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POLARIZING SAFE LIGHT

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FIG. 1

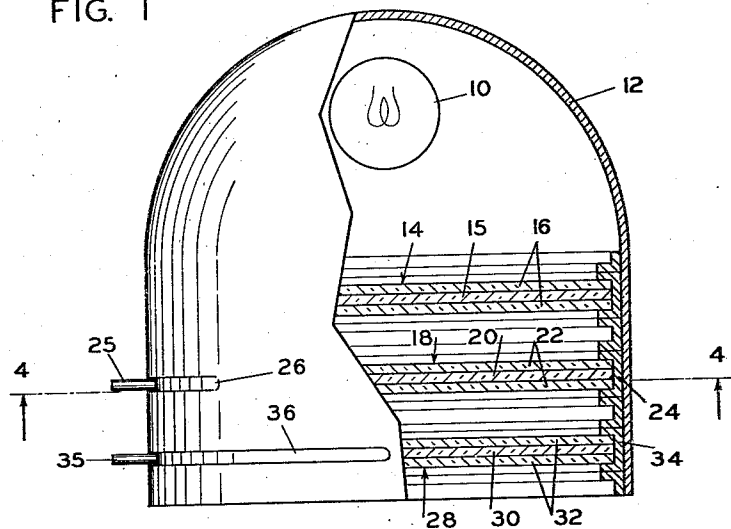


FIG. 2

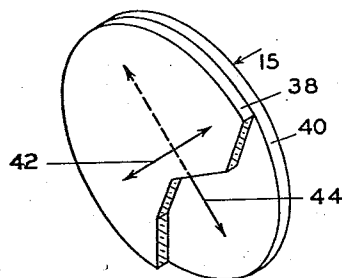


FIG. 3

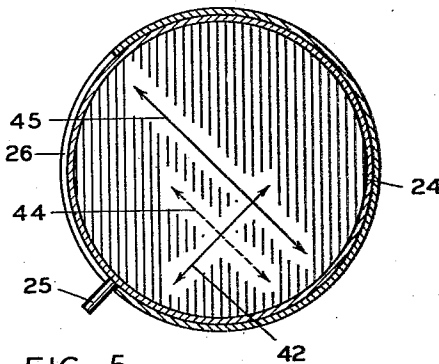


FIG. 4

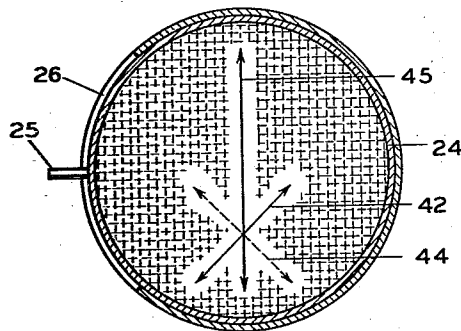
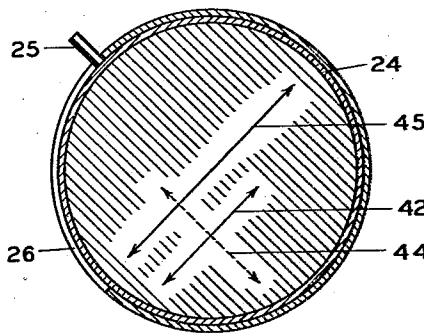


FIG. 5



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POLARIZING SAFE LIGHT

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9 Claims. (Cl. 88-65)

This invention relates to safe lights such, for example, as commonly used in the handling of photographic materials.

It is one object of the invention to provide a safe light wherein it is possible by adjustment within the casing to vary both the color and the intensity of the emitted light to suit all normal working conditions.

Another object is to provide a safe light wherein it is possible by simple adjustment of a rotatable element within the casing to vary the color of the light from, for example, green to yellow or red, and at the same time to control separately the intensity of the emitted light.

A further object is to provide such a safe light wherein the control of the color and intensity of the light is secured by relative rotation of polarizing elements mounted within the casing in the path of the emitted light.

A still further object of the invention is to provide a safe light wherein the control of the color and the intensity of the emitted light is secured by relative rotation of a plurality of color polarizers and a plurality of neutral polarizers mounted in the casing in the path of said light.

