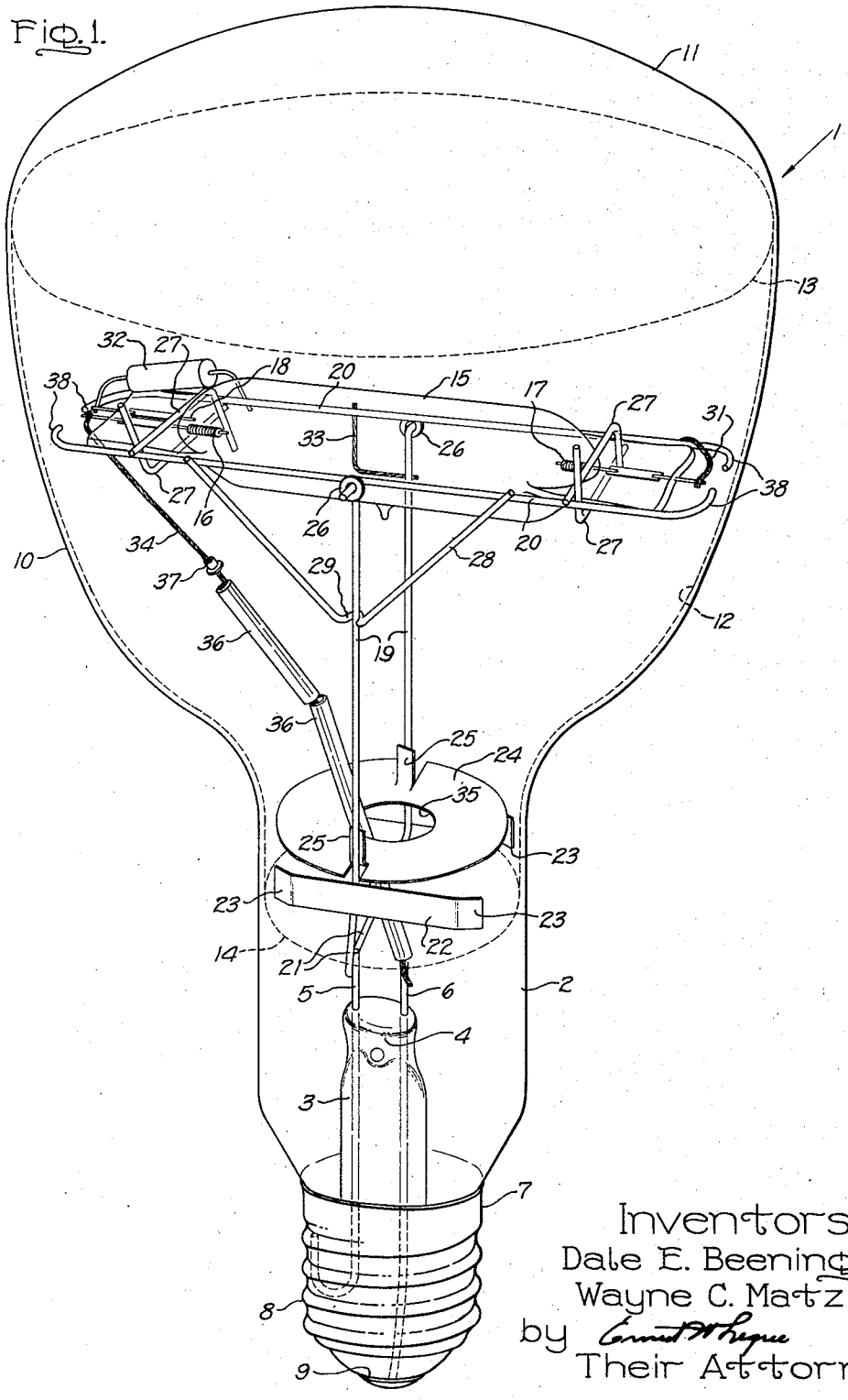
Sept. 15, 1959 D. E. BEENINGA ET AL 2,904,710

REFLECTOR MERCURY LAMP MOUNT

Filed April 19, 1957 3 Sheets-Sheet 1

Fig. 1.




Inventors:
Dale E. Beeninga,
Wayne C. Matz,
by Ernest W. Legree
Their Attorney

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Fig. 2.

