To all whom it may concern:

Be it known that I, Charles W. Albert, a citizen of the United States of America, and resident of Parkersburg, county of Wood, State of West Virginia, have invented certain new and useful Improvements in and Relating to Surgical and Dental Illuminators, of which the following is a specification.

The Illuminator of my invention is designed for use by the medical, surgical and dental professions, for illuminating operative areas or areas under treatment or examination; and the objects and nature of the invention will be readily understood by those skilled in the art in the light of the following explanations of the accompanying drawings illustrating what I now believe to be the preferred mechanical expression or embodiment of my invention from among other forms, constructions and arrangements within the spirit and scope thereof.

An object of the invention is to provide improved means for sharply and uniformly illuminating a clear cut restricted area of the human body while eliminating confusing reflections and shadows from such area and dim or diffused light rays surrounding said area with the end in view of uniformly and intensely illuminating the desired area with the periphery or boundary of such area sharply defined by the absence of a surrounding glow or corona effect, and a further object of the invention is to provide such a surgical illuminator in a comparatively simple construction and of minimum length and diameter so that the same can be conveniently carried in operative position on the head of the physician, without annoyance or inconvenience, through the medium of any suitable head piece.

With these and other objects in view, my invention consists in certain novel features in construction and in combinations and arrangements as more fully and particularly set forth and specified hereinafter.

Referring to the accompanying drawings, forming a part hereof:

Fig. 1 is a side elevation of an illuminator embodying my invention.

Fig. 2 is a longitudinal section thereof.

In the drawings, I show any suitable bulb socket and holder 1, for a removable electric light bulb 2. The flexible wires 3, whereby the filament of the bulb is supplied with the necessary electric current to render the same incandescent, extend rearwardly from the holder 1 for coupling in any suitable manner into the power circuit.

The renewable electric light bulb 2, is arranged in forward longitudinal continuation of the bulb socket and holder. The glass enclosure of this bulb is preferably approximately spherical in form and unground and colorless. The front end portion of this glass, opposite the filament, is smooth and otherwise formed to avoid casting shadows, i.e., the usual longitudinally projecting exterior tip being omitted. The small centrally arranged filament 2a is designed to avoid relatively large filament loops and a multiplicity of long distributed back and forth more or less scattered lengths of filament, or other forms that provide long filament lengths or loops that tend to be reflected in the beam of light. The filament 2a is designed to produce an intense or high-power centrally-arranged condensed or small body or spot of light-producing incandescence peculiarly adapted for projecting forwardly a longitudinal beam of clear shadowless light without filament reflection. In the example shown, the filament is formed by a comparatively short length of forwardly and centrally arched closely coiled comparatively strong durable wire extending transversely between and fixed to a pair of longitudinal spaced leading-in posts, although I do not wish to so limit my invention.

The illuminator embodies an elongated supporting and enclosing casing or housing. In the particular example illustrated, the supporting and enclosing casing supports the entire illuminator through the medium of a reduced tubular rear end 4 longitudinally receiving the bulb socket 1, and associated parts through which the power circuit is connected from wires 3, to include the filament 2a when the light bulb is in operative position in the bulb socket. These parts are suitably secured to and in the casing end 4.

The illuminator is intended to be normally operatively fixed to and supported by any suitable head piece, through the medium of any suitable clamp or coupling device applied to the casing end 4. For instance, I show a coupling member ball or other projecting radially from casing end 4 and adapted to be adjustably grasped by a clamp.
carried by the physician’s or dentist’s head piece, as will be understood by those skilled in the art.

The casing forwardly from its end 4, is enlarged in diameter to form an approximately spherical bulb housing or chamber, and in this instance, said chamber is formed by a rear cup-like casing section or flare 5, rigid with the casing end 4, and a complementary front cup-like casing section 6, carrying the front portions of the illuminator.

