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MANUFACTURE OF TRANSLUCENT SCREENS

Original Filed Nov. 22, 1935

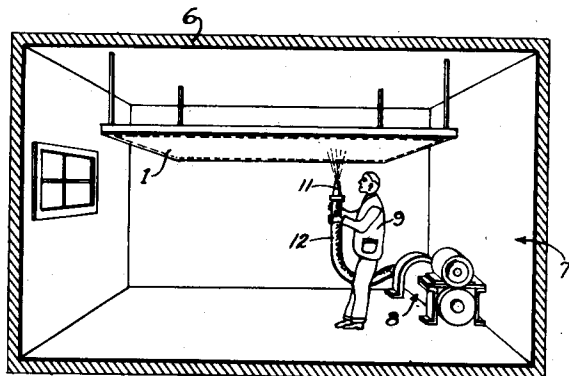


FIG. 1.

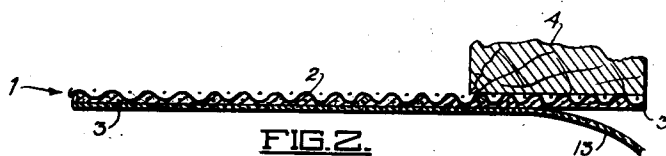


FIG. 2.

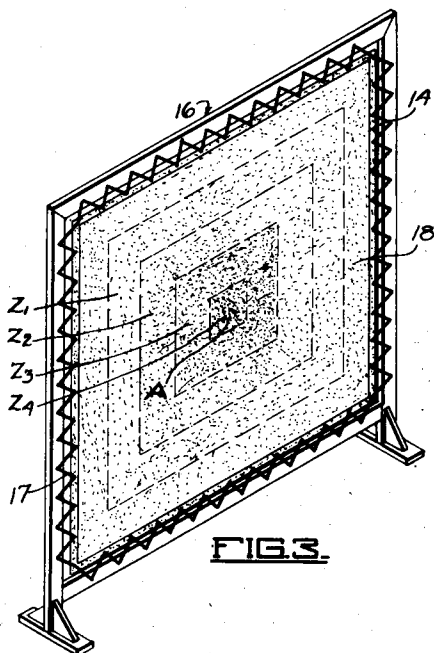


FIG. 3.

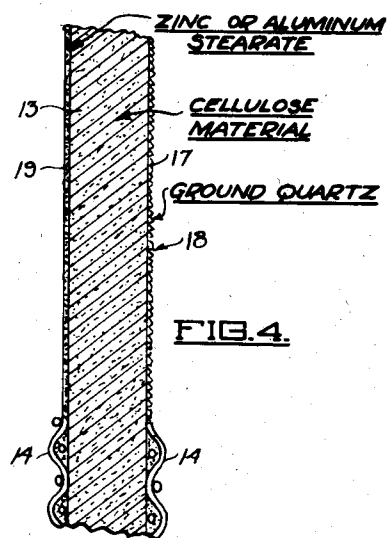


FIG. 4.

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## UNITED STATES PATENT OFFICE

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## MANUFACTURE OF TRANSLUCENT SCREENS

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Original application November 22, 1935, Serial No. 51,129. Divided and this application June 6, 1938, Serial No. 212,010

7 Claims. (Cl. 91-68)

This invention relates to picture projection screens and manufacture thereof and particularly to the translucent type of screens in which pictures projected on one side of the screen may be viewed or photographed on the opposite side.

This is a divisional application of application Serial No. 51,129 filed November 22, 1935, for "Manufacture of translucent screens." The screen made according to the invention is described and claimed in co-pending application Serial No. 85,275 filed June 15, 1936, for "Translucent projection screen."

Whether a translucent picture screen is to be employed for the photographing of composite pictures or for the projection of pictures to be viewed by an audience, it is desirable that the screen transmit as large an amount of light as possible while still retaining its translucency.

One object of the present invention is to obtain good tone qualities and a high degree of intensity of a picture transmitted by a translucent screen.

Preferably the screen is formed by spraying multiple coats of a solution of cellulose ester material on a matrix, allowing each coat to dry and stripping the base or screen thus formed from the matrix.

Another object of the invention is to reduce the possibility of water vapor, dirt, etc. from getting into the screen body in the course of spraying the same on the matrix.

This is accomplished by arranging the matrix on which the base or screen body is sprayed in a substantially horizontal position, the cellulose ester material being sprayed thereon from underneath. Any dirt or water vapor from the spray equipment or elsewhere will tend to settle downward, away from the surface of the sprayed cellulose. Furthermore, positioning the matrix so as to allow the transparent material to be sprayed on the bottom side thereof allows sheets of any size to be produced without the necessity of overhead scaffolding and ladders from which dirt might fall onto the screen if it were sprayed on the top of the matrix.

