

Nov. 11, 1924.

1,514,898

G. L. GEISEY

THERMIONIC DEVICE

Filed July 13, 1923

2 Sheets-Sheet 1

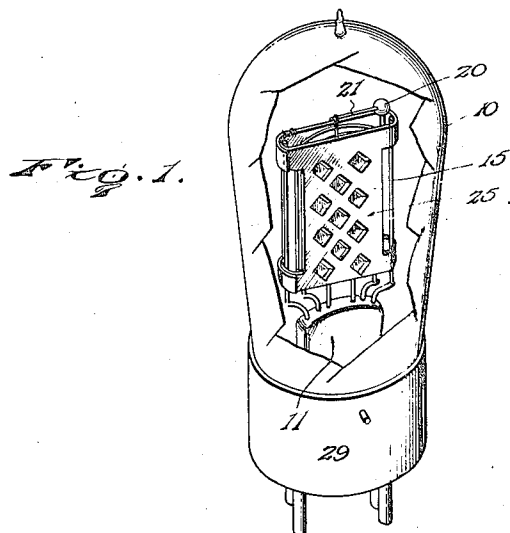


Fig. 4.

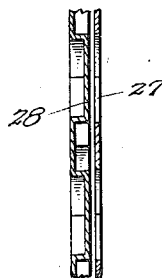


Fig. 2.

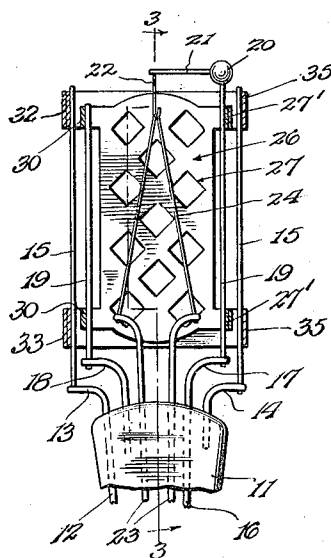
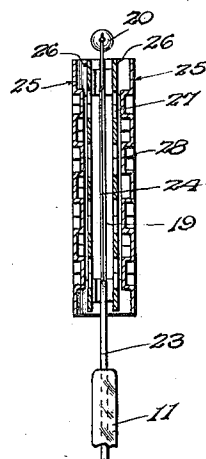


Fig. 3.



Inventor

G. L. Geisey.

By

Larry Thayer, Attorneys

Nov. 11, 1924.

G. L. GEISEY

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2 Sheets-Sheet 2

Fig. 5.

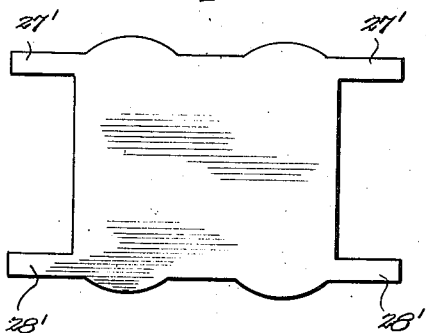


Fig. 8.

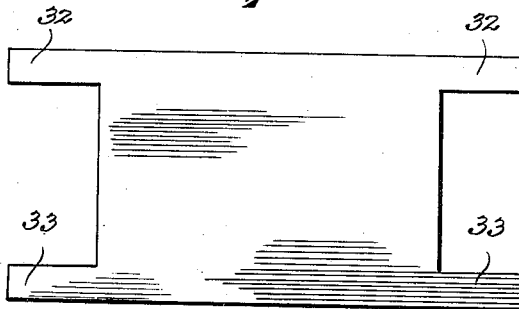


Fig. 6.

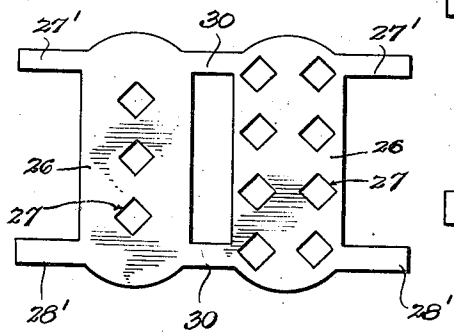


Fig. 9.

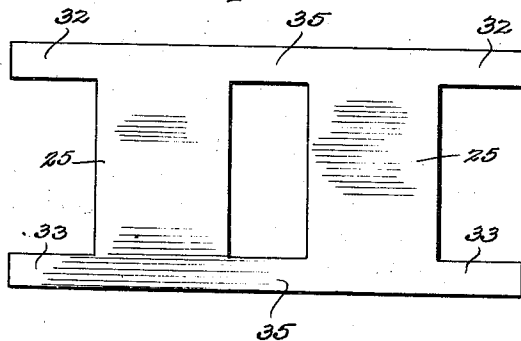


Fig. 7.

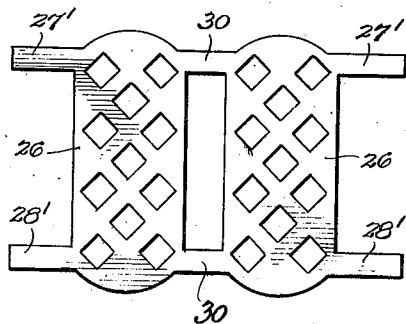
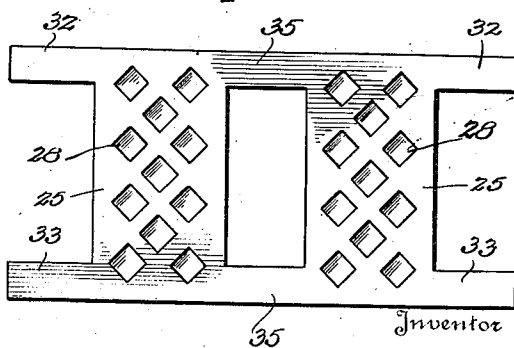


Fig. 10.



G. L. Geisey.

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Lacey & Lacey, Attorneys

UNITED STATES PATENT OFFICE.

GEORGE L. GEISEY, OF STEUBENVILLE, OHIO.

THERMIONIC DEVICE.

Application filed July 13, 1923. Serial No. 652,418.

To all whom it may concern:

Be it known that I, GEORGE L. GEISEY, citizen of the United States, residing at Steubenville, in the county of Jefferson and State of Ohio, have invented certain new and useful Improvements in Thermionic Devices, of which the following is a specification.

This invention relates to an improved thermionic device of the general character disclosed in my pending application for a similar invention, filed November 20, 1922, Serial Number 602,197, and seeks, among other objects to provide a thermionic device embodying a simplified mounting for the plate and grid of the device.

A further object is to provide a device whereby the plate and grid may be readily assembled in position, thus reducing the cost of manufacture of the device, and wherein the plate and grid will be rigidly sustained.

Another object of the invention, in this connection, is to provide a device wherein, by rigidly sustaining the plate and grid, uniform spacing therebetween will be maintained.

And the invention further comprehends a novel process for making the grid and plate in manufacture.

Other and incidental objects will appear hereinafter.

In the drawings:

Figure 1 is a perspective view of my improved thermionic device, the containing vessel being broken away,

Figure 2 is an enlarged vertical detail sectional view taken between the grid surfaces of the device,

Figure 3 is a vertical detail sectional view on the line 3—3 of Figure 2, looking in the direction of the arrows,

Figure 4 is an enlarged detail sectional view showing the plate and grid structure of the device,

Figures 5, 6 and 7 are plan views showing the steps followed in forming the double grid of the device, and

Figures 8, 9 and 10 are plan views showing the steps followed in forming the double plate employed.

Referring to the drawings, the numeral 10 indicates an evacuated containing vessel and upstanding within the vessel is an insulating stem 11. Extending through the stem near one edge thereof is a plate lead 12 bent laterally at its upper end portion

to form a support 13 and embedded in the stem near its opposite edge is a similar support 14. Welded or otherwise secured at their lower ends to said supports are spaced parallel wire supporting elements or posts 15. Extending through the stem adjacent the post 14 is a grid lead 16 bent laterally at its upper end to form a support 17 and embedded in the stem adjacent the lead 12 is a similar support 18. Welded or otherwise secured at their lower ends to the supports 17 and 18 are spaced parallel wire supporting elements or posts 19 to the upper end of one of which is fixed a glass bead 20 and embedded at one end in said bead is a laterally directed arm 21. The arm 21 is also preferably formed of a short length of wire, being insulated from said post by the bead, and welded or otherwise secured to the free end of the arm is a depending hook 22 disposed substantially midway between the posts. Extending through the stem between the lead 16 and support 18 are spaced cathode leads 23 deflected laterally away from each other at their upper ends and suitably secured at its extremities to the upper ends of said leads is a filamentary cathode 24 engaged over the hook 22 and supported thereby.

Mounted upon the posts 15 is a double output anode or plate comprising spaced parallel plate surfaces 25 and mounted upon the posts 19 between said anode and the cathode is a double control electrode or grid comprising spaced grid surfaces 26 lying at opposite sides of the cathode parallel thereto and to the plate surfaces 25. As particularly brought out in Figure 2, the grid surfaces are checkered with a plurality of regularly spaced openings 27 and while the plate surfaces are mounted close to the grid surfaces, still, in order to decrease the distance between the working faces of the plate surfaces and the cathode, I emboss or stamp the plate surfaces with checkered groups of regularly spaced projections 28 registering with the openings 27 to extend toward the cathode opposite said openings. The projections 28 correspond in shape and number to the openings 27 and, as shown in detail in Figure 4, the end walls 28 of said projections, which end walls form the effective or working faces of the plate surfaces, are advanced toward the cathode a distance equal to the height of said projections to effect a corresponding increase in the current and

voltage output of the device, said end walls being but slightly spaced from the grid surfaces. The plate and grid are preferably of substantially pure molybdenum. I have discovered that this metal gives off less gas under heat than metals now in common use for the same purpose with the result that the containing vessel 10 is, in the manufacture of the device, more easily evacuated while a correspondingly less amount of gas is generated in the vessel during the practical operation of the device. In Figure 1 of the drawings, I have shown the containing vessel 10 mounted in an appropriate socket 29. The grid is, as shown in Figures 5, 6 and 7 of the drawings, preferably stamped from suitable sheet material of the character previously indicated. In practice, a ribbon of the metal is fed through a die to stamp out an oblong blank of the character shown in Figure 5, this blank being provided near one longitudinal edge thereof with a pair of longitudinally directed tongues 27' and near its other longitudinal edge with a similar pair of tongues 28'. The blank is then passed through another die and, as shown in Figure 6, is formed with a central oblong opening defining the grid surfaces 26 as well as also defining straps 30 at the ends of said opening connecting the grid surfaces. Further, the blank is also coincidentally formed with spaced rows of the openings 27 in one of the grid surfaces and a single row of said openings in the other of the grid surfaces. The blank is then turned over end for end from the position shown in Figure 6 to the position shown in Figure 7 and fed through the same die used in the step typified in Figure 6. Thus, as will be seen, in the step typified in Figure 7, a single row of the openings 27 is formed in one of the grid surfaces between the double row produced in the step of Figure 6 while a double row of said openings is formed in the other of the grid surfaces at opposite sides of the single row produced in the step of Figure 6. The completed grid, as shown in Figure 7, is accordingly formed by the use of but two dies.

The plate is, as shown in Figures 8, 9 and 10, formed in a manner similar to the grid, being, like the grid, stamped from a ribbon of sheet material of the character noted. In practice, the ribbon is fed through a die to produce an oblong blank, as shown in Figure 8, this blank being provided at one longitudinal edge thereof with a pair of longitudinally directed tongues 32 and at its opposite longitudinal edge with a similar pair of tongues 33. The blank is then fed through a second die and is formed with a central oblong opening defining the plate surfaces 25 as well as straps 35 at the ends of said opening connecting said surfaces. The blank is then fed through a third die to form the plate surfaces with the projections

28. Thus, in forming the plate, three separate dies are used.

In assembling the device, the straps 30 of the grid are bent around one of the posts 19 when the grid surfaces 26 are brought into parallel relation at opposite sides of the cathode 24. The pair of tongues 27' is then bent in overlapping relation about the other of the post 19 as is also the pair of tongues 28', when the tongues and said straps are welded to the posts, this operation serving to secure the tongues of each pair together. Thus, the grid will be rigidly mounted. The plate is then applied by bending the straps 35 thereof about one of the posts 15 when the plate surfaces 25 are brought into parallel relation to the grid surfaces. The pair of tongues 32 is then bent in overlapping relation about the other of the posts 15 as is also the pair of tongues 33 when the tongues and said straps are welded to the posts, the tongues of each pair being thus secured together so that the plate, like the grid, will also be rigidly mounted. As will be seen, the grid and plate may thus be readily mounted in position and since both the grid and plate are constructed of sheet metal, the grid surfaces and plate surfaces will retain their parallel relationship and will, furthermore, be free from vibration when the device is in operation. The overlapping tongues of the plate are arranged opposite the overlapping tongues of the grid and, preferably, the plate is of slightly greater height than the grid.

