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LIGHTING DEVICE FOR DENTAL AND SURGICAL PROCEDURES

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Fig. 1

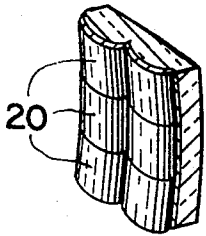
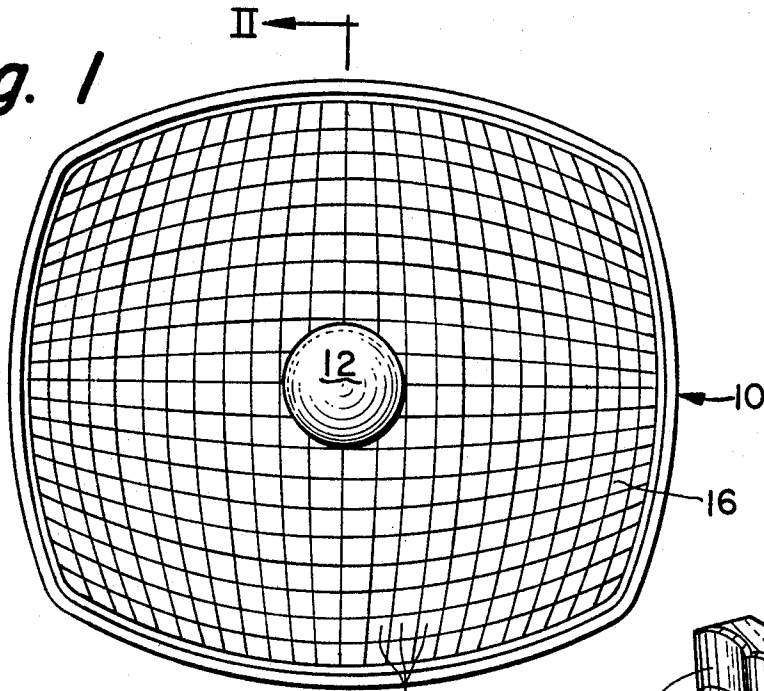


Fig. 3

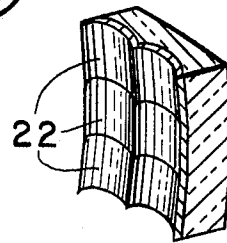


Fig. 4

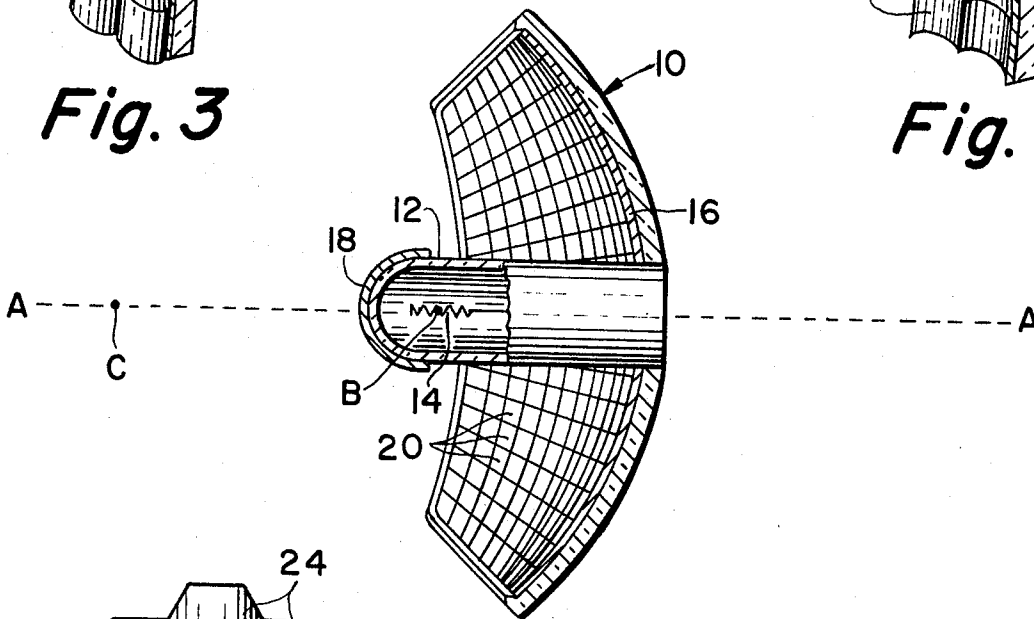


Fig. 2

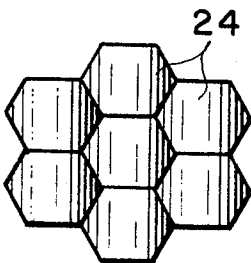


Fig. 5

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LIGHTING DEVICE FOR DENTAL AND SURGICAL PROCEDURES

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2 Claims

ABSTRACT OF THE DISCLOSURE

A lighting device for illuminating the oral cavity during dental and surgical procedures, the device having a reflector in the basic form of a portion of an ellipsoid of revolution and a light source located at a focus of the ellipsoid and elongated along the axis of revolution of the ellipsoid. The basic ellipsoidal shape of the reflector is modified by the superimposition thereupon of a large number of contiguous polygonal flutes having reflecting surfaces in the form of portions of circular cylinders.