For further details of the invention, reference is to be had to the accompanying drawing, in which:

Fig. 1 is a perspective view showing the method of making a transparent base for a translucent screen.

Fig. 2 is a sectional view through the matrix and the transparent screen formed thereon.

Fig. 3 is a perspective view showing the com-

pleted translucent screen suspended within a frame.

Fig. 4 is an enlarged fragmentary cross sectional view through the translucent screen.

The matrix 1 (Figs. 1 and 2) is formed of a fabric 2 having a base 3 thereon to present a smooth surface on the lower face thereof. Base 3 is formed of a suitable material such as an amber composition which is not compatible with the liquid employed in making the transparent base for the screen. The matrix 1 is secured to the bottom of a suitable frame 4 which is suitably suspended from the ceiling 5 of the spraying room 7.

The transparent sheet material such as cellulose acetate or cellulose nitrate, which is to be employed in producing the base for the translucent screen, is dissolved in suitable solvents, plasticizers, etc., to render it liquid and sprayable upon the matrix 1. The liquid cellulose material is sprayed under pressure upon the under surface of the matrix 1 in the manner shown in Fig. 1 through a suitable spraying apparatus as shown at 8. This spraying operation may be carried out manually by an operator 9 standing below the matrix 1. By directing the nozzle 11 of the liquid conveying hose 12 throughout the entire area of matrix 1 the transparent base 13 (Fig. 2) may be produced. Preferably the base 13 is formed by spraying a large number of cellulose coats upon the under surface of the matrix 1 and allowing each coat to dry before the application of the next succeeding coat. The completed transparent sheet thus formed may be of any desired thickness; however, I prefer to make it from .015" to .020" thick. Also, sheet 13 is preferably of substantially the same thickness throughout its entire area or it may increase slightly in thickness towards the edges so as to increase the strength of these portions and/or make the thickness of the finished screen exactly the same throughout; however, it is to be understood that the change in thickness of the sheet 13 is not utilized to affect the intensity of the transmitted light. In any case, a transparent homogeneous body portion is built up of sufficient strength to withstand stretching flat. After the sheet or base 13 is entirely dry, it is provided with a reinforcing web or strip 14 around its edges. The sheet 13 is then stripped from the matrix 1 and is suspended in a frame 16 (Fig. 3) as by interlaced elastic cords 17. The light refracting material employed to render the sheet 13 translucent is formed of a crystalline material which is ground to an extremely fine mesh.

quartz is preferably employed because of its high light refractive qualities. However, silicon, feldspar and other similar materials may be used although they are not as efficient.

In one method of obtaining a very finely ground quartz material, pieces of crystal quartz weighing one pound or less are placed in a dry condition within a ball mill and there ground for a period of about one week, whereby the quartz is reduced to a fine powder. At the end of this time the iron and other impurities are removed from the ground quartz by a magnet, acid, etc. The resulting quartz powder is then mixed with a cellulose material in liquid form in the approximate proportions of five pounds of quartz to one and a half gallons of cellulose material dissolved in a suitable thinner to render it liquid. This mixture is then ground between rolls or otherwise for a period of about a week to further decrease the size of the quartz particles and to thoroughly mix these particles with the liquid cellulose material. The resulting quartz particles will be sufficiently fine to pass through a 2000 to 3000 mesh screen. This resulting mixture of cellulose and finely ground or fractured quartz is then further mixed with liquid cellulose material in the approximate proportions of two quarts of quartz mixture to twenty gallons of dissolved cellulose material and is placed in a spraying apparatus similar to that shown at 8 (Fig. 1). The final quartz and cellulose mixture is sprayed under air pressure upon the transparent base or sheet 13 in the form of a fine mist or spray. The thickness of the quartz and cellulose coating upon the transparent base 13 is extremely small, being slightly larger than the thickness of the quartz particles. The density of distribution of the quartz particles is made greater at the center of the screen as shown at A (Fig. 3) and gradually decreases toward the edges. This is accomplished by applying more coats of the quartz and liquid cellulose mixture at the center than at the edges. For example, in the coating of the quartz mixture upon a transparent base of about sixteen feet on each side, about six to eight coats of quartz mixture may first be evenly applied over the entire area of the base, then about four or five coats may be applied over a smaller area or zone Z<sub>1</sub>, next about ten coats may be applied over a still smaller zone Z<sub>2</sub>, next about six coats over a next smaller zone Z<sub>3</sub>, and finally about six coats over a still smaller zone Z<sub>4</sub>. This last zone Z<sub>4</sub> may cover an area of about three square feet in the central portion of the screen. These coats, however, gradually blend together so as to form a single coat whose density of quartz distribution gradually increases toward the center of the screen. It is to be understood at this point that the thickness of the layer 20 of quartz particles remains substantially of the same thickness throughout the area of the translucent screen but that the density of distribution or the number of quartz particles per unit of area varies toward the center of the screen. By rubbing the fingers over the quartz sprayed surface after the same has dried, the surface feels rough, somewhat like emery paper, although of much finer texture. This indicates that as the solution of liquid cellulose and minute quartz particles are sprayed upon the base, the liquid cellulose material adhering to the projecting points of the quartz particles tends to flow toward the cellulose base due to surface tension of the liquid cellulose.

