July 1, 1969 M. ROBINSON 3,452,464

REFLECTIVE SHEET

Filed Sept. 6, 1967 Sheet 1 of 2

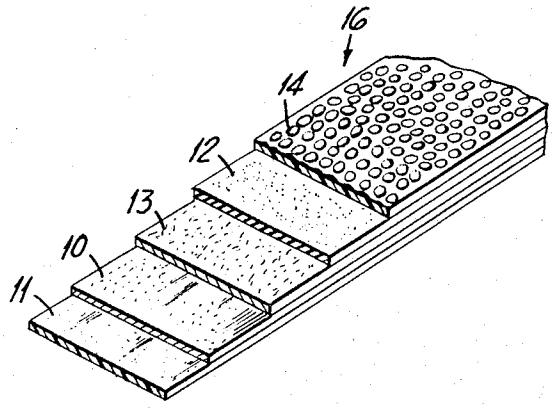


FIG. 1

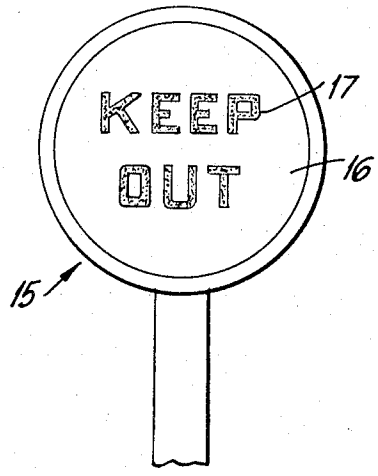


FIG. 2

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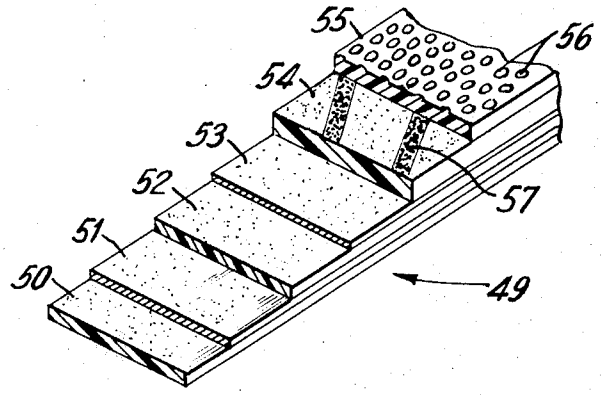


FIG. 3

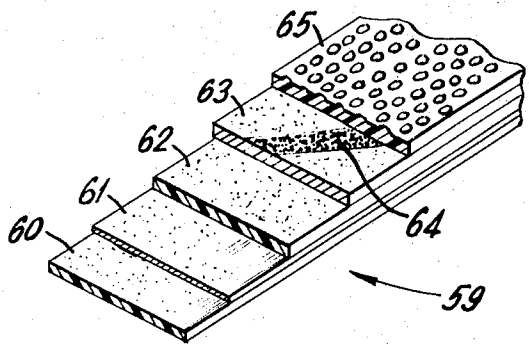


FIG. 4

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3,452,464

REFLECTIVE SHEET

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Continuation-in-part of abandoned application Ser. No. 440,211, Mar. 16, 1965. This application Sept. 6, 1967, Ser. No. 680,274

Int. Cl. G09f *13/20, 13/16*

U.S. Cl. 40—134 9 Claims

ABSTRACT OF THE DISCLOSURE

A highly visible flexible sign, for example, a temporary road sign, is adapted to be adhered to a backing, such as a board. The sign consists of a back layer to protect the next layer of adhesive. The adhesive is on the back of a laminated sheet. The laminations may include, as alternatives or in combination, a latex layer painted with fluorescent paint, a plastic film having a white coating, and a plastic film having fluoroescent material cast in the film. The symbols on the sign are preferably applied by a metallizing process.

This application is a continuation-in-part application based upon the applicant's prior applications Ser. No. 440,211, filed Mar. 16, 1965, for "Reflective Sheet," now abandoned and Ser. No. 490,158, filed Sept. 15, 1965, for "Reflective sheet," now abandoned.

The present invention relates to a daylight and nighttime fluoroescent flexible laminated structure in the form of an adhesive tape or sheet.

During construction of buildings and roads, it is often desired to provide warning or directional signs. These signs, for example saying "slow" or "detour to left," etc., are moved, replaced and changed. One widely used type of sign is obtained by painting a sign board. In order to provide greater visibility, fluorescent paints are sometimes employed, although they are relatively expensive and weather rapidly.

It is the objective of the present invention to provide printed flexible sheets which are printed with suitable legends and adhered to a board or other surface by pressure. During the day, and by reflected light at night, the sheet provides a highly visible warning sign.

