United States Patent [19]

Hulbert, Jr.

[11] **3,754,135**

[45] **Aug. 21, 1973**

[54] **LIGHT TREATING MEANS**

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[22] Filed: **Apr. 21, 1971**

[21] Appl. No.: **136,799**

[52] **U.S. Cl.** **240/46.59**, 240/7.1, 240/41.3, 240/41.4

[51] **Int. Cl.** **F21v 9/08**

[58] **Field of Search** ..... 240/41.3, 41.4 R, 240/46.57, 46.59, 7.1 R, 9.5, 46.01, 23

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[57] **ABSTRACT**

A central circle of blue, translucent light filtering material is surrounded by an annular circle of clear transparent material which in turn is surrounded by an annular area of blue translucent light filtering material to form a filtered zone plate through which artificially produced light is filtered and mixed to provide a more natural white light having reduced glare and improved color resolution and illumination. In a preferred form, the clear area functions as a light aperture and the central and annular translucent areas cooperate to provide a filtered light which mixes with the light passing through the aperture. The clear and translucent areas are provided by a flat, transparent plate which is removably secured to the light emitting face of a sealed beam lamp. The lamp includes a resistive incandescent filament for providing a light source, a parabolic reflector for collimating light directed through the plate and an opaque, reflective curved light shield positioned between the light source and the plate for preventing light produced by said light source from traveling through the plate without first being reflected from the reflector. The translucent areas are formed of a thin coating of an acrylic ester lacquer dyed with iron blue pigment. The filtered and unfiltered light combine to produce a white light surrounded by a blue field.

