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(54) **Method of manufacturing a cathode for cathode ray tubes**

(57) The invention relates to a method of manufacturing cathode skirts of low power electron guns comprising a thermal annealing step in which a realisation step of surface irregularities on the outer face of each skirt is provided, before the said thermal annealing. According to one embodiment of the invention this step comprises a chemical attack of the skirts to treat by annealing.

Applications: Television tubes

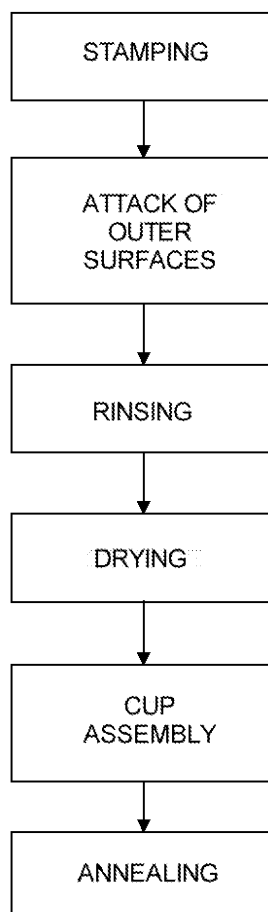


Fig. 2

Description

[0001] The invention relates to a method for manufacturing cathodes for cathode ray tubes and an electron gun obtained by this method. It is notably applicable to low power cathodes in which the sleeve containing the heating filament and its cup are manufactured separately.

PRIOR ART

[0002] Cathodes for electron guns of cathode ray tubes comprise a skirt (or sleeve) designed to contain the heating filament of the cathode.

[0003] In some cathodes, notably in the low power guns, a cup designed to receive the emissive layer of the cathode is fitted on the skirt.

[0004] The skirts have a very low wall thickness. For example, the thickness for NiCr skirts can be less than 18 micrometres at the level of the small diameter of the skirts (cup fitting diameter). Moreover, these skirts, during their manufacture by stamping and drawing out, are cold worked and have smooth outer surfaces that have a very low level of roughness.

[0005] After being shaped, the skirts are annealed at an approximate temperature of 1050°C. Currently, for this annealing operation, the skirts are placed in bulk in a boat. They therefore tend to stick to one another through a mechanism of local sintering. Owing to the low thickness of their wall, it is therefore very difficult to separate them and there is a frequent risk of deforming or even piercing them.

[0006] The purpose of the invention is to resolve this problem.

SUMMARY OF THE INVENTION

[0007] The invention therefore relates to a method of manufacturing cathode skirts of electron guns comprising a thermal annealing step followed by an assembly step for each skirt of a cup designed to bear the electro-emissive zone of the cathode. The method according to the invention comprises, before the said thermal annealing, a realisation step of surface irregularities on the outer face of each skirt.

[0008] This irregularity realisation step preferably comprises a chemical attack step.

[0009] However, this irregularity realisation step can also be carried out by an oxidation step of the outer face of each skirt.

[0010] If the method has recourse to a chemical attack step, this step is preferably performed collectively on a batch of skirts and the chemical attack step is followed by a rinsing step followed by a drying step.

[0011] According to one embodiment of the invention method, the said chemical attack is realised using a solution of hydrochloric acid.

[0012] In this case, the concentration of the said solu-

tion in hydrochloric acid is advantageously between 30 and 37%.

[0013] With such an acid concentration, the hydrochloric acid solution temperature is advantageously between 20°C and 40°C and can thus provide for the chemical attack step to be between 15 and 45 minutes.

[0014] According to one preferred embodiment of the invention the concentration in acid of the said solution of hydrochloric acid is 37%, the temperature of the acid solution is 22°C, and the duration of the chemical attack is 30 minutes.

[0015] According to one embodiment variation of the invention, the said chemical attack can also be realised using a solution of acetic acid and nitric acid.

[0016] According to this embodiment variation, the following volume composition of the said solution can be provided:

- acetic acid: 40%
- nitric acid: 0.2%
- water: 59.8%.

[0017] According to one preferred embodiment of the invention, it can therefore be provided advantageously that the temperature of the acetic acid and nitric acid solution is between 80°C and 110°C, and that the duration of the chemical attack is between 15 and 45 minutes.

[0018] More precisely, it can be provided that the temperature of the acetic acid and nitric acid solution is about 100°C and the duration of the chemical attack step is about 30 minutes.

