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MINIATURE LAMP AND METHOD FOR MAKING IT

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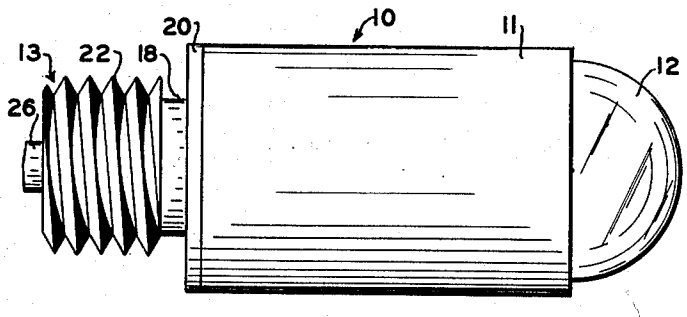


Fig. 1

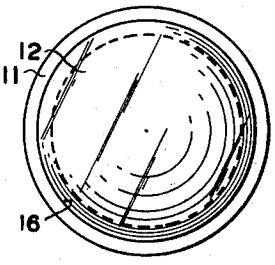


Fig. 2

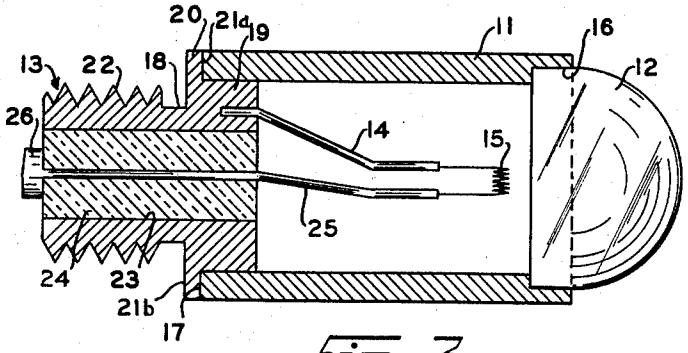


Fig. 3

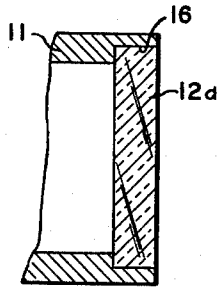


Fig. 4

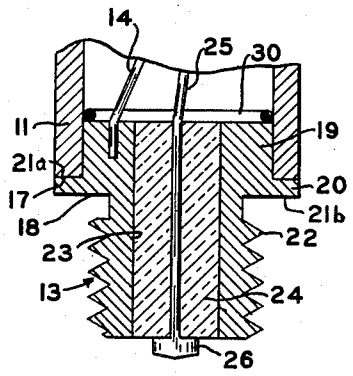


Fig. 5

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MINIATURE LAMP AND METHOD FOR MAKING IT

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This invention relates to a lamp construction and more particularly to a miniature lamp adapted for use in electrically illuminated diagnostic instruments.

Heretofore, small lamps adapted for use in ophthalmoscopes, nasopharyngoscopes, laryngoscopes and other diagnostic instruments have been made generally like other lamps but to a smaller scale. An elongated, partially spherical, partial hollow glass envelope is blown or otherwise formed. A cylindrical glass lamp bottom is then fused to the open end of the envelope with lead in wires and the tungsten, or other filament located as precisely as possible with respect to the lens-end of the envelope, fused therein. A stem or nipple passage by which the interior may be subjected to vacuum is formed and thereafter the interior is pumped out and the passage is sealed. Subsequently, the sealed glass envelope is enclosed and cemented in an externally threaded metal sleeve or other supporting base, the filament leads being secured to conventional terminals on the base and the lens end of the envelope being positioned during the cementing operation as accurately as possible with respect to the base.

Since these miniature lamps may be of the order of one-eighth inch or less in diameter and assembly operations are frequently done using magnifying glass means, it is apparent that it is difficult to maintain any high degree of precision in the location of the filament. Moreover, with a blown glass envelope, it is difficult to insure that the glass at the top of the lamp is of uniform thickness throughout, and though the outside surface of the lamp may be formed by grinding or the like, it is impractical to precisely control or shape the surface inside the lamp.

It will be understood that illuminated diagnostic instruments are designed to assist the physician in examining portions of the interior of a human body and the speculum portion of the instrument, and sometimes the light-source lamp itself, must be inserted in a body cavity. In eye instruments of the hand ophthalmoscope type the light source must be close to the eye when examining the interior through the pupil. It is essential, therefore, in working in such close quarters that the light beam from the lamp be properly focussed. In prefocussed instruments this requires that the end of the lamp be shaped with as much precision as any lens and that the filament, which is the light source, as well as the lens must be at precisely the correct distance from, and centered with respect to the lamp base and the filament must be precisely located with respect to the lens. Furthermore, it is important that the light beam be free from imperfections such as dark and light spots, striae and unevenness.

