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LIGHT SOURCE FOR ILLUMINATED APPLIANCES

SUBSTITUTE FOR MISSING XR

Original Filed Sept. 5, 1962

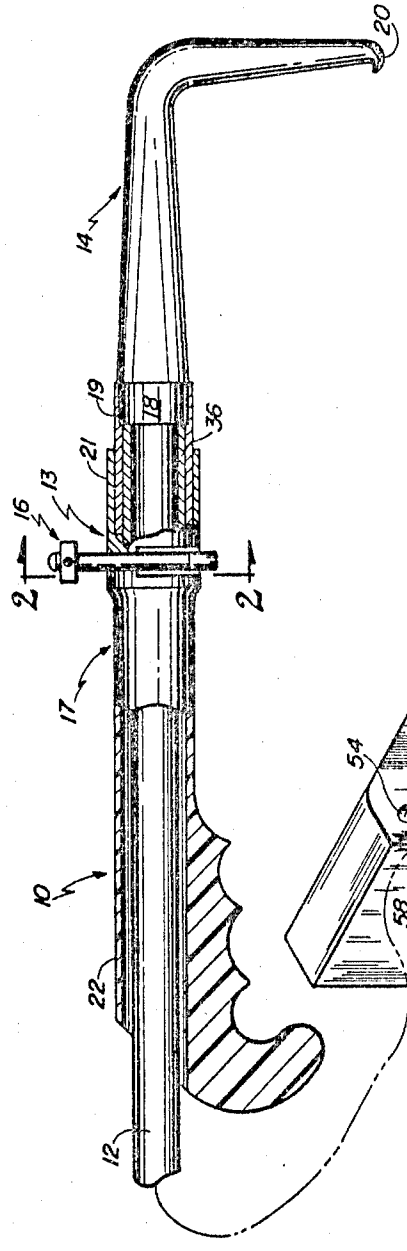


Fig 1

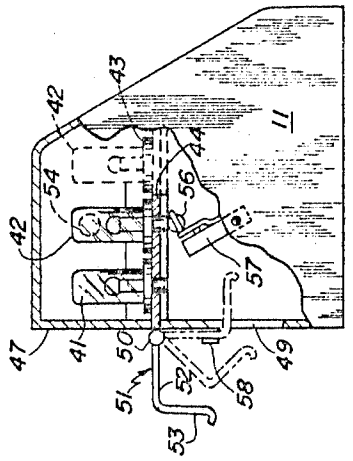


Fig 3

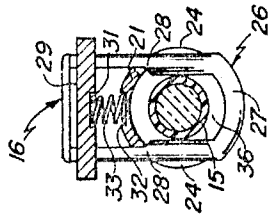


Fig 2

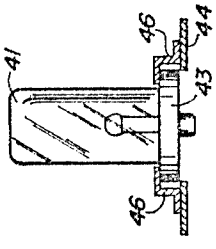


Fig 4

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LIGHT SOURCE FOR ILLUMINATED APPLIANCES

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Original application Sept. 5, 1962, Ser. No. 221,498, now Patent No. 3,195,536, dated July 20, 1965. Divided and this application Dec. 15, 1964, Ser. No. 433,242

6 Claims. (Cl. 240—11.2)

This invention relates to illuminated appliances and, in particular, to illuminated appliances using fiber optic light transmitting means and light conducting applicators such as retractors, anoscopes, tongue depressors, etc.; this application is a division of the co-pending application Serial Number 221,498, filed September 5, 1962 for "Illuminated Appliances," now Patent No. 3,195,536, and assigned to the assignee of the present invention.

Illuminated appliances, some of which are named above, are widely known in the art. Heretofore, however, these were battery operated. The light source consisted of one or more batteries and a small lamp, both contained in the handle of an appliance assembly. The prior art devices suffered from low light intensity and frequent replacement of lamps and batteries. When higher intensity lamps were used, operated from line voltages, two major shortcomings appeared: (1) excessive heat from lamp in proximity to patient and/or physician. and (2) voltages, wires and currents around the patient creating serious hazard problems.

Heretofore, illuminated appliances were primarily used for diagnostic purposes in hospitals and doctors' offices. Their low light intensity and limited battery life did not make them appealing to surgeons in operating rooms. Additionally, an ever present danger in an operating room is the possibility of an explosion caused by the ignition of ether. For this reason, all electrical equipment designed for use in an operating room below a minimum above a floor surface is constructed to be explosion proof. Methods of safeguarding electrical appliances from explosion invariably create a great deal of bulk.

