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LAMINATED FLEXIBLE SHEET MATERIAL

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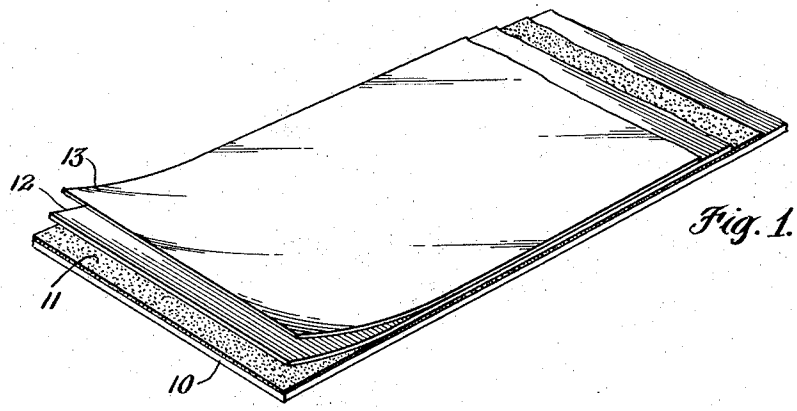


Fig. 1.

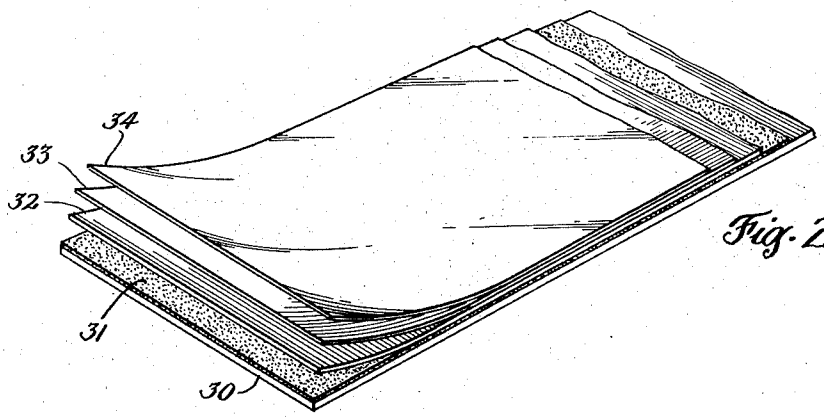


Fig. 2.

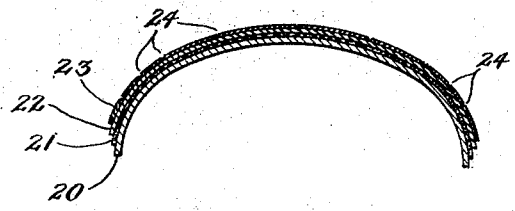


Fig. 3.

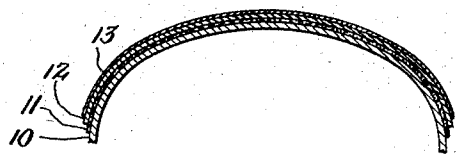


Fig. 4.

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# LAMINATED FLEXIBLE SHEET MATERIAL

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Application July 3, 1953, Serial No. 365,812

4 Claims. (Cl. 154—47)

This invention relates to laminated flexible sheet material, and more particularly concerns a flexible sheet such as leather, cloth, paper or the like covered with a uniform adherent metalized film. More specifically the invention concerns a flexible base material covered with an adherent internally metalized polyester film.

This application is a continuation-in-part of our copending applications Serial No. 140,197, filed January 24, 1950, now U. S. Patent No. 2,644,262, and Serial No. 334,491, filed February 2, 1953, now U. S. Patent No. 2,721,817.

It is conventional in the art to coat leather with gold, but the gold wears off in time, particularly when the leather is subjected to flexure, rubbing or more severe use. Efforts have been made to overcome this difficulty by coating the exposed surface of the gold with a clear protective coat, but such protective coats have not had the toughness required to resist rubbing, scuffing and other wear. Similarly, cellophane has been applied to flexible base materials, but the cellophane tends to separate from the base when the combination is bent or flexed. Moreover it is difficult to adhere gold or other metal permanently to cellophane and to adhere the combination of cellophane and gold permanently to a piece of leather or the like. Moisture further complicates the above problems.

