

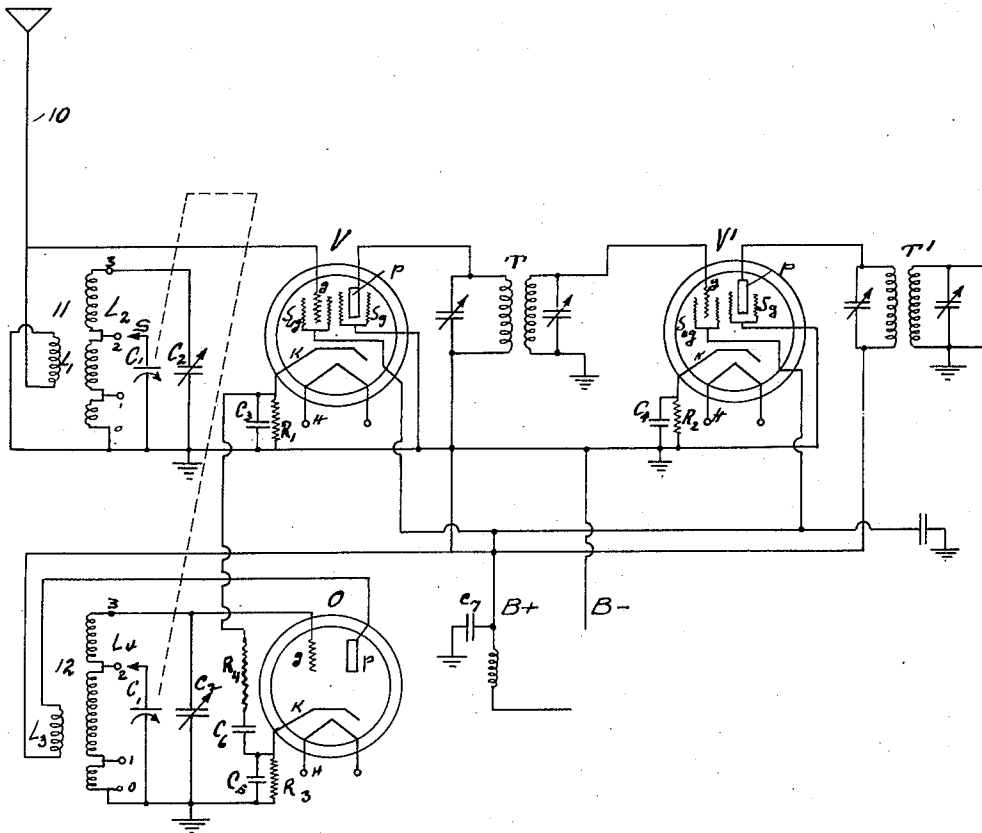
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RADIO SYSTEM

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RADIO SYSTEM

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The present invention relates to a tuning unit for radio apparatus, particularly of the superheterodyne type.

With short wave receiving sets, there generally occurs what is known as "fading" caused by variation in the electric field acting upon the collector of the receiver. Such "fading" is very objectionable. To obviate this objection, hitherto various special devices, such as resistors, filters and extra vacuum tubes have been used, which complicate the set unduly and render the operation difficult.

It is the principal and primary object of my invention, therefore, to provide a method and apparatus whereby "fading" can be entirely obviated in the simplest possible way, and whereby sharp and correct tuning can be readily and quickly effected.

Another object of this invention is to provide an apparatus in which the oscillator voltages are balanced to such an extent that no special voltage regulating devices are necessary.

A further object is to increase the degree of selectivity and sensitivity of the unit, so that in conjunction with the radio frequency stage the tuner will pick up not only radio frequency signals but also the side bands of undirected beams.

It is also an object to have the image frequency tube give maximum amplification.

With these and other objects in view my invention consists in the novel method of connection, construction, combination and arrangement of elements as will be hereinafter more fully set forth in the specification and defined in the appended claims.

In the accompanying drawing which forms part of this specification and in which similar reference characters denote corresponding parts:

The figure denotes a circuit diagram of connections of my new tuner for a short wave receiver.

My new tuner comprises an antenna circuit unit which, when the receiver is assembled for operation, includes an antenna 10, an inductance transformer 11 whose primary winding L^1 at its lower end, is connected to said antenna and whose secondary winding L^2 is connected to the upper end of the primary and to ground. The primary and secondary windings are closely coupled, being wound on the same form. The secondary is suitably tapped at several points and through switch S can be shorted according to the wave length desired. It is tuned through variable condenser C^1 and trimming condenser C^2 shunted across the same.

