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Belliveau

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(54) **TEMPERATURE REDUCTION FOR TOP PINCH OF ARC LAMP**

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H01J 11/00 (2006.01)

(52) **U.S. Cl.** **313/607**; 313/234

(58) **Field of Classification Search** 313/234, 313/607, 563

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,377,498	A	4/1968	Koury et al.	313/635
3,723,784	A	3/1973	Sulcs et al.	313/47
4,721,887	A	1/1988	Inukai et al.	313/623

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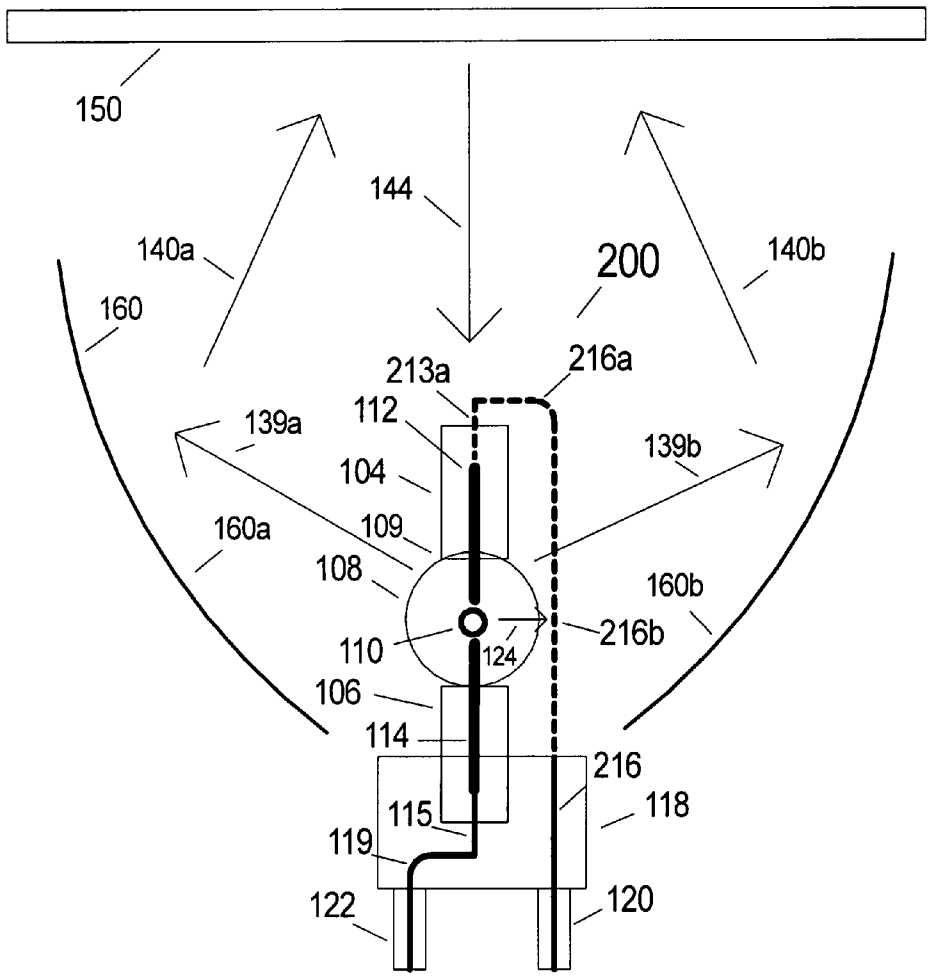
(57) **ABSTRACT**

An arc lamp apparatus is disclosed, which may include a base having a plurality of electrical connections, and a vessel. The vessel may include a plurality of electrodes, a gas filled bulb, and a plurality of pinches. An electrical arc that emits radiation may be formed within the plurality of electrodes. A first pinch may contain a first electrode of the plurality of electrodes. A second pinch may be fixed perpendicular to the base. The second pinch may contain a second electrode not fixed to the base. The second electrode may be connected to an external electrode connecting lead that routes in proximity to the gas filled bulb. The external electrode connecting lead may be shrouded by a reflective material.