The tapes and sheets of the present invention are relatively inexpensive and weatherproof. To change a sign, one simply rips off the old sign and sticks another one on the backing surface, or sticks the new sheet on top.

In accordance with one embodiment of the present invention, a sheet is provided consisting of a plurality of laminated layers. The bottom layer is a protective sheet of plastic which covers the backing layer of latex impregnated paper. A layer of heat-curved fluorescent paint covers the latex sheet and as printed on it, for example, by metallizing, the symbols of the sign. A clear plastic is laminated to the fluorescent paint and has on its inner surface a layer of ultra-violet light screening material, or such material is mixed into the clear plastic film. The clear plastic sheet is formed with a matted or irregular dappuled surface.

In accordance with a second embodiment of the present invention, the latex paper of the first embodiment is replaced by a plastic film having a white coating. The pigment, in the second embodiment, is mixed with resin and cast in the form of a film.

In accordance with a third embodiment, the pigmented film of the second embodiment is painted, for example, in stripes or a checkered pattern, with a water-based metallic paint; or pigmented film may be laminated to a film such as Mylar or Tedlar upon which has been imprinted the message desired, by a process known as metallizing, in silver or gold.

Other objectives will be apparent from the following detailed description of a preferred embodiment of the invention, in conjunction with the accompanying drawings, in which:

FIG. 1 is a perspective cut-away view illustrating the various layers of the laminated structure of the first embodiment of the present invention;

FIG. 2 is a front view illutsrating a sign using the laminated sheet of the present invention; and

FIGS. 3 and 4 are perspective cut-away views illustrating the various layers of the laminated structure of the second and third embodiments of the present invention.

In FIG. 1, the bottom layer **11** is a plastic cover which protects the adhesive layer. It prevents the laminated sheet from sticking to itself when stacked or rolled. Plastic layer **11** is stripped from the lamination when the lamination is ready to be placed on a backing support, such as a sign or truck. A suitable plastic for layer **11** is polyethylene or Mylar of 1–6 mil thickness, as it is inexpensive and will not stick too securely to the adhesive layer. Mylar is the tradename of E. I. du Pont de Nemours & Co. for a flexible transparent polyester film made from the condensation product of terephthalic acid and ethylene glycol. Alternatively, instead of plastic, a kraft paper may be used. The only requirements for layer **11** are that it be flexible and stay with the adhesive layer, but not adhere too well, so that it may be easily stripped off by the user from the remainder of the laminated sheet.

Layer **10** consists of a cellulose paper impregnated with white latex rubber. A suitable latex is a mixture of crude rubber and zinc oxide. The impregnated paper is white and preferably of 6 mil thickness. It provides a weatherproof and elastic base for the laminate and the latex is a pressure sensitive adhesive. In addition, the whiteness of the latex and the paper provides a good background for the paint of the laminate. Under certain circumstances, for example, when the sheet is applied to certain smooth metals, an additional or substitute adhesive material may be used on the back of layer **10**. For example, a non-tacky adhesive consisting of a butadiene-acrylonitrile polymer and a compatible phenolformaldehyde resin may be employed. Upon the application of heat, the resin is cured and adheres to the metal surface.

Layer **13** is a fluoroescent paint which is coated or painted on paper layer **10**. The layer is about 13 mil thickness when wet and dries to about 6 mil thickness. The color of the paint depends upon the desired color of the laminate. The colors red-orange and red-yellow are preferred.

A paint of metallic pigment, applied by a metallizing process on top of layer **13**, may be employed to give a silver or gold reflective appearance to the symbols of the sign.

The coloring of the fluorescent paint of layer **13** is obtained by fluorescent dyes, such as rhodamine B (diethyl-n-amino-phenolphthalein hydrochloride) which is dissolved in a plastic resin and the resin cured and powdered. Other suitable dyes are rhodamine 6G (xanthenyl-chloride-ethyl ester) and pyronin B (tetraethyl-diamino-xanthenyl-chloride). This type of dye is capable of absorbing light in the blue end of the spectrum and converting it into reflected color at the color of the dye. The pigments which incorporate these dyes are called "high visibility daylight pigments".

The dyes are dissolved, in about 1 percent by weight, in a plastic resin carrier to form the pigment for the paint. The dye is dissolved in the resin and the resin dried and cured and then powdered to form the pigment. Suitable

carriers include the resins polymethylmethacrylate and malamine formaldehyde.

The pain pigment preferably meets U.S. Government Defense Department specifications MIL–P–21563 or MIL–P–21600. Suitable pigments are available from the Lawter Chemical Company.