Other objects and advantages will in part appear and in part be pointed out in the course of the following description of one embodiment of the invention, which is given as a non-limiting example, in connection with the accompanying drawing, in which:

Figure 1 is a view partly in elevation and partly in section of a safe light embodying a form of the invention;

Figure 2 is a perspective view partly broken away showing one of the light-polarizing elements used in the safe light shown in Fig. 1; and

Figures 3, 4, and 5 are sections on the line 4-4 in Fig. 1, illustrating somewhat diagrammatically different positions of certain of the elements in the operation of the safe light shown in Fig. 1.

Referring to Fig. 1, element 10 represents a conventional light bulb mounted within a suitable reflecting casing 12. Positioned in the mouth of casing 12 in the path of light emanating from bulb 10 is a laminated filter element 14 comprising a central layer 15 bonded between the outer layers 16 of glass or other transparent plastic. Layer 15 preferably comprises polarizing material of special characteristics which will be described in more detail hereinafter in connection with Fig. 2.

Mounted in casing 12 in parallel relation with polarizer 15 is a second laminated filter element 18 comprising a central layer 20 bonded between

outer layers 22 of glass or other transparent plastic. Element 18 is preferably provided with means for controlling its rotation, for example, pin 25 mounted in filter rim 24 and passing through a slot 26 in casing 12.

Similarly mounted in casing 12 is a third laminated filter element 28 comprising a central layer 30 bonded between protective outer layers 32 and similarly provided with control means in the form of pin 35 mounted in filter rim 34 and passing through slot 36 in casing 12.

Preferably, one of the polarizing filters, for example the element 14 may be fixedly mounted and the other elements, as described, rotatably mounted. This is, however, not necessary. Furthermore, any of the elements may be fixedly mounted, the others being rotatable.

In the preferred embodiment of the invention, layers 20 and 30 comprise neutral polarizing material adapted to polarize uniformly substantially all visible light, and suitable materials for this purpose include polarizing sheets or films sold under the trade name "Polaroid." Slot 26 is preferably of such length as to permit polarizer 20 to be rotated through 90°. Slot 36 is preferably of such length as to permit polarizer 30 to be paralleled or crossed with polarizer 20 in any relative position of polarizer 20. Slot 36 should therefore be of sufficient length to permit substantially 180° of rotation for polarizer 30.

Polarizing layer 15 preferably comprises a pair of crossed polarizing elements each adapted to polarize light of different, predetermined wave length bands or colors. For example, referring to Fig. 2, layer 15 is shown as in laminated form, comprising a pair of component layers 38 and 40 each of which is a polarizer for a different wave length band. For example, one layer may advantageously be of such polarizing properties that it will polarize the incident light so as to transmit substantially only green light of one component of the incident beam, and the other layer similarly be adapted to transmit substantially only red light of one component of the incident beam. The transmission axes of layers 38 and 40 are represented as being parallel respectively to arrows 42 and 44 and the two layers are preferably assembled in such manner that their transmission axes are substantially at right angles to each other.

Layers 38 and 40 may be formed of a variety of materials such, for example, as films or sheets of suitably dyed or stained plastic. Preferred materials for this purpose comprise plastics of the class consisting of transparent, linear, high

polymers the molecules of which contain hydroxyl groups, and examples thereof include polyvinyl alcohol, polyvinyl acetal and regenerated cellulose. Particularly good results have been obtained with polyvinyl alcohol, and layers 38 and 40 may advantageously comprise sheets of this material which have had the molecules therein oriented to substantial parallelism and the oriented portions of which have incorporated therein a dichroic dye or dyes of the desired color. Such dyes are preferably chosen with a view to their ability to show high dichroism for a relatively narrow wave length band, and the dye used in one sheet will preferably be of such a color that it shows relatively little or no absorption for light of the wave length band absorbed by the dye used in the other said layer.

For use in a safe light, a preferred combination of colors in polarizer 15 is red and green. For example, layer 38 may comprise a sheet of polyvinyl alcohol which has been cast from a solution containing a suitable dichroic red dye such as Solantine Red 8BL. Layer 40 may similarly comprise a sheet of polyvinyl alcohol cast from a solution to which has been added a dichroic green dye such, for example, as a mixture of Solantine Yellow FF and Niagara Sky Blue 6B. Sheets prepared in this manner appear to show the best dichroism when the molecules therein are substantially completely oriented, as for example by stretching the sheet to six or seven times its cast length. The stretched sheets may then be assembled in superimposed relation with their respective directions of molecular orientation at right angles to each other, and they may, if desired, be laminated together by any suitable adhesive such as a solution of polyvinyl alcohol.