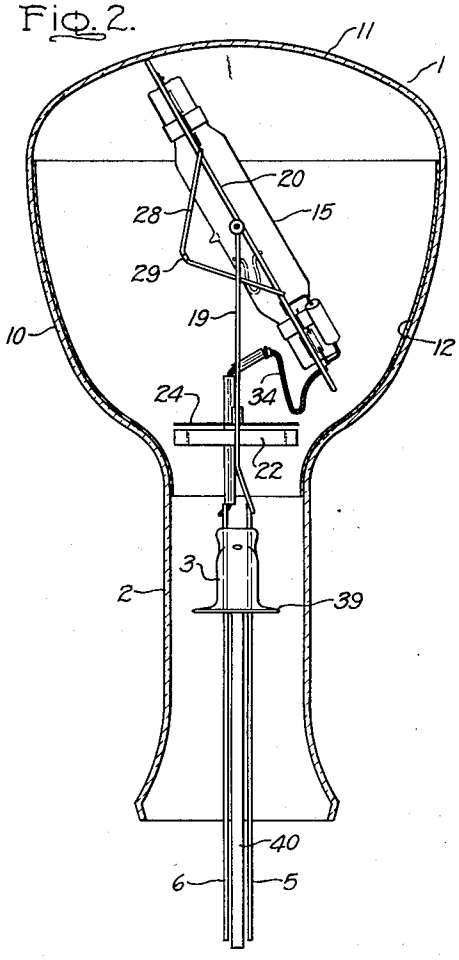
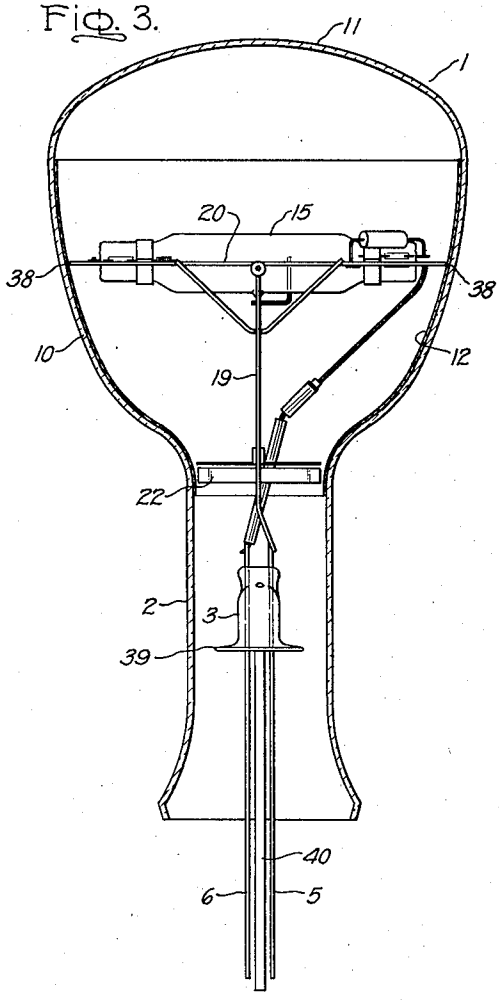



Fig. 3.




Inventors:
Dale E. Beeninga,
Wayne C. Matz,
by Ernest D. Lageer
Their Attorney.

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Fig. 4.