It is accordingly an object of this invention to prepare a laminated flexible sheet material the laminations of which are uniformly and permanently adhered together. Another object of this invention is to provide a flexible sheet material with a decorative metalized coating. Still another object is to provide a flexible sheet with a colored coating. Another object of this invention is to provide a flexible laminated sheet for coating cloth, leather, paper and the like with a metalized coating which is resistant to scuffiing and wear. Still another object is to provide leather articles such as shoes, handbags and the like having a metalized decorative coating which is resistant to rubbing, scuffing and wear. Other objects and advantages of this invention, including the relative simplicity and economy of manufacture of the same, will further appear hereinafter and in the drawings whereof:

Fig. 1 represents a view in perspective of a laminated flexible sheet material embodying this invention, portions of the laminations being separated for purposes of illustration;

Fig. 2 represents a view in perspective similar to Fig. 1 showing a modified laminated flexible sheet material;

Fig. 3 represents a sectional view of a laminated article having a lacquer coating, showing how the lacquer tends to break when the article is bent or curved; and

Fig. 4 is a sectional view similar to Fig. 3 showing the laminated flexible sheet material of Fig. 1 when similarly bent or curved.

Turning now to the specific embodiments of the invention selected for illustration in the drawings, Fig. 1 shows a piece of leather **10** having an adhesive coating **11** uniformly and continuously adhered to one surface



thereof. The number **12** designates a metal film vacuum-metalized to an external polyester film **13**. The metal **12** is uniformly and continuously adhered to the adhesive layer **11**. Chemically, the polyester film consists essentially of polyethylene terephthalate.

The sheet material **10** may be any flexible base material such as leather, cloth, fabric, etc. The adhesive is preferably the specific adhesive butadiene acrylonitrile. The layer **12** may be any metal capable of application by conventional vacuum metalizing process to the film **13**.

The film **13** is a tough very thin transparent flexible polyester film known in the art as "Mylar." The polyester film preferably has a thickness of .00025 inch or .25 mil but its thickness may vary between .1 and .5 mil in accordance with this invention. Thicknesses outside this range are not at present preferred, in that thicker films are noticeable when the laminated sheet is bent through 180° while thinner films present handling problems. The polyester film has a minimum tensile strength of about 1700 lbs. per square inch and a minimum tensile modulus of about 45,000 lbs. per square inch. The polyester film of one quarter mil thickness has a minimum elongation of about 25% while a similar film of one half mil thickness has a minimum elongation of about 35%. A one quarter mil thick sheet has a tear strength as determined on a single sheet tear tester of 2.5 grams minimum, while a one half mil thick sheet has a tear strength 6 grams minimum. The tear strength tests are discussed by D. W. Flierl in an article entitled "Method of Rating Film Durability," Modern Packaging, November 1951. The impact strength of a one quater mil thick polyester film is 10 kg. cm. minimum while the impact strength of a one half mil thick polyester film is 25 kg. cm. minimum. The impact strength tests are described in the aforementioned paper. The polyester film has maximum shrinkage of 5%, as determined by first measuring the length and width of the film test specimens at room temperature, placing the specimens in an oven at 150° C. for thirty minutes, suspended so as to allow free contraction, cooling the specimens to room temperature, and measuring length and width. It will be appreciated that the polyester film is extremely thin and the film thickness figures are subject to the approximately 20% variation more or less. It will also be apparent that the polyester film is very durable, water repellent and chemically resistant. It is characterized by its high tensile strength and high impact strength even at low temperatures. The film shows good dimensional stability up to 150° C.

The article shown in Fig. 1 may be manufactured by conventional high vacuum metalization of the polyester film followed by the application of adhesive to the metal and then applying a resulting laminated film to leather or another flexible base material.

The metalizing step is preferably carried out by passing the polyester film continuously over a source of aluminum vapor in an evacuated chamber while maintaining a high vacuum in the chamber. The aluminum is thus condensed and solidified on the polyester film in such manner that an exceedingly adherent film of microscopic thickness is applied. Preferably the metal film is just thick enough that the light transmission of the film is on the order of a few percent, preferably not more than 2½%.

The metalized face of the polyester film is then coated with adhesive utilizing any conventional coating technique such as spray coating, roller coating, etc. under conventional conditions of temperature and pressure. Preferably several thin coatings of such adhesive are applied, allowing or causing each to dry before the application of the next coating.

The resulting laminated sheet may readily be applied

to a piece of material such as cloth, paper, leather or the like. For application to leather, the leather is preferably degreased utilizing naphtha degreasing solvents for example, and the laminated film is placed against the leather surface with the adhesive in contact with the leather. The resulting materials are placed in a hot laminating press and subjected to any desired pressure or temperature.

The product has a bright shiny finish whether the base be leather, cloth or other flexible material. Its exposed surface is substantially inert to the action of water, acetone, trichlorethylene, perchlorethylene, petroleum solvents and other commonly used solvents or chemicals, and even the milder acids and alkalies.

Fig. 3 shows a piece of leather **20** affixed by means of adhesive **21** to a metal film **22** which is covered with transparent lacquer **23**. The laminated structure of Fig. 3 has a curved cross section as would be produced by stretching the laminated sheet over a shoe last, for example. It will be observed that the convex lacquer coating tends to break at **24** as a result of the bending operation due to the brittleness and lack of strength of the lacquer and its poor adhesion to the metal.

