

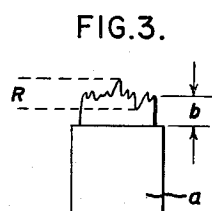
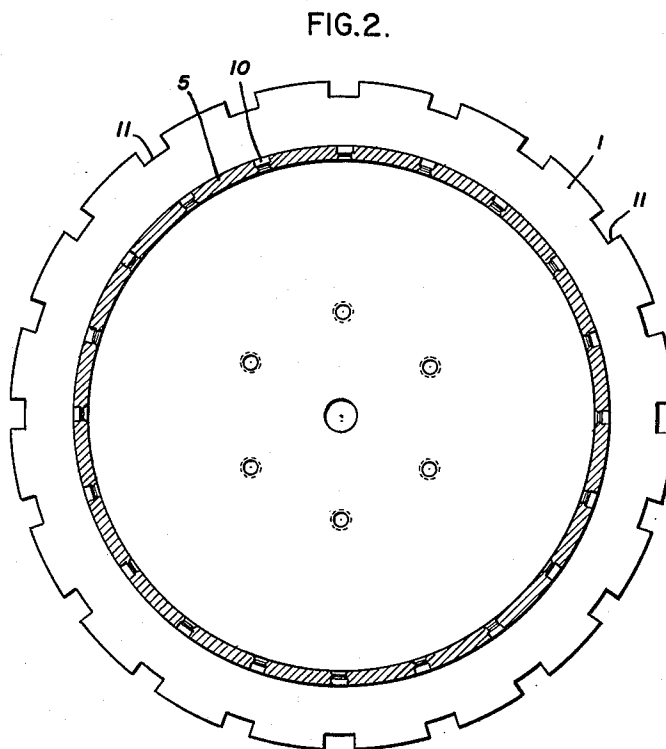
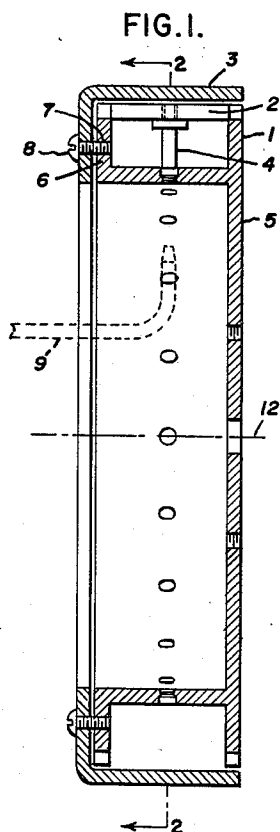
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HANS-JÜRGEN SCHÜTZE ET AL

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METHOD AND APPARATUS FOR MAKING CATHODES

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INVENTORS:  
HANS-JÜRGEN SCHÜTZE,  
HELGA KALLWEIT,  
BY *Robert J. Mooney*  
THEIR ATTORNEY.

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## METHOD AND APPARATUS FOR MAKING CATHODES

Hans-Jürgen Schütze and Helga Kallweit, Ulm (Danube), Germany, assignors to General Electric Company, a corporation of New York

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6 Claims. (Cl. 117-201)

This invention relates to a method of depositing emission material onto the cathode support structure of flat cathodes as well as a device to carry out this method.

It is known that a plane surface for the emissive layer is desirable if one is to manufacture electron tubes with very small spacing between the cathode and other electrodes. Various methods are known for manufacturing such smooth planar coatings; for instance it is known to achieve the smoothing of the surface of the emissive material by mechanical treatment such as by planing or pressing. There also is known a method using sedimentation of the crystallized carbonates upon the cathode carrier and using for the purpose a standard centrifuge. However, this latter procedure is quite uneconomical and costly, and also requires an additional mechanical working-over or cleaning of the cathode since with this method parts of the support structure that are not desired to be coated by emission material are also wetted by the vehicle. Another disadvantage of this centrifuging method is that experiments have shown that cathode coatings using vehicles such as ether, methanol, alcohol, naptha, acetone and standard binders have a very low adherence as compared to cathodes sprayed by standard methods.

To avoid these disadvantages and to obtain smooth surfaces of the emissive coating a system is hereby proposed which according to the invention comprises putting the cathode supports into a centrifuge in such a manner that the surfaces to be coated are always perpendicular to the radius of the centrifuge and that the cathode supports are sequentially sprayed by material while the centrifuge is revolving. This spraying is best done with a conventional spray gun pointing at the surfaces to be coated.

Emissive coatings made by the method of this invention are characterized by an excellent adherence because one can use the conventional formula for emission material of paste-like consistency when using this procedure. Since there are additional centrifugal forces active upon the coatings, one gets quite a smooth surface and besides one gets a very dense layer of coating which results in a long life. Another advantage resides in the fact that with this method there is no wetting of portions of the carrier that isn't supposed to be coated.

Referring to FIGURE 3 of the drawing, the cathode support is *a*, the thickness of the emissive layer is denoted *b*, and the roughness is marked as *R*. In a normally sprayed cathode having *b*=50 microns, the least roughness one can get is about *R*=30 microns. With a wiped cathode one can get a roughness as small as about 10 microns, and with a cathode made according to the present invention one gets down to a roughness of 3 to 5 microns. In addition to the foregoing obvious advantage of the present invention, one should also consider that the second one of the above methods, namely wiping of cathodes, can be used only on cathode structures of rotationally symmetrical shape.

If one uses suitable carbonates the new method of our invention can even produce a roughness of approximately 1 micron. It is also possible to shape the cathode surface in a form of a cup-shape and thereby to further reduce the roughness.

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Apparatus for performing the method of the present invention is shown in FIGURES 1 and 2. FIGURE 1 shows this device in a cross section while FIGURE 2 shows it bisected along the line 2-2 of FIGURE 1.

This equipment consists of a cylinder which revolves around the axis 12 during spraying. This cylinder is marked by reference character 5. At the front face of this cylinder 5 are two flanges 1 and 6 which are notched about their perimeter. The notches are marked by 11. Holders 2 consisting of flat members are inserted into these notches and secured to each of these holders is a pin or mandrel mounted for carrying a cathode structure. This pin is marked as 4. The fixtures 2 and 4 are mounted on the flanges 1 and 6 so that the pins 4 are oriented in line with radial bores 10 in cylinder 5. Consequently a cathode structure stuck on a pin 4 is supported with its front end in a corresponding bore 10 of cylinder 5 and the surface of this cathode structure to be pasted or coated faces radially into the inside of cylinder 5. After the various inserts 2 and 4 complete with cathode structures are attached, a cover plate 3 is placed across the entire assembly and is secured from falling off by a fastener 8. After loading the assembly in this way with the cathodes to be coated, a spray gun 9 is introduced into the cavity of the device and the whole system is made to rotate around the axis 12 at the same time. As will be evident from FIGURE 1, the cylinder 5 is of such a radius that the surface of the cathode structure to be coated is spaced from the rotation axis 12 of cylinder 5 a distance which is many times the dimensions of the cathode surface, so that there is a substantial centrifugal force active upon the coating applied to the cathode. After a few revolutions the cathodes will be further sprayed and following a short time for drying they can be recovered through the cover plate 3.

It will be appreciated by those skilled in the art that the invention may be carried out in various ways and may take various forms and embodiments other than those illustrative embodiments heretofore described. It is to be understood that the scope of the invention is not limited by the details of the foregoing description, but will be defined in the following claims.

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

1. The method of coating the cathode support of a flat cathode with emission material characterized by mounting the cathode support into a centrifuge in such a way that the surface to be coated is at all times substantially perpendicular to a radius pointing at the axis of rotation and in such a way that the surface to be coated is spaced from said axis a distance substantially greater than the dimensions of said surface, and directing a spray of emission material at the cathode support while the centrifuge is revolving, allowing the sprayed emission material to substantially completely dry in place on said support while the centrifuge continues to revolve.

2. The method defined in claim 1 wherein the spraying is done by a spray gun situated within said cylinder and having a nozzle directed in a plane perpendicular to said axis of rotation.

3. Apparatus for coating cathode supports with emission material comprising a rotatable cylinder having a radius substantially greater than the dimensions of the cathode supports to be coated, means associated with said cylinder for mounting a plurality of cathode supports on the interior surface thereof with the surfaces of said supports to be coated facing radially into the inside of the cylinder, and a spray nozzle associated with the rotatable cylinder and directed toward the path of rotation of said supports for ejecting a spray of emission material onto the cathode supports during rotation of the cathode supports.

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4. Apparatus according to claim 3 characterized by having two flanges on the two ends of the cylinders, said flanges having notches for receiving support fixtures for the individual cathode structures.

5. Apparatus according to claim 3 characterized by having two flanges on the two ends of the cylinder, said flanges having notches for receiving support fixtures for the individual structures, said support fixtures including plate members and a perpendicular pin carried by each plate on which the cathode support is adapted to be carried.

6. Apparatus according to claim 3 characterized by

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cathode holder fixtures, said cylinder having apertures in the cylindrical wall thereof opening into the inside of said cylinder, and means on said cylinder for receiving said holder fixtures with the cathode supporting surfaces thereof facing through said apertures.

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