15 Claims, 3 Drawing Figures

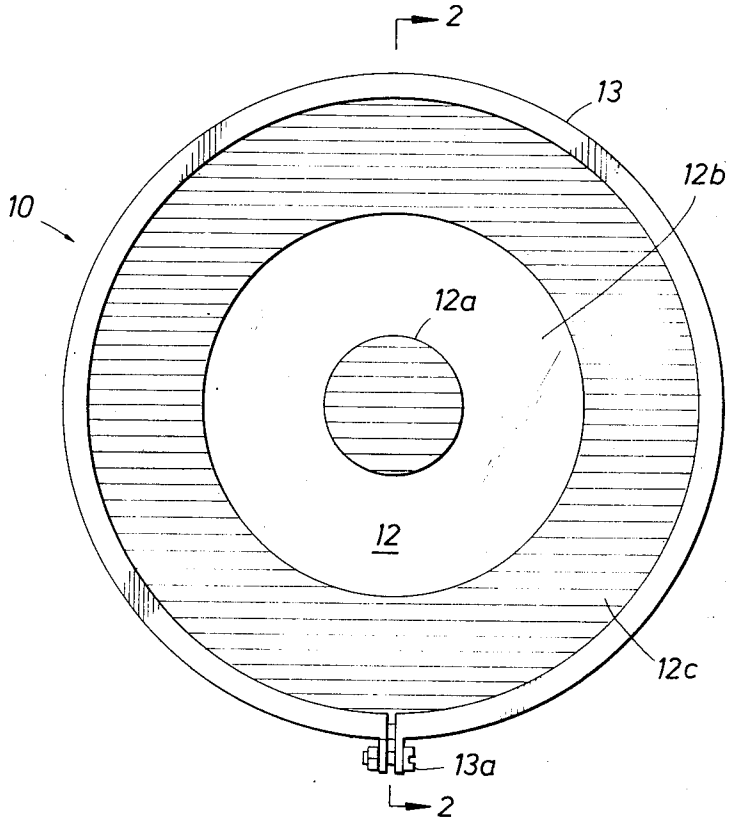


FIG. 2

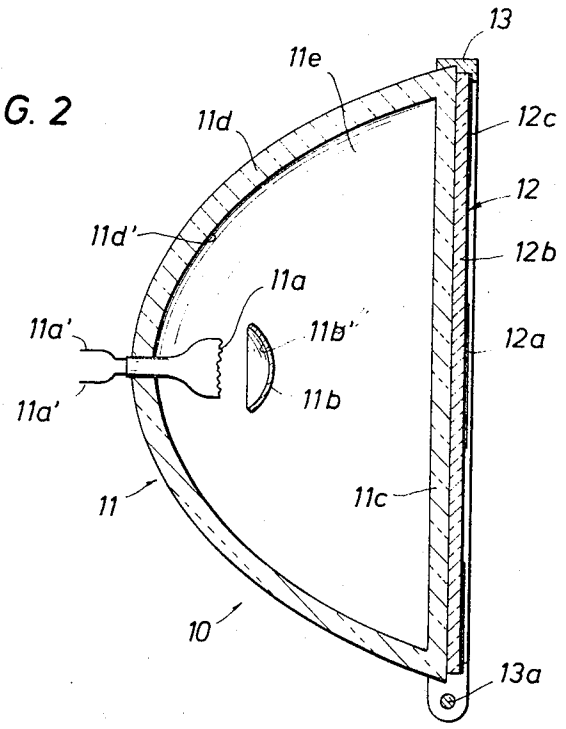


FIG. 1

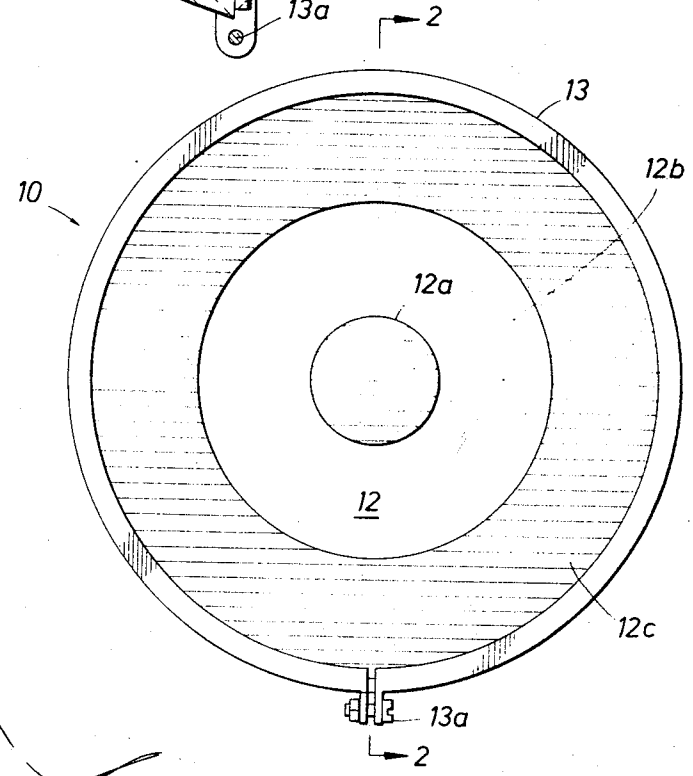
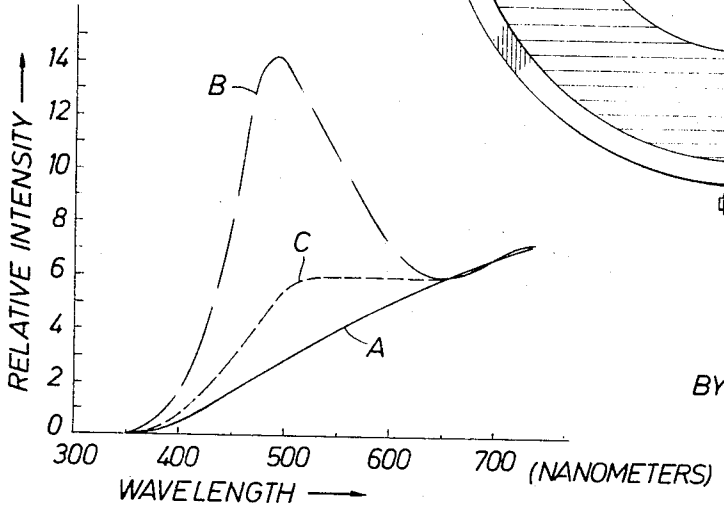


FIG. 3



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LIGHT TREATING MEANS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to means for improving artificial illumination. More specifically, the present invention relates to an improved light treating means for producing an improved artificially produced white light which exhibits superior illuminating characteristics, particularly in highly reflective environments such as found on water surfaces and in fog.

