March 25, 1952 H. L. LOGAN 2,590,192

DIRECT LIGHTING LUMINAIRE

Original Filed March 27, 1948

Fig. 1.

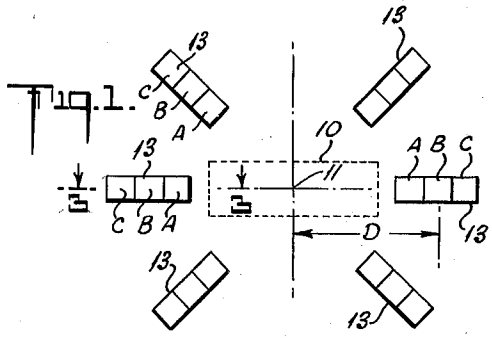


Fig. 2.

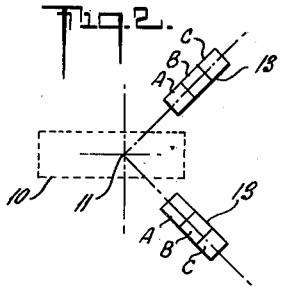


Fig. 3.

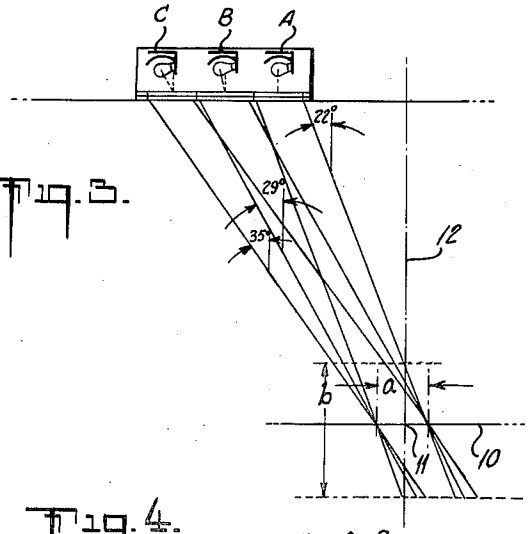
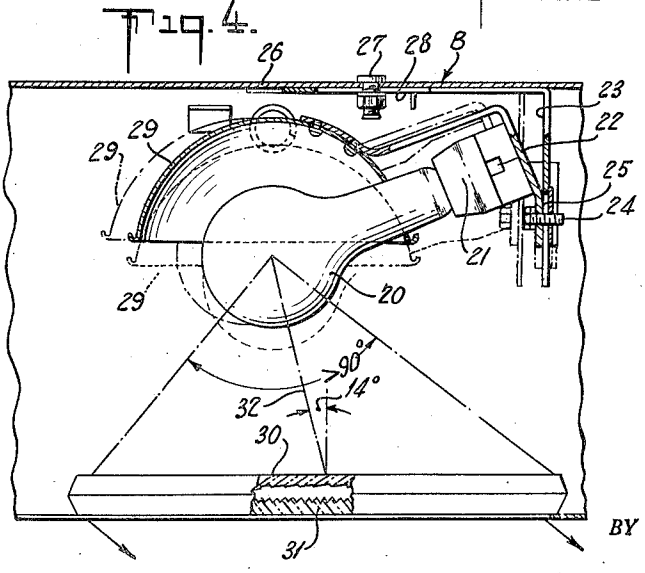


Fig. 4.



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DIRECT LIGHTING LUMINAIRE

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1 Claim. (Cl. 240—1.4)

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The present invention relates to direct lighting luminaires and is more particularly directed toward direct lighting luminaires suitable for use in all classes of surgical operations normally performed on an operating table.

Surgeons frequently operate by necessity near the limits of their visibility, skill and knowledge. They usually operate at the greatest possible speed in order to reduce surgical shock. The more quickly and surely they can see, the less do they depend on their sense of touch. The less the handling of the tissues, the less the shock to the patient; also the less their own tension with its quick fatigue build-up. Hence the quantity of illumination available should therefore be scientifically sufficient.

