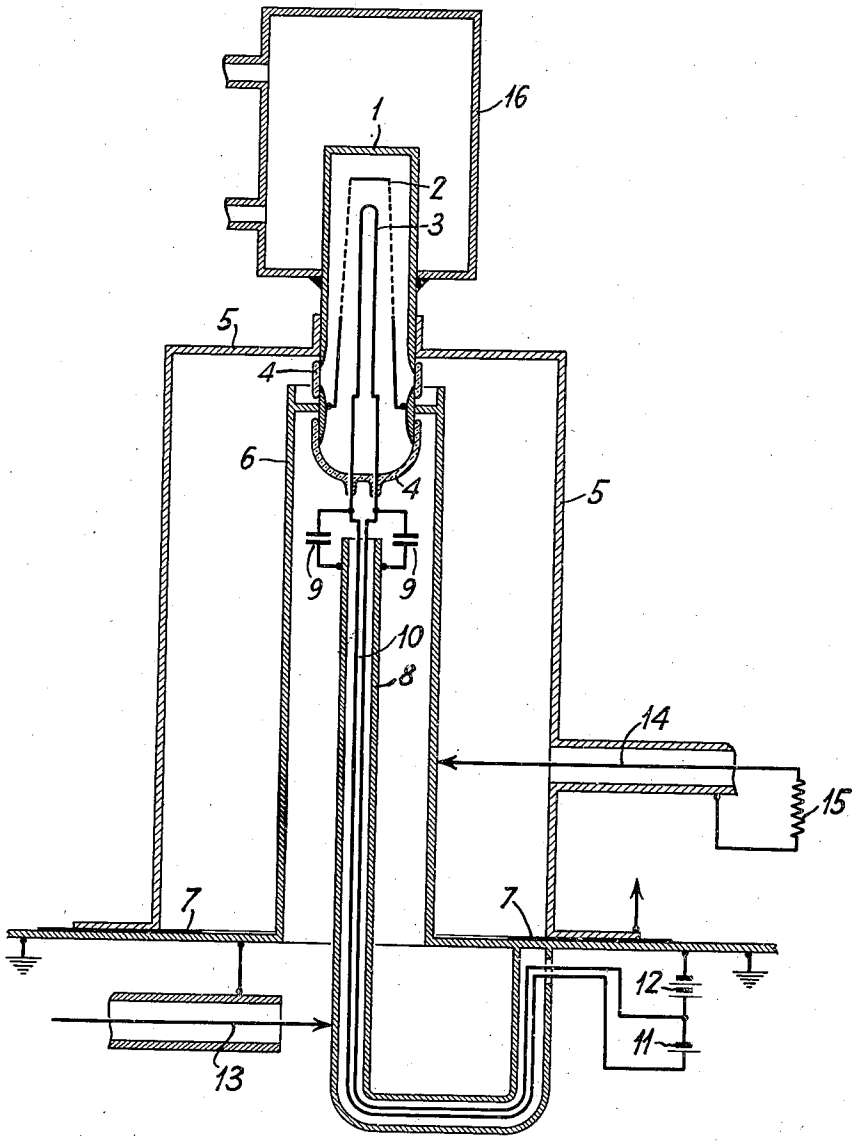
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THERMIONIC VALVE CIRCUITS

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THERMIONIC VALVE CIRCUITS

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The present invention relates to thermionic valve circuits and more particularly relates to improvements in radio-frequency amplifiers.

It is well-known that in any thermionic valve radio-frequency amplifier it is desirable to screen the input circuit of the amplifier from the output circuit in order to prevent the amplifier from oscillating due to feedback. The screening to be effective has to be continued inside the thermionic valve in addition to the external screening. For this reason the screened grid type of valve has been developed and used. However, for various reasons, including cheapness of manufacture and ease of operation, it is preferable especially in large power radio-frequency amplifiers to use valves of the triode type. These valves have the disadvantage that in the known circuit arrangements the difficulties of preventing oscillation without neutralisation are very great, because the anode-to-grid capacity of the valves couples the input and output circuits, and this disadvantage is especially prominent when the amplifier is operated at ultra short waves.

It is the object of the present invention to provide an improved radio-frequency amplifier in which these difficulties are substantially overcome.

According to the invention an ultra-short wave thermionic valve apparatus is provided comprising three tubular conductors arranged one within the other, the outer tubular conductor being associated with one electrode of a thermionic valve, the intermediate tubular conductor being associated with a control electrode of said valve and forming a tuned circuit with said outer tubular conductor, the inner tubular conductor being associated with another electrode of said valve and forming a tuned circuit with said intermediate tubular conductor the arrangement being such that the intermediate tubular conductor screens the inner tuned circuit from the outer tuned circuit.

In a preferred arrangement according to the invention the first mentioned electrode is the anode of a triode thermionic valve, and said inner tubular conductor is associated with the cathode of said valve.