The primary objects of the present invention, accordingly, are to provide a lamp with a glass end which may be precisely ground and shaped like a lens, which glass end may be precisely located with respect to the base, and with a filament which may be precisely located with respect to said base.

A further object is to provide a lamp which may be assembled with production techniques and with precision.

Still further objects are to provide a lamp which may be rapidly assembled in quantity, in which the lens portion may be separately ground and free from imperfection, and in which the filament may be attached and positioned with respect to the base and thereafter the lens portion may be positioned with respect to the base and filament prior to vacuum sealing the lamp.

Other objects and advantages will become apparent from the following detailed description taken in conjunction taken in conjunction with the accompanying drawings, in which:

FIGURE 1 is a side elevation of a lamp according to the present invention;

FIGURE 2 is an end elevation thereof;

FIGURE 3 is a longitudinal mid-sectional view of the lamp of FIGURE 1;

FIGURE 4 is a fragmentary sectional view similar to FIGURE 3 showing the lens-end of a lamp with a flat or window lens; and

FIGURE 5 is a fragmentary sectional view similar to FIGURE 3 showing the base-end of a lamp prior to vacuum sealing.

Referring more particularly to FIGURES 1–3, the lamp **10** comprises a tubular metal body portion **11**, a glass lens **12**, a metal and glass base assembly **13**, a lead-in wire **14** adapted to be secured to the base, and a filament **15**.

The body **11** has an enlarged, shouldered recess **16** at the forward or upper end for receiving the lens **12**, said recess being precisely machined and located with respect to the other end of the body. The lens **12** is cemented or sealed in recess **16** by any known cementing material which is stable in the presence of a vacuum. Such material may be an epoxy cement, a thermo-plastic cement or a high temperature wax. Alternately, a frit type seal, or a solder on fused silver type seal, or any compression type seal may be used. For the latter, obviously, the material from which body **11** is formed must have expansion and contraction characteristics compatible with the material chosen for the lens over the range of temperature to which the lamp can be expected to be subjected. To form a compression type seal the material of the body must have greater contraction upon cooling than the material of the lens.

The lens **12** may be shaped, ground and polished on both surfaces by any known method before it is cemented or otherwise sealed in place. Lens **12** is shown as a plano-convex spherical lens in FIGURE 3 and lens **12***a* is shown as a flat or plano-plano lens in FIGURE 4, usually for use in an instrument having another lens separate from the lamp. Obviously, any other lens such as a plano-concave or concavo-convex or a non-spherical lens could be used depending on the characteristics desired for the lamp.

The base assembly **13** with compression type seal comprises a tubular metal lamp bottom **18** having a top positioning or stopper portion **19**, a projecting flange **20**, shouldered at **21***a* and **21***b*, and a reduced lower threaded portion **22** for a screw fit in an appropriate socket. The threaded portion **22** and shoulder **21***b* provide means for precisely locating the lamp in the instrument. The upper cylindrical stopper portion **19** of the bottom **18** is adapted to fit inside the body **11** with a slide fit, and the shoulder **21***a* between the stopper portion **19** and flange **20** is square, providing means for precisely locating the body **11** with respect to the base.

An axial passage **23** through the bottom **18** is filled with a glass or ceramic plug **24** fused therein and bonded thereto. A second lead-in wire **25**, simultaneously fused axially within the plug **24** projects from the upper end of the plug and extends toward lens **12** within the lamp. The lower, exterior end of the wire **25** has formed thereon by upsetting or joined thereto by soldering, or the like, a contact button **26** for making the usual electrical contact with a cooperating contact in the socket. The but-

ton 26, being of smaller diameter than plug 24, is insulated from the bottom 18 by the material of plug 24, as is the remaining portion of the lead-in wire 25.

The base assembly 13 may be first made as a subassembly and the plug 24 and lead-in wire 25 fused within the bottom 18 in a manner known to those skilled in the art. The lead-in 25 must be of a metallic material such as platinum or one of the glass sealing alloys such as 50% nickel-iron which have coefficients of expansion and contraction similar to the selected material of plug 24. The bottom 18 must be of a material, suitable for forming a compression type seal with the glass or other material of the plug. The parts of the base assembly may, of course, be held in a jig during the fusing of the plug 24. Obviously any other known compression-type seal and means for insulating lead wire 25 can be used.

