

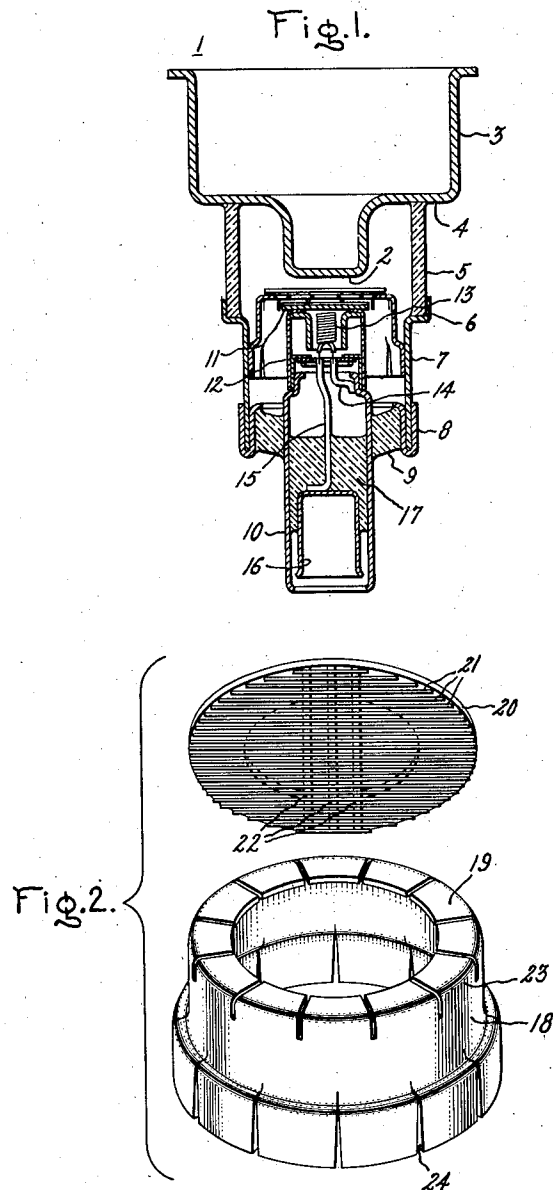
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GRID STRUCTURE FOR ELECTRIC DISCHARGE DEVICES

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GRID STRUCTURE FOR ELECTRIC DISCHARGE DEVICES

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My invention relates to improved grid structures for electric discharge devices and particularly to improved planar grid structures which are not deformed out of their normal plane during operation of the device.

In electric discharge devices designed for high frequency operation, it is important that the electrodes maintain their spacings during operation, otherwise the circuits associated with the electrodes become detuned and adjustments must be made to compensate for changes in capacity resulting from movement of the electrodes, particularly the grid. In a particular application utilizing a planar electrode tube and operating at 1900 megacycles a change in the grid-anode spacing of the order of .00025" is sufficient to cause undesirable detuning of the circuits. The electrical characteristics of the tube, such as the mutual conductance, and amplification factors are also changed by changes in electrode spacing. This variation in characteristics with temperature are undesirable. In accordance with an important feature of my invention, I provide an improved grid structure having greater positional stability than those of the prior art.

It is an object of my invention to provide a new and improved grid structure for electric discharge devices which provides positional stability of the grid during operation of the device.

It is another object of my invention to provide an improved planar grid construction in which stresses produced by thermal expansion are relieved in a direction parallel to the plane of the grid.

It is a still further object of my invention to eliminate the bowing of the grid structure resulting from the unequal expansions with temperature of the components of the grid.

Further objects and advantages of my invention will become apparent as the following description proceeds reference being had to the accompanying drawing in which Fig. 1 is an elevational view in section of an electric discharge device incorporating a grid structure embodying my invention; and Fig. 2 is an enlarged exploded view illustrating the details of construction of the grid employed in the device of Fig. 1.

Referring now to the drawing, I have shown my invention incorporated in the grid structure of an electric discharge device including an anode member 1 preferably formed of steel or nickel-iron which has been coated with a good conducting material such as copper or silver. The anode includes a planar active portion 2 of relatively small diameter in a cylindrical skirt por-

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tion 3 of relatively large diameter, these portions being connected by a disk-like portion 4 to which an insulating cylinder 5 is sealed. The other end of the cylinder 5 is sealed to an outwardly extending flange 6 formed on the upper end of a metal cylinder 7 which forms a portion of the envelope of the device, and as will be described at a later point, provides a support for a grid structure embodying my invention. The lower end of the metal cylinder 7 is received with a solder trough 8 sealed to the outer edge of a glass ring 9. The inner edge of the ring 9 is sealed to the outer cylinder 10 of a unitary cathode assembly which is of the type described and claimed in the copending Beggs application, Serial No. 522,097, filed February 12, 1944, now Patent 2,445,993, and assigned to the assignee of the present invention. The cathode proper is a disk-like member 11 supported from the sleeve 10 by thin metal cylinder 12 having reasonably good electrical conductivity and forming a heat transfer connection of relatively low thermal capacity. The cathode surface 11 is adapted to be heated by an element 13 supported adjacent the surface 11 by a pair of lead-in conductors 14 and 15. The conductor 14 is bonded to the conducting sleeve 10 which provides an externally accessible terminal for the cathode and one side of the heater. The other heater conductor 15 is connected with a thimble-like terminal 16 which is sealed concentrically within the cylinder 10 by a body of glass 17.

