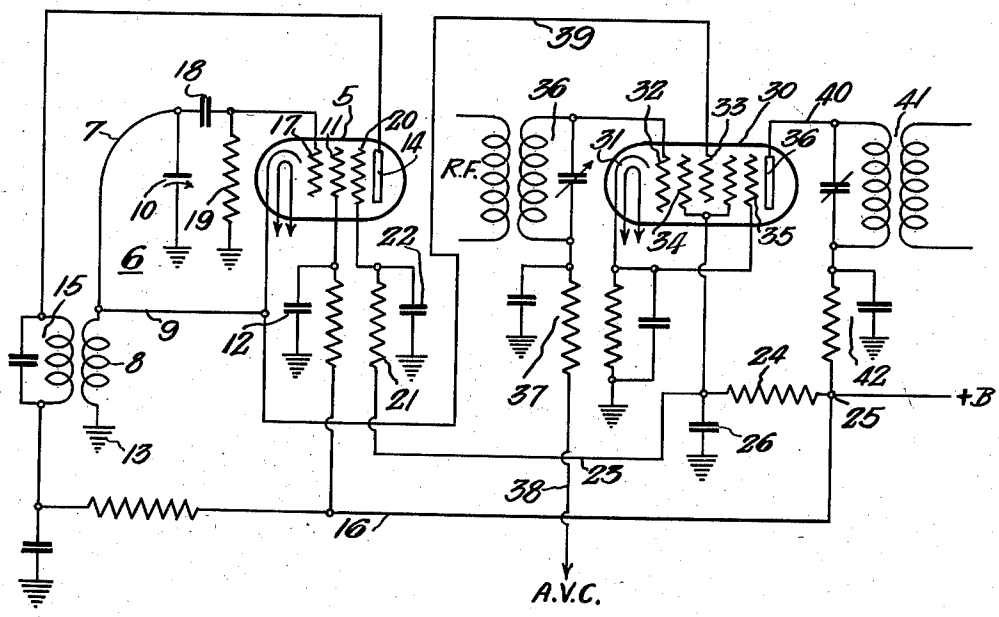
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OSCILLATOR STABILIZING CIRCUIT

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Inventor

John D. Reid

By

Attorney

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OSCILLATOR STABILIZING CIRCUIT

John D. Reid, Philadelphia, Pa., assignor to Radio Corporation of America, a corporation of Delaware

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The present invention relates to an oscillator stabilizing circuit for preventing frequency shift resulting from anode potential variations and variable load on the oscillator, and has for its primary object to provide an improved stabilizing circuit of that character in connection with an associated converter tube to which the output of the oscillator is applied.

The invention relates particularly to oscillator circuits for radio receiving systems in connection with a frequency changer or converter tube, commonly referred to as a first detector. It is, therefore, a further object of the present invention to provide an oscillator stabilizing circuit which may be provided in connection with the frequency changer tube in a superheterodyne receiver.

It is also a still further object of the present invention, to provide an improved oscillator stabilizing circuit comprising the combination of an oscillator tube and a frequency changer tube of the hexode or double-control grid type, such as is provided by a tube known commercially as an RCA 6L7 tube.

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

In the drawing, the figure is a schematic circuit diagram of an oscillator circuit provided with stabilizing means in accordance with the invention.

Referring to the drawing, 5 is an oscillator tube having an oscillator circuit 6 particularly adapted for generating ultra high frequency oscillations and comprising a grid inductance 7 and an anode inductance 8, with a cathode connection 9 between said inductances. The shunt variable tuning capacitor is indicated at 10 and feed back from the anode is provided by means of a screen grid 11 through a by-pass capacitor 12 to the grounded end 13 of the coil 8 and also from the main anode 14 through a feed back winding 15 coupled with the winding 8.

An anode potential is supplied to the screen grid 11 and the anode 14 through a supply lead 16, the ground connection being the negative B supply connection. The control grid of the oscillator device 5 is indicated at 17 and is connected in the usual manner with the tuned oscillator circuit through a grid capacitor 18 and a grid leak 19.