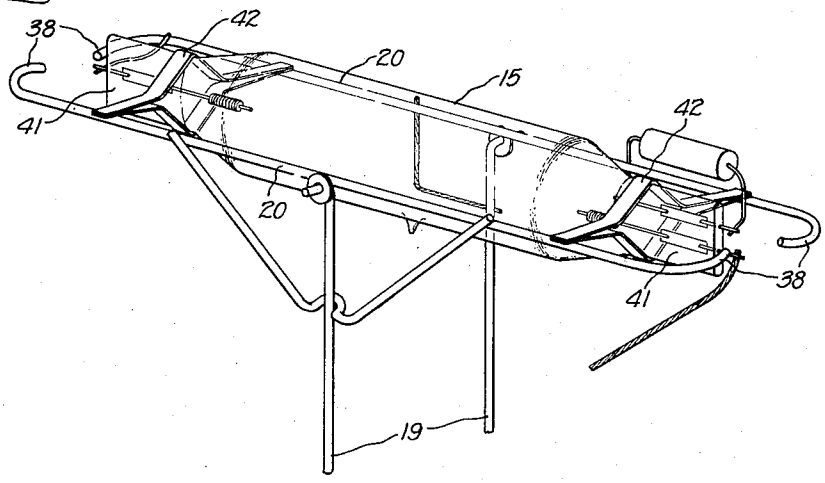
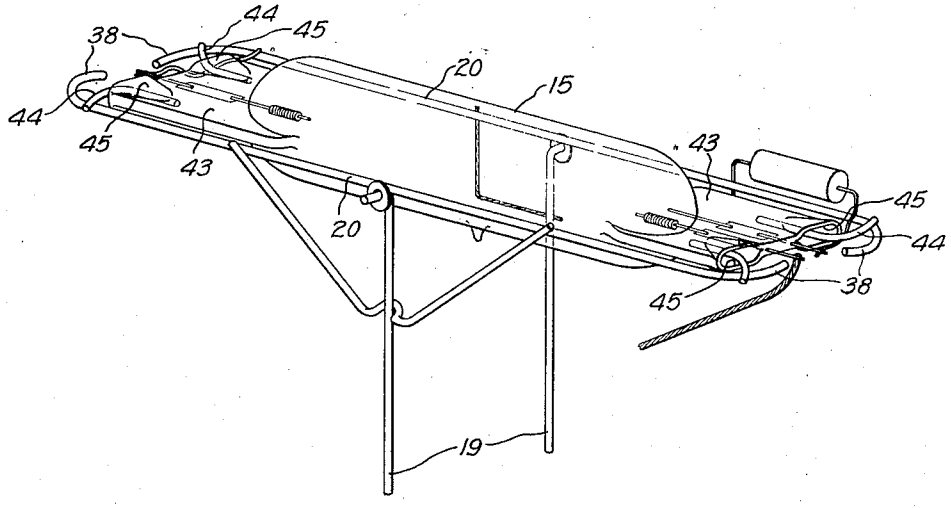



Fig. 5.




Inventors:
Dale E. Beeninga,
Wayne C. Matz,
by Ernest M. Prague
Their Attorney.

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2,904,710

# REFLECTOR MERCURY LAMP MOUNT

Dale E. Beeninga, Milwaukee, Wis., and Wayne C. Matz, Lakewood, Ohio, assignors to General Electric Company, a corporation of New York

Application April 19, 1957, Serial No. 653,855

9 Claims. (Cl. 313—25)

This invention relates to high-pressure mercury vapor lamps of the reflector type wherein the arc tube is mounted in a glass bulb provided with a reflecting coating for concentrating the light in a desired direction. The invention is more particularly concerned with the mount structure holding the arc tube in place within the reflector bulb.

High-pressure mercury vapor lamps used for general illumination are provided with a bulb or outer jacket which encloses the arc tube to keep air away from the seals and to give mechanical protection while serving also as a heat conservator and short wave ultraviolet filter. In the reflector type lamps, the glass bulb is formed to a bowl shape which is silvered in order to reflect and concentrate the light along the longitudinal axis. The bowl portion is extended at one end into a reduced diameter tubular neck portion to which is generally attached a screw type base for accommodating the lamp in a standard socket. The practice up until recently in reflector type lamps has been to mount the arc tube along the longitudinal axis of the bulb so that when the lamp is aimed down, the arc tube is vertical. For convenience of description, this mode of mounting the arc tube will be referred to as vertical mounting.

In copending application Serial No. 653,850 of Elton A. Linsday and Donald R. Phillips, entitled "Reflector Mercury Lamp," filed of even date herewith and assigned to the assignee of the present invention, there is disclosed a lamp in which the arc tube is mounted horizontally, that is transversely to the longitudinal axis of the reflector bulb. Such mounting provides a substantial increase of radiation in the 0° to 60° zone off the vertical wherein the utilizable light output of the lamp is concentrated. It also has the advantage of reducing the light transmitted in the 60 to 90° zone, that is at shallow angles below the horizontal; this is likewise a desirable feature inasmuch as excessive light in that zone produces undesirable glare.

