

- [54] **SURGICAL HEADLIGHT**
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[51] Int. Cl. **A61b 1/06, F21v 21/00**
[58] Field of Search **240/59, 60, 41.5, 240/1 EL, 6.4 W; 350/96 B; 128/23; 248/291**

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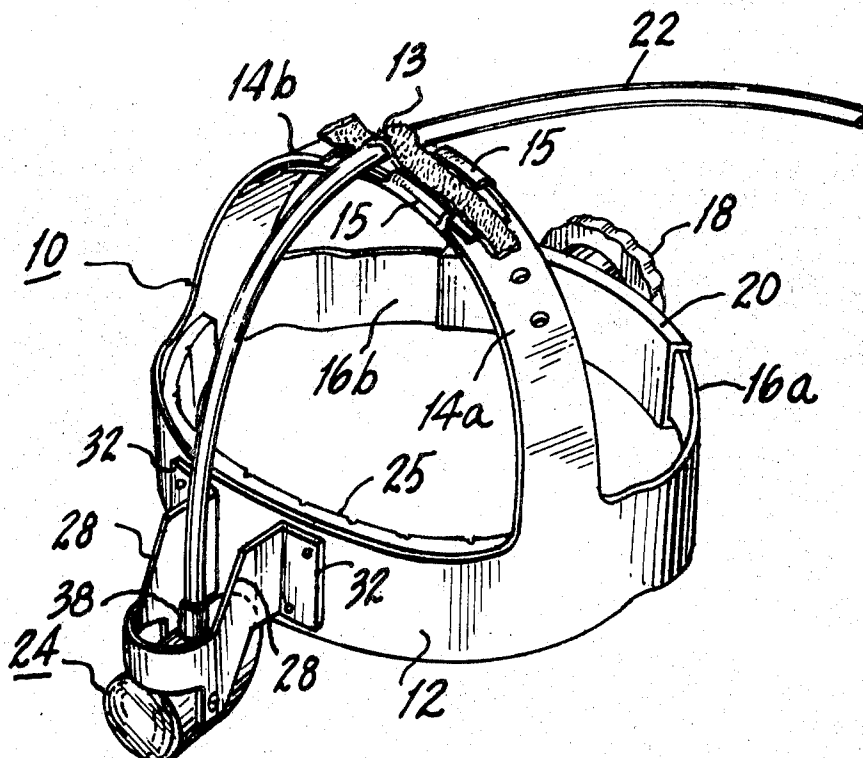
