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METHOD OF MAKING THERMIONIC CATHODES

Original Filed June 6, 1966

FIG. 1

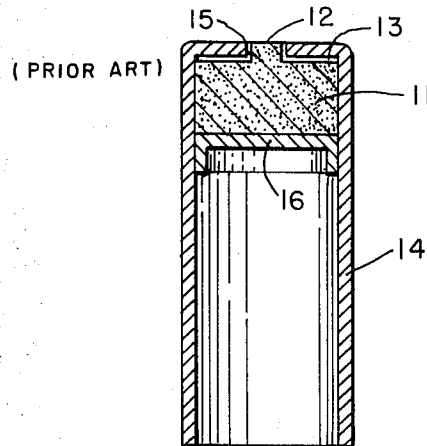


FIG. 2

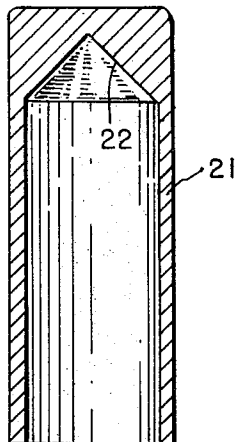
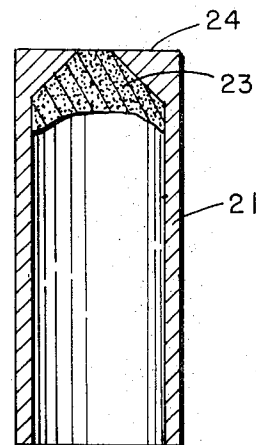


FIG. 3



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ATTORNEYS

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METHOD OF MAKING THERMIONIC CATHODES
Ralph J. Bondley, Scotia, N.Y., assignor, by mesne assignments, to the United States of America as represented by the Secretary of the Army
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3 Claims

ABSTRACT OF THE DISCLOSURE

A method of making a thermionic cathode comprising providing a sleeve that has a constant outside diameter and an inside diameter which is constant throughout the greater portion of the length thereof but decreases at one end thereof to a point, compressing emission material into the one end, sintering the material, and machining the one end of the sleeve to expose the desired area of the emission material.

This application is a division of application Ser. No. 556,813, filed June 6, 1966.

This invention relates to indirectly heated thermionic cathodes and to a method for making the same, and it relates more particularly to a method of making cathodes for producing high intensity, small diameter electron beams for cathode ray display tubes.

In certain cathode ray display tubes a high intensity electron beam having an extremely small diameter is required to give the desired resolution and brightness. It is also desirable to utilize a high efficiency cathode in this type of tube, so that an indirectly heated thermionic emitter is necessary. In this type of tube the conventional barium-oxide-on-nickel cathode will not supply the necessary emission, such as 10 amperes per cm.². Therefore the cathode should be made of a material such as active barium-strontium tungstate mix. The problem encountered in developing such a cathode is largely mechanical in that the final structure must consist of a precise emitting area, such as a 0.010 inch diameter disc, and still contain a heater and a suitable housing to allow accurate mounting to the focusing electrodes.

In the past, attempts have been made to machine the active cathode button from an impregnated tungsten matrix to a 0.045 inch diameter. The end of this button is further machined to provide a 0.010 inch diameter portion extending 0.005 inch above the surface. This button is then assembled inside a refractory metal sleeve. Due to the extremely small size of the parts, accurate positioning of the emitting button inside the sleeve becomes a very difficult and almost impossible manufacturing process.

It is therefore an object of this invention to provide a new and improved method of manufacturing thermionic cathodes having a geometrical configuration which simplifies the construction thereof.

Another object of this invention is to provide a new and improved method of manufacturing cathodes of the type which are used in high resolution cathode ray tubes where the emitting portion of the structure is confined to a very small and well defined area.

These and other objects and advantages of this invention will become apparent from the detailed description of the invention given in connection with the drawings in which:

FIG. 1 shows a cathode constructed according to methods used in the prior art;

FIG. 2 shows a support sleeve as originally machined for use in a cathode according to this invention, and,

FIG. 3 shows a cathode constructed according to this invention.

Referring now to FIG. 1 there is shown a thermionic cathode constructed by a prior art method. The active cathode button 11 is machined from an impregnated tungsten matrix to a diameter of 0.045 inch. The end 12 of this button is further machined to provide a 0.010 inch diameter portion extending 0.005 inch above the surface 13. This button is then assembled inside a refractory metal sleeve 14 so that the end 12 is situated in a hole 15 in the end portion of the sleeve 14 and fastened therein by a clamp 16. Due to the extremely small size of the parts, accurate positioning of the emitting button inside the sleeve is a very difficult and almost impossible manufacturing process.

To permit the use of the tungstate cathode and to simplify the cathode structure, a cathode housing shown in FIGS. 2 and 3 was developed. This housing consists of a sleeve 21 of molybdenum turned and bored to the conical shape 22 as shown in FIG. 2.

FIG. 3 shows the completed cathode. The active barium-strontium tungstate emission mix 23 is compressed in the tapered end of the sleeve, sintered in hydrogen, and finally the end 24 of the sleeve is machined until the closed end is cut away and the desired diameter of the emitting material is exposed. The emitting area is automatically flush with the inactive portion of the sleeve (a requirement for good focus from the gun). It is also firmly bonded to the sleeve to form a rugged mechanical structure free from vibration or poor thermal paths.

It is thus seen that this invention offers practical advantages over known methods in the difficult fabrication of a precise miniature electron source. This invention substitutes precision surface grinding or surface machining of a supported brittle cathode matrix material for unsuccessful methods of contour machining of this brittle material.

What is claimed is:

1. The method of making a thermionic cathode comprising machining a metallic sleeve so that it has a constant outside diameter and an inside diameter which is constant throughout the greater portion of the length thereof but decreases at one end thereof to a point; compressing active barium-strontium tungstate emission mix in said one end of said sleeve; sintering said mix; and machining said one end of said sleeve to expose the desired area of emission mix.

2. The method of making a thermionic cathode as set forth in claim 1 wherein the step of sintering said mix takes place in an atmosphere of hydrogen.

3. The method of making a thermionic cathode as set forth in claim 2 wherein the inside diameter of said sleeve decreases in a conical taper.

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29—25.17, 25.18; 313—346