The principal object of the invention is to provide a new and improved mount structure for mounting an arc tube horizontally within the bowl portion of a reflector type bulb and which allows the arc tube and associated mount to be inserted axially through the reduced diameter tubular neck portion of the bulb.

Another object is to provide such a mount structure which assures a rigid assembly not subject to dislocation or breakage.

In accordance with the invention, the mount structure provides a pivotable cradle for the arc tube which allows the tube to be lined up axially with the mount stem for insertion through the neck of the bulb into the bowl portion. A U-shaped support harp has its bight fastened to one of the inleads of the stem tube of the bulb with the parallel legs of the harp extending up into the bowl. The arc tube is supported in a pivotable cradle comprising a pair of side rods extending parallel to the arc tube along its sides and suitably secured to the ends of the arc tube. A pivotable joint about the ends of the harp legs and near the center of the side rods, in combination with a latching



device which extends from one side rod and engages one of the harp legs, permits the cradle to be tilted into the horizontal position after insertion into the bowl of the bulb. The cradle is provided with suitable means to engage or bear against the side walls of the bowl portion when the arc tube is transversely mounted in order to hold it securely in place and prevent the harp from bending. This insures against the ends of the arc tube striking the side walls with possible breakage of the bulb. In a preferred embodiment, the ends of the side rods are curved into confronting relation to provide a springy engagement with the sides of the bowl.

For further objects and advantages and for a detailed description of several embodiments of the invention, attention is now directed to the following description and accompanying drawings. The features of the invention believed to be novel will be more particularly pointed out in the appended claims.

In the drawings:

Fig. 1 is a pictorial view of a reflector type high-pressure mercury vapor lamp with a horizontal arc tube mount embodying the invention.

Figs. 2 and 3 illustrate consecutive stages in the assembly of the arc tube into the reflector bulb.

Figs. 4 and 5 illustrate variants of the cradle construction embodying the invention for different types of seals on the ends of the arc tube.

Referring to Fig. 1 of the drawing, the lamp illustrated therein comprises a glass bulb **1** having a reduced diameter tubular neck portion **2** to the end of which is sealed a re-entrant stem **3** having a press **4** through which extend relatively stiff inlead wires **5**, **6**. To the outer end of the neck is cemented the usual screw type base **7**, the inleads **5**, **6** being connected respectively to the threaded shell **8** and insulated center contact **9** thereof.

The bulb **1** is formed as a surface of revolution about the longitudinal axis extending from the base through the tubular neck portion **2**. The neck portion extends into a flaring bowl portion **10** which is closed by a convex end face **11**. For more details as to the actual configuration of the bulb and the curves constituting the surface of revolution thereof, reference is made to the aforementioned co-pending application of Linsday et al. The reflector portion of the bulb is coated with a light-reflecting layer **12**, for instance an internal coating of silver, from approximately the dotted line **13** in the region of maximum diameter of the bowl portion to the dotted line **14** in the proximate neck portion beyond the juncture of the bowl to the neck. The convex end face **11** is preferably lightly frosted, for instance to the extent necessary to blur the outlines of the arc tube when seen through the end face.

The inner arc tube **15** within the bulb is made of quartz and contains a small quantity of mercury and a starting gas such as argon. The arc discharge takes place through main thermionic electrode **16**, **17** at opposite ends of the arc tube, an auxiliary electrode **18** being provided adjacent main electrode **16** to facilitate starting. The arc tube illustrated has its ends closed by wide pinch seals such as described in co-pending application Serial No. 607,005 of Klaus Gottschalk, filed August 30, 1956, entitled "Quartz Tube Pinch Seal," and assigned to the assignee of the present invention. Molybdenum foils are sealed through the pinch stems of the arc tubes and have internal extensions which support the electrodes and external projections providing current terminals.