The oscillator device is of the screen grid pentode type in which the suppresser grid is indicated at 20, and this is energized from the positive B supply lead 16 through a series resistor 21, forming a filter with a suitable by-pass capacitor indicated at 22.

A second series resistor is connected in circuit with the suppresser grid 20, through a lead 23, as indicated at 24. The second resistor is connected with the positive supply lead 16, at a terminal 25. A suitable by-pass capacitor 26, connected with the lead 23 at the output end of the resistor 24, provides, with the last-named resistor, a second stage filter for the potential supply of the suppresser grid 20.

In a radio receiving system, particularly of the superheterodyne type employing a plurality of amplifier tubes, under control of automatic volume control means, the positive B potential may tend to vary widely unless the supply means has unusually good regulation, which is seldom the case. The resulting plate potential variation on the oscillator as well as load variations of associated tubes tends to cause the frequency to change or shift.

To prevent this tendency to shift frequency, a pentode tube is utilized as the oscillator of a superheterodyne receiver or the like, and the suppresser grid of the oscillator tube is supplied with positive operating potential under control of an associated tube which is, in turn, subjected to control of the automatic volume control means.

Since the oscillator and the frequency changer tube or first detector are closely associated in operation, it is preferable to utilize the first detector or frequency changer tube as the control means in the oscillator stabilizing circuit, particularly when the frequency changer tube is placed under control of automatic volume control means.

In the present example, a tube adapted for automatic volume control means and as a mixer or frequency changer tube is indicated at 30 and is of the type known commercially as an RCA 6L7, having a cathode 31, a first or inner control grid 32, a second or outer control grid 33, a screen grid 34 therefor, and a suppresser grid 35 connected with the anode 31, together with the usual output anode electrode 36.

The inner grid 32 is connected through a tuned input circuit 36 with incoming signals to be mixed with the oscillator signals, and, through this circuit and filter 37, is connected with an automatic volume control lead indicated at 38. As is well known, the automatic volume control circuit receives a controlling potential which

varies in accordance with received signal strength to provide an increasing negative bias upon the control grids thereby to reduce the gain with increased signal strength.

The outer or second control grid 33 is connected through a short supply lead 39 with the cathode connection 9 of the oscillator, whereby it receives energy from the oscillator for mixing with the incoming signals.

The intermediate or resulting frequency appears in the output circuit indicated at 40, in connection with the output anode 36, and is supplied to a suitable intermediate frequency or other amplifier (not shown) through a tuned coupling transformer indicated at 41. The anode 36 receives operating potential through a suitable filter 42 in connection with the positive supply lead 16 at the point 25.

The screen grid 34 is connected with the output end of the first filter resistor 24, which is in series with the suppresser grid 20 of the oscillator, whereby, in common with the suppresser grid, the screen grid 34 draws current through the first filter resistor 24. This arrangement permits variations in the current drawn by the screen grid 34 of the mixer or detector 30, to cause a corresponding variation in the potential applied to the suppresser grid 20 by reason of the variation in the potential drop established in the common series resistor 24. This control is highly effective, because the screen grid current is relatively high with respect to the suppresser grid current. The screen grid current thus controls as it provides a major portion of the drop in this common series resistor 24.

With this arrangement, the suppresser grid of the oscillator tube is supplied with positive operating potential in parallel with the screen grid through a potential drop-producing device, the latter also providing a filter stage for the two grids.

When an automatic volume control potential is applied to the control grid of the converter or frequency changer tube 30 from the control lead 38, the screen voltage on the screen grid 34 rises, which causes the voltage on the suppresser grid 20 of the oscillator to rise in turn. The effect of this rise in voltage on the suppresser grid of the oscillator is such that it tends to counteract the change in oscillator frequency, which normally takes place because of the change in the loading of the coupling grid 32 of the converter tube on the oscillator and because of changes in the operating potential applied to the oscillator from the supply source.

I claim as my invention:

1. In a frequency converter system, the combination of an oscillator tube having a suppressor grid, a converter tube having a screen grid, a resistor, and means for supplying positive operating potential to said grids in parallel through said resistor as a common series potential drop producing circuit element, whereby the potential drop in said resistor controls the potential on the suppressor grid in accordance with variations in the screen grid current to said converter tube.