20 Claims, 2 Drawing Sheets



Prior Art

FIG. 1

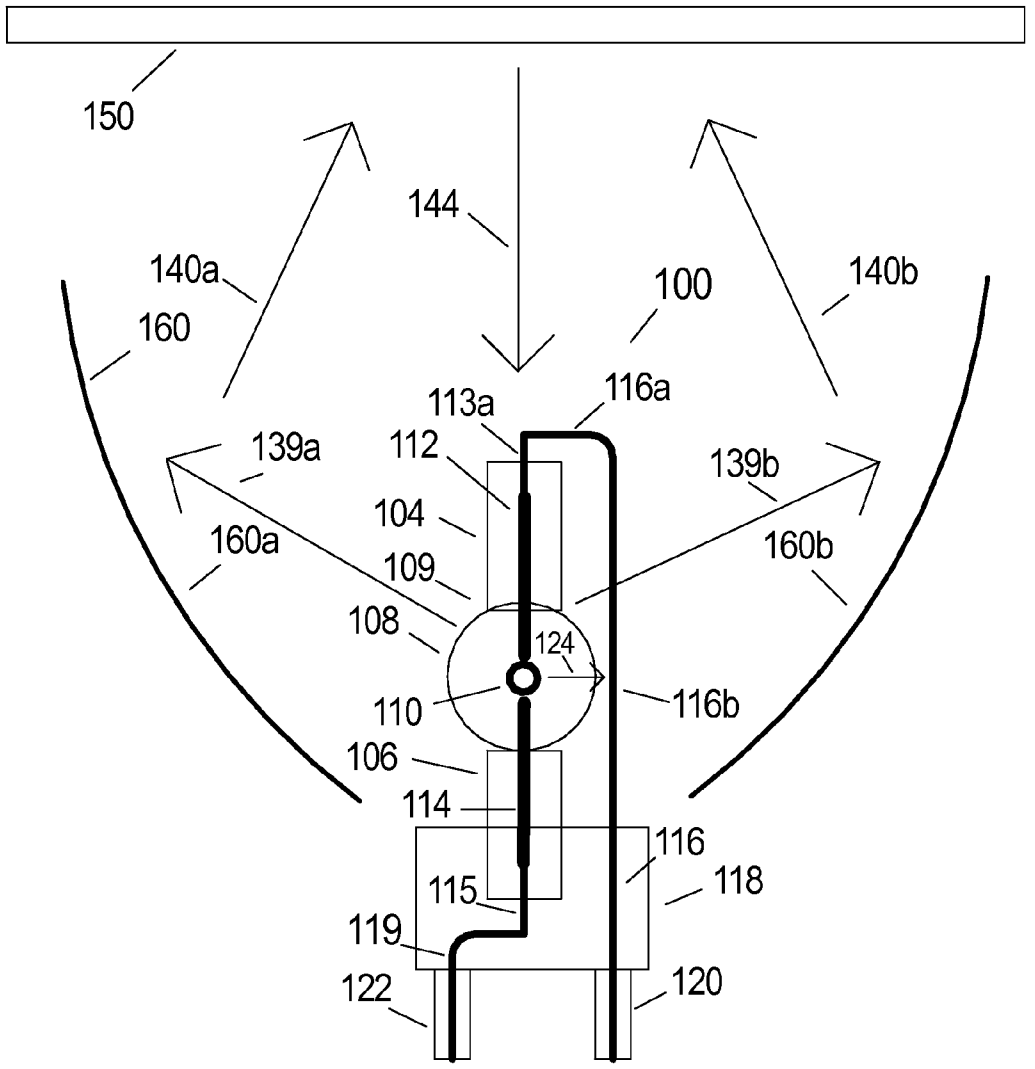
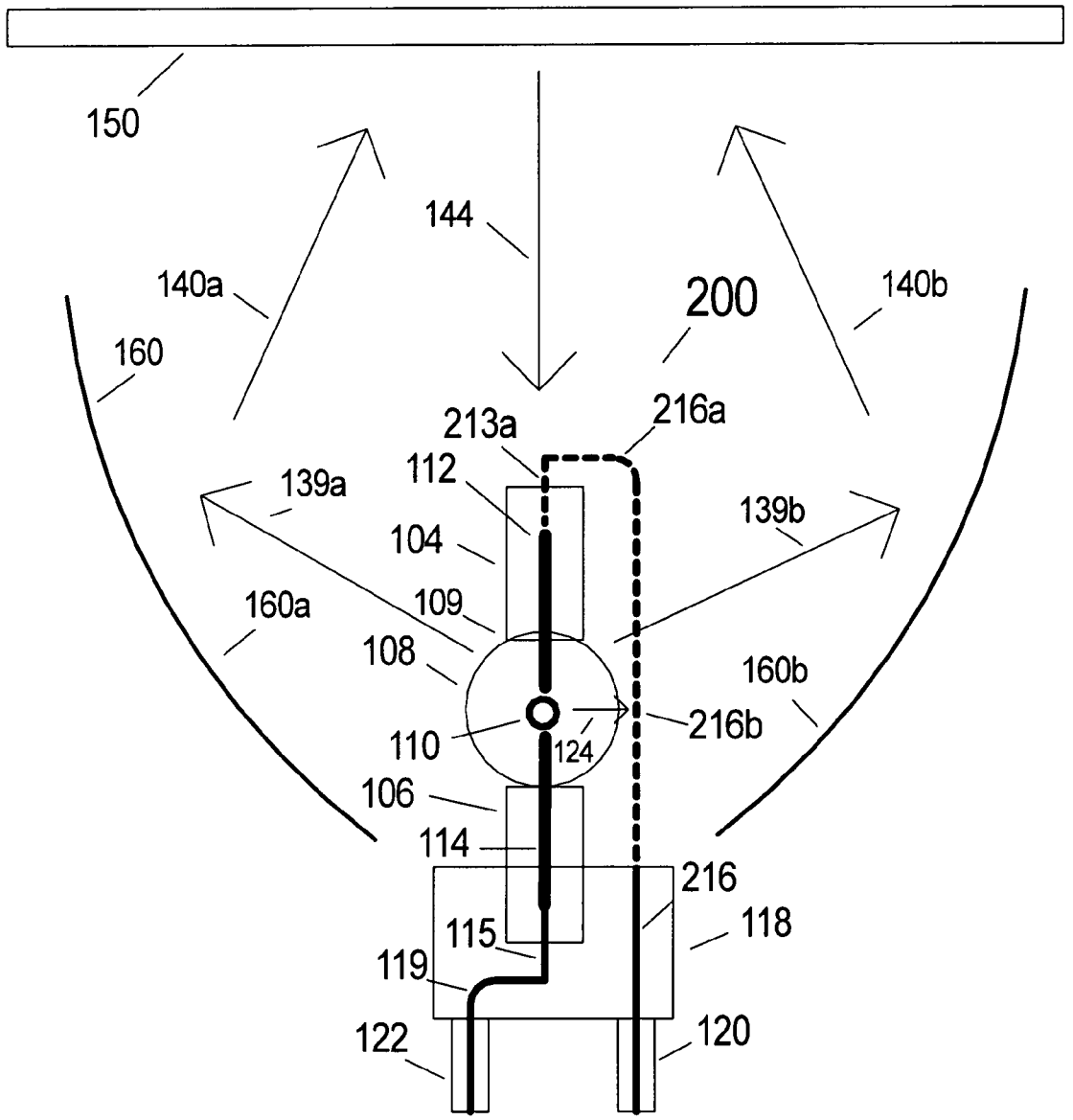


