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COATED FLUORESCENT FABRIC

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Fig.-1

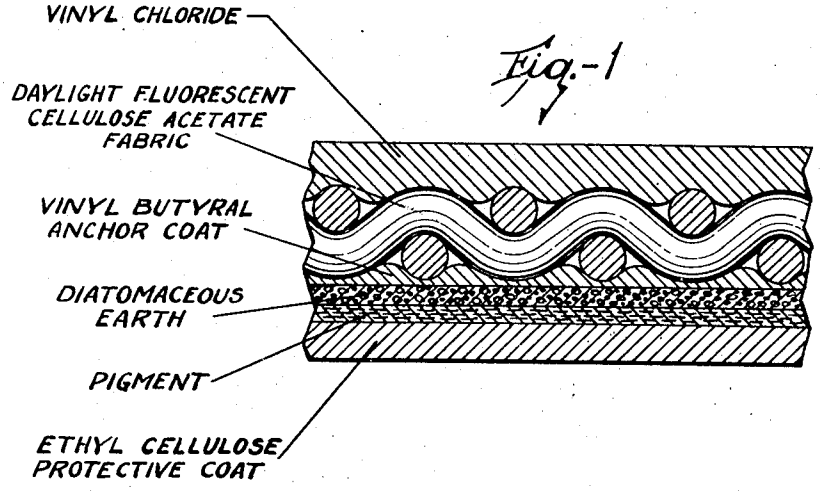
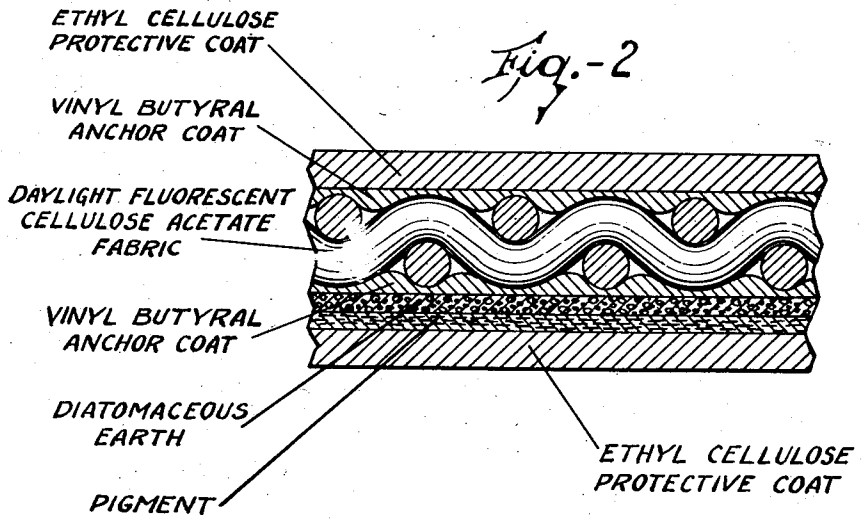


Fig.-2



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COATED FLUORESCENT FABRIC

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8 Claims. (Cl. 250—71)

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This invention relates to an improvement in coated dyed fabrics and, more particularly, to non-bleeding coated fluorescent fabrics used for display and signal purposes.

Fluorescent fabrics which exhibit the phenomenon of daylight fluorescence are very useful for daylight signaling and display purposes. As a result of the phenomenon of daylight fluorescence, sheets or banners (hereinafter referred to as "panels") of such fabric may be seen in daylight at distances much greater than panels which exhibit color by the normal reflection-absorption phenomenon. The reason for the greater visibility of daylight fluorescent fabrics is that such fabrics apparently not only reflect a portion of the incident visible daylight (sunlight or light having a spectrum similar to sunlight) but also emit light in response to wave-lengths of light which might otherwise be absorbed if the fabric exhibited color by the normal phenomenon of reflection and absorption. For example, the total red light emitted and reflected by a red daylight fluorescent panel may amount to 120% of the red light in the incident daylight; heretofore any object which exhibited a red color by the normal phenomenon of reflection and absorption was considered to be extremely "red" if it reflected as much as 60% of the red light in the incident daylight.

