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Feinbloom

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[54] **LIGHT SOURCES EMPLOYING UNIVERSALLY ADJUSTABLE BALL AND SOCKET JOINTS**

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[52] **U.S. Cl.** **240/1.4**; 240/70; 240/151

[51] **Int. Cl.**[2] **F21V 33/00**

[58] **Field of Search** ..... 240/1.4, 61.11, 61.12, 240/67, 68, 70, 73 R, 81 BC, 81 BD, 151, DIG. 5, 41.15, 1 EL; 285/263, 271, DIG. 8; 350/96 B; 403/90, 131, 143

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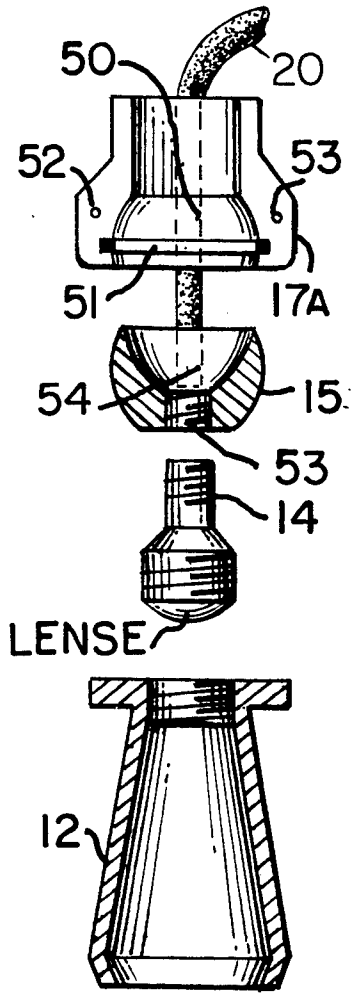
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[57] **ABSTRACT**

There is disclosed a light assembly or similar apparatus which is adjustable by means of a ball and socket assembly incorporating an elastomeric "O" ring which abuts against the periphery of the ball when a ball accommodating sectionalized socket assembly is clamped together.

7 Claims, 6 Drawing Figures



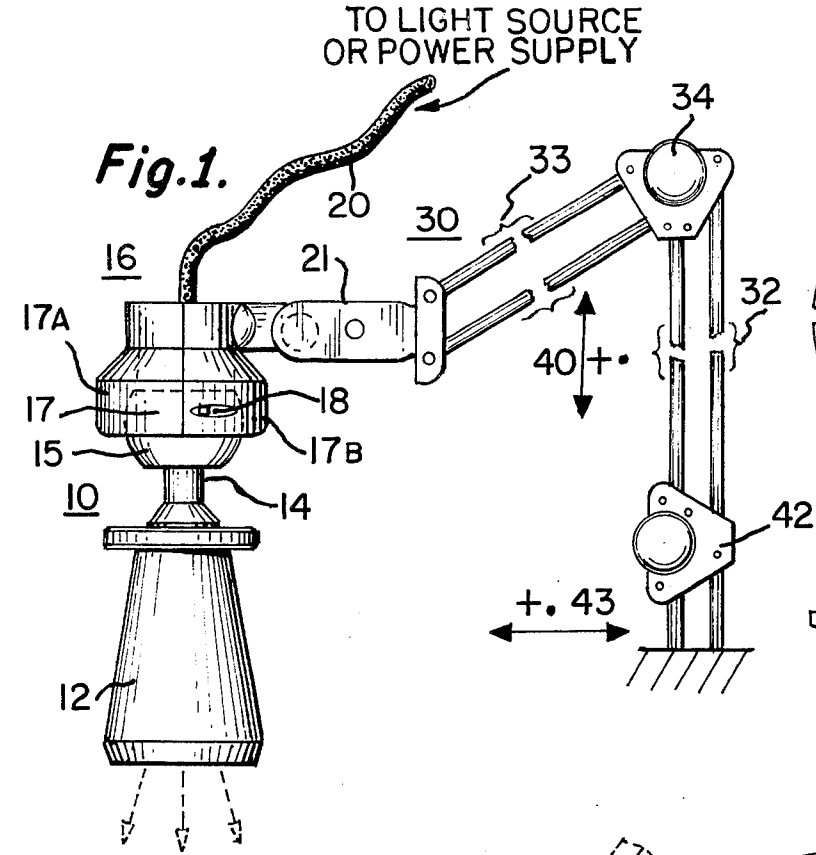


Fig. 1.

