

May 3, 1960

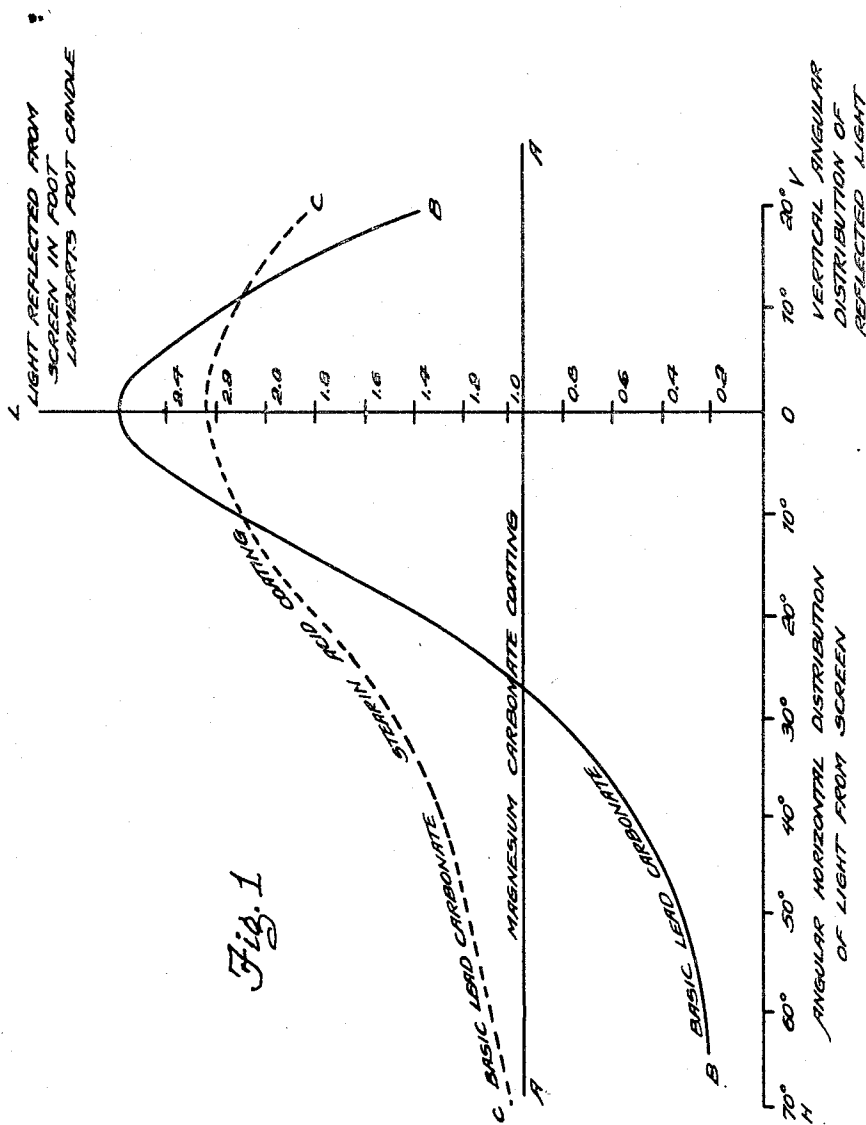
T. S. HARKNESS

2,934,997

CINEMATOGRAPH SCREEN HAVING IMPROVED PROPERTIES

Filed Feb. 25, 1957

2 Sheets-Sheet 1



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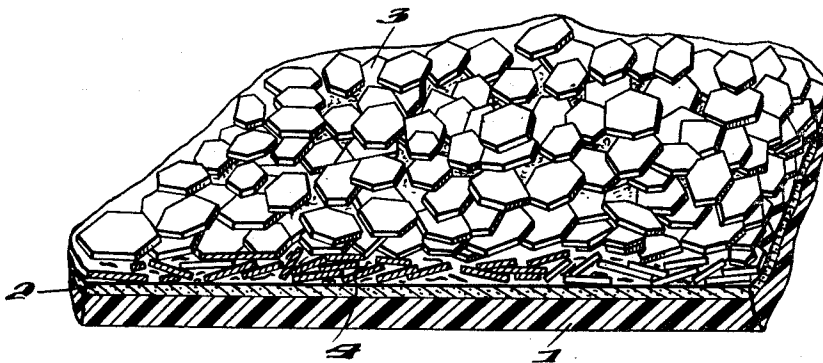
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Fig. 2.



