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GRID STRUCTURE FOR VACUUM TUBES AND THE LIKE

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Fig. 1.

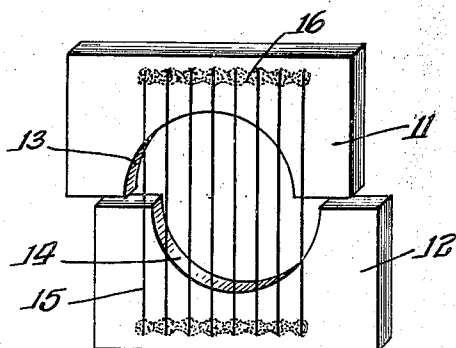


Fig. 2.

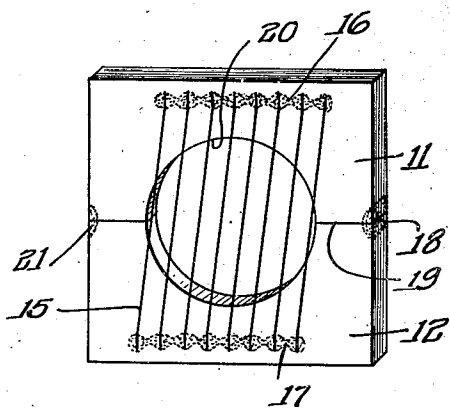
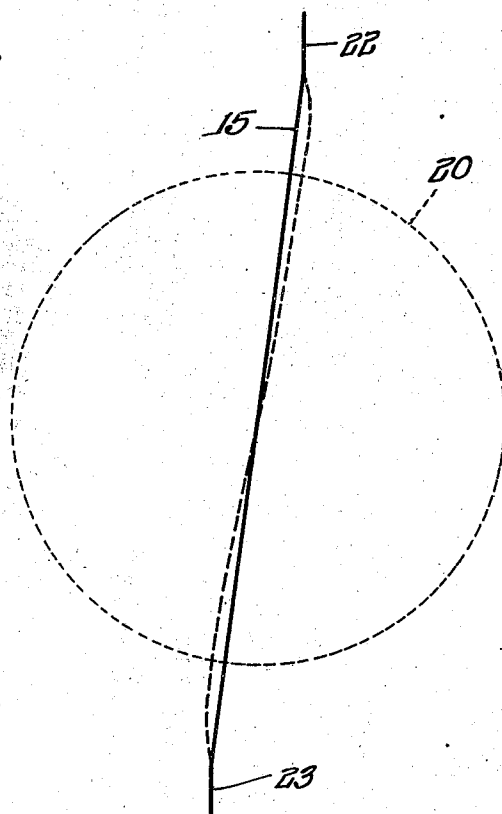


Fig. 3.



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GRID STRUCTURE FOR VACUUM TUBES
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6 Claims. (Cl. 250—27.5)

The present invention relates to vacuum tube structures and more particularly to a vacuum tube grid of the type having parallel grid wires.

In constructing such vacuum tube grid structures, the common practice in the past has been to use a generally rectangular or square frame having a suitable opening therein as the support for parallel arranged grid wires. To form the grid wires it has been found convenient to wind the grid wires completely around the grid frame supporting structure so that on one side of the grid frame the wires are arranged parallel to each other and substantially perpendicular to opposite edges of the frame. Those wires are then bonded to the frame adjacent the edges of the frame by any suitable securing process, such as brazing. After the wires have been brazed in position, the remaining wires on the other side of the grid frame are removed. It has been found that grid structures formed in this manner have the disadvantage of being subject to warping by heat. The grid wires when subjected to heat expand at a greater rate than the grid supporting frame so that not infrequently the expanded heated grid wires sag or are otherwise displaced from the plane in which the grid wires originally were positioned and secured.

By the present invention there is provided a parallel-wire grid structure which may be subjected to heat without incurring the disadvantage of having the grid wires displaced out of their original plane. In accordance with the present invention, this is accomplished by securing the wires in position on a frame in a manner to subject them to initial deformity adjacent the points where the wires are secured, so that when the wires are heated they are prevented from becoming displaced from their original plane, because the initial deformity of the wires causes any displacement thereof to occur in the plane of the wires which are caused to remain parallel.

It is therefore an object of the present invention to provide a new method of constructing a grid structure of the type described.

It is another object of the present invention to provide an improved method of constructing a parallel-wire grid structure wherein the grid wires, when subjected to heat, will remain in their original plane.

It is a further object of the present invention to provide an improved grid structure of the type having parallel-arranged grid wires.

Other and further objects will become apparent by reference to the following description taken in

connection with the accompanying drawing wherein:

Fig. 1 illustrates in perspective a partially completed grid structure formed in accordance with the method of the present invention;

Fig. 2 illustrates in perspective a completed grid structure formed in accordance with the present invention; and

Fig. 3 shows one of the grid wires enlarged and illustrates the action which takes place upon heating thereof.