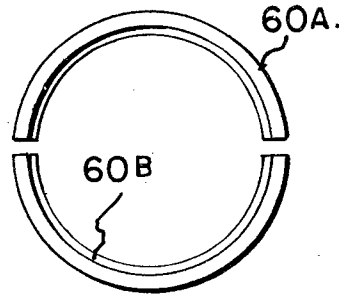


Fig. 3B.

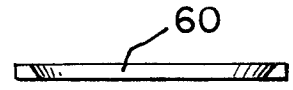


Fig. 3A.

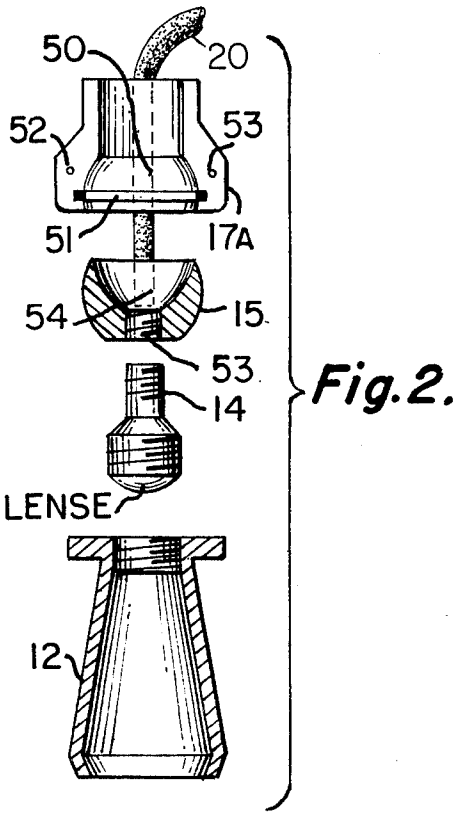


Fig. 2.

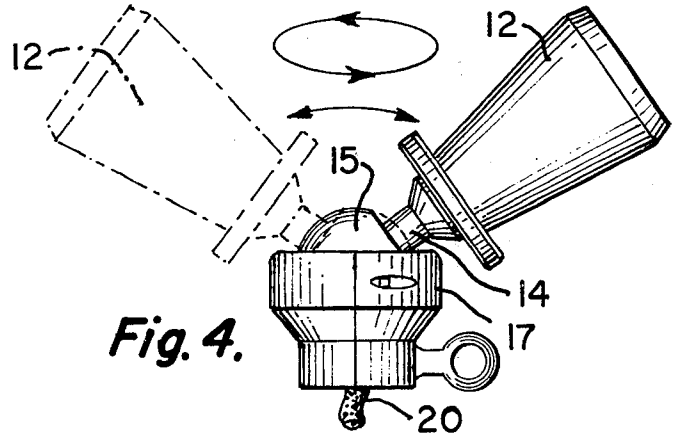


Fig. 4.

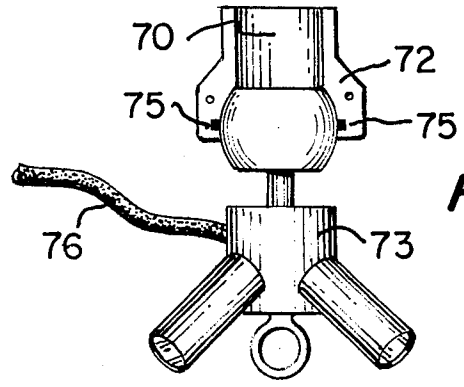


Fig. 5.