In order to protect daylight fluorescent fabric from soil and abrasion and to prolong the fluorescent life of the fabric, it is advisable to protect the fabric with clear coatings. Unfortunately, however, the dyes in daylight fluorescent fabrics exhibit a tendency to bleed through most satisfactory clear overcoatings. Such bleeding is not serious when the entire fabric panel is of one daylight fluorescent color. The bleeding, however, will seriously diminish, if not destroy, the utility of the panel when opposite sides or adjacent areas of the panel are of different colors. Thus, for example, if a panel, made prior to this invention and which was of a red day-light fluorescent color on one side and white on the other, were stored in a rolled or folded condition so that opposite sides of the panel were in contact, the white side would acquire a pinkish cast and would eventually become a definite red, thus destroying or diminishing the utility of a panel as a two-color panel.

Broadly, it is the object of this invention to provide a non-bleeding coated dyed fabric. Specifically, it is the object of this invention to provide a flexible signal or display panel in which one surface or area is non-bleeding and is dyed with a daylight fluorescent dye. It is a further object of

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this invention to increase the durability of a panel and lessen weather extraction of the dye in the panel.

The manner of accomplishing the foregoing objects and other objects of this invention will be apparent from the following specification, claims, and drawings, in which:

Fig. 1 is a greatly enlarged and partially diagrammatic cross-section through a signal panel made according to my invention.

Fig. 2 is a cross-section similar to Figure 1, but showing a modification of my invention.

In making a daylight fluorescent panel according to this invention, the dyed fabric employed is preferably a fabric dyed acording to the method disclosed in the copending application of Joseph L. Switzer and Richard A. Ward for Fluorescent textiles, Serial No. 430,792, filed February 13, 1942. As explained in that application, the daylight fluorescent dye molecules are probably oriented in or on the fibers and filaments of the textiles in an orientation similar to the orientation of the dye molecules when the dye is in a liquid solution. I assume, therefore, that the pronounced tendency of the daylight fluorescent dyes to bleed from the dyed fabric is largely attributable to the peculiar state, akin to that of a liquid solution, in which the dye molecules are dispersed on or in the fibers and filaments of the textiles.

In order to increase the utility of a daylight fluorescent panel, I coat one surface or area with a pigmented coating having a different color (which may include white) from that of the dyed fabric. The problem of preventing dye bleed from the fabric to the differently colored coating was particularly difficult because of two facts which were readily apparent. First, any effort to fix the dye to the fabric, as by mordanting, laking, or like normal procedures for fixing a dye, resulted in destruction of the daylight fluorescence of the fabric. This was true even though the color of the dye was not appreciably altered by so fixing the dye to the fabric. Second, all known clear coatings which possessed sufficient flexibility were permeable to the dyes, even though the dyes were not compatible with the coatings. Thus, bleeding occurred between the fabric and a differently colored pigmented coating regardless, apparently, of the composition of the flexible coatings.

I have overcome the foregoing apparently inherent obstacles in the following general manner: In the hopes of obtaining a "blotter" effect which would provide at least a temporary bar-

