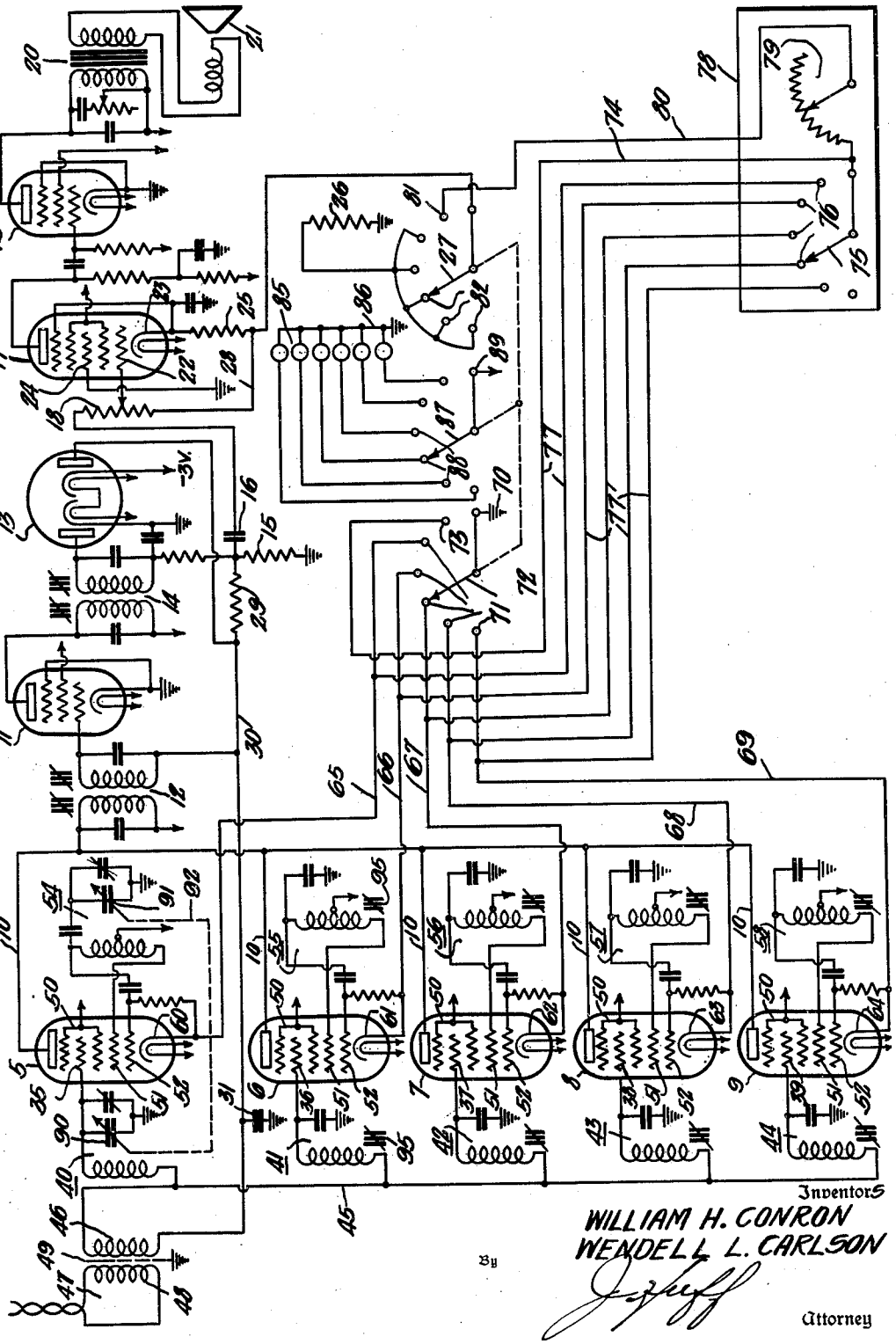
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RADIO SIGNAL RECEIVING SYSTEM

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RADIO SIGNAL RECEIVING SYSTEM

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The present invention relates to radio signal receiving systems, and has for its principal object to provide an improved radio signal receiving system of the superheterodyne type adapted for remote control tuning.