Typical operating room lighting systems may produce 5,000 foot candles above the operating table. By the time the light reaches the surface of the operating site its intensity may have decreased to below 100 foot candles. This level of light is general acceptable for operating purposes but because the lights are mounted a considerable distance above the operating table and because they are relatively difficult to maneuver and move about, they are quite often unsatisfactory for providing adequate light for probing inside a cavity such as the chest cavity and abdominal cavity. Overhead lights are particularly unsatisfactory for localized lighting and locating certain organs within the shadows of the cavity.

The need for a light which can be inserted directly in a cavity, particularly in surgical incisions, has long been felt. Besides obscuration due to instruments and medical staff, human organs are often obscured by each other and by fat and muscle; these organs have no real fixed positions and are often located in unexpected regions of the body with great variations in size. A small high intensity light via a highly mechanically flexible light pipe also has the advantage of not obstructing the surgeon in the limited interior of an incision, especially if it also substitutes for other functional instruments such as a retractor.

It is an object of the invention to provide an illuminated appliance which avoids the disadvantages and limitations of prior art devices of a similar type.

It is another object of the invention to provide an illuminated appliance for supplying a high intensity light at a remote location from a light source.

It is yet another object of the invention to provide an illuminated appliance which provides a high intensity cold light.

It is still another object of the invention to provide an illuminated applicator assembly which includes means for easily attaching and removing a fiber optic light transmitting means.

It is still another object of the invention to provide an illuminated applicator assembly which includes means for containing a portion of a fiber optic light transmitting means in an easily hand-manipulated assembly which is mechanically flexible.

It is a further object of the invention to provide an illuminated applicator assembly which may be rotated relative to a fiber optic light transmitting means supplying light energy to the applicator assembly.

In accordance with the invention an illuminated appliance comprises a light source and a fiber optic light transmitting means in light communication therewith. The fiber optic light transmitting means is connected to a light transmitting applicator assembly, in light communication therewith. The light transmitting applicator assembly includes a tubular handle in which the fiber optic light transmitting means is inserted and secured. It also includes a light transmitting applicator which has a diffused light emitting portion.

Another aspect of the invention is to provide a light source which comprises a plurality of lamps and means for energizing said lamps. The light source also includes means for supplying light to a utilization means. The plurality of lamps is mounted on a movable plate which can be moved to place one or another of the plurality of lamps in light communication with the light utilization means. An electrical control means for energizing the lamp which is in light communication with the light utilization means is operably coupled to the lamp mounting means and actuated thereby.

An additional feature of the invention comprises an illuminated applicator assembly having a tubular handle for receiving a fiber optic light transmitting means, a light conducting applicator and a latch mechanism for rotatably securing the fiber optic light transmitting means in the handle.

The novel features that are considered characteristic of the invention are set forth in the appended claims; the invention itself, however, both as to its organization and method of operation, together with additional objects and advantages thereof, will best be understood from the following description of a specific embodiment when read in conjunction with the accompanying drawings, in which:

FIGURE 1 is a partially schematic and partially sectional representation of an illuminated appliance embodying the principles of the present invention;

FIGURE 2 is a section of a latching mechanism taken along lines 2—2 in FIGURE 1;

FIGURE 3 depicts a light source with a cutaway section showing details of the lamp mounting means; and

FIGURE 4 is a section taken along lines 4—4 in FIGURE 3.

Referring to FIGURE 1, there is shown an illuminated appliance generally designated **10** comprising a light source **11**, a fiber optic light transmitting means **12** and an illuminated applicator assembly **13**. The light source **11** is generally of conventional construction but includes a novel lamp mounting means which will be discussed in detail hereinafter.

The fiber optic light transmitting means is of conventional construction and comprises a large number of glass rods, the ends of which receive or emit increments of

light applied thereto. The light is carried in the fiber optic light transmitting means by means of total internal reflection. An excellent discussion of fiber optic light transmitting means can be found in the book entitled "Concepts of Classical Optics" by John Strong, published by W. H. Freeman & Company (San Francisco 1958).

The illuminated applicator assembly comprises three major elements, a light transmitting applicator **14**, a latch mechanism **16** and a handle **17**. The applicator **14** is made preferably from a light transmitting material such as Lucite or Plexiglas. For purposes of illustration, it is shaped as a retractor and it includes a light emitting portion **20** at one end. The applicator **14**, like the fiber optic means **12**, conducts light by total internal reflection. A diffused light is emitted from areas of its surface that are roughened or frosted, such as at **20**. A remaining end **18** of the applicator **14** is generally cylindrical in shape and is inserted part way into a tubular metal sleeve **19** and secured therein in any suitable manner such as by cement. The metal sleeve **19** in turn is inserted into one end **21** of the tubular handle **17** and secured therein.

