

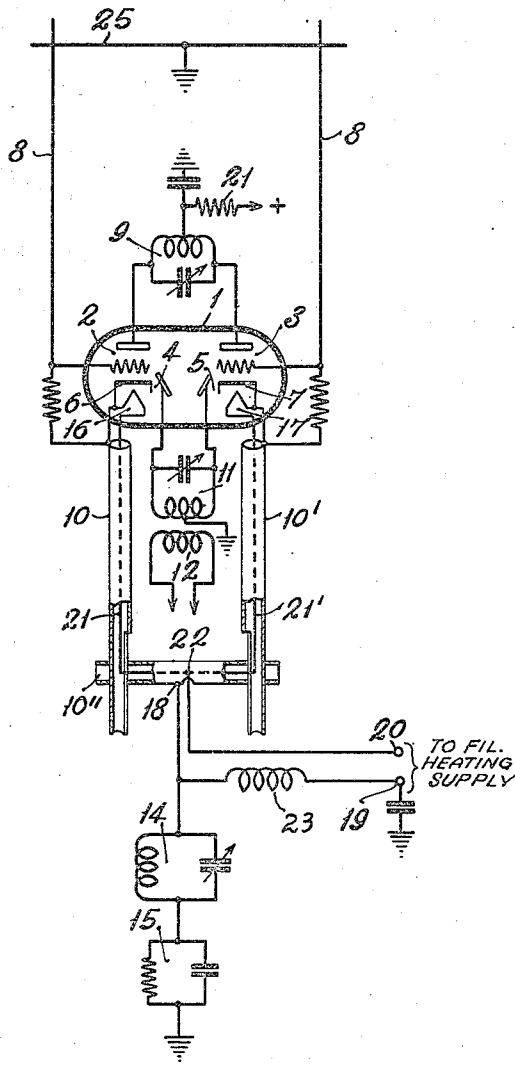
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CIRCUIT ARRANGEMENT FOR ULTRA SHORT WAVES

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CIRCUIT ARRANGEMENT FOR ULTRA
SHORT WAVES

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This invention relates to a circuit arrangement for ultra-short waves which comprises a resonant circuit mainly consisting of two parallel conductors, for instance a tunable Lecher-wire system, and an electron discharge tube which may serve for amplifying, mixing or detecting purposes.

More particularly, in mixing circuit arrangements for the reception of ultra-short waves, it is often advantageous to connect the cathode of the electron discharge tube to a point of a resonant circuit which is not earthed for high frequency. In such a circuit, however, disturbances occur when the cathode of the said electron discharge tube is indirectly heated by means of a filament which is fed from a supply earthed for high frequency, the said disturbances being audible as crackling or humming noises after detection of the high frequency oscillations.

One of the objects of the invention is to provide means by which the said disturbances, due to the high frequency voltage set up between the filament and the cathode of the electron discharge tube, can be avoided in a simple manner in arrangements of the kind referred to above.

To this end, according to the invention, the supply conductors for the filament between a point earthed for high frequency and the point of the resonant circuit connected to the cathode of the electron discharge tube are tightly coupled throughout their length for high frequency currents to the part of the resonant circuit conductors located between the two points in such manner that between the cathode and the filament of the tube there occur at least substantially no alternating voltages having a frequency whose order of magnitude corresponds to the natural frequency of the resonant circuit.

The said close coupling for high frequency currents can be realized by arranging for the supply conductors between the said points of the resonant circuit, with the interposition of insulating material, to extend along the surface of the resonant circuit conductors, which may be shaped as a band, or within the tubular resonant circuit conductors, thus establishing a capacitative coupling between the supply and resonant circuit conductors and avoiding the appearance of disturbing high frequency voltages between corresponding points of the conductors.

In another suitable form of construction of the circuit, according to the invention, at least one of the supply conductors is constituted by one or by both resonant circuit conductors or by a part thereof.

The invention will be more fully explained by

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reference to the accompanying drawing representing, by way of example, a particularly suitable form of construction of a push-pull mixing circuit according thereto.

The circuit represented in the drawing comprises a tube 1 having two uniform electrode-systems, each of which consists of a triode system 2, 3 and a diode system 4, 5 having a common cathode 6, 7 respectively. The push-pull connected triode systems produce the local oscillations, to which end the control grid circuits comprise a Lecher-wire system 8 which can be tuned by means of an earthed bridge 25, the anode circuits including a resonant circuit 9 and the cathode circuit comprising a tunable Lecher-wire system 10, 10', 10'', all of which circuits are tuned to the frequency of the local oscillations.

Between the two diode anodes is interposed a resonant circuit 11 which is tuned to the frequency of the incoming oscillations supplied to this circuit through the intermediary of a coupling coil 12.

The anodes of the triode systems are connected through a resistance 21 to the positive terminal of a source of anode voltage (not represented) whose negative terminal may be earthed.

