United States Patent

Alger

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[45] **Nov. 14, 1972**

[54] **ADJUSTABLE LIGHTING APPARATUS**

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[21] Appl. No.: **126,792**

Related U.S. Application Data

[63] Continuation of Ser. No. 770,578, Oct. 25, 1968, abandoned.

[52] **U.S. Cl.** **240/1.4,** 240/41.15, 240/44.27, 240/41.6

[51] **Int. Cl.**.....**H61g 13/00,** F21v 33/00

[58] **Field of Search**.....240/1.4, 41.15, 41.4, 41.55, 240/44.27, 41.6, 44, 46.33, 46.35, 46.45, 46.49, 41

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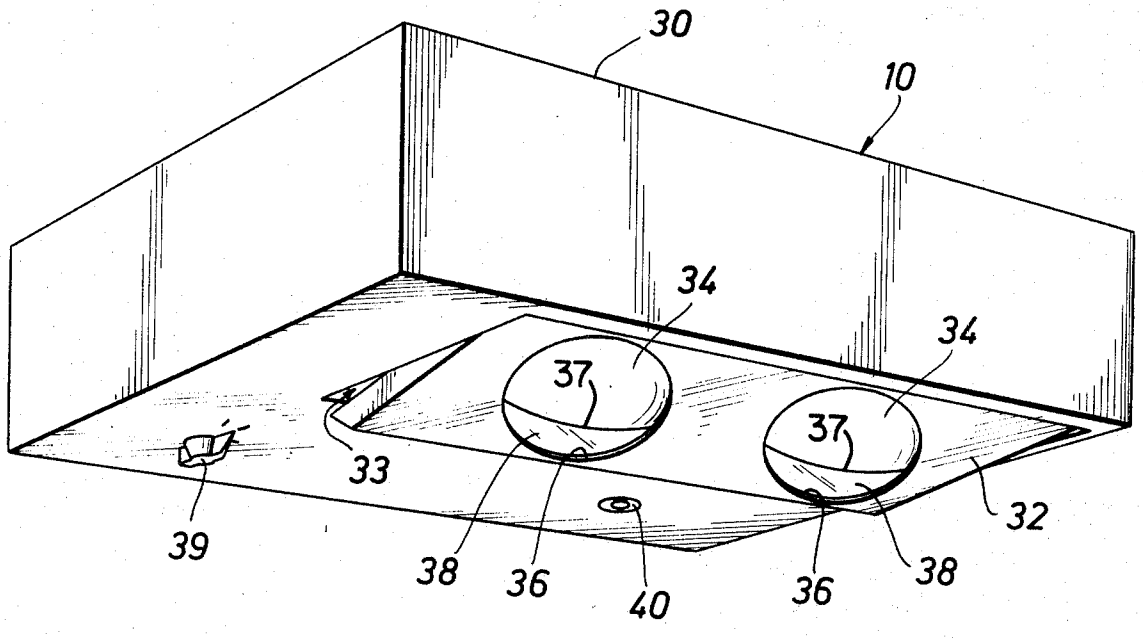
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[57] **ABSTRACT**

In one exemplary embodiment, a remote controlled adjustable dental operating light is provided that projects a light beam having an elongated cross-sectional configuration with the horizontal width being large in comparison to the vertical height of the beam. A pair of light sources each project a beam having an elongated cross-section, the two beam being longitudinally aligned and overlapping to form a single composite beam having an elongated cross-sectional configuration. The light beams are reversibly pivotable about a rotatable axis to adjust the central axis of the light beam to properly illuminate the patient's mouth. Shields provided over a portion of the external area of the light sources mask the bright filaments from the patient's eyes.