2. In a radio receiver having automatic volume control means, a frequency converter system, the combination of an oscillator tube having a suppressor grid, a converter tube having a screen grid and having a control grid connected with said automatic volume control means, a series filter resistor, and means for supplying positive operating potential to said grids in parallel through said series filter resistor as a common series potential drop producing element, whereby the potential drop in said resistor controls the potential on the suppressor grid in accordance with variations in the screen grid current to said converter tube through said resistor resulting from operation of the automatic volume control means, a by-pass capacitor for said filter resistor, and means providing a filter between said grids.

3. In a frequency converter system, the combination of an oscillator tube having a suppressor grid, a converter tube having a screen grid, means for coupling said tubes including a common tuned grid circuit to which said tubes are connected, whereby the converter tube provides a load on the oscillator tube, means providing a connection between said suppressor and screen grids, means for supplying a positive operating potential to said interconnected grids including a series potential drop producing resistor in circiut with said last named grids, and means for applying a variable biasing potential to the converter tube to control the gain therethrough.

4. The combination of an oscillator comprising a tunable oscillator circut, an oscillator tube connected therewith for generating oscillations, said oscillator having a suppressor grid, a tube having a control grid and a screen grid, coupled to said oscillator circuit to receive oscillations therefrom and to provide a variable load thereon in response to a variable grid biasing potential, grid means for applying a variable biasing potential to said last-named tube to vary the load on said oscillator, and means for minimizing the effect of said variable load in varying the oscillator frequency, said means including a connection between said screen grid in said last-named tube and said suppressor grid, means for supplying positive operating potential to said grids in parallel including a common circuit connection, and a filter in said connection having a series potential drop-producing element having a resistance of a value sufficiently high for controlling the potential on the suppressor grid in response to variations in current flow to the screen grid.

5. In a frequency converter system, the combination of an oscillator tube having a suppressor grid, a converter tube having a control grid and a screen grid, means for applying a variable biasing potential to said control grid of the converter tube, means for coupling said converter tube to the oscillator tube to receive oscillations therefrom, said converter tube thereby providing a variable load on the oscillator, and means for energizing said screen and suppressor grids in parallel at positive potentials including a supply circuit and a series high resistance element in said circuit providing a potential drop therein resulting from current flow to said grids, the current to the screen grid being relatively high with respect to the suppressor grid current and the value of the series resistance provided by said element being such that variations in screen grid current effect variations in suppressor grid potential.

6. In a radio receiving system, the combination of an oscillator tube having a suppressor grid, a mixer tube having two control grids and a screen grid, means for coupling one of said control grids to the oscillator, means for applying volume control potentials and received signals to the other of said control grids, a circuit for applying positive operating potentials to the screen grid including a series potential drop-

producing resistor, and means for applying a positive operating potential to the suppressor grid of the oscillator comprising a connection between said suppressor grid and the screen grid of mixer tube, whereby said screen and suppressor grids are parallel-fed through said potential drop-producing resistor.

7. In a superheterodyne receiver, the combination of a pentode oscillator tube, oscillation generating circuits connected with said tube, means for tuning said oscillation generating circuits through a predetermined frequency range, a frequency converter tube for converting said oscillations and received signal oscillations into a predetermined intermediate frequency signal, said frequency converter tube having a pair of control grids, a screen grid and an output anode electrode for intermediate frequency signals, means providing a signal-conveying connection between one of said control grids and one of the oscillation generating circuits for supplying oscillations therefrom to said converter tube, a tunable signal input circuit connected with the other of said control grids, means for applying automatic volume control potential to said last-named grid, and means for jointly supplying positive operating potential to the screen grid of the converter tube and to the suppressor grid of the oscillator including a potential drop-producing resistor through which screen and suppressor grid currents flow, whereby the suppressor grid potential is caused to rise in response to an increase in potential on the screen grid of the converter tube following an increase in automatic volume control potential on the signal input control grid of said converter tube, thereby to compensate for the effect of load change on the oscillator by reason of variation in automatic volume control potential.

JOHN D. REID.