rier to bleed between the dyed fabric and the pigmented coating, I placed a stratum of absorptive material between the dyed fabric and the pigmented coating. Of the many absorptive agents tested, I discovered that diatomaceous earth not only did not affect the daylight fluorescence of the fabric (as several of the absorptive agents did) but also served as a permanent (not merely a temporary) barrier to the dye when the coated fabrics were made in laboratory samples. Unfortunately, dye bleed still occurred when fabric containing the intermediate stratum of diatomaceous earth was produced in quantity on standard web coating machines. I overcame this last obstacle by utilizing my further discovery that, whereas all suitable clear coatings of a resinous type are permeable to the dyes, certain coatings, such as those of the vinyl resin type, for example, tend to absorb the dye but others, such as those of the cellulose ether type, for example, merely transmit the dye without apparent absorption and, further, that such dye transmission occurs only when the virtually non-absorptive resin (hereinafter referred to as "non-absorptive resin") is interposed between a source of the dye and an absorber for the dye. In other words, certain resins transmit the dyes only when interposed between surfaces having a dye absorption potential difference (hereinafter referred to as a "dye absorption potential"). Accordingly, my daylight fluorescent panel comprises, in general, a web of daylight fluorescent dyed fabric; on the reverse, i. e., pigmented, side of the fabric a barrier stratum is interposed between the fabric and the stratum of pigment; the pigment is dispersed in a non-dye-absorptive carrier and may be provided with one or more protective overcoats of transparent, non-dye-absorptive lacquer or the like. The obverse side of the panel is usually provided with a protective clear overcoat. The composition of the obverse overcoat is relatively immaterial in so far as its dye-absorptive characteristics are concerned; the important point of the composition of the coatings being that the coatings on the reverse side of the panel contain no dye absorptive coating material between the barrier stratum and the reverse surface of the panel.

In so far as I am able to explain the phenomena involved, my panels are non-bleeding for the following reason: First, the diatomaceous earth serves as a barrier between the dyed fabric and the stratum of pigment, even in the presence of an excessive quantity of solvent used during coating, because the dye forms an insoluble lake with the diatomaceous earth. The diatomaceous earth is not a mere "blotter," as was expected. The lake of diatomaceous earth and dye is substantially the same color as the daylight fluorescent fabric; therefore, the laked dye does not alter the color of the fabric but, instead, acts as a reflector of the visible light emitted and reflected by the fabric. Why a portion of the dye will not bleed between the interstices of the particles of the lake of dye and diatomaceous earth is not fully understood. Second, by employing on the reverse side of the panel only non-dye-absorptive resins and plasticizers in the coatings and in the carrier for the pigment, no dye absorption potential is created to cause the dye to bleed into the reverse side of the panel when the reverse side is in contact with the obverse side. The phenomenon of a dye absorption potential has been observed; it is not fully understood why non-dye-absorptive resins and the like should be permeable to the dyes nor is it fully understood what forces are involved in creating the observed potential.

By way of illustration and not by way of limitation, the following examples of non-bleeding daylight fluorescent panels are given:

Example 1.—In the greatly enlarged and somewhat diagrammatic sectional view shown in Fig. 1, a woven web of daylight fluorescent cellulose acetate fabric, dyed according to the method disclosed in the above identified application of Joseph L. Switzer and Richard A. Ward for Fuorescent textiles, is coated on its reverse surface with a tacky, thermoplastic anchor coat of a resin, vinyl butyral in this instance. To the vinyl butyral anchor coating is applied a second reverse coat comprising vinyl butyral resin containing a 20% to 60% dispersion, based on the weight of resin, of diatomaceous earth. Over the stratum of diatomaceous earth is applied a third coat comprising a non-dye-absorptive resinous carrier, ethyl cellulose in this instance, containing a 40% to 60% dispersion, based on the weight of resin, of a pigment, titanium dioxide in this instance. Over the stratum of pigment is applied one or more clear overcoats of a non-dye-absorptive material which is preferably non-tacky and relatively hard when dry; in this example, suitably plasticized ethyl cellulose is employed for the final clear overcoat. On the obverse of the web one or a plurality of clear protective overcoats of plasticized vinyl chloride is applied. One or more of the coatings on the obverse side of the fabric may contain a protective ultraviolet absorbing agent, as disclosed in the copending application of Joseph L. Switzer, Robert C. Switzer and Richard A. Ward for Light-responsive fluorescent media, Serial No. 455,610, filed August 21, 1942.