The pigment is mixed with a plastisol material to form the paint. Preferably the plastisol consists of a plastic resin dispersed in liquid plasticizer. The plastisol material should be chosen so that it cures rapidly at relatively low heats. A suitable cure is 350° F. for three minutes, to cure and fuse the paint. A suitable resin is polyvinyl-chloride and suitable plasticizers are polymeric materials such as di-octyl-phthalate. A suitable formula for the fluorescent paint in parts by weight is as follows: dispersion grade polyvinyl-chloride 52; di-octyl-phthalate 35; calcium and barium salt complex stabilizer 2; and fluorescent pigment 16.

The top layer **14**, of a transparent plastic film, is preferable of Mylar of ½ to 6 mil thickness. Mylar is a type of polyester film made from the condensation product of terephthalic acid and ethylene glycol. This film is waterproof. Preferably the film is of the oriented type. This type of film is available from Du Pont and others.

The back (reverse side—not exposed to weather) is preferably imprinted with special inks or can be printed by metallizing. The metallizing process, for example, may include coating a chemical, by a silk-screen process, on the reverse side of the film. The areas covered by the chemical coating are the symbols of the sign in reverse, i.e., their mirror image. The chemical attracts and holds the metal, such as silver nitrate or chrome, which may be sputtered or chemically deposited on the film.

The surface of the film **14** is covered with small protuberances or faceted. This effect, which covers the entire surface of the film, is obtained by pressing the film with a hot roller having the negative of the protuberanced surface as depressions in its surface. The pressure roller, heated, for example, at 350° F., also helps adhere the laminate together. Preferably each raised portion is an irregularly contoured bubble of about one-tenth of an inch in size and 2 or 3 mils in height and is surrounded by lowered portions.

In one embodiment of the invention, the pin holes are formed through the sheet all the way from film **14** through the latex layer **10** by short needles attached to the hot roller. These needles penetrate the film **14** and the latex layer **10**. Alternatively, the polyester film **14** is perforated with the plurality of small pin-point holes prior to the film being glued to the other layers of the reflective sheet. The holes, suitably, are one-fourth of an inch part and evenly spaced over the film **14** in a matrix design. These holes prevent discoloration of the paint and do not adversely affect the weather resistance of the sign.

The Mylar film is coated with a thin coating of an ultra-violet absorbing (screening) material. This coating is invisible so that the Mylar does not lose its transparency. The absorbing material is coated on the back of the Mylar, i.e., on the side in contact with the fluorescent paint. Suitable absorbing agents are chemicals of the substituted benzenone class. These materials absorb light up to the visible range and prevent the breaking down of the fluorescent paint. They are available, for example, under the trade name "Uvinul" from General Aniline & Film Corp. or "Cyasorb" from American Cyanamid Company.

The transparent film **14** is glued to the other layers by adhesive layer **12**. A suitable adhesive is L358 of Pittsburgh Plate Glass Company, a modified vinyl resin having the trade designation of "rubber asbestos." Other suitable adhesives for Mylar are available and may be used, such as that disclosed in U.S. Patent 2,850,406.

The sign **15** of FIG. 2 has the laminated sheet **16** of the present invention adhered to its face. The sheet **16** has printed on its paint layer **13** in block black letters **17** the words "KEEP OUT." These letters are underneath the top clear plastic layer **14** and are protected from the weather.

The embodiment of FIG. 3 shows a laminated sign **49**. The backing sheet **50** is a protective or plastic similar to layer **11** of FIG. 2, for example, kraft paper or a polyethylene plastic film. Layer **51** is a coating of adhesive on the back of sheet **52**. The sheet **52** is a plastic material, preferably Mylar, a trademark of duPont for a polyester film made from the condensation product of terephthalic acid and ethylene glycol. A suitable adhesive for the layer **51** is one which will permit the protective sheet **50** to be pulled off and yet stick the laminated sign **49** to a board or other surface. The sheet **52** has a thin top coating **53** of white paint-like material. The white coating **53** provides an excellent visual backing for the paints and pigments of the subsequent letters. The coating **53** enables the sign to be placed on dark, or even black, boards or walls. Preferably the coating **53** is 1 or 2 mils thick and is a vinyl or acrylic compound having a white zinc or titanium pigmentation.

The sheet **52** is covered by a plastic film **54** having impregnated pigment. The film **54** is about 6–20 mil thick and is cast with paint pigment mixed into the resin. The purpose of the film **54** is to provide a carrier for the pigment. The film **54** provides a depth of pigment and a protection for the pigment that is not obtainable by painting the pigment on a surface.

The pigments mentioned previously as being of the type "high visibility daylight pigments," such as the dye rhodamine B (diethyl-n-amino-phenolphthalein hydrochloride) are suitable for mixing with the resin. A suitable compound, by weight, is: 1% of rhodamine B, 60% of polyvinyl-chloride, and 39% of di-octyl-phthalate as the plasticizer. The compound is mixed together in the liquid state and cast and cured as a thin film.