It is further object of the present invention to provide a remote control tuning system adapted for the preselection of a plurality of signals in a predetermined tuning range, such as the standard broadcast band or tuning range, for example.

It is a still further object of the present invention to provide, in a superheterodyne radio signal receiving system, an improved detector-oscillator circuit and control means therefor, whereby remote preselection tuning to a plurality of different signals or broadcasting stations may be effected by simple switching circuits conveying only direct currents.

It is a still further object of the present invention to provide a remote preselection tuning control system for a superheterodyne receiver, which may be built at low cost and adapted for small, low-priced receivers and the like.

Preselection tuning, as used herein, should be understood to mean that the receiving system may be adjusted for response in one or more signal receiving channels or for response to one or more broadcasting stations, and thereafter may be made to respond to any one of the selected signal channels or broadcasting stations by rendering the preadjusted tuning means effective to control the response of the receiving system.

It is, therefore, also an object of the present invention to provide, in a system of the type above referred to, means for instantaneously shifting from one signal channel or broadcasting station to another with substantially no time delay between operation of the station selector means and hearing the received signals or program. By this means, it is possible to explore, in a few seconds, the program material offered in a group of broadcasting or signal channels.

It is also an object of the invention to provide a radio signal receiving system having remote tuning control means, with additional means for tuning the same in the conventional manner throughout a predetermined range, such as the broadcast band, for example.

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

In the drawing, the figure is a schematic circuit diagram of a superheterodyne radio signal receiving system provided with remote tuning control means, embodying the invention.

Referring to the drawing, a plurality of converter or signal mixer tubes **5**, **6**, **7**, **8** and **9**, providing combined detector-oscillators, are connected in parallel through their output or anode circuits **10** with an intermediate frequency amplifier represented by the tube **11**, through an intermediate frequency coupling transformer **12**, which is tuned, for example, to 460 kilocycles.

The amplifier **11** is coupled to a second detector of the diode retifier type, indicated at **13**, through a second tuned intermediate frequency coupling transformer **14** responsive to the same frequency. Audio frequency signals are derived from the rectifier output resistor **15** through a coupling capacitor **16**, and the audio frequency signals are applied to an audio frequency amplifier tube **17** through a volume control potentiometer **18**. The tube **17** is coupled to any suitable audio frequency amplifier represented by the tube **19**, which in turn is connected through an output transformer **20** with a loud speaker or other sound reproducing device **21**.

The audio frequency amplifier tube **17** may be of the type known as the RCA 6L7, having a control grid **22** adjacent to the cathode **23** and connected with the volume control potentiometer **18**. The tube also has a second control grid, indicated at **24**, connected to ground to receive a biasing potential from the cathode resistor comprising two sections **25** and **26**, the latter being connected between ground and the section **25** through a switch **27**. As shown, the grid **24** receives a biasing potential from both sections **25** and **26** of the self-bias or cathode resistor, while the grid **22** receives biasing potential from only the section **25**, through the potentiometer connection thereto, as indicated at **28**. The operation of this tube for volume control purposes will hereinafter referred to.

In addition to the audio frequency potentials derived from the resistor **15**, AVC potentials are also derived therefrom through a filter resistor **29**, and applied to an AVC lead **30** for the receiving system. This is provided with a suitable filter capacitor **31**.

The detector-oscillator or mixer tubes **5–9** inclusive are provided with signal input grids **35–39** inclusive, connected, respectively, with tuned signal input circuits **40–44** inclusive, connected in parallel at low potential sides through a lead **45**, with a signal input winding **46**. The latter is coupled to a signal input circuit **47** through an input winding **48**. An electrostatic grounded

shield 49 is provided between the windings 46 and 48, as indicated.

It will be noted that the grids 35–39, inclusive, are connected through the inductances of the tuned circuits 40–44 and through the winding 46 to the AVC lead 30, whereby AVC potentials are applied to the control grids referred to.