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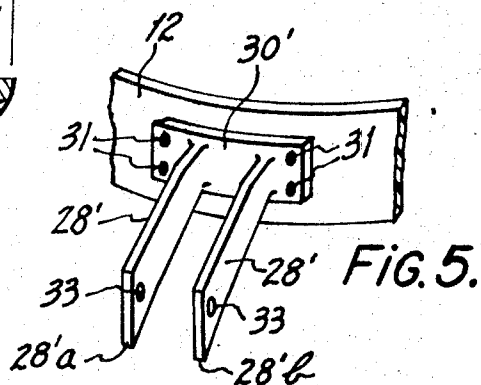
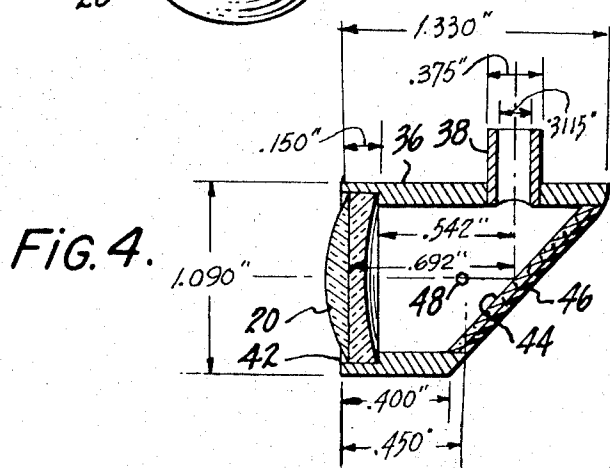
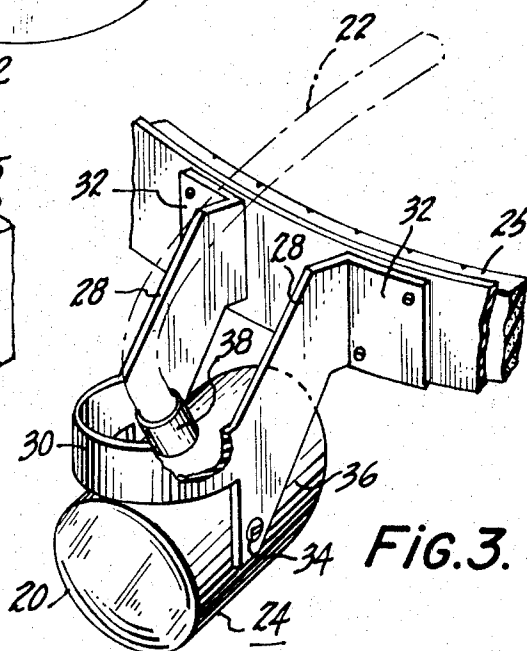
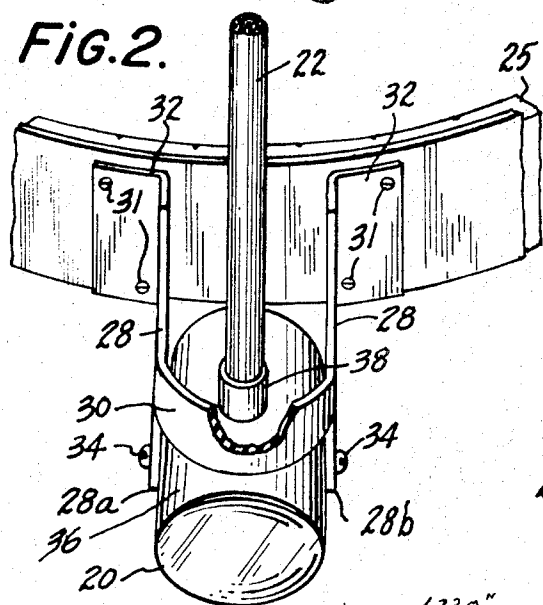
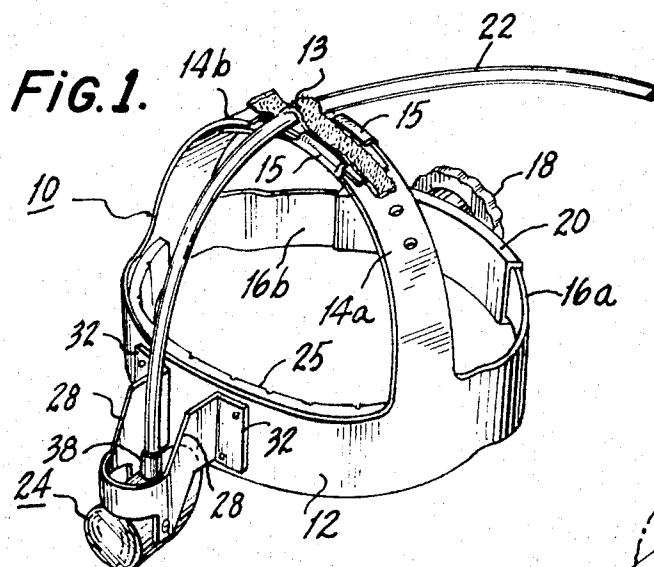
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[57] **ABSTRACT**

