

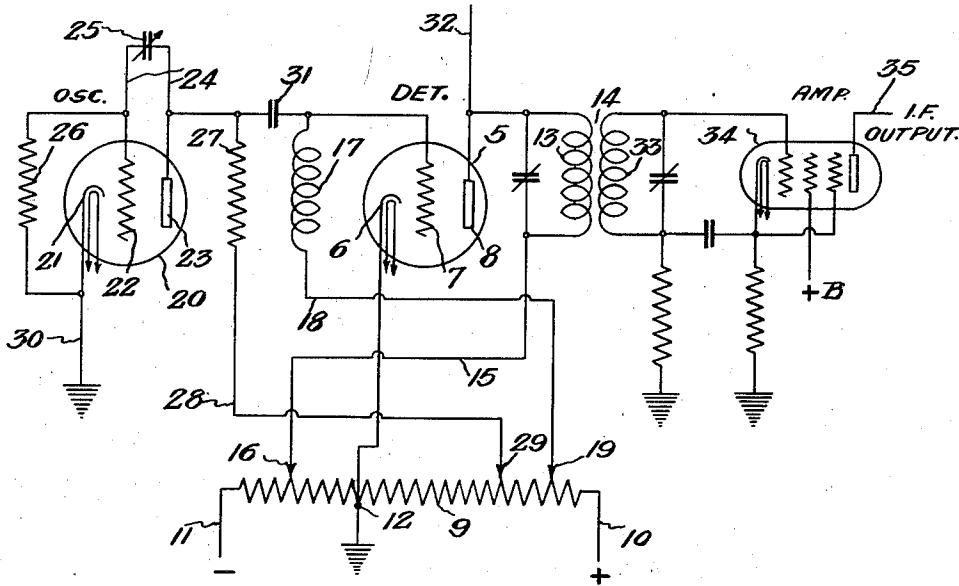
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HIGH FREQUENCY SUPERHETERODYNE RECEIVER

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HIGH FREQUENCY SUPERHETERODYNE
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5 Claims. (Cl. 250—20)

The present invention relates to high frequency superheterodyne receivers, and has for its object to provide a high frequency first detector or converter circuit which will function effectively when the frequencies of the incoming signal or carrier wave are relatively high, such as above 300 megacycles, for example.

It is a further object of the present invention to provide a high frequency converter for a superheterodyne receiver which provides a diode having a virtual cathode which may be modulated by a local oscillator, as a detector for the audio frequency modulation, on an ultra high frequency carrier wave.

It is a further object of the present invention to provide a virtual cathode diode as a first detector of a superheterodyne receiver and an improved mixing circuit in connection therewith.

For the detection of audio frequency modulation on a carrier wave, the usual connection of the detector includes the primary of a transformer feeding the amplifier, in the grid circuit of the detector. This is for the reason that the plate impedance of the detector, as a diode, is higher than the grid impedance and more difficult to match to a transformer.

In accordance with the invention, however, the intermediate frequency transformer supplying the intermediate frequency amplifier is of relatively high impedance and its primary winding may be connected directly into the plate circuit of a virtual cathode diode provided by a three element electric discharge device or tube having a control grid which is coupled to the local oscillator. A diode is thus obtained, the virtual cathode of which is modulated by the local oscillator.

The invention will, however, be better understood from the following description when considered in connection with the accompanying drawing, and its scope will be pointed out in the appended claims.

In the drawing the figure is a circuit diagram of a frequency changer circuit for a superheterodyne receiver embodying the invention.

Referring to the drawing, 5 is a triode electric discharge device providing the first detector of a superheterodyne receiver and including a cathode 6, a control grid 7 and an output anode 8. A source of operating potentials for the tube elements of the receiver is indicated at 9 and comprises a tapped bleeder resistor having positive and negative supply leads 10 and 11, respectively, which may be connected with any suitable

source of direct current potential (not shown).

The grid, plate and cathode of the detector are connected with the potential supply means to apply to the grid a positive potential and to the anode a zero or negative potential, as shown. In the present example, the cathode is connected to a grounded terminal 12, the anode 8 is connected through the tuned primary winding 13 of an intermediate frequency output transformer 14 and a plate supply lead 15 with an adjustable tap 16 more negative than the cathode connection 12, while the grid 7 is connected through an input inductor 17 and a supply lead 18 to a more positive adjustable tap 19.

The taps 16 and 19 are so adjusted that the triode tube 5 may be operated with a positive grid and with the anode negative or at zero potential whereby a virtual cathode is obtained near the anode 8, the spacing between the virtual cathode and the anode being governed by the grid and plate potentials established by adjustment of the contacts 16 and 19.

