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ULTRA SHORT WAVE RECEIVER

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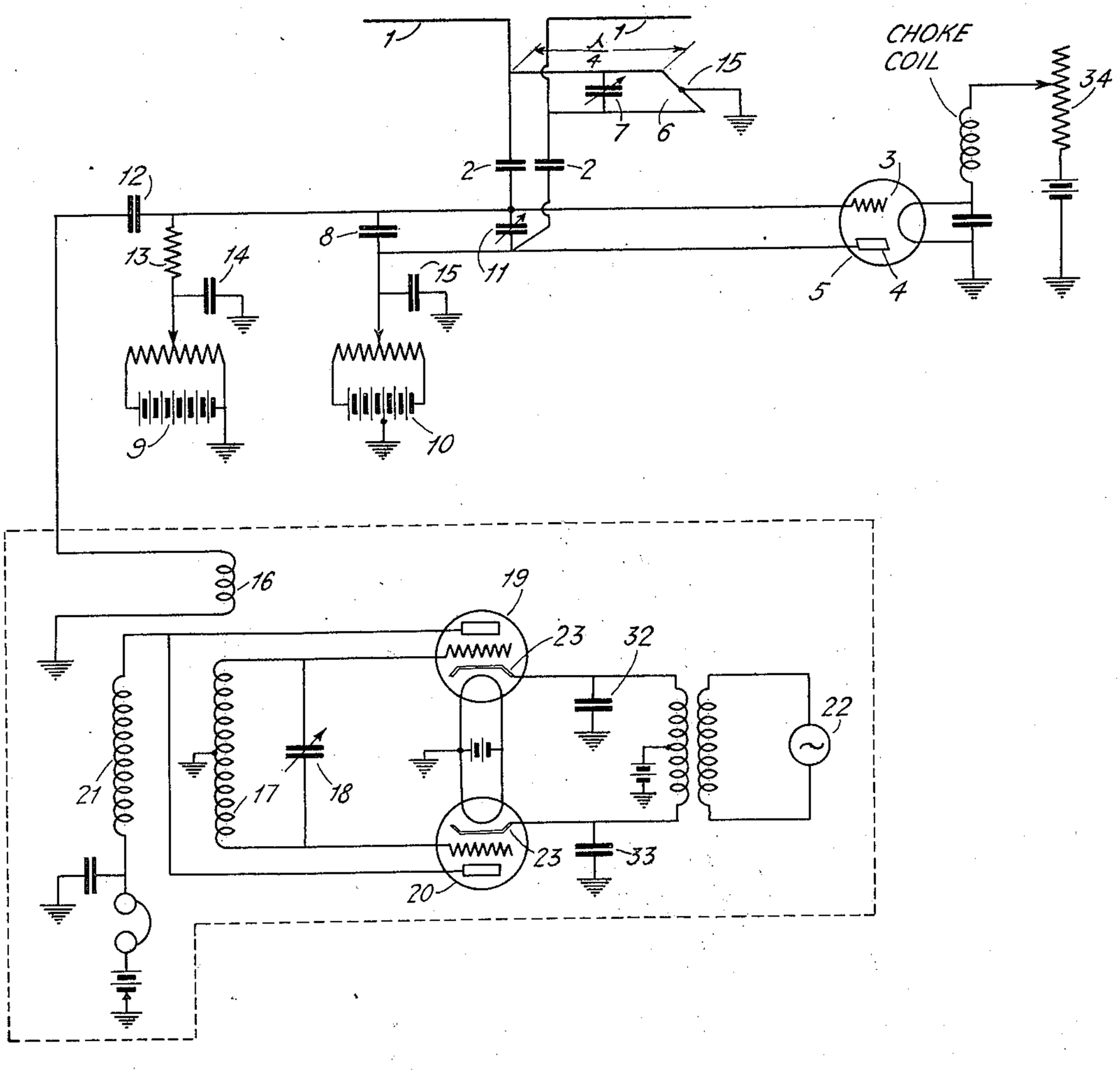

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ULTRA SHORT WAVE RECEIVER

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3 Claims. (Cl. 250—20)

This invention relates to radio receiving circuits and has especial reference to such of these circuits which are capable of receiving ultra short waves.

The development of suitable apparatus for receiving signals from transmitters operating on low wave lengths has been attended in the past with certain difficulties, one of the most prominent of which has been the difficulty of adjusting the frequency of the receiver so exactly that the oscillations received from the transmitter, when "beating" with the locally generated oscillations, produce a steady audio note. It is well known in the art that the usual present day methods used for receiving continuous wave signals, i. e., the audible beat note system, are impractical for the reception of signals having ultra high frequencies such as a frequency of the order of 400 megacycles per second.

Accordingly, one of the objects of the present invention is to overcome the aforementioned difficulty, and this is accomplished by producing a short wave receiver which is capable of receiving signals over a wide range of ultra high frequencies with high efficiency and reliability.

A further object of the present invention is to produce a receiver which is compact, of light weight and easily portable.