Each of the converter tubes 5–9 inclusive is provided with a screen electrode 50 for the signal input or control grids, and with oscillator elements comprising an anode electrode 51 and a grid electrode 52. These electrodes are connected with tunable oscillator circuits for the tubes 5 to 9 inclusive, as indicated at 54–58 inclusive, and these circuits are tuned by the amount of the intermediate frequency above the tuning of the corresponding input circuit for the particular tube.

The tubes 5–9 are provided with heater type cathodes 60–64, respectively, provided with separate cathode circuits 65–69 inclusive, respectively, connected selectively to ground, indicated at 70, through the contacts 71 of a selector switch 72. The switch 72 is movable to a contact 73 for grounding a remote control lead 74 connected with a remote control switch 75 having similar remote control contacts 76 for extensible leads 77 for the cathode leads 65–69.

It will be seen that when the switch 72 is moved over the contacts 71, the cathode of the tubes 5–9 are selectively connected to ground, and when the switch is moved to the contact 73, the switch 75 is connected to ground and may be moved to operate in the same manner over the contacts 76, to ground the cathodes of the tubes 5–9 selectively at the remote control unit at the end of the leads 77 and 74. This unit is indicated by the rectangle 78 and includes a remote volume control device, such as a resistor 79 having a remote control extension lead 80 connected with a contact 81 at the switch 27.

The latter switch has a series of contacts 82 corresponding in number and position to the contacts 71, for connecting in circuit the local volume control resistor 26 with the tube 17, and the contact 81 corresponding to the contact 73 in position for connecting in circuit, in place of the resistor 26, the remote volume control resistor 79, for which the return connection to ground is completed through lead 74 to contact 73 and switch 72.

A series of indicator lamps 85 are connected on one side in parallel with a supply lead indicated at 86, and on the other side selectively through a switch 87, having contacts 88 corresponding in position and number to those on the switches 72 and 27, to a second supply lead indicated at 89. This represents any suitable arrangement for indicating the tuning adjustments effected by operation of the switch 72.

The input circuit 40 and oscillator circuit 54 of the tube 5 are arranged to be variably tuned by the usual variable capacitors 90 and 91, gang connected for unicontrol operation as indicated by the dotted connection 92, while the remaining circuits, in connection with the tubes 6–9 inclusive, are fixed tuned for producing the desired intermediate frequency in response to preselected signals or broadcasting stations, and these circuits are tunable by means of movable cores 95 of magnetic material such as magnetite.

In order to keep the cost of the tuning system at a minimum, the signal input and oscillator circuits were developed so that they may be tuned over a limited range by moving the magnetite cores 95 through the coils. Following experiments on such coils, it was found that sufficient range could be obtained for each unit so that the number of units that would be required to cover a certain tuning range could be reduced to a minimum. It was found, for example, that four circuits as shown were sufficient to cover the standard broadcast band from 540 kilocycles to 1600 kilocycles, with sufficient overlap so that any station could be selected within that band, and two stations relatively close together could be so selected for preselection tuning. For the broadcast band, the unit including the tuning circuits 41–44 inclusive may have the following adjustment ranges:

	Kilocycles
41	540– 800
42	730–1080
43	800–1185
44	1080–1600

The tuning inductances for these circuits have been found, preferably, to comprise a single layer solenoid winding, and consist of a magnetite core substantially ¾" long and ⅜" in diameter, movable within an average coil of approximately 100 turns of #38 enamel wire, close wound. Differing numbers of turns are used for the differing tuning ranges.

With this arrangement, a station between 540 and 730 kcs. may be tuned in on circuit 41; a station between 730 and 800 kcs. on circuit 41 or 42; a station between 800 and 1080 kcs. on circuit 42 or 53; a station between 1080 and 1185 kcs. on circuit 43 or 44; and a station between 1185 and 1600 kcs. on circuit 44. Each circuit (radio frequency and oscillator) will be tuned to a separate station selectively with the oscillator circuits 55–58, tuned by the amount of the intermediate frequency for 60 kcs., for example, above the tuning of the respective circuits 41–44.