In considering the operation of the polarizer prepared as described above, it should be borne in mind that red layer 38 is a polarizer primarily for light in the green band of the spectrum and partially for light in the violet band, by reason of the fact that it absorbs one component of such light but transmits most of both components throughout the remainder of the spectrum. Similarly, green layer 40 is primarily a polarizer for light in the red and blue bands of the spectrum, inasmuch as it absorbs one component of light in those points but transmits both components of other light. It follows that when layers 28 and 30 are superimposed with their transmission axes crossed, they will together absorb most of both components of the light at the blue-violet end of the spectrum but will transmit one component of light throughout the remainder of the spectrum. Since this light is substantially minus blue-violet, its color will be predominantly yellow.

Figs. 3-5 illustrate somewhat diagrammatically the operation of a safe light embodying the invention. In these figures arrow 45 represents the transmission axis of neutral polarizer 20 and arrows 42 and 44 represent the directions of the transmission axes of polarizers 38 and 40 respectively. It will be noted that these elements are preferably so positioned with respect to each other and to slot 26 that when pin 25 is at either end of said slot, the transmission axis of polarizer 20 will be respectively parallel and crossed with the transmission axes of the color polarizers.

In Fig. 3, polarizer 20 is shown as having been rotated within the casing to a position wherein pin 25 is at one end of slot 26. In this position

arrow 45 is substantially parallel with arrow 44 and therefore perpendicular to arrow 42.

The light transmitted to polarizer 20 by element 15 comprises predominantly red light vibrating parallel to arrow 44 and predominantly green light vibrating parallel to arrow 42, the red light vibrating parallel to arrow 42 having been absorbed by green layer 40 and the green light vibrating parallel to arrow 44 having been absorbed by red layer 38.

Inasmuch as the green component of the light incident on polarizer 20 is vibrating at right angles to arrow 45, it is absorbed in said polarizer. The red component, however, is vibrating parallel to the transmission axis of polarizer 20 and is accordingly freely transmitted thereby. It follows, therefore, that in this relative position of polarizers 15 and 20 the light transmitted is predominantly red, as is indicated by the shading in Fig. 3. Such light is suitable in a photographic dark room when working with orthochromatic materials, that is to say, light-sensitive photographic materials which are not affected by red light.

In Fig. 4 the polarizer 20 is shown as having been rotated within the casing to a position wherein pin 25 is substantially equidistant from the ends of slot 26. In this position, the transmission axis of polarizer 20 is at angles of substantially 45 degrees with the transmission axes of both layers in polarizer 15, as is indicated by the relative positions of arrows 42, 44, and 45. Polarizer 20, therefore, will absorb approximately fifty percent of both the red and green components transmitted to it by element 15, but will transmit the remaining fifty percent. Inasmuch as the transmitted portion will contain virtually no blue-violet light, as pointed out above, it will be seen that its predominant color will be yellow, as is indicated by the shading in Fig. 4. Such light is suitable for use in a photographic dark room when working with light-sensitive materials which are not affected by yellow light such, for example, as the ordinary types of photographic printing papers.

In Fig. 5, polarizer 20 is shown as having been rotated within the casing until pin 25 is at the opposite end of slot 26 from the position shown in Fig. 3. In this position, arrow 45 is substantially parallel with arrow 42 and therefore perpendicular to arrow 44. The converse of the operation shown in Fig. 3 will therefore take place. The red component of the light transmitted by element 15 is vibrating parallel to arrow 44 and is accordingly absorbed by polarizer 20. The green component, however, is vibrating parallel to the transmission axis of polarizer 20 and is therefore transmitted thereby. It follows, therefore, that in these relative positions of polarizers 15 and 20, the light transmitted is green, as is indicated by the shading in Fig. 5.

