June 23, 1942. E. H. LAND 2,287,556

TRANSLUCENT SCREEN

Filed Feb. 25, 1938

Fig. 1.

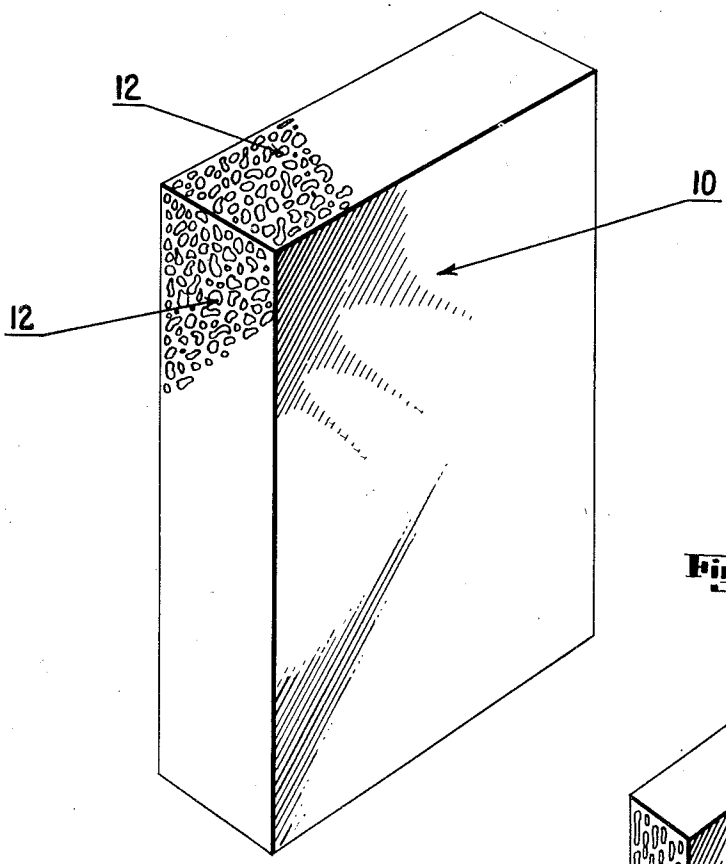
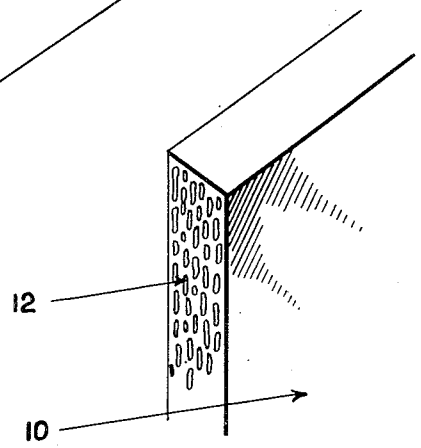


Fig. 2.



INVENTOR.
Edwin H. Land
BY
Brown & Jones
ATTORNEYS.

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UNITED STATES PATENT OFFICE

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TRANSLUCENT SCREEN

Edwin H. Land, Wellesley Farms, Mass., assignor, by mesne assignments, to Polaroid Corporation, Dover, Del., a corporation of Delaware

Application February 25, 1938, Serial No. 192,493

5 Claims. (Cl. 88—24)

This invention relates to a new and improved translucent screen and to a method of manufacturing the same.

An object of the invention is to provide a translucent screen adapted to transmit polarized light without depolarization thereof.

Other objects of the invention are to provide a translucent screen of the character described showing little or no scintillation, having substantially no grain, showing substantially no hot spot or area of excessive brilliance, and diffusing the transmitted light over a wide area.

Other objects of the invention are to provide a screen of the character described comprising plastic material in the form of a self-supporting flexible film or sheet which may be rolled for packing and transportation.

A still further object of the invention is to provide a method for controlling the direction of spread of light transmitted by a screen of the character described which comprises effecting an orientation of the suspended particles of the discontinuous plastic phase of the screen by extending or stretching the screen in a predetermined manner and to a predetermined extent.

A still further object of the invention is to provide a translucent screen of the character described comprising benzyl cellulose.

A still further object of the invention is to provide a process for the production of a translucent screen of the character described comprising forming a solution of plastics, casting the said solution or flowing it, or otherwise extending it in such a manner as to provide a sheet or film thereof having smooth surfaces, and drying the solution to form a dispersion of one plastic in another.

A still further object of the invention is to provide a translucent screen of the character described comprising a plurality of plastic materials, one present as a continuous phase, the other present as a discontinuous phase, one of said materials comprising benzyl cellulose, the other of said materials comprising a plastic having a refractive index differing from that of benzyl cellulose.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises the several steps and the relation of one or more of such steps with respect to each of the others, and the article possessing the features, properties, and the relation of elements which are exemplified in the following detailed disclosure, and the scope of the application of which will be indicated in the claims.

This application is a continuation in part of my copending application Serial No. 175,421, filed November 19, 1937, for Translucent screen, which has issued as United States Patent No. 2,180,113 under date of November 14, 1939.

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description taken in connection with the accompanying drawing, in which:

Figure 1 represents diagrammatically and greatly enlarged a view partially in section and partially in perspective of a translucent screen embodying one form of the invention; and

Fig. 2 represents a modification thereof.

In my said copending application Serial No. 175,421, filed November 19, 1937, for Translucent screen, there is disclosed a translucent screen comprising a dispersion or emulsion of a transparent material in another transparent material having a relatively slightly different index of refraction from that of the first material. The dispersed or emulsified material is described as comprising a multiplicity of globular particles of varying size distributed throughout the other material, and the screen itself is described as comprising a sheet formed of the two materials with or without supporting plates on glass or other rigid supporting materials positioned on either side of the sheet.

This invention relates to the same type of translucent screen, and more particularly to an improved form thereof wherein benzyl cellulose is employed as one of the materials forming the screen or film. In a preferred form of the invention, a dispersion of particles of benzyl cellulose in another plastic is formed, and this dispersion is produced in the form of a sheet or film of any desired thickness, for example from .002 to .004 of an inch or thicker. Such a film or sheet may be formed by casting or by flowing, or by pouring, or by spraying, or by extrusion. It may preferably be formed by casting a solution of benzyl cellulose and another plastic, for example ethyl cellulose, in a suitable solvent, for example isopropyl acetate, upon a glass or other flat surface. Upon evaporation of the solvent and hardening of the sheet or film, a dispersion of particles or globules of benzyl cellulose in ethyl cellulose is produced.

Fig. 1 shows somewhat diagrammatically such a film in the form of a suspension of particles 12 of benzyl cellulose in the continuous sheet or film

10 of ethyl cellulose. The particles of benzyl cellulose may preferably be of varying sizes, ranging for example from tiny globules of less diameter than the wavelengths of light to globules or particles approximately 15 microns in over-all diameter. The globules or particles of the dispersed material may be irregularly shaped or formed and are preferably distributed substantially uniformly throughout the ethyl cellulose. The cast film or sheet, when dry, may be stripped from the glass support. Where it is properly prepared, the film may have smooth surfaces and may present a substantially milky appearance, being completely translucent. Tests show that such a film may transmit in excess of 80% of the incident light, and if that light be polarized it may be transmitted by the film without depolarization of the beam. The transmitted light is substantially uniformly diffused over a wide angle. The screen shows substantially no scintillation or bright spots, no grain, and no hot spot or brightly illuminated area. It is admirably adapted for use in connection with rear projection pictures or wherever a ground glass screen may be satisfactorily employed. The screen may be rolled upon a suitable support for shipment without breakage, creasing, or injury.

In the preparation of the dispersion forming the product of the present invention, a solution of ethyl cellulose and benzyl cellulose in isopropyl acetate is prepared by mixing or stirring the ingredients until the benzyl cellulose has completely dissolved. The proportions of both solvent and plastic employed may be widely varied. Generally speaking, a preferred translucent screen may be formed from mixtures comprising substantially equal parts of ethyl cellulose and benzyl cellulose by weight dissolved in a suitable solvent, such for example as isopropyl acetate. A satisfactory product for forming the screen by casting may be secured with a solution in which substantially 8 c. c. of the solvent is employed for each gram of plastic. The proportions of ethyl cellulose and benzyl cellulose are not critical and may be departed from without greatly impairing the product of the invention. A preferred product may be obtained from a solution comprising from 40% of benzyl cellulose and 60% of ethyl cellulose to 60% of benzyl cellulose and 40% of ethyl cellulose. Where more ethyl cellulose is employed, i. e., where the proportion of ethyl cellulose to benzyl cellulose exceeds approximately three to two, the finished screen shows somewhat less efficient hot-spot elimination than the screen produced by employing the preferred proportions. Such a screen may be said to be more transparent than the preferred embodiment of the invention. Where an excess of benzyl cellulose to ethyl cellulose is employed, i. e., where the ratio of benzyl cellulose to ethyl cellulose exceeds approximately three to two, the finished screen shows too much grain. The size of the suspended particles of the discontinuous phase becomes larger than in the preferred embodiment of the invention. With the preferred embodiment of the invention, the grain size or size of particles of the discontinuous phase and the translucent properties of the screen are such as to give a minimum of scintillation with a maximum of hot-spot elimination.