10 Claims, 7 Drawing Figures



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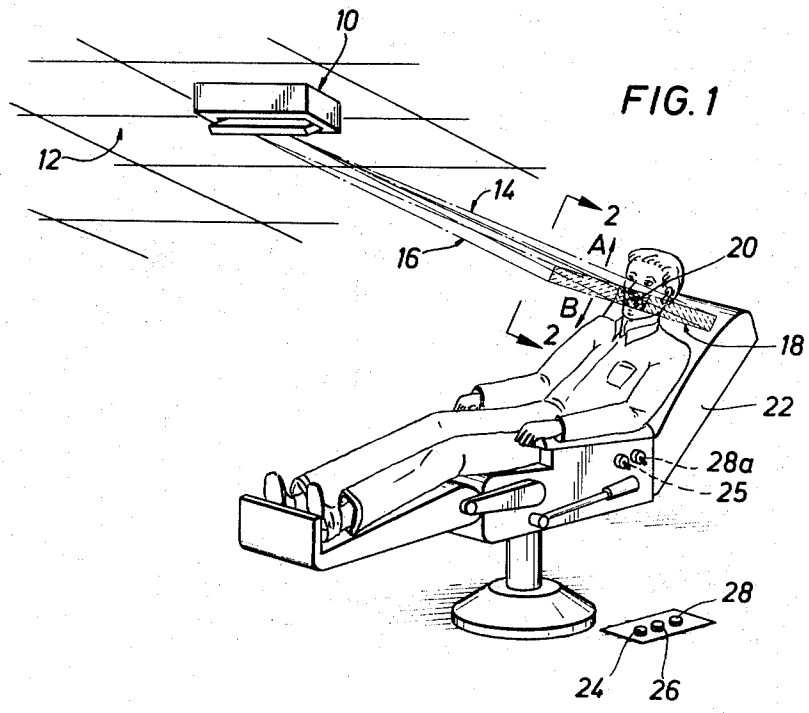
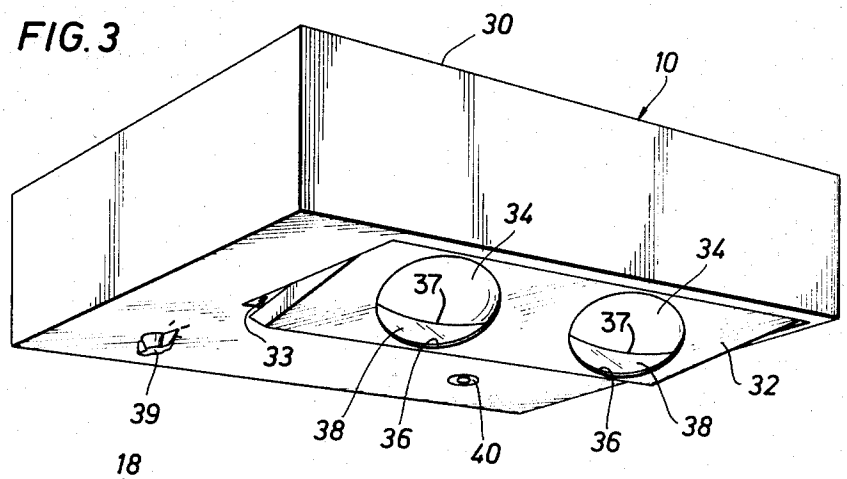


FIG. 1

FIG. 3



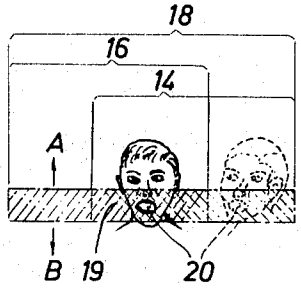


FIG. 2

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FIG. 4

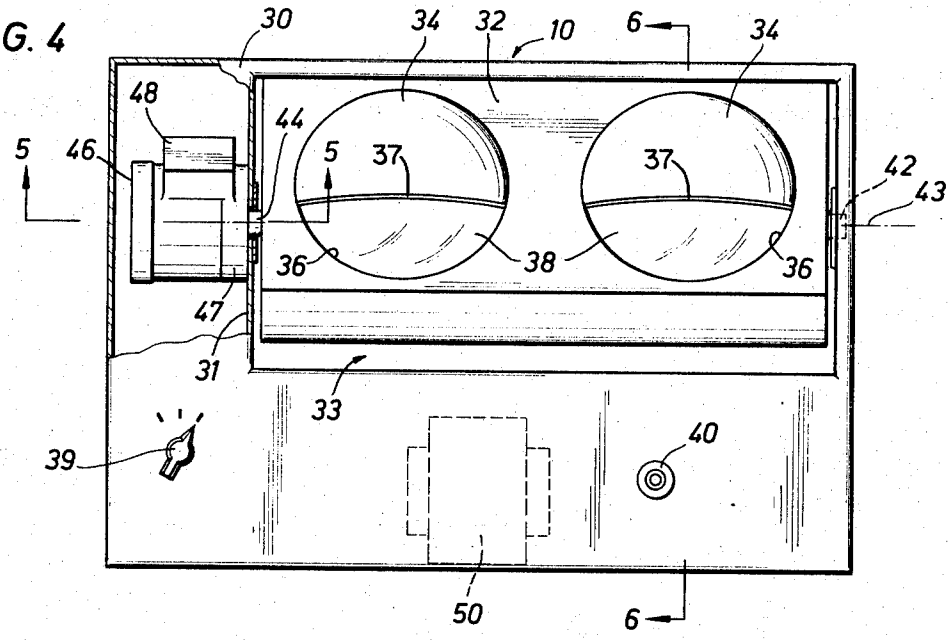
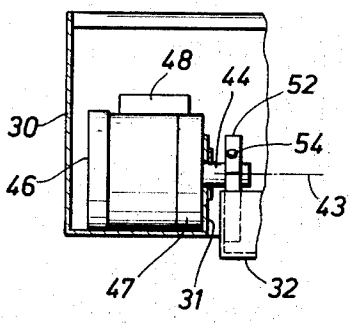


