June 4, 1935. H. M. CAVANAUGH 2,003,342

LIGHTING APPARATUS

Filed July 30, 1932

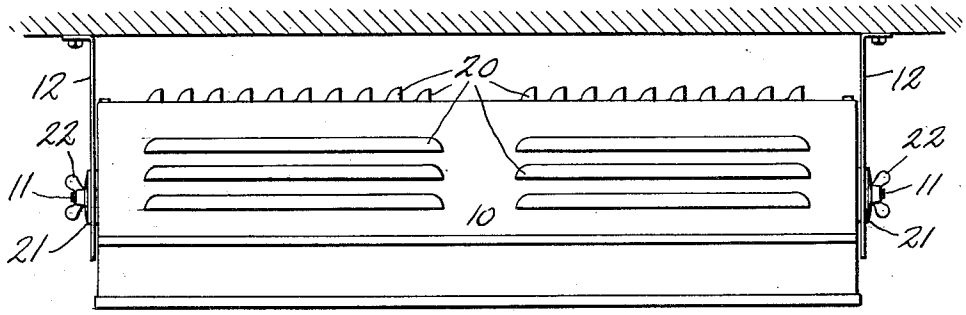

Fig. 1.

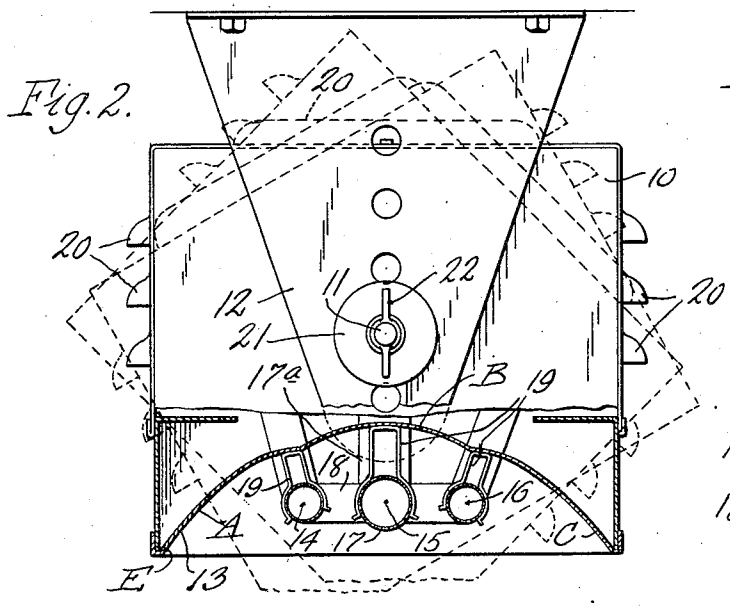

Fig. 2.

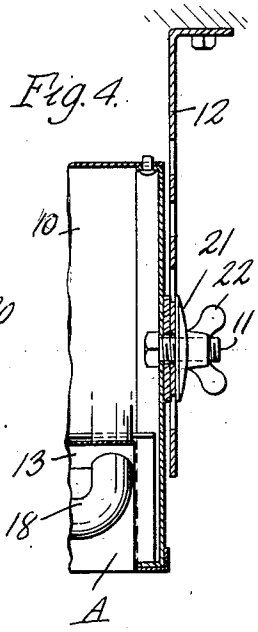

Fig. 4.

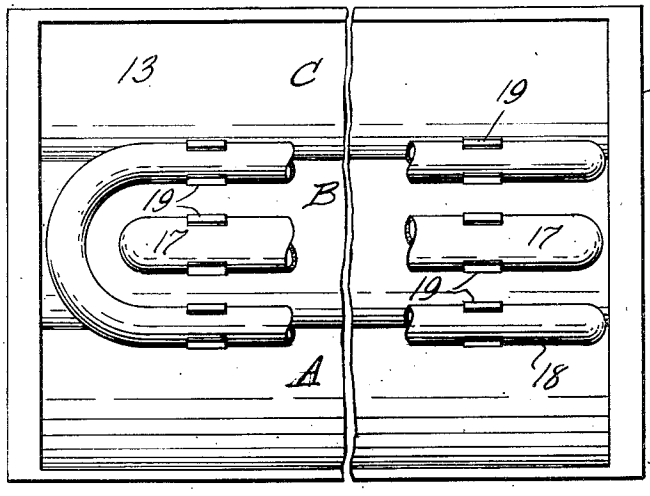

Fig. 3.