2. Description of the Prior Art

A variety of devices have been suggested by the prior art for producing improved, non-glare illumination for various environmental conditions. One such prior art device includes a sealed beam lamp having an opaque, reflective shield disposed between the filament and the light emitting face of the beam. Light reflected from a parabolic surface in the lamp is collimated and directed through refractor elements to form a horizontal, non-diffused light with sharp vertical and horizontal cutoffs. Another prior art teaching discloses means providing diffuse lighting from a light aperture positioned at the focal point of a display lens for directing a light beacon toward a limited viewing area.

U.S. Pat. No. 1,457,565 to Warrick discloses a headlight lens which carries a central translucent coating of silver surrounded by an annular transparent ring. A parabolic reflector cooperates with a light source to collimate the light before it is directed through the lens. The net result is a reduction in glare caused by permitting certain of the light rays to pass directly through the lens from the light source and reflecting the remainder of the rays against the parabolic surface before they are emitted.

By and large, the prior art known to applicant fails to disclose a suitable, low glare, artificially produced white light which satisfactorily reduces the reflection problems encountered in rain, fog, water and on water surfaces.

SUMMARY OF THE INVENTION

In the preferred form of the present invention, a clear transparent aperture defined between blue translucent light transmitting areas cooperate to form a filter zone for producing light beams of two colors which combine to form a circular beam of a substantially white, natural-like light surrounded by an annular blue light field. The translucent blue areas are preferably provided by an acrylic ester lacquer with iron blue pigmentation to form two blue beams which combine with the beam from the aperture to produce a white light set in a field of blue.

In the preferred form of the invention, a central circular area of translucent, blue filter material is surrounded by an annular clear or transparent aperture area which in turn is surrounded by a second annular area of translucent blue filter material. Preferably, the blue filter material is coated on the surface of an uncolored, transparent glass plate with the thickness of the coating being regulated to control the wavelengths and intensity of the transmitted light which in turn are functions of the wavelengths and intensity of light produced by the source. The width of the clear annular aperture area is varied to control the amount of unfiltered light being mixed with the filtered light. The plate is removably secured to a sealed beam lamp which includes a transparent, flat, light emitting face, a parabolic reflecting surface, a light source and a curved, reflective opaque light shield positioned between the light source and the light emitting face. The dimensions of the central blue area establish the principle focal point for the central beam. Beyond this principle focal point of the light treating means, the unfiltered light passing through the transparent annular aperture area combines with the blue light passing through the translucent filter areas to form a central circular beam of white light set in an annular blue light field. The combined light beam exhibits significantly improved illuminating characteristics including improved color illumination and, a reduction in specular and diffusely reflected aberrations that cause glare in highly reflective environments such as are encountered in fog, smog, rain and on the surface of water.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a vertical, front elevation of the light treating means of the present invention;

FIG. 2 is a vertical section taken along the line 2—2 of FIG. 2; and

FIG. 3 is a graph showing relative spectral intensities of different light wavelengths found in light produced by the present invention and found in untreated light.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring jointly to FIGS. 1 and 2, the light treating means of the present invention is indicated generally at **10**. In its preferred form, the invention **10** includes a sealed beam lamp indicated generally at **11** to which is removably secured a filtered zone, light treating face plate **12** formed from a suitable light transmitting material such as clear, uncolored glass or other suitable material. The lamp **11** includes a light source filament **11*a***, a curved, reflective, opaque light shield **11*b***, a transparent light emitting glass face **11*c***, a parabolic reflecting body **11*d***, and an evacuated area **11*e***. The lamp is energized in a conventional fashion by applying an electrical potential across external terminals **11*a'*** and **11*a''***. The parabolic reflector lid is provided with a reflective surface **11*d'*** and cooperates with the shield **11**b which is provided with a curved reflective surface **11*b'*** to collimate and direct light produced by the filament **11*a*** through the transparent lamp face **11**c. In the preferred form of the present invention, the face **11**c and plate **12** are substantially planar or flat.

The face plate **12** is removably secured to the body of the lamp **11** by any suitable means such as a split metal ring or clamp **13**. The clamp **13** may be equipped with any suitable tightening or securing means such as an adjustable bolt **13*a*** by which the clamp may be secured about or removed from the lamp **11**.

