# United States Patent [19]

**Makar, Jr.**

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[54] **ELECTRODE FOR ARC DISCHARGE LAMP**


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[52] **U.S. Cl.**..... **313/346 R;** 313/217; 313/218; 313/311; 313/354; 29/25.14; 29/25.17

[51] **Int. Cl.**[2]..... **H01J 1/14;** H01J 19/06

[58] **Field of Search** ..... 313/311, 317, 346, 352, 313/354, 218, 217; 29/25.14, 25.17



[56] **References Cited**

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| | | | |
|---|---|---|---|
| 2,367,579 | 1/1945 | Henry | 313/346 R X |
| 2,375,808 | 5/1945 | Miller | 313/346 R |
| 3,243,635 | 3/1966 | Louden et al. | 313/317 |



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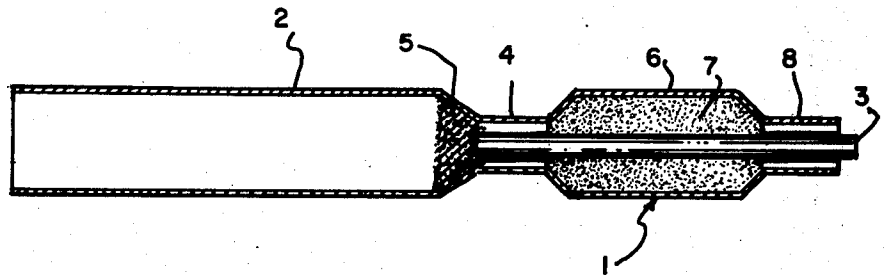
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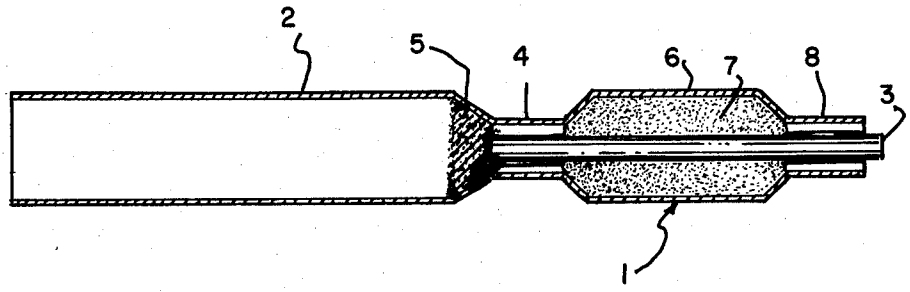


[57] **ABSTRACT**

An electrode for a high pressure sodium arc discharge lamp comprises a refractory metal tube, a portion of which contains electron emissive material. The ends of said portion are crimped to provide a container for the electron emissive material.


**4 Claims, 1 Drawing Figure**




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# ELECTRODE FOR ARC DISCHARGE LAMP

## THE INVENTION

This invention relates to electrodes for high pressure sodium arc discharge lamps.

Such electrodes of the prior art generally comprise a helical tungsten coil mounted on a tungsten rod. A second tungsten coil is threaded onto the first tungsten coil and electron emissive material is disposed between the two coils. Examples of such electrodes are shown in the following U.S. Pat. Nos.: 3,243,635; 3,248,590; 3,448,319; 3,520,039; 3,708,710; 3,723,784.

In arc tube manufacture, the tungsten rod of such electrodes had to be welded to a metal, typically niobium, that could be hermetically sealed to the alumina comprising the arc tube.

It is the purpose of this invention to provide a simpler, less expensive electrode for high pressure sodium lamps.

The single FIGURE in the drawing is a sectional view of an electrode in accordance with this invention.

The manufacture of electrode **1**, in a specific embodiment, comences with a one inch length of 158 mil diameter niobium tubing **2** having a 10 mil wall thickness. First, a 47 mil diameter tungsten rod **3**, one-half inch long, is inserted for almost its entire length into one end of tubing **2** and fastened therein by crimping a 100 mil length **4** of tubing **2** onto the inner end of rod **3**. Length **4** was crimped on rod **3** by means of a circumferential crimping tool, having six equally spaced teeth, surrounding length **4**. The edge of each tooth was a substantially flat surface, about 16 mils wide by 93 mils long, the length thereof running longitudinally with respect to tubing **2**. To crimp the niobium tubing, the teeth of the crimping tool were radially closed on the tubing, thereby pressing it against rod **3** to form crimped length **4**, the cross-sectional shape thereof being somewhat hexagonal. The crimping of the niobium tubing onto rod **3** does not, of course, provide a hermetic seal; however it does close the tubing at crimped length **4** sufficiently to provide a closure for powder that may be poured into either end of tubing **2**.

Tubing **2** is next hermetically sealed at braze **5** by pouring brazing powder, for example, titanium, into the free end of tubing **2** and firing tubing **2**, in a vertical position, in a vacuum or an inert atmosphere sufficiently to melt the brazing powder and hermetically seal the inside of tubing **2** at about the end of rod **3** and crimped length **4**.

Next, electron emissive powder **7**, for example, 115 milligrams of barium calcium tungstate, is poured into the other end of tubing **2**, around rod **3**, and tamped therein to insure complete filling of enclosure **6**.



End **8** of tubing **2** is then crimped, in the same manner as before, to completely enclose powder **7** in enclosure **6**. The end of rod **3** protrudes slightly beyond crimped end **8**, for example, 45 mils, in order to provide an arc striking point during lamp operation.

Electrode **1**, comprising essentially a single length of niobium tubing, is now in condition for sealing into the alumina arc tube of a high pressure sodium lamp by known methods, such as shown in U.S. Pat. No. 3,609,437.

An advantage of the instant electrode, in comparison with prior art tungsten coil electrodes, lies in its flexibility in providing for variations in the quantity of electron emissive powder **7** for use in diverse wattage lamps. Such changes in the quantity of electron emissive powder can be accommodated merely by slight changes in the length and/or diameter of enclosure **6**, which do not substantially change the total mass of electrode **1**. In contrast, similar changes in electron emissive powder capacity for tungsten coil electrodes require substantial changes in the coil geometry, with the result that the appreciable change in the mass of the electrode can cause difficulties in attaining the proper electrode temperature during lamp operation.

I claim:

**1.** A high pressure sodium lamp electrode comprising a length of niobium tubing, a portion of said length forming an enclosure which contains electron emissive material, a tungsten rod extending out of said enclosure and projecting slightly beyond said length of niobium tubing, the interior of said tubing being hermetically sealed at a section thereof intermediate the ends of the tubing.

**2.** The electrode of claim **1** wherein the ends of said enclosure comprise crimped portions of the niobium tubing.

**3.** The electrode of claim **2** wherein said tungsten rod is fastened within said tubing by said crimped portions.

**4.** The method of making a high pressure sodium lamp electrode comprising the steps of: inserting a tungsten rod into a length of niobium tubing so that only a small portion of the tungsten rod axially extends beyond the tubing; crimping an intermediate portion of the niobium tubing into the inner end of the tungsten rod; hermetically sealing the interior of the niobium tubing at about the crimped section thereof; placing electron emissive material within the niobium tubing adjacent the crimped section and within the portion of the niobium tubing that contains the tungsten rod; and crimping the niobium tubing onto the tungsten rod so as to form an enclosure within which is contained the electron emissive material.

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