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[54] **GLOW LAMP WITH NICKEL-PLATED ELECTRODES**

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[52] **U.S. Cl.**..... **313/217**, 313/218, 313/354

[51] **Int. Cl.**..... **H01j 61/06**

[58] **Field of Search**..... 313/210, 217, 218, 313/354

[56] **References Cited**

UNITED STATES PATENTS

1,803,985	5/1931	Walker	313/210
3,238,408	3/1966	Kayatt	313/210

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Assistant Examiner—Darwin R. Hostetter
Attorney—Emil F. Sos, Jr. et al.

[57] **ABSTRACT**

A glow discharge device is provided with nickel-plated steel electrodes. The nickel plating thickness and steel composition vary within certain limits.

3 Claims, 2 Drawing Figures

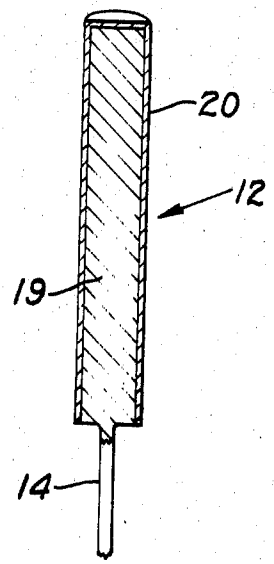


Fig. 1.

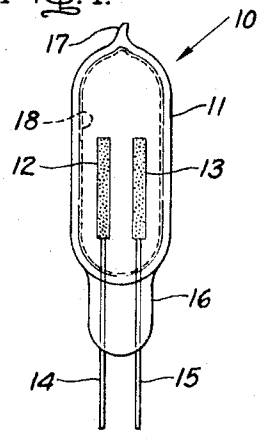
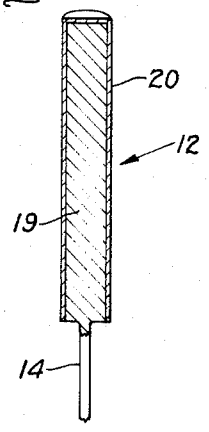


Fig. 2.



GLOW LAMP WITH NICKEL-PLATED ELECTRODES

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates generally to glow discharge devices. More particularly, it relates to electrodes used in the glow discharge device.

2. Description of the Prior Art

The use of solid nickel electrodes is well known in the glow lamp art. One of the disadvantages of using solid nickel as an electrode material is that nickel of any appreciable thickness absorbs various gases. These gases must be removed before the nickel electrode is sealed in the glow lamp device envelope. Degasification of the impurities takes place through the heating of the electrodes and simultaneous evacuation of the glow lamp envelope. Furthermore, the amount of power required to heat the solid nickel electrode during the degasifying is relatively high when compared to a metal such as steel.

In an attempt to alleviate this situation, nickel-plated steel was used as an electrode material. This use is more fully described in Walker U.S. Pat. No. 1,803,985. Although nickel-plated steel electrodes are an improvement over solid nickel electrodes, a certain amount of impurities continued to be present in the electrode. These impurities were a product of the type of steel and the absence of thickness control of the nickel plating.

SUMMARY OF THE INVENTION

It is, therefore, an object of the invention to provide a nickel-plated steel electrode with a minimum of impurities. A further object of the invention is to provide an electrode which requires less degasification processing.

In accordance with one aspect of the invention, a low carbon steel is plated with nickel. The thickness of the nickel is controlled within the range of 0.00005 and 0.0026 of an inch. The minimum thickness gives an operable electrode without burning off the nickel coating, and the maximum thickness of the nickel has a negligible absorption of impurities.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a front elevation of a glow lamp embodying the invention; and

FIG. 2 is an enlarged perspective view partially in section of an electrode of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. 1 of the drawing, a glow lamp **10** is comprised of an envelope **11**, electrodes **12** and **13** and lead-in conductors **14** and **15** which are hermetically sealed in the envelope and pinch seal **16**. After glow lamp **10** is exhausted, it is filled with a gas such as neon, argon, xenon or mixtures thereof and tipped off as shown at **17**. The lamp may also contain a phosphor coating **18** for transforming ultraviolet energy into visible light energy. However, the electrodes of the invention may be used in many types of glow lamps without a phosphor.

As shown in FIG. **2**, electrode **12** is made up of a steel core **19** and a thin film of nickel **20**. The most preferred core material is steel of a high degree of purity such as a low carbon steel having 99.9 percent by weight of iron and 0.015 percent or less by weight of carbon. In lamp processing, it is necessary to degas the electrodes and evacuate the gases from the lamp envelope. This is accomplished by resistance heating the electrodes. One advantage of using steel as the core material as compared to a pure nickel electrode is that it takes approximately one-half the power to heat the electrode. Another advantage of using the preferred steel is that the impurities such as sulfur and carbon are minimized thereby minimizing the possibility of lamp contamination.

Nickel surface **20** is a high purity thin film of nickel deposited by electroplating nickel on the steel core **19**. Unlike a solid nickel electrode which contains many impurities, the plated nickel is of a high degree of purity and smoothness because of the nature of electroplating. Only nickel ions are transferred to the core material thereby leaving behind other impurities and irregularities.

It has been determined that the thickness of nickel surface **20** is critical to the manufacture of an improved nickel-plated electrode. The thickness of coating **20** must be within a range of 0.00005 as a minimum, and 0.0026 inch as a maximum. If the thickness of the plated nickel were less than 0.00005 inch, the nickel would be consumed and deposited upon the bulb wall in a relatively short period of time. This would render the lamp unsatisfactory for operation.

On the other hand, if the plating thickness exceeds the maximum of 0.0026 inch, not only does the electroplating process of the electrode become expensive, the nickel thickness begins to behave as those it were a solid nickel electrode and begins to absorb various gaseous impurities. Consequently, it would be necessary to degas and process the electrode as though it were solid nickel. A preferred range of thickness between the minimum-maximum range is 0.00007 to 0.00009. This range gives the best results; however, other thicknesses within the minimum-maximum range do give an improved electrode.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A glow discharge device comprising a sealed envelope, a fill gas, and a plurality of electrodes wherein the improvement comprises that the electrodes are nickel-plated steel, said steel having an iron content of at least 99.9 percent by weight, and said nickel thickness varying between 0.00005 inch and 0.0026 inch.

2. A glow discharge device as claimed in claim 1 wherein said nickel thickness varies between 0.00007 and 0.00009 inch.

3. A glow discharge device as claimed in claim 1 wherein the carbon content of the steel is in the range of 0.000 percent to 0.015 percent by weight.

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