As will be seen in FIGURE 1, the handle **17** broadly comprises an elongated portion **22** which includes a finger grip to facilitate manual manipulation and the end **21** mentioned previously. Spaced from the edge of the end **21** is the latch mechanism **16**, the construction of which is shown in FIGURE 2.

Referring to FIGURE 2, it is seen that a pair of diametrically opposing slots **24** are provided through the wall of the end **21**. A fork **26** comprising a bight **27** and a pair of parallel spaced prongs **28** is inserted in the slots **24**. The width of the prongs **28** is not uniform. The spacing between prongs **28** adjacent to the bight **27** is smaller than the spacing between prongs **28** at their opposed end remote from the bight **27**. A header **29** bridges the prongs **28** at the end remote from the bight **27**. A recess **31** is provided on the under side of the header **29** and a complementary recess **32** is provided in the end **21**. A spring **33** bridges the distance between the recesses **31** and **32**. The spring **33** maintains the fork **26** in the position shown in FIGURES 1 and 2.

It will be seen in FIGURE 2 that the fiber optic light transmitting means **12** includes a protective cover **15**. The cover **15** is made from rubber, or a suitable plastic and it is inserted in a metal ring **36**. Allowing for a slight clearance, the length of the ring **36** is substantially equal to the distance between the latch mechanism **16** and the end **18** of the applicator **14** as shown in FIGURE 1. When inserted and locked in the handle, the fiber optic light transmitting means **12** will abut against the applicator **14** forming an excellent light communication path therebetween.

Referring to FIGURE 2, it will be noted that the diameter of the ring **36** is larger than the spacing between the prongs **28** adjacent to the bight **27**. On the other hand, the spacing between the prongs remote from the bight **27** and adjacent to the header **29** is larger than the diameter of the ring **36**.

Thus, to insert or remove the fiber optic light transmitting means **12** it is merely necessary to depress the header and slide the fiber optic light transmitting means into or out of the handle respectively. Upon releasing the header **29**, the spring **33** returns the latch mechanism **16** to the position shown in FIGURE 2 thus preventing axial translation of the fiber optic light transmitting means **12** with respect to the applicator **14**. It will be noted, however, that these two components are freely rotatable relative to one another.

A significant advantage of the combination described above is the versatility of the system. It enables a practitioner to interchange applicator assemblies in a simple and facile manner, to rotate the applicator assembly relative to the fiber optic light transmitting means, and to manipulate the applicator assembly independent of the light source **11**. This latter benefit arises from the complete mechanical flexibility of the fiber optic light transmitting means, a typical length of which is six feet.

By means of the FIGURE 1 illuminated appliance, it has been possible to supply a light intensity of 500 foot candles at the light emitting surface **20** using a 150 watt lamp with an internal reflector in conjunction with a fiber optic light transmitting means six feet long with an outside diameter of half an inch. The light emitted from the surface **20** is cold and can be used within a patient's body with complete safety and comfort. There are no electrical connections in the applicator assembly. The light source need not be explosion proof since it can be mounted at a safe height.

FIGURES 3 and 4 depict details of the light source **11** and, in particular, details relating to the novel feature of providing a plurality of lamps, two shown in the drawings, which are easily interchanged to provide continuous light during a surgical procedure.

Referring to FIGURE 3, the light source **11** includes a pair of lamps **41** and **42** mounted on a slidable mounting plate **43** (see FIGURE 4). The plate, in turn, sits on a shelf **44** and its movement is guided by means of a pair of Z-shaped channels **46**.

One wall **47** of the light source **11** includes a pair of spaced openings **48** and **49** (see also FIGURE 1). One end of the plate **43** is extendable through the opening **48** and terminated in a hinged connection with a handle **51**. The handle **51** is generally L shaped and includes two transverse portions **52** and **53**. The handle **51** is shown extended in FIGURE 3 and recessed in FIGURE 1. In the recessed position shown in FIGURE 1, the plate **43** is positioned at one extreme of its travel (see the phantom outline in FIGURE 3). By simply actuating the handle **51** it is possible to place either lamp **41** or lamp **42** in light communication with an opening **54**, shown dotted in FIGURE 3, through which light is carried to the fiber optic light transmitting means **12** or other utilization means.

