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[54] ILLUMINATION SYSTEM FOR COLOR ENLARGERS AND THE LIKE

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[52] **U.S. Cl.** **355/71**, 355/32
[51] **Int. Cl.** **G03b 27/72**
[58] **Field of Search** 355/32, 35, 71

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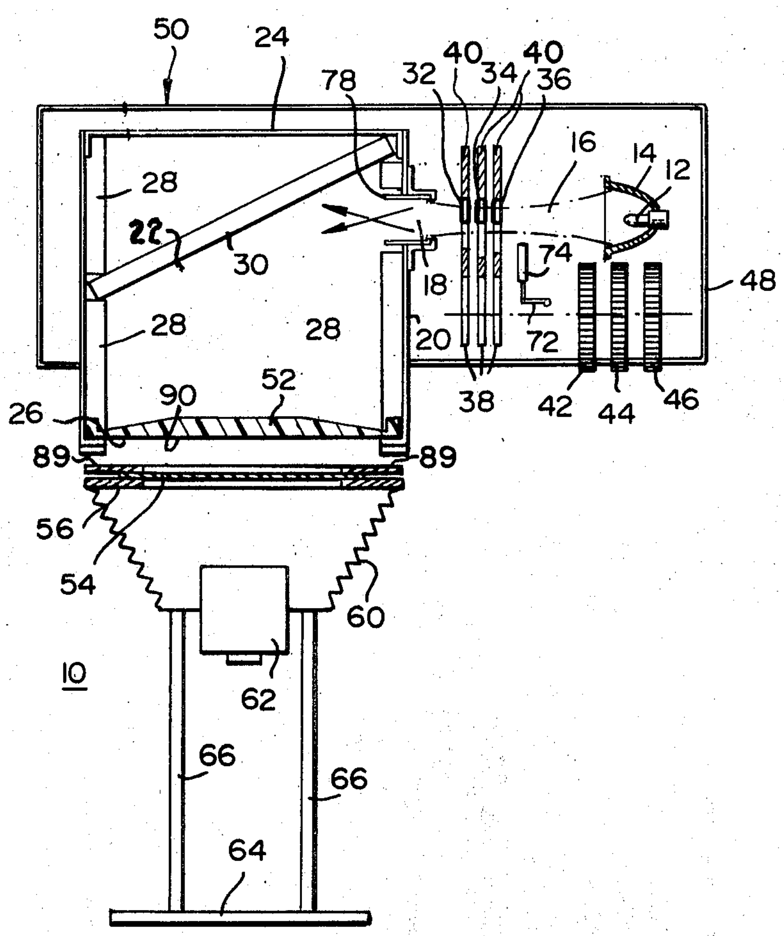
Assistant Examiner—Michael L. Gellner
Attorney—Toren & McGeady

[57] **ABSTRACT**

In the apparatus disclosed, three dichroic filters partially intercept a white light beam emerging from a light source having an elliptical reflector with a focal point at the location of the filters. The filters thus divide the beam into a white portion and an intensely colored portion. The beam enters a mixing chamber through a porthole and strikes a slanted white-opaque ceiling to form a hyperbolic section. White-opaque sidewalls coact with the ceiling to mix the white and intensely colored light. The light exists through a diffuser at the bottom of the chamber so that it can be used to illuminate a color negative in a color enlarger which focuses the light on printing paper. A cylindrical mirror at the entrance porthole reflects a part of the marginal portion of the colored part of the beam toward the white side while reflecting part of the white light into the intensely colored light. This allows the mixing chamber to blend the light and avoid a color wedging effect on the print. The diffuser at the exit of the chamber tapers from a thick center outwardly toward thinner edges. Thus, the diffuser scatters more of the light at its center and transmits more at its edges. This compensates for falloff of intensity from center to outside. The scattering of light within the diffuser causes unused light to reenter the chamber for further mixing. A matte finish on the bottom of the diffuser prevents the light which is reflected by a carrier holding the film from being rereflected onto the edges of the film.

