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ELECTRODE ELEMENTS OF VACUUM TUBES

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Fig. 1

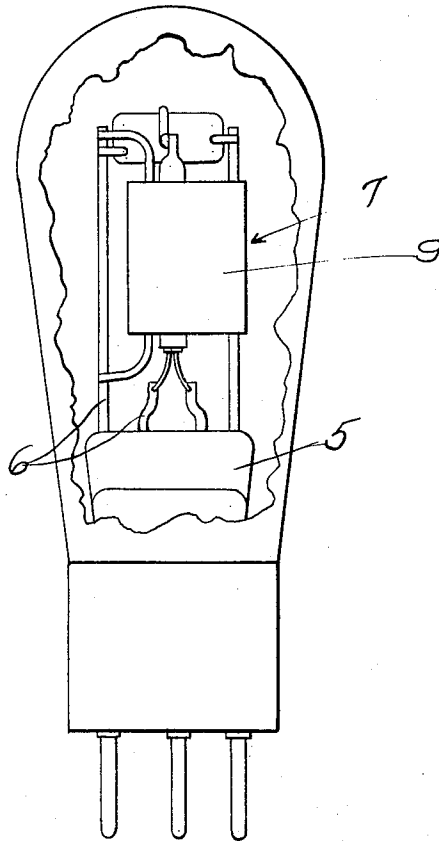
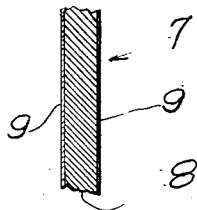


Fig. 2



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ELECTRODE ELEMENTS OF VACUUM TUBES

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4 Claims. (Cl. 250—27.5)

My invention relates to electrode elements of vacuum tubes and particularly to coatings for the anodes or plates of such tubes.

In operating vacuum tubes the plate or anode has a tendency to become heated due to the bombardment of electrons passing from the cathode to the anode. It is therefore, advantageous to provide the anode with a surface which readily radiates heat to maintain the anode at a low temperature. A dark surface on the anode also reduces the secondary emission of electrons from the anode and thus improves the operating characteristics of the tube.

An object of my invention is to provide a new and improved surface for an element of a vacuum tube.

A further object is to provide an anode having a good radiating surface.

A further object is to provide an anode having a surface of low electron emissivity.

Other objects and advantages will be apparent from the description taken with the drawing, in which

Fig. 1 is an elevational view of a vacuum tube of ordinary design having an electrode of my invention.

Fig. 2 is a sectional view of an enlarged fragmentary portion of the electrode.

In accordance with the general features of the invention I provide a plate or other electrode of a nickel silicon alloy and cover the electrode with an oxide coating of the alloy formed by heating the electrode in an atmosphere containing oxygen.

It has been the common practice heretofore, to make the electrodes of vacuum tubes of rolled plate nickel or nickel wire. In order to increase the heat radiation from the electrodes, particularly the anode, the nickel was provided with a carbonized coating. The oxide of nickel is unstable at high temperatures in a vacuum, and therefore, oxidation of nickel anodes has been scrupulously avoided in the past. I have found that by making the anodes of an audion of a nickel silicon alloy and oxidizing the surface of the anode, a surface is obtained which has the requisite characteristics for increasing the heat radiation and preventing secondary emission from the anode. The drawing illustrates the conventional audion with a stem 5 carrying a plurality of supports 6 upon which the elements, including an anode 7, are mounted. As previously described the anode is formed of a nickel silicon alloy 8 and oxidized to provide a thin dark surface coating 9.

The greater portion of the alloy consists of nickel. Silicon should be present in amounts not less than $\frac{1}{2}$ of 1% and not in excess of 6% to 7%. The alloy may contain other ingredients such as manganese, aluminum, zirconium, titanium or vanadium. The manganese has the property of decreasing the content of occluded gas as well as increasing the strength of the alloy. The remaining elements may be used to replace a portion of the silicon. Alternatively, chromium and tungsten may be added in small proportions when it is desired to increase the electrical conductivity of the material.

An anode 7 consisting of a nickel silicon alloy with the variations pointed out above is highly resistant to oxidation. However, upon heating the alloy to a sufficiently high temperature in an atmosphere containing oxygen, or in a pure oxygen atmosphere, the alloy oxidizes, producing a dark surface particularly suited for the anodes of vacuum tubes.

Inasmuch as cobalt behaves in a manner very similar to nickel and may be substituted for nickel in preparing an alloy as described above for use as an electrode of an audion, I considered it the full equivalent of nickel and wish it to be understood that where nickel is referred to in the claims cobalt may be substituted without departing from the spirit and scope of the invention.

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

1. An electrode for an audion consisting essentially of an alloy of nickel and substantially $\frac{1}{2}$ to 7% of silicon and having a coating of an oxide of said alloy.

2. An electrode for an audion consisting of a nickel silicon alloy having substantially 93 to 99½% nickel, the surface of said electrode being oxidized with an oxide of nickel silicon to increase heat radiation.

3. An electrode for an audion consisting of a metallic body and having a surface coating of an oxide of nickel silicon.

4. An anode electrode for an audion consisting of a nickel silicon alloy and having a coating of an oxide of said alloy.

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