These objects are attained in the present invention by utilizing an ultra high frequency oscillator of the Barkhausen-Kurz or Gill-Morrell type to effect an intermediate frequency which is then amplified and detected by suitable apparatus and fed into a translating device. The ultra high frequency oscillator is tuned to the incoming signal frequency plus or minus a desired intermediate frequency, which intermediate frequency is then amplified and detected by a super-regenerative detector-amplifier circuit.

The use of an intermediate frequency output from the Barkhausen-Kurz or Gill-Morrell type oscillator in this invention has been found to practically eliminate the microphone tube noises which are almost always present in the usual audio output of such detectors.

One feature of this invention is the auxiliary antenna tuning circuit for eliminating undesirable signals.

Another feature is the tuning means provided in the ultra high frequency oscillator circuit for controlling the resonant period of the first detector circuit.

A still further feature resides in the super-regenerative circuit which dispenses with a separate low frequency quenching oscillator.

Other objects, features and advantages will appear in the subsequent detailed description. It will be noted, however, that some of the features are useful in other fields than that of short wave reception.

The accompanying drawing illustrates a complete ultra short wave receiving system embodying the principles of this invention.

Referring to the drawing, there is shown a simple bi-polar antenna system 1, 1 connected through condensers 2, 2 to the grid 3 and plate 4 of an ultra high frequency oscillator circuit 5. Attached to the antenna wires in the manner shown in the drawing is a tuned antenna circuit 6 for eliminating undesirable frequencies. This circuit includes a tunable condenser 7. The individual wires of circuit 6 are each approximately a quarter-wave length long and, together, form a U shaped circuit grounded at its center point 15. The inductance of these wires taken with the capacity of condenser 7 form a parallel resonant circuit which is tuned to the frequency of the incoming signal waves. As is well known, such a parallel tuned circuit presents infinite impedance to the incoming signals and much less impedance to the undesired signal frequencies.

Condensers 2, 2 are blocking condensers which act to prevent the batteries 9 and 10 in the respective grid and plate potentiometer circuits from grounding through the antenna tuned circuit 6. These condensers may also be utilized to assist in controlling the degree of coupling between the antenna and the high frequency oscillator detector circuit 5.

The electron discharge tube circuit 5 comprises an ultra high frequency oscillator of the well known Barkhausen-Kurz or Gill-Morrell type which acts in the present invention both as an oscillator and detector. The grid 3 and plate 4 of the tube are supplied with suitable potentials by batteries 9 and 10 in their respective potentiometer circuits. Tunable condenser 11 is utilized for changing the resonant period of the first detector circuit for heterodyning the incoming signal to any desired intermediate frequency.

The output of the ultra high frequency circuit is shown coupled by means of blocking condenser 12 to an intermediate frequency amplifier detector circuit of the super-regenerative type. It is to be understood, of course, that, if desired, a transformer coupling arrangement may be employed instead of the capacity coupling 12 shown in the drawing; also, that the output circuit may suitably be connected to the plate instead of the grid in a very obvious manner. Connected across

the output circuit of the oscillator on one side of condenser 12 is a coupling impedance 13 for tuning the output to any frequency band. This coupling impedance may be a resistance, capacity or inductance and may take any known form depending upon how wide a frequency band is desired in the output circuit. For example, if impedance coupling 13 is a resistance, as shown in the drawing, the output currents of the oscillator will have a wide frequency range. On the other hand, if impedance 13 is a parallel resonant tuned circuit, a very narrow frequency band output will result for very obvious reasons.

Condensers 14 and 15 are by-pass condensers for the intermediate frequency currents to prevent their passage into potentiometer battery circuits 9 and 10.

One form of intermediate frequency amplifier which has been used in this invention with excellent results is the super-regenerative circuit. The use of such circuit as a second detector makes the complete ultra high frequency receiver well adapted to portable use since its employment eliminates a multi-tube intermediate frequency amplifier and possesses such desirable qualities as high sensitivity and ease of adjustment. Although any type of intermediate amplifier circuit may be used with the ultra short wave receiver described herein, the super-regenerative type of circuit is preferred. It is to be clearly understood, however, that the super-regenerative circuits described herein are not limited in their use to the oscillatory system shown since they have been used with excellent results on long waves.

The super-regenerative receiving circuit shown in the figure is described in my copending application Serial No. 589,392, filed January 28, 1932, and is an improvement over the super-regenerative circuits described in W. Van B. Roberts' Patents Nos. 1,948,315 and 1,982,694, granted February 20, 1934 and December 4, 1934, respectively, to which reference is made for a more complete understanding of the general operation of this type of circuit. This circuit involves the use of one tube coupled to the input circuit to give regeneration and another tube coupled to the input circuit to give degeneration, each tube functioning alternately according to the quenching frequency impressed on the cathodes.