47 Claims, 13 Drawing Figures



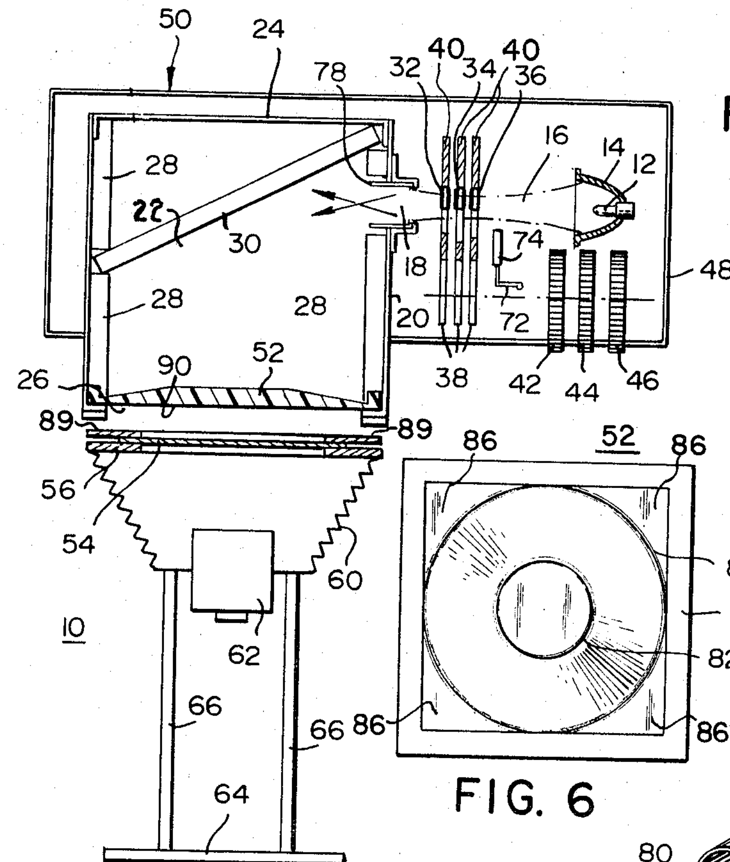


FIG. 1

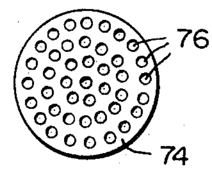


FIG. 3

FIG. 6

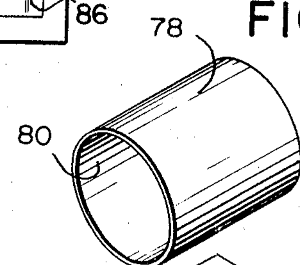


FIG. 5

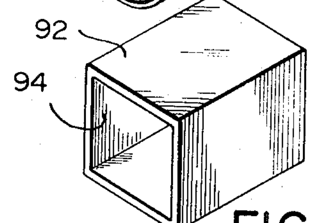


FIG. 5A

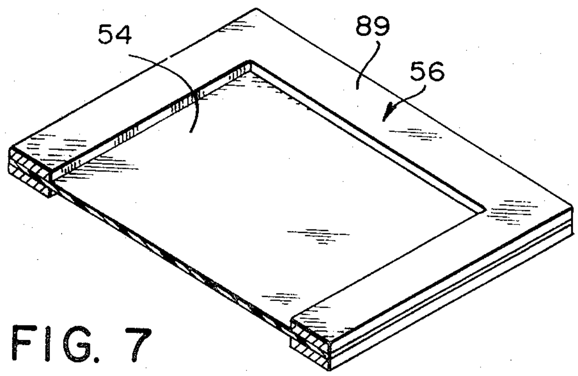


FIG. 7

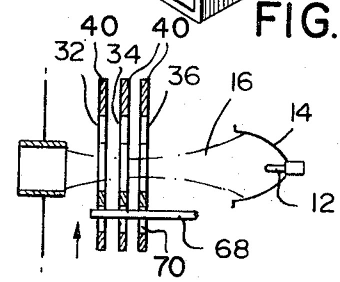


FIG. 2

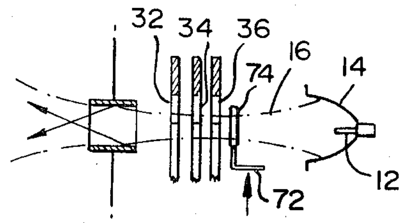


FIG. 4

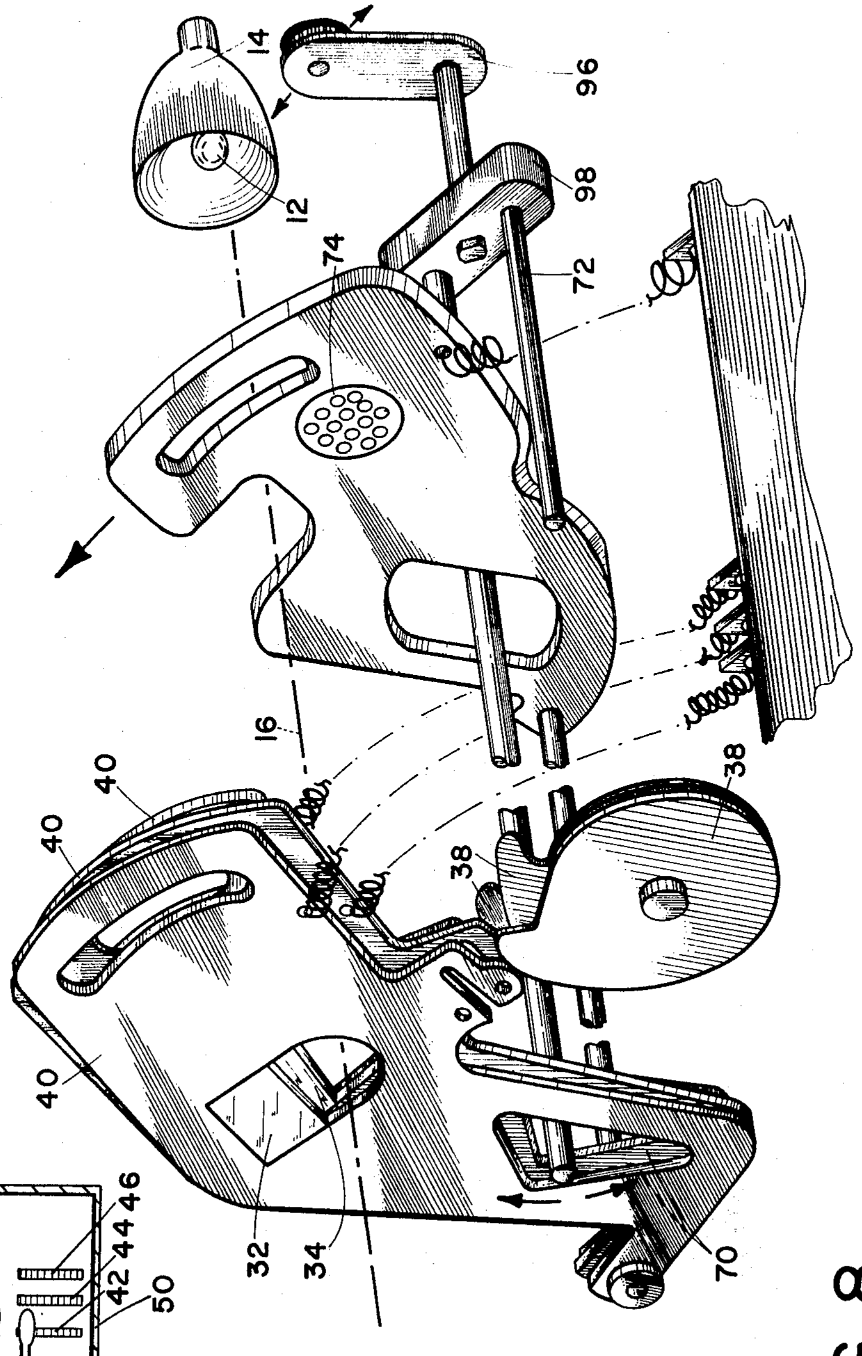


FIG. 8

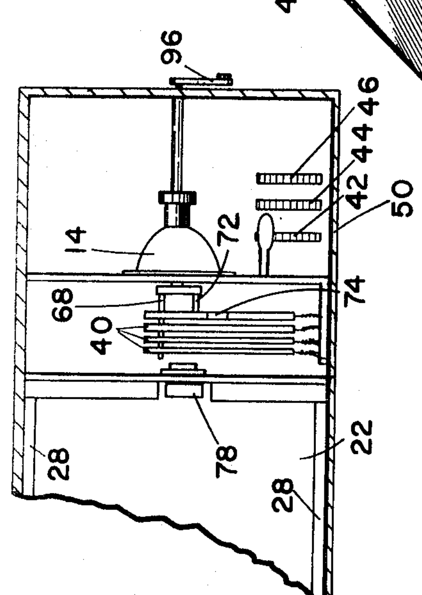


FIG. 9

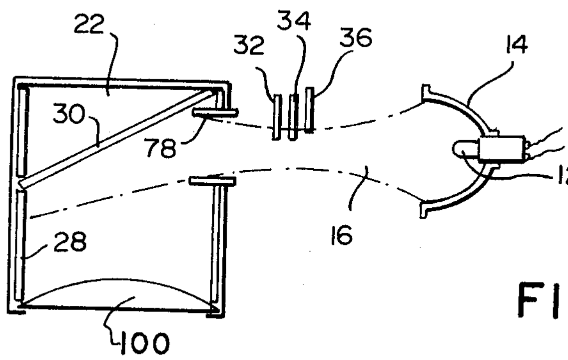


FIG. 10

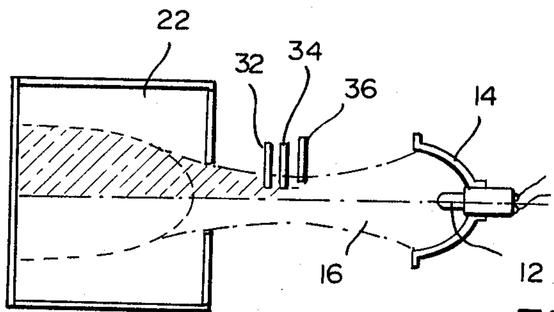


FIG. 11

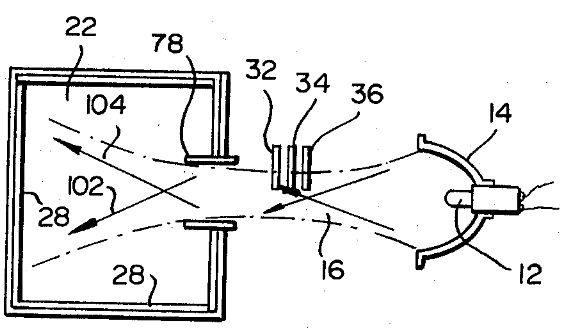


FIG. 12

ILLUMINATION SYSTEM FOR COLOR ENLARGERS AND THE LIKE

CROSS-REFERENCES TO RELATED APPLICATIONS

This application is related to the following applications being filed on or about the date of this application. The content of those applications filed concurrently herewith or before this application are herewith made a part of this application as if fully recited herein. All these applications are assigned to the same assignee as this application.

Application of Louis L. Weisglass, entitled "Color Englarging Apparatus" (Attorney's Docket No. T800);

Application of Louis L. Weisglass, Robert A. Flieder, and Lewis Rubin, entitled "Light Color Control Apparatus" (Attorney's Docket No. T798); and

Application of Louis L. Weisglass, Robert A. Flieder, and Alfred Simon entitled "Light Source for Color Enlargers," (Attorney's Docket No. T799).

This application contains subject matter disclosed in disclosure documents No. 006567 dated Sept. 7, 1971, No. 006568 dated Sept. 7, 1971, and No. 006635 dated Sept. 13, 1971.

BACKGROUND OF THE INVENTION

This invention relates to light coloring apparatuses, and particularly to apparatuses for producing desired chromaticities and saturations of light to be used in photographic color enlarging apparatuses. The invention also relates to photographic color enlarging apparatuses.

It is desirable that the light emerging from such light coloring apparatuses be substantially uniform in intensity, chromaticity and saturation.

It is possible to achieve such results by passing a white light beam, as a whole, through a uniform filter that lends the beam the desired characteristics. However, a different filter is necessary for each application. That is to say, it is not possible to vary the results over wide ranges with even a large number of filters.

It has been suggested that the beforementioned problems be overcome by intercepting only a portion of a white light beam with three color filters that saturate that portion of the beam that each intercepts. The rest of the beam remains white. This method involves mixing the colored portion of the beam with the white portion. The relative amounts that the filters intercept the beam vary the overall color balance or chromaticity. On the other hand, the overall interception by all three filters determines the overall saturation. The portions of the beam are mixed in a mixing chamber where the light is bounced off the walls of the chamber and leaves through a diffuser that directs the light towards film in a film carrier, from whence the image of the film is cast by suitable lenses onto color printing paper.