In the embodiment disclosed in Fig. 1, the daylight fluorescent dye will bleed from the fabric through the reverse anchor coat to the stratum of diatomaceous earth. The dye will there form with the diatomaceous earth an impenetrable, insoluble lake of the same color as the fabric. The barrier stratum of laked dye simultaneously protects the adjacent stratum of pigment and serves as a reflector for the light emitted and reflected by the daylight fluorescent fabric. On the obverse of the panel, dye will bleed into the protective coating, primarily during coating; no harm, however, will result from such bleeding. The bled dye will merely tint the obverse coating, and, being in a state akin to solution, will render the tinted coatings daylight fluorescent. When the panel is rolled up so that the obverse surface of the panel will contact the reverse surface of the panel on the next adjacent turn or ply, no bleed into the stratum of pigment will occur because there is no absorption potential between the obverse surface of the panel and the non-absorptive material in the adjacent reverse layer.

To employ the coated daylight fluorescent panel described above as a signal panel, the coated web is preferably cut to the desired size, reinforced at its edges with suitable tapes, and provided with grommets or like means to permit the panel to be staked or tied to a suitable supporting surface.

Example 2.—The modification shown in Fig. 2 is similar to that shown in Fig. 1, except that the obverse of the fabric is provided with an anchor coat of vinyl butyral resin to which is applied one or more clear protective overcoats of a non-dye-absorptive resin, such as the ethyl cel-

lulose employed in this instance, to render the obverse of the panel less thermoplastic and more scratch resistant than the vinyl chloride overcoat employed in Example 1. No bleed into the stratum of pigment will occur when the panel is rolled because of the barrier interposed between the fabric and the pigment and because of the absence of a dye absorption potential between the obverse surface and the non-absorptive material in the adjacent reverse layer.

It is to be understood that, in view of the disclosure of the principles involved and the results obtained, the invention is not to be limited to the specific examples disclosed but may be varied in whole or in part to meet the needs and exigencies of specific uses and to accommodate the characteristics of specific materials employed. For example:

The daylight fluorescent fabric in the embodiments disclosed is a woven cellulose acetate textile. Other daylight fluorescent fabrics which may be employed are disclosed at length in the above identified application for fluorescent textiles. Although this invention is employed at present for daylight fluorescent signal and display panels, it is obviously not limited for use with daylight fluorescent fabrics but may be used in connection with any dyed sheet material which is provided with a differently colored coating into which the dye may tend to bleed.

Instead of diatomaceous earth, one may employ any other laking compound, preferably insoluble, which will not appreciably affect the color of the dye. Examples of other laking compounds are phospho-tungstic acid, activated aluminas and silicates, green earth, and the like.

By simple observation of the tendency of the dye to bleed into the coating from the fabric, those skilled in the art will be able to select any number of suitable non-dye-absorptive and dye-absorptive coatings from the vast number of coating compositions available to the art. It is to be understood that the term "resinous" as applied to such coating compositions and compounds includes derivatives of cellulose. In addition to ethyl cellulose, other suitable resinous compounds for non-dye-absorptive coatings may include, for example, other cellulose ethers such as benzyl cellulose, acrylic acid polymers, polystyrene, and the like. Absorptive resins for daylight fluorescent dyes, in addition to vinyl butyral and vinyl chloride, may include other vinyl resins such as vinyl acetate and copolymers of vinyl acetate and vinyl chloride, alkyd resins, urea-formaldehyde resins, and the like. In selecting suitable coating compositions, tackiness at normally encountered atmospheric temperatures, thermoplasticity, moisture and moisture-vapor permeability, abrasion resistance, flexibility, transparency, and similar characteristics should be taken into consideration in addition to the absorptiveness or non-absorptiveness with respect to the particular dye involved. It should also be borne in mind that particular plasticizers may radically alter the characteristics of the resinous component of the coatings employed.

From the foregoing, it should be obvious that the scope of this invention is not limited to the embodiments disclosed but by the following claims.