Mounted to the bottom of the plate **43** is an actuating mechanism **56** which actuates a switch **57** when the plate **43** is in the position shown in FIGURE 3. When actuated, the microswitch **57** energizes lamp **42**. Lamp **41** is energized when the microswitch **57** is not actuated, when the plate **43** is in the extreme right hand position of its travel.

To avoid having the handle **51** protrude from the light source at the left hand terminus of its travel, the length of the portion **52** is substantially equal to the distance separating the openings **48** and **49**. Thus, the handle **51** may be pivoted about the hinge **50** and the portion **53** inserted through the opening **49** and stored within the light source **11**. A clip **58** is provided to hold the handle **51** against the wall **47** in either position of its travel.

The various features and advantages of the invention are thought to be clear from the foregoing description. Various other features and advantages not specifically enumerated will undoubtedly occur to those versed in the art, as likewise will many variations and modifications of the preferred embodiment illustrated, all of which may be achieved without departing from the spirit and scope of the invention as defined by the following claims:

What is claimed is:

1. A light source comprising:

(a) a housing defined by a plurality of wall members, one of which walls includes an upperan d a lower slot spaced apart by a predetermined distance;

(b) a light utilization means in light communication with one of a pair of spaced lamps;

(c) said pair of spaced lamps separated by a distance equal to said predetermined distance attached to a slidable mounting, the combination being in said housing;

(d) an L-shaped handle including a first and a second portion, said first portion having a length equal to said predetermined distance and adapted to be in-

serted in said upper slot and hinged to said slidable mounting for positioning either lamp in light communication with said utilization means, said second portion being alternately insertable in said lower slot or abuttable against said one wall adjacent to said upper slot.

2. A light source as described in claim 1 which includes, in addition, clip means secured to said one wall intermediate said upper and lower slots for securing said handle against said one wall.

3. A light source as described in claim 1 which includes, in addition, electric switch means and an actuator for said switch, the latter being mounted on said slidable mounting for energizing the lamp in light communication with said utilization means.

4. A light source for a fiber optic light-transmitting means, comprising:

(a) a housing defined by a plurality of walls;

(b) one of said walls having a first opening provided therein for carrying light to a fiber optic light-transmitting means;

(c) a plurality of lamps disposed adjacent said one wall such that one of said lamps is in light communication with said first opening and another of said lamps is remote from said first opening;

(d) a movable handle member having a portion thereof extending outside said housing through a second opening therein;

(e) means interconnecting said plurality of lamps with said handle such that movement of said handle causes both removal of said one lamp from light communication with said first opening and simultaneous movement of said other lamp into light communication with said first opening, the position of said lamps being determined as selected between the cooperative relationship of said handle with a wall of said housing and the cooperative relationship of said handle with said second opening; and

(f) means for energizing a lamp which is in light communication with said opening.

5. A light source for a fiber optic light-transmitting means, comprising:

(a) a housing defined by a plurality of walls;

(b) one of said walls having an opening provided therein for carrying light to a fiber optic light-transmitting means;

(c) guide means disposed in said housing adjacent said wall;

(d) a plurality of lamps mounted in spaced relation for movement along said guide means such that one of said lamps is in light communication with said opening and another of said lamps is remote from said opening;

(e) a movable handle member having a portion thereof extending outside said housing;

(f) means interconnecting said plurality of lamps with said handle such that movement of said handle causes both removal of said one lamp from light communication with said opening and simultaneous movement of said other lamp into light communication with said opening; and

(g) means for energizing a lamp which is in light communication with said opening.

6. A light source for a fiber optic light-transmitting means comprising:

(a) a housing defined by a plurality of walls;

(b) one of said walls having an opening provided therein for carrying light to a fiber optic-transmitting means;

(c) a shelf disposed in said housing and having one edge thereof disposed adjacent said one wall;

(d) guide means disposed on said shelf adjacent said one wall;

(e) a slidable mounting plate connected to said guide means for movement parallel to said one wall;

(f) a plurality of lamps mounted in spaced relation on said plate such that one of said lamps is in light communication with said opening and another of said lamps is remote from said opening;

(g) a movable handle member having a portion thereof extending outside said housing and connected to said slidable plate such that movement of said handle causes both removal of said one lamp from light communication with said opening and simultaneous movement of said other lamp into light communication with said opening; and

(h) means for energizing a lamp which is in light communication with said opening.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,265,881 August 9, 1966

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It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 4, line 65, for "upperan d" read -- upper and --; column 6, line 18, for "optic-transmitting" read -- optic light-transmitting --.

Signed and sealed this 25th day of July 1967.

(SEAL)
Attest:

Edward M. Fletcher, Jr.
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents