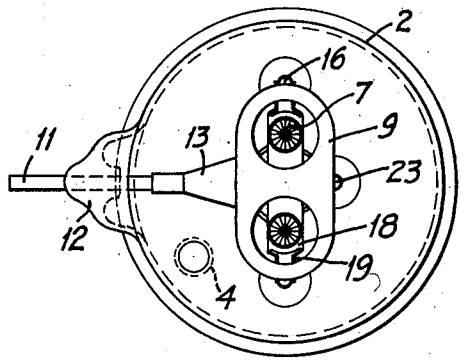
Nov. 30, 1943. W. W. EITEL ET AL 2,335,587

ELECTRONIC TUBE AND METHOD OF MAKING THE SAME

Filed May 19, 1942

Fig. 3



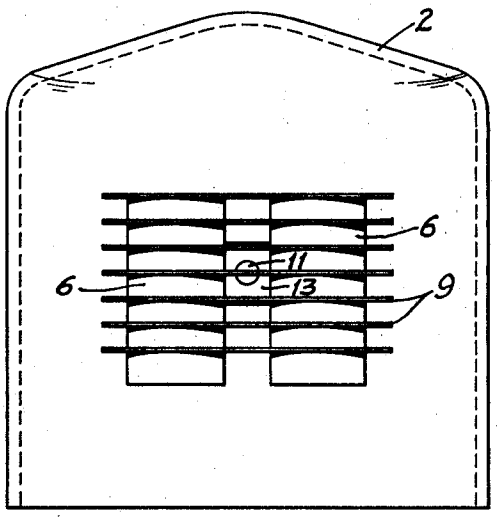
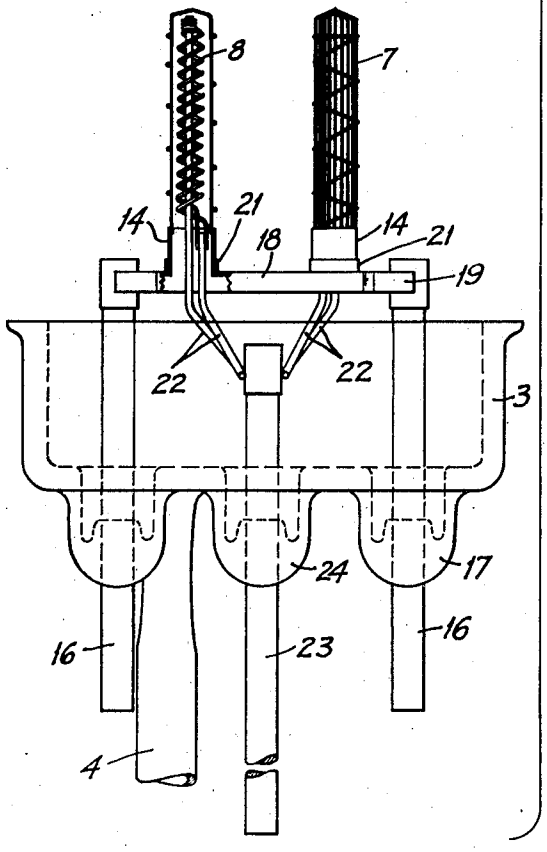


Fig. 1



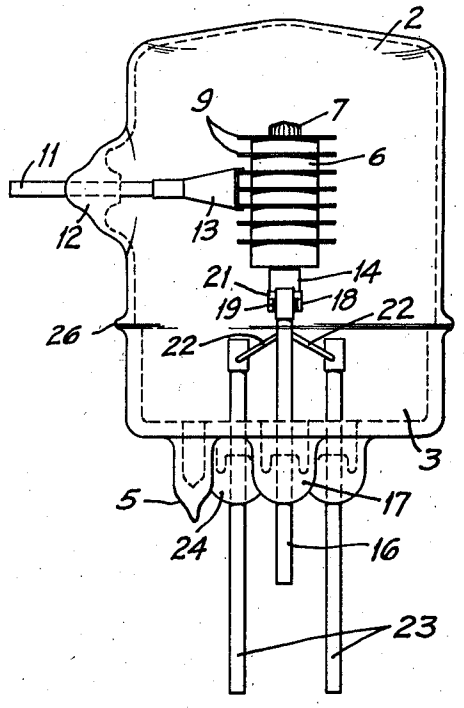


Fig. 2

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ELECTRONIC TUBE AND METHOD OF MAKING THE SAME

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10 Claims. (Cl. 250—27.5)

Our invention relates to an electronic tube particularly adapted for ultra high frequency work.

It is among the objects of the invention to provide a tube having a plurality of electronic units, each unit containing its complement of electrodes, all mounted within the same envelope.

Another object is to provide a tube embodying a plurality of triode units co-acting to give a large power output; each unit being designed, by reason of its small physical size, with electrode spacings approximating the ideal in regard to transit time effect, electron migration, interelectrode capacity, and thermionic efficiency.

