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(54) Linear electron beam tubes

(57) In a tube such as an IOT, an electron gun includes a cathode 2 grid and anode surrounded by a resonant input cavity 5. A grid lead 10 supplies a voltage to the grid 3 and includes a filter comprising a capacitor 11 and inductor 12 which are both approximately one quarter wavelength long at a selected frequency to reduce or prevent rf leakage along the grid lead. The grid lead is arranged to extend through the cavity 5 and is located within the interior space which is surrounded by the annular cavity 5.

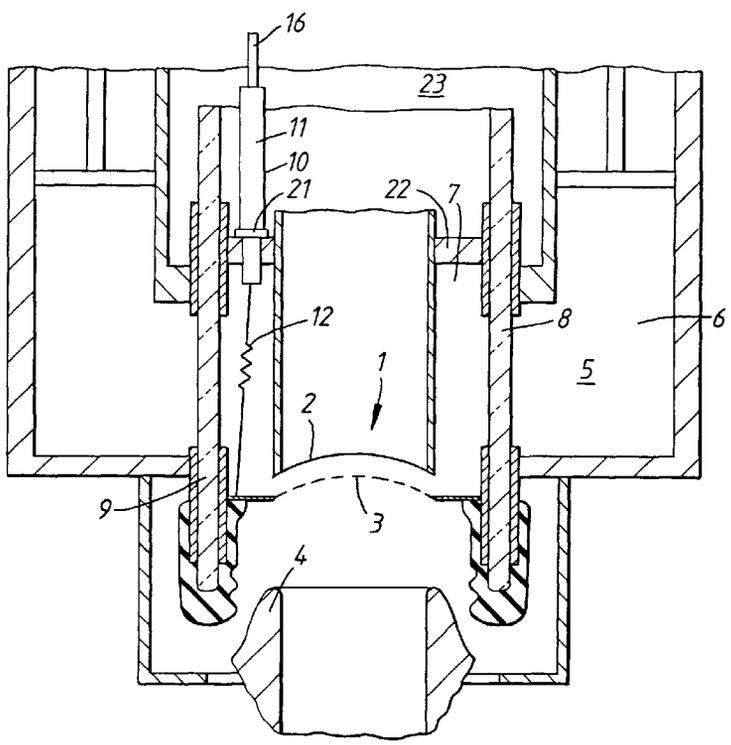

Fig.1

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Description

This invention relates to linear electron beam tubes and more particularly to inductive output tubes (IOT's).

An IOT is an arrangement in which a high frequency input signal is applied via a resonant input cavity to a region between the cathode and grid of an electron gun. This produces modulation of the electron beam generated by the electron gun. The resulting density modulated beam is directed to interact with an output resonant cavity from which an amplified high frequency output signal is extracted.

The present invention seeks to provide an improved linear electron beam tube and in particular an improved IOT but it may also be applicable to other tubes in which an input cavity surrounds an electron gun.

According to the present invention there is provided a linear electron beam tube comprising an electron gun assembly including a cathode, grid and anode and in which, in use, a high frequency input signal to be amplified is applied to the grid/cathode region via an input resonant cavity arranged about the electron gun and wherein an electrical lead for applying voltage to the lead includes a filter for reducing leakage of rf signal via the lead.

During normal operation of an IOT, the application of high frequency signals to the input cavity which are used to modulate the electron beam may also result in leakage of signal down the grid lead and this may interfere with the drive of the IOT. This interference may be sufficiently severe as to prevent proper operation of the tube at certain frequencies over its bandwidth. By including a high frequency filter in the grid lead such interference may be damped sufficiently that it no longer causes significant problems in the operation of the IOT.

Preferably, the filter includes an inductor and a capacitor and in one advantageous embodiment of the invention, the inductor is connected to the grid mount at one end and to the capacitor at the other end. Advantageously, the capacitor is of cylindrical configuration having a centre conductor via which a voltage is applied to the grid and a surrounding cylindrical member spaced therefrom. An air gap or some other dielectric material is present between the centre and outer parts. Other capacitor configurations may be used.

Preferably, at least one of the capacitor and inductor is approximately one quarter wavelength long at a selected frequency. The frequency selected is that which tends to cause interference if leakage along the grid lead occurs.

The cylindrical configuration of the preferred capacitor included in the filter is particularly compact and can be fabricated to high tolerances by accurately selecting spacers to define the gap between the inner and outer cylinders.

In a particularly advantageous embodiment of the invention, the input resonant cavity is of an annular configuration having inner and outer annular walls about a volume and the grid lead is arranged within the volume surrounded by the inner wall of the cavity. This gives a particularly compact arrangement and protects the lead from accidcntal damage during shipping or installation. Advantageously, where the input cavity is in two parts which are separated by RF choke means, the grid lead is extensive through an aperture in a wall of the inner part of the cavity and extends across the cavity to the grid or grid mount.

