SUPERHETERODYNE RADIO RECEIVER

INVENTOR.

AGENT
The present invention relates to a superheterodyne receiver, and more particularly to a mixing circuit arrangement wherein both the local oscillations and the input signals are applied between the cathode and the grid of the mixing tube.

For frequency transformation of ultra-short waves a diode is generally used. This, however, has the disadvantage that an additional tube is required for generating the local oscillations.

It is known to use a triode as an oscillator-modulator, but these known circuit-arrangements are, as a rule, unsuitable for frequency transformation of ultra-short waves.

The principle object of the present invention is to provide a mixing circuit-arrangement for the reception of ultra-short waves, of the type referred to in the preamble, in which stable oscillator operation is ensured and in which a high conversion conductance is achieved.

Another object of the invention is to provide a mixing circuit wherein local oscillations are not radiated by the antenna and in which a favourable signal-to-noise ratio is achieved.

Further objects of the invention will appear from the following description.

According to the invention, the mixing circuit includes a discharge tube having a cathode, a control grid and an anode. An impedance network, from which the intermediate-frequency oscillations are derived, is coupled between the anode and the grid. Connected in series with this impedance network is an impedance element across which the local oscillations occur and which is inductively coupled with an impedance connected between the cathode and the grid, so that the local oscillations are produced in the tube itself and are applied, together with the input signals, between the cathode and the grid of the tube.

The grid is preferably connected to a point of constant potential, such as ground, and acts as a static screen between the cathode and the anode. It is to be noted that such so-called grounded-grid arrangements for amplifying ultra-high-frequency oscillations are often used when it is desired to amplify a comparatively wide frequency band. In mixing circuits it is also known to connect the cathode, through an impedance across which the local oscillations occur, to a point of constant potential and to supply the signal voltage to the grid. In such an arrangement, however, the output circuit is generally connected between the grid and the point of constant potential, so that the grid does not constitute a static screen between the output circuit and the input circuit of the tube and the arrangement is not well suited for frequency transformation of ultra-short waves.

According to the invention, there is interposed between the point of constant potential, to which the grid is connected, and the anode a series-connection of a circuit tuned to the local oscillator frequency and the impedance from which the intermediate-frequency oscillations are derived. The inductance of the said circuit is inductively coupled with an inductor, one end of which is connected to the cathode of the tube and the other end of which is connected, through a condenser, to the point of constant potential.

The input signal is fed to a tapping on the inductor, preferably to a center tapping.

In order that the invention may be more clearly understood and readily carried into effect, it will now be described more fully with reference to the accompanying drawing, in which one embodiment thereof is shown by way of example.

Referring now to the drawing, the antenna circuit inductance 1 is coupled with the inductance of a first circuit 2, which is tuned to the desired signal frequency. The high-frequency oscillations developed across this circuit are applied through filters 3 and 4, the purpose of which will be explained hereinafter, and part of a feedback coil 5 to a cathode 6 of a triode 7. A grid 8 of triode 7 is grounded, with respect to high-frequency oscillations, through a parallel-connection 11 of a resistance and a condenser. An anode 10 is connected, through a circuit 12, which is tuned to the intermediate frequency, and a circuit 14 which is tuned to the oscillator frequency, to the positive terminal of the supply. The circuit 12 is coupled with a circuit 13, which is also tuned to the intermediate frequency, and from which the intermediate-frequency oscillations are derived for further amplification and detection.

As a triode, it is advantageous to employ a so-called "disco-seal" tube or a grounded-grid triode, in which the grid constitutes an effective static screen between the anode and the cathode and is grounded for this purpose. In the latter, the grid is provided with a number of supply leads in order to reduce the inductance.

The inductance of circuit 14 is inductively coupled to coil 6 so that the triode operates as an oscillator and local oscillations occur across the circuit 14. If the antenna circuit is connected to the centre of coil 6 and a condenser 15 is connected between the lower end of this coil and ground, and if condenser 15 is chosen to be ap-
proximately equal to the grid-cathode capacity, local oscillations will not occur across the antenna circuit 2 and troublesome radiation will not take place. A resistance 17, connected in parallel with condenser 15, is chosen to be approximately equal to the input resistance of the tube. A parallel-connection 5 of a resistance and a capacity coupled between the tap on coil 6 and ground serves to apply a suitable positive bias to the cathode 8. This resistance is traversed by the cathode current. An inductance 16, interposed between the tap on coil 6 and circuit 5, serves to prevent the high-frequency signal currents from flowing to ground. The filters 3 and 4 included in the lead between the antenna circuit and the tap on coil 6 serve to keep the antenna circuit isolated from the intermediate-frequency oscillations and the local oscillator oscillations respectively. The filter 4 thus amplifies the effect of the balanced bridge-circuit formed by the two parts of coil 6, condenser 15 and the grid-cathode capacity of the tube.

While I have described my invention in a specific use thereof and in a specific embodiment, I do not wish to be limited thereto, for obvious modifications will occur to those skilled in the art without departing from the spirit and scope of the invention.

What I claim is:

1. A mixing circuit arrangement for mixing a first wave and a second wave to produce an intermediate frequency wave, comprising an electron discharge tube having cathode, control grid and anode electrodes defining a control grid-cathode circuit, first and second impedance networks tuned respectively to the frequencies of said intermediate frequency wave and said second wave and coupled in series between said anode and ground potential, said second impedance network including an inductance, means to derive said intermediate frequency wave from said first impedance network, a third impedance network having a low impedance at the frequencies of said first and second waves interposed between said control grid and ground potential, a tapped inductive element having one end thereof coupled to said cathode and having the other end thereof coupled to ground potential, said inductive element and said second impedance network being inductively coupled to apply said second wave to said control grid-cathode circuit in positive feedback relationship, and means to apply said first wave to the tap on said inductive element.

2. A mixing circuit arrangement, as set forth in claim 1, further including a resistance-capacitance parallel network interposed between said other end of said inductance element and ground potential to apply a positive bias to said cathode.

REFERENCES CITED

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