The mount assembly for supporting the arc tube comprises a fixed portion which includes a U-shaped harp having parallel legs **19** which extend into the bowl portion of the bulb, and a pivotable portion consisting in a cradle formed by side rods **20** extending alongside the arc tube. The bight **21** of the harp is welded to inlead

5 and transverse mount braces 22 are welded to both legs of the harp and have curved ends 23 bearing against the inside surface of the neck portion 2 of the bulb. Immediately above the mount braces, a heat disk 24 is fastened to the legs 19 of the harp by means of tabs 25 spot-welded to the legs. The heat disk serves to reflect light back towards the convex end face 11 of the bulb, and also prevents overheating of the stem 3 of the bulb and of the base 7 fastened to its end. The upper ends of the legs 19 are bent over at right angles into opposite directions to serve as pivot pins for the eyelets 26 welded to the side rods 20 at their mid-points. The side rods are secured to the arc tube 15 by means of clamping members in the form of L-shaped wire straps 27 overlapping the seals at both ends and welded to the side rods or to each other. A latching device consisting in a V-shaped piece of wire 28 is fastened to one of the side rods 20 and is provided with a laterally offset notch 29 at the apex of the V to engage one of harp legs 19 and lock the cradle and arc tube in a horizontal position.

The harp legs 19 and the side rods 20 of the cradle serve as one side of the electrical circuit to the arc tube. To this end, electrode 17 is connected through a flexible wire 31 to the rear side rod 20, and auxiliary electrode 18 is similarly connected through current limiting resistor 32 to the same side rod. In order to assure a positive current connection at all times, a flexible strap 33 welded from rear side rod 20 to rear harp leg 19 provides a current bridge across the pivotable joints through eyelets 26. The other side of the current circuit is made to electrode 16 through flexible conductor 34 which extends through aperture 35 in heat disk 24 to inlead 6. Insulators are provided for lead 34 where it goes through aperture 35 and in order to prevent contact with harp legs 19 or with the silver coating 12; they consist of short lengths of glass tubing 36 which are retained in place by a lug 37 crimped to the lead 34.

In accordance with the invention, side rods 20 of the cradle for the arc tube extend substantially up to the side walls of the flaring bowl portion of the bulb. We have found it impractical merely by stiffening the legs 19 of the harp to prevent bending or swaying of the mount structure if the lamp is roughly handled or if it should be dropped. The ends of the arc tube would then strike the side walls of the bowl portion, and the lead connections to the arc tube may be broken or the bowl portion of the bulb may be fractured. In either case the lamp would be ruined. By so proportioning the side rods 20 that their ends bear against the side walls of the bowl portion or extend substantially into engagement therewith, these possibilities are avoided.

In the preferred embodiment illustrated, the side rods 20 are provided with curved ends 38 turned inwardly together. During the sealing of the stem 3 to the neck 2 of the bulb, the mount assembly is pulled down so that the curved ends 38 bear against the side walls of the bowl. With this arrangement, the curved ends of the side rods provide some resiliency to the mounting structure and provide greater strength as confirmed by actual drop tests. Another advantage is that the mount assembly will not rattle when the lamp is shook, thereby avoiding an obvious sale detriment. Also, minimum scratching of the silver reflecting surface occurs with a tight fit as described.

It has been observed that dark spots may form in the electrically conductive reflective coating 12 about the points of engagement by the curved ends 38 of the side rods. They may be due to some form of electrolytic action resulting from current flow through the coating or the hot glass of the bulb due to a slight potential difference between the base shell 8 and the ends of the side rods. According to a feature of the invention, the formation of these dark spots is substantially prevented through the provision of the mount braces 22 whose curved ends 23 contact the silver coating 12 extended up the neck. Side rods 20, harp legs 19, and mount braces 22 are all connected to the same side of the electrical circuit to which connection is made through the base shell. With these connections, dark spots do not form in the coating about the ends of the side rods; they may form about the ends of the mount braces, but at these places they have substantially no effect on the effectiveness of the coating as a reflector. The mount braces 23 serve also to stiffen the harp legs 19 and make the arc tube mounting more rigid and secure.

Preferably, for minimal absorption of light within the reflector bulb, all parts of the mount structure including the side rods 20 of the cradle, the harp legs 19, and the heat disk 24 are made of a highly light-reflecting metal. Suitably, all these parts may be silver plated.