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Patented June 4, 1935 2,003,342

UNITED STATES PATENT OFFICE

2,003,342

LIGHTING APPARATUS

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Application July 30, 1932, Serial No. 626,611

5 Claims. (Cl. 240—11.4)

This invention relates to illuminating or lighting devices, and particularly to the use of gaseous illuminating tubes of the low voltage, hot cathode type. These gaseous illuminating tubes may be constructed to emit light of different colors including the principal primary colors, such as red and green.

An object of the invention is to provide an improved illuminating device for the use of gaseous illuminating tubes, with which a concentrated light may be delivered in any desired direction, with which light may be produced which has the illuminating characteristics of substantially white light, and which will be relatively simple, compact and inexpensive in construction and operation.

Another object of the invention is to provide an improved lighting device with which gaseous illuminating tubes emitting different primary colors may be utilized to deliver a column of mixed light closely resembling sunlight in illuminating characteristics.

A further object of the invention is to provide improved means for mixing the light from a plurality of illuminating tubes emitting different primary colors, so that a mixed light may be obtained which is a maximum possible approach to white light in its illuminating characteristics.

Another object of the invention is to provide an improved light reflector which will have a minimum of glare and produce a minimum of shadows.

Various other objects and advantages will be apparent from the following description of one embodiment of the invention, and the novel features will be particularly pointed out hereinafter in connection with the appended claims.

In the accompanying drawing:

Fig. 1 is a side elevation of a lighting device constructed in accordance with this invention;

Fig. 2 is an end elevation of the same, partly in section, to illustrate certain details of construction of the reflector;

Fig. 3 is a bottom plan of the reflector and tubes; and

Fig. 4 is a longitudinal sectional elevation of the same, the section being taken through the center of the device at one end.

In the illustrated embodiment of the invention, a box like structure 10 is provided with studs or pins 11 at its ends which are pivotally mounted in hanger brackets 12 which may be suspended from the ceiling or supported upon a wall from which the device is to be supported. The supporting pivot pins 11 are aligned with one another so that the box 10 may tilt into a plurality of different angular positions, some of which are shown by the dash lines in Fig. 2. The lower face of the box is closed by a reflector 13 which is concave on its lower face and bowed or arched upwardly into the interior of the box, as shown clearly in Fig. 2. This reflector may be made of sheet metal and its concave face represents a surface of generation having its elements, or lines of generation, straight lines, and has three sections A, B and C. The concave face may also be considered as a single curved surface, that is, one generated by a straight line moving so that any two but no three of its consecutive positions are in the same plane. The sections A and C in cross section represent the two halves of a parabola, the two halves beginning at the major axis. The middle section B in cross section also corresponds to the portion of a parabola at the end of the major axis and is symmetrical with respect to said major axis. The side edges of the middle section preferably merge into, or with, the inner side edges of the two parabolic half sections to make a continuous surface of generation. In other words, the concave reflecting surface represents or corresponds to a surface generated by a straight line moving from one side edge of the reflector, such as the edge E, in a parabolic path about the focus 14 in the major axis of that parabolic curve, until the line reaches the major axis of that parabolic curve, whereupon the line moves in a new parabolic path about the focus 15 of the parabolic curve of the middle section B to generate a symmetrical curve, and then changes its path and moves in a new parabolic path about the focus 16 of the section C. If the middle section B were removed and the two sections A and C moved closer together until they met, the foci 14 and 16 would merge. The focus 15 for the middle section B is on a straight line and midway between the foci 14 and 16 and, therefore, the three foci 14, 15 and 16 are in the same line and the same plane.

