

March 20, 1945.

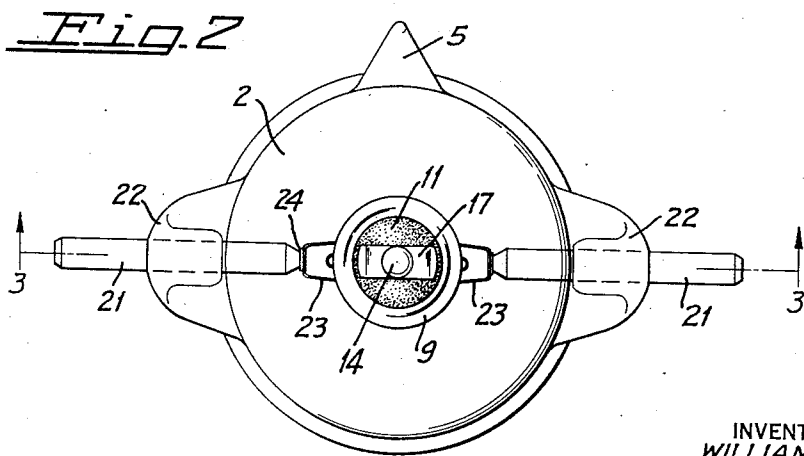
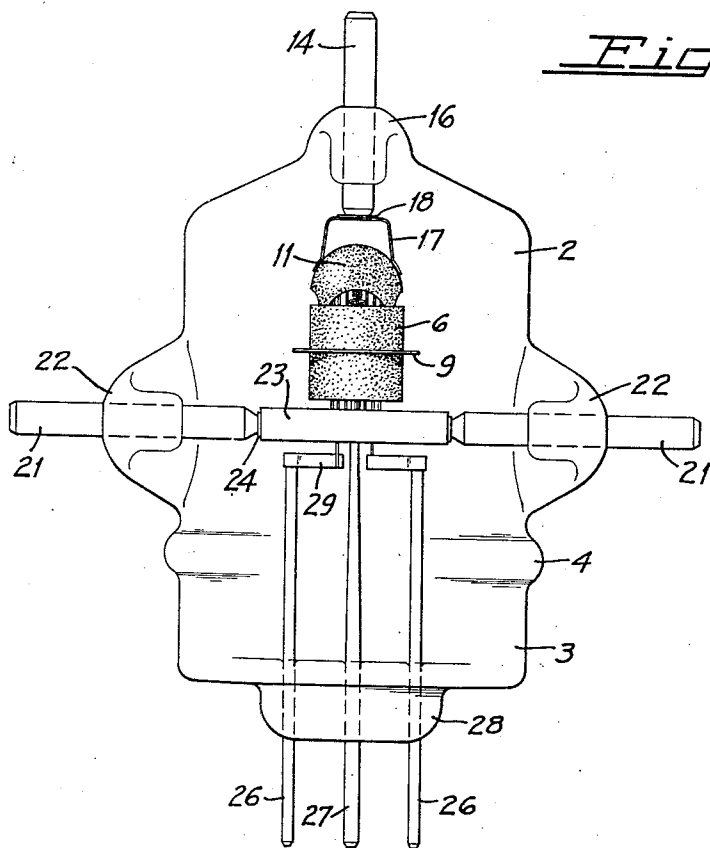
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2,371,683