Figs. 2 and 3 illustrate steps in the assembly of the mount structure into the reflector bulb. To insert the mount structure into the bulb, the end of the arc tube to which flexible lead 34 is connected is tipped down and the arc tube tilted into a substantially vertical position, that is into alignment with harp legs 19 and the axis of stem 3. In this position, the mount assembly is readily inserted through the neck 2 of the bulb and it is moved up until the upper end of the cradle, that is the curved ends 38 of side rods 20 engage the end face 11 of bulb. By cocking the mount assembly over slightly from the vertical, the arc tube may be tipped slightly out of line, and then by pushing upon the mount assembly, the arc tube is tilted into its horizontal position whereupon notch 29 in latching member 28 engages harp leg 19 and locks the arc tube horizontal. The mount assembly is then pulled down as illustrated in Fig. 3 until the curved ends 38 of the side rods engage the flaring side walls of the bowl portion 10 of the bulb. The neck 2 is then sealed to the flare 39 of stem tube 3 by playing gas flames thereon in the usual fashion. The reflector bulb or outer envelope is then evacuated of air through the exhaust tube 40 and filled for instance with nitrogen at half an atmosphere. Thereafter the base 7 is cemented to the end of the neck and connections of the lead wires made to the base shell and center contact.

It will be observed that the mount structure of the present invention permits the arc tube to be tilted over into its horizontal position by engagement with the clear or lightly frosted end face 11 of the bulb and without requiring any previous engagement or contact with the silvered side walls of the bowl portion 10. This has the advantage of preventing any unsightly scratches on the silvered bowl portion as would otherwise result.

Figs. 4 and 5 illustrate variants of the invention in ragards to the cradle for accommodating different types of seals on the ends of the arc tube 15. In Fig. 4 the ends of the arc tube are closed by narrow pinch seals 41 of a well-known type. The side rods are fastened to the arc tube by means of metal bands 42 which wrap around the shoulders of the seals and have their ends welded to the side rods 20.

In Fig. 5, the ends of the arc tube 15 are closed by wide pinch seals 43; near the edges of the seals are embedded integral support wires 44 which emerge through conical apertures 45 as described in co-pending application Serial No. 607,096, filed August 30, 1956, of Klaus Gottschalk entitled "Arc Tube Mounting," now Patent 2,845,557 and assigned to the same assignee of the present invention. With this type of seal and integral mount, no clamps are used to fasten the side rods 20 to the arc tube, the integral mount supports 44 being merely welded to the curved ends 38 to provide all the support needed.

It will be observed that in all the illustrated embodiments of the invention, the side rods 20 are distinct and not joined at the ends 38. This has been determined to be a desirable feature inasmuch as it provides some extra resilience providing greater resistance to breakage when the lamp is bumped or struck. Some lamps were made

wherein the side rods 20 formed a continuous frame joined at the ends 38. Whereas this structure is more rigid than those which have been illustrated, it is disadvantageous for the present application inasmuch as the excessive rigidity makes more likely a fracture of the bulb wall should the lamp be struck.

While certain specific embodiments of the invention have been shown and described in detail these are intended as illustrative and not as limitative of the invention. Various modifications of the illustrated mount structures for adapting them to other sizes of arc tubes or reflector bulbs will readily suggest themselves to those skilled in the art. The appended claims are intended to cover any such modifications coming within the true spirit and scope of the invention.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. An electric lamp comprising a glass bulb having a neck portion opening into a bowl portion, an arc tube within the bowl portion of substantially greater overall length than the internal diameter of the neck portion, and a support for the arc tube allowing it to be inserted axially through the neck portion and positioned transversely thereto in the bowl portion, comprising a pair of support legs fastened into the outer end of the neck portion and extending into the bowl portion, a pivotable cradle comprising a pair of side rods extending alongside and fastened to the arc tube, a pivotable joint between the ends of the support legs and the side rods, the side rods extending substantially to the walls of the bowl portion when the arc tube is transversely pivoted in order to hold it securely in place.

2. An electric lamp comprising a glass bulb having a neck portion closed at its outer end and opening into a flaring bowl portion closed by an end face, an arc tube within the bowl portion of substantially greater overall length than the internal diameter of the neck portion, and a mount support structure for the arc tube allowing it to be inserted axially through the neck portion and positioned transversely thereto in the bowl portion, comprising a pair of support legs fastened into the outer end of the neck portion and extending into the bowl portion, a pivotable cradle for said arc tube comprising a pair of side rods extending parallel to the sides of the arc tube, means securing the arc tube ends to the side rods, a pivotable joint between the ends of the support legs and the side rods, the side rods having their ends bearing against the flaring walls of said bowl portion when the arc tube is transversely pivoted in order to hold it securely in place.