One way in which the invention may be p erformed is now described by way of example with reference to the accompanying drawings, in which:

Figure 1 is a schematic sectional view of part of an IOT in accordance with the invention; and

Figure 2 is a schematic sectional view of a capacitor used in the IOT of Figure 1.

With reference to Figure 1, an IOT includes an electron gun assembly 1 having a cathode 2, a grid 3 and an anode 4, the electron gun 1 being surrounded by an annular input high frequency resonant cavity 5. The input cavity 5 includes an outer part 6 and an inner part 7 which are separated by RF chokes 8 and 9 to prevent leakage of high frequency energy from the cavity. A lead 10 to the grid 3 for applying a voltage thereto includes a cylindrical capacitor 11 and an inductor 12 each of which is one quarter of wavelength long at a selected frequency which is chosen so as to reduce high frequency signal loss down the grid lead.

The capacitor 11 is shown in greater detail in Figure 2 and includes a central conductor 13 having an aperture therein 14 into which the next section of the grid lead is connected to join to the inductor 12. The other end of the inner conductor 13 includes an aperture 15 at which an external connector 16 is fixed for connection to the appropriate supply. A hollow stainless steal cylinder 17 surrounds the central conductor 13 being spaced therefrom by alumina spacers 18 and 19 at each end to define an air gap 20 between them. The outer cylinder 17 is connected to a plate 21 which is fixed to a transverse plate 22 of the IOT defining part of the inner portion 7 of the cavity 5. The capacitor is thus fixed securely to the tube in the region 23 within the annular cavity 5, the grid lead extending through the cavity 5 to the grid 3.

Claims

1. A linear electron beam tube comprising an electron gun assembly (1) including a cathode(2), grid (3) and anode (4) and in which, in use, a high frequency input signal to be amplified is applied to the grid/cathode region via an input cavity (5) arranged about the electron gun assembly (1) and wherein an electrical lead (10) for applying voltage to the grid (3) includes a filter (11, 12) for reducing leakage of

rf signal via the lead (10).

2. A tube as claimed in claim 1 wherein the filter includes a capacitor (11) and an inductor (12).

3. A tube as claimed in claim 2 wherein the capacitor (11) and the inductor (12) are both approximately one quarter wavelength long at a selected frequency.

4. A tube as claimed in claim 2 or 3 wherein the capacitor (11) is cylindrical having a central conductor (13) via which a voltage is applied to the grid (3) and an outer conductive cylinder (17) spaced therefrom.

5. A tube as claimed in any of claims 2, 3 or 4 wherein the inductor (12) is connected to the grid (3) at one end and to the capacitor (11) at its other end.

6. A tube as claimed in any preceding claim wherein the input cavity (5) is arranged to comprise inner and outer parts separated from one another by RF chokes (8,9) and the grid lead (10) is extensive through a cavity wall included in the inner part (7) of the cavity (5).

7. An IOT including a tube as claimed in any preceding claim in combination with external cavity means (5).

8. An IOT as claimed in claim 7 wherein the cavity (5) is annular and the grid lead (10) is located within the volume defined by it.

