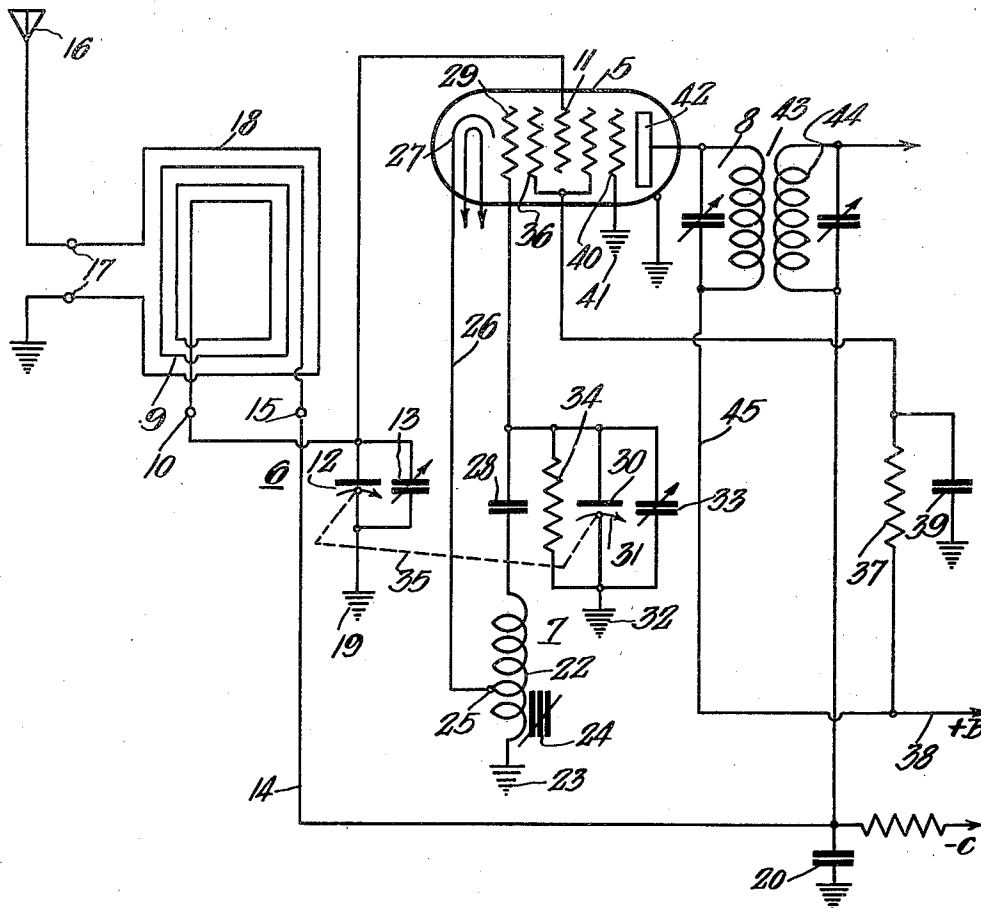


April 29, 1941.

J. M. RIDDLE, JR
SUPERHETERODYNE RECEIVER

2,239,756

Filed May 31, 1939



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UNITED STATES PATENT OFFICE

2,239,756

SUPERHETERODYNE RECEIVER

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Application May 31, 1939, Serial No. 276,547

4 Claims. (Cl. 250—20)

The present invention relates to superheterodyne receivers and, more particularly, to the first detector and local oscillator circuits of superheterodyne receivers, and has for its primary object to provide an improved and simplified oscillator circuit for effecting tracking in the tuning of the oscillator, first detector and other tuned signal receiving circuits with the usual gang-controlled tuning means.

It is a further and more specific object of the present invention to provide an oscillator tracking circuit for a superheterodyne receiver wherein the usual series tracking capacitor may be eliminated or replaced in function by another existing capacitor in the oscillator circuit, and whereby the operating characteristics of the oscillator circuit may be improved.

It is a still further object of the present invention to provide an improved oscillator tracking circuit for superheterodyne receivers of the portable type providing a simplified arrangement of component parts and circuit connections whereby it is adapted to low cost production and with improved tuning characteristics.

The invention will be further understood from the following description when considered in connection with the accompanying drawing, and its scope will be pointed out in the appended claims.