A surgical headlight adapted to be worn on the head of a user including a novel bracket construction attached to the headband for pivotally and frictionally supporting a light projecting focussing element such that the coaxial design coincides with the visual axis of the eye. The bracket includes a pair of spaced-apart substantially parallel flat metal bands of steel which are slightly spread further apart at one end than at the other end for supporting the focussing element which is force-fit between the lower ends of the arms. The bottom portions of the arms exert an inward pressure against the housing of the focussing element. The focussing element is highly compact and includes a 45° angle mirror arranged at one end of an opaque housing, an achromatic lens at the other end of the housing having an axis the extension of which falls on the center of the mirror, and a fiber optic light carrying cable for projecting a beam of light from the top of the housing onto the center of the mirror for bending the light beam 90° to strike the concave surface of the achromatic lens.

7 Claims, 5 Drawing Figures





SURGICAL HEADLIGHT

The present invention relates to surgical headlights adapted to be worn upon the head of the user and particularly suited for use by surgeons.

It is known that surgical headlights may include an annular headband which surrounds the forehead and rear portion of the head of the user. The harness may be padded and is easily adjusted to fit the contour of any size head. A light projecting element is usually attached to the front of the headband and a light carrier cable attached to the light projecting element. Problems with known types of surgical headlights involve shadows caused by the light beam which is projected into the operative area, and the light projecting element itself. Size and weight and ease of adjustment are important aspects in the design of such headlights.

An object of the present invention is to enable the light projecting focussing element to be frictionally supported from the headband at such distance therefrom and in such manner that the light beam always coincides with the visual axis of the eye and prevents shadows in the operative area.

Another object is to provide a novel bracket construction for supporting the light projecting element with respect to the headband such that the axis of the light beam from the focussing element is in the plane formed by the two visual axes of the eyes of the user as they converge upon the target or operatara being illuminated.

A further object is to provide a novel, compact light projecting element which is of light weight and especially suitable for attachment to the harness of a surgical headlight.

One important advantage of the novel construction of the surgical headlight of the present invention is the elimination of light shadows in the operative area.

A more detailed description of the invention follows in conjunction with a drawing, wherein:

FIG. 1 is a perspective view of the headlight of the invention;

FIG. 2 is a fragmentary view of the headlight which highlights the details of the bracket and the manner in which it is supported by the headband and the manner in which the bracket supports the light projecting focussing element;

FIG. 3 is a view similar to that of FIG. 2 but from a different angle;

FIG. 4 is a horizontal sectional view of the light projecting focussing element; and

FIG. 5 shows a modification of the bracket of the invention.

Throughout the figures of the drawing like parts are represented by like reference numerals, and equivalent parts have prime designations.

The surgical headlight of the invention comprises a head harness having an adjustable annular type headband 12, a steel bracket construction attached to the headband by flanges 32, as shown in the FIGS. 1 to 3 embodiment, a light projecting focussing element 24 pivotally supported by the bracket, and a fiber optic cable 22.

The annular headband 12, generally disposed horizontally, is made of a synthetic light-weight plastic material integral with an upper band member of the same material composed of two parts 14a and 14b. The interior of the front part of the headband 12 between parts

14a and 14b is provided with a soft foam-like absorbent material cemented thereto. The rear part of the headband 12 is split into two band members 16a and 16b which fit into a hollow arcuate-shaped plastic member 20. Member 20 is provided in its interior with teeth adapted to mesh with a pinion rotating by means of an externally positioned knob 18 for increasing or decreasing the effective periphery of the front and rear band members of the headband in order to adjust the size of the headband to the head of the wearer. A headband of this design is known in the art and no claim is made to it per se.

The upper band member is made of two overlapping parts 14a and 14b with slot constructions 15 in band member 14a engageable with the free end of band member 14a. Part 14b is provided with spaced holes into any one of which a plastic pin on part 14a may be inserted to enable adjustment of the overall size of the upper member to fit the head of the wearer. An upper band member of this construction is known in the art and no claim is made to it per se. A flexible pile member 13 of a type commercially sold under the trademark "Velcro" and consisting of similar though different length piles are brought into operative engagement by pressure exerted on the upper pile, whereby the hooks of one member engage the pile of the other and are conventionally separated by merely pulling the same apart. The "Velcro" piles serve to hold the fiber optic light carrying cable 22 in the proper position on the surgical headlight harness.