That is, the cellulose at the projecting points has an affinity for the cellulose base and thus tends to flow thereto. It will be seen therefore that the quartz particles become partially imbedded in the cellulose material with projecting light refracting points in direct contact with the air.

During the operation of spraying the ground quartz upon the transparent cellulose sheet 13, a suitable projector is employed to project a beam of light upon the back surface of the screen. The cross sectional area of this beam of light preferably varies in intensity thereacross in the same proportions as the beam of light to be ultimately used to project pictures, etc., upon the screen. That is, the beam increases in intensity toward its center. The finely ground quartz is so sprayed upon the sheet 13 that the transmitted light from the projected beam of light passing through the sheet and the quartz layer is of substantially constant intensity over the entire area of the screen. The more intense portions of the projected beam of light are refracted through a larger number of paths than the less intense portions to decrease the intensity of illumination at these points.

Although the above description is directed toward the production of screens for maintaining an even intensity throughout the entire area of the resultant translucent screen 18, it is apparent the density of distribution of the quartz particles may be so varied throughout the area of the screen 18 as to produce other desired effects. Also, if desired, the quartz may be uniformly applied to the surface of the transparent base so that the density of distribution of the quartz grains or particles is the same throughout the entire area of the screen. In this case the "hot spot" may be overcome by other means such as by placing a light filter in the path of the light beam between the projector and the screen.

In order to prevent back glare or reflection from the rear of the sheet 13 due to the sheen or polished effect of the surface, a coating 19 of a stearate compound such as zinc stearate may be provided thereon to produce a slightly dull surface. Preferably the stearate compound is mixed in a liquid cellulose solution and is applied to the untreated surface of sheet 13 by spraying it in the form of a mist or spray upon this surface.

I claim:

1. The method of making a sheet of cellulose ester material which comprises spraying multiple coats of a solution of cellulose ester material upon the under surface of a substantially horizontal matrix, allowing the sheet thus formed to dry and stripping said sheet from said matrix.

2. The method of making a large sheet of cellulose ester material which comprises spraying a transparent solution of cellulose ester upon the under surface of a substantially horizontal matrix, allowing said sprayed solution to solidify, and stripping the solidified sheet thus formed from the matrix.

3. The method of making a picture projection screen which comprises arranging a flat matrix face down in a substantially horizontal position and at such a height that an operator may walk underneath said matrix with spraying equipment, spraying a solution of screen material upwardly on the under surface of said matrix, allowing the sheet of screen material thus formed to dry and

stripping said sheet of screen material from said matrix.

4. The method of making a picture projection screen according to claim 3 wherein said screen material comprises a solution of cellulose ester.

5. Method of making a translucent picture projection screen which comprises spraying on the under surface of a flat smooth horizontal matrix multiple coats of cellulose ester material substantially free from diffusing ingredient to build up a transparent homogeneous body of sufficient strength to withstand stretching flat, stripping said body portion from said matrix, supporting said body portion vertical in light receptive relation to a motion picture projector, and spraying a liquid comprising cellulose ester on one surface of said body to render the different portions of said body translucent to a different degree depending on the intensity of the light from said projector.

6. Method of making a translucent picture

projection screen which comprises spraying multiple coats of cellulose ester onto the under surface of a flat smooth horizontal matrix to form a homogeneous transparent sheet, stripping said sheet from said matrix and rendering said sheet translucent and light intensity equalizing by spraying a surface of graduated roughness on one side of said sheet, said roughness increasing in a series of steps from the edge to the center of said screen to substantially equalize the intensity of a "hot spot" beam of light from a motion picture projector.

7. The method which comprises suspending in a substantially horizontal position a fabric having a matrix surface thereunder, spraying upwardly onto said surface a plurality of coats of screen material, allowing the sheet thus formed to dry, and stripping said sheet from said matrix.

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