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DEMOUNTABLE ELECTRON DISCHARGE TUBE

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FIG. 1.

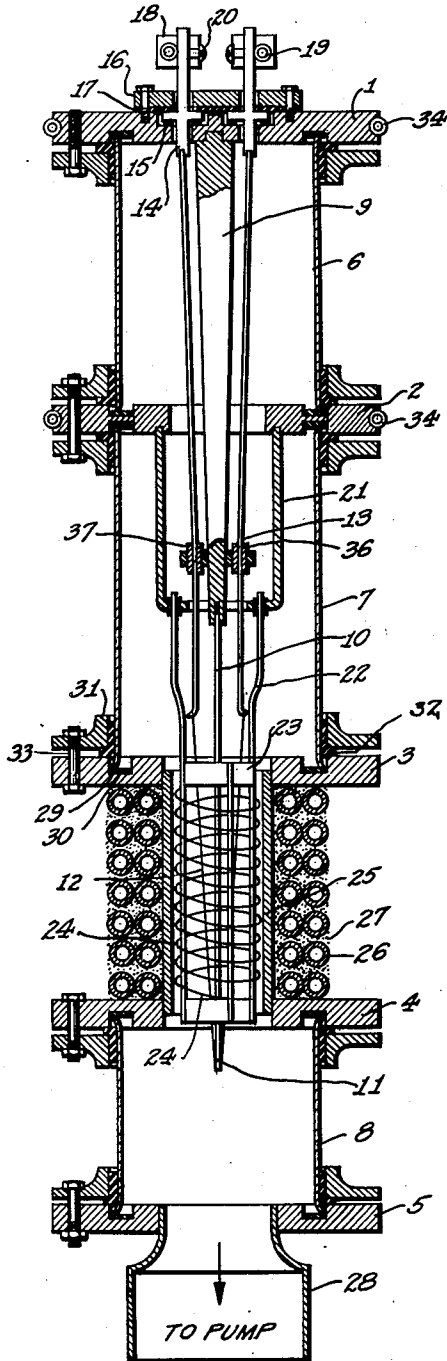
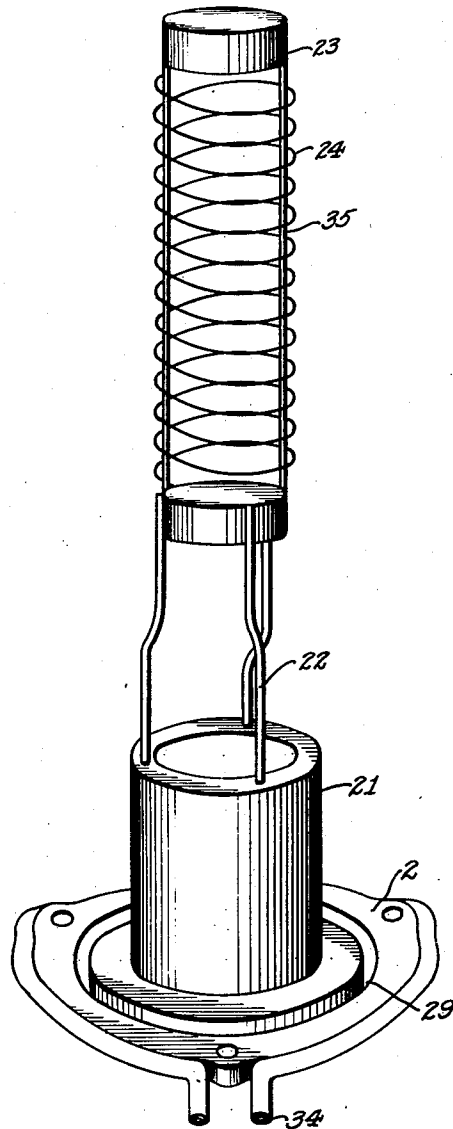


FIG. 2.



