Feb. 9, 1943. C. M. WHEELER 2,310,822

GRID CONSTRUCTION

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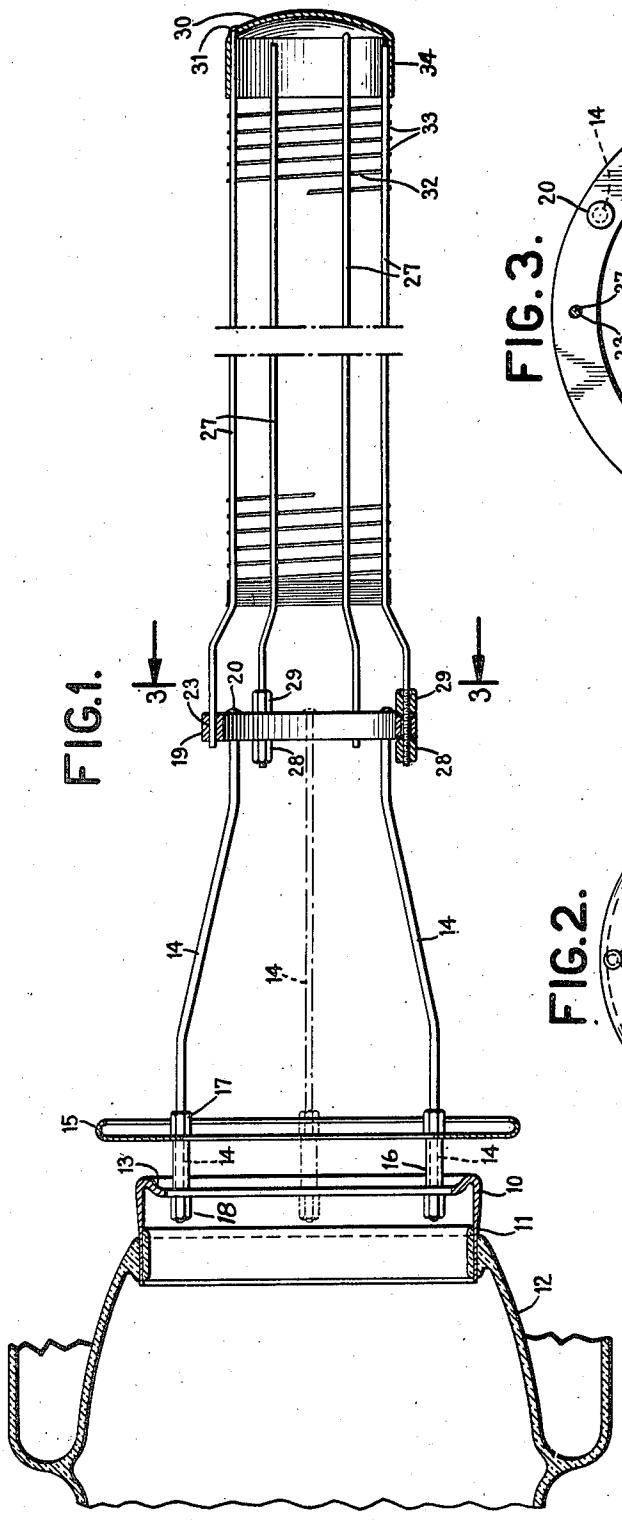


FIG. 1.

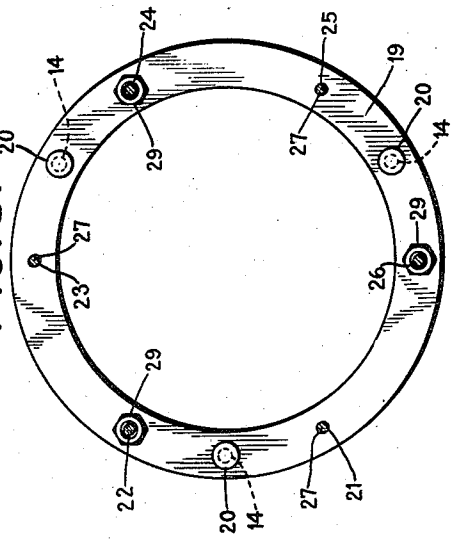


FIG. 3.

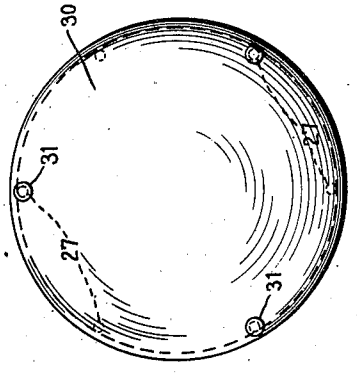


FIG. 2.

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GRID CONSTRUCTION

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8 Claims. (Cl. 250—27.5)

This invention relates to vacuum tube electrodes, and particularly to grid-like electrodes.

The object of my invention is to provide a grid-type electrode construction which permits easy assembly and which will not readily warp and deform under changes of temperature.

It has been customary to construct grid or grid-like electrodes by attaching wire helices or equivalent meshes to supports which are mounted in a suitable manner in the tube. It has commonly occurred that heat developed within the tube during operation has been unsymmetrically distributed throughout the grid structure so that the structure would become deformed and moved out of its proper position within the tube. In accordance with my invention, there is provided an assembly of the supports and grid arranged to minimize the tendency toward the physical distortion.

The invention will be understood from the following detailed description and accompanying drawing, of which

Fig. 1 shows a longitudinal mid-section of a grid-like electrode construction in accordance with this invention:

Fig. 2 is an end view of the structure of Fig. 1; and

Fig. 3 is an enlarged cross section view taken at line 3—3 of Fig. 1.

The drawing illustrates an electrode which may be used as a control grid or screen electrode in a vacuum tube. The electrode may be normally centrally located within a tube, and may be mounted on a metallic base member 10 having a thin cylindrical collar portion 11 sealed to a re-entrant part of a glass envelope 12, the glass envelope being only partially shown. There is formed from the collar of the base member 10, a flat ring portion 13 of sufficient width to receive supporting rods 14 through holes in the ring 13. The supporting rods 14 also pass through suitable holes in an annular ring member 15 which is spaced from ring 13 by spacing sleeves 16 placed over the rods. The ends of the rods are threaded so that nuts 17 and 18 may be turned to tighten the rings 13 and 15 against sleeves 16.

The opposite ends of supporting rods 14 are passed through an annular ring 19 to which they are fastened, as by welding, at 20. The ring 19 is provided with a plurality of holes other than the holes through which rods 14 pass. There are shown six such holes 21, 22, 23, 24, 25 and 26, through which the corresponding number of grid supporting rods 27 pass. The number of holes and rods is not critical, but the six rods used herein is a satisfactory number. The three rods 27 which are passed through the three alternate holes 22, 24 and 26 are threaded, and the portions of the ring 19 around the holes through which these three rods pass are rounded out on both surfaces of the ring to form spherical sockets for spherical ended nuts 28 and 29, as shown in Fig. 1, so that the cooperating surfaces of the nuts will fit in the sockets. The holes 22, 24 and 26 are made of sufficiently larger diameter than the rods 27 to provide a substantial clearance from the rods passing through them so that the rods may have considerable leeway of movement in the holes, and the nuts may be tightened down to seat with the rods in any desired position within their range of adjustment.

The other three rods 27 are passed through the remaining alternate holes 21, 23 and 25 which are made to provide a slide fit for the rods. The opposite ends of these latter three rods 27 are passed through a cap 30, to which they are fastened as by welding at 31. The rods are dimensioned so that when the three rods fixed to the cap at 31 are slid through holes 21, 23 and 25, the other three rods which are fastened by nuts 28 and 29 to the ring 19, do not quite reach the cap 30, but lie within the inside of the collar 34 thereof. In assembling the grid, the grid supporting rods 27 will generally be placed in their proper relative positions in a suitable holding device, and the grid element, shown in the form of a wire helix 32 will then be wrapped around the rods and suitably attached to the rods at its points of contact therewith. A very satisfactory way of attaching the grid wire 32 to the rods 27 is by a "notch and swedge" arrangement. According to this method the rods 27 are first suitably notched along their outside surfaces at the points where the grid wire is intended to be placed. Then, when the grid wire is wrapped around the rods it is placed in these notches. The fastening may then be accomplished by again notching each rod at each side of each grid wire so as to knock a small burr of the rod metal against the grid wire in the notch. Another suitable method of attaching would be to spot weld the grid wires at their points of contact with the rods.

After the rods 27 and helix 32 are thus assembled, the rods may be placed through their respective holes in ring 19, and the nuts 28 and 29 may be applied to the three rods shown in a preliminary manner without tightening them. With the grid in this position the cap 30 may be brought into position and welded to the ends of the other three rods 27 as shown in Fig. 2. This

attachment of the three rods 27 to cap 30 need not necessarily be made by welding, as it might be done by strapping or otherwise suitably fastening them. The three rods 27 which are attached to ring 19 by the nuts 28 and 29 need not necessarily touch the inside of collar 34 as the principal requirement is that there shall be no binding of these three rods against the cap or its collar. In this condition, the grid structure is properly adjusted with reference to the supporting ring 19 so that the grid will properly lie in its desired position; and if necessary the grid may be given whatever slight tilt, relative to the supporting ring, may be found necessary; and the proper adjusting is readily accomplished by manipulation of nuts 29 followed by tightening of nuts 28. The ball and socket construction of nuts 28 and 29 and the cooperating ring member 19 permit the desired adjustment to be made without putting any strain on any of the grid rods, as the nuts will seat without producing strain in any desired position of a rod 27 relative to ring 19 within the range of adjustment permitted by the clearance of the hole through which the rods pass. After being thus adjusted the grid structure may be attached to base member 10 by the nuts 18.