FIG. 5



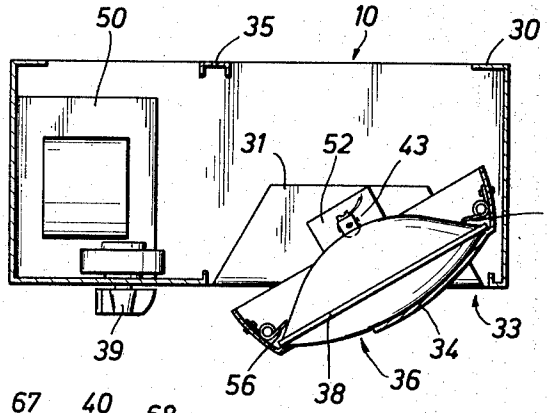


FIG. 6

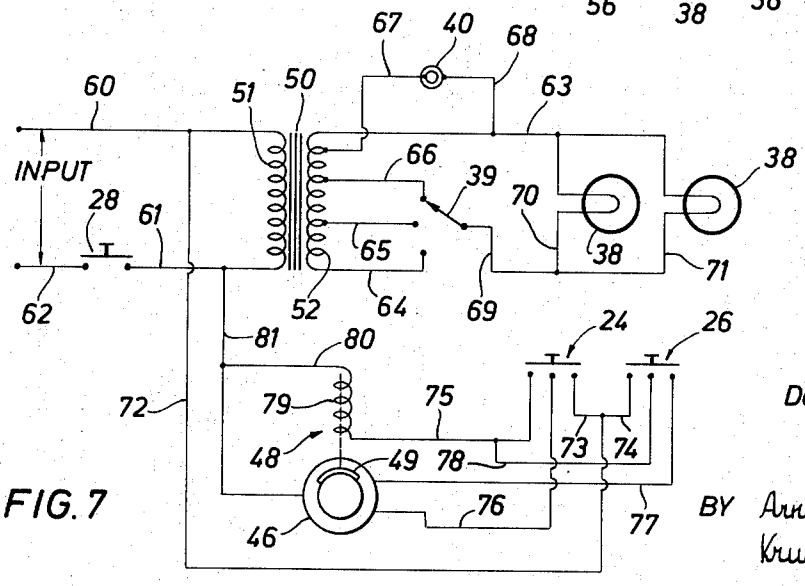


FIG. 7

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ADJUSTABLE LIGHTING APPARATUS

CROSS-REFERENCE TO RELATED APPLICATION

The instant patent application is a continuation of application, Ser. No. 770,578, now abandoned, entitled "Adjustable Lighting System" filed Oct. 25, 1968 in the name of David W. Alger as inventor.

BACKGROUND OF THE INVENTION

In modern dental operations, many advances in equipment design have been made in recent years. New reclining contoured chairs have been designed that are more comfortable for the patient and easier to operate by the dentist. High-speed air drills have replaced the clumsy belt driven drills of the past. The old "dental units" which supported a multi-armed dental operating light, the electric-driven drill, a cuspidor, water, suction devices and provided for other attachments has been replaced in many dental offices by a compact console which does not have the typical multi-armed dental operating light.

