

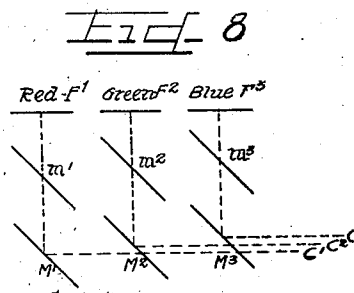
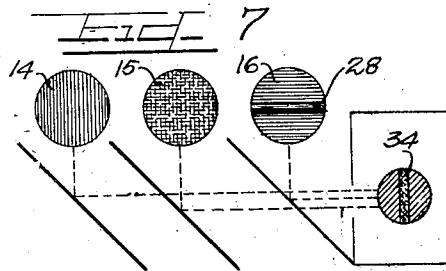
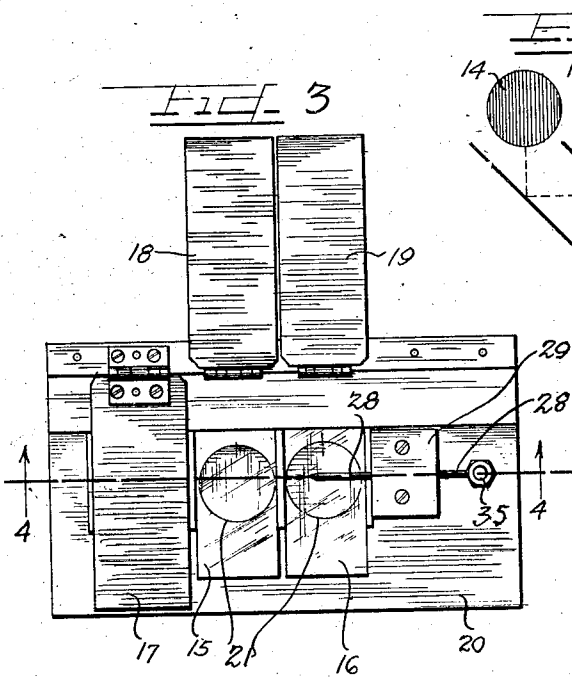
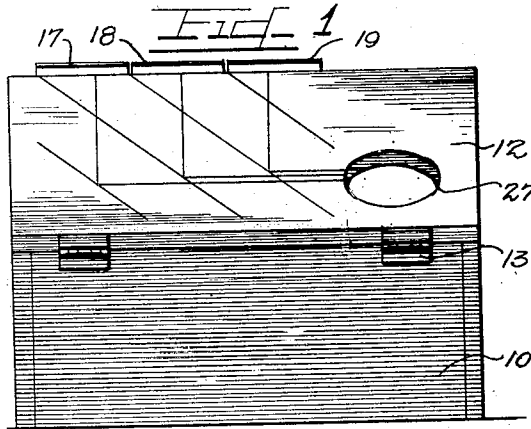
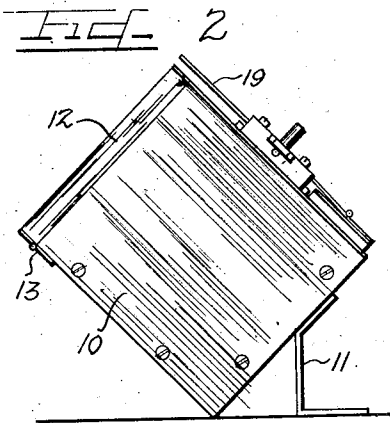
March 1, 1927.

1,619,468

H. GRUENDER

COLOR MIXER

Filed April 28, 1924 2 Sheets-Sheet 1



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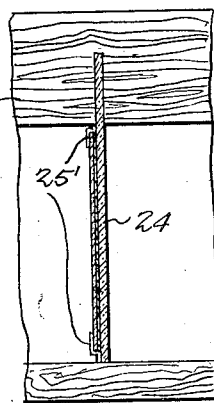
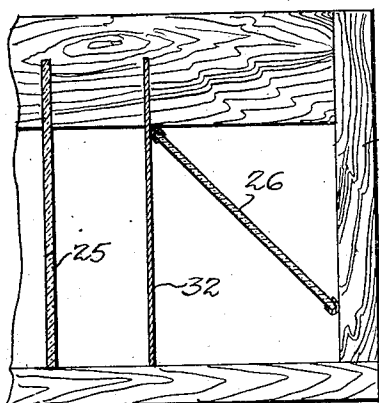
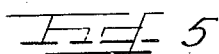
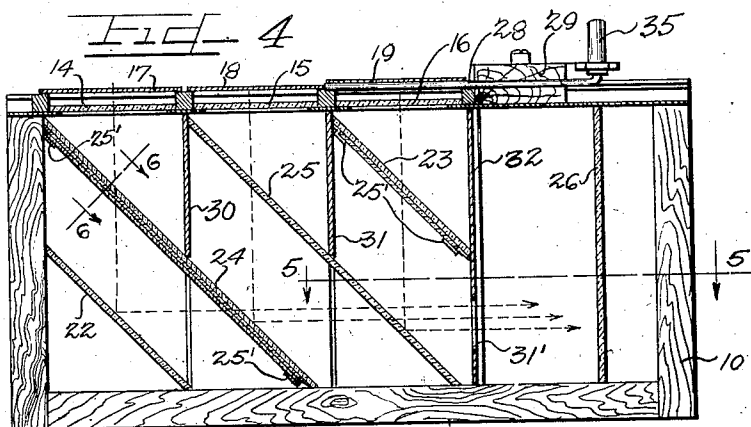
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H. GRUENDER