The circuits 40 and 54 of the tube 5 are tunable throughout the broadcast band variably, in the usual manner, by the variable capacitors 90–91. By tuning the capacitors 90–91 to a fifth signal or broadcasting station, preselection tuning to five different signals may be effected by the switch 72 or the switch 75 at the remote control point. The selector switching operation consists of selectively connecting to ground the cathodes of the various converter tubes, one for each preselected signal channel.

By utilizing a tube of the type having two control grids, and by controlling the gain on the second control grid with the signal applied to the first, the volume of the signal output may be controlled, and this system of control is employed in connection with the tube 17 and the resistor 79 at the remote control point. Since the control grid 22 is connected back to the resistor 25, variation of the resistor 79 serves only to vary the gain control potential on the control grid 24. At the receiver, the gain may be controlled by the potentiometer 18, and therefore the resistor 26 may be fixed and may be substantially half the value of the remote volume control resistor 79.

In a practical embodiment of the receiving system shown, with the selector switch in the fifth position, corresponding to the energization of the tube 5 and variable tuning, the indicator lamp in the series shown at 85 for that position may be utilized to indicate the tuning scale desired. Likewise, the remaining indicator lamps may be utilized to illuminate other indicator elements for the various preselected signal channels and for the remote control position.

From the foregoing description, it will be seen that a preselection tuning system adapted for remote control operation may be provided by simplified circuits whereby it is adapted for low priced receivers and consists in utilizing several combined oscillator-detector tubes at the input of the receiver, with their associated circuits each tuned for response to a different signal channel. The circuits are preferably tunable by means of adjustable core inductances, and one of the circuits may be variably tunable over a preselected frequency band.

In the selection of the desired fixed or adjustable signal channels, the only control operation necessary is to switch the cathode of the tube corresponding to the desired signal channel, to ground by a simple multipoint selector means. Thus the system does not depend upon any mechanical adjustment or movement other than the switching for signal selection.

We claim as our invention:

1. In a superheterodyne receiver, the combination of a plurality of converter tubes each having a signal input grid, an output anode, a cathode and oscillator electrodes, means providing a tunable input circuit for each of said control grids, and a tunable oscillator circuit for each tube in connection with said oscillator electrodes, means for applying received signals to said tunable input circuits in parallel, means for connecting said output anodes in parallel including a tunable signal output circuit responsive to a predetermined frequency, means for selectively connecting each of said cathodes to ground in said system, means for adjustably tuning a plurality of said input and oscillator circuits to predetermined fixed frequencies and means for variably tuning one of said input circuits and one of said oscillator circuits for the same tube variably throughout a predetermined tuning range.

2. In a superheterodyne receiver, the combination of a plurality of converter tubes each having a signal input grid, an output anode, a cathode and oscillator electrodes, means providing a tunable input circuit for each of said control grids, and a tunable oscillator circuit for each tube in connection with said oscillator electrodes, means for applying a received signal to said tunable input circuits in parallel, means for connecting said output anodes in parallel including a tunable signal output circuit responsive to a predetermined intermediate frequency, means for selectively connecting each of said cathodes to ground in said system, means for variably tuning one of said input and oscillator circuits through differing tuning ranges for receiving signals variably through a predetermined frequency band, means for adjustably tuning the remainder of said input and oscillator circuits to differing predetermined fixed frequencies for receiving signals at each of a plurality of fixed frequencies in said band.

3. In a superheterodyne receiver, the combination of a plurality of converter tubes each having a signal input grid, an output anode, a cathode and oscillator electrodes, means providing a tunable input circuit for each of said control grids, and a tunable oscillator circuit for each tube in connection with said oscillator electrodes, means for applying a received signal to said tunable input circuits in parallel, means for connecting said output anodes in parallel including a tunable signal output circuit responsive to a predetermined intermediate frequency, means for selectively connecting each of said cathodes to ground in said system, means for variably tuning one of said input and oscillator circuits through differing tuning ranges for receiving signals variably through a predetermined frequency band, and means for adjustably tuning the remainder of said input and oscillator circuits to differing predetermined fixed frequencies for receiving signals selectively at each of a plurality of fixed frequencies in said band, said last named means in each circuit comprising a single layer tuning inductance, and a magnetite core therefor adjustable to vary the value of said inductance in circuit.