It will be apparent from the foregoing that the relative positioning of polarizers 20 and 15 with respect to their transmission axes may be varied at will and produce any desired proportion of green and red in the transmitted light. During such adjustment, polarizer 30 will preferably be rotated in unison with polarizer 20, inasmuch as it takes no part in the determination of the color of the light. However, once the desired position of polarizer 20 is determined, polarizer 30 may be rotated with respect thereto in order to control the intensity of the beam emitted from the light. If the transmission axes of polarizers 20 and 30 are parallel,

polarizer 30 will transmit substantially all of the light transmitted to it by polarizer 20. If polarizer 30 is then rotated through ninety degrees, it will absorb substantially all of the light transmitted by polarizer 20 and will accordingly act as a shutter. Obviously any desired intermediate position may similarly be secured. This feature of easy control of the intensity of the emitted light is particularly advantageous in the positions shown in Figs. 4 and 5 when yellow and green light, respectively, are emitted. For example, with polarizers 15 and 20 in the relative positions shown in Fig. 5, polarizer 30 may be set with its transmission axis at an angle slightly less than ninety degrees to the axis of polarizer 20, thus permitting the transmission of a faint green light suitable in a photographic dark room when working in the usual manner with panchromatic materials.

It will be seen that one of the outstanding features of the above safe light is that it may be used under any conditions of photographic dark room practice. Furthermore, the construction shown makes it extremely simple to vary the color and intensity of the light to suit all conditions.

Another advantage of the invention is that it is possible to set polarizers 15 and 20 for light of one color, for example red, and then to rotate polarizer 30 and thus fade the emitted light at will from red to extinction and vice versa. If desired, the same effect may be obtained in a simpler construction by eliminating one of the color polarizers and setting polarizer 20 with transmission axis crossed with that of the other color polarizer.

It will be obvious that numerous other changes may be made in the construction of the above described light without departing from the scope of the invention. For example, the relative positioning of the polarizers may be altered, and any two or three may be provided with rotatable mountings. Furthermore, polarizers for colors other than red and green may be substituted herein without changing any essential of the invention.

Since certain changes may be made in the above article and different embodiments of the invention could be made without departing from the scope thereof, 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 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. An article of manufacture comprising, in combination, a light source, casing means substantially enclosing said light source, a light-polarizing element adapted to polarize light of a predetermined wave length band less than the visible spectrum, a second light-polarizing element adapted to polarize light of a predetermined wave length band less than the visible spectrum and at least partially different from the band polarized by said first named element, means for mounting said polarizing elements in substantially parallel relation within said casing in the path of the light emitted therefrom, said elements being positioned with their respective

transmission axes relatively perpendicular, a third polarizing element adapted to polarize uniformly substantially all visible light, and means for rotatably mounting said third polarizing element within said casing in parallel relation with and substantially overlying said first named polarizing elements.

2. An article of manufacture comprising, in combination, a light source, casing means substantially enclosing said light source, a plurality of light-polarizing elements adapted to polarize uniformly substantially all visible light, a third light-polarizing element adapted to absorb one component of light of a predetermined wave length band and the component vibrating at right angles thereto of light of a different predetermined wave length band, each of said bands being respectively narrower than the visible spectrum, means for mounting said polarizing elements in substantially parallel relation within said casing in the path of the light emitted therefrom, said uniformly polarizing elements being positioned adjacent each other, two of said elements being rotatably mounted with respect to each other and to said third element, and means for rotating said rotatably mounted elements.

3. An article of manufacture comprising, in combination, a light source, casing means substantially enclosing said light source, a light-polarizing element adapted to polarize light of a predetermined wave length band less than the visible spectrum, a second light-polarizing element adapted to polarize light of a predetermined wave length band less than the visible spectrum and at least partially different from the band polarized by said first named element, means for mounting said polarizing elements in substantially parallel relation within said casing in the path of the light emitted therefrom, said elements being positioned with their respective transmission axes relatively perpendicular, a third polarizing element adapted to polarize uniformly substantially all visible light, means for rotatably mounting said third polarizing element within said casing in parallel relation with and substantially overlying said first named polarizing elements, a fourth polarizing element adapted to polarize uniformly substantially all visible light, and means for rotatably mounting said fourth polarizing element within said casing adjacent to, in parallel relation with, and substantially overlying said third polarizing element.