Referring to the drawing, the single figure is a schematic circuit diagram of the first detector and oscillator circuits of a superheterodyne receiver embodying the invention. These circuits may include a separate oscillator and a separate detector or the same may be combined in one tube. In the present example, a combined detector-oscillator tube 5 of the RCA 6SA7 type is employed as a converter or a signal mixer between a tunable signal input circuit 6, a tunable oscillator circuit 7 and the usual intermediate frequency output circuit 8.

The signal input circuit comprises a loop antenna or tuning inductance 9, the high signal potential terminal 10 of which is connected with the signal grid 11 of the detector-oscillator tube 5 and with the stator of one section 12 of the gang-tuning capacitor for the receiver, and the usual shunt trimmer capacitor therefor indicated at 13. The control grid 11 is provided with suitable AVC and biasing potentials through a bias supply connection lead 14 connected with the low signal potential terminal 15 of the loop.

The loop inductance 9 may be coupled to an external signal source such as an antenna 16, through antenna and ground connection terminals 17 and a coupling coil 18 connected there-

with and inductively coupled with the loop inductance 9. The tuning capacitor section 12 is of the grounded rotor type, as indicated by the ground connection 19 and this is connected through a path of low reactance at signal frequencies with the low potential terminal 15 of the loop inductance through a suitable filter capacitor 20 and the lead 14. The signal input circuit 6 comprising the tuning inductance or loop 9, the tuning capacitor 12, together with the shunt trimmer capacitor 13 and the filter capacitor 20, is relatively sharp in its tuning response to provide a high degree of selectivity to received signals, whereas the oscillator-tuned circuit 7 per se is more broadly tuned, as will hereinafter appear.

The main oscillator tuning inductance is indicated at 22 and is connected to chassis or ground 23 at the low potential end and is also provided with a magnetite tuning core indicated at 24 for trimming the oscillator tuning at the low frequency end of the tuning range. The oscillator is of the Hartley type, having a cathode tap indicated at 25 adjacent the chassis or ground end of the tuning inductance 22 connected through a cathode lead 26 with the cathode 27, which functions in both the oscillator and detector circuits as a common cathode for the detector and the oscillator portions of the tube 5.

The high signal potential end of the oscillator tuning inductance is connected through a capacitor 28 with the oscillator control grid 29 and with the stator element or electrode 30 of the oscillator section 31 of the main variable tuning capacitor. The rotor is connected to chassis or ground, as indicated at 32, whereby the capacitor section 31 is connected in parallel with the main tuning inductance 22 through the capacitor 28, as a series tracking capacitor.

The main variable tuning capacitor 31 may also be provided with a shunt variable trimmer capacitor 33. The oscillator grid leak resistor indicated at 34 is also connected in shunt therewith, since the stator 30 by this arrangement is connected directly with the oscillator control grid 29 without the intermediary of the usual grid blocking capacitor.

The grid blocking capacitor function is provided by the capacitor 28 and in conjunction with the grid resistor 34 establishes the grid bias potential for the oscillator. Because of its location in the oscillator tank circuit, said capacitor functions both as a grid blocking capacitor and as a tracking capacitor. For this reason, it is increased in capacity value above that ordinarily

employed in a grid blocking capacitor to a value of the order of the maximum value of the variable tuning capacitor 31. For example, in connection with an RCA 6SA7 oscillator-detector tube, as indicated in the drawing, the combined tracking and grid blocking capacitor 28 may have a capacity value of 430 micromicrofarads, the grid resistor 34 may have a resistance value of 33,000 ohms, and the variable tuning capacitor 31 may have a variation range of from 10 to 420 micromicrofarads in the reception of standard broadcast band signals. Highly stabilized oscillator operation and effective tracking operation is obtained with this circuit in connection with gang variable tuning capacitor means, as indicated by the dotted connection 35.

With the larger value of grid blocking capacitor, the grid leak or resistor 34 is of a correspondingly low value, for proper time constant, tending to load the oscillator and to provide an oscillator circuit per se somewhat more broadly tuned than the signal input circuit and highly stabilized in frequency output.

The oscillator grid in effect is connected to ground and to the low potential end of the main oscillator tuning inductance through the tuning capacitor circuit comprising the main variable tuning capacitor, the shunt trimmer capacitor and the shunt grid resistor, the connection between the oscillator control grid and each of the three elements referred to being direct without the intermediary of the usual grid blocking capacitor.

The high potential end of the main oscillator tuning inductance may be considered as connected to the junction of the connection between the oscillator control grid, the main tuning capacitor and oscillator grid leak through a capacitor which functions both as a grid blocking capacitor for the oscillator grid and a series tracking capacitor for the main oscillator variable tuning capacitor.