ELECTRONIC TUBE

Filed June 30, 1942

2 Sheets-Sheet 1



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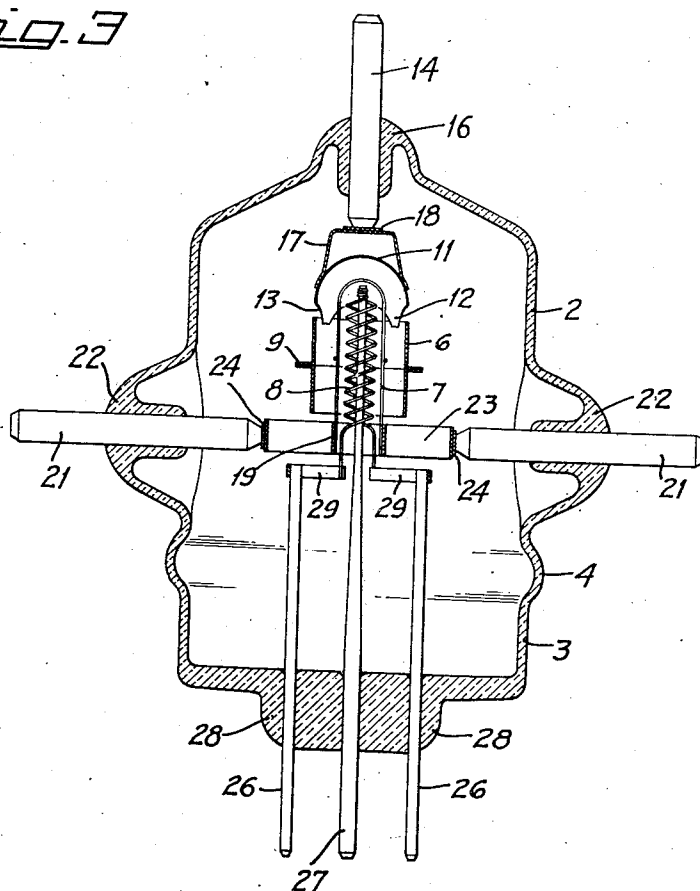
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Fig. 3



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## UNITED STATES PATENT OFFICE

2,371,683

## ELECTRONIC TUBE

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Application June 30, 1942, Serial No. 449,146

4 Claims. (Cl. 250—27.5)

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

It is among the objects of our invention to provide a tube of small physical size, having an improved structure of, arrangement for and mounting of the electrodes and leads in the envelope.

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 drawings:

Figure 1 is a side elevational view of a tube embodying the improvements of our invention; and

Figure 2 is a plan view of the same.

Figure 3 is a vertical sectional view on the same scale, taken in a plane indicated by line 3—3 of Figure 2.

In terms of broad inclusion, our tube comprises an envelope enclosing a plurality of coaxial electrodes including a cathode and grid and plate. The plate is supported on a lead disposed coaxially of the electrodes; and the grid is supported on a pair of leads disposed transversely of the electrode axis. The envelope comprises a pair of cup-shaped sections sealed together along abutting edges. Cathode leads are sealed to the base section, while the plate and grid leads are sealed to the body section of the envelope.

In greater detail, and referring to the drawings, our tube comprises a cylindrical envelope of glass or the like having a body section 2 and a base section 3, both cup-shaped and fused together along abutting edges at seal 4 in a plane lying transversely of the envelope. The base section is shorter than the body; more like a shallow dish compared to the deeper cupped body 2. A tabulation for evacuating the envelope is connected to the body section and, after exhaust, is sealed off the pump at point 5. The envelope is of small physical size, say about  $1\frac{3}{8}$  inches in diameter by about 2 inches in length.

Within the envelope are mounted a plurality of coaxial electrodes, including a plate 6, grid 7 and cathode 8. The plate or anode 6 comprises a pair of drum-like sections, preferably of tantalum, disposed end-to-end. Integral flanges 9 at adjacent ends of the sections are welded together to form a unitary plate structure. The flanges also form an annular heat radiating fin about the

mid-portion of the plate. A hemispherical cap 11 of tantalum is secured over the top of the tubular plate by means of depending tabs 12 welded to the upper plate section. Arched recesses 13 between the tabs form vent openings.

Plate lead 14 is disposed coaxially of the electrodes and projects thru the top of envelope section 2 at seal 16. The lead is preferably a heavy rod of tungsten. Support for the plate is provided by a yoke-shaped strap 17 of tantalum having arms spot welded to cap 11. Both parts being of tantalum they weld readily. It is more difficult to weld to tungsten however, and we preferably first spot weld a piece of nickel 18 to the bracket and then weld this to the end of lead 14. The body of nickel interposed between the parts alloys or fluxes with both the tantalum and tungsten providing a strong joint. The weld is also clean, devoid of oxides and contamination which, if present, would make it difficult to out-gas the parts during evacuation.