Referring to the drawing it will be seen that a grid frame which is generally rectangular or square in outline has been formed in accordance with the present invention in two similar sections 11 and 12, each having one-half of a centrally arranged aperture 13 and 14, respectively, which may comprise a semi-circle. In accordance with the method of the present invention the two halves, 11 and 12, of the grid frame are initially displaced laterally with respect to each other in a common plane by a predetermined amount, and are also slightly separated, as shown in Fig. 1. The two displaced grid frame portions 11 and 12 may be secured in a suitable jig as is customary practice in manufacturing production methods. With the two halves of the grid frame 11 and 12 thus arranged, a suitable fine resilient wire is then completely wound around the grid frame members so as to provide across one face thereof spaced wire strands 15 which are parallel to each other and substantially perpendicular to opposite edges of the grid frame. Each of the said strands is then secured to the face of the grid frame by a suitable bonding process, such as brazing, as indicated at the areas 16 and 17. After the wire strands 15 have been secured in position by spot welding or brazing or in other suitable manner, the other portions of the wound wire are cut off, leaving the parallel wires 15 as shown in Fig. 1. When this operation has been completed, the two frame sections 11 and 12 are removed from the jig or other holding means and are then moved so as to align the displaced centers thereof and to bring their edges into abutment, as shown in Fig. 2, and the edges 18 and 19 on each side of the aperture 20 are then secured in position by bonding or spot welding indicated by the stippled area 21. When the two grid frame sections 11 and 12 are aligned in positions as shown in Fig. 2, each of the wires 15 is initially deformed or bent at points adjacent the bonded portions 16 and 17.

The initial positioning of the frame sections, as shown in Fig. 1, should be such that the grid wires will at least be taut when the frame sections

are brought into alignment as in Fig. 2. If desired, the initial positioning of the frame sections may be such that grid wires will be placed under slight tension when the frame sections are positioned as in Fig. 2. In such case, the tension of the wires will reduce their tendency to elongate.

By reason of the structure above-mentioned, the grid wires are prevented from being displaced from their original plane, when they are heated during operation of a tube embodying the structure. The action which takes place during heating and expansion of the wires may be clearly seen by considering the action of one wire as shown in Fig. 3. The solid line representation shows the normal position of a wire 15 whose end portions 22 and 23 are secured as above described. It will be seen that the wire has reverse bends adjacent the secured end portions. Owing to the resilience of the wire and the stresses produced by the deforming or bending thereof, any elongation of the wire due to heating will cause the wire to assume a position such as shown by the broken line. The deformed portions of the wire act as resilient cantilevers and tend to move counter-clockwise, as viewed in the figure. Any elongation of the wire will permit these cantilever portions to move and thus compensate for such elongation. Thus all of the grid wires will assume similar new positions and will remain substantially parallel in their common plane.

It will be noted that the effective portion of each grid wire within the area of the aperture 20 will remain substantially straight.

Thus the structure provided by the invention prevents displacement of the grid wires from the plane in which the maximum field strength is found when a vacuum tube incorporating the grid structure is utilized.

While for the purpose of disclosure the grid frame structure has been shown as being of square shape and as having a circular opening, it is of course to be understood that other suitable configurations may be utilized and that such modifications are to be deemed within the scope and spirit of the invention as set forth in the appended claims.

I claim:

1. A method of forming a parallel-wire grid structure for a vacuum tube or the like, which comprises arranging the grid wires rectilinearly in parallel relation, securing the end portions of the wires, and then relatively shifting the opposite secured end portions of the wires in their common plane, thus initially deforming the grid wires in their common plane at points adjacent their secured end portions, thereby causing any displacement of the wires to occur in the common plane thereof.

2. The method of constructing a grid structure

for a vacuum tube, utilizing a two-section grid supporting frame, which comprises initially displacing said sections a predetermined amount, arranging on said displaced sections a plurality of parallel wires, securing said wires to said frames, aligning said sections of said grid supporting frame, and securing said aligned sections in position.

3. The method of constructing a grid structure for a vacuum tube, which comprises forming a rectangular grid supporting frame in two sections, displacing said sections with respect to each other, winding a wire about said displaced sections to arrange on one face thereof spaced parallel wires substantially perpendicular to opposite edges of said frame, bonding said parallel wires to said frame adjacent said edges, removing the wires on the opposite side of said frame, aligning said frame sections, and securing said sections in aligned position.

4. The method of constructing a grid structure for a vacuum tube, utilizing a two-section grid supporting frame, which comprises displacing said sections with respect to each other in the plane of said sections, arranging on said displaced sections a plurality of parallel wires, securing said wires to said sections, aligning said sections to deform the wires adjacent their points of securement, and securing said sections in aligned relation.

5. The method of constructing a grid structure for a vacuum tube, which comprises forming a flat apertured rectangular grid supporting frame in two similar sections, displacing said sections in a common plane a predetermined amount with respect to each other, winding a wire about said displaced sections so as to arrange on one face of said displaced sections spaced parallel wires arranged substantially perpendicular to opposite edges of said frame, bonding said wires to said frame adjacent said edges, removing the wires on the opposite side of said frame, aligning said frame sections to deform said wires adjacent the points where they are secured to said frame, and bonding the edges of said aligned sections to secure said sections in permanent position.

6. A grid structure for a vacuum tube or the like, comprising a frame, and a plurality of substantially parallel coplanar spaced resilient wires extending across said frame and having their end portions secured to the frame, the points of securement of the ends of each wire being relatively offset, and the end portions of each wire being consequently deformed so as to cause said portions to act as resilient cantilevers in the common plane of the wires whenever the wires become elongated, whereby the wires are caused to remain substantially parallel in their common plane.

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