4. An article of manufacture comprising, in combination, a light source, casing means substantially enclosing said light source, a dichroic, light-polarizing element adapted to transmit light in the green band of the spectrum in substantially unpolarized condition and to polarize light of other wave lengths, a second dichroic, light-polarizing element adapted to transmit light in the red band of the spectrum in substantially unpolarized condition and to polarize light of other wave lengths, means for mounting said elements in substantially parallel relation within said casing in the path of light emitted therefrom, said elements being positioned with their respective transmission axes relatively perpendicular, a third polarizing element adapted to polarize uniformly substantially all visible light, and means for rotatably mounting said third polarizing element within said casing in parallel relation with and substantially overlying said first named polarizing elements.

5. A safe light comprising, in combination, a light source, casing means substantially enclosing said light source, a dichroic, light-polarizing element adapted to transmit light in the green band of the spectrum in substantially unpolarized condition and to polarize light of other wave lengths, a second dichroic, light-polarizing element adapted to transmit light in the red band of the spectrum in substantially unpolarized condition and to polarize light of other wave lengths, means for mounting said elements in substantially parallel relation within said casing in the path of light emitted therefrom, said elements being positioned with their respective transmission axes relatively perpendicular, a third polarizing element adapted to polarize uniformly substantially all visible light, means for rotatably mounting said third polarizing element within said casing in parallel relation with and substantially overlying said first named polarizing elements, a fourth polarizing element adapted to polarize uniformly substantially all visible light, and means for rotatably mounting said fourth polarizing element within said casing adjacent to, in parallel relation with, and substantially overlying said third polarizing element.

6. A safe light comprising, in combination, a light source, casing means substantially enclosing said light source, a light-polarizing element adapted to polarize uniformly substantially all visible light, a second light-polarizing element adapted to transmit, of one component of incident light, light in the red band of the spectrum, and of the component vibrating at right angles thereto, light in the green band of the spectrum, said element being adapted to absorb both components of light of other wave lengths, means for mounting said polarizing elements in substantially parallel relation within said casing in the path of the light emitted therefrom, one of said elements being rotatably mounted with respect to the other, and means for rotating said rotatably mounted element.

7. A safe light comprising, in combination, a light source, casing means substantially enclosing said light source, a plurality of light-polarizing elements adapted to polarize uniformly substantially all visible light, a third light-polarizing element adapted to transmit, of one component of incident light, light in the red band of the spectrum, and of the component vibrating at right angles thereto, light in the green band of

the spectrum, said element being adapted to absorb both components of light of other wave lengths, means for mounting said polarizing elements in substantially parallel relation within said casing in the path of the light emitted therefrom, two of said elements being rotatably mounted with respect to each other and to said third element, and means for rotating said rotatably mounted elements.

8. A safe light comprising, in combination, a light source, casing means substantially enclosing said light source, a light-polarizing element adapted to polarize uniformly substantially all visible light, a second light-polarizing element comprising a substantially molecularly oriented sheet of a transparent, linear, high polymeric plastic the molecules of which contain hydroxyl groups, the direction of molecular orientation of one surface of said sheet being substantially perpendicular to that of the other said surface, one of said surfaces having incorporated therein a red dichroic dye, the other of said surfaces having incorporated therein a green dichroic dye, means for mounting said polarizing elements in substantially parallel relation within said casing in the path of the light emitted therefrom, one of said elements being rotatably mounted with respect to the other, and means for rotating said rotatably mounted element.

9. A safe light comprising, in combination, a light source, casing means substantially enclosing said light source, a plurality of light-polarizing elements adapted to polarize uniformly substantially all visible light, a third light-polarizing element comprising a substantially molecularly oriented sheet of polyvinyl alcohol, the direction of molecular orientation of one surface of said sheet being substantially perpendicular to that of the other said surface, one of said surfaces having incorporated therein a red dichroic dye, the other of said surfaces having incorporated therein a green dichroic dye, means for mounting said polarizing elements in substantially parallel relation within said casing in the path of the light emitted therefrom, said uniformly polarizing elements being positioned adjacent each other, two of said elements being rotatably mounted with respect to each other and to said third element, and means for rotating said rotatably mounted elements.

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