The intermediate frequency current is fed to coil 16 which is coupled to 17, 18, in turn connected to a pair of triodes 19 and 20 of the indirect heater type. Circuit 17, 18 is tuned to the incoming intermediate frequency. The triodes 19 and 20 have connected to their plate circuits a feed back coil 21 which is coupled to the grids of the tubes. Condensers 32 and 33 are radio frequency by-pass condensers. A keying or low quenching frequency oscillator 22 is shown coupled to the cathodes 23 of the tubes for varying, at a predetermined frequency, the potential of the cathodes with respect to the grids. This oscillator preferably functions at a frequency of about 25 kilocycles per second. In practice it has been found that a wide range of quenching frequencies may be used when the super-regenerative receiver is operated at 100 meters and less. This manner of connecting the quenching oscillator to the cathodes has the advantage of giving simplicity and symmetry to the circuit and at the same time maintaining the efficiency of the grid circuit. A further advantage of this type of coupling is that the low frequency quenching currents have no detrimental effect on the high frequency circuit.

Although this manner of coupling has been shown in connection with a two tube circuit it is to be clearly understood that it is not limited thereto, but may be applied to any super-regenerative circuit.

Referring now to the operation of the circuit in detail, let us assume, for the purpose of illustration only, that it is desired to receive electromagnetic waves of a length of approximately one-half meter, corresponding to 600 megacycles. In actual practice, wave lengths of the order of one centimeter may be received. The incoming ultra high frequency signals are received over bi-polar antenna 1, 1, and passed to the high frequency oscillator circuit 5 through condensers 2, 2, the undesired low frequency signals being by-passed to ground through antenna tuned circuit 6. Ultra high frequency oscillator circuit 5 is adjusted to give the desired intermediate frequency by means of tuning condenser 11, filament rheostat 34 and the plate and the grid potentiometers 9 and 10 respectively. The intermediate frequency obtained by the reaction of oscillator circuit 5 with the incoming signals is then passed through the condenser 12 to the super-regenerative second detector amplifier, the coupling impedance 13 being adjusted to give the desired frequency band.

The super-regenerative second detector amplifier circuit may be adjusted, if desired, to receive currents of a frequency of 3 megacycles. In order to receive currents of this frequency on the super-regenerative second detector, the first oscillator detector circuit 5 should be adjusted to oscillate at 603 or 597 megacycles. The ultra high frequency circuits are arranged to be sufficiently broad in frequency response to efficiently pass a band several megacycles either side of the desired signal frequency, which, in this case, is 3 megacycles. The output circuit, including condenser 12 and coupling impedance 13, is arranged to efficiently pass the three megacycle intermediate frequency, with its modulation. Ultra high frequency oscillator circuit 5 operates both as a detector and heterodyne oscillator, i. e., the circuit oscillates at 600 ± 3 megacycles and also detects at the same frequency. The combination of the incoming signal waves at 600 megacycles and the waves generated by high frequency oscillator 5, namely, 600 ± 3 megacycles, results in an output intermediate frequency of 3 megacycles across condenser 8. This intermediate frequency is received in the super-regenerative circuit and amplified and detected. The audio frequency signals are then heard in the headphones.

The embodiment of the invention illustrated and described herein has been selected merely for the purpose of clearly setting forth the principles involved. It will be apparent, however, that the invention is susceptible of being modified to meet different conditions encountered in its use and it is, therefore, aimed to cover by the appended claims all modifications within the spirit and scope of the invention.

I claim:

1. In combination in an ultra short wave receiving system, a bipolar antenna tuned to the incoming signal wave, an ultra high frequency detector heterodyning oscillator for producing an intermediate frequency, said oscillator comprising an electron discharge device having an anode, cathode and control electrode, and having means for maintaining the control electrode at a high

positive potential relative to the cathode and anode, a pair of Lecher wires connected to said anode and control electrode, a tuning condenser connected across said Lecher wires, said antenna being coupled to said Lecher wires through blocking condensers, an output circuit coupled to one of said Lecher wires, and an impedance in said output circuit for tuning the band of frequencies in said output circuit.

2. In combination in an ultra short wave receiving system, a bipolar antenna tuned to the incoming signal wave, an ultra high frequency detector heterodyning oscillator for producing an intermediate frequency, said oscillator comprising an electron discharge device having an anode, cathode and control electrode, and having means for maintaining the control electrode at a high positive potential relative to the cathode and anode, a pair of Lecher wires connected to said anode and control electrode, a tuning condenser connected across said Lecher wires, said antenna being coupled to said Lecher wires through blocking condensers, an output circuit capacitively coupled to that one of said Lecher wires which is connected to the control electrode, a resistance in said output circuit for tuning the band of frequencies, and a radio frequency by-pass condenser in circuit with said resistance.

3. In combination in an ultra short wave receiving system, a bipolar antenna tuned to the incoming signal wave, an ultra high frequency detector heterodyning oscillator for producing an intermediate frequency, said oscillator comprising an electron discharge device having an anode, cathode and control electrode, and having means for maintaining the control electrode at a high positive potential relative to the cathode and anode, a pair of Lecher wires connected to said anode and control electrode, a tuning condenser connected across said Lecher wires, said antenna being coupled to said Lecher wires through blocking condensers, an output circuit comprising a super-regenerative amplifier detector circuit coupled to one of said Lecher wires.

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