The plate **12** includes a translucent filtering portion **12*a***, a transparent aperture portion **12*b*** and a second translucent filtering portion **12*c***. As used in the specification and claims herein, the term "translucent" is employed to designate a material which filters light and transmits visible light of certain wavelengths more readily than light of other wavelengths. The term "translucent" as employed herein may also include transparent, colored materials. The phrase "clear transparent" as used herein is employed to designate clear material which transmits all wavelengths of visible light in substantially the same manner without attenuat-

ing or filtering. The portion **12***a* is a central circular area which is provided with a thin, blue translucent coating. The blue coating provides preferential transmission of light wavelengths of approximately 500 nanometers which is substantially a blue light. Other wavelenghts are attenuated or filtered by the coating. The area **12***b* is an annular area of clear, uncolored, transparent light transmitting glass which transmits substantially all wavelengths of visible light to the same degree because of its clarity. The annular area **12***c* which surrounds and is concentric with both the area **12***b* and the circular area **12***a* is also formed of a thin translucent blue coating. In the preferred form, the coating is formed by applying a thin (0.001") coat of a blue acrylic ester lacquer to the plate **12** followed by a sheet of a stretched polyvinyl alcohol (in the form of a liquid coating—0.001" thick—which is later heat shrinked) which in turn is covered by a second thin (0.001") layer of acrylic ester lacquer to form a total coating thickness of approximately 0.003". It should be noted that the thickness and color of the coating is varied according to the intensity and type of the light source to control the filtering characteristics of the translucent filtering areas to thereby provide the desired preferential transmission of given light wavelengths. It is theorized that the sheet of stretched polyvinyl alcohol cooperates with the acrylic coatings so that the light transmitted through the translucent areas is partially polarized. If desired, the intermediate polyvinyl alcohol sheet may be omitted. In the latter case, the total coating would be approximately 2 mils thick for a lamp having the characteristics of the lamp **11**. A suitable acrylic ester lacquer with iron blue pigmentation which may be employed for the lacquer coatings is manufactured for use in aerosol containers by the Sinclair Paint Company of Los Angeles, Calif. as aerosol glass tint L-18-134.

While the translucent areas **12***a* and **12***c* have been shown as being formed by thin surface coatings on the plate **12**, it will be understood that the translucent areas may be formed as an integral part of the plate **12** rather than as a coating, and if desired, may be a transparent material with a blue coloring. Moreover, if desired, the plate **12** may be dispensed with and the translucent areas may be formed directly on the clear glass of the light emitting face **11***c*. It will also be appreciated that the translucent areas may be formed as an integral part of the light emitting face **11***c*.

While the preferred form of the invention employs acrylic esters in combination with a stretched polyvinyl alcohol sheet, it will be appreciated that other suitable materials may also be employed. Thus, where polarization is desired, a dichrotic material may be used. Dichrotic materials are birefringent, doubly refracting, that is, one of the components of light passing through such material is absorbed much more strongly than the other.

The translucent blue coating material formed as described functions to partially polarize the light transmitted through the translucent areas of the plate **12** and to filter the light by preferentially transmitting those wavelengths of light which substantially correspond to the color blue. The filtered light combines with the untreated light passing through the annular aperture area **12***b* at a point remote from the light means **11**, such point being dependent upon the dimensions of the areas **12***a*, **12***b* and **12***c*. When combined, the blue and unfiltered light emitted from the filament produce a central white light beam surrounded by an annular blue beam to form a light which is highly directional, produces good color illumination, exhibits diffused diffraction spectra, and low specular reflection to improve resolution and image quality. The annular blue beam circumscribing the central beam contains a sharply peaking wavelength to provide sharp cut off of scattered light.

FIG. **3** illustrates results of measurements made with a lamp incorporating the teachings of the present invention. In FIG. **3**, three curves are employed to show the relative intensity of treated and untreated light having wavelengths ranging from approximately 350 to 700 nanometers. The vertical axis of the graph of FIG. **3** represents the relative intensity of light having a given wavelength. The data has been normalized at a wavelength of 700 nanometers.