Fig. 4 shows the laminated sheet of Fig. 1 in a curved form similar to Fig. 3. It will be observed that when this laminated sheet is stretched tight over a convex surface such as a shoe last the metallic finish does not break up; on the contrary the polyester film is tensioned and stretched and the exposed surface becomes even more bright and mirror-like.

When the laminated film shown in Figs. 1 and 4 is applied to leather it adheres tenaciously to the leather even when the leather is flexed or bent. In fact, no perceptible wrinkle is produced on the leather when bent through 180° as compared to leather having no laminated polyester sheet thereon. The tenacious adhesion is the result of the coaction of the fused metal-polyester film bond and the butadiene acrylonitrile bond between the metal and leather.

Butadiene acrylonitrile adhesive may be coated on the metal and the coating dried to produce a laminated film which may be stored, shipped, etc. before application to a base material such as leather or the like. Its adhesiveness may readily be activated after storage by heat. It is highly flexible when embodied into the final product even after substantial periods of time.

Turning now to Fig. 2 of the drawings, a laminated structure is shown wherein color is incorporated into the coating. The number **30** designates a leather or other flexible base, **31** is an adhesive such as butadiene acrylonitrile, **32** is a metal film such as aluminum, **33** is a film of adhesive lacquer into which a color dye has been uniformly incorporated, and **34** is a polyester film as heretofore described.

The laminated article shown in Fig. 2 may be manufactured by applying an adhesive lacquer to the polyester film after the lacquer has been mixed with a suitable dye. Adhesive nitrocellulose lacquer containing a plasticizer is suitable. Some other adhesive lacquers are also suitable. The mixed dye and lacquer coat is applied to the polyester film at room temperature and pressure by conventional means such as a roller coater for example. The lacquer is heated and dried. The metal is applied to the resulting lacquer film by high vacuum metalizing as heretofore described, preferably utilizing metals such as aluminum for example. A thin layer of butadiene acrylonitrile or other adhesive is then applied to the metalized face, one or more additional adhesive layers may be applied, and the adhesive side of the resulting article is adhered to the leather or other flexible material in a hot laminating press as heretofore described.

The product shown in Fig. 2 is advantageous in that the color of the decorative product does not depend upon the color of the metal since a wide variety of dyes may be incorporated into the lacquer. It has the advantages of the product shown in Fig. 4 and heretofore described, when it is stretched over a last or otherwise brought to a convex form.

It will be appreciated that, although vacuum metalizing is highly preferred, thin metal films may be prepared in other ways, such as electrolytic deposition or reduction of a metallic salt solution.

While two embodiments of the invention have been selected for illustration in the drawings, it will readily be apparent that the form of the device may be considerably varied, and that equivalent structures and materials may be employed for accomplishing the same results. Such changes, including reversals of parts and the use of certain features of the invention independently of other features, are within the spirit and scope of the invention as defined in the appended claims.

Having thus described our invention, we claim:

1. A metallized, decorative sheet comprising a flexible leather base material, an adhesive layer affixed to one face of said flexible base material, and a thin continuous, wear resistant polyethylene terephthalate film having a thin metal layer on one face thereof, said metal also being uniformly and continuously bonded to said adhesive layer, the polyethylene terephthalate film having a thickness of about .1 to .5 mil, a minimum tensile strength of about 1700 pounds per square inch, a minimum tensile modulus of about 45,000 pounds per square inch, and a minimum elongation of about 25%.

2. The coated sheet defined in claim 1 wherein the thickness of the metal film is about the minimum thickness reducing its light transmission to about 2½%.

3. A metallized, decorative sheet comprising a flexible leather base material, an inner adhesive layer affixed to said base material, a thin flexible metal layer affixed to said adhesive, an outer layer of adhesive material containing uniformly distributed coloring substance affixed to said metal, and a thin strong continuous, wear resistant polyethylene terephthalate film affixed to the outer adhesive layer, the polyethylene terephthalate film having a thickness of about .1 to .5 mil, a minimum tensile strength of about 1700 pounds per square inch, a minimum tensile modulus of about 45,000 pounds per square inch, and a minimum elongation of about 25%.

4. A metallized, decorative sheet comprising a flexible leather base material, an adhesive layer affixed to one face of said flexible base material, a thin continuous, wear resistant polyethylene terephthalate film, a lacquer containing coloring material affixed to said polyethylene terephthalate film and a thin, continuous metal layer affixed to the lacquer, said metal also being affixed to said adhesive, the polyethylene terephthalate film having a thickness of about .1 to .5 mil, a minimum tensile strength of about 1700 pounds per square inch, a minimum tensile modulus of about 45,000 pounds per square inch, and a minimum elongation of about 25%.

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