LIGHT SOURCES EMPLOYING UNIVERSALLY ADJUSTABLE BALL AND SOCKET JOINTS

BACKGROUND OF INVENTION

Lighting fixtures and light sources are an integral part of modern day surgical techniques. As physicians and surgeons develop new surgical techniques, the need increases for more reliable and efficient optical aids. Thus, the field of optical aids and equipment has also been associated with rapid strides and progress in order to supply the lighting required by the significant advances made in the medical and related fields.

Coupled with the desire to provide better illumination while reducing glare and improving efficiency, is the need for a light source which can be easily and conveniently adjusted either prior to or during the surgical technique.

The surgeon desires to adjust the light source in a given direction and position and must be assured that it will be maintained in that position during the surgical procedure.

As one can easily envision, the prior art is replete with a number of references that are directed toward the problem of adjusting a source of light and maintaining the same in a predetermined and desired position.

To facilitate solution of this problem, certain of the prior art devices employ the conventional ball and socket joint with various modifications to insure greater capability of adjustment. While a "ball and socket joint" is a well-known and conventional means for providing adjustability, it suffers from many disadvantages.

First, the problem of maintaining the apparatus in a given position is considerable; as due to the nature of the joint it is capable of easy positioning and once utilized for an extended time becomes loose fitting and can move due to extremely small spurious forces. Also depending upon the weight of the apparatus to be positioned, the forces thus exerted on the assembly may cause one to experience difficulty in accurately positioning the same caused by slippage or inertia due to the weight. Such mechanical drifts would be extremely detrimental and disturbing to a physisian or surgeon during an operating procedure and, in general, would be disturbing to any user desiring to maintain an accurate, predetermined positioned assembly, be it a light source or any other device whose adjusted position is to be accurately maintained once aligned properly.

BRIEF DESCRIPTION OF PREFERRED EMBODIMENT

A ball and socket joint associated with a optical assembly comprises a hollow socket having an internal groove or channel about the inner periphery thereof, said hollow accomodating a ball section with friction means accomodated in said channel for frictionally engaging the peripheral surface of said ball when accommodated by said socket to maintain said ball in any one of a plurality of positions of adjustment, said frictional means including a beveled "O" ring seated and positioned in said channel socket.

BRIEF DESCRIPTION OF FIGURES

FIG. 1 is a side elevational view of an auxillary lamp apparatus according to the invention.

FIG. 2 is a partial cross sectional view of the ball and socket apparatus according to the invention.

FIGS. 3A and 3B are respectively a side view of a hemispherical "O" ring section and a top view showing the two "O" sections.

FIG. 4 is a front perspective view depicting certain adjustable aspects of the apparatus.

FIG. 5 is a partial cross sectional front view of an alternate use of the apparatus.

DETAILED DESCRIPTION OF FIGURES

Before describing the invention in detail one should be aware that the ball and socket joint to be depicted has wide-spread applicability as a positional apparatus and may be used to support and position surgical microscopes, all types of other lighting arrangements as well as additional apparatus. In any event, the specification will concentrate on an auxillary lighting source used primarily for surgical procedures, understanding that a plethora of additional apparatus could be accommodated as well.

Referring to FIG. **1**, there is shown a perspective side elevational view of a lighting apparatus **10** including a ball and socket joint assembly according to this invention.

A conical shaped front assembly **12** is utilized to permit sterilization of the section and the assembly **12** acts as a means for adjusting the light source under sterile conditions. The surgeon adjusts the light by grasping the sterile conical section **12** and hence he does not become contaminated while affording adjustment. The section **12** is fabricated from aluminum or other metal capable of being sterilized prior to surgical procedure. As such, the cone **12** is removably secured to a shaft **14** which is fixed or rigidly secured to the ball section **15** of a ball and socket assembly **16.** The socket assembly **17** surrounds the ball **15** and permits rotational movement of the same and hence of the shaft **14** secured to the ball **15** and therefore of the light emitting conical section **12.**

The socket portion **17** is split into a first and second section **17A** and **17B** which are held together by means of set screws as **18,** which, as will be explained, can be tightened to set the assembly at a fixed position or loosened to provide adjustability. Once the set screws are tightened constant tension is exerted on the ball allowing the user to adjust the apparatus at any time without having to loosen or tighten any position fixing nuts and screws.