The data represented in FIG. **3** was taken at 11 feet from the filament of a shielded filament G.E. No. 4435 bulb powered by a 12 volt source and rated at 75,000 candle power. A plate having translucent areas and a clear light aperture arranged as shown on the plate **12** was employed to produce the treated light. A 3 mil thick coating of blue acrylic ester lacquer with an intermediate sheet of stretched polyvinyl alcohol was employed to form the translucent portions of the filtered zone plate in the manner and with the materials previously described. The radii of the external circumferences of **12***a*, **12***b* and **12***c* in the plate employed to obtain the data of FIG. **3** were 1.475 inches, 2.075 inches and 3.625 inches, respectively. The principle focal point for the central beam produced by the plate **12** and employed in securing the data of FIG. **3** was approximately 7 feet, 8 inches. At and beyond this focal point, the beam formed by the light passing through the plate includes a central beam of white light surrounded by an annular beam of blue light. In the following description, the term "central beam" is employed to designate the light appearing in the circular area which would be occupied by the beam of white light at a point 11 feet from the filter zone plate with the plate in position over the face of the lamp. With the plate removed, the untreated central beam is the light appearing in the same circular area at a point 11 feet from the filament. The term "annular beam" is employed to designate the annular area of blue light surrounding the circular white beam at 11 feet from the plate with the plate in position against the face of the bulb.

In FIG. **3**, the solid line curve A represents the relative intensity of light varying in wavelength from approximately 350 to 700 nanometers which appears in the untreated central beam with the filter plate removed. Broken line curve B of FIG. **3** represents relative intensity of light in the same wavelength range appearing in the annular blue beam with the plate **12** in position. Dashed curve C represents relative intensity of the light in the same wavelength range appearing in the central beam with the filter plate in position.

The curves of FIG. **3** illustrate the significant increase in relative spectral intensities for substantially all wavelengths of treated light in the pertinent range as compared with untreated light. Curve B illustrates the preferable transmission of light wavelengths of approximately 500 nanometers through the translucent areas of the filter plate.

It is theorized that the outstanding characteristics of artificially produced light treated in accordance with the present invention are attributable to a natural phenomenon occurring in primate color vision whereby the blue annular beam produces peripheral light wavelengths to stimulate the rods of the eye through excitation in a manner to provide threshold sensitivity and increase reception by the cones of the eye to thereby improve visual acuity. The filter zone plate **12** of the present invention filters the artificially produced light through the translucent areas **12***a* and **12***c* and transmits the untreated light without substantial alteration through the clear, uncolored transparent aperture area **12***b*. The area **12***b* functions as a Fresnel aperture. The focal point of the central beam mixing area is the principle focus of the aperture and this length is determined by the diameter of the circular area **12***a*. The width of the aperture regulates the amount of mixing of blue and untreated light at and beyond the focal point of the lamp. As illustrated in FIG. **3**, the mixed treated and untreated light combine to produce light of increased intensity which peaks and forms a wave motion approximating that of natural sunlight.

It will be understood that in obtaining optimum results, the coating on the treated surfaces of the plate **12** must be controlled in thickness and coloring in a manner which is determined by the absolute intensity of the light produced by the source (bulb candle power untreated) and the relative spectral intensities of the different light wavelengths present in the light from the source. The Fresnel aperture may or may not assume an annular configuration but should have dimensions proportioned to regulate the amount of untreated light mixed with the filtered light passing through the treated surfaces. Brightness contrast is also controlled by the transmittance of the treated filtering area which in turn—in a filtering device formed by coatings—is controlled by the thickness of the coatings.

The reasons for the unusual results achieved by light produced according to the teachings of the present invention are not altogether understood. Basically, it is theorized that improved lighting is achieved by mixing light in the wavelength range of 350 to 700 nanometers having relative intensities following the curve A of FIG. **3** with light wavelengths in the same range having relative intensities represented by the curve B. This combination alone or coupled with a beam configuraiton wherein a central circular beam of white light is surrounded by an annular beam of blue light produces unexpected results in illumination and image quality.

The light treating means of the present invention has a wide range of application and is particularly useful when employed in high reflection environments such as are encountered on the water surface, in relatively dense fog or smog conditions, in rain and under water.

The foregoing disclosure and description of the invention is illustrative and explanatory thereof, and various changes in the size, shape and materials as well as in the details of the illustrated construction may be made within the scope of the appended claims without departing from the spirit of the invention. Thus, by way of example rather than limitation, the circular and annular areas may take on straight rather than curved boundaries or the light filament may be replaced by an arc or gas discharge light source or other suitable light source. It will be understood also that suitable color or polarizing filters may be employed with the present invention. Thus, the clear annular aperture **12***b* may be replaced with a transparent, colored filter to produce a colored central beam in a blue light field. It is also theorized that the blue color in the translucent areas may be replaced with another color to change the color of both the central beam and the surrounding annular beam. These latter modifications are not considered to be superior to the preferred form of the invention described in detail hereinbefore, however, based on the present conception of the underlying operation of the invention such modifications are considered to be within the scope thereof.

