use, the tape of FIG. 1 generally indicated at **13** is placed between a punch **14** and die **15** (FIG. 2), and a standard printing plate **16** is inserted between the tape **13** and die **15**. The layers of tape **13** have the same disposition in FIG. 2 as shown in FIG. 1, that is, the carrier layer **10** is closest to the punch **14**. The plate **16** may be either plastic or metal. When the punch and die are brought together, plate **16** is deformed as illustrated by FIG. 3 to form a character or other indicia, a part of the resulting intaglio cavity being shown at **17**. The three layers **10**, **11** and **12** of tape **13** are likewise deformed, but due to the combined and dissimilar properties of layers **10** and **11**, there is no breakage of the tape. Yet, the inherent softness and flexibility of layer **11** enables it and the pigment-containing layer **12** completely to fill the cavity **17**. Simultaneously, a section **18** of the pigment-containing layer **12** is fragmented from that layer because of the action of the punch **14** and adheres to the cavity **17**. Consequently, when the punch **14** and die **15** are separated, section **18** remains behind as shown in FIG. 4 stuck to the intaglio cavity **17**. In this manner, the color of the pigment permits the printing plate **16** to be easily read when viewed from above as illustrated in FIG. 4.

The following examples are intended to illustrate the invention and should not be construed as limiting the claims. Percentages are by weight.

EXAMPLE 1

The following formulation may be used for preparing a mixture or dispersion which after application to an intermediate layer, as herein described, forms the pigment-containing layer. Range tolerances or variations are parenthetically noted. This formulation is best used with a metallic printing plates.

Ingredient	Amount	Function
Vinyl chloride-vinyl acetate copolymer ("VMCH" grade).	7 grams	Continuous, universal thermoplastic matrix vehicle for remaining ingredients.
Toluene	35 ml. (25-50 ml.).	Agent for dispersing and wetting the resin ingredients vinyl chloride-vinyl acetate copolymer prior to solution in the strong solvent.
2-nitropropane	50 ml. (40-60 ml.).	Solvent.
Sucrose acetate isobutyrate.	4 grams (3-5 grams).	A plasticizer and stabilizer which hinders rearrangement and separation of the various liquid and solid components of the transfer film.
Glyceryl phthalate alkyd resin.	8 grams (6-10 grams).	Adheres the off-set pigment coating to the embossed plate.
Mogo varnish	8 grams (4-12 grams).	Extender for the oil and pigment.
Mineral or vegetable oil.	6 grams (5-7 grams).	Non-drying carrier or vehicle for pigment material.
Carbon black	10 grams (10-15 grams).	Pigment.
Iron oxide	10 grams (5-10 grams).	Abrasive pigment for embossed plate.

EXAMPLE 2

Another formulation for depositing a pigment-containing layer is the following, also best suited for use with metallic printing plates:

Ingredient	Amount	Function
Vinyl chloride-vinyl acetate copolymer.	200 grams	Continuous, universal thermoplastic matrix vehicle for remaining ingredients.
Toluene	950 ml. (800-1,100 ml.).	Agent for dispersing and wetting the resin ingredients vinyl chloride-vinyl acetate copolymer prior to solution in the strong solvent.
2-nitropropane	1,400 ml. (1,100-1,700 ml.).	Solvent.
Sucrose acetate isobutyrate.	120 grams (60-140 grams).	Plasticizer and stabilizer agents which adhere the pigment coating to the plastic film, which plasticizes coating to promote its release or off-set to the embossed plate, and which hinders rearrangement and separation of the various liquid and solid components of the transfer film.
Dicotyl phthalate	200 grams (150-250 grams).	
Glyceryl phthalate alkyd resin.	160 grams (140-180 grams).	Adheres the off-set pigment coating to the embossed plate.
Mogo varnish	80 grams (60-100 grams).	Extender for the oil and pigment.
Mineral or vegetable oil.	40 grams (35-42 grams).	Non-drying carrier or vehicle for pigment material.
Carbon black	240 grams (220-260 grams).	Pigment.
Iron oxide	60 grams (10-100 grams).	Abrasive pigment for metal plates.

EXAMPLE 3

Formulations for the pigment-containing layer useful on either plastic or metallic printing plates are represented by the following. After application of the formulation to another layer of the tape, the liquid organic medium is removed as by evaporation to deposit a layer as before.

Ingredient	Weight Percent
Copolymer of vinyl chloride and vinyl acetate.	3.5 to 4.5
Toluene	20 to 25
Nitropropane	50 to 55
Sucrose acetate isobutyrate.	2.5 to 3.5
Mineral oil	0.5 to 1.0
Dioctyl phthalate	2.0 to 3.0
Diglycol laurate	1.0 to 2.0
Alpha-naphthol	0.1 to 0.3
Carbon black	8.5 to 10.5
Iron oxide	1.0 to 2.0

The vinyl copolymers are approximately 88 percent vinyl chloride and 12 percent vinyl acetate.

EXAMPLE 4

Other formulations suitable for casting a pigment-containing layer over the intermediate layer and useful on either plastic or metallic printing plates are:

Ingredient	Weight Percent
Copolymer of vinyl chloride and vinyl acetate.	3.5 to 4.5
Toluene	25.0 to 30.0
Nitropropane	45.0 to 50.0
Sucrose acetate isobutyrate.	3.0 to 5.0
Mineral oil	3.0 to 4.0
Dibutyl phthalate	3.0 to 5.0
Alpha-naphthol	0.1 to 0.3
Carbon black	8.5 to 10.5

EXAMPLE 5

As one embodiment of the invention, a composite tape was prepared by using a strip of polyethylene terephthalate, about 0.5 mil in thickness, sold under the trademark MYLAR and having a designation "**50A**." A 7 percent by weight solution of a film-forming, organic solvent-sensitive, coating grade of polyethylene was prepared in toluene. The polyethylene was purchased from Allied Chemical Company and designated A/C 6. The solution was rod coated over the polyethylene terephthalate and the toluene removed as by evaporation. The polyethylene was coated on the polyethylene terephthalate at a coating weight of 0.10 to 0.20 pounds per ream. The drying roll temperature in the coater was about 140° F. The resulting tape was then used in the manner of FIGS. **2** through **4** with a metallic printing plate.