FIG. 2


150
144
140a
200
140b
160
213a
216a
112
139a
139b
104
160a
109
108
160b
216b
110
124
106
114
216
115
118
119
122
120

TEMPERATURE REDUCTION FOR TOP PINCH OF ARC LAMP

FIELD OF THE INVENTION

This invention relates to arc lamps.

BACKGROUND OF THE INVENTION

Arc lamps are glass or quartz vessels that house electrodes that are used to produce an electrical arc for illumination purposes. The vessel is usually filled with a gas such as xenon or mercury. Sometimes various other elements are added to obtain an enhanced color temperature or the electrical arc such as sodium. The electrodes of the arc lamp are usually sealed by pinching the glass or quartz from the vessel around each electrode during a heat sealing process. The area where the electrodes have been sealed by the pinching process is commonly referred to as a "pinch".

It is important during operation of the arc lamp that each pinch not be allowed to rise above a certain temperature. Allowable temperatures for the pinch range from three hundred degrees centigrade to four hundred and fifty degrees centigrade. If the temperature of a lamp pinch is allowed to rise over the highest operating temperature the pinched area can start to oxidize rapidly in the area where the sealing of the electrode takes place. The oxidization of the pinch area at the electrode causes a catastrophic seal leak and can cause the vessel to leak out the filler gas sometime resulting in an explosion. U.S. Pat. No. 3,377,498 to Koury et al describes a high pressure arc lamp, and is incorporated by reference herein. U.S. Pat. No. 3,723,784 to Sulcs et. al. is incorporated by reference herein, and describes a high pressure sodium lamp with "heat reflecting shields surrounding its electrodes". Sulcs describes "Thus the seal temperature and the cold spot temperature can be controlled by adjusting the width of the foil". U.S. Pat. No. 4,721,887 to Inukai et al, incorporated by reference herein, describes a method of creating a pinched arc lamp seal.