Mixing produces a number of problems. Because one portion of the beam, for example the right side, is intensely colored while the left side is white; the mixing chamber often produces a slight color wedging effect on the print. That is to say, the mixing chamber frequently fails to mix the colors adequately from one side of the chamber to the other so that the original separation between left and right produces an overall effect on the printing. Moreover, the mixing chamber fails to eliminate the falloff of light intensity from the center of the beam to the edges. Thus, the mixed light is more intense at the center of the diffuser than at the edges. This problem has been overcome in the past by using some type of density control to block some of the light striking the diffuser in the center. This improves the light distribution but results in absorption of a significant amount of light energy, thereby lowering the overall efficiency.

Another problem arises because of the nature of the diffuser that has been used. This last problem can be best understood by first considering that it has been suggested that a film carrier disposed directly below the diffuser be painted so as to exhibit a bright reflective white surface. Thus, if the film carrier must be sufficiently wide to carry a small film, much of the light which would otherwise to absorbed by the film carrier is reflected back into the diffuser. This results in a substantial gain in the efficiency of the light use. However, inspection of the print produced with an enlarger using such a carrier reveals a dark border around the edge of the prints.

An object of the invention is to improve light coloring apparatuses.

Another object of the invention is to overcome the beforementioned disadvantages.

SUMMARY OF THE INVENTION

According to a feature of the invention, these objects are attained and the beforementioned disadvantages are overcome, by passing a white light beam, a part of which has been intercepted and colored by color filters, into a mixing chamber where it is bounced off dispersing walls of the chamber, and then passing the mixed light out of the chamber through translucent diffusing plate.

For convenience, the terms diffusing plate is also referred to a diffusion plate and diffuser.

According to another feature of the invention reflecting surfaces extending almost parallel to the beam edges at the entrance to the mixing chamber, intersect the beam near the margin and deflect respective sides of the beam to the other side within the chamber so that a substantial proportion of the colored portion of the beam enters on the white side of the chamber and vice versa.

According to another feature of the invention, the mirrored surfaces are part of a cylindrical mirror having an axis parallel to the beam. Preferably, the beam converges and then diverges. The cylindrical mirror is positioned near the diverging portion of the beam.

According to another feature of the invention, the cylindrical mirror has a short cylindrical shape at the entrance of the chamber.

According to another feature of the invention, the mirrored surfaces are part of flat planes.

According to yet another feature of the invention, the diffuser constitutes a plate having a given thickness at the center and becoming progressively thinner towards the outer edges. The diffuser is composed of material whose diffusion power varies with the thickness of the material.

According to another feature of the invention, the diffusion plate has a frusto-conical shape, thicker in the center and decreasingly thick toward the edges.

According to another feature of the invention, the diffusion plate has a surface facing out of the chamber and a surface facing into the chamber, the outside facing surface being flat and the inside facing having a central mesa with conically declining walls.

According to yet another feature of the invention, the diffusing plate inc'udes a diffusing material distributed so as to achieve a greater dispersion power towards the center than the outer portion thereof.

According to yet another feature of the invention, the outer facing surface of the diffusion plate has a matte finish.

By virtue of these features any failure on the part of the mixing chamber to achieve complete mixing is overcome by the mirrored surfaces. This distributes the chromaticity and saturation evenly across the diffusion surface.

The varied diffusion overcomes the fall-off in intensity from the center to the edges of the diffuser. The central portion of the diffuser effectively scatters a larger proportion of the light back to the mixing chamber than the edges. The edges transmit more of the light than the center of the diffusion plate. As a result, the light emerging from the diffusion plate is substantially uniform in intensity. Moreover, the light scattered back into the mixing chamber is remixed and strikes the diffusion plate again. This constitutes a substantial rise in efficiency.

The matte surface at the bottom of the diffusion plate allows light striking a bright film carrier below the diffusion plate to reenter the chamber rather than being reflected. Such reflections would otherwise distort the uniform intensity distribution at the diffuser.

These and other features of the invention are pointed out in the claims. Other objects and advantages of the invention will become obvious from the following detailed description read in light of the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a somewhat schematic sectional elevation of an enlarger embodying features of the invention;

FIG. 2 is a schematic illustration of a portion of FIG. 1 with filters moved out of the path of a light beam;

FIG. 3 is a drawing illustrating an attenuator of the enlarger in FIG. 1;

FIG. 4 is a schematic illustration showing the attenuator of FIG. 3 in the path of the beam of FIG. 1;

FIG. 5 is a perspective view of a cylindrical mirror in FIG. 1;

FIG. 5A is a perspective view of another mirror which may be used in FIG. 1;

FIG. 6 is a plan view of a diffusing plate used in FIG. 1;

FIG. 7 is a perspective view of a film carrier forming a part of FIG. 1;

FIG. 8 is an exploded view of a filter control illustrated in FIG. 1;

FIG. 9 is a top or plan view of the structure of FIG. 8 assembled;

FIG. 10 is a sectional elevation illustrating another mixing chamber embodying features of the invention and usable in the structure of FIG. 1; and

FIGS. 11 and 12 are plan sections illustrating the operation of the circular mirror of FIG. 1.

DESCRIPTION OF PREFERRED EMBODIMENTS

In the enlarging apparatus 10 of FIG. 1, a light source 12, together with a substantially elliptical reflector 14, directs a light beam toward the entrance port 18 of the port wall 20 in a mixing chamber 22. The mixing chamber is generally composed of a metal shell 24 having an exit opening 26 extending virtually across the bottom. Solid white expanded foam panels 28 line the front and side walls of the chamber while a ceiling or roof panel 30 extends angularly upward from the far end of the chamber toward the closer end. The ceiling panel intercepts the light beam entering the entrance port 18 so as to form a hyperbolic section of the beam.

Three dichroic filters 32, 34 and 36 intercept a portion of the beam so as to impart an intense color to the intercepted portion of the beam. The filters 32, 34, 36 pass the respective subtractive primary colors, cyan, yellow and magenta. Suitable cams 38 move respective filter holders 40 so that each filter 32, 34 and 36 intercepts a portion of the beam determined by the rotary position of the cam 38 engaging its holder 40. Each of the filters 32, 34 and 36 may then intercept different porportions of the beam 16. Suitable knurled wheels 42, 44 and 46 extending through the housing 48 of the overall light mixer 50 are each coupled to one of the cams 38. Thus, an operator may set the intercept proportion of the filter 32 by turning the wheel 46 to a particular position. A digital indicator, not shown, apprises the operator of the extent to which the wheel 46 has been turned, and hence the extent to which the filter 32 intercepts the beam 16. Similarly, digital indicators, coupled to the wheels 44 and 42, indicate the extent to which these wheels have been turned and the corresponding extent to which the filters 34 and 36 enter the beam 16. The cams 38 and the wheels 42, 44 and 46 are coaxial with each other and coupled by coaxially surrounding shafts (not shown).

Within the chamber 22, the opaque ceiling panel 30, composed of a white hardened foam material disperses the partly colored beam in all directions. Together with the remaining panels 28, each of which corresponds to the panel 30, it bounces the light back and forth in all directions. Ultimately, the panels 28 and 30 mix the white portion of the beam with the colored portion so as to achieve a saturation dependent upon the overall degree to which the filters 32, 34 and 36 extend into the beam. The color of the resulting light, the factor often called chromaticity, is determined by the degree to which each filter extends into the beam relative to the other filters.

The dispersed and mixed light leaves the chamber through a translucent opal diffusion or scattering plate 52 in the exit opening 26 so that it can illuminate an interchangeable color negative or slide 54 mounted in a removable film carrier 56. The plate 52 diffuses the light as it passes through. The diffused light is then passed from the negative 54 through adjustable bellows 60 to an adjustable objective 62. The latter focuses the light as modified by the negative upon printing paper (not shown) mounted on a paper carrier 64.

Suitable racks 66 support the upper projection portion of the enlarger 10 above the paper carrier. In the usual manner, the position of the projection portion of the enlarger is adjustable on the racks 66 by means of pinions for up and down movement. This adjusts the size of the image being focused upon the printing paper in the print carrier 64. The housing 50 can be removed from the enlarger for servicing and adjusting.

An arm 68 passing loosely through opening 70 in the holders 40 can be operated from outside the housing 48 to withdraw all the filters simultaneously from the positions shown in FIG. 1, out of the beam 16, and into the positions shown in FIG. 2. This allows uncolored white light from the source 12 and the reflector 14 to illuminate the negative 54. The wheels 42, 44 and 46 can only move one filter at a time with the cam 38.

Moreover, an arm 72, operable from outside the housing 50, can move a light attenuator 74, such as shown in FIG. 3, from the position shown in FIG. 1, to the position shown in FIG. 4. The light attenuator is composed of a metal plate having a plurality of evenly distributed light perforations 76. When moved into the position shown in FIG. 4, the light attenuator reduces the overall intensity of the light beam emerging from the source 12 and reflector 14. It thus dims the illumination of the negative 54 and the image on the paper in the carrier 64.

The nature of the source 12 and the reflector 14 is such as to make the beam converge to a narrow waist and then diverge as shown in FIGS. 1 to 3. The filters are located to intercept the beam at the waist, that is the narrowest portion of the beam. The beam thereafter diverges as it enters the chamber 22. As the diverging light beam 16 passes through the entrance port 18, a cylindrical mirror 78 having an interior reflecting surface 80 reflects the outer margin of the beam diagonally across the beam. In this way, the light from one side of the beam now passes to the other side. Thus, the colored portion of the beam is reflected to the white portion and the white portion toward the colored portion. This greatly improves the mixing process within the mixing chamber.

The translucent diffusing plate 52 at the bottom exit 26 tapers outwardly from a thick circular center 82 toward a thin, circular rim 84 as shown in FIGS. 1 and 6. From the circular rim 84, the material remains thin at the corner margins 86 toward a thickened, square, support frame 88. The entire plate is monolithic and composed of a diffusing or scattering material. The diffusion plate exhibits a variable degree of diffusion, that is, the diffusion is greater at the center and gradually tapers off towards the rim 84. The diffusion plate is constructed by molding or machining a material which has a diffusion characteristic that is a function of its thickness. Therefore, increasing the thickness increases the diffusion. To obtain the desired effect, it is then only necessary to produce a greater thickness at the center than toward the edges. According to one embodiment of the invention, an acrylic resin with minute reflective particles in suspension is used. Such a material has the desired characteristics of increasing diffusion with thickness.

Since it is the property of a diffuser to scatter in all directions each ray of light impinging upon it, and the amount of scattering is related to the amount of diffusion, it follows that the variable diffusion plate 52 will scatter more of its light at the center and transmit more at its edges. As a result, more light is transmitted at the edges and less at the center.

This selective transmission at the edges as compared to the center has the effect of compensating for the fall-off in intensity from the center to the edges experienced when using a uniform diffuser. This results from the cosine law fall-off occurring from the center of the light beam toward the edges. The chamber maintains this fall-off.