In accordance with an important feature of my invention, I provide an improved grid structure which is particularly suited for use in devices of the construction just described. It will be apparent, however, that in its broader aspects that the invention is applicable to discharge devices having substantially different construction. Referring now to the drawing and particularly to Fig. 2, the grid construction includes a supporting sleeve 18 of generally cylindrical construction and is provided with an inwardly directed flange 19 at its upper end. The grid or control electrode proper is provided by a grid washer 20 to which a plurality of grid wires 21 are brazed. The wires as illustrated extend in parallel and equally spaced relation across the central opening of the grid washer. In order to maintain the temperature of all of the grid wires substantially uniform and to prevent the formation of localized heating of any one of the wires, I provide a plurality of wires 22 extending transversely with respect to the other grid wires 21 and brazed to the grid washer 20. While various materials

may be employed for the components of the grid structure in accordance with considerations well-known to those skilled in the art, I have found that the sleeve 18 may to advantage be formed of iron and the washer 20 and the grid wires 21 and 22 formed of tungsten or one of the other refractory metals. With such a combination of materials, having as they do unequal temperature coefficients of expansion, considerable difficulty has been experienced with variations in the electrical characteristics of the tube and after considerable experimentation these difficulties have been traced to the movement of the grid relative to the other electrodes of the device as a result of a bow of the grid in a direction normal to its plane. This action has been found to occur when the grid washer 20 is welded or otherwise secured directly to the inwardly directed flange 19 unless some precaution is taken. I have found that this movement of the grid in a direction normal to the plane of the grid is substantially eliminated by slotting the inwardly directing flange and the upper edge of the sleeve 18 as illustrated at 23. The slotting, in effect, divides the flange and the upper portion of the grid support into a plurality of sections which may be flexed in a radial direction and in this way relieve the strain that otherwise results from the unequal expansion of the tungsten and iron parts involved in the particular structure described above. This structure in combination with the wires 22 which prevent sagging or buckling of individual grid wires due to excessive localized heating cooperate to produce a grid structure which remains in a substantially fixed position during operation of the device with variations in temperatures with the result that once the circuit with which the device is utilized is tuned, no undesirable detuning as a result of shifting of the electrode spacing is encountered and the electrical characteristics of the tube remain as desired. The grid sleeve 18 is preferably slotted at its lower end as shown at 24 to temporarily position the grid structure in the sleeve 7 of the envelope while the spacing of the grid and anode is adjusted. The sleeve 18 is then welded in position.

While a particular embodiment of the invention has been shown and described, it will be obvious to those skilled in the art that changes and modifications may be made without departing from the invention in its broader aspects, and it is, therefore, the aim in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of this invention.

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

1. A grid structure for electric discharge devices including a metal sleeve having an inwardly directed flange, a plurality of spaced slots extending through said flange and the adjacent side wall of said sleeve, an apertured disk of metal

having a different temperature coefficient of expansion than said sleeve, and a plurality of wires bonded to said disk, said disk being bonded to said inwardly directed flange.

2. A grid structure for electric discharge devices including a conducting sleeve having an inwardly directed flange, a plurality of spaced slots extending through said flange and the adjacent side wall of said sleeve, an apertured disk of metal, a plurality of wires bonded to said disk and extending across said aperture, said disk being bonded to said inwardly directed flange.

3. A generally planar grid structure comprising a conducting support having a flange portion extending in the direction of the plane of the grid and a supporting portion extending at substantially right angles to said flange portion, said support having a plurality of slots extending through said flange portion and the adjacent supporting portion, a plurality of grid wires having a different temperature coefficient of expansion than said conducting support joined to said flanged portion, said slots providing sufficient flexibility of said support in a radial direction to prevent deformation of said grid wires in a direction perpendicular to the plane thereof.

4. A planar grid structure comprising a conducting support having a plurality of distinct flange sections extending generally in the plane of the grid, an apertured metal plate, a plurality of grid wires bonded to said plate and extending across the aperture, said plate being bonded to said flange portions, said sections providing sufficient flexibility in a radial direction to prevent distortion of the wires out of their normal plane due to differences in expansion with temperature changes of said wires, plate and support.

5. A grid structure for electric discharge devices including a conducting support having an inwardly directed flange defining an opening, a plurality of spaced slots extending through said flange and the adjacent side wall of said sleeve, a plurality of wires joined to said flange and extending across said opening, said slots dividing said sleeve into a plurality of sections having sufficient flexibility in a radial direction to relieve the strain produced by the unequal expansion with temperature of said wires and sleeve.

6. A grid structure for electric discharge devices including a metal sleeve having an inwardly directed flange defining an opening, a plurality of spaced slots extending through said flange and the adjacent side wall of said sleeve, a plurality of wires joined to said flange and extending across said opening, said slots dividing said sleeve into a plurality of sections having sufficient flexibility in a radial direction to relieve the strain produced by the unequal expansion with temperature of the sleeve and said wires.

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No references cited.