It has been found that direct radiation and reflected radiation emitted from the arc created by the arc lamp can be absorbed by the external electrode connecting leads. It is desirable to reduce the absorbed radiation of the external electrode connecting leads in order to reduce the temperature of the lamp pinch.

SUMMARY OF THE INVENTION

A novel means of altering the absorbing properties of the external electrode connecting leads of an arc lamp is disclosed. The electrode leads may be coated with a light reflecting ceramic paste to reduce the absorption of light emitted by the arc.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** shows a simplified diagram of a prior art arc lamp installed in a reflector with light created by the arc lamp being reflected by the reflector towards an optical component; and

FIG. **2** shows a simplified diagram of an arc lamp of an embodiment of the present invention installed in the reflector with light created by the arc lamp being reflected by the reflector towards an optical component with reduced radiation absorption of the external electrode connecting leads.

DETAILED DESCRIPTION OF THE DRAWINGS

In the description that follows, like parts are marked throughout the specification and drawings with the same reference numerals, respectively. The drawing figures are not necessarily to scale. Certain features of embodiments of the present invention may be shown exaggerated in scale or in somewhat schematic form and some details of conventional elements may not be shown in the interest of clarity and conciseness. The present invention is susceptible to embodiments of different forms. There are shown in the drawings, and herein will be described in detail, specific embodiments of the present invention with the understanding that the present disclosure is to be considered an exemplification of the principles of the present invention, and is not intended to limit the invention to that illustrated and described herein. It is to be fully recognized that the different teachings of the embodiments discussed below may be employed separately or in any suitable combination to produce the desired results.

FIG. **1** shows arc lamp **100** of the prior art mounted inside of a reflector **160** with the left half of the reflector shown as **160***a* and the right half of the reflector shown as **160***b*. Reflector **160** may be an ellipsoid or parabolic reflector as known in the art. The arc lamp **100** is constructed of a vessel **109** that may be of clear quartz material. The vessel **109** is comprised of a bulb or globe like structure **108**, an upper pinch **104**, and a lower pinch **106**. The bulb **108** is filled with a gas such as mercury, xenon or other gases. The upper pinch **104** contains an upper electrode **112** connected to an upper external electrode connecting lead **113***a*. The upper external electrode connecting lead **113***a* connects to a top section **116***a* of an upper external electrode connecting lead **116** and connects to a power terminal pin **120**. The lower pinch **106** contains a lower electrode **114** connected to a lower external electrode connecting lead **115**. The lower external electrode connecting lead **115** connects to a lower external electrode connecting lead **119** and connects to a power terminal pin **122**. A lamp base **118** houses the lamp vessel **109** by cementing the lower pinch **115** (cement not shown for simplification) perpendicular to the base **118** as known in the art. The lamp base **118** comprises the power terminal pin **122** that is connected to the lower external electrode connecting leads **115** and **119**. The lamp base **118** also comprises the power terminal pin **120** that is connected to the upper external electrode connecting lead **116**. Fixing one end of the lamp vessel **109** into the lamp base **118** and routing both upper external electrode connecting leads **116** and lower external electrode lead **115** to the lamp base **118** is also known as a single ended lamp as known in the art.

FIG. **1** shows an electrical arc **110** that emits radiation. The radiation may be comprised of visible, ultra violet and infrared radiation. Radiation from the arc **110** is emitted through the clear quartz wall of the bulb **108** in a predominantly spherical pattern as known in the art including the direction shown by arrow **124**. The radiation directed in the direction of arrow **124** is cast upon the center section **116***b* of the upper external electrode connecting lead **116**. The upper external electrode connecting lead **116** is commonly manufactured of tungsten or molybdenum but can be manufactured using a different conductive material. Tungsten or molybdenum are dark materials and thus can absorb visible and infrared radiation to a significant degree. The radiation directed in the direction of arrow **124** is thus absorbed by the center section **116***b* of the upper external electrode connecting lead **116** and causes a rise in the temperature of the upper external electrode connecting lead **116**.