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## UNITED STATES PATENT OFFICE

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DEMOUNTABLE ELECTRON DISCHARGE  
TUBE

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11 Claims. (Cl. 250—27.5)

My invention relates to electron discharge tubes and more particularly to tubes of the type in which the various structural parts of the tube may be removed for replacement of new parts.

Vacuum tubes of high power are expensive to manufacture and costly to replace, and because of the high operating voltages and currents employed certain elements of the tubes are liable to breakdown. It is therefore desirable to build such tubes in a manner so that a damaged element may be removed and replaced without necessitating a complete replacement and reconstruction of the tube. Tubes which fulfill these requirements are generally known as demountable tubes.

My invention relates to demountable tubes and an object of the invention is the provision of a tube in which any of the electrodes may be removed and replaced with a minimum of trouble.

It is a further object of the invention to provide a simple and efficient means for cooling the electrodes during the operation of the tube.

According to one feature of the invention the various electrodes of the tube are supported each on a separate metallic mounting plate extending in a plane at right-angles to the major axis of the tube. These mounting plates are spaced along the length of the tube by the interposition of tubular glass envelope sections, and demountable gas-tight joints are provided between the ends of the glass sections and the adjacent mounting plates. To cool the electrodes during operation, channels for the circulation of cooling fluid are provided around the periphery of the mounting plates.

The above and other objects and features of my invention will be apparent from the particular description which follows with reference to the accompanying drawing, in which

Fig. 1 illustrates a vertical cross-section of an electron discharge tube according to my invention and

Fig. 2 is an enlarged perspective view of a grid electrode and its associated mounting plate.

Referring to Fig. 1, the tube comprises an annular metallic mounting plate 1 for the cathode, a metallic annular mounting plate 2 for the grid or control electrode, annular metallic mounting plates 3 and 4 for supporting the anode 25, and an annular plate 5 for closing the lower end of the tube. The last-mentioned plate 5 is provided with an opening through which ingress is given to a vacuum pump by way of a tube 28 for maintaining a vacuum inside the envelope of the tube during its operation. The mounting plates

1 and 2, 2 and 3, and 4 and 5, are respectively separated by tubular glass envelope sections 6, 7 and 8. The ends of these sections are outwardly flared, and in each case a demountable gas-tight joint is provided between each end of each section and the adjacent mounting plate. These demountable joints are constructed in the following manner: A mounting plate, such as 3, is provided on its face adjacent the end of tubular glass section with a circular groove 29 in which is provided a rubber seating ring 30 onto which the end of the glass section 7 is forced to provide a gas-tight joint by means of a metal ring 31 which is clamped against the mounting plate 3 by means of three bolts 33. The bolts 33 pass through ears formed on the annular ring 31 and on mounting plate 3. A rubberized asbestos gasket 32 is provided between the ring 31 and the end of the glass section 7, to prevent fracture of the glass as the bolts are tightened. The gas-tight joints provided on the cathode mounting plate 1, the grid mounting plate 2, and the mounting plates 4 and 5, are similar to that already described, with the exception that in the case of the grid mounting plate 2, a gas-tight joint is provided at both its upper and lower faces.

Referring to the cathode mounting plate 1, this supports a tapered rod 9, the end of which is provided with a bore in which an extension rod 10 is slidably fitted. The end of the rod 10 is provided with a hook 11 over which the filament 12 passes, the ends of the filament being secured to a pair of lead-in conductors 13 secured to a pair of terminal pins 14 mounted in the plate 1. The conductors 13 pass through insulating bushes 36 in a metal disc 37 secured to the support 9. The terminal pins are held in depressions in the plate 1 by means of a disc 16, washers 15 and 17 being provided for insulation purposes. Terminal blocks 18 are secured to the free ends of the pins 14 by means of locking screws. These terminal blocks are also provided with channels 19 for the circulation of cooling fluid. A tube 34 is soldered or brazed into a peripheral groove in the plate 1, and the passage of cooling fluid through this tube cools the cathode structure during the operation of the tube. Since, in normal operation the tube will be mounted so that the cathode hangs downwardly, the weight of the rod 10 serves to maintain the filament 12 in tension.