In the construction used, the grid structure is supported from the ring 19 by the three rods secured to the ring by the nuts; the other three rods 27 which merely slide through the ring, are supported only by the grid wire attached to all the rods 27; and the cap 30 is in turn supported at only the three points of attachment of the last-mentioned three rods 27. This supporting construction has been found to afford the desired freedom from deformation or tilting of the grid structure as a whole, under conditions of non-uniformity of temperature in the different parts. The grid is ordinarily placed within a vacuum tube around a centrally located hot cathode which heats all the part of the grid. Due to local conditions, some of the rods 27 are likely to become somewhat hotter than others and thus expand a little more. The construction used herein permits the rods to expand nonuniformly as individual rods without tilting the grid, because a greater expansion of one rod will not strain the next rod which may not expand quite as much, inasmuch as said next rod is not fixed to the same member 19 or 30. For example, an excessive expansion of a rod which is fastened to ring 19 by the nuts will not tend to tilt the cap 30 because the rod will simply elongate within the collar 34 of the cap. Likewise an excessive expansion of a rod which is attached to cap 30 will simply cause such rod to protrude a little further through its clearance hole in ring 19 without tilting the cap. Thus, while the several rods 27 may elongate and contract relative to each other, there will be no change in the position of the grid structure as a whole relative to its supporting ring 19 or a cathode placed within it, and the only change may be a slight displacement of some side of the grid helix, which is of little importance.

It will be further understood that the rods fastened to ring 19 need not necessarily reach the collar 34, and the rods which are welded to cap 30 need not necessarily reach to the ring 19, as the attachments of the grid helix to the rods is sufficient to keep the structure in position. Some additional security from damage is doubtless afforded, however, by extending all the rods from within the collar 34 to a sliding engagement with ring 19, as shown.

What is claimed is:

1. A vacuum tube grid construction comprising a plurality of grid rods extending between a supporting annulus and a collar member, a grid wire fastened to said rods, some of said rods being fastened to said annulus and movable relative to said collar, and other of said rods being fastened to said collar member and movable relative to said annulus.

2. A vacuum tube grid construction comprising a plurality of grid rods extending between two supports, at least one of said supports being annular in shape, supporting means for holding said annular support, some of said rods being fixed to said annular support and slidably related to the other support, and other of said rods being fastened to said other support and slidably fitted through said annular support.

3. A vacuum tube grid construction comprising a plurality of grid rods, a threaded end portion on each of said rods, a grid attached to said rods, a supporting member for said grid provided with holes, said holes being rounded out at each end, and adapted to fit loosely over the threaded end portions of said rods, a pair of nuts for each rod having rounded faces, said nuts being screwed on said rods on opposite sides of said supporting member with their rounded faces extending into the rounded out holes in said support, whereby the position of said grid may be adjusted in reference to said support.

4. A vacuum tube grid construction comprising a plurality of grid rods, a threaded end portion on each of said rods, a grid attached to said rods, a supporting member for said grid comprising a flat ring-shaped member provided with holes adapted to fit loosely over the threaded end portions of said rods, means for adjustably securing said grid to said supporting member comprising a pair of nuts provided with rounded faces screwed on each rod so as to engage with their rounded faces the opposite sides of said member, and a complementary recess formed around each end of said holes to receive the rounded faces of said nuts.

5. A vacuum tube grid construction comprising a plurality of grid rods, a threaded end portion on each of said rods, a grid attached to said rods, a supporting member for said grid comprising a flat ring-shaped member provided with holes adapted to fit loosely over the threaded end portions of said rods, means for adjustably securing said grid to said supporting member comprising a pair of nuts screwed on each rod so as to engage opposite sides of said member, other grid rods disposed between the first-mentioned grid rods also secured to said grid, said supporting member being provided with holes for slidably supporting an end portion of each of said other grid rods.

6. A vacuum tube construction according to claim 5 in which a cap member is provided for supporting the opposite ends of said other grid rods, said grid rods being secured to said cap member in spaced relation.

7. A vacuum tube construction according to claim 5 comprising a second supporting member secured to the tube envelope, and means for supporting the first mentioned supporting member comprising a plurality of supporting rods secured thereto, and means for securing said rods to said second supporting member.

8. A vacuum tube construction according to claim 5 comprising a second supporting member secured to the tube envelope provided with a plurality of holes and means for adjustably supporting the first-mentioned supporting member comprising a plurality of rods secured at one end in spaced relation to the first mentioned supporting member, a threaded portion at the opposite ends of said rods adapted to enter the holes in said second supporting member, and nut means on said threaded portion of said rods for adjustably securing said rods to said second supporting member.

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