

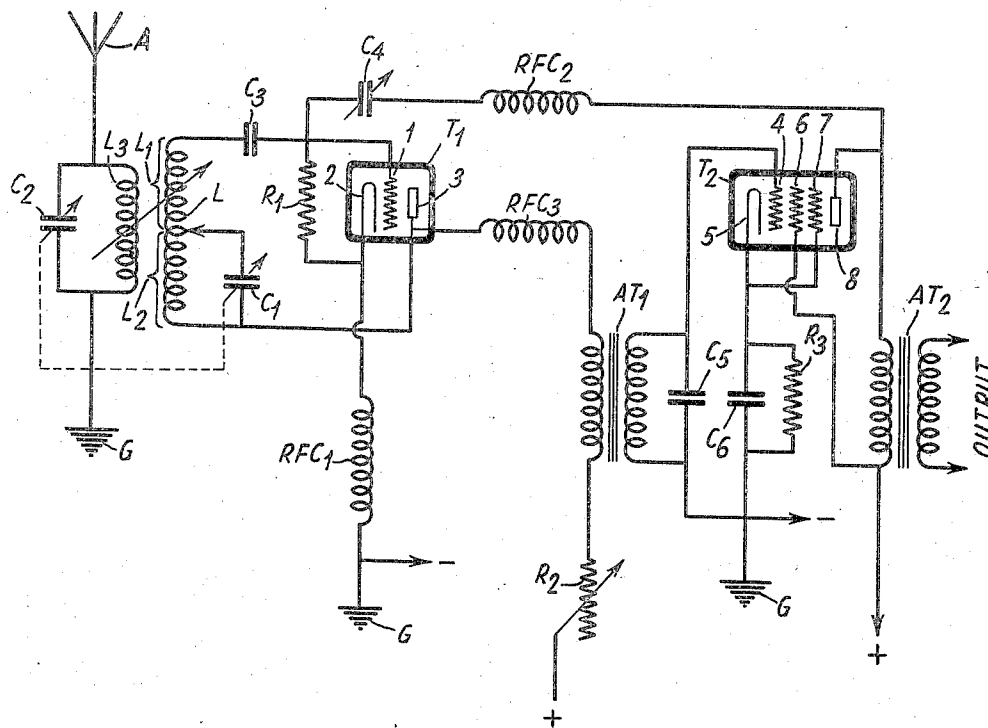
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SUPERREGENERATIVE RECEIVER

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SUPERREGENERATIVE RECEIVER

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The present invention relates to super-regenerative receivers generally, and more particularly to a novel circuit arrangement for preventing the fatigue that goes with constant listening to the background noise that is usually identified with super-regeneration in receivers for high frequency use. It is an object of the present invention to do away with the background noise mentioned above and still maintain the sensitivity which is part of super-regeneration.

For the theory underlying the operation of super-regenerative receivers, reference may be had to U. S. Patent 1,424,065 issued July 25, 1922, to E. H. Armstrong. In connection with the present case, reference may also be had to my co-pending application Serial No. 59,803 filed January 20, 1936 and entitled Super-regenerative receivers now United States Patent #2,114,038.

Generally speaking, the present invention is concerned with a super-regenerative receiver which receives its interruption frequency from an audio amplifier which is part of the receiver, in the same manner as in the circuit of my above entitled patent application. In this particular circuit use is made of the same audio feedback in such voltage values and frequency values as will allow greater sensitivity when the circuit is used in the ultra high frequency range at 5 meters and below.

The invention will be more fully understood by reference to the drawing, wherein the single figure shows a super-regenerative receiver incorporating the features of the present invention.

Referring to the drawing, it is seen that there is provided the usual antenna A, which is grounded at G through the tank circuit comprising the variable condenser C₂ and shunted inductance coil L₃. The first tube of the receiver comprises a normal triode detector T₁, which is provided with an anode, 3, a cathode, 2, and a control electrode, 1. The cathode is connected to ground through a radio frequency choke RFC₁, and to the control electrode 1 through a leak resistor R₁. The control electrode 1 is connected to the anode 3 of the tube T₁ through a grit condenser C₃ and an inductance coil L in series. The inductance coil L is variably coupled to the antenna inductance coil L₃. A portion of the inductance coil L, namely, portion L₂, is shunted by a tuning condenser C₁. The portion L₂ across which the tuning condenser is coupled, may be varied by the variable tap of the inductance L as shown. The anode 3 is connected to the positive terminal of a source of potential through a radio frequency choke coil RFC₃, the primary

of audio frequency transformer AT₁, and a variable resistor R₂, all in series. The negative terminal of the source is grounded in the customary manner.

From the external circuits of the tube T₁ it will be seen that the tube is arranged so that it will oscillate by virtue of the cathode R. F. choke, RFC₁, and the plate R. F. choke RFC₃. In operation of the device the value of this oscillation peak is controlled through the anode variable resistor R₂ to the point where the tube T₁ becomes a very sensitive regenerative detector. With the tube in this condition, it will respond to weak signals as an autodyne detector. However, it will not be possible to use the receiver then for the reception of frequency modulated 5-meter signals. In the ordinary 5-meter super-regenerative receiver it is necessary to continually listen to the background noise that is characteristic of such receivers, and, as previously inferred, this is conducive to fatigue on the part of the listener, especially when it is necessary to listen to signals for a considerable period of time.