The bracket for supporting the light projecting focussing element is comprised of a pair of metal spaced-apart vertical arms 28,28 bent at their upper ends to form flanges 32,32 which are attached by screws 31 to the annular headband 12. A curved metal band 30 located about two-thirds of the distance down the arms 28 from the upper ends of the arms and integral with the arms 28 rigidly holds the arms in their spaced relation to each other. The metal bracket may be made from dull nickel-plated spring steel. The lower ends 28a and 28b of the arms 28,28 are slightly forced apart to accommodate the light focussing element 24 to which the arms are secured by screws 34,34 located on opposite sides of the light focussing element. In one embodiment of the surgical headlight constructed and tested with the bracket of FIGS. 1-3, the distance between the interior adjacent surfaces of arms 28,28 at the upper ends was 1.065 inches while the distance between the interior adjacent surfaces of the arms at their lower ends was 1.090 inches. This larger distance corresponds to the exterior diameter of the light projecting focussing element 24. Stated in other words, the outside diameter of the focussing element is larger than the inside distance between the arms at their upper ends. In practice, the light projecting focussing element is force-fit into the spring steel arms 28,28, thereby producing a tension or inward force between the lower end portions of the arms for frictionally holding the focussing element in place. The screws 34,34 act as pivot points on which the element 24 may swivel in a vertical direction or arc only and also assure attachment of the focussing element to the arms. There is no need for other movement of the light focussing element 24 which is thus securely held in coaxial alignment with the visual axes of the eyes.

The effective length of the bracket, particularly the arms 28,28 and its design is such that the light from the

light projecting focussing element is in the same plane as the visual axis of the eye, thereby assuring the absence of shadows in the operative area on which the light beam falls.

The light projecting focussing element 24 is highly efficient and more compact than known optical systems used with surgical headlights, and is shown in detail in the horizontal cross-sectional view of FIG. 4. Element 24 includes a housing 36 of light-weight aluminum which is a section of a cylinder having at one end an achromatic lens 20 and at its other end a polished 45° angle mirror 44 so arranged that the axis extension of the lens 20 falls on the center of the mirror. The external surface of the mirror is covered with an opaque plastic substance 46. The aluminum housing 36 is provided with two oppositely disposed holes 48 for accommodating the screws 34,34. The top portion of the housing 36 is provided with a tubular opening 38 whose axis falls on the center of the mirror 44, whereby light rays entering the tubular opening 38 impinge on the mirror and are bent 90° as to cause the beam to strike the lens 20 on its axis.

The achromatic lens 20 consists of individual concave and convex lenses suitably joined together and held in place on the shoulder 42 at one end of the housing, as shown. The convex surface faces outwards while the concave surface faces inwards. The light rays from the mirror 44 strike the concave surface of the lens 20 and are projected out from the convex surface. The precise distances between parts of the light projecting focussing element for a highly compact, light-weight, efficient system, as constructed in one embodiment of the invention are indicated on FIG. 4. The convex surface of the lens 20 extends outside the end of the housing about 0.217 inches.

A fiber optics light cable or carrier 22 of a type known is suitably connected in any desired manner, as by friction locks, to the tubular opening 38 for introducing an intense beam of light into the interior of the housing 36 of the light projecting focussing element so as to cause the light rays to fall on the center of the mirror 44. In this way, the brilliant, cool white light passing through lens 20 may penetrate even the deepest surgical cavity and bathe the operative site with a high level of illumination.

FIG. 5 is a modification of the bracket of FIGS. 1 to 3. Whereas the bracket of FIGS. 1 to 3 may be made of spring steel cut from a sheet of metal and then suitably bent, or cast, the bracket of FIG. 5 is cast as a single integral element constituting a wider and larger band 30' and arms 28',28' such that the distance between the lower ends 28'a and 28'b is slightly less than the distance between the upper ends of the arms. The housing 36 of the light projecting focussing element 24 is then force-fit between the lower ends 28'a,28'b so that the arms 28',28' exert tension or inwardly directed pressure upon the housing 36 of the focussing element. The bracket is supported from the annular headband by suitable screws 31. The holes 33 at the lower ends of the arms accommodate the screws 34 in the manner shown in FIGS. 2 and 3.