For the purpose of describing the invention more in detail reference will now be made to the accompanying drawing which illustrates a particular embodiment according to the invention.

In the figure which illustrates an embodiment according to the invention, a triode thermionic valve, which is preferably of the ring sealed grid type, is used as an amplifier valve in a short wave transmitter. The metal anode 1 of the valve is surrounded by a water jacket 16 for the purpose of cooling the valve. The grid 2 of the valve is situated between the anode 1 and the cathode 3 and effectively shields these electrodes one from the other. The glass insulation of the valve is indicated at 4.

To the grid 3 of the valve is fastened a cylindrical or rectangular tube 6 of metal, for example, copper, the far end having a broad rim which is connected to earth. Concentrically surrounding the tube 6 is another tube 5 of metal, one end of which is fastened to the anode 1 of the valve and the other end of which is by-passed to earth by means of a condenser. As shown in the diagram the condenser is formed by means of a flange on the tube 5 butting against the rim of the tube 6, a piece of mica 7 serving as an insulator. The outside of the tube 5 is taken to a suitable source of positive potential. Arranged concentrically within the tube 6 is an additional metal tube 8, one end of which is connected via blocking condensers 9 to the cathode 3 of the valve, the other end being fastened to the rim of the tube 5 and thus being effectively earthed. The heater current for the valve is conveyed through the tube 8 by means of a two wire conductor 10 from a suitable source 11 (shown as a battery). The bias source 12 for the valve is connected between the source 11 and earth.

The input radio frequency oscillations are fed into the amplifier stage by means of a conductor 13 which is suitably tapped on the cathode circuit. The ouput from the amplifier is taken from tappings on the outside of tube 6 and is conveyed by means of lead 14 (which may be a suitable feeder-line) to the load circuit represented by resistance 15.

Since the cathode circuit is inside the tube 6 and the anode circuit is outside the tube 6, the output and input circuits are effectively shielded one from another. Similarly the grid of the valve shields the anode from the cathode. Although the circuit has been illustrated with reference to a thermionic triode valve it will be appreciated that other multi-electrode valves such as tetrodes and pentodes, may be used with appropriate potentials on their electrodes.

In operation it is arranged that the dimensions of the concentric tubes are such that the input and output circuits are tuned to resonance at the operating frequency. It can be shown that the apparent impedance between the cathode and the grid is comparatively low and is approximately equal to the reciprocal of the mutual conductance

of the valve. The input circuit is thus heavily damped and the circuit is therefore of value when modulated signals covering a wide frequency band have to be transmitted, as for example, in television and multiplex systems. It should be noted that, since there is no actual resistance damping, the power absorbed in this impedance is not dissipated, but re-appears in the anode circuit and is finally transferred to the load. Since the input circuit of the amplifier is of comparatively low impedance it will be necessary suitably to adjust the tapping on the input circuit for matching purposes.

The amplifier may be modulated in known manner by varying the anode potential at modulation frequencies and although cathode modulation can be employed it is not desirable as this causes the damping on the input circuit to vary considerably.

A further advantage of the embodiment shown is that the outside of the tube **5** is effectively at earth potential at radio-frequencies so that there is no harmful capacity or radio-frequency loss introduced by the water jackets or air cooling fins should the latter be used. In addition, as the only tuning capacity of the output circuit is the anode-to-grid capacity of the valve the circuit is particularly useful for television transmission. If desired the positive terminal of the source of supply connected to the tube **5** may be earthed and the cathode of the valve maintained at a suitable negative potential with respect to earth. In this case the grid of the valve is not connected directly to earth but is connected to a suitable biasing arrangement and effectively to earth by means of a condenser or by an acceptor circuit.

I claim:

1. An ultra-short wave amplifier system comprising an electron discharge tube having an anode which constitutes a portion of the tube envelope, a cathode and a grid; two resonant circuits constituted by a plurality of concentric tubular conductors and comprising an outer conductor connected to said anode, an intermediate conductor connected to said grid, and an inner conductor coupled to said cathode; a capacitor constituted by metallic flanges connected respectively to the outer and intermediate tubular conductors and having an insulation separator interposed therebetween; means including a potential source connected to said cathode for heating the same and also connected to said anode for attracting electrons thereto; means for applying input potentials in circuit between the cathode and grid; and a load in circuit between the outer and intermediate tubular conductors; said intermediate tubular conductor constituting shielding means between the two said resonant circuits.

2. A system in accordance with claim 1 and having means including a jacket surrounding the anode and a fluid therein for cooling the same.

3. A system in accordance with claim 1 and having at least one conductor within and shielded by said inner tubular conductor for interconnecting said cathode and said potential source.

4. A system in accordance with claim 1 and having cooling means surrounding said anode, said anode being maintained at ground potential for radio frequencies.

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