The cathodes 6, 7 of the two triode systems 2, 3 are connected respectively to the ends of the resonant circuit constituted by the parallel conductors 10 and 10' and the bridge 10'', the centre of the bridge 10'' for tuning the circuit being connected to earth through the series connection of a resonant circuit 14 tuned to the intermediate frequency and a network 15 which serves to produce a suitable diode bias and consists of the parallel connection of a resistance and a condenser.

In the circuit illustrated, the cathodes 6 and 7 of the tube 1 convey alternating voltages having the frequency of the local oscillations with respect to earth so that, if the cathodes are indirectly heated by filaments 16, 17 connected to an earthed supply, alternating voltages also occur between each of the two cathodes and the associated filament, which voltages cause undesirable disturbances, as has already been said above.

According to one aspect of the invention, the occurrence of these disturbances in the circuit illustrated is avoided by supplying the heating voltage E_{g1} , in the case under review an alternating voltage, to the filaments 16, 17 through conductors coupled to the resonant circuit conductors between the point 18 of the resonant circuit 10, 10', 10'' earthed for local oscillations and the

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ends of this circuit which are connected to the cathodes. For this purpose, one end of each filament 16, 17 is directly connected to the associated cathode 6, 7 respectively and through the intermediary of the resonant circuit conductors 10, 10' respectively themselves and the point 18 of the bridge 10'' to the junction terminal 19 for the heating voltage, which terminal is earthed for high frequency, whereas the other end of each filament is connected to the junction terminal 20 through conductors 21, 21' respectively insulatingly arranged within the tubular resonant circuit conductors 10, 10' respectively and a lead-in point 22 located similarly to point 18 of the tubular bridge piece 10''. The supply conductor connected to the junction terminal 19 includes a choke 23 constituting a high impedance to intermediate frequency oscillations.

By supplying the heating current to the filaments in the manner set out above, the occurrence of alternating voltages having a frequency whose order of magnitude corresponds to the natural frequency of the resonant circuit is avoided with certainty between cathode and filament, thus removing the cause of the said disturbances.

What I claim is:

1. A circuit for ultra short waves, more particularly a mixing circuit, comprising a resonant circuit which includes two parallel conductors and an electron discharge tube having a filament, an indirectly heated cathode connected to a point on the resonant circuit which is not earthed for high frequency, an alternating current supply earthed for high frequency for heating the cathode, heating supply conductors for the filament, means for grounding a point on said supply conductors for high frequency energy, said supply conductors considered between said ground point and the point of the resonant circuit connected to the cathode being tightly coupled throughout their lengths for high frequency currents to the part of the conductors of the resonant circuit located between both points; in such manner that between the cathode and the filament of the tube there appear at least substantially no alternating voltages having a frequency whose order of magnitude corresponds to the natural frequency of the resonant circuit.

2. A circuit for ultra short waves, as claimed in claim 1, in which said resonant circuit comprises tubular conductors and one or both supply conductors between the said points of the resonant circuit are provided within said tubular conductors.

3. A frequency mixer comprising a pair of oscillator electrode structures each including an indirectly heated cathode, a filament therefor, a grid and an anode, all located in a single evacuated envelope, a diode anode cooperating with each cathode and also located in said envelope; tuned circuits coupled between corresponding electrodes of said structures and tuned to the frequency of the locally produced oscillations, said cathode tuned circuit comprising a pair of parallel tubular conductors one end of which is shunted by a tubular conductor, and the other

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end of which is connected to said cathodes, one terminal of each filament being connected directly to its cathode, the other terminal of each filament being connected to a supply lead extending through the interior of that tubular conductor which is associated with its cathode, a connection from the center point of said shunting tubular conductor to one terminal of an alternating current filament supply, a condenser connecting said last terminal to ground for radio frequency energy, and a connection from the other terminal of said filament supply to the supply leads in the interiors of said pair of tubular conductors, a tuned circuit coupled between said diode anodes and tuned to the frequency of the input waves, and a circuit tuned to the difference of the frequency of the locally produced oscillations and the frequency of the input waves, said last circuit being located between the cathode tuned circuit and the diode anode tuned circuit.

4. A frequency mixer comprising a pair of oscillator electrode structures each including an indirectly heated cathode, a filament therefor, a grid and an anode, a diode anode cooperating with each cathode, tuned circuits coupled between corresponding electrodes of said structures and tuned to the frequency of the locally produced oscillations, said cathode tuned circuit comprising a pair of parallel tubular conductors one end of which is shunted by a tubular conductor, and the other end of which is connected to said cathodes, one terminal of each filament being connected directly to its cathode, the other terminal of each filament being connected to a supply lead extending through the interior of that tubular conductor which is associated with its cathode, a connection from the center point of said shunting tubular conductor to one terminal of an alternating current filament supply, a condenser connecting said last terminal to ground for radio frequency energy, and a connection from the other terminal of said filament supply to the supply leads in the interiors of said pair of tubular conductors, a tuned circuit coupled between said diode anodes and tuned to the frequency of the input waves, and a circuit tuned to the sum or difference frequency of the locally produced oscillations and the frequency of the input waves, said last circuit being coupled to the center point of said shunting tubular conductor.

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