BACKGROUND OF THE INVENTION

This invention relates to lighting devices of the type generally used by dentists for illuminating the oral cavity of a patient during the performance of dental or surgical procedures. Such devices are generally constructed with reflectors in the form of portions of ellipsoids of revolution, i.e., surfaces formed by revolving an ellipse about its major axis. A light source is located on the axis of the ellipsoid at one focus thereof, while the device is oriented such that the oral cavity of the patient is in the vicinity of the conjugate focus. It has been customary to employ in such devices light sources having filaments elongated in directions transverse to the axis of the reflector. Due to the transverse extent of the filament, a light pattern of sufficient width has been formed in the area of the conjugate focus.

Inasmuch as a light filament which is elongated in an axial direction with respect to a reflector extends only a small distance in transverse directions, the illuminated pattern produced at the conjugate focus of a reflector by an axially oriented filament is substantially less than that produced by a transversely oriented filament. It is, therefore, necessary to modify the basic ellipsoidal shape of the reflector when such reflector is used with an axially oriented filament. Accordingly, it is an object of the present invention to provide a dental lighting device having a reflector of the common ellipsoidal configuration, but having superimposed thereupon a configuration which permits light emanating from an axially oriented filament at the principal focus of the reflector to be spread by an amount sufficient to illuminate a useful area at the conjugate focus of the reflector.

SUMMARY OF THE INVENTION

According to the invention, a dental lighting device of the conventional type is provided with an axially oriented filamentary light source. In order to form a light pattern of useful dimensions at the conjugate focus of the reflector, the basic ellipsoidal configuration of the reflector is modified by the superimposition thereon of a plurality of polygonal flutes, each flute having a surface in the form of a portion of a cylinder, the axis of the cylindrical surface being in a vertical plane generally parallel to the major axis of the ellipsoid. Due to the horizontal curvature of the flutes, light emanating from the unit is spread horizontally by an amount greater than the vertical spread of the light, thereby providing a horizon-

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tally elongated pattern of illumination at the conjugate focus of the reflector.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a front elevational view of a dental lighting device according to the invention.

FIG. 2 is a sectional view taken on line 2—2 of FIG. 1.

FIG. 3 is an enlarged perspective view showing the cylindrical flutes employed on the reflector of FIGS. 1 and 2.

FIG. 4 is a view similar to that of FIG. 3 illustrating an alternative flute configuration.

FIG. 5 is a front elevational view of an alternative form of flute.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In its preferred embodiment, the lighting device of the invention comprises a glass reflector 10 in the form of a portion of an ellipsoid of revolution. The ellipsoid is formed by rotating an ellipse about its major axis, indicated by broken line A—A in FIG. 2 of the drawing. Axis A—A passes through principal focus B and conjugate focus C of the ellipse. As used herein the term "principal focus" refers to the focus nearer the reflector. A light source 12 has its filament 14 elongated along axis A—A and located with its center generally at principal focus B. A reflective coating 16 covers the inner surface of reflector 10. Another reflective coating 18 covers the outer surface of the outer end of light source 12 in order to prevent the escape of light rays directly from the light without reflection by the reflector. The end of the light source is preferably in the form of a portion of a sphere having its center in the vicinity of the center of filament 14, such that reflective coating 18 directs light back past the filament and against reflective coating 16.

Since filament 14 is located at the principal focus of the ellipsoidal reflector surface, light emitted therefrom is reflected by the reflector in the general direction of conjugate focus C. If the filament were a point, all the light falling directly upon the reflector would be reflected precisely through point C. However, since the filament has a finite length and width, only a small part of the light emitted therefrom can be considered to emanate precisely from the principal focus. Accordingly, only a small amount of light is reflected precisely through the conjugate focus, all remaining light being directed around the conjugate focus in a pattern which is dependent upon the shape and orientation of the filament. When a transversely oriented filament is used, this pattern, or "source spread," from an ellipsoidal reflector may be sufficient to provide illumination of the oral cavity. However, when an axially oriented filament is used, the average angle subtended at the reflector surface by light rays originating at each end of the filament and falling on a point on the reflector is substantially less than the average such angle produced by a transversely oriented filament. That is, when viewed from points on the reflector surface, the average angular extent of the filament is less for an axially oriented filament than for a transversely oriented filament. Accordingly, in order to increase the dimensions of the light pattern produced at the conjugate focus by an axially oriented filament, the basic ellipsoidal configuration of the reflector is modified according to the present invention by the superimposition thereon of a large number of flutes 20 in the form of portions of circular cylinders. The lighting device is oriented such that the axes of the cylindrical surfaces are in vertical planes which are generally parallel to axis A—A, that is, the axes of the cylindrical surfaces are in planes which are parallel to one another. Accordingly, the hori-