A local oscillator, comprising a second triode tube 20, is coupled to the grid of the detector to supply oscillations thereto to modulate the virtual cathode. In the present example, the oscillator comprises a cathode 21, a control grid 22 and an output anode 23, the latter elements being connected with the ends of a tunable oscillator circuit comprising parallel leads 24 providing the inductance element of the tuned circuit and a variable capacitor 25 connected between said leads at the opposite ends thereof from those which are connected between the grid and plate. At ultra high frequencies the inductance of the leads is sufficient to provide a tuned circuit with a variable capacitor 25. The grid is connected to the cathode through a grid leak 26 and anode potential is supplied to the anode 23 through a coupling impedance or resistor 27 and a supply lead 28 from an adjustable tap point 29 on the supply resistor 9 at a point more positive than the grounded tap point 12 which is connected to the cathode through a ground connection 30.

The coupling with the detector grid is made through a coupling capacitor 31 connected between the high potential end of the coupling resistor 27 or anode end thereof, and the grid end of the coupling impedance 17 in the grid circuit of the detector.

High frequency modulated signals are received on an energy collector comprising a half wave antenna wire 32 connected with the anode 8 of the detector device. In this manner the incom-

ing signal is impressed on the anode of the detector device, and the frequency conversion takes place between the virtual cathode and the anode, the virtual cathode and the anode thereby functioning as a diode device. The intermediate frequency signal or resulting signal is applied to the primary 13 of the intermediate frequency output transformer which is suitably coupled through a tuned secondary winding 33 with an intermediate frequency amplifier, the first stage amplifier tube thereof being indicated at 34. The latter device may be coupled through an output circuit 35 with further amplifier stages (not shown).

The impedance of the primary winding 13 is relatively high and therefore may be connected directly in the plate circuit of the diode detector without occasioning loss in signal response or sensitivity and without causing signal distortion, while the local oscillations may be applied to the grid of the detector device to modulate the virtual cathode between it and the anode.

It has been found that a circuit of this character provides for the effective detection of the audio frequency modulated carrier waves at ultra high frequencies and, in particular, for carrier waves about 300 megacycles, for example.

I claim as my invention:

1. In a superheterodyne receiver for ultra-high frequency modulated carrier waves, the combination of an electric discharge device having an anode, a cathode and a control grid therebetween, means for applying to the anode and to the control grid with respect to the cathode, potentials providing a virtual cathode adjacent to the anode, a high frequency oscillator coupled to the control grid to apply oscillations thereto for modulating the virtual cathode, a carrier wave collector connected to the anode, an output circuit connected with said anode, and an intermediate frequency amplifier coupling device having a high impedance connected in said circuit.

2. A frequency converter for a high frequency superheterodyne receiver comprising a triode tube having a cathode, an anode and a control grid means for operating said grid at a positive potential and said anode at a negative potential thereby to provide a virtual cathode near the anode, means for varying the potentials applied to said grid and anode to control the spacing between the virtual cathode and the anode, a local oscillator connected to the grid to modulate the virtual cathode, means for impressing an in-

coming carrier wave on the anode of the triode, whereby frequency conversion is obtained between the virtual cathode and the anode operating as a diode, and means for conveying signals at the conversion frequency from said converter comprising a high impedance coupling device in the anode circuit of the triode.

3. In a high frequency superheterodyne receiver for modulated carrier waves, a first detector comprising an electric discharge device having cathode and anode electrodes, said anode electrode being more negative than the cathode, means including a control electrode more positive than the cathode providing a virtual cathode between said cathode and anode electrodes adjacent to said anode electrode, an output circuit for said anode electrode including a high frequency high impedance coupling device, means for impressing a high frequency modulated carrier wave on said anode electrode, and means for modulating said virtual cathode at a local oscillation frequency.

4. In a high frequency superheterodyne receiver for modulated carrier waves, a first detector comprising an electric discharge device having a cathode and an anode, said anode being more negative than the cathode, means including a control electrode more positive than the cathode, providing a virtual cathode between said cathode and the anode adjacent to said anode, an output circuit for said anode including the tuned primary winding of an intermediate frequency transformer, means for impressing a high frequency modulated carrier wave on said anode, and means coupled to said control grid for modulating said virtual cathode at a local oscillation frequency, said means for impressing said carrier wave on the anode including a half wave antenna.

5. A frequency converter for modulated high frequency carrier waves in the frequency range above 300 megacycles comprising, in combination, an electric discharge device having cathode, control grid and anode electrodes, means for applying direct current potentials thereto whereby a virtual cathode is formed adjacent to the anode electrode, a local oscillator coupled to the control grid to modulate the virtual cathode, a carrier wave collector connected with the anode electrode, an intermediate frequency amplifier coupled to said anode electrode, the coupling including a tuned circuit having a relatively high impedance in circuit with the anode electrode.

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