A cable **20,** which may be a fiber optic assembly or a power cable is coupled to a lens assembly or a lamp source which, as will be shown, can be positioned in or mounted within the shaft **14** or ball assembly **15** of the assembly **10.** The shaft **14** actually contains the optical system and together with the lens controls the light pattern. The socket **17** may have an additional coupling member **21** secured thereto to enable the entire assembly to be coupled to or fastened to additional adjustment means for providing complete horizontal and vertical movement.

Thus shown in FIG. **1,** is an adjustable bracket arrangement **30,** consisting of a vertical support member **32** and a horizontal support member **33.** The vertical and horizontal members are attached to each other via a hinged joint **34,** which may also be a ball and socket assembly or a hinged assembly affording the motion shown by the arrow **40.** The horizontal member **33,** in a similar manner, may be associated with an additional hinge **42** to permit motion in the direction shown by ar-

rows **43.** Thus, as one can see, the entire assembly can move in all planes and at all angles at distances determined by the length of the assemblies **32** and **33.** The conical front section **12** can also be independently adjusted by means of the ball and socket assembly **16** to be described.

Referring to FIG. **2,** there is shown a cross sectional view of the ball and socket apparatus **16** of FIG. **1.**

The socket assembly **17,** as indicated, comprises two mirror image sections having a central aperture **50** for accomodating a ball joint. Each section as **17A** and **17B** has a groove **51** along the inside of the socket wall. The groove is adaped and dimensioned to hold and contain an elastomeric split "O" ring. The interior chamber **50** is formed when two sections as **17A** are secured together by means of "Allen" type set screws which engage and are held within the threaded apertures as **52** and **53** formed in the socket assemblies **17A** and **17B,** as more clearly depicted in FIG. **1.** The socket sections **17A** and **17B** may be fabricated from aluminum or another suitable structurial material.

The ball assembly **15** is integral and is fabricated from a mixture of bronze and brass. The ball has a central aperture **54** to accomodate and permit the cable assembly **20** to couple via an aperture **53** in the ball assembly into which aperture a lens accomodating shaft as **14** of FIG. **1** is inserted and rigidly held. The fiber optic or power cable **20** is thus directed, as shown (dashed) throughout the socket aperture via the aperture **54** in the ball **15** and thence to the shaft **14,** which may contain a lens assembly for further focusing the light rays emanating from cable **20.** The shaft **14** has a threaded end which engages with a corresponding thread in the conical section **12** to permit the easy removing of the conical section **12.**

Thus, the ball assembly **15** is retained within the recess or aperture **50** formed when the two socket sections are placed in contact and secured together by means of the set screws. The "O" ring is shown in FIGS. **3A** and **3B.** The "O" ring **60** is placed and retained in each groove **51** of the socket sections **17A** and **17B.** Once the socket sections are placed and secured about the ball section **15,** the "O" ring **60,** having a beveled edge forms a continuous surface for engaging and contacting the surface of the ball **15.** The "O" ring **60** as indicated, is split as shown in FIG. **3B** into a first section **60A** and a second section **60B** for insertion into the grooves as **51** associated with the socket sections **17A** and **17B.**

The "O" ring is pushed into contact with the surface of the ball **15** upon the tightening of the set screws. The ring assures that contact tension is impressed about the periphery of the ball **15** restraining movement of the same once adjusted to a desired position by tightening the set screws. The frictional forces impressed upon the ball by the "O" ring and socket assembly assure it is rigidly held with relatively constant tension at any position of adjustment.