COLOR MIXER

Filed April 28, 1924 2 Sheets-Sheet 2

1,619,468



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UNITED STATES PATENT OFFICE.

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COLOR MIXER.

Application filed April 23, 1924. Serial No. 709,388.

This invention relates to the mixing or blending of colors.

At the present time the best method available is that which makes use of rapidly rotating discs having sectors of different colors. This method has various disadvantages.

In the first place it does not mix colors, that is, it does not produce a physical mixture of different colored lights. When we rotate a color disk, the different colored lights which are reflected from its several sectors remain distinct and separate just as they are when the disk is at rest. What the color wheel really does is to present, in rapid succession, to the same retinal elements, those amounts and kinds of light which are reflected from the several sectors.

Another disadvantage of the color wheel is that many colors produced by it are of a rather low degree of saturation. Thus, for instance, the combination in appropriate proportions of red and green on the color wheel results in a rather greyish yellow.

A third disadvantage of the color wheel method is that we can never see the exact components which enter into a mixture. This holds true even when all the colored sectors are of equal size. For we must imagine that the light which is reflected from each sector is spread uniformly over the whole disc, that is, over 360 degrees. But if the light which is reflected from any particular sector were thus spread uniformly over 360 degrees, it would produce a very different color sensation from that which is produced by the same sector at rest.

It is an object, therefore, of the present invention to provide a true color mixer.

A further object is to provide simple means for varying to a predetermined extent the intensity of each constituent of a beam of mixed colored lights.

Other and further important objects of this invention will be apparent from the disclosures in the drawings and specification.

The invention (in a preferred form) is illustrated in the drawings and hereinafter more fully described.

On the drawings:

Figure 1 is a side elevation of a color mixer constructed in accordance with the present invention.

Figure 2 is an end view of the same.

Figure 3 is a top plan view of the same.

Figure 4 is a section on the line 4—4 of Figure 3.

Figure 5 is a section on the line 5—5 of Figure 4.

Figure 6 is a section on the line 6—6 of Figure 4.

Figure 7 is a diagrammatic illustration of the method by which the colors are mixed.

Figure 8 is a diagrammatic illustration of the method by which the intensity of the individual colors is varied.

As shown on the drawings:

Before describing the apparatus embodying the preferred form of the invention the principles of optics on which it is based will be explained. If a plain unsilvered sheet of glass is placed in the path of a beam of light at 45° thereto about 10% of the light is reflected and 90% transmitted. If two such sheets are superimposed an additional percentage is reflected. This additional amount of reflected light is smaller than the first amount for various reasons: first, the amount of incident light reaching the second reflector is only 90% of the original light and 10% of this is 9.0%; second, the light reflected from the second reflector has to be transmitted through the first and therefore there is a loss of 10% by reflection by the first reflector. This gives as the total increment 8.1%. Other factors enter into the problem and these figures are given merely to illustrate how, as the number of superimposed reflectors increases, the proportion of reflected light increases and the amount of transmitted light decreases by successively smaller increments.

This provides a ready means for either adding light to or subtracting light from a beam. By using reflected light each extra reflector adds to the quantity and by transmitted light each extra reflector subtracts

from the quantity of light reaching the observer.

This is clear from the following table:—

No. of superimposed reflectors.	Reflected.	Amount of light (red) transmitted.
	Per cent.	Per cent.
1	10	90
2	17.9	82.1
3	24.1	75.9
4	29.0	71.0
5	32.9	67.1
6	36.0	64.0

In Figure 8 F^1 , F^2 and F^3 represent color screens of the three colors, red, green and blue-violet respectively. M^1 , M^2 , M^3 , m^1 , m^2 , and m^3 are plain unsilvered glass reflectors or sets of reflectors in the paths of the beams of light passing through the color screens and at 45° to the latter.