The old multi-armed dental light was inconvenient for the patient as well as the dentist. The light had to be repositioned each time to allow the patient to get out of the chair. The dentist had to be constantly moving the light to a new position to obtain different views of the patient's mouth, which was annoying and time consuming. In addition, the dentist had to use his hand to reposition the conventional light unit, thus leaving only one hand continuously free and creating a sterility hazard by having to touch the light while performing the dental operations.

It is generally not feasible for an assistant to position the light since it is extremely difficult to do so to the doctor's satisfaction for the view that he is seeking of the patient's mouth. Use of the conventional light is a strictly trial and error operation to obtain the desired illumination. When using the newer consoles, many doctors attempted to mount the conventional light on the floor or wall, but the same problems were encountered.

Other lighting systems found in the prior art, such as remotely controlled surgical operating lights are not feasible for use in a typical dental office. Further, these lights are generally quite large in size and were designed to illuminate an extremely large area. Further, they generate a great deal of radiated heat that would cause discomfort to the patient and the doctor in the confines of a dentist's office. The fixed ceiling mounted lighting systems are not practical since a dental operating light must be capable of being repositioned for each individual patient and because of the varying dental operations to be performed.

One prior art device has made a stride in the proper direction. Such a dental operating light is a remote controlled lighting system that provides a plurality of high intensity light beams that are focused to a desired focal point within the patient's mouth. The light sources are mounted in a housing secured to the ceiling of the dental office and the beams may be positioned upwardly or downwardly by remote control to adjust the height of the light beam for patients of varying heights and sizes. Such an improved lighting system is disclosed in a U.S. Pat. to J. Drandell, No. 3,287,552, entitled "Remote Controlled Lighting System," issued Nov. 22, 1966.

However, the Drandell lighting system has several serious drawbacks. In the Drandell system the plurality of light beams are focused to a point within the patient's mouth, and if the dentist desires to move the chair laterally the patient's mouth is moved out of the lighted area. This limits the dentist in his movement of the chair to only various reclining positions longitudinally aligned with the focused light beam. Further, if the dentist desires to remove dental work, such as crowns, bridges and the like from the patient's mouth for examination, the doctor will either have to have an additional light to enable him to examine the dental work or he will have to hold the dental work up in front of the patient's face to examine the work in the projected light beam. In addition, the high intensity light beams, although they are positioned to converge at a focal point at the patient's mouth, are uncomfortable for the patient's eyes since he receives considerable glare and direct light from the light sources.

The present invention remedies the problems of the prior art by rotatably mounting the light sources for movement about a fixed rotational axis, and projecting light beams having a rectangular vertical cross-section positionable to illuminate the patient's mouth when seated in the dental chair. The width of the light beam is large compared to its height, allowing the light beam to extend beyond the sides of the patient's face for providing illumination of dental work outside of the patient's mouth, and to allow lateral movement of the dental chair without having to reposition the light beam.

SUMMARY OF THE INVENTION

The instant invention provides a novel adjustable dental operating light positionable about a single axis but providing a light beam having a rectangular vertical cross-section with a large width dimension compared to the height of the beam.

In the preferred embodiment, the light sources are motor-driven and controls in the form of push-button switches are mounted on the floor adjacent to the dental chair for allowing ready accessibility by the dentist for actuating the motor and positioning the light beam while leaving both hands of the dentist free for performing dental operations within the patient's mouth. A magnetic brake device is provided which instantaneously stops the movement of the motor as soon as it is deenergized in order to prevent overshooting of the light beam from its desired position.

The lighting system is designed to be mounted upon the ceiling, on a wall, or recessed flush with the ceiling. Other mounting arrangements could, of course, be utilized as desired by the doctor and depending on the layout of his office.

Accordingly, one primary feature of the present invention is to provide an adjustable dental lighting system which may be precisely and easily controlled and which is capable of providing a light beam having an elongated cross-section for illuminating the patient's mouth.

Another primary feature of the present invention is to provide a dental lighting system which is capable of providing a light beam having an elongated cross-section for providing illumination to either side of the patient's head to enable the doctor to examine dental work removed from the patient's mouth.

Yet another primary feature of the present invention is to provide a dental lighting system which is capable of providing a light beam having an elongated cross-section for illuminating the patient's mouth and extending to either side of the patient's head to allow the doctor to move the dental chair laterally without having to reposition the light.