[0019] Generally, the method according to the invention comprises the following steps:

- chemical attack on the skirts,
- washing the skirts,
- drying the skirts,
- assembling cups on the skirts,
- annealing the skirts.

[0020] The invention is also applicable to an electron gun for cathode ray tubes realised by means of the method thus described.

BRIEF DESCRIPTION OF THE FIGURES

[0021] The different objects and characteristics of the invention will appear more clearly in the description that follows as well as in the annexed figures, wherein:

- figures 1a and 1b, an example of a cathode to which the invention applies,
- figure 2, a diagram of the manufacturing method according to the invention.

DETAILED DESCRIPTION

[0022] Figure 1a shows an example of a skirt of a cath-

ode such as can be found in the art in the low power cathodes. The skirt 1 comprises a widened part 11 for attaching the cathode to the electron gun and a shrunken part 10. As can be seen in figure 1b, the top extremity of the shrunken part 10 is not closed. A cup 2 is therefore provided which is placed on the extremity of the skirt 1 according to the direction of the arrow indicated in figure 1a. This cup is designed to receive the emissive material of the cathode.

[0023] The skirt 1 is manufactured by stamping and drawing out. The diameter of the shrunken part 10 is typically in the order of a millimetre and the thickness of the wall of this part 10 is about 18 micrometres.

[0024] As has been explained above, a batch of skirts thus manufactured is placed in bulk in a boat to undergo annealing at around 1000°C. The skirts then tend to stick to one another. Owing to the small thickness of the walls of the skirts, the skirts have a certain fragility.

[0025] To overcome this disadvantage, the invention thus provides, after the realisation step of the skirts by stamping and before the annealing step, an attack step of the outer surface of the skirts enabling skirts to be obtained having an outer surface presenting sufficient roughness so that the number of contact points between the skirts is reduced when they are placed in bulk in the boat with a view to annealing.

[0026] This attack of the outer surface of the skirts can be carried out by oxidation, by sand blasting or by chemical attack.

[0027] Figure 2 shows the method of the invention using a chemical attack method. According to the invention, after stamping, the NiCr skirts undergo a chemical attack in a bath of acid for a duration comprising between 15 and 45 minutes.

[0028] The method then provides for a rinsing step in a current of deionised water at a temperature of between 60°C and 80°C for a duration of 10 to 30 minutes.

[0029] Next, a drying step at a temperature of between 140°C and 160°C for 4 to 8 hours.

[0030] Cups, such as the cup 2, are assembled on the extremities of the skirts (by laser welding for example).

[0031] One can then proceed with the annealing step of the skirts at a temperature close to or greater than 1000°C.

[0032] According to a preferred embodiment, the acid used is a hydrochloric acid.

[0033] For example the concentration is between 30 and 37% of hydrochloric acid. The temperature of the acid bath in which the skirts are immersed can be between 20°C and 40°C, namely almost at ambient temperature. The period of treatment in an acid bath is approximately between 15 and 45 minutes.

[0034] Preferentially, an HCl acid can be used at a concentration of about 37% and this chemical attack step will be carried out at a temperature close to 22°C for approximately 30 minutes.

[0035] According to one embodiment variation of the method of the invention, a solution of glacial acetic acid,

nitric acid and water is used.

[0036] According to one embodiment, the volume composition of this solution will be as follows:

5 acetic acid: 40%
 water: 59.8%
 nitric acid: 0.2%

[0037] With such an acid solution, the treatment will be carried out at a temperature of between 80°C and 110°C for 15 to 45 minutes.

[0038] Preferentially, the treatment will be carried out at around 100°C (103°C for example) for 30 minutes.

[0039] The chemical attack thus carried out according to the method of the invention enables a sufficient roughness to be reached.

[0040] The measurement of the said roughness accounted for in the present invention is the statistical criterion R_a that represents the arithmetical average deviation from the mean with respect to the mean line of the surface profile.

[0041] Hence, measured according to the ISO standard, an R_a value of at least 0.25 μm will prevent the tendency that the skirts have to stick together when they are undergoing annealing when their surface is not treated.

[0042] The chemical attack nevertheless only moderately reduces the initial thickness of 18 micrometres of the skirts. Typically, up to 2 micrometres at most are lost on the thickness of the skirts.

[0043] It must be noted that the composition of the acid baths, their temperature and the duration of the chemical attack must be optimised in accordance with the invention to prevent the roughnesses from being smoothed by an attack that is too powerful or too long.

