

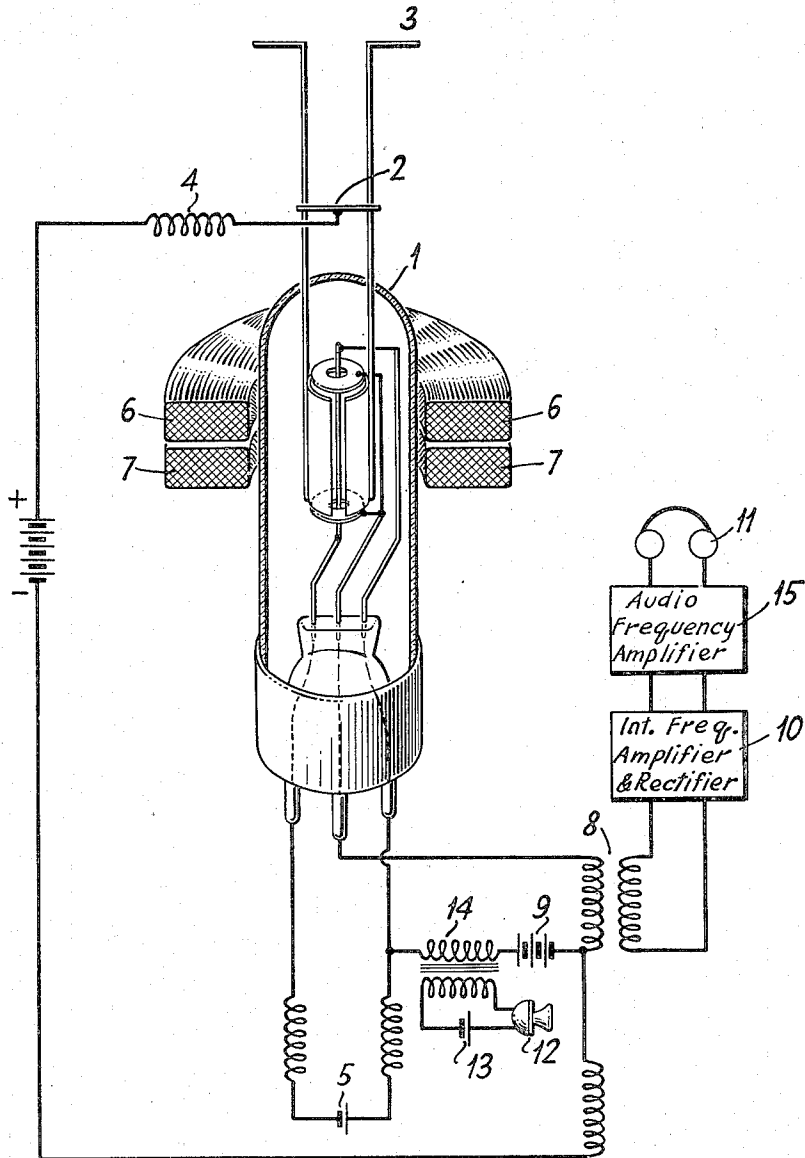
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HETERODYNE RECEIVER FOR ULTRA-SHORT WAVES

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HETERODYNE RECEIVER FOR ULTRA-SHORT WAVES

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7 Claims. (Cl. 250—9)

The invention is concerned with a heterodyne receiver set for ultra-short waves in which a magnetron serves simultaneously for the production of the local oscillation and for mixing the latter with the incoming wave to produce an intermediate frequency wave.

Heterodyne receivers are known in the prior art in which a magnetron is used to produce the local oscillation. Mixing is effected in a separate rectifier tube. It is also known in the art that a magnetron tube may be used to rectify the incoming signal waves, the modulation potential being taken off between anode and cathode. As an improvement upon the last-named circuit organization it has also been suggested to take off the modulation potentials between separate auxiliary electrodes and the cathode in order that the resonance properties of the rest of the tube may remain unaffected by the potentials so taken off.

In carrying out my invention I preferably employ an oscillation generator in combination with a rectifier for producing an intermediate frequency wave by heterodyning with the incoming signalling energy collected on an antenna system designed for ultra-high frequency reception. The local oscillator and rectifier may be combined in one magnetron discharge tube by inserting therein so-called end plates. According to the method of the invention the intermediate frequency output is derived from a circuit which interconnects the end plates and the cathode through a suitable direct current source. The local oscillations are produced in the magnetron discharge tube circuit which includes the cathode and the segmented cylindrically formed anode or anodes.