Still another feature of the present invention is to provide a dental lighting system in which a portion of the light source is shielded for minimizing patient discomfort due to direct light and glare.

BRIEF DESCRIPTION OF THE DRAWINGS

In order that the manner in which the above-recited advantages and features of the invention are attained, as well as others which will become apparent can be understood in detail, a more particular description of the invention may be had by reference to specific embodiments thereof, which are illustrated in the appended drawings, which drawings form a part of this specification. It is to be noted, however, that the appended drawings illustrate only typical embodiments of the invention and therefore are not to be considered limiting of its scope for the invention may admit to further equally effective embodiments.

In the Drawings:

FIG. **1** is a perspective view showing the adjustable dental operating light system projecting a light beam onto a patient seated in a dental chair.

FIG. **2** is a cross-sectional view of the light beam projected by the lighting system and showing the positioning of the light beam with relation to the patient's face.

FIG. **3** is an enlarged perspective view of the adjustable dental operating light system with the unit in an operating position.

FIG. **4** is a bottom view of a preferred embodiment of the lighting system with a fragmentary portion of the enclosure cut away for showing the location of the drive motor.

FIG. **5** is an enlarged fragmentary detail view of a portion of the light unit showing the direct connection of the electric motor to the support member for rotationally adjusting the light unit.

FIG. **6** is a partial vertical cross-sectional view of the adjustable dental operating light unit showing the mounting of the sealed beam lamps within the supporting member.

FIG. **7** is a schematic wiring diagram of the adjustable dental operating system.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to FIG. **1**, a preferred embodiment of the adjustable dental operating light system **10** is shown attached to the ceiling **12** of a dentist's office by any suitable attaching means such as screws or bolts (not shown). Two light beams **14** and **16**, are shown as being projected across the lower facial portion, including mouth **20**, of a patient seated in a dental chair **22**. Light beams **14** and **16** have an elongated cross-section, and are longitudinally aligned and overlap to form a single composite beam **18** having a rectangular vertical cross-section, wherein the central portion of beam **18** is an area of reinforced light as will be hereinafter explained.

For convenience, dental operating system **10** may be remotely controlled by means of push-button switches located on the floor of the dentist's office adjacent chair **22**, as shown by switches **24**, **26** and **28**. In this arrangement, switch **28** is an on-off switch and switches **24** and **26** are utilized for actuating the light system and sweeping or adjusting the light beam **18** either up, as shown by the arrow A, or down, as shown by the arrow B, to properly illuminate the patient's mouth. In the preferred embodiment of the invention, the switches **24** and **26** are of the push-button type so as to adjust the light beam **18** either up or down when the switches are depressed and to stop the motion of the light beam when the switch is released. In the configuration shown, the dentist would be able to operate switches **24**, **26** and **28** as "foot switches," thereby freeing both hands for handling dental instruments and performing dental operations on the patient.

Alternatively, the operating switches for the dental operating light system **10** could be located on the side of the dental chair, or they could be located in any other convenient location, and utilize either push-button type switches or toggle switches shown as **25** and **28*a*** in FIG. **1**. Toggle switch **25** may conveniently be a double-pole double-throw switch for sweeping the light beam **18** upwardly or downwardly as shown by the arrows A and B, respectively. Switch **28*a*** is an on-off switch for performing the same function as the push-button counterpart **28**.

Referring now to FIG. **2**, a cross-sectional view of light beams **14**, **16** and **18** is shown superimposed over the lower facial area of the patient. Each of the light beams **14** and **16** have an elongated horizontal cross-section, are longitudinally aligned, and longitudinally overlap to form a single composite light beam **18** having a rectangular vertical cross-section. The central area **19** of the composite light beam **18**, where light beams **14** and **16** overlap, is an area of greater light intensity that may be adjusted upwardly or downwardly, shown by arrows A and B respectively, to cover the patient's lower facial area and approximately centered on the patient's mouth **20**. This narrow area of high intensity light provides a brilliant operating light free of shadows for illuminating the patient's mouth during dental operations.

Since the beam has a narrow vertical height, the light may be raised or lowered as shown by the arrows A and B, respectively, to accommodate various sizes and heights of patients and varying reclining positions of the patient within the dental chair **22** (see FIG. **1**). Direct light and glare are eliminated by use of the narrow-height beam. However, because the composite beam **18** has a wide horizontal width, it extends outwardly beyond the patient's face on either side. The dentist may remove plates, partial bridgework, crowns or other dental handwork from the patient's mouth for convenient viewing and examination immediately adjacent the patient's head. In addition, the broad horizontal width of the light beam **18** allows the dental chair **22** (see FIG. **1**) to be rotated laterally, either to the left or right and the patient's mouth may still be kept within the horizontal and vertical limits of light beam **18**.