[0044] Moreover, after the annealing step, the NiCr is reconstructed and the skirt matt and rough after attack becomes smooth and glossy after annealing.

[0045] The invention method has the advantage of:

- 40 - being reproducible,
- being easily mastered by the adjustment of the duration of the chemical attack,
- of uniformly reducing the thickness of the skirts,
- of not being costly,
- 45 - of having only limited risk for personnel safety.

Claims

- 50 1. Electron gun for cathode ray tube comprising at least one cathode of which the skirt is manufactured in NiCr, **characterized in that** the outer surface of the skirt has a mean deviation of roughness R_a of at least 0.25 μm .
- 55 2. Method of manufacturing cathode skirts of an electron gun in accordance with claim 1, **characterized in that** it comprises a thermal annealing step fol-

lowed by an assembly step for the skirt of a cup designed to bear the electro-emissive zone of the cathode, and a realisation step of surface irregularities on the outer face of each skirt by chemical attack.

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3. Method of manufacturing according to claim 2, **characterized in that** the said realisation step of surface irregularities comprises an oxidation step of the outer face of each skirt.

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4. Method of manufacturing according to claim 2, **characterized in that** the said chemical attack is realised by means of a solution of hydrochloric acid.

5. Method of manufacturing according to claim 4, **characterized in that** the concentration of the said solution in hydrochloric acid is between 30 and 37%.

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6. Method of manufacturing according to claim 5, **characterized in that** the hydrochloric acid solution temperature is between 20°C and 40°C.

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7. Method of manufacturing according to claim 4, **characterized in that** the duration of the chemical attack is between 15 and 45 minutes.

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8. Method of manufacturing according to claim 2, **characterized in that** the said chemical attack is realised by means of a solution of acetic acid and nitric acid.

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9. Method of manufacturing according to claim 8, **characterized in that** the temperature of the acetic acid and nitric acid solution is between 80°C and 110°C, and that the duration of the chemical attack is between 15 and 45 minutes.

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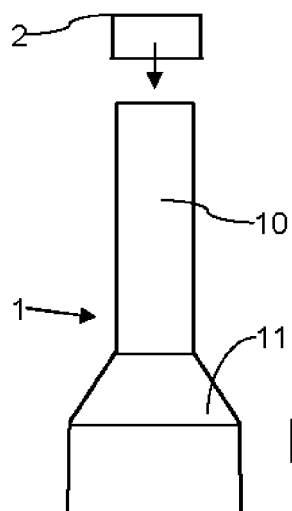


Fig. 1a

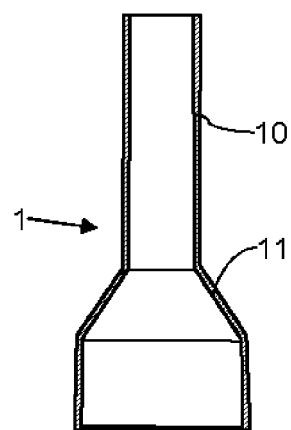


Fig. 1b

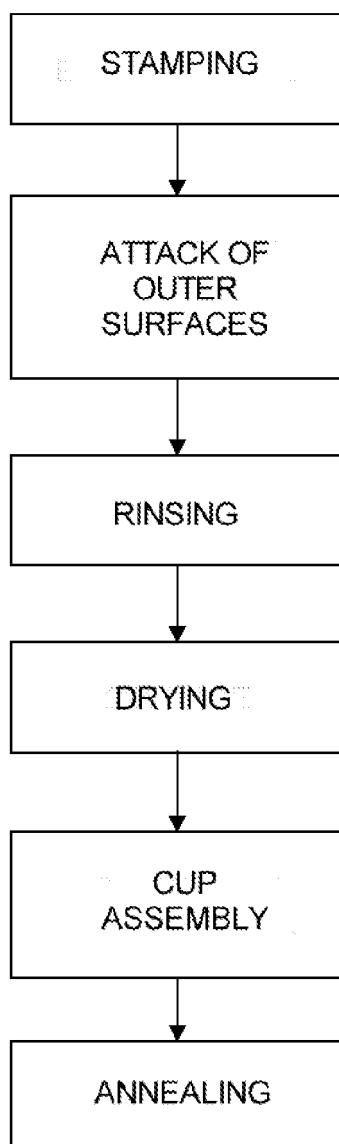


Fig. 2