It should also be observed that the term "focal point" as employed herein designates the point where the light beams from the aperture and filter portions are superimposed and is not necessarily synonymous with the term "focus" customarily applied to optical instruments such as telescopes and microscopes.

What is claimed is:

1. Light treating means comprising:

a. a source of artificially produced light containing substantially all wavelengths of visible light;

b. light transmitting means having light transmitting portions positioned with respect to said source whereby light from said source is transmitted through said light transmitting means;

c. first and second light filtering portions included in said light transmitting portions each of which includes means for preferential transmission of visible light of a substantially blue color through said transmitting means; and

d. light aperture means disposed intermediate said first and second light filtering portions and included in said light transmitting means for transmission of light from said source through said aperture means whereby filtered light transmitted through said first and second light filtering portions is mixed with light transmitted through said aperture means to form a combined light at a preselected point remote from said light filtering portion.

2. Light treating means as defined in claim **1** wherein:

a. said first light filtering portion includes a central, substantially circular area; and

b. said light aperture means includes a substantially annular light aperture area formed concentrically about said circular area.

3. Light treating means as defined in claim **2** wherein said second light filtering portion comprises a substantially annular area formed concentrically about both said central circular area and said annular light aperture area.

4. Light treating means as defined in claim **1** wherein said aperture means includes means for non-preferential transmission of visible light of all wavelengths.

5. Light treating means as defined in claim **1** wherein said first light filtering portion includes means for preferential transmission of light wavelengths of approximately 500 nanometers.

6. Light treating means as defined in claim **1** wherein said first light filtering portion includes light polarizing means for at least partially polarizing light transmitted through said first light filtering portion.

7. Light treating means as defined in claim **3** further including:

a. reflective means for directing light produced by said light source through said light transmitting means whereby light passing through said first light filtering portion and said aperture means is mixed at a point remote from said source; and

b. light shielding means disposed between said light source means and said light transmitting means for preventing light produced by said light source means from traveling through said light transmitting means without first being reflected from said reflective means.

8. Light treating means as defined in claim **7** wherein:

a. said light source means includes a resistive electrical element for producing light upon being energized by an electrical potential; and

b. said reflective means includes a parabolic reflector for substantially collimating light directed through said light transmitting means.

9. Light treating means as defined in claim **8** wherein:

a. said reflective means and said light source means are included in a sealed beam lamp adapted to produce and direct light through a light emitting face; and

b. said light transmitting means is removably secured over the light emitting face of said lamp.

10. Light treating means as defined in claim **9** wherein said light emitting face of said lamp and said light transmitting means are substantially planar.

11. Light treating means as defined in claim **1** wherein said first second and light filtering portions include a surface coating of blue acrylic ester lacquer to form a translucent area on said light transmitting means.

12. Light treating means as defined in claim **11** wherein said first and second light filtering portions include a thin blue acrylic ester coating covered by a thin sheet of a stretched polyvinyl alcohol which in turn is covered by a thin coating of blue acrylic ester.

13. A method of producing improved natural-like light comprising mixing light having characteristics which are substantially equivalent to the light emitted by a 12 volt G.E. **4435** bulb rated at 75,000 candle power and transmitted through a filtered zone plate positioned adjacent and over the light emitting face of said bulb, said filtered zone plate having a central, circular translucent filtering area with a radius of 1.475 inches, surrounded by a concentric, annular, uncolored transparent area having an outer radius of 2.075 inches which in turn is surrounded by a concentric, annular, translucent filtering area having an outer radius of 3.625 inches, said translucent filtering areas being formed by a coating, 2 mils thick, carried on a thin plate of uncolored, transparent glass and formed by applying to said plate an acrylic ester lacquer with iron blue pigmentation, said lacquer being of the type manufactured by Sinclair Paint Company of Los Angeles, Calif. as aerosol glass tint No. L-18-134.

14. A method producing improved natural-like light comprising mixing light in the wavelength range between approximately 350 and 700 nanometers having substantially the relative intensities represented by the curve B in FIG. **3** with light in said range having substantially the relative intensities represented by the curve A in FIG. **3.**

15. A method as defined in claim **14** wherein said light is mixed to form a central circular beam of substantially white light set in an annular blue light field.

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