The symbols, words or a pattern (such as a striped pattern or a checkerboard pattern) may be painted on the film **54** by using coating **57**. The coating **57** is preferably a water-based metallic paint which is sprayed or brushed on and heat-dried before the adhering of sheet **55** to film **54**; or alternatively it is applied by a metallizing process. The use of a water-based and dried paint avoids the evolution of gas which would have difficulty in escaping due to the continuous sheet **55**.

The film **54** is covered by a transparent weather protective sheet **55** of plastic. Instead of applying the symbols, words or pattern to the top of film **57**, they may be applied backwards, i. e., a mirror image, to the underside of film **55**, for example by a metallizing process. Preferably layer **55** is Mylar of 6 mil thickness and contains ultra-violet ray absorbers. The surface of layer **55** is covered with protrusions **56** (faceted) of 2 or 3 mils in height. This effect is obtained by pressing the film **54** with a hot roller (embossing), as in the case of film **14** in the previous embodiment.

The layers **52** (with its coating **53**), **54** and **55** are firmly adhered together, i.e., laminated together. Such lamination may be obtained by the use of a "rubber adhesive" type of adhesive, mentioned previously.

The embodiment of FIG. 4 is similar in some respects to the prior embodiments in having a removable backing sheet **60**, of kraft paper or polyethylene film, and an adhesive layer **61** on the back of plastic film sheet **62**. The sheet **62** is preferably of 4–6 mil thick Mylar film. The sheet **62** is painted with a water-based metallic paint coating **63** and the paint dried, or metal coating **63** is applied by a metallizing process. The symbols, letters or a pattern may be painted or stenciled using black or other colored paint **64**, on top of the metallic coating **63**. Preferably the paint **64** is a red or orange fluorescent reflective paint. The paint **64** should be a water-based paint which is heat-dried before the further lamination of the sheets occurs. A transparent film of plastic **65**, preferably Mylar,

containing ultra-violet ray absorbers, is adhered to the film **62** over the paints **63** and **64**. The film **65** is embossed, as in the previous embodiments. The layers are laminated together, forming an inexpensive, flexible sign having a metal background.

The laminations of the present invention provide easily positioned, inexpensive and weather-proof signs. Their appearance, because of their paints and embossing, is clear, day and night, providing added safety to roads, vehicles and buildings.

Modifications may be made in the present invention within the scope of the subjoined claims. For example, in the lamination of FIG. **2**, the film sheet **52** may be eliminated and the white coating **53** may be applied directly on the back of the pigmented film **54**. The adhesive layer **51** would then be brushed or sprayed onto the back of the coating **53**.

I claim:

1. A laminated sheet comprising in sequence from the bottom layer, a protective sheet of thin material, a layer of white paper impregnated with a white latex material, said latex material being slightly adhesive to the protective sheet but does not secure the said protective layer to the other layers of the laminate, a layer of fluorescent paint, and a covering layer of weather-proof transparent plastic having its surface embossed with small protuberances of the said plastic, wherein the layers of the laminate are flexible and except for the back protective sheet are adhered securely together.

2. The laminate of claim **1** wherein visible printing contrasting in color to the color of the fluorescent paint is printed on said paint.

3. The laminate of claim **1** wherein the covering layer is perforated by a matrix of pin holes.

4. The laminate of claim **1** wherein the white paper, paint, screening material and covering layer are perforated with a matrix of pin holes.

5. a laminated sheet comprising in sequence from the bottom layer, a protective sheet of thin material, an adhesive which is slightly adhesive to the protective sheet but does not secure the said protective layer to the other layers of the laminate, a white coating, a plastic film having mixed therein fluorescent dye, a partial covering of printed symbols or pattern contrasting in color to the said dye, and a covering layer of weather-proof transparent plastic having its surface covered with small protuberances of the said plastic, wherein the layers of the laminate are flexible and except for the back protective sheet are adhered securely together.

6. The laminate of claim **5** wherein visible printing contrasting in color to the color of the fluorescent dye is printed on the said mixed film with a metallizing process.

7. The laminate of claim **5** wherein the printed symbol is a metal printed by a metallizing process in a mirror image to the underside of said covering layer.

8. The laminate of claim **5** wherein said coating is applied to a film of plastic, said coated film being laminated to said mixed film.

9. A laminated sheet comprising in sequence from the bottom layer, a protective sheet of thin material, an adhesive which is slightly adhesive to the protective sheet but does not secure the said protective layer to the other layers of the laminate, a plastic film coated with a metallic covering, a partly covering plastic film layer containing a visible fluorescent dye, printing contrasting in color to said metallic covering, and a covering layer of weather-proof transparent plastic having its surface covered with small protuberances of the said plastic, wherein the layers of the laminate are flexible and except for the back protective sheet are adhered securely together.

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