EXAMPLE 6

A procedure was carried out like that of example 5 except that the formulation of example 3 was used, and the resultant tape was similarly used but with both plastic and metal printing plates.

The present multilayer tape combines the stronger physical properties such as tensile strength of a carrier layer with the softer, more extensible and better pigment-releasing properties of an intermediate layer resulting in greatly reduced breakage of the tape during its use and also in the capability of printing from a third pigment-containing layer onto a variety of plastic and metal surfaces. Also, there is more latitude in physically handling of the tape in embossing machines without fear of breakage.

Although the invention has been disclosed as a three layer sandwich construction and reference made to an "intermediate" layer and the like, additional layers can be used, if desired, without departing from the concept of the invention. Ordinarily, however, a thicker film has less acceptable release of the pigment.

While the foregoing describes several embodiments of the invention, it is understood that the invention may be practiced in still other forms within the scope of the following claims.

What is claimed is:

1. A multilayer tape for coating intaglio depressions of a printing plate simultaneously with their formation during embossing of the plate, said tape comprising:

a. a carrier layer comprising a relatively hard, substantially nonextensible, heat and rupture-resistant, film-forming organic resinous polymer and having a tensile strength of at least 10,000 p.s.i.;

b. an intermediate layer comprising a film-forming, organic solvent-sensitive, organic resinous polymer more extensible and softer than the resinous polymer of the carrier layer selected from the group consisting of polyethylene and polypropylene, said resinous polymer having a tensile

strength less than 10,000 p.s.i. and being pigment-receptive and pigment releasable;

c. a fragmentable organic resinous matrix layer containing a coloring pigment and effective to release sections thereof to a receiving surface that are generally commensurate with areas of pressure applied thereagainst;

said layers being substantially continuous and superimposed in the order stated, and said intermediate layer being self-bonding to the carrier layer.

2. The multilayer tape of claim 1 wherein said carrier layer comprises polyethylene terephthalate.

3. The multilayer tape of claim 1 wherein said resinous polymer of the carrier layer is selected from the group consisting of polyurethanes, polyamides, and polyesters.

4. The multilayer tape of claim 1 wherein said resin of the matrix layer is selected from the group consisting of polyvinyl and polyacrylate resins.

5. The multilayer tape of claim 1 wherein said resin of the matrix layer is a polyvinyl resin selected from the group consisting of polyvinyl chloride, polyvinyl acetate, polyvinylidene chloride, polyvinyl alcohol, polyvinyl butyral, and copolymers thereof.

6. The multilayer tape of claim 1 wherein said pigment of the matrix layer is carbon black.

7. The multilayer tape of claim 1 wherein said carrier layer has a thickness of about 0.5 mil to about 1.0 mil; said intermediate layer has a weight application of about 0.3 to about 0.5 pound per ream; and said matrix layer has a weight application of about 1.0 to about 2.0 pounds per ream.

8. The multilayer tape of claim 1 wherein the resinous polymer of said intermediate layer consists of polyethylene having an average molecular weight within the range of about 2,000 to 25,000.

9. A multilayer tape for coating intaglio depressions of a printing plate simultaneously with their formation during embossing of the plate, said tape including a carrier layer comprising polyethylene terephthalate, an intermediate layer overlying the carrier layer and consisting essentially of polyethylene; and a fragmentable matrix layer overlying the intermediate layer and comprising a polyvinyl resin having a pressure-transferable coloring pigment; said layers being substantially continuous and superimposed in the order stated; and said intermediate layer being self-bonding to the carrier layer and more adherent thereto than to the matrix layer.

10. In the process of embossing a printing plate by positioning over the plate a resinous film having a pressure-transferable pigment, and coloring from said film the intaglio depressions in the plate simultaneously with their formation, the improvement including using as such resinous film a multilayer tape comprising:

a. a carrier layer comprising a relatively hard, substantially nonextensible, heat and rupture-resistant, film-forming organic resinous polymer and having a tensile strength of at least 10,000 p.s.i.;

b. an intermediate layer comprising a film-forming, organic solvent-sensitive, organic resinous polymer more extensible and softer than the resinous polymer of the carrier layer selected from the group consisting of polyethylene and polypropylene, said resinous polymer having a tensile strength less than 10,000 p.s.i. and being pigment-receptive and pigment-releasable;

c. a fragmentable organic resinous matrix layer containing a coloring pigment and effective to release sections thereof to a receiving surface that are generally commensurate with areas of pressure applied thereagainst;

said layers being substantially continuous and superimposed in the order stated.

* * * * *

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,628,977 Dated December 21, 1971

Inventor(s) James E. Deegan

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 6, line 35, after "ream." there should be inserted -- The ingredients of the formulation of Example 1 were then ball milled together and applied over the polyethylene layer at a coating weight of 1.8 to 2.3 pounds per ream. --

Signed and sealed this 16th day of May 1972.

(SEAL)
Attest:

EDWARD M.FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents

FORM PO-1050 (10-69)

USCOMM-DC 60376-P69
* U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334