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ELECTRON DISCHARGE TUBES

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Fig. 1.

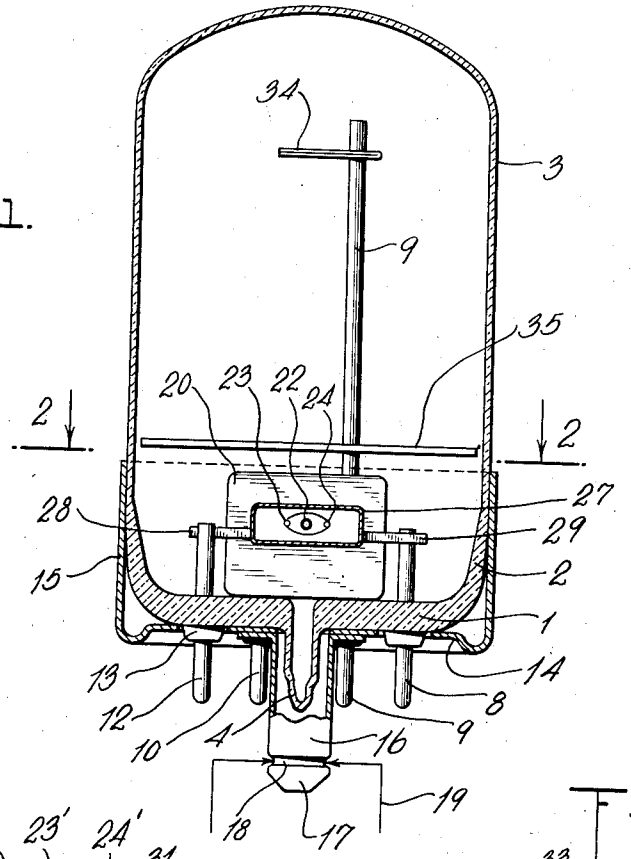
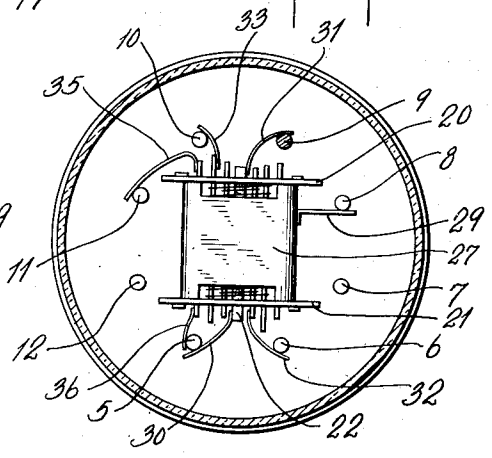


Fig. 3.



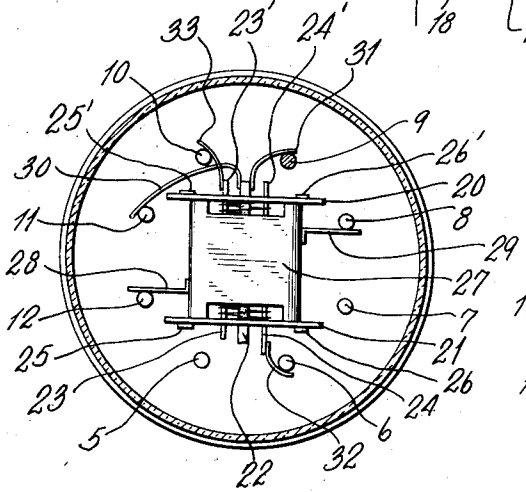


Fig. 2.

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ELECTRON DISCHARGE TUBE

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6 Claims. (Cl. 250—27.5)

This invention relates to electron discharge tubes and in particular to vacuum tubes used in ultra short wave circuits.

In the region of ultra short waves, and in particular in the region of decimeter waves, the capacitances of the tube electrodes, and that of the leads of the tube electrodes carried through the tube envelope must be kept as low as possible, as is well-known in the art. The structure of the circuits used in ultra short wave work makes it furthermore, desirable to provide an arrangement of the lead wires of the tube, which insures a minimum capacity and inductance coupling between the grid and plate circuits of the tube. During recent years, Lecher wire systems and concentric transmission line circuits have become more and more the preferred form of oscillation circuits used in short wave work. In some of the known circuits of this kind, the tubes are arranged in "double ended" connection, that is, the tube is placed in the center of a tuned transmission line, which may be made up of two quarter wave lengths or two half wave lengths symmetrical to the tube.

In the design of such tubes, convenience of connection between the tube electrodes and the wires or members constituting the tuned transmission line must be taken into account, as well as the shortness of such connections. As a result the conventional tube design with the tube prongs extending from the base of the tube parallel to its longitudinal axis, has not in all cases been satisfactory. For ultra-high frequency work therefore, this has led to compromise designs represented for example by the "Acorn" tube, which designs preclude their manufacture and processing on conventional tube-making machines. As a result, these compromise designs have been manufactured in most cases as individual hand-made units, particularly as regards the sealing-in of the amount into the tube.