The sole figure of the drawing shows an exemplified embodiment of the invention. An aerial 3 is connected by way of an energy feeder comprising two down leads to the anode segments of the magnetron tube 1. The anode D. C. potential is supplied by way of the radio-frequency choke coil 4 which is connected to a bridging member 2 disposed across the two conductors of a Lecher wire system by which said down leads are constituted. The filament of the tube is connected with battery 5. The magnetic field is set up by the two solenoids 6 and 7 of an electromagnet. Mounted within the tube are two auxiliary electrodes which are radially disposed in reference to the filament. These auxiliary electrodes are the same as lateral or wing plates, which are interconnected inside the tube, their terminals being brought out and connected with

the intermediate frequency transformer 8. The battery 9 furnishes a suitable and preferably negative biasing potential for the auxiliary electrodes. It has been found that when the auxiliary electrodes are negatively biased with respect to the cathode, the control action thereon is more precise because the electrons which pursue spiral courses under the influence of the magnetic field tend to cluster in the central portion of the discharge zone, whereas if the end-plates were operated at zero bias or positive bias, they would attract the electrons so that an insufficient number would reach the anodes to become effective as output energy of the oscillator tube. Finally there is an amplifier 10 designed to amplify and rectify the intermediate frequency so that the modulation of the signal wave may be amplified by the device 15 and made audible in the telephone receiver 11.

The magnetron tube 1 is so adjusted that it will generate oscillations whose frequency will differ from the frequency of the signal wave by an amount such as to produce the desired intermediate frequency. As has been ascertained by tests, an intermediate frequency voltage will then be developed between the auxiliary electrodes and the cathode. The local oscillator wave, as known in the art, may, of course, be used in turn as a transmitter wave so that two-way communication is feasible without circuit changes or changeovers. In this case, for the purpose of modulation of the transmitter or carrier wave there are required in addition a microphone 12, battery 13 and an audio-frequency transformer 14. The latter acts upon the end plate potential and thus upon the frequency of the sending wave.

I claim:

1. A two-way heterodyne transmitting and receiving apparatus for ultra-short waves comprising an oscillation generating magnetron discharge tube having a linear cathode, cylindrically segmented anodes and end plates, a mixer frequency circuit connecting the cathode to the end plates, a constant current source in said circuit arranged to apply a negative bias to said end plates with respect to the cathode, means in said circuit at times operative to modulate the magnetron-generated oscillations by a low frequency, and further means in said circuit operative at other times to deliver an intermediate frequency which results from the heterodyning of incoming ultra-short waves with said magnetron-generated oscillations.

2. An ultra-high frequency radio apparatus

comprising a magnetron discharge tube having a linear cathode, cylindrically segmented anodes and end plates, a dipole antenna and Lecher-wire transmission system individual conductors of which are respectively connected each to an appropriate one of said anode segments, means for producing a magnetic field in the discharge zone of said tube, means including a direct current source connected between the cathode and the anode segments for enabling said tube to generate oscillations, a circuit connected between the cathode and said end plates, means in said circuit for biasing the end plates negatively with respect to the cathode, further means in said circuit for applying modulations to said tube, and still further means in said circuit for deriving an intermediate frequency output current as the product of heterodyning the oscillations locally generated with incoming signalling energy collected by said dipole antenna.

3. In an ultra-high frequency communication system in which oscillations are generated in a magnetron discharge tube having segmented anodes, a linear cathode and end plates, the method of conducting a two-way communication which comprises heterodyning incoming signalling energy with the locally generated oscillations to produce at times intermediate frequency wave potentials between the cathode and the end plates, and at other times impressing modulation potentials on said end plates thereby to radiate modulated high frequency energy from said system when desired, and maintaining a constant negative bias on said end plates with respect to said cathode.

4. Apparatus for heterodyne reception of ultra-short waves comprising a magnetron discharge tube having a linear cathode, cylindrically seg-

mented anodes surrounding the cathode, and end plates, means for collecting said waves and applying them contraphasally to opposing segmented anodes, means for producing oscillatory potentials between said cathode and said end plates which beat with said waves, means for negatively biasing said end plates with respect to said cathode, and means for deriving intermediate frequency potentials between the cathode and the end plates.

5. A duplex radio communicating station comprising apparatus as defined in claim 4 in combination with means for impressing low frequency modulation potentials between the cathode and the end plates thereby to reverse the action of the means for collecting and applying the ultra-short waves and to cause ultra-short wave signalling energy to be radiated.

6. An ultra-high frequency two-way communication system comprising a magnetron discharge tube having segmented anodes, a linear cathode and end plates, means for generating oscillations in said tube, means operative at times for heterodyning incoming signalling energy with said oscillations to produce intermediate frequency wave potentials between the cathode and end plates, means operative at other times for impressing modulation potentials on said end plates thereby to radiate modulated high frequency energy from said system, and means for maintaining a negative bias on said end plates with respect to said cathode.

7. A system according to claim 6 and including a tunable Lecher-wire system connected to said segmented anodes, and a dipole antenna connected to said Lecher-wire system at its extremity remote from the magnetron tube.

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