Another object is to provide an improved arrangement of leads and means for mounting the electrodes, specially constructed to satisfy the requirements for ultra high frequency operation.

Still another object is to provide a tube construction which is compact, strong mechanically, and capable of withstanding fairly rough handling without undue danger of breakage.

A further object is to provide an improved method of making the tube, adapting it for rapid production while maintaining accurate spacing and alignment of the parts.

The invention possesses other objects and features of advantage, some of which, with the foregoing, will be set forth in the following description of our invention. It is to be understood that we do not limit ourselves to this disclosure of species of our invention, as we may adopt variant embodiments thereof within the scope of the claims.

Referring to the drawing:

Figure 1 is an exploded view showing the two separate sections of the envelope with the elctrodes mounted thereon, prior to uniting the sections.

Figure 2 is a side elevational view of the complete tube; and

Figure 3 is a plan view of the same.

In terms of broad inclusion, our tube comprises an envelope, a plate and grid and cathode in the envelope, leads for the grid and cathode extending longitudinally of the plate axis and sealed to an end portion of the envelope, and a lead for the plate extending transversely of the axis and sealed to a side of the envelope. In our preferred construction, a pair of operative units are mounted within the envelope; the grids of both units being unitarily supported on the longitudinal leads, and the plates being unitarily supported on the transverse lead. Our improved method of making the tube comprises forming the envelope in a plurality of separate sections, including a body section and a shorter base section; mounting the cathodes and grids on the base section; mounting the plates on the body section; and then uniting the sections of the envelope.

In greater detail, and referring to the ddrawing, our tube comprises a cylindrical envelope of glass or the like having an upper body portion 2 and base portion 3. The base portion has a substantially flat bottom and its walls are preferably somewhat thicker than the body to give added strength at the base of the tube. A tubulation 4 for evacuating the envelope is preferably connected with the bottom and, after exhaust, is sealed off the pump at the point 5.

The tube illustrated embodies two operative units, each including a plate 6, grid 7 and cathode 8. These triode units are disposed side-by-side and have parallel axes extending longitudinally of the tube; the axes referred to being those about which the electrodes are concentrically disposed. Each plate is preferably made of a series of drum-like sections joined end-to-end, with a section of one plate integrally connected with that of another plate by a flange 9. An annular recess or seat is provided at the flange end of each section so that the sections may be nested. After assembly the nested sections are secured together, as by welding. Parallel flanges 9 tie the plates together into a unitary structure and also function as heat radiating fins.

Plate lead 11 is disposed transversely of the plate axes in a plane lying midway between the plates, and projects through the side of envelope body 2 at seal 12. A stubby rod of good size is used for the lead. The plates are unitarily supported on lead 11 by means of a conical bracket 13 having a tubular end embracing the inner end of lead 11, and having its flared end secured to flanges 9. Welded joints are preferred. This arrangement provides a short heavy lead, desirable for high frequency work. In addition to furnishing a short connection the transverse lead permits several of our tubes to be grouped together, with the plate leads converging toward a common central connection.

Grids 7 are preferably of the cage type having an upper free end and a lower terminal end. Those illustrated comprise vertical wires embraced by a reinforcing helix and held by a ring 14 at the lower end. A pair of grid leads 16 are disposed longitudinally of the plates in a plane coincident with the axes of the units, and project through the bottom of the envelope at the seals 17. The inner ends of these leads terminate alongside the lower ends of the grids, adjacent

rings 14. Grids 7 are unitarily supported on leads 16 by a transverse bracket comprising a channel-shaped strap 18 having inturned extension tabs 19 welded to sleeves on the ends of the leads. The bends in the end tabs allow for some come and go to take care of expansion when the parts get hot. Neck flanges 21 drawn from the strap provide collars for embracing grid rings 14 to which they are welded.

Cathodes 8 are preferably of the filamentary type, each comprising a pair of thoriated tungsten coils connected at top and bottom to supporting rods 22. This connects the coils in parallel between the ends of rods 22, providing a filament structure having much better emission than the usual single coil type, even though the single coil wire is comparable in size to the sum of the wires in the twin coils. One rod of each pair is welded to a sleeve on the inner end of a cathode lead 23, and the other rods are welded to a sleeve on the inner end of another cathode lead, thus connecting the filaments in parallel. Leads 23 extend longitudinally of the plate axes and project thru the bottom of the envelope at seals 24. The cathode leads preferably lie in a plane transverse to that of the grid leads, thus providing good spacing and a symmetrical arrangement of the leads.