In the past, such fall-off has been avoided to some extent by using some type of density means to block some of the light striking the diffuser in the center. This had the effect of improving the light distribution. However, this method absorbed a significant amount of light energy, thereby lowering the overall efficiency.

Another advantage of the diffusion plate 52 is that some of the scattered light returns to the chamber while the remaining light passes through the diffuser. This effect is very desirable because a large percentage of the light is scattered back toward the chamber by the center of the diffuser. At the edges, a large amount is transmitted and a smaller amount is reflected back. Aside from producing the uniformity, it increases efficiency, because when the light is reflected back it is re-reflected by the panels or walls of the mixing chamber and eventually passes through the diffuser again. Thus, the total light output of the system is raised significantly.

The bottom surface 90 of the plate 52 has a matte finish. This prevents the plate from reflecting upwardly directed light.

The cylindrical mirror 78, the tapered plate 52 and the bottom 90 with the matter finish act individually and coact with each other to render the color and light distribution as uniform as possible.

Without the mirror 78, the mixing chamber fails to effect perfect mixing. As a result a residual portion of the more intensely colored light may remain on one side of the chamber while the other side remains white. This may have the effect of creating a "color wedge" at the printing paper. The cylindrical mirror thus aids the mixing chamber in its function.

This aid of the cylindrical mirror is particularly important with the tapered diffusion plate 52. It performs color distribution that the thin edges of the diffusing plate 52 cannot accomplish but which a uniformly flat plate might otherwise achieve in part.

The cylindrical mirror 78 may be replaced or substituted with a square mirror arrangement 92 having either two or four interior reflecting surfaces 94 as shown in FIG. 5A.

The tapered plate 52 coacts with the dispersing interior of the chamber 22 to distribute light energy from the chamber evenly. Effectively, this disperses the light at the center more than at the edges.

Ordinarily, light passing from the chamber strikes the negative or film 54. However, when the film 54 is smaller than the plate 52 it must be held in a film carrier having larger borders. A sample of a film carrier is shown in FIG. 7. Where these borders are large they block out a considerable amount of light. In FIG. 1, the upper surface of this carrier is painted white to reflect as much of the light as possible back into the mixing chamber. If this light is then reflected downwardly by the surface of the plate 52, the reflected light would be concentrated near the edges of the film. Such reflected light would again re-distort the uniform light distribution by increasing the intensity around the margin. The matte finish of the surface 90 limits the downward reflection and permits as much of the light as possible to reenter the chamber.

Ordinarily, it might be possible to overcome this double reflection, namely by the carrier 56 and the surface 90 by other means. However, any such means would be effective for only one size of film carrier. As the size changes, the distribution would again be distorted.

FIGS. 8 and 9 illustrate details of the mechanism which moves the filters 32, 34 and 36 in response to the wheels **42, 44** and **46.** A lever **96** when turned downwardly moves the arm **72** so that the attenuator **74** enters the light beam. The same lever **96,** when moved upwardly, causes the arm **68** to draw the holders **40** and hence the filters **32, 34** and **36** back out of the path of the beam. This allows for a simple means to produce an all-white light, or a dim exposure, with but a single lever.

It can be seen from FIGS. **8** and **9** that the movement of the filters **32, 34** and **36** in FIGS. **1, 2** and **3** is shown somewhat schematically. That is, the filters do not move precisely up and down. Rather, they move angularly. FIG. **10** illustrates another type of diffuser plate embodying features of the invention. The plate is designated **100** and forms part of the mixing chamber **22.**

FIGS. **11** and **12** are plan sectional views of the chamber **22,** the filters **32, 34** and **36,** and the source **12** as well as the reflector **14.** FIG. **11** shows the manner in which the light beam **16** enters the chamber without the effect of the cylindrical mirror **78.** In that case, the beam forms a hyperbolic intersection with the ceiling panel of the chamber **22.** With the filters in the position shown, one side of the intersection is composed of colored light and the other side of white light.

FIG. **12** illustrates, by mean of arrows **102** and **104,** the manner in which the light from the beam is reflected to the other side of the chamber. The colored portion of the beam **16** is partially reflected to the other side and fills the white area with partially colored light and vice versa. If the proportion of the cross-over reflections compare to the main non-reflected portion are chosen properly, the sidewalls of the chamber **22** will receive equal colored densities and the color wedge effect on the printing paper will fully disappear.

Combinations of small, flat mirrors can replace the cylindrical mirror. However, the cylindrical mirror is substantially simpler and more effective.

The short, inner reflecting cylindrical mirror requires the mixing chamber **22** because only one bounce of each light beam occurs within the mirror **78.**

The proportions of the cross-over may be controlled by shifting th position and varying the length of the cylindrical mirror **78.** Where small plain mirrors are used the angle of intersection may be changed to vary the proportion of the cross-over.

The mirror **78** may also be conical so as to produce a specific angle of cross-over relative to the beam. The invention has the effect of producing a substantial uniformity in the distribution of both color and light and is effective for eliminating many of the problems involved with such maldistribution.

The term color negative or slide as used herein refers to what is often called a color transparency.

