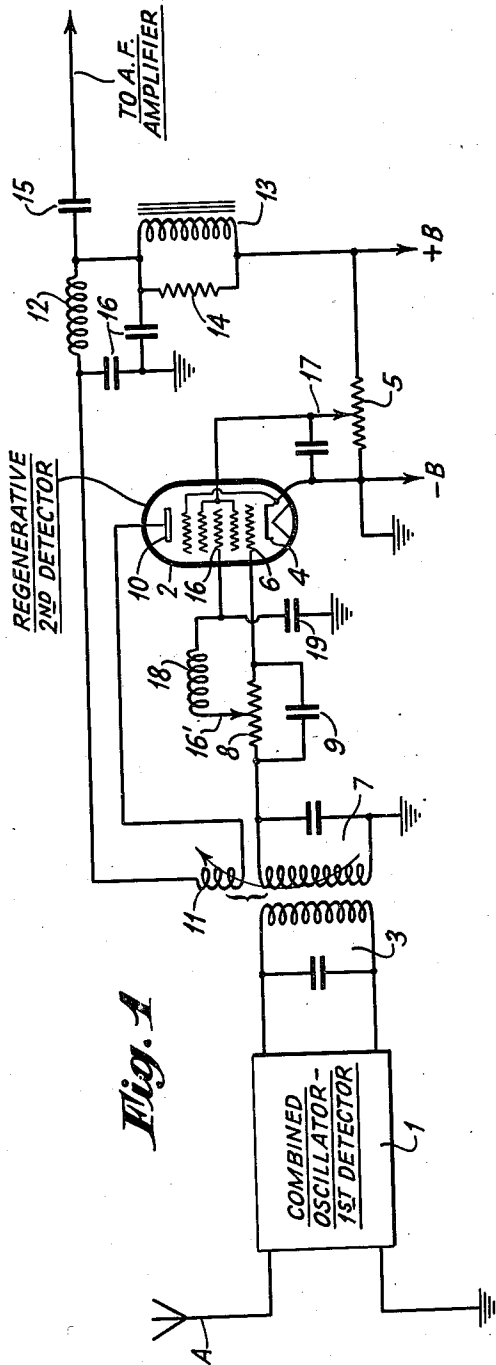
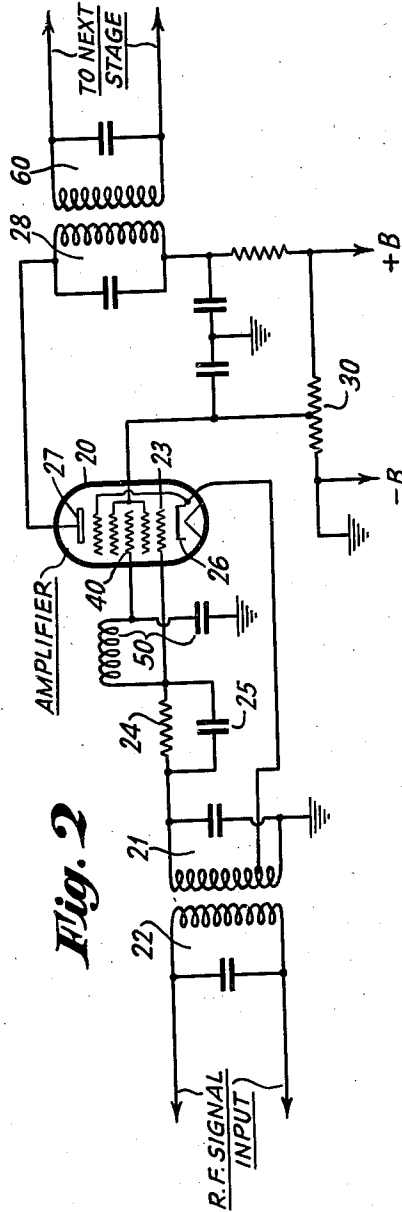


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REGENERATIVE CIRCUITS
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REGENERATIVE CIRCUITS

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4 Claims. (Cl. 250—27)

My present invention relates to regenerative signal receiver circuits, and more particularly to automatically controlled regenerative circuits.