The adjustable dental operating light system **10** is shown in greater detail in FIG. **3**. The light system is housed by an enclosure **30** made of a light weight sheet metal having a high temperature-resistant baked-on

enamel finish. In the bottom face of enclosure **30** is a rectangular opening **33** within which is rotationally mounted a rectangular supporting frame **32** having a pair of elongated openings **36** having the configuration of a chordal segment of a circle, the upper side or portion **37** of each opening defining a straight line. Sealed beam light units **38** are mounted behind the elongated openings **36** and the upper two-thirds of the light units are shielded by a curved shield **34** that is formed to accommodate the curved surface of the lens of light units **38**. General Electric sealed beam lamp units, Numbers 4502 and 4505 have been advantageously used in the dental light application. The Nos. 4505 and 4502 lamp units provide the desired elongated light beam, the No. 4502 unit providing a beam measuring approximately 3×36 inches, and the No. 4505 unit providing a beam measuring approximately 3×18 inches. Shield **34** blocks the sealed beam filament from the patient's eyes, thereby eliminating a source of discomfort for the patient during the dental operation.

The lower edges **37** of shield **34** (the upper edge **37** of openings **36**) also serve to sharply define and straighten the top edge of the composite light beam projected by the lamps **38** in order to assist the dentist in correctly positioning the light beam and to further aid patient comfort by eliminating glare from the patient's eyes.

The supporting frame member **32** mounting the sealed beam units **38**, as hereinabove mentioned, is rotationally suspended within the aperture **33** of housing **30**. A reversible drive motor through a reduction gearbox (not shown) rotates frame **32** and the attached sealed beam units **38**. The rotation of frame **32** sweeps the composite light beam **18** in an arc (see FIG. **2**), for the proper desired position on the patient's face. The sealed beam units **38** are suitably mounted on support member **32** to place the axes of the projecting light beams **14** and **16** in a substantially parallel relationship.

A switch **39** is provided for varying the intensity of the light beam from light units **38**. In the preferred embodiment shown, a three-position switch has been provided, although it is apparent that a switch having a greater number of positions or one being continuously variable may be provided without departing from the scope of the invention. An accessory jack **40**, providing 6 volts AC, is provided for powering instruments such as an operating headlight often used by many oral surgeons and other dental specialists.

Referring now to FIGS. **1**, **2** and **3**, the lighting system **10** is advantageously mounted to the ceiling of the dentist's office and positioned to intersect an imaginary line which would bisect the angle between the upper and lower dental arches of the patient in a customary working position in chair **22**. The center of the distance between the adjacent elongated openings **36** would, in a preferred installation, lie within a vertical plane passing through the longitudinal centerline of chair **22** in its usual working position. With such a preferred installation, the horizontal width of the beam at the chair would be approximately 2 to 4 feet and the vertical height would be approximately 3 inches.

More than two light units **38** may be utilized to increase the horizontal width of the beam or to increase the intensity of the central area **19** of beam **18**. However, it will be apparent that only one lamp unit **38** may just as effectively be utilized, although the horizontal width of light beam **18** will be somewhat shortened.

Referring to FIGS. **4**, **5** and **6**, supporting frame member **32** is shown supporting two sealed beam light units **38** held in place by means of any suitable attaching device, such as the spring clamps **56**. A pair of outwardly projecting circular areas are provided in the face of member **32** for accepting the face of the circular sealed beam light units **38**. The lower portion of the circular areas in the face of member **32** is cut away to form an elongated opening having a configuration of a chordal segment of a circle. The upper portion **34** of the outwardly protruding circular area is left intact to cover approximately the upper two-thirds of the sealed beam light unit **38** and acts as a shield to block direct light from the filament of the light source from the patient's eyes, thereby cutting glare to a maximum extent.

Attached to each longitudinal end of the supporting member **32** is an extending arm member **52**. Arm members **52** are removably fixed to shafts **42** and **44** by means of set screws **54**. An electrical motor **46** and a reduction gear box **47** are suitably mounted within enclosure **30** and directly coupled to shaft **44**. Shaft **42** is rotatably supported within enclosure **32** by means of insertion through an aperture in an upright wall (not shown), identical to wall **31** adjacent to motor **46** and gearbox **47**, and allows supporting member **32** to pivot about rotational axis **43**. A magnetic brake **48** is adapted for instantaneously stopping the movement of drive shaft **44** when the motor **46** is de-energized, thus preventing overrun by the supporting member **32** when the light beam has been positioned as desired.

A transformer **50** is suitably mounted within enclosure **30** by any suitable means such as screws or bolts, (not shown) and provides suitable stepdown voltages from a standard 110–115 volt AC source for the operation of the lamp units **38** and accessory jack **40**. The placement of transformer **50**, motor **46** and gear box **47**, and associated brake **48**, lamp units **38**, the light intensity switch **39** and the accessory jack **40** are shown in their physical relationship without the necessary interconnecting wiring, which will be hereinafter discussed.

For mounting purposes, a transverse channel member **35**, connected between opposite longitudinal ends of enclosure **30** is provided for suitably attaching the light system **10** to a ceiling or wall or any other suitable surface by means of screws or bolts (not shown). Of course, the system **10** may be recessed into the ceiling for a flush-type mounting.

FIG. **7** is a schematic wiring diagram for the light system **10**. A source of AC voltage (commonly 110–115 volts AC) is applied to one side of the primary winding **51** of transformer **50** via conductor **60**, and to the other side via conductor **62**, on-off switch **28**, and conductor **61**. Input line voltage is also applied via conductors **60**, **72**, **73** and **74** to one terminal of three-point make push-button switches **24** and **26**, respectively. The secondary winding **52** of transformer **50** has three primary taps for providing lower voltages, preferably 25-27-29 volts AC via conductors **66**, **65** and **64**, respectively, to the light intensity switch **39**. The selected secondary voltage of transformer **50** is applied via one of conductors **66**,**65** and **64** to switch **39** and thence through wires **69** and **70** to the parallel con-

nected filaments of lamps **38**. The other side of the filaments of lamps **38** are connected through conductor **63** to the other side of secondary winding **52**.

Light intensity switch **39** is provided to vary the intensity of lamps **38**. In performing dental operations, it may be desired to vary the intensity of the light depending on other office lighting conditions and the desired light intensity necessary for a particular examination of the patient's mouth. However it has been found that a particular light intensity, once selected for the lighting conditions available, need not be changed unless the line voltage varies or office lighting conditions change.

When switch **24** is closed, line voltage is applied via conductors **60**, **72** and **73** through switch **24** to motor **46** via conductor **76**. The circuit is completed from motor **46** through conductors **81** and **61**, and switch **28** to line voltage through wire **62** for energizing motor **46**. When switch **24** is closed, line voltage is also applied through switch **24** via conductor **75** to one side of coil **79** of the magnetic brake device **48**, and the other side of coil **79** is connected to conductor **81** by wire **80** for energizing coil **79** and disengaging brake means **49** for releasing the shaft of motor **46**.

When switch **24** is released, line voltage is removed from conductors **75** and **76**, thereby de-energizing motor **46** and the electromagnetic coil **79** of the brake device **48**, allowing the brake means **49** to engage the shaft of motor **46** causing it to stop instantaneously. When switch **26** is depressed, line voltage is applied from conductor **74** through switch **26** and conductors **78** and **75** to coil **79**, thereby energizing the coil as hereinbefore described and disengaging the brake means **49** from the shaft of motor **46**. Line voltage is also applied via conductor **74**, switch **26** and conductor **77** to motor **46** for energizing motor **46** and causing it to be rotated in an opposite direction than that previously described when switch **24** was actuated. When switch **26** is released, the motor **46** and the electromagnetic coil **79** are de-energized and brake means **49** instantaneously stops the rotational motion of motor **46**.

In operation, switch **24** would be utilized to rotate the light units **38** mounted on the supporting frame member **32** upwardly by rotating member **32** about rotational axis **43**. As switch **24** is released, the magnetic brake device **48** instantaneously stops the motor and the support member **32** carrying the light units **38** in the desired position. Similarly, switch **26** may be utilized to rotate the motor in a reverse direction and rotate support member **32** downwardly to re-position the light beams.