Supporting bracket 17 also functions to thermally insulate lead 14 from plate 6, due to the fact that tantalum is a poor conductor of heat and because the wide arms of the yoke-shaped strap radiate heat efficiently. Cap 11 presents considerable heat radiation surface and aids in thermally isolating the lead from the plate. As a result, the glass at the lead seal is kept cool and cracking of the seal is prevented.

Grid 7 is of the cage type, preferably of platinum, terminating in a tantalum base ring 19. The grid is supported on a pair of aligned tungsten leads 21 extending transversely of the electrode axis and projecting thru the sides of envelope section 2 at seals 22. Support for the grid is provided by an oblong loop-like bracket 23 formed by a strip of tantalum bent and welded to make a continuous band. Terminal ring 19 of the grid is welded between the legs of the loop intermediate the ends of the bracket; and the bracket ends are in turn welded to the opposed inner ends of leads 21. Pieces 24 of nickel are interposed between the leads and bracket to flux the welds. This grid bracket provides a rigid support for the grid, and also has good heat radiating properties needed for keeping seals 22 cool.

Cathode 8 is supported on three leads including a pair of short leads 26 and a longer central lead 27. The center lead is disposed coaxially with the electrodes and has a reduced upper portion projecting thru the cathode. These leads, also preferably of tungsten, extend thru the bottom of base section 3 at seals 28.

The cathode comprises a pair of filament coils of thoriated tungsten having interspaced convolutions concentrically arranged about the axis of the electrodes. The upper ends of the coils are connected to center lead 21, preferably by wrapping the ends of the filament wires about the lead and welding. The lower ends of the coils are welded to tantalum straps 23 which in turn are welded to leads 26.

Our tube is fabricated by forming the envelope in two separate sections which, prior to sealing together, are open at one end. Plate lead 14 and grid leads 21 are sealed in place in body section 2. The plate assembly is welded to lead 14, after which the grid assembly is welded to leads 21. An alternate procedure is to first weld the electrodes to the leads, apart from the envelope, and then seal the leads to the glass, using a suitable jig to maintain proper spacing and alignment.

The cathode leads are sealed to the separate base section, and filament 3 is welded in place. Since the cathode leads project out thru the open mouth of the shallow base section, the filament coils may be readily positioned and welded. After mounting the electrodes the filament is centered within the grid and the two envelope sections are fused together along abutting edges at seal 4.

We claim:

1. An electronic tube comprising an envelope embodying a pair of cup-shaped sections sealed together along abutting edges, a plurality of coaxial electrodes including a cathode and grid and plate in the envelope, a lead coaxial with the electrodes and sealed to one of said sections, a pair of leads disposed transversely of the electrode axis and sealed to the side of the last mentioned section, means supporting the plate on

the coaxial lead, means supporting the grid on said pair of leads, and leads for the cathode sealed to the other section of the envelope.

2. An electronic tube comprising an envelope embodying a pair of cup-shaped sections sealed together along abutting edges, a plurality of coaxial electrodes including a cathode and grid and plate in the envelope, a lead coaxial with the electrodes and sealed to one of said sections, a pair of aligned leads disposed transversely of the electrode axis and sealed to the side of the last mentioned section, means supporting the plate on the coaxial lead, means supporting the grid on said pair of leads, and leads for the cathode sealed to the other section of the envelope.

3. An electronic tube comprising an envelope embodying a pair of cup-shaped sections sealed together along abutting edges, a plurality of coaxial electrodes including a cathode and grid and plate in the envelope, a lead coaxial with the electrodes and sealed to one of said sections, a pair of leads disposed transversely of the electrode axis and sealed to the side of the last mentioned section, a cap on one end of the plate, a bracket on the cap for supporting the plate on the coaxial lead, means adjacent the other end of the plate for supporting the grid on said pair of leads, and leads for the cathode sealed to the other section of the envelope.

4. An electronic tube comprising an envelope, a grid in the envelope, a pair of aligned leads disposed transversely of the grid axis and sealed to the envelope, and a grid support comprising an oblong loop secured intermediate its ends to the grid and at its ends to said leads.

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