Regenerative circuits are of particular advantage in radio receivers of the portable and compact types. Where a radio broadcast receiver is limited by design to three tubes, exclusive of the power rectifier, in compact sets, or as in the case of battery-operated portable receivers, regeneration provides a very useful way of increasing selectivity and sensitivity. However, one of the main obstacles to using the regenerative circuit resides in the ease of self-oscillation at high signal levels.

Accordingly, it can be stated that it is one of the primary objects of this invention to provide a regenerative signal transmission tube which utilizes an auxiliary electrode for maintaining regeneration at a high level without permitting self-oscillation.

Another important object of my invention is to provide a method of operating a regenerative detector with high selectivity and sensitivity without danger of self-oscillation; there being utilized a special electrode in the tube space current path which is responsive to the flow of grid current in the signal grid circuit for automatically preventing the oscillation.

Another object of the invention is to provide a multi-grid amplifier whose signal input circuit is regenerated to impart high sensitivity to the amplifier; and a grid other than the signal grid being responsive to flow of current in the circuit of the latter for automatically maintaining the degree of regeneration high without encountering self-oscillation.

Still other objects of my invention are to improve generally the efficiency and reliability of regenerative signal circuits, and more especially to provide controlled regenerative tube circuits which are not only economical and reliable but are readily adapted for compact and portable sets.

The novel features which I believe to be characteristic of my invention are set forth in particularity in the appended claims; the invention itself, however, as to both its organization and method of operation will best be understood by reference to the following description taken in connection with the drawing in which I have indicated diagrammatically several circuit organizations whereby my invention may be carried into effect.

In the drawing:

Fig. 1 shows a compact receiver which uses a

regenerative detector circuit employing the invention,

Fig. 2 is a modification applied to a radio frequency amplifier.

Referring now to the accompanying drawing, let it be understood that Fig. 1 illustrates in schematic manner a compact superheterodyne receiver, either of the battery-operated portable type or the alternating current-operated type, comprising a signal converter stage 1, a second detector tube 2 and an audio power output tube which is not shown. The signal pick-up device A may be of any appropriate construction, and feeds the desired signal energy to the network.

The latter may consist, for example, of a pentagrid converter tube having connected thereto circuits to render it operative as a combined tunable local oscillator and tunable first detector. Those skilled in the art are fully aware of such construction, and it will be understood that in the tuned output circuit 3 there is developed signal voltage of intermediate frequency (I. F.). The tube 2 can be a multi-grid tube of the 6L7 type; its circuits are shown in detail.

The cathode is established at the -B potential, or ground, side of the power supply resistor 5. The signal grid 6 is connected to the high potential side of the resonant input circuit 7 through a resistor 8. The latter is shunted by the usual condenser 9, and the elements 8—9 function to provide grid leak detection. The circuits 3 and 7 are magnetically coupled, the latter circuit being tuned to the operating I. F. The plate 10 is connected to the +B potential side of the supply resistor through a path comprising feedback coil 11, radio frequency choke coil 12 and audio choke coil 13, the latter element being shunted by resistor 14. The audio voltage developed in the plate circuit is fed to the following audio amplifier through condenser 15; condensers 16 by-pass the intermediate frequency currents to ground.

The coil 11 is reactively coupled to circuit 7 to regenerate the latter. The arrow designates adjustability of the degree of regeneration. It will be understood that sufficient regeneration is desired to impart high selectivity and high sensitivity to the detector. To prevent the tube from going into self-oscillation it is only necessary to connect grid 16 to a suitable point on resistor 8. While grid 16 is shown as terminating in a slidable tap 16', it will be generally desirable to position the latter at the grid end of resistor 8. The screen electrodes on either side of grid 16 are adjusted by lead 17 to a positive potential point on

supply resistor 5 such that optimum operation is secured. Radio frequency filter elements 18—19 are included in circuit between tap 16' and grid 16.

It is not believed essential to a proper understanding of this invention to provide a theoretical explanation of the control action. It is believed that the flow of grid current produced by the conditions causing oscillation provides a direct current voltage across resistor 8. Grid 16 is biased negatively, and acts to inhibit the sudden rise of plate current which is conducive to self-oscillation. Actual experimental operation with a receiver using this type of detector circuit demonstrates freedom from oscillation while the regeneration is at a high level.