4. In a tuning control system for a superheterodyne receiver, the combination of a plurality of signal mixer tubes each having a tunable signal input circuit and a tunable oscillator circuit, means for applying signals to said input circuits in parallel, means providing a common intermediate frequency output circuit for said tubes, means for tuning each of said input circuits to differing signal frequencies within a predetermined signal wave band and for tuning said oscillator circuits to frequencies differing therefrom by a predetermined intermediate frequency, means providing an individual grounded cathode circuit for each of said tubes and means for individually completing each of said cathode circuits to ground thereby to cause said receiver to respond to signals at said differing signal frequencies, said last-named means comprising a selector switch having contacts for connecting each of said cathode circuits to ground, a remote control unit having selector switch contacts connected with each of said cathode circuits, and means providing a contact in said first-named selector switch providing a ground connection through said second-named selector switch for said cathode circuits, thereby to provide remote control tuning of said receiver through said remote control unit.

5. In a superheterodyne receiver the combination of a plurality of signal mixer tubes each having a tunable signal input circuit and a tunable oscillator circuit, a common intermediate frequency output circuit for said tubes, a cathode circuit for each of said tubes, selector switch means for completing said cathode circuits individually to ground, means for applying signals to said input circuits in parallel, means for applying automatic volume control potentials through said signal input circuits in parallel, means for tuning each of said input circuits to differing preselected signal frequencies and said oscillator circuits to frequencies differing therefrom for each tube by a predetermined intermediate frequency, whereby said receiver is tunable instantly to any one of said preselected signal frequencies by selectively completing said cathode circuits individually, a remote control unit including a second selector switch means, means for extending said cathode circuits to said selector switch means in said remote control unit, and means for completing a ground connection for said cathode circuits from said second selector switch means through said first-named selector switch means.

6. In a superheterodyne receiver, the combination of a plurality of signal mixer tubes, each having a signal input circuit and an oscillator circuit connected therewith and having a common intermediate frequency output circuit, means for tuning said input and oscillator circuits to differing fixed signal frequencies including adjustable core tuning inductances in a plurality of said circuits and variable tuning means in one

of said signal input circuits and one of said oscillator circuits for the same tube, a cathode circuit for each tube, and means for selectively connecting said cathode circuits to ground thereby to energize said tubes selectively and to effect tuning of said receiver selectively to said differing signal frequencies and a plurality of signal frequencies over a variable range provided by said variable tuning means.

7. A preselection tuning control system for a superheterodyne receiver comprising, in combination, a plurality of detector-oscillator tubes, a tunable signal input circuit and a tunable oscillator circuit connected with each of said tubes, means including a movable core inductance in each of said circuits for tuning each of said tubes to produce a predetermined intermediate frequency in response to received signals at differing fixed frequencies throughout a predetermined wave band, means for tuning one of said signal input circuits and the oscillator circuit for one of said tubes variably through said wave band, means including a coupling circuit common to said signal input circuits for applying received signals to said input circuits in parallel, means providing a common intermediate frequency output circuit for said tubes, a cathode circuit for each of said tubes, and means for selectively connecting each of said cathode circuits to ground as the sole selector means for controlling the response of said receiver to a plurality of preselected signal waves.

8. In a superheterodyne receiver, the combination of a plurality of signal mixer tubes each having detector electrodes, oscillator electrodes and a common cathode, means for applying signals to said detector electrodes in parallel and including an input circuit for each tube adjustably tunable through different portions of the same predetermined wave band, an oscillator circuit connected with the oscillator electrodes of each tube, said oscillator circuits being tunable each to a frequency differing from the tuning of the input circuit for said tube by substantially the amount of a common intermediate frequency, means providing a common intermediate frequency output coupling circuit for said tubes, an intermediate frequency amplifier coupled thereto, selector switch means for individually grounding said cathodes, thereby to tune said receiver to any one of a plurality of differing signals by selectively closing the cathode circuits as the sole signal selecting means for said receiver, and means for variably tuning the signal input and oscillator circuits for one of said tubes variably through said wave band, thereby to provide additional means for tuning said receiver throughout said wave band.

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