The reflector 13 preferably has a greater length than width and an elongated, gaseous illuminating tube 17 extends in a direction endwise of the reflector substantially at the focus 15 which is in the axis of generation of the reflecting surface of the middle section B. The tube 17 extends parallel to the lines of generation of the reflecting surface so that it is everywhere equi-distant from the reflector except at its ends which are bent upwardly as at 17a and pass through the reflector into the box. The ends of the tube within the box are provided with the usual electrodes, one

end having an anode or anodes, and the other end having a cathode. Such tubes are well known in the art and are gas-tight tubes of transparent material, such as glass, containing an inert gas and operated by a relatively low voltage. The cathodes of such tubes are usually heated, but since such details of the tubes are well known in the art, they have not been illustrated.

The character of the light emitted by such a tube depends upon the inert gas which is placed in the tube, and preferably the center tube is of the type which emits one of the primary colors, such as a red color. A second gaseous illuminating tube 18, generally U-shape in character, is also disposed below or in front of the reflector 13, and the arms of the U extend along opposite sides of the tube 17 and substantially at the foci 14 and 16, as shown in Fig. 2. The free ends of the arms of this U-shaped tube 18 are bent upwardly and enter the box 10 where they are provided with anodes and a cathode by means of which current is passed through the tube. The tube 18 is provided with inert gas which causes the tube to emit a color of light representing another of the primary colors, such as the color green. The color green is a mixture of blue and yellow and, therefore, takes the place of blue and yellow.

The light from the tube 18 striking the reflecting surfaces of the sections A and C will be reflected generally in a parallel path and the light from the tube 17 which strikes the reflecting surface of the middle section B of the reflector will also be reflected generally in a parallel direction, and parallel to the light reflected by the sections A and C. The light from the tubes 17 and 18 will, therefore, be concentrated and directed in one general direction by the concave reflector 13 and the mixing of the two colored lights, red and green, will produce a light which has the illuminating characteristics of substantially white light, because it is known that the mixing of primary colors will produce white. The intensity of light provided in each of the tubes 17 and 18 is designed to give a proper balance between the primary colors and produce a white light approximately free from an excess of either color. The tubes are all spaced from the reflector far enough to permit them to cool during use.

While the reflecting surface of the reflector 13 may be a highly polished surface, and of any desired shape or size I have found that preferable results are obtained by providing this reflecting surface with a satin-like or light-diffusing finish. For example, the reflector 13 may be made of sheet aluminum, which is stamped or bent into the desired shape, and the reflecting surface is subjected to the action of an acid which gives a light etch to the reflecting surface, thereby producing a finish which is known in the trade as an aluminum oxide finish. One may also use a mottle finish paint surface or a porcelain enamel finish. Such a surface, while reflecting the light generally in accordance with the parabolic character of the curvature, nevertheless causes material diffusion of the light rays and a thorough mixing of the rays of colored light. The resulting light so produced has the principal illuminating characteristics of white light, and closely resembles day light. The diffusion also reduces glares and shadows to a considerable extent. While the tubes for giving the different colors may be arranged in different combinations in front of the reflecting surface, I have found that somewhat better results are obtained where the red is interposed between the green tubes, as illustrated in the drawing.

The tubes may be supported in proper position in front of the reflector in any desired manner, such as by the use of spring clips 19 that are somewhat U-shaped in character and secured at the bases of the U to the reflector. The arms of each clip are made of spring metal, and are somewhat oppositely arcuate at their ends which spring apart to receive a tube. Each tube thus may be snapped into a fixed, desired position between the arms of the spring clamps and held yieldingly in that position.