Radiation emitted from the arc **110** is also emitted in the direction of arrow **139***a* that reflects off of the left hand side of the reflector **160***a* in the direction of arrow **140***a*. Radiation emitted from the arc **110** is also emitted in the direction of arrow **139***b* that reflects off of the right hand side of the

reflector **160***b* in the direction of arrow **140***b*. Often an optical device **150** such as a hot mirror that reflects infrared energy is placed in the path of the emitted radiation from the arc **110** as shown by arrows **140***a* and **140***b*. The optical device **150** could also be a lens, a protective window or an integrator as known in the art. The optical device **150** will often reflect some of the radiation that is collected by the reflector **160** from the arc lamp **100** in the direction of arrow **144**. The radiation reflected off of the optical device **150** in the direction of arrow **144** casts itself upon the upper external electrode connecting lead **113***a* and the top section **116***a* of upper external electrode connecting lead **116** and thus raises the temperature of the upper external electrode connecting leads **113***a* and **116**. The upper external electrode connecting lead **113***a* is often made from a metal such as tungsten or molybdenum or another metal that absorbs the radiation reflected from the optical device **150** in the direction of arrow **144**. Absorption of the reflected radiation shown in the direction of arrow **114** by the upper external electrode connecting lead **113***a*, the top section **116***a* of the upper external electrode connecting lead **116** and absorption of the direct radiation shown in the direction of arrow **124** by the center section **116***b* of the upper external electrode connecting lead **116** raises the temperature of the upper external electrode connecting leads **113***a* and **116**. When the temperature of the upper connecting leads **113***a* and **116** are raised the operating temperature of the pinch **104** also rises. This is an undesirable since management of the maximum pinch temperature of the pinch **104** is important for obtaining maximum life time of the arc lamp **100**.

FIG. **2** shows an arc lamp **200** of an embodiment of the present invention. In FIG. **2** all of the like numbered components are the same components of FIG. **1**. However, the upper external electrode connecting leads **116** and **113***a* of FIG. **1** have been replaced by the upper external electrode connecting leads **216** and **213***a* in FIG. **2**. The upper external electrode connecting lead **216** of FIG. **2** may a modified version of the upper external electrode connecting lead **116** of FIG. **1**, wherein the top section **116***a* has been shrouded by a reflective material to form a modified top section **216***a* shown as a dashed line in FIG. **2**, and the center section **116***b* has been shrouded by a reflective material to form a modified center section **216***b* shown as a dashed line in FIG. **2**.

The reflective material used for upper external electrode connecting lead **213***a* and center portion **216***b* of external upper electrode lead **216** may be any material that can significantly reflect the radiation emitted in the direction of arrows **144** and **124**. The center portion **216***b* is the portion of the upper external electrode connecting lead **216** that is shown routed in proximity to the bulb **108**. The reflective shrouding of the modified center section shown as **216***b* of the upper external electrode connecting lead **216** reflects a large portion of the direct radiation in the direction of arrow **124** from the arc **110**. In a preferred embodiment of the invention the reflective material used as a shroud is a ceramic paste that is bright white in color and can withstand a high temperature. The white ceramic paste is coated upon the upper external electrode connecting leads **113***a* and **116**, shown in FIG. **1**, to form upper external electrode connecting leads **213***a* and **216**, shown in FIG. **2** wherever direct or reflected radiation from the arc **110** is cast upon the upper external electrode connecting leads (shown in FIG. **2** by a dotted line area of the upper external electrode connecting leads **213***a*, and sections **216***a*, and **216***b* of the upper external connecting lead **216**. The white ceramic paste acts as a shroud and reflects a large portion of the radiation cast upon the upper external electrode connecting leads **213***a* and **216** thus reducing the temperature rise that the upper external electrode connecting leads **213***a* and **216** would normally conduct to the upper pinch **104**. Reducing the absorption of upper external electrode connecting leads **213***a* and **216** can reduce the operating temperature of the upper pinch **104** by as much as 20 degrees centigrade. The reduction of 20 degrees centigrade at the upper pinch **104** can provide the necessary thermal headroom for improved operation of the arc lamp **200** or allow more power to be applied to the arc **110** and produce a higher output arc lamp **200** over the prior art **100**.