Good seeing for surgical work depends on more than just the amount of light in a spot. Extreme contrasts of brightness in the field of view, create serious drains on the energy of the surgeon. This fatigue is just as exhausting as that caused by physical exertion and reflects just as adversely on his skill. The design of the present surgical lighting system is based upon the recognition of the fact that there must be proper balance of brightness between the wound area and the background. Accordingly, the large spot area of high illumination tapers off to adequate room lighting, with no line of demarcation.

The present invention contemplates the employment of a plurality of sources of light spaced laterally from the vertical axis through the center of the work area over the operating table. By having the light come from these laterally located sources, there is the minimum likelihood of obstruction from the head and shoulders of the surgeon and from the attendants assisting the surgeon, and vertical surfaces may be illuminated.

The present invention contemplates that the light sources will be located so that it is possible to obtain high levels of illumination on both vertical and horizontal surfaces in a region of substantial width and depth, and that a light can be obtained from the various azimuths.

In carrying out the present invention, all the luminaires employed in any particular system are preferably alike. They are recessed in the ceiling or mounted below the ceiling of the room at a common level and so oriented that the maximum light output is directed toward the center of the operating table. Each luminaire employed has a lens-lamp-reflector system prefocused so as to place the maximum beam candle power in the direction of the work region.

The accompanying drawings show for purposes

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of illustrating the present invention an embodiment in which the invention may take form, together with modified arrangements of luminaires, it being understood that the drawings are illustrative of the invention rather than limiting the same.

In the accompanying drawings:

Figure 1 is a diagrammatic plan view of a major surgery system;

Figure 2 is a view similar to Figure 1, indicating a delivery room system;

Figure 3 is a diagrammatic vertical section taken on the line 3—3 of Figure 1;

Figure 4 is an enlarged sectional view taken on the plane 3—3 of Figure 1.

In Figures 1 and 2, an operating table is indicated at 10. The center of the operating table is indicated at 11 in each case, and the vertical axis through the center of the table is indicated at 12, Figure 3. In the major surgery system of Figure 1, the ceiling of the room carries six multiple luminaire light boxes 13. Two of these are arranged as shown opposite the head and the foot of the table. The other four are arranged in pairs opposite one another and in directions oblique to both the longitudinal and transverse planes of the table. Each of the light boxes 13 carries three luminaires, indicated at A, B and C. It may be recessed or surface attached.

One of the luminaires, for example, central luminaire B, is shown in greater detail in Figure 4. It has an incandescent lamp 20 carried in a lamp socket 21, mounted on a strip 22. This socket carrying strip 22 is secured to an angle bracket 23 by a bolt 24 passing through a vertical slot 25. The angle bracket 23 is secured to the box 26 by a bolt 27 passing through an elongated slot 28. The socket support 22 also carries a hemispherical reflector 29. The slot 28 extends in the direction of the plane lengthwise of the box, so that it is possible to shift the lamp and reflector in the radial plane 4—4 both horizontally and vertically. The light output of the lamp and reflector is intercepted by a compound light controlled lens system having two plates 30 and 31, whose physical center is offset so that the median ray 32 is at an angle of about 15°. These parts are preferably so proportioned that the top lens accepts all the light within an oblique pyramid with an apex angle between the sides in excess of 90° as apparent from the figure.

The plates 30—31 are provided with suitable prismatic constructions such that they convert the downwardly directed light rays in this pyramid into a beam of substantially parallel rays

having an oblique direction. This makes it possible to have all the refractors for controlling the light in a common horizontal plane as indicated in Figure 3 and to direct the light rays downwardly and laterally to bring them toward the work area where the high illumination is desired. The lower member of the lens pair is made of heat absorbing glass. Where a plurality of optically independent luminaires are arranged in each azimuth, it is necessary to adjust the angle of beam-throw so that the high intensity light rays are not spread over too large an area.

In any particular layout, the ceiling height must be considered. These ceiling heights vary widely and inasmuch as the desired range of obliquity of the light needed in the work area remains the same, irrespective of ceiling height, it is necessary to vary the spacing of the lighting equipment from the vertical axis of the system. The table below indicates the proper dimension D (Figure 1) for various ceiling heights, and it also shows the vertical angle of beam-throw of the luminaires A, B and C when so located, it being understood that the same luminaires will be used at all locations and in installations of various ceiling heights.