The tuner also includes a radio frequency detector tube V preferably of the so-called 58 pentode type comprising a heater H, cathode k, control grid g, screen grid Sg, suppressor grid Ssg, and plate p.

The control grid g of tube V is connected directly to the antenna and to the primary winding L^1 . Contrary to the hitherto used practice, the secondary L^2 of said radio frequency transformer 11 is not connected to the grid of the radio frequency tube V, but is independent of the latter, as a result whereof the grid return is forced right back into the primary L^1 . Also contrary to the usual practice, the screen grid Sg of the tube is connected to the B minus instead of to the B plus, while the suppressor grid Ssg is connected to the B plus of the power supply and is filtered by a by-pass condenser C^3 . The cathode k is connected in usual manner to B minus through a bias resistor R^1 and by-pass condenser C^3 .

The intermediate frequency amplifier tube V^1 which is also a 58 pentode type tube, is inductively coupled to the radio frequency detector tube V through an intermediate frequency transformer T. The primary of said transformer is in series with the plate p of tube V and the secondary is connected directly to the control grid g of said tube V^1 and to B minus through ground.

The screen grid Sg, suppressor grid Ssg and cathode of tube V^1 are connected in identically the same manner as those of tube V to the power supply and the cathode k is connected in usual manner to B minus through bias resistor R^2 and by-pass condenser C^4 . Connection to succeeding stages of amplification is inductively made through transformer T^1 the primary of which is in series with the plate p of tube V^1 .

The oscillator circuit unit includes tube O of the 56 triode type, comprising heater H, cathode k, control grid g and plate p, an oscillator inductance transformer 12 whose primary L^3 has one end connected to the plate p of said tube O and its other end to B plus of the power supply. The secondary L^4 is tapped similarly to secondary winding L^2 and has one end connected to the control grid g of tube O and its other end to ground. Condensers C^1 and C^2 across the secondary L^4 of transformer 12 serve similar purposes as condensers C^1 , C^2 of the secondary L^2 of transformer 11. The condensers controlling the secondary L^2 of the detector unit and those of the secondary L^4 of the oscillator unit are ganged and may be rotated as a unit, so that the secondaries of both radio frequency and oscillator transformers may be tuned simultaneously.

The cathode of said oscillator is connected to B minus through the cathode bias resistor R³ and cathode by-pass condenser C⁵.

The cathode of the radio frequency tube V and the cathode of the oscillator tube are coupled through condenser C⁶. In order to prevent any overloading of the tubes, I provide a resistance R⁴ in series with the condenser C⁶.

The tests made with the apparatus constructed by me in accordance with the above description has given the most remarkable results. Without using a voltage regulator or other special auxiliary devices, there is an even distribution of voltage throughout the receiving unit and a steady flow of rectified alternating current in the oscillator tube. It effectively operates over 20 to 80 meters wave lengths, but good results may be obtained over any desired band of wave lengths.

In the said apparatus the radio frequency transformer 11 is hand wound on a cylindrical form using B and S gauge enameled wire. Its secondary L² has about 5 turns (gauge 20) between taps 0 to 1, 7 turns (same gauge) between taps 1 and 2 and 22 turns (gauge 24) between taps 2 to 3. The primary of said transformer has 8 turns (gauge 28). The transformer 12 of the oscillator, is also hand wound on a separate cylindrical form. It has about 5 turns between taps 0 to 1 (gauge 20), 5 turns between taps 1—2 (gauge 20) and 18 turns (gauge 24) between taps 2 and 3. The tickler or primary L³ has 9¾ turns (gauge 32) of double silk covered wire.

The capacity ranges of the condensers in the detector and oscillator units are as follows:

	Microfarads
Tuning condenser C ¹ -----	.00014
Trimming condenser C ² (incorporated in tuning condenser)-----	.000035
May be increased to-----	.00005
	Microfarads
By-pass condenser C ³ (mica)-----	.002
By-pass condenser C ⁴ (paper)-----	.1
By-pass condenser C ⁵ (mica)-----	.0001
By-pass condenser C ⁶ (mica)-----	.00005
By-pass condenser C ⁷ (mica)-----	.001
By-pass condenser C ⁸ (500 volts)-----	1

The value of the cathode bias resistors are as follows:

- R¹ (variable) maximum 5000 ohms (if fixed 2500 ohms)
- R² (fixed) 400 ohms.
- R³ (fixed) 10000 ohms 3 watt size (if variable maximum 12000 ohms)
- R⁴ (fixed) 2½ megohms

One of the important novel features of my device is that the tuning is accomplished by tuning the inductance itself, so that the action of the latter is that of preselector and radio frequency transformer at the same time.