The grid structure shown in Fig. 2 consists of a cylindrical metal element 21 secured to the grid mounting plate 2. The grid consists of two end caps 23 joined by supporting rods 35 on which is wound a helical grid wire 24. The lower cap 23

is secured by three supporting struts 22 to the member 21. The grid supporting plate 2 also has a tube 34 through which cooling fluid is adapted to circulate secured to its periphery.

Two or more layers of copper tubing 26 are wound around the outer surface of the cylindrical anode 25, the interstices between the convolutions of the tubing being filled with solder 27. During operation, cooling fluid circulates through the tubing 26 for the purpose of cooling the anode.

It will be appreciated that in the event of any electrode or other element of the tube becoming damaged during operation, the tube may be easily dismounted and the faulty element replaced.

It should be distinctly understood that the invention is not limited to the specific construction which has been described in detail, but numerous modifications may be made coming within this scope of the accompanying claims.

What I claim is:

1. An electron discharge tube comprising a cathode, a control electrode and an anode each supported on an annular metallic mounting plate disposed at right-angles to the axis of the tube, a tubular glass envelope section disposed between the mounting plate for said cathode and the mounting plate for said control electrode, a further tubular glass envelope section disposed between the mounting plate for said control electrode and the mounting plate for said anode and a demountable gas-tight joint between each end of each of said tubular glass envelope sections and an adjacent mounting plate.

2. An electron discharge tube according to claim 1, wherein said mounting plate for said cathode is provided with a peripheral channel for the circulation of cooling fluid.

3. An electron discharge tube according to claim 1 wherein said mounting plate for said control electrode is provided with a peripheral channel for the circulation of cooling fluid.

4. An electron discharge tube according to claim 1, comprising tubular glass sections having outwardly flared ends, circular grooves in said mounting plates to accommodate the ends of said tubular sections, rubber seating rings in said grooves and means for clamping said flared ends onto said seating rings.

5. An electron discharge tube according to claim 1 comprising tubular glass sections having outwardly flared ends, circular grooves in said mounting plates to accommodate said ends, rub-

ber seating rings in said grooves, metallic collars encircling said glass sections, and means for clamping said collars to said mounting plates so as to press the ends of said glass sections on to said rubber seating rings.

6. An electron discharge tube according to claim 1 comprising a heating filament and lead-in conductors therefor, said conductors being supported in and insulated from said cathode mounting plate and provided with terminal blocks having channels for the circulation of cooling fluid.

7. An electron discharge tube comprising a cathode, a control electrode and a cylindrical anode, a first metallic mounting plate for supporting said cathode and forming a closure for one end of said tube, a second metallic mounting plate for supporting said control electrode, a first tubular glass envelope section interposed between said first and second mounting plates, third and fourth mounting plates for supporting said anode at its ends, a second tubular glass envelope section interposed between said second and third mounting plates, and a demountable gas-tight joint between each end of said first and second tubular glass envelope sections and an adjacent mounting plate.

8. An electron discharge tube according to claim 7, further comprising a tube for the circulation of cooling fluid wound around the exterior surface of said anode.

9. An electron discharge tube according to claim 7, further comprising a tube for the circulation of cooling fluid wound around the exterior surface of said anode in a plurality of layers, and solder filling the interstices between the convolutions of the tube.

10. An electron discharge tube according to claim 7, further comprising a closure plate for the other end of the tube, a third tubular glass envelope section interposed between said fourth mounting plate and said closure plate and a demountable gas-tight joint between each end of the said third tubular glass envelope section and the adjacent plate.

11. In an electron discharge tube an electrode, an annular plate for supporting said electrode, a tubular glass envelope section, a demountable gas-tight joint between said annular plate and an end of said tubular glass envelope section and a channel surrounding the periphery of said plate for the circulation of cooling fluid.

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