Vertical beam throw for 3 ceiling heights

Box No.	9′	10′	12′
A.....degrees..	19	22	25
B.....do....	27½	29	30½
C.....do....	35	35	35
Dim. D.....	3′	3′-8″	5′-1″

By suitably locating the lamp boxes 13 relative to the axis of the system as determined by the height of the ceiling line, one can, by the supplemental adjustments available in the lamp reflector mounting, secure an adequate variation in the angle of maximum light intensity so that the output of all the luminaires is brought into one area. The employment of light boxes of standard dimensions in operating rooms of various ceiling heights and the desire to keep the beam-throw within angles of 35° from the vertical affects the variation in the angle of beam-throw for the luminaires A and B as indicated in the table.

By connecting up the various lamps to suitable control switches, it is of course possible to vary the intensity of light received and the azimuths in which it is received. Failure of a single lamp does not greatly affect the illumination level.

In a typical installation, as shown in Figure 2, the ceiling light is 10 feet from the floor and is 6 feet 8 inches from the plane in which the maximum lighting intensity is desired. With a 3-luminaire light box and 150 watt lamps with 12″ square lenses and having its center located 3 feet 8 inches from the axis of the system, one can by suitable adjustment of the lamp-reflector mounting obtain beams of substantially parallel light rays at angles of 22°, 29° and 35°, so that these beams will be directed onto the work area.

Inasmuch as the same types of 3-luminaire lamp boxes are employed in the various positions about the axis of the system, it is possible to place in the work area high light intensities coming from lenses one foot square and from all six directions or any selected direction so that in a rather extensive area of width *a* (Figure 2) and throughout a very substantial depth (*b*) the high intensities of illumination are available for lighting both horizontal and vertical surfaces. This illumination is received at angles varying from 22° to 35° so that shadowing from the surgeon or his assistants is avoided and so that light can be directed into a deep incision irrespective of whether the table is flat or tilted.

In the delivery room lighting system, shown in Figure 2, two light boxes 13—13 are employed arranged at about 45° to the longitudinal axis of the table, and each of these boxes carries three luminaires A, B and C.

The light control plates 30 and 31 are disposed in a horizontal plane and are for the purpose of converting the downwardly symmetrical beam of divergent rays into the desired oblique beam of substantially parallel rays. Various optical constructions may be employed for this purpose with various optical efficiencies and losses. For example, upper plate 30 may be a Fresnel lens designed to deliver light rays in parallel directions and the lower plate 31 may be a plate with parallel refracting prisms which bend this beam laterally. Another form of construction which may be used is a lens pair symmetrical about a vertical axis, such as shown in Rolph Patent No. 2,310,810. A third form of lens construction, however, is that shown in Patent No. 2,495,320, granted January 24, 1950, to Kurt Franck. The plates shown therein are asymmetric and designed for beam-throw in a narrow horizontal angle and are of higher efficiency than either of the other two forms of construction for the purpose here intended.

This application is a division of my copending application, Serial No. 17,401 filed March 27, 1948.

Since it is obvious that the invention may be embodied in other forms and constructions within the scope of the claims, I wish it to be understood that the particular forms shown are but a few of these forms, and various modifications and changes being possible, I do not otherwise limit myself in any way with respect thereto.

What is claimed is:

A direct lighting luminaire for surgical lighting comprising a downwardly opening elongated lamp box, a plurality of lenses closing the bottom of the box, each lens having a prismatic formation which collects light from a focal point above the center of the lens and transforms it into an oblique beam of parallel rays, all the beams being in the direction of the median vertical plane through the lens centers and focal points, a plurality of incandescent lamps, one for each lens, and mounting means for the lamps whereby each may be shifted both vertically and horizontally in said plane relative to the respective focal point whereby the obliquities of the beams may be adjusted while they are kept in said vertical median plane.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,870,241	Dorey	Aug. 9, 1932
1,987,019	Logan	Jan. 8, 1935
2,310,810	Rolph	Feb. 9, 1943
2,495,320	Franck	Jan. 24, 1950