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CINEMATOGRAPH SCREEN HAVING IMPROVED PROPERTIES

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7 Claims. (Cl. 88—28.9)

This invention relates to projection screens for use, for example, in cinemas and is concerned with a projection screen of the kind having a base made of a fabric or synthetic plastic material provided on one side thereof with a coating or coatings to give the desired final screen surface. A particularly suitable plastic material base is that made from sheeted polyvinylchloride which is coated with titanium dioxide.

It heretofore had been proposed to provide, on such a base, a final screen surface by coating one side of the base (i.e., that side bearing the titanium dioxide coating) with a multiplicity of layers of a luster paint conveniently made of a lead compound in crystalline form, such as crystalline basic lead carbonate, mixed with appropriate quantities of nitro-cellulose and butyl acetate.

Such a paint gives an excellent screen surface for the smaller size of screen and for narrow halls, but for the large, wide and sometimes curved screens now in use in many cinemas for motion picture presentation the illumination from a single light source often results in an uneven angular reflection of light from the screen which shows an area of excessive brilliance or glare on the screen—a phenomenon frequently referred to in the trade as a "hot spot" or "glare spot." In reality, the glare is due to a rapid falling off in the amount of light reflected from the screen center towards the sides and also towards the top and bottom of the screen.

The object of the present invention is to obviate this drawback by providing means which result in a substantially even angular distribution of light reflected from the screen in both the horizontal and vertical directions.

Broadly, according to the invention, this object is achieved by mixing stearic acid and its fatty acid associates or its compound in the form of a metal stearate with the crystalline luster paint so that the light reflection from the crystals is influenced in such a way that the distribution of reflected light is widened over a larger angle in the horizontal as well as the vertical direction.

Stearic acid of commerce is mostly associated with other fatty acids of a similar nature such as palmitic acid and oleic acid and is very suitable as an additive to the crystalline lead compound essence forming the basis of the luster paint, especially where these exist in crystalline form and are white in color or colorless.

It has been found that stearic acid mixtures associated with similar fatty acids are advantageous as they form mixtures in which the crystals are of needle and leaf shape structure and intermix very well with the plate-shaped crystals of basic lead carbonate when this latter ingredient forms the basis of the luster paint essence.

As these small crystals intermingle with the crystals of the basic lead carbonate or lead compounds, they have the effect, if they happen to be positioned in front of the reflecting crystal plates, of a dulling action on the reflection from the crystals as well as a diffuse dispersing effect, whilst if they are intermixed between the crystal plates they have an additional tilting effect on the crystals. The

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result of both these effects is a widening of the angle of distribution of the reflected light.

In the drawings:

Figure 1 is a graph showing the angular distribution and intensity of light reflected from the screen of the invention and selected screen coatings of the prior art.

Figure 2 is an enlarged view, partially in section, of a screen constructed in accordance with the invention.

Instead of stearic acid per se, the metal stearates having a white color may be used, for example, zinc stearate.

The nature of the invention will be more readily understood from Fig. 1 of the accompanying drawing in which the line O—H represents the angular horizontal distribution of light reflected from the screen whilst the line O—V represents the vertical angular distribution of reflected light.

The line O—L represents the amount of light reflected in foot lamberts per foot candle. The line A—A represents the light reflected from a screen coated with magnesium carbonate and forming the standard reference as the amount of light reflected from such a screen is independent of the angle at which the surface of the screen is viewed. As illustrated by the drawing, the light reflection is substantially constant but low at all angles which means, in practice, that an appreciable amount of light is lost by being reflected on to the walls, floor and ceiling of the cinema.

To concentrate the light more usefully in the auditorium, particularly one of any size, a screen with a higher reflectivity in the center has to be used. One example of such a screen is that coated with a crystalline lead compound luster paint—specifically, crystalline basic lead carbonate—and the light reflection curve of this type of screen is illustrated by the line B—B. It will be noted that such a screen surface has a narrow angular distribution of light and this makes it eminently suitable for narrow auditoria but as the falling off in reflection is rather steep it is not so suitable for wide halls or cinemas. This is because the rather steep drop in reflectivity becomes visibly apparent under such circumstances as a glare spot on the screen due to the greater reflectivity in the middle of the screen than at the sides.

A correction of the reflectivity characteristic of the screen is therefore desirable to make it suitable for a wide auditorium, and it has been found that the use of an additive to the luster paint essence of the type referred to above gives a practicable solution to the problem since it results in a screen having a characteristic similar to that illustrated by the line C—C of the drawing. It will be noted that the value of the reflection in the middle of the screen is lowered but the angle of distribution of the reflected light so widened that even up to a viewing angle of 70°—which would represent the extreme end row seats in an averagely wide cinema—the amount of light in the horizontal direction rises above even that from the standard magnesium carbonate screen represented by the characteristic A—A.

Fig. 2 is a diagrammatic representation of a cross-sectional view of a projection screen embodying principles of the present invention. In Fig. 2, the base material is represented at 1, and at 2 an intermediate coating of polyvinyl chloride paint pigmented with titanium dioxide is shown. In the surface coating basic lead carbonate crystals and interspersed stearic acid crystals are shown at 3 and 4 respectively.

To make up the paint preparatory to coating the screen, and as an example of the method of carrying the invention into effect, a luster paint essence consisting, by weight, of approximately 35 percent basic lead carbonate crystals, 10 percent nitrocellulose and 55 percent butyl

acetate is mixed with approximately 15 percent crystalline stearic acid.

As already mentioned stearic acid as usually available industrially is associated with palmitic and oleic acids. A sample of a very suitable stearic acid, which was obtained commercially, showed on analysis that it consisted of 43 percent stearic acid associated with 52 percent palmitic acid and 5 percent oleic acid.

The crystalline form of this mixture is mostly needle shaped and has a setting point of 60° C.

After the luster paint essence and stearic acid additive have been mixed together they are added to a suitable lacquer which is then thinned to the desired consistency to make the final paint for coating the screen base. Preferably, the lacquer is a polyvinyl lacquer prepared by dispersing about 92% of polyvinyl chloride solids and about 8% of copolymerized vinylacetate solids in ketones and aromatic hydrocarbons, the latter being used in amounts to yield a sprayable lacquer composition. A screen coated with a uniform continuous layer of such a paint will have a reflection characteristic substantially the same as that illustrated by the line C—C.

When the screen base material is made of polyvinyl-chloride the use of stearic acid as the additive has the great advantage that it forms a protective layer which prevents the leaching out of the plasticizer from the base material.

The amount of the stearic acid can be varied up to approximately 30 percent by weight of the initial luster paint essence which will result in a great degree of flexibility in the final characteristic obtained and make it possible to provide a close approximation to the requirements of a customer and as dictated by the shape of the cinema auditorium or hall.

In the case where metal stearates are used instead of stearic acid the necessary percentages of the amount of the additive are best obtained by experiment but, generally speaking, are lower. For example, where zinc stearate is used a much smaller percentage is required since it has been found that only approximately 2 percent of zinc stearate will give the same results in widening the angular distribution of light as 15 percent of stearic acid per se. In general, the size of the metal stearate crystals corresponds to that of stearic acid crystals.

The paint is advantageously applied to the screen surface by automatic spraying means or by roller coating apparatus and in a plurality of individually thin layers.

Specific example

In the following illustrative but not limitative example, the term "gallon" means an Imperial gallon (=277.42 cubic inches).

Into 7.5 gallons toluene there are introduced, with agitation, 23.4 lbs. of "VYNS" vinyl chloride-acetate resin and 15.6 "VYHH" vinyl chloride-acetate resin, and to the resulting mixture there are added 5.5 gals. methyl ethyl ketone, 8.0 gals. methyl isobutyl ketone and 2.0 gals. diacetone alcohol, and the resulting "initial solution" is stirred until homogeneous.

12.0 pounds of crystalline stearic acid of commerce are wetted with .05 gallon of toluene and thereupon introduced into and thoroughly blended with the above "initial solution." The viscosity of the resulting "syrup" is approximately 40 Ford cup.