The quantity of solvent may be varied. The proportion given in the above formula is that which gives a viscosity to the dispersion suitable for casting. It is to be understood that the solvent mentioned may not completely volatilize and that small portions thereof may remain in the finished product.

Other mixes embodying benzyl cellulose may be employed with other solvents to produce the product of the present invention. For example, a mix may be prepared comprising three parts of cellulose acetate to two parts of benzyl cellulose with acetone as the solvent. A translucent screen produced from such a solution as by casting, flowing, or as otherwise described, tends to show areas where the translucent properties of the screen are less efficient than in other areas. The areas of greatest efficiency are, however, of such size that they may be selected for use where small translucent screens may be employed.

In the formation of the screen a solution of desired viscosity may be poured or spread upon a sheet of glass, where it may remain until the solvent has volatilized, and the dispersion dried to a point where it is self-supporting and may be readily handled.

The direction of spread of the transmitted beam may be controlled in any of the translucent screens of the type herein described or of the type described in my said copending application Serial No. 175,421 by stretching or extending the screen in a predetermined direction. This may be accomplished by uniformly heating the screen to a point where it may be extended, or it may be accomplished by depositing the softened plastics comprising the screen on a support or base which may be stretched, and then stretching the base before the screen has itself become hardened or set, or it may be accomplished in any other manner. Where the screen has been extended or stretched, the particles forming the discontinuous phase are also elongated or stretched in the direction of extension of the screen. The resulting product is somewhat diagrammatically shown in Fig. 2, where the particles 12 forming the discontinuous phase are shown as comprising extended ellipsoidal particles, the direction of extension being uniform and coinciding with the direction of extension of the screen itself.

It will be apparent that light transmitted by such a screen will be spread to a much greater extent in a direction at right angles to the direction of extension of the screen and of the particles forming the discontinuous phase of the screen. Where, for example, such a screen is positioned so that the long axes of the extended particles forming the discontinuous phase are vertical, the transmitted beam will be spread horizontally.

It will be apparent that with such a screen the direction of spread may be so controlled as to provide maximum efficiency in a theatre or home where the screen is employed in connection with the projection of motion pictures and the like.

Since certain changes in carrying out the above process, and certain modifications in the article which embody the invention may be made without departing from its scope, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A translucent screen comprising a sheet-like, set dispersion of one transparent plastic material in the form of a discontinuous phase in another transparent plastic material in the form of a continuous phase, one of said plastics comprising benzyl cellulose and the other plastic comprising ethyl cellulose, the particles of the plastic forming the discontinuous phase having non-planar and non-parallel surfaces and having over-all diameters not exceeding substantially fifteen microns.

2. A translucent screen comprising a sheet-like, set dispersion of one transparent plastic material in the form of a discontinuous phase in another transparent plastic material in the form of a continuous phase, said plastics having relatively slightly different indices of refraction, said screen comprising from 40% to 60% of benzyl cellulose and from 60% to 40% of another plastic, the particles of the plastic forming the discontinuous phase having non-planar and non-parallel surfaces and having over-all diameters not exceeding substantially fifteen microns.

3. A translucent screen comprising a sheet-like, set dispersion of one transparent plastic material in the form of a discontinuous phase in another transparent plastic material in the form of a continuous phase, said screen comprising from 40% to 60% of benzyl cellulose and from 60% to 40% of ethyl cellulose, the particles of the plastic forming the discontinuous phase having non-planar and non-parallel surfaces and having over-all diameters not exceeding substantially fifteen microns.

4. A translucent screen comprising a sheet-like, set dispersion of one transparent plastic material in the form of a discontinuous phase in another transparent plastic material in the form of a continuous phase, said screen comprising substantially equal parts of benzyl cellulose and ethyl cellulose, the particles of the plastic forming the discontinuous phase having non-planar and non-parallel surfaces and having over-all diameters not exceeding substantially fifteen microns.

5. A translucent screen comprising a sheet-like, set dispersion of one transparent plastic material in the form of a discontinuous phase in another transparent plastic material in the form of a continuous phase, said plastics having relatively slightly different indices of refraction, the particles of plastic forming said discontinuous phase being elongated and oriented in substantially the same direction, the particles of the plastic forming the discontinuous phase having non-planar and non-parallel surfaces and having over-all diameters not exceeding substantially fifteen microns.

EDWIN H. LAND.