The panels **28** and **30** are composed of expanded foam and exhibit rough white surfaces which disperse or dispersely reflect light impinging thereon. The term diffusion or diffusive reflection has been used to describe this effect. However, dispersion is used to prevent confusion with the diffusion performed by the plate **52.**

In use, the source **12** and elliptical reflector focus the beam **16** at about the location of the center filter **34.** This forms the waist of the beam. An operator adjusts the wheels **42, 44,** and **46** to position the filters **32, 34,** and **36** so they intercept and color predetermined portions of the beam. The cylindrical mirror **78** reflects the colored portion of the beam into the white and the white into the colored. The thus interspersed light is multiply reflected by the dispersing surfaces of the panels **28** and **30** which scatter the light as it impinges on each surface. The resulting mixed or integrated light, (the mixing chamber **22** is often called an integrating chamber) is selectively transmitted by the diffuser **52** to produce a uniform cross-sectional intensity. The objective **62** focuses the image of the film on the printing paper. The white surface on the carrier **56** reflects the light striking it back toward the chamber **22** while the matte finish on the surface **90** prevents distortion of the uniform intensity and helps increase light gains.

While embodiments of the invention have been described in detail, it will be obvious that the invention may be embodied otherwise without departing from its spirit and scope.

We claim:

1. An illuminating system, comprising source means forming a light beam, filter means in the path of only a portion of the beam for coloring a portion of the beam, mixing chamber means having an opening in the path of the beam beyond said filter means and having opaque reflective dispersing means for mixing the light of the beam entering said chamber means, said chamber means having an exit window for allowing egress of the light from said chamber means, a transparent diffusing plate covering the window for diffusing light as it leaves said chamber means, said filter means being movable across the beam, said source means focusing the beam so as to produce a focus between said source means and the opening of said chamber means.

2. A system as in claim **1,** wherein said filter means is located so as to be movable across the beam at the focus.

3. A system as in claim **1,** wherein the beam converges and then diverges before reaching said chamber means, said chamber means including mirror means extending substantially parallel to the axis of the beam but intersecting the beam at the opening for mingling the portion of the beam passing through the filter means with the portion of the beam which passes the filter means, said mirror means having a reflecting surface for reflecting light on one side of the beam to the other.

4. An enlarger comprising a housing, light source means in said housing for forming a light beam, filter means in said housing in the path of a portion of the beam for coloring a portion of the beam, mixing chamber means in the housing and having an opening in the path of the beam and opaque dispersing means for mixing the light of the beam entering the chamber means, said filter means being located along the beam between said chamber means and said source means, said chamber means having an exit window for allowing exit of light from said chamber means, a translucent diffusing plate covering the window for diffusing light as it leaves said chamber means, optical means for focusing light emerging from said diffusing plate, and printing paper holding means for holding printing paper near the focus of said optical means, said source means focusing the beam and forming a focus between said source means and said mixing chamber means, the focus being closer to said filter means than said mixing chamber means.

5. An enlarger as in claim **4,** wherein said filter means is movable across said beam, said filter means being movable through the focus.

6. An enlarger comprising a housing, light source means in said housing for forming a light beam, filter means in said housing and in the path of a portion of the beam for coloring a portion of the beam, mixing chamber means in said housing and having an opening in the path of the beam and opaque dispersing means for mixing the light of the beam entering the chamber means, said chamber means having an exit window for allowing exit of light from said chamber means, a translucent diffusing plate covering the window for diffusing light as it leaves the chamber means, optical means for focusing light emerging from said diffusing plate, and printing paper holding means for holding printing paper near the focus of said optical means, said diffusion plate including a diffusion material distributed so as to achieve greater diffusion power toward the center than the outer portion thereof.

7. An enlarger, as in claim 6, wherein said chamber means includes mirror means extending substantially parallel to the beam but intersecting the beam at the opening of said chamber means and having reflecting surfaces for reflecting the light on one side of the beam to the other side within the chamber means.

8. An enlarger, as in claim 6, wherein said translucent diffusing plate has a given thickness at the center and become progressively thinner toward the edges, said plate being composed of material having a diffusion power varying with the thickness of the plate.

9. An enlarger, as in claim 6, wherein said diffusing plate has an outer face and an inner face relative to said chamber means, said outer face having a matte finish.

10. An illuminating system, comprising source means forming a light beam, filter means in the path of only a portion of the beam for coloring a portion of the beam, mixing chamber means having an opening in the path of the beam and opaque reflective dispersing means for mixing the light of the beam entering said chamber means, said chamber means having an exit window for allowing egress of the light from said chamber means, a transparent diffusing plate covering the window for diffusing light as it leaves said chamber means, said chamber means including mingling means in the path of the beam for mingling the portion of the beam passing through the filter means with the beam portion which passes by the filter means, said mingling means having mirror means extending substantially parallel to the beam but intersecting the beam at the opening and having a reflecting surface for reflecting light on one side of the beam to the other.

11. A system, as in claim 10, wherein said mirror means includes a cylindrical mirror having an axis extending substantially along the axis of the beam and having an interior reflecting surface.

12. A system, as in claim 11, wherein said dispersion plate includes a diffusing material distributed so as to achieve a greater diffusion toward the center than the outer portion thereof.

13. A system, as in claim 11, wherein the translucent diffusing plate has a given thickness at the center and becomes progressively thinner toward the edges, said diffusing plate being composed of a material having a diffusion power which varies with the thickness of the material.

14. A system, as in claim 11, wherein said diffusing plate has an outer surface relative to the chamber and an inward surface relative to the chamber, said outer surface having a matte finish.

15. A system, as in claim 10, wherein said mirror means includes two mirror surfaces on opposite sides of the beam for reflecting light on opposite sides of the beam toward each other.

16. A system, as in claim 10, wherein the mirror surface extends along two flat planes intersecting the beam.

17. A system, as in claim 16, wherein said plate has a frusto-conical shape thicker in the center and decreasingly thick towards the edge, said plate being made of a material having a diffusion power which increases with the thickness of the plate.

18. A system, as in claim 16, wherein said plate includes a diffusing material distributed so as to achieve a greater diffusion towards the center than the outer portion thereof.