Subsequent to the sealing of lead wire 25 in base 13, the first mentioned lead-in wire 14 may be joined to the bottom 18 as by drilling a hole in the upper or inner face of the stopper portion 19 spaced from the plug 24, and the end of wire 14 inserted by a press fit. Lead-in wire 14 projects inward of the lamp and its inner end is substantially parallel and adjacent the inner end of the lead-in wire 25 as shown.

The filament 15 is imbedded in the inner ends of the wires 14 and 25 by any mechanical known means such as by shaping the end of each wire arcuately around a substantially axially extending space, inserting the ends of the filament in said spaces, and then pinching the ends of each of the wires together around the respective ends of the filament.

It will now be apparent that the shouldered flange 20 of the bottom 18 and the shouldered recess 16, in which lens 12 is secured, provide means by which the filament 15 and the lens 12 may be precisely located with respect to the base 13 and hence with respect to the instrument in which the lamp is to be used. The base 13 with lead-in wire 14 secured thereto may be fixed in a jig and the filament 15 accurately placed in predetermined relation thereto in the same jig when the ends of the filament are clinched or otherwise secured to, or imbedded in, the ends of the wires 14 and 25. When the base assembly 13 is thereafter inserted in the lower end of the body 11 the filament will then be precisely located with respect to the base and the lens will also be precisely located with respect to the base by reason of the accurate machining of the recess 16.

The final step in assembling lamp 10 is the sealing of the base assembly 13 to the bottom of the body 11. As shown in FIGURE 5, the assembled lamp 10 is placed and held upright in a suitable vacuum chamber (not shown) with a ring of solder 30 placed inside the lamp 10 on the upper, inner surface of the bottom 18 in contact with or adjacent the inner wall of the body 11. The vacuum chamber is then pumped out and air from the interior of the lamp is sucked out from between bottom 18 and body 11 as the vacuum chamber is exhausted. Body 11 and bottom 18 are then heated to the melting point of the solder as by a high frequency coil surrounding the vacuum chamber in the vicinity of the soldered joint or by any other known means. The solder ring 30 melts and runs down between body 11 and bottom 18 and is held therebetween by capillary attraction in the usual manner. After the solder has cooled, the lamp may be removed from the vacuum and excess solder on the outside may be removed in the usual manner.

It will be apparent that the sequence of sealing the lens in the body and sealing the body and the base together may be reversed if it is found desirable. To those skilled in the art it will also now be apparent that there is hereinabove described a miniature lamp, differing little in outward appearance or shape from prior art lamps,

but which may be made with the utmost precision by mass production methods using known techniques, and in which the lens may be carefully selected and precisely pre-ground and the lens and filament secured in place in precise alignment and spacing with respect to the base.

As will be apparent to those familiar with the art, the invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The embodiment disclosed is therefore to be considered in all respects as illustrative rather than restrictive, the scope of the invention being indicated by the appended claims.

What is claimed is:

1. In a miniature lamp, a tubular metal lamp body having a precise predetermined length, a metal base assembly forming a sealed bottom closure for said body, means on said base assembly in engagement with said body for locating the inner surface of the base assembly an exact predetermined distance from the top edge of the body, an independent optically ground lens forming a sealed top closure for said body, coacting engaging means on said body and lens for locating the inner surface of the lens an exact predetermined distance from the top edge of the body, lead-in wires supported by said base assembly, said wires extending axially into the interior of said lamp body an exact predetermined distance from the inner surface of said base assembly, and a filament connecting the inner ends of said wires and located at an exact predetermined distance from the wire inner ends whereby said filament and lens inner surface are positioned at an exact predetermined distance from one another, said metal lamp body and base assembly permitting accurate machining to insure location of said lamp parts at said exact distances.

2. In a miniature lamp, a tubular metal lamp body having a precise predetermined length, a metal base assembly forming a sealed bottom closure for said body, said base assembly having a stopper portion that is telescopically received in the bottom of said body and flange means engaging the bottom edge of the body for locating the inner surface of said stopped portion on exact predetermined distance from said bottom edge, an independent optically ground lens forming a sealed top closure for said body, shoulder means on said body engaged by said lens for locating the inner surface of the lens an exact predetermined distance from the top edge of the body, lead-in wires supported by said base assembly, said wires extending axially into the interior of said lamp body an exact predetermined distance from the inner surface of said stopper portion, and a filament connecting the inner ends of said wires and located at an exact predetermined distance from the wire inner ends whereby said filament and lens inner surface are positioned at an exact predetermined distance from one another, said metal lamp body and base assembly permitting accurate machining to insure location of said parts at said exact distances.

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