The white ceramic paste is one method of reducing the absorption of the upper external electrode connecting leads **213***a* and **216**. A white ceramic tube may also be used over the upper external electrode connecting leads **213***a* and **216** in the areas where direct and reflected radiation are present to reduce absorption of the direct and reflected radiation. Any radiation reflecting material that reflects the radiation created by the arc **110** may be applied to the upper external electrode connecting lead **113***a* and areas **116***a* and **116***b* or lead **116**, to form lead **213***a*, and areas **216***a*, **216***b*, and lead **216**. Alternatively the upper external electrode connecting leads **213***a* and **216** may be constructed of a conducting material that is also reflective to the energy emitted by the arc **110**.

I claim:

1. An arc lamp apparatus comprising:
a base comprising a plurality of electrical connections;
a vessel comprising:
a plurality of electrodes,
a gas filled bulb,
and a plurality of pinches,
wherein an electrical arc that emits radiation is formed within the plurality of electrodes;
wherein a first pinch of the plurality of pinches contains a first electrode of the plurality of electrodes;
wherein the first pinch is fixed perpendicular to the base;
wherein a second pinch of the plurality of pinches contains a second electrode of the plurality of electrodes not fixed to the base;
wherein the second electrode is connected to an external electrode connecting lead that routes in proximity to the gas filled bulb;
wherein the external electrode connecting lead is shrouded by a reflective material in an area where the external electrode connecting lead is routed in proximity to the gas filled bulb;
and wherein the external electrode connecting lead is located outside of the gas filled bulb, and outside of the first pinch and the second pinch.

2. The arc lamp apparatus of claim **1** wherein
the reflective material is comprised of a ceramic.

3. The arc lamp apparatus of claim **2** wherein
the ceramic is comprised of a ceramic tube placed over the external electrode connecting lead in proximity to the gas filled bulb.

4. An arc lamp apparatus comprising:
a base comprising a plurality of electrical connections;
a vessel comprising:
a plurality of electrodes,
a gas filled bulb,
and a plurality of pinches,
wherein an electrical arc that emits radiation is formed within the plurality of electrodes;
wherein a first pinch of the plurality of pinches contains a first electrode of the plurality of electrodes;
wherein the first pinch is fixed perpendicular to the base;
wherein a second pinch of the plurality of pinches contains a second electrode of the plurality of electrodes not fixed to the base;

wherein the second electrode is connected to an external electrode connecting lead that routes in proximity to the gas filled bulb;

wherein the external electrode connecting lead is shrouded by a reflective material in an area where the external electrode connecting lead is routed in proximity to the gas filled bulb;

wherein the reflective material is comprised of a ceramic; and

wherein

the ceramic is white in color.

5. The arc lamp apparatus of claim **4** wherein

the white ceramic is comprised of a paste that is coated upon the external electrode connecting lead in proximity to the gas filled bulb.

6. An arc lamp apparatus comprising:

a base comprising a plurality of electrical connections;

a vessel comprising:

a plurality of electrodes,

a gas filled bulb,

and a plurality of pinches;

wherein an electrical arc that emits radiation is formed within the plurality of electrodes;

wherein a first pinch of the plurality of pinches contains a first electrode of the plurality of electrodes;

wherein the first pinch is fixed perpendicular to the base;

wherein a second pinch of the plurality of pinches contains a second electrode of the plurality of electrodes not fixed to the base;

wherein the second electrode is connected to an external electrode connecting lead that routes in proximity to the gas filled bulb;

wherein the second pinch contains the second electrode not fixed to the base; and

wherein the external electrode connecting lead is shrouded by a reflective material in the area where the external electrode connecting lead is routed in proximity to the second pinch;

and wherein the external electrode connecting lead is located outside of the gas filled bulb, and outside of the first pinch and the second pinch.

7. The arc lamp apparatus of claim **6** wherein

the reflective material is ceramic.

8. The arc lamp apparatus of claim **7** wherein

the ceramic is comprised of a ceramic tube placed over the external electrode connecting lead in proximity to the second pinch.