19. A system, as in claim 16, wherein said diffusing plate has a surface facing inwardly relative to the chamber means and a surface facing outwardly relative to the chamber means, said outwardly facing surface having a matte finish.

20. A system, as in claim 16, wherein said source means includes reflector means for producing a converging and then diverging beam, said mirror means being in the diverging portion of the beam.

21. A system, as in claim 10, wherein said source means include reflector means for producing a converging and then diverging beam.

22. A system, as in claim 21, wherein said chamber means include mirror means extending substantially parallel to the beam but intersecting portions of the beam at the opening of said chamber means and having a reflecting surface for reflecting light on one side of the beam to the other side, said mirror means being located in the diverging portion of the beam so as to intersect the beam.

23. A system, in as in claim 10, wherein the translucent diffusing plate has a given thickness at the center and becomes progressively thinner toward the edges, said diffusing plate having a diffusion power varying with the thickness of the plate.

24. A system, as in claim 10, wherein said diffusing plate includes diffusing material distributed to achieve a greater diffusion power toward the center than at the outer portions thereof.

25. A system, as in claim 10, wherein said diffusing plate has an outwardly facing surface and an inwardly facing surface relative to said chamber means, said outwardly facing surface having a matte finish.

26. A system, as in claim 25, wherein said mirror means is in the diverging portion of the beam.

27. A system as in claim 10, wherein said filter means is located between said source means and said chamber means, said source means forming a focus between said source means and said chamber means.

28. A system as in claim 27, wherein said filter means are movable transverse to the beam through the focus.

29. An illuminating system, comprising source means for forming a light beam, filter means in the path of a portion of the beam for coloring a portion of the beam, mixing chamber means having an opening in the path of the beam and opaque reflective dispersing means for mixing the light of the beam entering said chamber means, said chamber means having an exit window for allowing egress of the light from said chamber means, a transparent diffusing plate covering the window for diffusing light as it leaves said chamber means, said dif-

fusing plate including a diffusing material distributed so as to achieve greater diffusion power toward the center than the outer portion thereof.

30. A system, as in claim **29,** wherein said translucent diffusing plate has a given thickness at the center and becomes progressively thinner towards the edges.

31. A system, as in claim **30,** wherein said plate has a portion having a frusto-conical shape thicker in the center and decreasingly thick toward the edges.

32. A system, as in claim **30,** wherein said plate includes a surface facing outwardly of said chamber means and a surface facing inwardly of said chamber means, said outwardly facing surface being flat and said inwardly facing surface having a central mesa with conically declining walls.

33. A system, as in claim **29,** wherein said plate has a portion having a frusto-conical shape thicker in the center and decreasing toward the edges, said plate being composed of a material having diffusion power varying with the thickness of the material.

34. A system as in claim **29,** wherein said filter means is located between said source means and said chamber means, said source means forming a focus between said source means and said chamber means.

35. A system as in claim **34,** wherein said filter means are movable transverse to the beam through the focus.

36. An illuminating system, comprising source means for forming a light beam, filter means in the path of a portion of the beam for coloring a portion of the beam, mixing chamber means having an opening in the path of the beam and opaque reflective dispersing means for mixing the light of the beam entering said chamber means, said chamber means having an exit window for allowing egress of the light from said chamber means, a transparent diffusing plate covering the window for diffusing light as it leaves said chamber means, said diffusing plate having a surface facing outwardly of said chamber means and a surface facing inwardly of said chamber means, said outwardly facing surface having a matte finish.

37. A system, as in claim **36,** wherein said outwardly facing surface is flat.

38. A system, as in claim **36,** wherein said plate has portion having a frusto-conical shape thicker in the center and decreasingly thick toward the edge, said plate being composed of a material having a diffusion power that varies with the thickness of the material.

39. A system, as in claim **36,** wherein said diffusing plate includes a diffusing material distributed so as to achieve a greater diffusion power towards the center than the outer portions thereof.

40. A system, as in claim **36,** wherein said source means includes reflector means for producing a converging and then diverging beam, said chamber means including mingling means in the path of the beam for mingling the portion of the beam passing through the filter means with the beam portion which passes by the filter means, said mingling means having mirror means extending substantially parallel to the beam but intersecting the beam at the opening and having a reflecting surface for reflecting light on one side of the beam to the other, said mirror means being located in the diverging portion of the beam.

41. A system, as in claim **36,** wherein the translucent diffusing plate has a given thickness at the center and becomes progressively thinner toward the edges, said diffusing plate having a diffusion power varying with the thickness of the plate.

42. A system, as in claim **36,** wherein said diffusing plate includes diffusing material distributed to achieve a greater diffusion power toward the center than at the outer portions thereof.

43. A system, as in claim **36,** wherein said chamber means includes mingling means in the path of the beam for mingling the portion of the beam passing through the filter means with the beam portion which passes by the filter means, said mingling means having mirror means extending substantially parallel to the beam but intersecting the beam at the opening and having a reflecting surface for reflecting light on one side of the beam to the other, said mirror means is in the diverging portion of the beam.

44. A system, as in claim **36,** wherein the translucent diffusing plate has a given thickness at the center and becomes progressively thinner toward the edges, said diffusing plate being composed of a material having a diffusion power which varies with the thickness of the material.

45. A system, as in claim **36,** wherein said diffusing plate includes a diffusing material distributed so as to achieve a greater diffusion power towards the center than the outer portions thereof.

46. A system as in claim **36,** wherein said filter means is located between said source means and said chamber means, said source means forming a focus between said source means and said chamber means.

47. A system as in claim **46,** wherein said filter means is located between said source means and said chamber means, said source means forming a focus between said source means and said chamber means.

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