

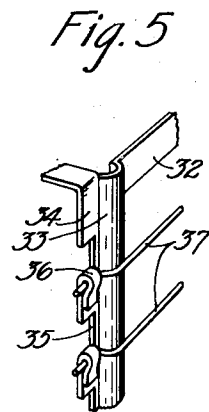
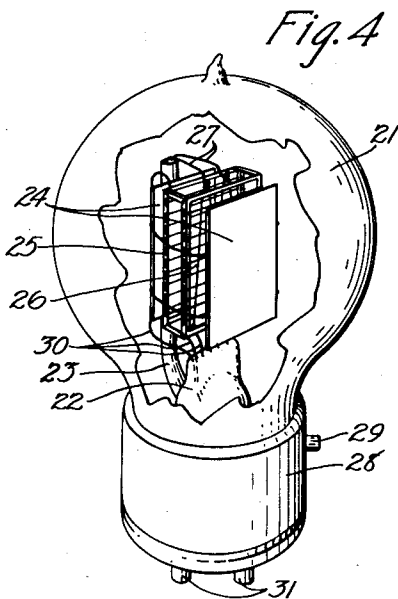
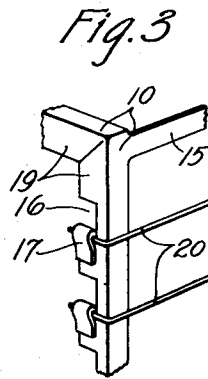
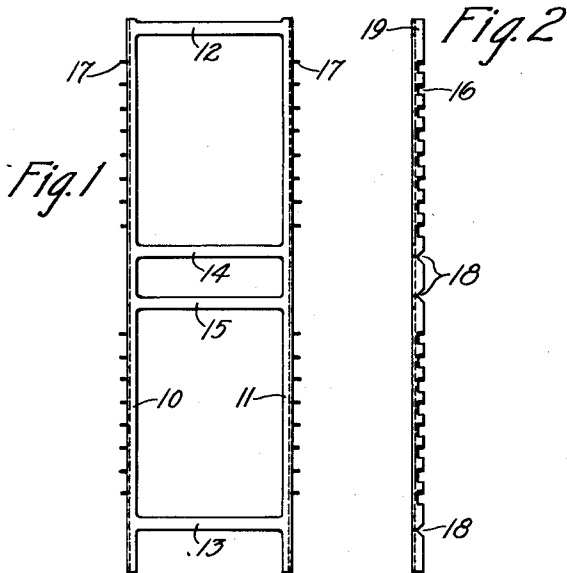
Jan. 3, 1928.

1,654,899

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ELECTRON DISCHARGE DEVICE

Filed Aug. 7, 1924



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UNITED STATES PATENT OFFICE.

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ELECTRON-DISCHARGE DEVICE.

Application filed August 7, 1924. Serial No. 730,563.

This invention relates to electron discharge devices and more particularly to the grid electrode therefor.

The object of this invention is an efficient and easily manufactured grid structure for electron discharge devices in which the manufacturing operations are materially reduced.

This object is attained by providing a grid electrode comprising a punched metallic frame having integral ears formed on the edging thereof and spacing apart and mechanically clamping the grid lateral wires to the punched frame by pressing the ears back on the frame.

Referring to the drawings, Fig. 1 illustrates a front elevation of the punched frame; Fig. 2 is a side view of Fig. 1; Fig. 3 is an enlarged perspective view of a section of the grid with the lateral wires held in position; Fig. 4 illustrates an electron discharge device embodying the invention; and Fig. 5 shows a modified form of the grid structure.

The grid electrode consists of a frame punched from a single sheet of metal, preferably nickel. The punched frame consists of parallel side members 10 and 11 which are joined together at the upper and lower ends by connecting strips 12 and 13. A plurality of closely spaced connecting strips 14 and 15 are provided intermediate the ends of the side members 10 and 11. The outer edges of the parallel members 10 and 11 are provided with L shaped cuts 16 to provide clamping ears 17 for the grid wires. These cuts are in opposed relation toward the center of the side members whereby the ears on the upper portion of the side members will be in the same plane as the ears on the lower portion when the grid frame is bent in its final form. A pair of V shaped slots 18 are cut on the edges of parallel members 10 and 11, adjacent to the connecting strips 14 and 15. A similar slot is cut in the parallel members adjacent to the connecting strip 13. The edges 19 of the members 10 and 11 are bent at right angles to the plane of the grid frame proper, to provide reinforcing means for the frame. The ears 17, provided by the L shaped cuts in the parallel members, are bent outwardly at right angles to the surface of the reinforcing member 19. The grid frame is now in condition for winding the lateral wires on the frame. This