Such designs are particularly undesirable for small size ultra-high frequency tubes of intrinsically low power, which would have to be made up very nearly as individual hand made jobs, at least in the sealing-in of the mount into the tubes.

It is, therefore, a principal object of the present invention, to provide an ultra-high frequency tube of small size, high efficiency, and minimum losses, which can be made up of standard parts generally used in the production of certain well-known types of radio tubes.

It is another object of the invention, to provide an ultra-high frequency tube, in which the tube mount is so arranged that the connections between the tube electrodes and their leads through the tube envelope are of minimum length.

A further principal object of the invention consists in the positioning of the tube mount in a tube header in such a way, that at least one of the tube electrodes can be connected symmetrically to two of the lead pins of the tube header which lead pins extend perpendicular to the tube header.

A feature of the invention refers to the symmetrical connection of the two ends of the cathode of a tube mount to a pair of lead pins of the tube header.

Another feature of the invention refers to the symmetrical connection of certain electrodes of an ultra-high frequency triode to pairs of lead pins of a tube header, and wherein the connectors between each electrode and the corresponding pairs of header lead pins are of minimum length.

It is another object of the invention, to locate the axis of the tube mount parallel to the main surface of a tube header, whereby symmetrical, short connections of at least one of the tube electrodes to one symmetrical pair of lead-in conductors of the tube header is provided.

One feature of the invention refers to the reduction to a minimum of the capacities and inductances of the members connecting the tube electrodes to the leads of a tube header.

Another feature refers to the adaptability of the tube leads for direct connections to a tuned transmission line circuit, in particular for "double ended" operation, whereby a minimum reflection loss of the oscillations in the circuit is insured.

It is an object of the invention to provide an ultra-high frequency tube, which allows a complete separation of the grid and plate circuits of the tube, due to the symmetrical arrangement of two leads connected to the cathode.

Another feature of the invention relates to a tube wherein the electrode assembly is formed of elements of very small size and which are mounted on the tube header in such a way as to form in effect a rigid unit therewith.

A feature of the invention refers to an ultra-high frequency tube of extremely low losses and high efficiency which is easily assembled and mounted.

In the drawing which shows certain preferred embodiments;

Fig. 1 is a vertical cross-section of a triode tube embodying the invention.

Fig. 2 is a sectional plan view of Fig. 1 taken

along the line 2—2 thereof viewed in the direction of the arrows.

Fig. 3 is a modification showing the invention embodied in a pentode.

Referring to Figs. 1 and 2, the tube envelope may be of any well-known construction, but is preferably of the type shown in Patent No. 2,250,184 comprising a cup-like glass header having a relatively thick flat bottom 1 and a tapered upstanding rim 2. Rim 2 is arranged to be sealed to the corresponding edge or lip of the glass bulb portion 3. The header 1 is formed with a central downwardly extending exhaust tubulation 4 which can be "tipped off" after proper evacuation of the tube. It will be understood of course that the invention is not limited to glass envelope tubes but may be equally well embodied in a tube having a metal envelope closed off by a flattened or button-like header through which the contact pins are insulatingly sealed in a vacuum-type manner.

Rigidly mounted in header 1 and disposed symmetrically around the center thereof, for example in a circular path, are the rigid rods 5 to 12 which constitute the lead-in pins for the tube. Pins 5 to 12 are sealed in a vacuum-tight manner through the header 1 and the latter preferably is thickened as by integral beads 13 in the regions where the prongs are sealed.

For the purpose of supporting the tube in a suitable socket or receptacle, there is cemented to the bulb a metal cup-shaped member having a substantially flat bottom 14 and a cylindrical rim 15. The bottom 14 is provided with a series of circularly disposed openings to receive the corresponding glass beads 13 whereby the metal base is insulated from the various pins. Attached to, or formed centrally of, the bottom 14 is a metal stud 16 which may be of hollow metal stock having a somewhat tapered rounded end 17 and an intermediate peripheral groove 18 adapted to engage a suitable detent contact 19 to lock the tube in its socket; it being understood that the socket has suitable spring contacts to engage the respective pins 5 to 12.

The electrode assembly, which for purposes of illustration is of the triode type, is of so-called unitary construction wherein all the electrodes are rigidly mounted and spaced between end spacers 20, 21, in the form of rectangular mica discs having aligned sets of openings to receive respectively the opposite ends of cathode sleeve 22; the ends of the control grid side rods 23, 23' and 24, 24'; and the bent-over lugs 25, 25', 26, 26' of the rectangular box-like plate electrode 27. In accordance with the invention, the unitary mount instead of being suspended between and carried by the lead-in pins, is directly supported by the flat header 1. For this purpose, mica spacers 20, 21, are extended downwardly beyond the lower surface of plate 27 so that their lower straight edges engage and rest upon the header 1. By this means, the electrodes are spaced above the header a fixed distance and the plate is sufficiently spaced from the header so as not to obstruct the exhaust tube 4.