By using a plurality of reflectors at M^3 the proportion of blue-violet light will be increased and at the same time the green and red will be decreased to a lesser extent owing to the smaller amount of transmitted light which a plurality of reflectors will allow to pass as compared with only a single reflector.

If it is desired to decrease the green still further a plurality of reflectors at m^2 may be used. In this way without varying the intensity of light passing through the color screens, which may therefore all be illuminated from a single source of white light, the components of the final beam represented by the sum of C^1 , C^2 and C^3 may be varied relatively to each other as desired.

The apparatus shown comprises a wooden box 10 provided with a bracket or support 11 so that it will stand tilted up on one edge as shown in Figure 2. The side 12 opposite to the one to which this bracket is attached by hinges 13 so that access may be had to the interior of the box for the purpose of changing the slides which carry the reflectors.

In another side are arranged a series of color filters 14, 15 and 16. See Fig. 4. Over these filters are a series of hinged flaps 17, 18 and 19 so that any one or more of the color filters may be covered as desired. These color filters rest upon a base 20 provided with three circular apertures 21 as shown more particularly in Figure 3.

Within the box at 45° to the color filters are arranged a series of plates of plain unsilvered glass. Some of the plates as 22, serve only as reflectors. Others as 23, serve only to reduce the amount of light transmitted therethrough. Still others, as 24 and 25, combine both functions on account of the fact that they are each arranged beneath two of the color filters. Then, as shown, 22 and 25 consist of a single plate

23 of two sheets and 24 of three plates. Obviously any number of plates in any combination may be used as occasion requires. Each plate or set of plates may be removable or four permanently fixed plates may be used, as shown, with ledges 25' beneath into which frames carrying additional plates or sets of plates may be inserted as desired.

For convenience in operation a silvered mirror 26 is provided in one end of the box to deflect the composite beam of light out through an aperture 27 in the side 12 instead of projecting it through the end of the box. It is frequently desirable that a direct comparison be obtained between light without a given component and the same light with such component. To enable this to be done a rod 28 provided with a handle 35 is slidably mounted in a block 29 on the box so that it may be projected over the adjacent color filter 16. See Fig. 7. This rod casts a shadow 34 across the color filter 16 beneath it. Assuming, therefore, that the three color screens are red, green and blue-violet and that the rod 28 extends over the latter, the main portion of the image seen through aperture 27 will be composed of a mixture of all three colors while the center strip will be composed of only red and green.

The box is finished dull black on the interior in order to absorb all light reaching the sides. Further, partitions 30, 31 and 32, also dull black, are provided for keeping separate the light beams passing through the various color filters. An aperture 31' is arranged in the partition 32 for the passage of the composite beam of light.

All the reflectors used are thin glass plates of substantially uniform thickness and size. Conveniently microscope cover glasses may be used for the purpose.

The accuracy of the results obtained by the apparatus depends upon keeping the reflectors clean. They should never be touched with the fingers as the latter leave a film upon the glass and the amount of light transmitted (or reflected) will vary with the thickness of the film. This instrument is very sensitive in this regard. This inconvenience in handling the instrument may be readily avoided by providing a set of thin uniform frames (30 or more) in which the plates are loosely but permanently enclosed. There should be one set of such frames containing one plate; another, each containing two plates; a third, each containing three plates; and so forth. Then the plates, once thoroughly cleaned, need never be touched. This arrangement has the further advantage that the danger of breaking the thin plates is lessened and the uniform frames make it easy to have the plates always in perfect register.

Various forms of color filters may be em-

ployed such as colored gelatine films. Such films should each be backed by a thin plate of finely ground glass so that no object can be seen through the films. The films themselves are the objects observed. In use the instrument is held against the brightly illuminated clouds and the eye of the observer is above the aperture 27. As a result, he sees superimposed images of the filters and the size of the apparatus is such that the filters are approximately at reading distance. In some cases, instead of arranging ground glass behind the color filters, a ground glass may be placed in the aperture 27.

I am aware that many changes may be made, and numerous details of construction may be varied through a wide range without departing from the principles of

this invention, and I therefore do not propose limiting the patent granted hereon, otherwise than necessitated by the prior art.

I claim as my invention:

A device of the kind described comprising a plurality of color screens, a plurality of reflectors of plain unsilvered glass adapted to form a single beam of light of a single color composed of the light reflected by each of said reflectors and means for interrupting the light incident upon one of the color screens over a portion of its area in order to produce an image consisting in part of a color combination without the latter color and in part of a color combination with such color.

In testimony whereof I have hereunto subscribed my name.

HUBERT GRUENDER, S. J.