In the circuit shown and described so far, the background noise is not heard; in other words, the circuit is absolutely quiet. When the circuit is tuned to a carrier, there will be the characteristic autodyne action, and there will be heard a heterodyne tone determined by the tuning. If the carrier is a modulated carrier, it will not be possible to make out the modulation in the case of voice modulation, if the carrier is from a frequency modulated transmitter such as is usual in the 5-meter band. To make the signals intelligible, there is provided a second tube, T₂, the input of which is coupled to the output of the first tube T₁. The second tube includes a cathode 5, an anode 8, and three grid electrodes, 4, 6 and 7. The input grid electrode 4 is connected to the cathode through the secondary winding of the transformer AT₁, and the bias resistor R₃ in series. The resistor R₃ is by-passed by a condenser C₆, while a condenser C₅ is shunted across the secondary of the transformer AT₁. The grid electrode 7 is connected directly to the cathode 5, in some instances this may be done within the tube envelope. The anode 8 on the tube T₂ is connected to the positive terminal of a suitable source of potential through the primary of an audio frequency transformer AT₂, the secondary of which is connected to any utilizing device such as a loud speaker or ear phone. The negative terminal of the source is grounded, and it will be noted that the cathode 5 is also grounded as at G, thus completing the anode to cathode cir-

cuit. The grid electrode 6 is also connected to the positive terminal of the source in customary manner.

As previously stated, the interrupting frequency for the super-regenerative action is obtained in the same manner as in applicant's copending application above referred to, and for this purpose the anode 8 of the tube T_2 is connected to the grid 1 of the tube T_1 through a suitable radio frequency choke RFC_2 and a variable condenser C_4 in series. Through this circuit there is obtained feedback in the form of a lower frequency, from the anode circuit of the amplifier tube T_2 by virtue of the small variable condenser C_4 . When this is obtained in the circuit shown, the receiver as a whole acts in all respects as a super-regenerative receiver with the important difference that it is possible to retain the releasing or interruption frequency in the inaudible frequency range which allows regenerative action in all its important functions, but without the background noise. In the circuit shown, if the carrier goes off the receiver will be as quiet as any regenerative receiver. In operation of the device, it will be found that for any given carrier strength a certain setting of the feedback condenser C_4 will be necessary for best results. This gives complete control over the action of the receiver at the point where it is most sensitive as a regenerative circuit, as previously set by the anode series resistance R_2 which was described above.

In actual practice, it is preferable to set the detector tube T_1 at the point of regeneration that makes the detector tube most sensitive to any incoming carrier. If the carrier is keyed, it is possible to copy this keying or starting and stopping of the carrier provided it is not an unsteady carrier, that is, if the frequency stability of the transmitter is good. If the carrier is modulated and the frequency is steady, it is preferable to tune to zero beat and hear the modulations. If the carrier is modulated and also has a frequency shifting as in present-day 5-meter plate modulated self-oscillating circuits, it will not be possible to understand the modulation if it is voice, for the reason that the carrier will not allow being tuned to zero beat.

At this point, there is obtained by means of the feedback condenser C_4 , between the anode of the audio amplifier tube T_2 and the grid of the electrode tube T_1 , such a frequency and voltage combination as will allow the circuit to react in the manner of a super-regenerative receiving circuit that has broad frequency admittance and it will thus be possible to hear and understand the voice modulations of the frequency modulated 5-meter carrier. However, with the present invention, when the carrier stops, the receiver does not exhibit the other characteristic of the super-regenerative receiver in normal use. In other words, with the present circuit there will be no background noise.

While applicant has described only one embodiment of his invention, it should be understood that this is not to be construed as limiting the scope of the invention, since obviously many modifications may be made without departing from the broad scope of the invention.

What I claim is:

1. In a radio receiver, a signal pick-up circuit, a detector tube provided with an anode, a cathode and a control electrode, means for impressing signals picked up by the pick-up circuit upon the control electrode of said tube, a source of space current for said tube having a positive terminal and a negative terminal, means connecting the cathode of the tube to the negative terminal of the source including a radio frequency choke coil, means for connecting the anode of the tube to the positive terminal of the source, including a radio frequency choke coil, an energy transfer device and a variable resistor in series, said detector tube being capable of oscillating by virtue of the cathode radio frequency choke and the anode radio frequency choke, the value of the oscillation peak being controlled by means of said variable resistor, an audio frequency amplifier comprising a second tube having an anode, a control electrode and a cathode, means including said energy transfer device for impressing the output of the detector tube between the control electrode and cathode of said second tube, a source of space current for the second tube having negative and positive terminals, means including a bias resistor for connecting the cathode to the negative terminal of said source, means connecting the anode of the second tube to the positive terminal of the source, and means including a radio frequency choke coil and a variable condenser in series for connecting the anode of the second tube to the control electrode of the detector tube, said last named connection being adapted to feed inaudible alternating voltages from the output of the second tube to the input of the first tube, the amplitude of said voltages being controlled by the said last named variable condenser, and means for utilizing the output of the second tube.

2. In a super-regenerative receiver, a regenerative detector having an input circuit and an output circuit, a signal intercepting circuit coupled to said input circuit, an audio frequency amplifier having an input circuit and an output circuit, means for coupling the output circuit of the regenerative detector to the input circuit of the audio frequency amplifier, and means including a radio frequency choke and a condenser in series for coupling the output circuit of the audio frequency amplifier to the input circuit of the detector, said last named means acting to provide interrupting frequency energy to said detector tube and thereby produce super-regenerative action.

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