The electrode unit is positioned so that the electrodes are longitudinally parallel to the bottom 1 of the header. Furthermore, the electrodes are dimensioned so that the entire unit is symmetrically centered within the circle defined by the pins 5 to 12, and so that the plate electrode 27 is below the rim 15. In order to prevent relative movement between the electrode unit and the header, there are provided two rigid metal straps 28, 29, welded at their inner ends respectively to the flat sides of plate 27, and welded at their outer ends to the oppositely disposed pins 8 and 12. Likewise, the opposite sides of the cathode sleeve are connected through respective metal straps 30, 31, to the oppositely disposed pins 9 and 11. The end 24 of the right-hand grid rod, and the end 23' of the left-hand grid rod, are connected symmetrically by respective short metal straps 32, 33, to the oppositely disposed pins 6 and 10. The ends of the cathode heater filament (not shown) may be connected to pins 5 and 7 respectively. With this arrangement therefore, the entire electrode unit is surrounded by the pins and is connected thereto by the shortest possible wire lengths while at the same time being rigidly mounted with respect to the header.

As is well-known, during the evacuation of devices of this type, it is necessary to flash a getter and for this purpose the pin 9 may be extended upwardly towards the top of the bulb 3 and carries adjacent its upper end a getter carrier 34. In order to protect the electrode unit from the deposition of the getter, there is provided a disc 35 which is fastened to the rod 9 in any suitable manner, for example by means of an eyelet. Preferably the disc 35 is positioned slightly above the electrode unit and is slightly spaced from the interior wall of the bulb 3. If desired, the disc 35 may be of metal or other conductive material so that it cooperates with the members 14 and 15 to complete the electrostatic shielding of the electrode unit within the tube.

Fig. 3 shows the invention embodied in a pentode tube, the parts which are the same as those of Figs. 1 and 2 bearing the same designations. The cathode sleeve 22 is connected at opposite ends by metal straps 30 to the oppositely disposed pins 5 and 9. The control grid is connected by metal strap 32 to pin 6, and the shield grid is connected by a metal strap 33 to pin 10. The suppressor grid has one end connected by metal strap 35 to pin 11 and the opposite end of the suppressor grid is connected by strap 36 to pin 5. The plate is connected by member 29 to pin 8 and the ends of the filament heater (not shown) may be connected to pins 7 and 12, respectively.

From the foregoing description, it will be seen that the electrode unit is mounted and sealed within a bulb of a well-known construction known to the trade as "Sylvania" lock-in type, and therefore the same standard sealing-in machinery that is used for the conventional lock-in types can be used for tubes of the present invention. Furthermore, the electrode assembly forms in effect a rigid unit with the header. Instead of fastening the electrode unit against displacement by the metal straps 28 and 29, the unit may be fastened in place by means of metal straps each fastened at one end firmly to a mica spacer and the other end of each metal strap welded to a corresponding base pin.

Subject matter disclosed herein and not claimed is claimed in copending application Serial No. 416,433, filed October 25, 1941.

What we claim is:

1. An electron tube for ultra-high frequency systems comprising an evacuated envelope having a header through which are sealed in a vacuum-tight manner a plurality of rigid pins arranged in a symmetrical path around the center of the header, an electrode unit mounted adjacent the

header with the longitudinal axes of the electrodes extending transversely to the inwardly projecting ends of said pins, short and substantially symmetrical connections from opposite ends of at least one of said electrodes to a corresponding pair of said pins, and means to support the electrode unit rigidly on the inwardly projecting portions of another pair of pins, the last-mentioned means including a pair of mica spacers forming part of the electrode unit, said spacers each having an edge in direct engagement with said header whereby the weight of the electrode unit is carried directly by said header through said spacers.

2. An electron discharge tube mount comprising a header, a plurality of rigid metal pins carried by said header around a common center, an electrode unit consisting of an electrode assembly united by a pair of insulator spacers at opposite ends, and means to support said unit with an edge of each spacer in direct supporting engagement with said header whereby said unit is spaced a fixed distance from said header.

3. An electron tube having an evacuated envelope with a flattened header extending transversely thereof, a plurality of rigid contactor pins sealed through said header with portions extending inwardly from the envelope, said pins being arranged symmetrically around the center of said header, a unitary electrode assembly mounted between and surrounded by the inwardly projecting portions of said pins, and short metal straps extending from opposite ends of each electrode and substantially symmetrically connected to corresponding pairs of said pins, said assembly including a pair of rectangular mica end spacers with their edges in engagement with said header.

4. An electron discharge tube according to claim 3 in which said mica spacers each has a metal strap firmly fastened thereto at one end and with the other end of each strap welded to a corresponding base pin.

5. An electron discharge tube according to claim 3 in which the electrode assembly including said mica end spacers is rigidly held against the header by said short metal straps.

6. A high frequency electron discharge tube comprising a bulb closed off at one end by a header having a portion substantially flattened in a plane transverse to the longitudinal axis of the tube, a plurality of base pins carried by said header with portions extending inside the tube, an electrode assembly unit including a pair of electrode spacers, and means to connect said assembly to said header to form a rigid unit therewith including metal straps having one end fastened to the electrode assembly unit and the other end fastened to corresponding lead-in pins with the edges of said spacers held firmly against said header.

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