Typically, the ball assembly **15** defines a diameter of about two inches, while the central socket aperture is slightly larger. (2 inches plus 0.005 inch). This increased diameter of the socket allows for all motion as shown in FIG. **4,** for example. The tightening of the screws causes the "O" ring to firmly abut the ball assembly **15** and impress a force thereon about the periphery of the ball to secure it firmly within the recess formed by the socket parts. The "O" ring **60** has a beveled edge closest to the lens shaft **14.** The bevel prevents the edge of the ball assembly **15** from catching on the surface of the "O" ring as one part of the ball is turned below the "O" ring during an extreme adjustment angle as shown in FIG. **4,** for example. When the cone **12** is supported as shown in FIG. **1,** relatively horizontally or upright, the "O" ring **60** contacts the ball relatively in the center or about the major diameter thereof. As also can be verified from FIG. **4,** the diameter of the shaft **14** limits the extreme position of the cone **12** by contacting with the edge of the socket. This prevents undue flexing or bending of the light transmitting cable assembly **20.**

For the assembly, one can obtain, in excess of 130° range of movement of the ball, which movement is further complemented by the hinged joint and rotatable movement of the supporting assembly as **32** and **33** of FIG. **1.**

In utilizing the apparatus shown, the surgeon or his associates would disengage the reflector conical section **12** and sterilize the same prior to surgery. The sterilized section **12** would then be secured to the shaft assembly **14,** the set screws are preadjusted to provide constant tension and the surgeon can now adjust the light apparatus by means of the cone **12** to any position desired. The adjustment as facilitated is maintained by tightening of the set screws **18** and held securely by causing the elastomeric "O" ring to press or abut against the ball assembly **15.** Since, the entire assembly is sterilized, further adjustment can be made under sterile conditions.

Due to the fact that the cable **20** may be an optical cable, it can therefore transmit light emanating from a remote source and eliminates the need for an incandescent bulb.

Thus, one can readily ascertain from the description above, that there is provided a unique ball and socket joint employing a split socket assembly with an "O" ring accomodating channel. The "O" ring assures constant tension on the ball firmly securing the same within the socket. This feature can be employed in a plurality of circumstances and can, for example, be used to support a surgical microscope to enable adjustment of the same as seen in FIG. **5.**

Thus, in FIG. **5** a ball assembly is shown secured within a split socket housing **72.** The housing **72** has a channel accomodating an "O" ring **75** with a shaft **76** coupled to a surgical microscope **73.** While the ball section **70** may have a cable accomodating aperture as previously shown, it can also be solid and a cable **76** may be directed to the microscope from another source; the main feature being the adjustability aspects of the ball and socket assembly.

Other modifications and uses will become apparent to those skilled in the art upon reading this specification and all such embodiments are deemed to be encompassed within the spirit and scope of the claims appended thereto.

I claim:

1. An auxiliary operating room light comprising:

a. a hollow socket having an internal groove about the inner periphery thereof,

b. a hollow ball member located within said socket and movable with respect thereto in a plurality of circular positions,

c. a light concentrating element including a lens located at a first smaller open end, said light concen-

trating element including a flared section having a central tapered aperture tapering from a large second open end to said smaller first open end, and having said smaller open end coupled to said ball member with said lens located within said central tapered aperture, said central tapered aperture permitting light rays from said lens to pass therethrough to provide illumination, and

d. a beveled "O" ring seated and positioned in said groove to coact with and engage a peripheral surface of said ball for anyone of said positions, said "O" ring exerting a frictional force on said ball for maintaining the same in said position due to said beveled edge assuring coaction of said ring with said periphery of said ball including extreme circular positions.

2. An auxiliary operating room light according to claim **1** wherein said "O" ring comprises two semicircular sections beveled at a lower edge which contacts the surface of said ball.

3. The operating room light according to claim **2** further including:

a. a shaft coupled to said bottom end of said ball member, said shaft having a threaded end portion, and

b. a thread located about the periphery of said first smaller open end of said flared section to threadly serve said flared section to said threaded end portion of said shaft.

4. An auxiliary operating room light as defined in claim **3** wherein said ball, socket and cone are fabricated from a metal, and said socket has an internal diameter which is slightly larger than the diameter of said ball.

5. The apparatus according to claim **1** wherein said socket comprises first and second mirror-image sections which are clamped together by means of set screws to enable said "O" ring to intimately coact with the surface of said ball.

6. The apparatus according to claim **1** further including a fiber optic cable directed through the hollow of said socket and said ball and positioned to direct any light transmitted thereby to said lens assembly.

7. The apparatus according to claim **1** wherein said internal diameter of said socket is relatively 0.005 inches greater than the diameter of said ball.

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