The sections 5, 6, are formed at their open ends to fit longitudinally one within the other and are removably coupled together through the medium of a screw threaded connection 8 formed by screw threading the meeting ends of said sections.

A suitable reflector 7, is arranged within the casing section 5 and is formed with a central longitudinal opening or bore at its rear end to receive the shank of the light bulb or the front end of the bulb socket. This reflector is, usually, formed with an annular out turned flange 7a, at its front or large end, that fits over the front annular end edge of the rear casing section, so as to be clamped between the meeting end edges of the casing sections when those sections are screwed tightly together.

The front cup-like casing section 6 is formed with an enlarged central or longitudinal front end opening surrounded by a forwardly projecting longitudinal threaded neck or nipple 6a, into which the threaded rear end portion of a light directing tube 8 longitudinally fits and screws.

This tube 8 is longitudinally elongated and projects forwardly from the bulb chamber 5, 6, in longitudinal alignment with the light bulb and its socket and the filament 2a, and is centrally and longitudinally arranged with respect to the reflector 7.

The front end of the tube 8 is open, for the forward direction of the beam of light, except for a removable front end cap 9 fitted on the front end of the tube and having a more or less restricted central opening 9a, alined with the longitudinal axis of said tube and designed to determine or control the diameter or size of the operative area illuminated. Several caps 9, each having an outlet 9b, of a different size from the outlets or openings of the remaining caps, can be supplied with the illuminator to be used interchangeably on the front end of the tube, to illuminate the desired area of the human body that is to be operated on, examined, or treated. It is desirable in surgical work, that the area illuminated be restricted or limited to the operative area, that the illuminated area be as small as possible, generally being restricted to and concentrated on the exact area being operated on, examined or treated.

A bi-convex condensing lens 10 is carried by the inner or rear end of the tube 8 and is located within the bulb or light chamber 5, 6, directly in front of and close to the bulb but out of direct contact therewith and of small diameter with respect to the bulb and in axial alignment with the tube 8, opening 9a, the bulb and the filament 2a.

In the example shown, the tube 8 is of uniform diameter from its front end to its screw threaded rear portion 9b that screws into the bulb chamber neck 6a. The rear end of the tube is contracted to form a small central rear opening surrounded by a rearwardly projecting cylindrical neck 9c axially alined with the lens and of reduced diameter with respect to the lens.

The lens 10 is secured in the rear open end of a removable flared lens holder 10a having a central forwardly projecting reduced neck that is longitudinally fitted onto and held on the rearwardly extending neck 9d of the light tube 8. However, the drawing can, if so desired, be read to show the rear portion of the tube within the bulb chamber annularly reduced to form the central contracted longitudinal neck and again enlarged rearwardly to form the rear end of the tube flared or enlarged to constitute a lens holder in the rear open end of which the lens is removably secured and which covers the annular edge portion of the front face of the lens.

The diameters of the lens and its holder, are less than the internal diameter of the neck 6a, at the front end of the bulb chamber 5, 6, so that the tube 8, can be unscrewed and removed from said chamber, carrying the lens holder and lens, and this also permits insertion of the holder and its lens with the tube, into the bulb chamber and securing the tube by screwing into neck 6a.

The length of the light tube 8, with relation to other parts and dimensions, is preferably such that the front end restricted opening 9b is located approximately at the plane or point where the light beam begins to expand or the light rays begin to diverge.

The contraction of the tube or forward light passage in front of the lens, serves to effectively cut out objectionable peripheral rays and materially aid in producing the desired clear cut sharply defined illuminated operative area and in eliminating the objectionable glow, corona, or dim light surrounding said area.

The interior surfaces of the bulb chamber 5, 6, and the light tube 8, are preferably insulated to reduce heating the exterior metal surfaces of said chamber or tube, and for this purpose I show interior linings 11, of asbestos or other suitable insulating material within the bulb chamber and tube.
The insulating packing or lining within chamber section 5 is preferably located in the space within said section surrounding the reflector 7.

Any suitable provision can be provided for ventilating the interior of the bulb chamber, and if so desired, the interior of the light tube 8.

If so desired, air openings can be formed through the bulb chamber section 5, and air perforations through the bulb chamber 6, and these openings and perforations will be shaded or shuttered against objectionable emission of light, by the reflector and by the asbestos lining secured to the inner surface of the chamber.

If so desired, ventilation of the interior of the bulb chamber can be promoted forwardly through the light tube 8 and the open front end 9, thereof, by providing forwardly or longitudinally opening air perforations from the bulb chamber into the tube, in the annular transverse wall 9, of the tube surrounding the central contraction of said tube. These perforations in wall 9, will be in front of the lens holder and protected thereby from direct light rays from the filament and will not cause objectionable shadows, reflections and side lights in the operative area.

In the particular embodiment illustrated, the overall diameter of the light bulb is about one and three sixteenths of an inch, and the diameter of the bulb chamber about one and three quarters of an inch. In the embodiment shown, I gain the desired results, using a bi-convex lens of about 24 mm. and about 20 diopters, in a tube about seven eighths of an inch diameter reduced immediately in front of the lens to about one half inch in diameter with the lens located about one eighth of an inch from the front end of the bulb and about two inches from the front opening 9, which is about eleven sixteenths of an inch in diameter. However, I do not wish to limit my invention to such dimensions.

The concentrated condensed or small high power source 2 of intense light is centrally arranged within, or preferably focused with respect to, the reflector 7, and said source of light and the reflector are particularly designed to project the light rays forwardly with a minimum production of shadows and reflections. The condensing lens 10, is located as close to the concentrated spot or source of light 2, as possible without contacting the front end of the glass light bulb, and this lens is greatly reduced in diameter with respect to the diameter of the light bulb, but the diameter of the lens is preferably at least equal to the greatest dimension or length of the concentrated source of light 2, and is axially aligned therewith.

The tube and its reduced outlet 9 are axially aligned with the lens in the front end of the tube, and the axial distance from the lens to the outlet of the reduced end 9 is as short as possible consistent with the end in view of concentrating the light rays from the source 2 into a reduced diameter bright beam of light projected from the outlet of end 9, with the elimination therefrom of objectionable shadows, reflections, and peripheral rays.

In surgical work, a clear cut sharply defined brightly and uniformly illuminated operative area, without shadows, filament or other reflections, or peripheral light rays or other glow beyond the clear cut circle that should define the area, is highly desirable. I attain this highly desirable result by the combination wherein the light bulb is without the shadow and reflection forming tip and provides a small concentrated more or less high power source of light with the condensing lens located directly in front thereof and in a reduced light tube that cuts out peripheral light rays, and having an operative area defining front end outlet.

I am thereby enabled to produce the clearly defined operative area illumination desired, and am also enabled to eliminate object lens and various other parts, and to materially reduce the length and diameter of the casing and device as an entirety, and to prevent the reflection or appearance of the filament, lines or a small reflected light spot in the illuminated area.

It will be noted, that the casing can be separated by unscrewing the sections 5, 6, to permit access to and renewal of the light bulb and examination and cleansing of the lens, and also by removing the tube 8 from section 6, the lens is rendered freely accessible.

It is evident that various changes, modifications or variations might be resorted to without departing from the spirit and scope of my invention, and hence I do not wish to limit myself to the exact disclosures heretofore.

What I claim is:

1. An illuminator for use in examining and operating on parts of the human body, comprising an opaque supporting and enclosing housing embodying a cup-like section having a reduced projecting tubular shank and means for attachment to a headpiece, a complementary relatively-removable cup-like section having a reduced straight projecting light tube, and means whereby said cup-like sections are removably secured together to form a light bulb chamber with said shank, chamber and tube in axial alignment, a light bulb holder fixed in said shank and provided with an electric light bulb in said chamber axially aligned with said tube, and a lens holder provided...