3. A lamp as defined in claim 2 wherein the ends of the side rods are inwardly curved to provide a resilient engagement with the flaring walls of the bowl portion.

4. A reflector type mercury vapor lamp comprising a glass bulb having a narrow tubular neck portion closed at its outer end and opening along the longitudinal axis of the bulb into a flaring bowl portion closed by an end face, an arc tube within the bowl portion of substantially greater overall length than the internal diameter of the neck portion and mounted transversely to said axis, and a mount support structure for the arc tube allowing it to be inserted axially through the neck portion comprising a U-shaped support harp having its bight fastened into the outer end of the neck portion and having its legs extending into the bowl portion, and a pivotable cradle for the arc tube comprising a pair of side rods extending parallel to the sides of the arc tube, means securing the arc tube ends to the side rods, a pivotable joint about the ends of the harp legs and the side rods near their mid-point, a latching device extending from one side rod and engaging one of the harp legs to lock the arc tube transversely to the axis of the bulb, and curved ends on said side rods bearing against the side walls of the bowl portion to hold the arc tube securely in place and to prevent the harp from bending and allowing the ends of the arc tube to strike the bowl portion.

5. A lamp as defined in claim 4 wherein the latching device comprises a V-shaped wire attached at its ends to the side rod and having a notch at the apex of the V engaging the harp leg when the arc tube is transversely pivoted.

6. A reflector type mercury vapor lamp comprising a glass bulb having a narrow tubular neck portion closed at its outer end and opening along the longitudinal axis of the bulb into a flaring bowl portion closed by an end face, an arc tube within the bowl portion of substantially greater overall length than the internal diameter of the neck portion and mounted transversely to said axis, and a mount support structure for the arc tube allowing it to be inserted axially through the neck portion comprising a U-shaped support harp having its bight fastened into the outer end of the neck portion and having its legs extending into the bowl portion, and a pivotable cradle for the arc tube comprising a pair of side rods extending parallel to the sides of the arc tube, means securing the arc tube ends to the side rods, a pivotable joint for the cradle comprising eyelets on the side rods at their midpoints engaging laterally bent ends on the harp legs, a latching device comprising a V-shaped wire attached at its ends to one side rod and having a notch at the apex of the V engaging one harp leg to lock the arc tube transversely to the axis of the bulb, and curved ends on said side rods bearing against the side walls of the bowl portion to hold the arc tube securely in place and to prevent the harp from bending and allowing the ends of the arc tube to strike the bowl portion.

7. A lamp as defined in claim 6 wherein the means securing the arc tube ends to the side rods comprise straps wrapped around said ends and fastened to the side rods.

8. A lamp as defined in claim 6 wherein the means securing the arc tube ends to the side rods comprise integral support wires embedded in said ends and fastened to the side rods.

9. A reflector type mercury vapor lamp comprising a glass bulb having a neck portion closed at its outer end and opening into a flaring bowl portion closed by an end face, the bowl portion having a conductive reflective coating thereon extending into the neck portion, a base including a metal shell on the outer end of the neck, an arc tube within the bowl portion of substantially greater overall length than the internal diameter of the neck portion, and a mount support structure for the arc tube allowing it to be inserted axially through the neck portion and positioned transversely thereto in the bowl portion comprising a pair of support legs fastened into the outer end of the neck portion and connected to the base shell, said legs extending into the bowl portion, a pivotable cradle for the arc tube comprising a pair of side rods extending alongside and fastened to the arc tube, a pivotable joint between the ends of the support legs and the side rods, the side rods having their ends bearing against the side walls of the bowl portion and the reflective coating thereon when the arc tube is transversely pivoted in order to hold it securely in place, a connection from the side rods to an arc tube terminal, and mount braces attached to the harp legs and having their ends bearing against the reflective coating in the neck portion to prevent the formation of dark spots in the reflective coating at the points of engagement by the ends of the side rods.

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