In summation, there is disclosed herein a novel surgical headlight which includes a novel bracket of such design and dimensions as to assure an illuminating light focussing beam whose axis is in the plane formed by the visual axes of the eyes of the user, and a cooperating novel, compact, light weight, highly efficient light pro-

jecting focussing element. No part of the headlight or head harness extends appreciably beyond the tip of the nose of the surgeon, thereby assuring the surgeon of ample room for the movement of surgical instruments without interference or contamination of the instruments or the hands of the surgeon by contact with the headlight. The coaxial design of the surgical headlight of the invention eliminates light shadows in the operative or target area. From an inspection of FIGS. 1, 2 and 3 of the drawing, it will be seen that when the light projecting element 24 is in the horizontal position that end of the element 24 which is opposite the lens 20 is almost on a straight vertical line or plane extending down from the front of the annular band at the midway portion between flanges 28,28, thereby assuring close positioning of the light projecting element 24 to and above the nose of the user.

What is claimed is:

1. A surgical headlight comprising a headband adapted for encircling the head of a user, a light projecting focussing element, a bracket for supporting said light projecting focussing element, said focussing element including an opaque housing having two ends, a 45° angle mirror in the interior of and at one end of said housing, an achromatic lens in the interior of and at the other end of the housing so arranged that the extension of its optic axis falls on the center of said mirror, said housing having a top and a bottom and an opening in the top for introducing into said housing relatively high intensity cool light directly onto the center of said mirror, said bracket comprising a pair of substantially downwardly inclined spaced-apart arms attached at an upper portion thereof to the headband in fixed, non-moveable relation thereto and a band located between said arms and integrally joining said arms together as a single integral element, the distance between said arms at the upper portion thereof being different from the distance between said arms adjacent a lower portion thereof, said arms frictionally supporting in force-fit relation thereto said focussing element adjacent the lower portion thereof and constituting the sole elements which support said housing therebetween, said bracket being so dimensioned with the arms thereof so downwardly inclined that said light projecting focussing element is positioned immediately above and adjacent the nose of the user, said arms enabling pivotal movement of said focussing element only in a vertical arc for projecting its light along the visual axis of the eye of the user.

2. A surgical headlight according to claim 1, wherein said bracket including the arms and band is metal, said arms being flat and having flanges at the upper portion integral therewith and at right angles thereto for attachment to said headband, said housing being a section of a cylinder the outside diameter of which is larger than the inside distance between said arms near the upper portion of said arms, such that the lower portion of said arms exert an inward directed force or tension on said housing, thereby frictionally holding said housing in place, and screws in said arms on oppositely disposed sides of said cylinder acting solely as pivot points for said section of cylinder.

3. A surgical headlight according to claim 2, wherein said arms, band and flanges are made of spring steel, and said housing is made of aluminum.

4. A surgical headlight adapted to be worn on the head of a user, including a harness, a light projecting

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focussing element having a housing, a bracket for supporting said light projecting focussing element, said bracket comprising a pair of substantially downwardly inclined spaced-apart arms attached at an upper portion thereof to the headband in fixed, non-moveable relation thereto and a band located between said arms and integrally joining said arms together as a single integral element, the distance between said arms at the upper portion thereof being different from the distance between said arms adjacent a lower portion thereof, said arms frictionally supporting in force-fit relation thereto said focussing element adjacent the lower portion thereof and constituting the sole elements which support said housing therebetween, said bracket being so dimensioned with the arms thereof so downwardly inclined that said light projecting focussing element is positioned immediately above and adjacent the nose of the user, said arms enabling pivotal movement of said focusing element only in a vertical arc for projecting its light along the visual axis of the eye of the user.

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5. A surgical headlight according to claim 4, wherein said bracket includes a metal band extending between said arms, said bracket including said arms and band being cast as a single integral element, said band being located at the upper portion of said arms, the distance between said arms at the upper portion thereof being greater than the distance between said arms at the lower portion thereof.

6. A surgical headlight according to claim 4, wherein said bracket includes a curved metal band extending between said arms and forming an integral part thereof, said band being positioned intermediate the lower portion of said arms.

7. A surgical headlight according to claim 4, wherein the distance between said arms at one location thereof is slightly smaller than the outside diameter of said housing of said light projecting element, said light projecting element being force-fit between said arms at said location.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,745,993 Dated July 17, 1973

Inventor(s) Richard E. Feinbloom

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 2, line 16, "14a" should read -- 14b --;
same line "14b" should read -- 14a --. Column 2, line 17,
"14a" should read -- 14b --.

Signed and sealed this 12th day of February 1974.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents