June 11, 1957 D. R. KERSTETTER 2,795,032

ELECTRO DEPOSITED GRIDS FOR CYLINDRICAL TYPE CATHODES

Filed Oct. 12, 1953

Fig. 1

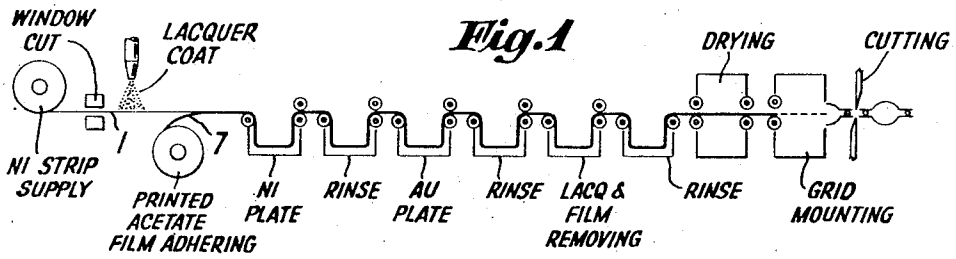


Fig. 2

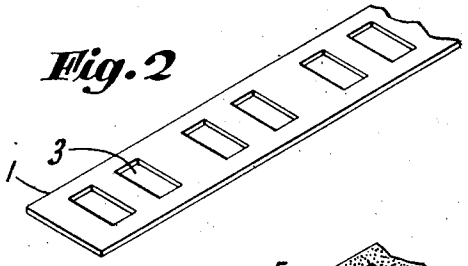


Fig. 3

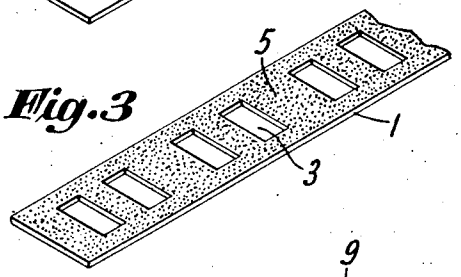


Fig. 4

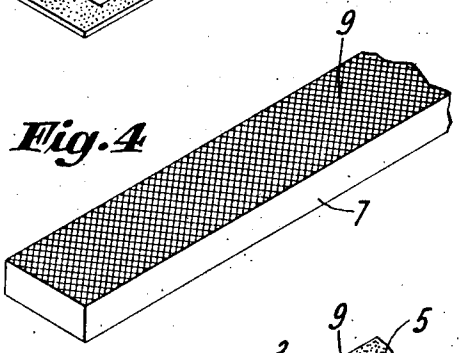


Fig. 5

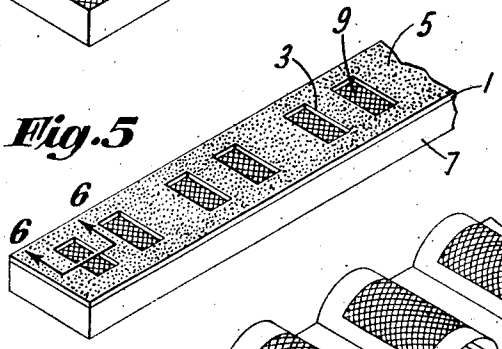


Fig. 6

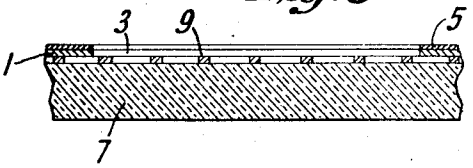


Fig. 7

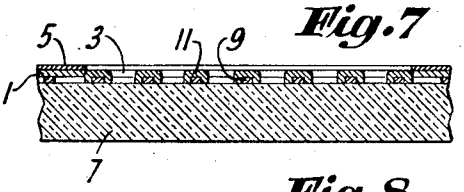


Fig. 8

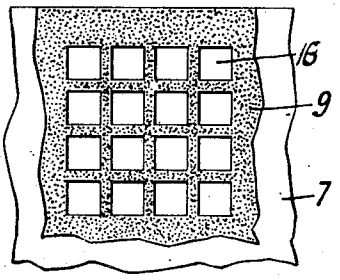


Fig. 9

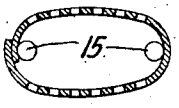
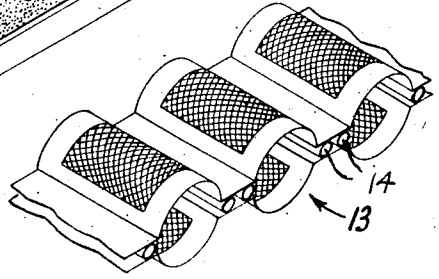


Fig. 10



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ELECTRO DEPOSITED GRIDS FOR CYLINDRICAL TYPE CATHODES

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Application October 12, 1953, Serial No. 385,584

8 Claims. (Cl. 29—25.17)

This invention relates to grids and to the process of making the same.

In the manufacture of radio tubes of very small size, it has been found difficult to make the conventionally wound grids of a size commensurate with the rest of the electrodes in the tube and yet secure the desired electrical characteristics. Particularly in the case of the control grid of a radio tube it has been found difficult to obtain a small sized grid which shall yet have an excellent control function on the electron tube. It is desirable to make the grid small, of fine mesh and very thin to cause the tube to have a high transconductance and to allow for positioning of other electrodes in the tube, all within a very small space.

An object of this invention, therefore, is to provide such a grid.

A further object is to provide a method for forming this grid.

For a full disclosure of the invention, attention is directed to the following description and accompanying drawing, in which:

Fig. 1 is a block flow diagram of a process of making grids in accordance with my invention.

Fig. 2 is a view of metallic strip with windows cut out in which the grid formation is to appear.

Fig. 3 is a similar view after one side of the strip has been lacquered.

Fig. 4 is a view of a film with a metallic design imprinted thereon.

Fig. 5 is a view of the apertured metallic strip lacquered on the top face and covered with the film of Fig. 3 on the lower face, the film having its metallic design on the face exposed through the apertures.

Fig. 6 is a cross sectional view through the laminated structure, taken along the line 6—6 of Fig. 5.

Fig. 7 is a view of the same portion after being subjected to a plating bath.

Fig. 8 is a view of a modified form of grid.

Fig. 9 is a cross section through a grid made in accordance with my invention, and

Fig. 10 is a perspective view of a number of grids during the process of their manufacture.

Referring more in detail to the figures, a continuous strip of metal 1, such as nickel .001" to .002" thick and a width to be the height of the grid in a radio tube, is fed into a stamping machine to have windows such as windows 3 in Fig. 2 formed in the strip. These windows are subsequently to be filled in with a metallic lattice work of a suitable design to exercise the control function of a grid in a radio tube.

The apertured nickel strip is then coated on one side, as the upper surface, with a non conductive coating, such as lacquer 5, to prevent subsequent plating materials from being deposited on that surface.

The opposite surface of the strip, either simultaneously with this coating operation or subsequently thereto, has applied to it a film, such as an acetate film 7, having imprinted thereon an electroconductive lattice work 9

at least over areas which would coincide with the windows 3 in the strip. In the simplest form of my invention, the lattice work appears on the entire face of the film. The film may be made to adhere to the nickel strip in any desired manner as simply by pressing the film hard against the nickel strip, driving out occluded air between the imprinting and the nickel strip or by coating the lower surface of the nickel strip with some form of adhesive.

After the nickel strip has had the lacquer coating and imprinted acetate film associated with it, the laminated structure would appear as indicated diagrammatically in Fig. 5 and in cross section in Fig. 6. The design of the imprintings on the acetate film is then visible through the windows. The laminated strip is then fed slowly through a nickel plating bath, see Fig. 1, the speed of the strip and the current strength being adjusted so as to deposit on the imprinted design appearing in the windows an amount of nickel 11 to bring the same almost to the level of the upper surface of the nickel strip. In this process, also, the electro deposited material bonds in with the adjacent window walls of the nickel strip. If desired the laminated structure may, after passing through a rinse, as a rinsing bath, be passed through further rinsing and plating baths to cause a deposit of gold plate to appear on the nickel deposit lattice work.

After plating the strip as described above, the formed strip is passed through another rinse or rinsing bath to remove the plating solutions, then successively through a lacquer and film removing station or stations whereat the lacquer coating and the acetate film may be stripped off mechanically or by solution or both, another rinse or rinsing bath, a drier, and onto a grid forming machine, for example of the type disclosed in Kershaw 2,064,169 to form series connected grids 13 mounted on support rods 14 which may be cut up into individual grids by cutting the connected grids between pairs of support rods 14, see Fig. 10. If desired the laminated strip may be cut between pairs of windows and the strip bent around support rods 15 as indicated in Fig. 9, with the window portions facing each other.

In Fig. 8, instead of the lattice work being close and of diagonal formation, it is shown as forming large square openings 16, since in some operations a grid work of this type is more desirable than that shown in Fig. 4.

Having thus described the invention, what is claimed as new is:

1. In the method of making grids, the steps of applying to a surface of an apertured metallic strip a layer of material having grid-work conductive design portions exposed through the apertures in the strip, and plating the so exposed portions to build up the level of the design to a desired thickness in the strip and to bond the plating to the strip.

2. In the method of making grids, the steps of applying to a surface of an apertured metallic strip, a non conductive supporting layer having a conductive grid-work design on one surface, with the design exposed through the apertures in the metallic strip, and plating the design areas exposed through the apertures to build up a grid-work in the apertures and bond the grid-work to the metallic strip.

3. In the method of making grids, the steps of applying to a surface of an apertured metallic strip, a non conductive supporting layer having a conductive grid-work design on one surface, with the design exposed through the apertures in the metallic strip, plating the design areas exposed through the apertures to build up a grid work in the apertures and bond the grid-work to the metallic strip, and removing the non conductive portion of the supporting layer.

4. In the method of making grids, the steps of apply-

ing to a surface of an apertured metal strip, an acetate film having a conductive grid-work design exposed through the apertures in the metal strip, plating the so exposed grid-work, said plating effecting bonding of the grid-work to the adjacent walls of the strip, and removing the acetate film from the nickel strip while leaving the grid-work in the metal strip.

5. In the method of forming grids, the steps of applying an non conductive coating to a surface of an apertured metallic strip, applying a second non conductive supporting layer to the opposite surface of said strip, said layer having on its surface a grid-work design of conductive material with the conductive material exposed through the apertures in the metallic strip, plating the design areas exposed through the apertures to build up a grid-work in the apertures and bond the grid-work to the metallic strip, and removing the non conductive portion of the supporting layer.

6. In the method of making grids, the steps of applying to one surface of an apertured strip a non conductive film bearing a conductive imprint thereon of a grid-work design, with the design exposed through the apertures, plating the so exposed design to build up the thickness of the conductive imprint to substantially the upper face of the metallic strip and to bond the plated material to the strip, and removing the film to leave the grid-work design as an integral portion of the strip.

7. In the method of making grids, the steps of applying a non conductive coating to one surface of an apertured conductive strip, applying a non conductive film bearing a conductive grid-work imprint thereon to the other surface of the strip, with the imprint exposed through the apertures, plating the so exposed imprint to build up the thickness thereof as a grid-work to substantially the upper face of the metallic strip and to bond the plated material to the strip, and removing the film to leave the grid-work as an integral portion of the strip.

8. In the method of making grids, the steps of applying a non conductive coating to one surface of an apertured conductive strip, applying a non conductive film bearing a conductive imprint thereon to the other surface of the strip, with the imprint exposed through the apertures, plating the so exposed imprint to build up the thickness thereof as a grid-work to substantially the upper face of the metallic strip and to bond the plated material to the strip, and removing the non conductive coating and film to leave the grid-work as an integral portion of the strip.

No references cited.