As hereinabove described, the intensity of the light emitted by each of the sealed beam units may be varied by means of the light intensity switch **39**. The supporting member has a special heat resistant baked-on enamel finish to withstand the intense heat from the sealed beam light units, however, any other suitable finish capable of resisting the high temperature associated with such sealed beam units may be employed.

Numerous variations and modifications may obviously be made in the structure herein described without departing from the present invention. Accordingly, it should be clearly understood that the forms of the inventions herein described and shown in the figures of the accompanying drawings are illustrative only and are not intended to limit the scope of the invention.

What is claimed is:

1. A dental operating light for projecting a light beam having a generally rectangular vertical cross-section, comprising

an enclosure,

an elongated rotatable member having a pair of longitudinally aligned spaced-apart elongated openings, the upper side of each of which defines a straight line, and adapted for rotational movement with respect to said enclosure about an axis of rotation,

a pair of light units each of which is capable of projecting a light beam having a generally rectangular vertical cross-section, the width of said beams being greater than the height of said beams,

attaching means for attaching each of said light units to said rotatable member adjacent one of said elongated openings for projecting therethrough a pair of light beams, each having said generally rectangular vertical cross-section, said light units being positioned to cause said light beams to centrally overlap to form a single composite light beam having a generally rectangular vertical cross-section, with a central portion thereof being of a brighter intensity than the end portions thereof,

a reversible electric motor mounted within said enclosure,

a gearbox directly coupling said motor and said elongated rotatable member for rotating said rotatable member about said axis of rotation when said motor is energized and sweeping said composite light beam in an arc to a selected position,

switch means for reversibly energizing said motor, and

means adapted for instantaneously braking said motor upon de-energization thereof for stopping the rotation of said elongated rotatable member and said composite light beam at a selected position.

2. The apparatus as described in claim **1**, wherein said elongated openings have a generally rectangular configuration.

3. The apparatus as described in claim **1**, wherein said elongated openings have the configuration of a chordal segment of a circle.

4. The apparatus as described in claim **1**, wherein a portion of each of said light units is masked by a portion of said elongated rotatable member adjacent said elongated openings for shielding the filaments of said light units.

5. The apparatus as described in claim **1**, wherein the upper straight line side of each of said elongated openings acts to sharpen and straighten the upper side of said projected rectangular light beams.

6. The apparatus as described in claim **1**, wherein the axes of said projecting light beams are positioned in a substantially parallel relationship.

7. The apparatus as described in claim **1**, including means for selectively varying the intensity of said plurality of light units.

8. A dental light for projecting a light beam having a rectangular vertical cross-section upon the mouth of a seated patient, comprising

an enclosure,

an elongated support member having a pair of longitudinally aligned spaced-apart elongated openings, the upper side of each of which defines a

straight line, said support member having a pair of extending arms,

first and second shafts connected to respective ones of said pair of extending arms and mounted within said enclosure for allowing rotational movement of said support member about an axis of rotation,

a pair of light sources each of which is capable of projecting a light beam having a generally rectangular vertical cross-section, the width of said beams being greater than the height of said beams,

attachment means for attaching each of said light sources to said support member adjacent one of said pair of elongated openings respectively for projecting therethrough a pair of beams of light, each of said beams having a rectangular vertical cross-section and longitudinally overlapping to form a single composite light beam having a rectangular vertical cross-section, said composite light beam having a central portion of greater intensity than the end portions thereof,

the axes of said pair of projecting light beams being in spaced substantially parallel relationship,

a reversible motor mounted within said enclosure adjacent to said first shaft,

speed reducing means interconnecting said motor and said first shaft for imparting rotational motion to said support member about said axis of rotation when said motor is energized and sweeping said elongated cross-sectional composite light beam through an arc about said axis to a selected position,

brake means mounted on said motor for instantaneously stopping the rotational movement of said support member when said motor is de-energized,

first switch means for selectively energizing said reversible motor, and

second switch means for selectively varying the intensity of said pair of beamed-light sources.

9. The apparatus as described in claim **8**, wherein a portion of each of said light units is masked by a portion of said elongated rotatable member adjacent said elongated openings for shielding the filaments of said light units.

10. The apparatus as described in claim **8**, wherein the upper straight line side of each of said elongated openings acts to sharpen and straighten the upper side of said projected rectangular light beams.

* * * * *