Into this syrup there is added, with thorough mixing, an amount of reflectance-modifying composition (about to be described) corresponding to 1.5 lbs. per each 1 (one) gallon of the above syrup. Said reflectance-modifying composition consists essentially of a suspension of basic lead carbonate crystals, 35% by weight, in a butyl acetate, 55% by weight, solution of nitrocellulose, 10% by weight.

Then, to the above mixture there is added, with agitation, a volume of said "initial solution" equal to the first,

and the resulting mixture is thinned with a mixed solvent. (hereinafter to be described) in an amount equal to volume to that of said resulting mixture. Said mixed solvent consists essentially of the following components in the following ratio by volume:

	Gals.
Methyl ethyl ketone -----	4
Methyl isobutyl ketone -----	8
Diacetone alcohol -----	2
10 Toluene -----	20

The so-thinned mixture, after having been made homogeneous by stirring, has a viscosity of about 20 Ford cup, and is adapted to be applied by spraying to the prepared base material. Said thinned mixture is applied to the prepared base material by means of known automatic spraying machinery, in one or more—usually, in two—complete coats each composed of 4 strokes. After drying, the final surface coating has a thickness of from 20 to 30 microns.

This application contains subject matter in common with my copending application Ser. No. 607,357, filed August 31, 1956, for "Cinematograph Screens."

I claim:

1. A cinematograph screen comprising an opaque white screen base material in sheet form and on one side of said base a surface coating layer comprising the solids content of a lacquer composition comprising a binder ingredient and a solid reflective ingredient in lamellar or plate-like crystalline form, wherein the lamellar crystals of the lacquer composition are intermingled with a crystalline organic material of the group consisting of commercial stearic acid and metal salts of stearic acid, said crystalline organic material being in needle and leaf forms and serving to tilt the lamellar crystals at a variety of angles with respect to the opaque white screen base material.

2. A directional cinema reflection screen comprising an opaque white screen base material in sheet form and on one side of said base a surface coating layer consisting essentially of the solids content of a lacquer composition containing dispersed therethrough lamellar crystals of basic lead carbonate and a crystalline organic compound selected from the group consisting of crystalline commercial stearic acid and colorless and white crystalline metal stearates, said crystalline organic material being in needle and leaf forms and being intermingled amongst said lamellar crystals.

3. The screen defined in claim 2 in which commercial stearic acid is a mixture consisting essentially of stearic, palmitic and oleic acids wherein the percentage of stearic acid is 43, of palmitic acid 52 and oleic acid 5.

4. A directional cinema reflection screen comprising an opaque white screen base material in sheet form and on one side of said base a surface coating layer consisting essentially of the solids content of a lacquer composition containing dispersed therethrough lamellar crystals of basic lead carbonate and a crystalline stearic acid compound in needle and leaf forms serving to tilt the lamellar crystals at a variety of angles with respect to the opaque white screen base material.

5. The screen defined in claim 4, in which the stearic acid compound is zinc stearate in the form of needle-like crystals.

6. The screen defined in claim 1, in which the binder ingredient includes a polyvinyl resin.

7. A directional cinema reflection screen comprising an opaque white screen base material in sheet form and on one side of said base a surface coating layer comprising the solids content of a lacquer composition comprising a polyvinyl resinous binder component and dispersed therethrough lamellar crystals of basic lead carbonate and crystalline commercial stearic acid in needle form, wherein the lamellar crystals of basic lead carbonate are tilted at a variety of angles with respect to the screen

base material by the crystalline commercial stearic acid
in needle form.

References Cited in the file of this patent

UNITED STATES PATENTS

1,293,433	Hill	Feb. 4, 1919
1,676,553	Hewitt	July 10, 1928
1,747,425	Cawley	Feb. 18, 1930
1,891,849	Suzuki	Dec. 20, 1932

5

10

1,926,923
2,002,733
2,032,363
2,097,269
2,246,452
2,440,963
2,568,599

656,651

Suzuki	Sept. 12, 1933
Earle	May 28, 1935
Holden	Mar. 3, 1936
Brassman	Oct. 26, 1937
McGrew	June 17, 1941
Luce	Mar. 4, 1948
Weidlich	Sept. 18, 1951

FOREIGN PATENTS

Great Britain	Aug. 29, 1951
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