What is claimed is:

1. As an article of manufacture, a coated dyed fabric comprising a web of fabric, a daylight fluorescent dye dispersed in said fabric in a state akin to solution, a laking substance for said

daylight fluorescent dye disposed in a barrier stratum anchored to the reverse of said fabric, said laking substance forming a lake with said fluorescent dye, which lake is of a color which will reflect light reflected and emitted by said fabric, a pigmented coating on said barrier stratum, said pigmented coating comprising a pigment dispersed in a relatively non-dye-absorptive carrier, a final clear overcoating of a relatively non-dye-absorptive resinous composition on said pigmented coating, and a clear protective coating on the obverse of said fabric, whereby no dye absorption potential will exist between the barrier stratum and the reverse surface of the coated fabric when the obverse of said fabric is in contact with the reverse of said fabric.

2. In a coated dyed fabric, a fabric, daylight fluorescent dye dispersed in said fabric in a state akin to solution, a barrier stratum of diatomaceous earth anchored to said fabric, and pigmented coating, having a color different from the dyed fabric, on said barrier stratum, whereby said diatomaceous earth will form an insoluble lake with said dye when said dye bleeds from said fabric into said earth.

3. A signal and display panel comprising a web of cellulose acetate fabric, a bleeding daylight fluorescent dye dispersed in said web, a resinous anchor coat on the reverse of said web, a stratum of diatomaceous earth on said anchor coating, a pigmented coating on said stratum of diatomaceous earth, said coating comprising a pigment dispersed in a cellulose ether carrier, a clear cellulose ether overcoat on said pigmented coating, and a vinyl resin coating on the obverse of said web.

4. A signal and display panel comprising a web of cellulose acetate fabric, a bleeding daylight fluorescent dye dispersed in said web, a resinous anchor coat on the reverse of said web, a stratum of diatomaceous earth on said anchor coat, a pigmented coating on said stratum comprising a pigment dispersed in a cellulose ether carrier, a resinous anchor coat on the obverse of said web and a clear cellulosic overcoat on said obverse anchor coat.

5. A two-color signal and display panel comprising a web of translucent cellulose acetate fabric, a daylight fluorescent dye dispersed in said fabric in a state akin to solution, a transparent protective coating on the obverse surface of said web, a barrier stratum of opaque reflective material adhered to the reverse side of said web and reflecting light of the color emitted and reflected by said web, said barrier stratum reflecting through the web light transmitted and emitted by the web, and a pigmented coat on the reverse side of said barrier stratum, and a transparent protective coating on said pigmented coating.

6. A two-color signal and display panel comprising a web of cellulose acetate fabric, a daylight fluorescent dye dispersed in said fabric in a state akin to solution, a transparent protective coating adhered to the obverse surface of said fabric, and a backing coating adhered to the reverse surface of said fabric, said backing coating comprising a lamina adjacent the obverse surface of the web and tinted by dye bled from the web to provide a surface reflecting light of the color of light emitted by daylight fluorescent dye in the fabric and a second lamina pigmented to provide a second color for the reverse surface of the panel.

7. A two-color signal and display panel comprising a translucent fabric, a daylight fluores-

cent dye dispersed in said fabric in a daylight fluorescent state akin to solution, a backing coating on the reverse surface of said panel containing a dispersion of reflective pigment of a color different from the color of the daylight fluorescent dye, the surface of said pigmented backing coating adjacent the daylight fluorescent dyed fabric being reflective of light of the color emitted and reflected by said dyed fabric to reflect through the fabric light transmitted by the fabric.

8. A two-color signal and display panel comprising a web of cellulose acetate fabric, a daylight fluorescent dye of a color other than white dispersed in said fabric in a daylight fluorescent state akin to solution to provide a daylight-fluorescent obverse surface for said panel, a flexible backing coating adhered to the reverse surface of said coating and a white opaquing pigment dispersed in said backing coating.

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