operation is more expeditiously accomplished by providing two frames such as are shown in Fig. 1 and placing them on a winding tool, similar to the tool shown in R. F. Trimble U. S. Patent 1,465,381 dated August 21, 1923. The grid frames are securely fastened to the upper and lower faces of the winding tool, by any known means, and a continuous wire, preferably nickel, wound around the frames, adjacent turns of the wire being equally spaced apart by means of the projecting ears 17. After the required number of turns have been applied to the frames, a pressing tool or other implement is passed over the outwardly extending ears 17 to press them over the associated turns of the grid wire, thereby securely clamping the wires to the grid frame. The pair of frames are then severed from the winding tool in the same manner as described in the above mentioned patent, by cutting the successive turns of wire on the edge of the tool and thereafter trimming the wires adjacent the outer edge of the clamping ears 17. The two frames are removed from the winding tool by cutting the securing wires and are bent at the V shaped slots 18, to form a box-like structure. The V shaped slots provided a mortised joint for the reinforcing edges 19. This construction provides a rigid frame for the grid wires 20, in which the connecting strips 14 and 15 reinforce the frame at the upper end and the connecting strips 12 and 13 reinforce the frame at the lower end. The parallel grid surfaces are joined at the lower end preferably by spot welding. The angular shape of the frame adjacent the ears 17, provides leverage means for tightening the grid lateral wires in case of loose winding of the wire, since the edges 19 can be bent inwardly to tension the wires 20 and thereby utilize the ridges formed by bending over the edge 19 as points of leverage for tensioning the wires.

Fig. 4 shows an electron discharge device embodying a grid structure, as described above, and consists of an enclosing vessel 21 having a press 22, on which a glass cane arbor 23 is fused. The plate electrode 24 which consists of parallel plane surfaces is supported from the glass arbor 23. A grid 25, made in accordance with this invention, is supported from the glass arbor 23, between the parallel surfaces of the plate elec-

trode 24. An oxide coated filament 26 is positioned within the box-like structure of the grid and supported at its upper end from the glass arbor by means of wire connections 27. The glass vessel is provided with a circular metallic base 28 having an outwardly extending bayonet pin 29, to provide locking means when the device is inserted in a vacuum tube socket. The lead wires 30, from the electrodes are sealed in the press 22 and connected to contacts 31 attached to the underside of the base 28.

It is, of course, understood that various modifications can be made in the details of the structure, for instance, as shown in Fig. 5, in which construction of the grid structure the punching, cutting and forming operations may be performed at the same time. The grid may be punched from a single sheet of nickel, to provide connecting strips 32, reinforcing ridges 33, and supporting portions 34, which are in the same plane as the connecting strips 32. In a construction of this type, the punching of the frame, forming the ridge and cutting the L shaped slots 35 may be performed in one operation, thereby greatly reducing the manufacturing cost of the finished product. The bending of the ears 36 and winding the wires 37 on the frame may be performed in the same manner as described above in connection with Fig. 1.

A grid structure made in accordance with this invention provides an easily manufactured element in which the numerous welding operations are eliminated and a punched frame member having lateral wires of substantially uniform diameter and spacing throughout its length is produced at greatly reduced manufacturing cost.

Although the invention has been described in connection with an electron discharge device having a glass vessel, it is apparent, that the invention can be applied to other types of vacuum tubes without departing from the scope of the invention as indicated in the appended claims.

What is claimed is:

1. A grid electrode comprising a punched frame, reinforcing ridges formed near the edges thereof, portions of the frame adjacent to said ridges being cut to form projections, and lateral wires equally spaced on said frame and clamped thereto by means of said projections.

2. A grid electrode comprising a punched frame, lateral wires equally spaced on said frame, ridges formed on said frame, and integral projections on said frame, said wires passing over said ridges and being held taut by said projections.

3. A grid electrode comprising a punched

frame, projections formed on the edges thereof, a plurality of wires clamped to said frame by said projections, and ridges adjacent to said projections to provide reinforcing means for said frame.

4. A grid electrode comprising a punched frame, projections formed on the edges thereof, a plurality of wires clamped to said frame by said projections, and ridges adjacent to said projections to tension said wires.

5. A grid electrode comprising a frame having parallel plane surfaces, lugs formed on the outer edges thereof, a plurality of wires equally spaced on said frame, said lugs being bent back on the frame to clamp said wires in position.

6. A method of making a grid electrode which consists of punching a frame member from a single metal sheet, cutting ears on the parallel edges thereof, bending said edges at right angles to the plane surfaces of said frame, forming said frame into a box-like structure having parallel planary surfaces, winding a continuous wire around said frame, pressing said ears over said wires, and thereafter cutting said wires adjacent said ears.

7. The method of making a grid electrode which consists of punching a frame member from a single piece of metal, forming ears on the edges thereof, winding a continuous wire around said frame, clamping said ears over said wire, and cutting said wire at the outer edge of said ears.

8. A grid comprising a punched frame, a plurality of lateral wires equally spaced on said frame, and overlapping lugs formed on the edges of said frame for clamping said wires in position.

9. A grid electrode comprising a punched frame having integral projections formed on the edges thereof, and a plurality of wires on said frame, said wires being equally spaced and held by said projections.

10. A grid electrode comprising a punched metallic frame having reinforcing ridges formed thereon, integral projecting ears on said frame, and a plurality of lateral wires equally spaced on said frame, said ears and ridges maintaining said wires taut on said frame.

11. A grid comprising a punched frame having integral projections formed on the edge thereof, a ridge formed adjacent said projections, and a plurality of wires equally spaced on said frame by said projections, said wires being bent around said ridge and clamped to said frame by said projections.

In witness whereof, I hereunto subscribe my name this 6 day of August A. D., 1924.

PAUL SCHWERIN.