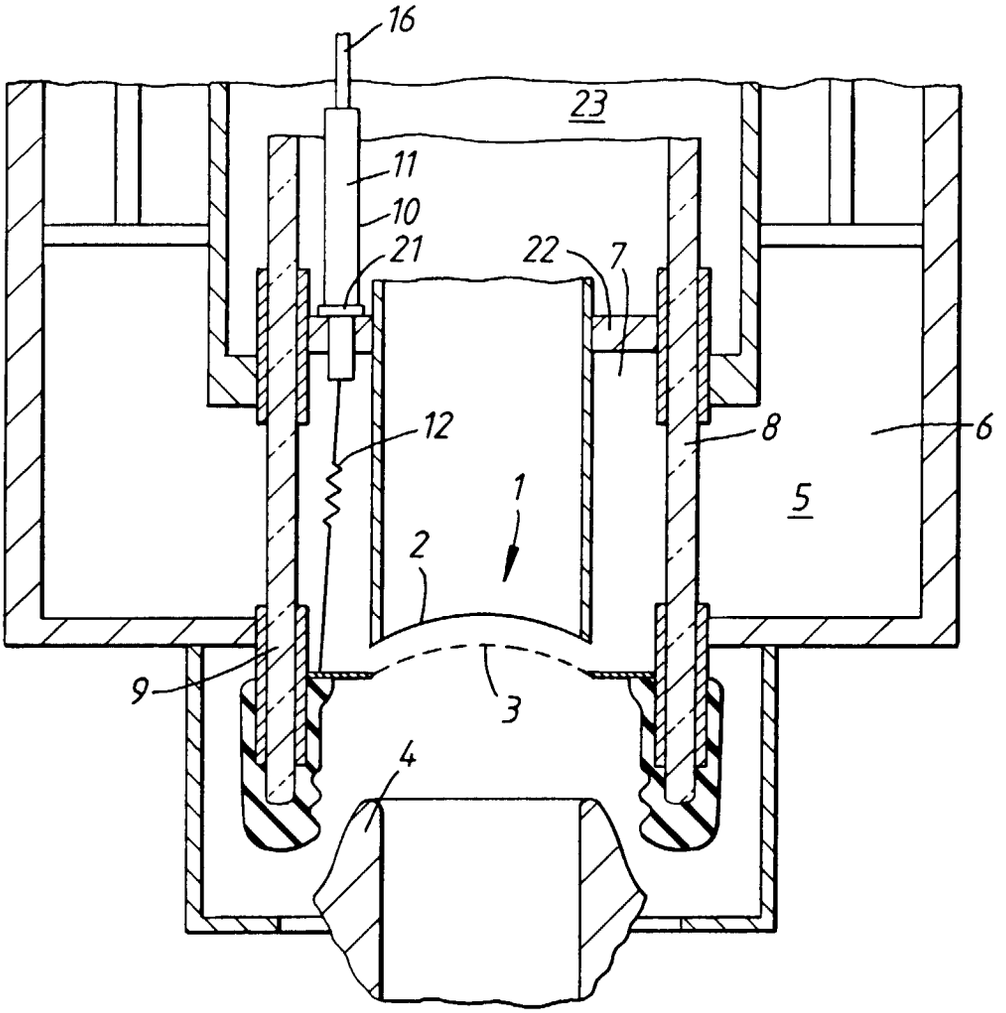

Fig.1

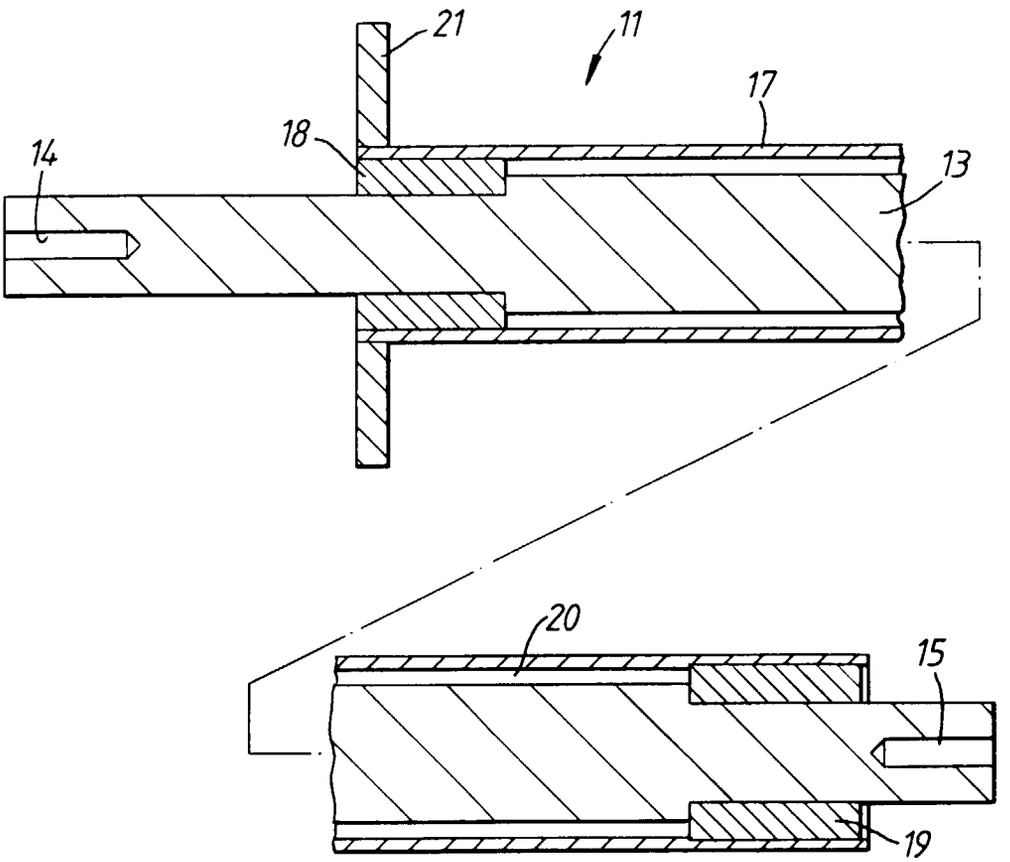

Fig.2