9. An arc lamp apparatus comprising:

a base comprising a plurality of electrical connections;

a vessel comprising:

a plurality of electrodes,

a gas filled bulb,

and a plurality of pinches;

wherein an electrical arc that emits radiation is formed within the plurality of electrodes;

wherein a first pinch of the plurality of pinches contains a first electrode of the plurality of electrodes;

wherein the first pinch is fixed perpendicular to the base;

wherein a second pinch of the plurality of pinches contains a second electrode of the plurality of electrodes not fixed to the base;

wherein the second electrode is connected to an external electrode connecting lead that routes in proximity to the gas filled bulb;

wherein the second pinch contains the second electrode not fixed to the base;

wherein the second electrode is connected to an external electrode connecting lead; and

wherein the external electrode connecting lead is shrouded by a reflective material in the area where the external electrode connecting lead is routed in proximity to the second pinch;

wherein the reflective material is ceramic; and

wherein

the ceramic is white in color.

10. The arc lamp apparatus of claim **9** wherein

the white ceramic is comprised of a paste that is coated upon the external electrode connecting lead in proximity to the second pinch.

11. A method comprising

forming an electrical arc that emits radiation within a plurality of electrodes;

wherein a first pinch of a plurality of pinches contains a first electrode of the plurality of electrodes;

wherein the first pinch is fixed perpendicular to a base;

wherein a second pinch of the plurality of pinches contains a second electrode of the plurality of electrodes not fixed to the base;

wherein the second electrode is connected to an external electrode connecting lead that routes in proximity to a gas filled bulb;

wherein the external electrode connecting lead is shrouded by a reflective material in an area where the external electrode connecting lead is routed in proximity to the gas filled bulb;

and wherein the external electrode connecting lead is located outside of the gas filled bulb, and outside of the first pinch and the second pinch.

12. The method of claim **11** wherein

the reflective material is comprised of a ceramic.

13. The method of claim **12** wherein

the ceramic is comprised of a ceramic tube placed over the external electrode connecting lead in proximity to the gas filled bulb.

14. A method comprising

forming an electrical arc that emits radiation within a plurality of electrodes;

wherein a first pinch of a plurality of pinches contains a first electrode of the plurality of electrodes;

wherein the first pinch is fixed perpendicular to a base;

wherein a second pinch of the plurality of pinches contains a second electrode of the plurality of electrodes not fixed to the base;

wherein the second electrode is connected to an external electrode connecting lead that routes in proximity to a gas filled bulb;

wherein the external electrode connecting lead is shrouded by a reflective material in an area where the external electrode connecting lead is routed in proximity to the gas filled bulb;

wherein the reflective material is comprised of a ceramic; and

wherein

the ceramic is white in color.

15. The method of claim **14** wherein

the ceramic is comprised of a paste that is coated upon the external electrode connecting lead in proximity to the gas filled bulb.

16. A method comprising:

forming an electrical arc that emits radiation within a plurality of electrodes;

wherein a first pinch of a plurality of pinches contains a first electrode of the plurality of electrodes;

wherein the first pinch is fixed perpendicular to a base;

wherein a second pinch of the plurality of pinches contains a second electrode of the plurality of electrodes not fixed to the base;

wherein the second electrode is connected to an external electrode connecting lead that routes in proximity to a gas filled bulb;

wherein a second pinch contains the second electrode not fixed to the base;

wherein the external electrode connecting lead is shrouded by a reflective material in the area where the external electrode connecting lead is routed in proximity to the second pinch;

and wherein the external electrode connecting lead is located outside of the gas filled bulb, and outside of the first pinch and the second pinch.

17. The method of claim **16** wherein

the reflective material is comprised of a ceramic.

18. The method of claim **17** wherein

the ceramic is comprised of a ceramic tube placed over the external electrode connecting lead in proximity to the second pinch.

19. A method comprising:

forming an electrical arc that emits radiation within a plurality of electrodes;

wherein a first pinch of a plurality of pinches contains a first electrode of the plurality of electrodes;

wherein the first pinch is fixed perpendicular to a base;

wherein a second pinch of the plurality of pinches contains a second electrode of the plurality of electrodes not fixed to the base;

wherein the second electrode is connected to an external electrode connecting lead that routes in proximity to a gas filled bulb;

wherein a second pinch contains the second electrode not fixed to the base;

wherein the second electrode is connected to an external electrode connecting lead; and

wherein the external electrode connecting lead is shrouded by a reflective material in the area where the external electrode connecting lead is routed in proximity to the second pinch;

wherein the reflective material is comprised of a ceramic; and

wherein

the ceramic is white in color.

20. The method of claim **19** wherein

the ceramic is comprised of a paste that is coated upon the external electrode connecting lead in proximity to the second pinch.

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