In Fig. 2 there is shown the invention applied to an amplifier, either operating at I. F. or at carrier frequency, comprising a tube 20 which may be of the 6SA7 type. The input circuit 21 may be coupled to any desired signal circuit 22. The signal grid 23 is connected to the high potential side of circuit 21 by resistor 24 shunted by condenser 25. Resistor 24 and condenser 25 have a large time constant. The cathode 26 is connected to a tap on the input circuit coil which is above ground, and provides regenerative feedback. The plate 27 includes the output circuit 28 which is tuned to the desired signal frequency. The various positive voltages are supplied to the screen electrodes and plate from the voltage supply resistor 30. To prevent oscillation the grid 40 is connected through filter 50 to the grid end of resistor 24.

The signal grid 23, is will be noted, is operated at zero bias under no-signal conditions. If desired the resonant output circuit 28 may be coupled to the following tuned network 60. Here, again, grid 40 controls the space current flow to plate 27 so that self-oscillation is prevented. Flow of grid current through resistor 24 provides bias voltage both to grid 40 and to grid 23.

While I have indicated and described several systems for carrying my invention into effect, it will be apparent to one skilled in the art that my invention is by no means limited to the particular organizations shown and described, but that many modifications may be made without departing from the scope of my invention, as set forth in the appended claims.

What I claim is:

1. In a signal transmission network, an electronic discharge tube provided with at least a cathode, signal grid and a plate, a signal input circuit connected between the signal grid and cathode, a signal output circuit connected between the plate and cathode, means reactively coupling the plate circuit and input circuit to provide regeneration of the input circuit, and additional means responsive to grid current flow in the signal grid circuit for sufficiently adjusting the space current flow to said plate to prevent said regeneration causing self-oscillation, said responsive means including a resistive impedance in circuit with said signal grid for de-

veloping a direct current voltage from said grid current, and an electrostatic element, having a direct current voltage connection to said impedance, disposed in the space current path between the signal grid and plate.

2. In a signal transmission network, an electronic discharge tube provided with at least a cathode, signal grid and a plate, a signal input circuit connected between the signal grid and cathode, a signal output circuit connected between the plate and cathode, means reactively coupling the plate circuit and input circuit to provide regeneration of the input circuit, and additional means responsive to grid current flow in the signal grid circuit for sufficiently adjusting the space current flow to said plate to prevent said regeneration causing self-oscillation, said additional means comprising an auxiliary grid disposed in the space current path between the signal grid and the plate, an impedance in circuit with said signal grid and input circuit for developing thereacross a direct current voltage from said grid current, and a direct current voltage connection between the auxiliary grid and a point on the impedance which assumes a negative potential relative to the cathode when said grid current flows.

3. In a detection network, a tube provided with at least a cathode, signal grid, plate and an auxiliary electrode disposed between the signal grid and plate, a signal input circuit connected between the signal grid and cathode, a resistive impedance in circuit between said input circuit and said signal grid, said impedance developing thereacross a direct current voltage from grid current flow in the signal grid circuit, means regeneratively coupling said plate to said input circuit, and a direct current voltage connection between the auxiliary electrode and the point on said impedance which assumes a negative potential with respect to the cathode when grid current flows through said impedance by virtue of an excessive increase of regeneration and said point being chosen to bias said auxiliary electrode sufficiently to adjust the space current flow to said plate to prevent said excessive increase of regeneration causing self-oscillation.

4. In a signal amplifier circuit, a tube having a cathode, a signal control electrode and an anode, a signal input circuit connected between the signal electrode and the cathode, a signal output circuit connected to the anode, means regeneratively coupling said output circuit and input circuit, a control electrode disposed between the signal electrode and the anode, means in circuit with said input circuit and signal control electrode for producing a direct current voltage in response to grid current flow through the signal grid circuit, and means for applying said voltage to said auxiliary control electrode in sufficient magnitude and in a sense to reduce the space current flow to said anode thereby to prevent said regeneration causing self-oscillation.

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