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(58) Field of search

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been added from 0.1 to 5 wt% of a
reducing agent such as one or more
of Zr, Si, Al, and Mg. The Ni-W
alloy may contain 10-15 wt.%W.

(54) **Cathode electrode assembly
of an electron tube**

(57) In a cathode electrode assembly
for an electron tube of the type
comprising a cap having an electron
emissive layer thereon and a sleeve
supporting the cap, the sleeve is
made of Ni-W alloy to which has

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SPECIFICATION

Cathode electrode assembly of an electron tube

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This invention relates to an indirectly heated cathode electrode assembly of an electron tube such as a picture tube, and more particularly to an improvement of a sleeve for use in such an assembly for supporting a cap having an electron emissive layer thereon.

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A cathode electrode assembly of the type mentioned is normally with a structure comprising a cap having an electron emissive layer thereon disposed opposite a control grid and an anode, and a cathode sleeve or a sleeve supporting the cap, the sleeve being supported in the tube by suitable members. The present invention is particularly concerned with such a type of cathode electrode assembly wherein the cap is not formed integrally with the sleeve but is secured thereto by welding.

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For such an assembly, a sleeve made of nichrome (Ni-Cr alloy) was popular in consideration of working or machining thereof and heat conductivity characteristic but chromium heated at high temperatures tends to be expelled to evaporate and the sleeve consequently contracts in the longitudinal direction. A typical sleeve (of 1.4 mm ϕ and 6mm in length) shrinks as much as 50 μ m in length in 6,000 hours of operation. The phenomenon increases the spacing between the electron emissive layer and the control grid and creates a problem of degradation in electron emission.

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Thus, a sleeve made of Ni-W alloy, in place of Ni-Cr alloy, having a lower heat conductivity was proposed as in Japanese Patent Publication No. 32458/82, for example.

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The Ni-W alloy solved the problem of contraction which occurred to a sleeve made of nichrome, and additionally the durability against high temperature was enhanced compared with a sleeve made of nichrome. In the process of preparing a Ni-W alloy, however, some tungsten oxide is included and the presence of tungsten oxide causes blowholes in the material, which results in defective rolling. It is, therefore, impossible to obtain a precisely formed sleeve.

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An object of this invention is to provide a cathode electrode assembly for use in an electron tube which can be improved in its precision and heat conductivity to the cap.

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To accomplish the above, according to the invention, there is provided a cathode electrode assembly of an electron tube of the type comprising a cap having an electron emissive layer thereon and a sleeve supporting said cap, said sleeve being made of Ni-W alloy, characterized in that 0.1 to 5 weight percent of reducing metal and/or Si is added to the

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65 Ni-W alloy.

Descriptions of Preferred Embodiment

The invention will now be explained with reference to a preferred embodiment.

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First, powder constituents of Ni, W, ZrHx and Si, W being 10 weight percent (hereinafter abbreviated as wt%), Zr and Si being 0.4 wt%, and Ni being the rest to complete to 100 wt%, are evenly mixed with a ball mill.

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The mixture is then press moulded into a predetermined form and subsequently, sintered by radio frequency induction heating. While being repeatedly annealed, the sintered body is cold rolled into a sheet having a

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thickness of approximately 0.5 mm, and the sheet is further thinned through a known squeezing process, while it is made cylindrical, so that a sleeve having a thickness of 20 to 30 μ m is formed. This way, ZrHx and Si

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which are both reducible metal reduce the surface of tungsten oxide by their cleaning effect, thereby making the sintered body denser. This also materializes such highly desirable effects as that the material for the subsequent rolling workability is greatly improved and that a sleeve of uniform density (without blowholes) is obtainable.

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In the preferred embodiment above, the weight percentage of W is 10 but the contraction of a sleeve can be suppressed to the level of desired values when the weight percentage is preferably with the range of 10 to 15. When the weight percentage is less than 10, however, the heat conductivity increases compared with that of Ni-Cr alloy, and when more

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than 15, the sintered body crumbles and can not be rolled smoothly. As for Zr and Si, it is ascertained that the workability of Ni-W alloy can be improved when the weight percentage

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of each Zr and Si is 0.1 to 5, though preferably 1 to 5. When the weight percentage of each Zr and Si is more than 5, the Ni-W-Zr or Ni-W-Si alloy cannot take the form of solid solution and the form of the sleeve tends to

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be distorted because of segregation of Zr or Si. When the weight percentage of Zr or Si is less than 0.1, the effect can not be sufficient. Further, because the weight percentages of Zr and Si added are minimal, Zr and Si do not

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affect the heat conductivity. In this sense, the alloy is similar to the conventional Ni-W alloy. Besides the reducing metal Zr, Si and the like, Al, Mg and the like can also be used, either singularly or in plurality as in the preferred embodiment.

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Besides the reducing metal Zr, Si and the like, Al, Mg and the like can also be used, either singularly or in plurality as in the preferred embodiment.

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Thus, according to this invention, the contraction of the sleeve can be suppressed since there is no chromium included, which eliminates a variation of the distance between the electron emissive surface of the cathode electrode and the control grid electrode and also the problem of decreased electron emission during the operation of the electron tube, and on account of the addition of reducing metal

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or Si, the workability of rolling for forming a

sleeve can be improved.

Although it is advantageous to form alloys with powders of metals and to sinter the moulded body by radio frequency induction

- 5 heating, other method, for example vacuum melting can also be used.

CLAIMS

1. A cathode electrode assembly for an
10 electron tube comprising a cap having an electron emissive layer thereon and a sleeve fitting into and supporting said cap, said sleeve being made of Ni-W alloy containing from 0.1 to 5 wt% of reducing agent.
- 15 2. A cathode electrode assembly according to claim 1, wherein the reducing agent is at least one of Zr, Si, Al and Mg.
3. A cathode electrode assembly according to claim 1 or claim 2, wherein the W in
20 the Ni-W alloy is of 10 to 15 wt%.
4. A cathode electrode assembly for an electron tube substantially as described herein as a preferred embodiment.

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