This circuit arrangement simplifies the circuit requirements for the local oscillator of a superheterodyne receiver both as to construction and cost, and, as pointed out, has been found to provide stable operation and improved tracking between the variable oscillator circuit and the remaining tuned circuits ganged therewith in a superheterodyne receiver, such as the RF input circuit shown herein.

The remainder of the oscillator circuit is substantially conventional. As in the usual Hartley oscillator circuit, the screen grid indicated at 36 is connected through a filter resistor indicated at 37 with positive potential supply means indicated by the lead 38 and is connected to ground and to the low potential end of the main tuning inductance 22 through a suitable path of low alternating current impedance provided by the by-pass capacitor indicated at 39. The screen grid thus provides the anode electrode for the oscillator portion of the tube 5. A suppressor grid is indicated at 40 and is connected to ground, as indicated at 41.

The output anode indicated at 42 is connected with the intermediate frequency output circuit 8, which may be the tuned primary winding of a suitable interstage intermediate frequency coupling transformer 43, having a tuned secondary output circuit 44. The oscillator anode circuit 45 is also connected with the positive potential supply lead 38.

From the foregoing description, it will be seen that, in a superheterodyne receiver, the tuning

system may be simplified in construction and reduced in cost and with improved operating characteristics including tracking between the ganged circuits, by providing a capacitor in the high alternating current lead of the oscillator tuning inductance and providing a capacity value therein such that, in conjunction with a low resistance grid resistor shunting the main tuning capacitor, the first-named capacitor may function both as a grid blocking capacitor and as a tracking capacitor, the stator of the gang-connected oscillator tuning capacity unit being connected directly to the grid of the oscillator. It will furthermore be seen that this arrangement in no way interferes with the normal and preferred arrangement of the gang-tuning capacitor wherein the rotor elements are all connected to the tuning capacitor frame and chassis ground.

I claim as my invention:

1. In a superheterodyne radio receiving system, the combination with a tunable signal input circuit, of a tunable oscillator circuit comprising a main tuning inductance, a variable tuning capacitor unit operable to tune said first-named circuit and the oscillator circuit conjointly and including an oscillator tuning section having a stator element connected with said inductance, a series combined tracking and grid capacitor in said connection, a grid leak resistor connected with said variable tuning capacitor stator element, and means providing a connection for an oscillator grid directly with said stator element, said first-named capacitor having a capacity value of the order of the maximum capacity of the main tuning capacity unit, whereby it functions both as a grid blocking capacitor and as a tracking capacitor, and said grid leak having a relatively low value as a bias potential supply means.

2. In a superheterodyne radio receiving system, the combination with a tunable signal input circuit, of a tunable oscillator circuit comprising a main tuning inductance, an oscillator having a control grid connected with the high signal potential end of said tuning inductance, a grid blocking capacitor in said connection, a variable tuning capacitor unit operable to tune said first-named circuit and the oscillator circuit conjointly and including an oscillator tuning section having a stator element connected directly with the oscillator control grid and a grid resistor connected in shunt with said variable tuning capacitor section, said first-named capacitor having a capacity value of the order of the maximum capacity of the main tuning capacity unit, whereby it functions both as a grid blocking capacitor and as a tracking capacitor, and said grid leak having a relatively low value as a bias potential supply means.

3. In a superheterodyne radio receiving system, the combination with a tunable signal circuit, of an oscillator circuit conjointly tunable with said first-named circuit, said oscillator circuit comprising a tuning inductance and a tuning capacitor, a series tracking capacitor connected between said inductance and an electrode of said tuning capacitor, means providing a connection for an oscillator grid directly with said electrode, and a grid leak resistor connected with said electrode to provide a predetermined time constant with said series tracking capacitor whereby said capacitor is effective as an oscillator grid blocking capacitor.

4. In a superheterodyne radio receiving system, the combination of a main variable tuning capacitor and a plurality of circuits conjointly vari-

ably tunable thereby, one of said circuits including an oscillator having a control grid and a section of said variable tuning capacitor having a stator element connected directly with said control grid, a grid leak resistor for said oscillator tube connected in shunt with said variable tuning capacitor section, means providing an oscillator tuning inductance, and a grid blocking capacitor for said oscillator tube connected between said tuning inductance and said stator element, said capacitor having a capacity value of the order of the maximum value of the variable tuning capacitor section thereby to function in circuit between said tuning inductance and variable capacitor section as a series tracking capacitor for said oscillator circuit.

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