With particular reference to Figure 1, our improved method of making the tube comprises forming the body and base portions of the envelope in separate cup-shaped sections. Base section 3 has an annular wall considerably shorter than the body section, and is more like a shallow dish compared to the deeper cupped body 2. This gives ample room and freedom of action for assembling the cathode and grid structures on the upper ends of leads 16 and 23 which are first sealed in place and extend upwardly toward the open mouth of the base section. Since the relative spacings between the grids and cathode are very critical, our structure which enables these parts to be mounted in place and aligned in the open will be appreciated. The grids and cathodes are fabricated apart from the tube ready for mounting on the leads.

The plate assembly is also fabricated apart from the tube and its connected bracket 13 is then slipped over the end of lead 11 and welded in place. Because lead 11 projects laterally, this joint is easily reached for welding. After all electrodes have been mounted in position, the rims of the two envelope sections are abutted and fused together along the sealed joint 26 lying in a plane transversely of the tube axis, as shown in Figure 2.

We claim:

1. An electronic tube comprising an envelope, a pair of plates disposed about parallel axes in the envelope, a grid and cathode associated with each plate, leads connected with the cathodes and sealed to the envelope, a pair of grid leads extending longitudinally of said axes and sealed to the envelope, means unitarily supporting the grids on said pair of leads, a plate lead extending transversely of said axes and sealed to the envelope, and means unitarily supporting the plates on the last mentioned lead.

2. An electronic tube comprising an envelope, a pair of tubular plates disposed about parallel axes in the envelope, a grid and cathode associated with each plate, said grids each having a free end and a terminal end, leads connected with the cathodes and sealed to the envelope, a pair of leads extending longitudinally of said axes and sealed to the envelope, means connected to the terminal ends of the grids unitarily supporting them on said pair of leads, a plate lead sealed to the envelope, and means unitarily supporting the plates on the last mentioned lead.

3. An electronic tube comprising an envelope, a pair of tubular plates disposed about parallel axes in the envelope, a grid and cathode associated with each plate, said grids each having a free end and a terminal end, leads connected with the cathodes and sealed to the envelope, a pair of leads extending longitudinally of said axes and sealed to the envelope, means connected to the terminal ends of the grids unitarily supporting them on said pair of leads, a plate lead extending transversely of said axes and sealed to the envelope, and means unitarily supporting the plates on the last mentioned lead.

4. An electron tube comprising an envelope, a pair of plates disposed about parallel axes in the envelope, fins interconnecting the plates and arranged transversely of said axes, a grid and cathode associated with each plate, leads for the grid and cathode sealed to the envelope, an anode lead extending transversely of said axes, and means connected to said fins for unitarily supporting the plates on the last mentioned lead.

5. In an electronic tube, an envelope comprising a pair of cup-shaped sections sealed together along adjacent edges in a plane disposed transversely of the envelope, a plurality of plates in the envelope, a grid and cathode associated with each plate, leads for the cathodes sealed to one of said sections, grid leads sealed to the last mentioned section, means for unitarily supporting the grids on said grid leads, a plate lead sealed to the other section, and means for unitarily supporting the plates on the last mentioned lead.

6. The method of making an electronic tube having a plate and grid and cathode within an envelope, which comprises forming the envelope in separate base and body sections, said base section being cup-shaped, sealing leads for the cathode and grid to the base section with the inner portions of the leads extending toward the open mouth of said base section, mounting the cathode and grid on said leads, sealing a lead to the body section, mounting the plate on the last mentioned lead, and then uniting the sections of the envelope.

7. The method of making an electronic tube having a plate and grid and cathode within an envelope, which comprises forming the envelope in separate cup-shaped base and body sections, said base section having a substantially flat bottom and a shorter wall than the body section, sealing leads to the bottom of the base with the inner ends of the leads extending toward the open mouth of the base section, mounting the grid and cathode on said leads, sealing a lead to the body section, mounting the plate on the last mentioned lead, and then uniting the sections of the envelope.

8. The method of making an electronic tube having a plate and grid and cathode within an envelope, which comprises forming the envelope in separate cup-shaped base and body sections, sealing vertically disposed leads to the base section with the inner portions of the leads extending toward the mouth of said base section, mounting the grid and cathode on said leads, sealing a horizontally disposed lead to a side of the body section, mounting the plate on the last mentioned lead, and then uniting the sections of the envelope.

9. In an electron tube, an envelope comprising a pair of sections sealed together along adjacent edges, a plurality of plates in the envelope, plate conductor means sealed to one of said sections, means unitarily supporting the plates on said conductor means, a grid and cathode associated with each plate, grid conductor means sealed to the other section, means unitarily supporting the grids on the grid conductor means, and conductor means connected with the cathodes and sealed to the last mentioned section.

10. An electronic tube comprising an envelope, a pair of plates disposed about parallel axes in the envelope, a single plate lead extending transversely of said axes and sealed to the envelope, means unitarily supporting the plates on said lead, a grid and cathode associated with each plate, and conductor means connected with the grids and cathodes and sealed to the envelope.

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