Another important feature is that there is no direct connection between the secondary of the radio frequency transformer and the detector tube, as a result of which a stabilized frequency is obtained.

At the same time because of the close coupling between the primary L¹ and secondary L² an increase of mutual inductance between them is obtained.

Furthermore, as I have found by tests on a receiver constructed as specified above because of the connection of the screen grid Sg to the B minus and suppressor grid, S_{ug} to B plus, I ob-

tain a new function of the tube because of the decrease of the mutual conductance thereof resulting from said connections. Owing to the increased mutual inductance in the transformer 11 and the decreased mutual conductance of the tube I obtain an automatic volume control. This enables the use of intermediate transformers between the succeeding stages without affecting the signal frequency and without decreasing the gain per stage.

While I have described in detail my new device, I am aware that various changes may be made without departing from the spirit of my invention and I therefore do not wish to restrict myself to such details, nor to receivers, as my device may be used just as well for broadcasting.

What I claim is:

1. In a tuner system for short wave radio apparatus, an antenna, a radio frequency inductance transformer having coupled primary and tuned secondary windings, a multiple grid detector tube including among its elements an anode, a cathode, a control grid, a screen grid and a suppressor grid, the primary winding of said inductance transformer being connected directly to said control grid and to said antenna, means for electrically connecting said secondary winding in said tuner system without direct electrical connection to said control grid, a source of B plus and B minus potentials, electrical connection between said screen grid and said B minus potential, electrical connection between said anode and said suppressor grid and said B plus potential and means for electrically connecting the elements of said tube in said tuner system.

2. In a tuner system for short wave radio apparatus, an antenna, a radio frequency inductance transformer having coupled primary and secondary windings, a multiple grid detector tube including among its elements an anode, a cathode, a control grid, a screen grid and a suppressor grid, the primary winding of said inductance transformer having one terminal thereof directly connected to said antenna and directly to said control grid, the other terminal of said winding being directly connected to ground, means for electrically connecting said tuned secondary in said tuner system without direct connection to said control grid, an intermediate frequency amplifier multiple grid tube including among its elements an anode, a cathode, a control grid, a screen grid and a suppressor grid, said amplifier tube being inductively coupled to said detector tube, a source of direct current biasing B plus and B minus potentials, means for the electrical connection of the screen grids of said tubes and said B minus potential, means for the electrical connection of said anodes and said suppressor grids of said tubes and said B plus potential and means for connecting the other elements of said tubes in said tuner system.

3. In a tuner circuit for short wave apparatus an antenna, a radio frequency transformer having coupled primary and secondary windings, a detector tube having a cathode, an anode, a control grid, a screen grid and a suppressor grid, direct electrical connection between one end of said primary winding, the antenna and said control grid, the other end of said primary winding and one end of said secondary being electrically directly connected together and to ground, and means for completing the electrical connection of said secondary winding in said tuner circuit without direct connection to said control grid, a source of direct current biasing B

plus and B minus potentials, means for supplying B plus potential from said source to said anode and to said suppressor grid, means for connecting said screen grid to said B minus potential, biasing means for connecting said cathode to the common ground and means for heating said cathode.

4. In a tuner circuit for radio systems including a source of direct current biasing B plus and B minus potentials and a multiple grid tube having as its elements, an anode, a cathode, a control grid, a screen grid and a suppressor grid, electrical connection between said screen grid and said B minus potential, electrical connection between said anode and said suppressor grid and said B plus potential and means for operatively connecting said elements of said tube in said tuner circuit.

5. In a tuner system for short wave radio apparatus, an antenna, a radio frequency induc-

tance transformer comprising coupled primary and tuned secondary windings, a multiple grid detector tube having as elements an anode, a cathode, a control grid, a screen grid, and a suppressor grid, means for directly connecting one terminal of said primary winding to said control grid and to said antenna, means for directly grounding the other terminal of said primary winding and one terminal of said tuned secondary winding, said grounding means constituting the sole direct electrical connection of said secondary winding in said tuner system, means for connecting said cathode and anode in said system, a source of direct current biasing B plus and B minus potentials, means for connecting said suppressor grid and said anode to said B plus potential and means for directly connecting said B minus potential to said screen grid.

ALBERT F. BLUME. 20