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

1. The method of forming a thermionic device electrode which consists in stamping a blank having companion electrode portions, punching one of said portions to form an opening and punching the other of said portions to form spaced openings, and turning the blank over end for end and punching said first mentioned portion to form spaced openings at opposite sides of a plane occupied by the initial opening therein and punching said second mentioned portion to form an opening between planes occupied by the initial spaced openings therein.

2. The method of forming a thermionic device electrode which consists in stamping a blank having tongues at inner end thereof, perforating the blank to define companion electrode portions as well as to define straps connecting said portions and coincidentally punching one of said portions to form an opening and punching the other of said portions to form spaced openings, and turning the blank over end for end and punching said first mentioned portion to form spaced openings at opposite sides of a plane occupied by the initial opening therein and punching said second mentioned portion to form an opening between

planes occupied by the initial spaced openings therein.

3. The method of making an electrode unit of a thermionic discharge device which consists in stamping a blank to provide companion electrode portions, and embossing each of said portions to provide each portion with a checkered group of projections.

4. The method of making an electrode unit of a thermionic discharge device which consists in stamping a substantially oblong blank, punching said blank transversely along a medial line to form an opening terminating short of the side edges of the blank and defining spaced electrode surfaces united by upper and lower reduced bendable connecting straps, and embossing each of said portions to provide each portion with a checkered group of projections.

5. The method of making an electrode unit of a thermionic discharge device which consists in stamping a blank to provide companion electrode portions, and punching each of said portions to provide each portion with a checkered group of openings.

6. The method of making an electrode unit of a thermionic discharge device which consists in stamping a substantially oblong blank, punching said blank transversely along a medial line to form an opening terminating short of the side edges of the blank and defining spaced electrode surfaces united by upper and lower reduced bendable connecting straps, and punching each of said portions to provide each portion with a checkered group of openings.

7. The method of making an audion which consists in stamping a substantially oblong blank provided at one end edge with reduced bendable tongues, punching said blank transversely along a medial line to form an opening terminating short of the sides edges of the blank and defining spaced electrode surfaces united by upper and lower reduced bendable connecting straps, transversely bending the straps about a post to dispose said surfaces in spaced parallel relation, transversely bending said tongues about another post, and welding said straps and tongues to the posts for connecting the unit therewith.

8. In a thermionic device, a stamped oblong sheet metal electrode unit provided at one end edge with reduced bendable tongues and apertured transversely to define companion electrode surfaces as well as to define reduced upper and lower bendable straps integrally connecting said surfaces, said surfaces being checkered with openings.

9. In a thermionic device, a stamped oblong sheet metal electrode unit provided at one end edge with reduced bendable tongues and apertured transversely to define companion electrode surfaces as well as to define reduced upper and lower bendable straps integrally connecting said surfaces, said surfaces being checkered with raised portions.

10. In a thermionic device, a cathode, a stamped oblong sheet metal electrode unit provided at one end with reduced bendable tongues and formed with a medial transverse aperture terminating short of the side edges of the unit to define companion plate surfaces integrally united by reduced upper and lower bendable connecting straps flexed to dispose said surfaces in parallel relation at opposite sides of the cathode, a pair of spaced vertical posts one embraced by said straps and the other having said tongues flexed thereabout supporting said unit, a second stamped oblong sheet metal electrode unit provided at one end with reduced bendable tongues and formed with a medial transverse aperture terminating short of the side edges of such unit to define companion grid surfaces integrally united by reduced upper and lower bendable connecting straps flexed to dispose said grid surfaces in parallel relation lying between the plate surfaces and the cathode, and a second pair of spaced vertical posts one embraced by the straps of the latter unit and the other having the tongues of such unit flexed thereabout supporting said latter unit, the grid surfaces being checkered with openings and the plate surfaces being checkered with raised portions extending toward the cathode opposite said openings respectively.

In testimony whereof I affix my signature.

GEORGE L. GEISEY. [L. S.]