The transformers and other operating mechanism (not shown) for the operation of the tubes 17 and 18 may be contained within the box 10 above the reflector 13 and in order to dissipate any heat which may be generated by such operating mechanism, the box is provided with ventilating louvers 20 in its sides and top. To enable access to be had to the interior of the box 10, parts of the sides and the top may be made in a single piece of sheet metal which is removed from the frame of the box. The pins 11, which pivotally mount the box in the hangers 12, may be in the nature of threaded studs or bolts which carry washers 21 and wing nuts 22 which, when tightened, will clamp the box in any angular position into which it is adjusted or tilted.

It will be obvious that various changes in the details, which have been herein described and illustrated in order to explain the nature of the invention, may be made by those skilled in the art within the principle and scope of the invention as expressed in the appended claims.

I claim:

1. An illuminating device comprising a reflector having a concave, single curved reflecting surface representing a surface of generation whose elements are straight lines, said reflector being formed of two longitudinally extending sections and an intermediate connecting section, said sections being disposed side by side, and having different axes of generation, each side section in transverse cross section having the form of half a parabola at one side of the major axis of the parabola, the two side sections representing the two halves of a single parabola, but with their major axes spaced apart laterally, and said central section being also parabolic in cross section with its focus centrally in front thereof, the foci of all of said sections being arranged substantially in a common plane, and a gaseous illuminating tube elongated in shape and running lengthwise of the reflector at each focus of a section.

2. An illuminating device comprising a reflector having a concave, single curved, relatively shallow reflecting surface representing a surface of generation whose elements are straight lines, said reflector being formed of two longitudinally extending sections and an intermediate connecting section, said sections being disposed side by side, and having different axes of generation, each side section in transverse cross section having the form of half a parabola at one side of the major axis of the parabola, the two side sections representing the two halves of a single parabola, but with their major axes spaced apart laterally, and said central section being also parabolic in cross section with its focus centrally in front thereof, the foci of all of said sections being arranged substantially in a common plane, and a gaseous illuminating tube elongated in shape and running lengthwise of the reflector at each focus

of a section, so that its emitted light rays may strike a plurality of said sections, said tubes emitting light of different primary colors whereby the light from the different tubes will be mixed and concentrated and will produce a column of light having substantially the illuminating characteristics of white light.

3. An illuminating device comprising an elongated reflector having a concave, single curved reflecting face representing a surface of generation, said face having three sections, the two side sections of which in cross section represent the two halves of a parabola on opposite sides of the major axis and spaced apart and connected by the middle section, and said middle section being symmetrical with its major axis which is approximately midway between, and in the same plane as the axes of, the separated side parabolic sections, a gaseous illuminating tube extending along and approximately at the focus of the middle section of the reflecting face, and a gaseous illuminating tube extending along the focus of each side parabolic section, the foci of all of said sections being disposed in a straight plane extending transversely of said reflector, and said tubes emitting different primary colors, whereby the mixture of light delivered by said device will be a substantially white light for illumination purposes.

4. An illuminating device comprising a reflector having a trough like, concave, single curved, focusing reflecting surface, divided longitudinally of the trough into a plurality of sections having different foci that lie side by side in proximity to one another and approximately in the same plane but sufficiently away from said surface to enable light rays from any focus to strike a plurality of said sections directly, and an elongated source of light extending approximately along each focus, said sources of light emitting light rays of complementary colors, which mix immediately to create an approximately white light.

5. An illuminating device comprising a reflector having a trough like concave, single curved, focusing reflecting surface, divided longitudinally of the trough into a plurality of sections having different foci that lie side by side in proximity to one another and approximately in the same plane but sufficiently away from said surface to enable light rays from any focus to strike a plurality of said sections directly, the two side sections being so shaped that if those sections were brought together edge to edge to form a single reflecting surface, their foci would be substantially coincident, and an elongated source of light extending approximately along each focus, said sources of light emitting light rays of complementary colors, which mix immediately to create an approximately white light.

HOWARD M. CAVANAUGH.