zontal curvature of the flutes causes light reflected thereby to be spread horizontally. Since the flutes are substantially flat in vertical cross-section, the vertical extent of the pattern of light at the conjugate focus resulting from source spread is greater than that which would be produced by the basic ellipsoidal reflector, which is concave in vertical cross-section.

Due to the fact that the reflector is elongated in the horizontal direction, i.e., its width is greater than its height, the flutes near the peripheries of the lateral edges of the reflector are farther from the light source than are the flutes near the upper and lower peripheries of the reflector. Since source spread is greater for light reflected from areas on the reflector near the light source than for light reflected at more remote areas on the reflector, in an alternative embodiment of the invention, due to the fact that greater spreading power is required at greater distances from the light source, the curvatures of the cylindrical flutes may increase with increasing distance from the light source.

Although flutes 20 have been illustrated as being convex, they may alternatively be made in the form of concave cylindrical surfaces, in which case light rays striking the flutes will be reflected in a manner so as to cross one another and subsequently diverge, producing the necessary spread. Such alternative configuration is illustrated by flutes 22 of FIG. 4. Similarly, the polygonal shape of the cylindrical surfaces need not be square as illustrated in the preferred embodiment, but may be of other forms, such as hexagonal flutes 24, illustrated in FIG. 5.

Reflecting coatings 16 and 18 may be any conventional silver or aluminum coatings; however, it has been found that a vacuum deposited coating having the ability to transmit infrared radiation while reflecting visible light is particularly advantageous when applied to the reflector flutes. Thus, coating 16 may be a standard dichroic coating such as the "cold mirror" coating obtainable from Optical Coating Laboratories, Inc.

According to a preferred embodiment of the invention, reflector 10 may be an end portion of an ellipsoid of revolution having its principal focus approximately 2.27 inches from the reflector when measured along the axis thereof. The height of the reflector may be 8 inches and the width 9 inches. Filament 14, which has its center at the principal focus may extend along the axis of the reflector by approximately 0.375 inch. Flutes 20 may be square in plan view and approximately 0.4 inch on each side and may have a radius of curvature of approximately 2.5 inches. The eccentricity of the ellipse is such that the conjugate focus is separated from the principal focus by approximately 36.6 inches. An illuminated area approximately 3.5 by 9 inches will result.

The foregoing description has been provided solely as that of preferred embodiments of the invention. Accordingly, it is recognized that various changes and modifications may be made without departing from the spirit and scope of the invention.

I claim:

1. A lighting device useful for illuminating the oral cavity during dental and surgical procedures, said device comprising:

a concave reflector comprising a glass body having a surface in the general form of a portion of an ellipsoid of revolution about an axis, said reflector being located on said axis and extending transversely therefrom,

a plurality of rows of polygonal flutes superimposed on the concave surface of said reflector, each said row having a plurality of flutes with each flute having a reflecting surface in the form of a portion of a circular cylinder, whose axis generally lies within a common plane with an axis of an adjacent cylinder, taking into consideration the curvature of the reflector,

said rows of circular cylinders having a plurality of contiguous axes lying in vertical planes generally parallel to said axis of revolution,

a light source elongated along said axis of revolution at the focus of said ellipsoid of revolution nearer said reflector, and

a concave reflecting shield disposed in the vicinity of said light source between said light source and the conjugate focus of said ellipsoidal surface so as to direct toward said reflector light from said light source which would not otherwise fall thereupon.

2. A lighting device comprising:

a concave reflector in the general form of a portion of an ellipsoid of revolution about an axis, said reflector being located generally on said axis and extending transversely therefrom,

a plurality of rows of flutes superimposed upon the concave surface of said reflector, each said flute having a concave reflecting surface in the form of a portion of a cylinder, each row of flutes having a plurality of said cylinders lying end to end with axes of adjacent cylinders being contiguous, adjacent end portions of said cylinders abutting one another to form continuous reflecting surface portions along the vertical extent of said concave surface, the cylinders in each row of flutes having axes lying in planes generally parallel to such axes in an adjacent row, and

a light source located longitudinally along said axis of revolution at the focus of said ellipsoid of revolution nearer said reflector, such that light emitted by said light source and reflected by said reflector is directed by said reflector in the general direction of the conjugate focus of said reflector to form a transversely extending pattern of light.

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