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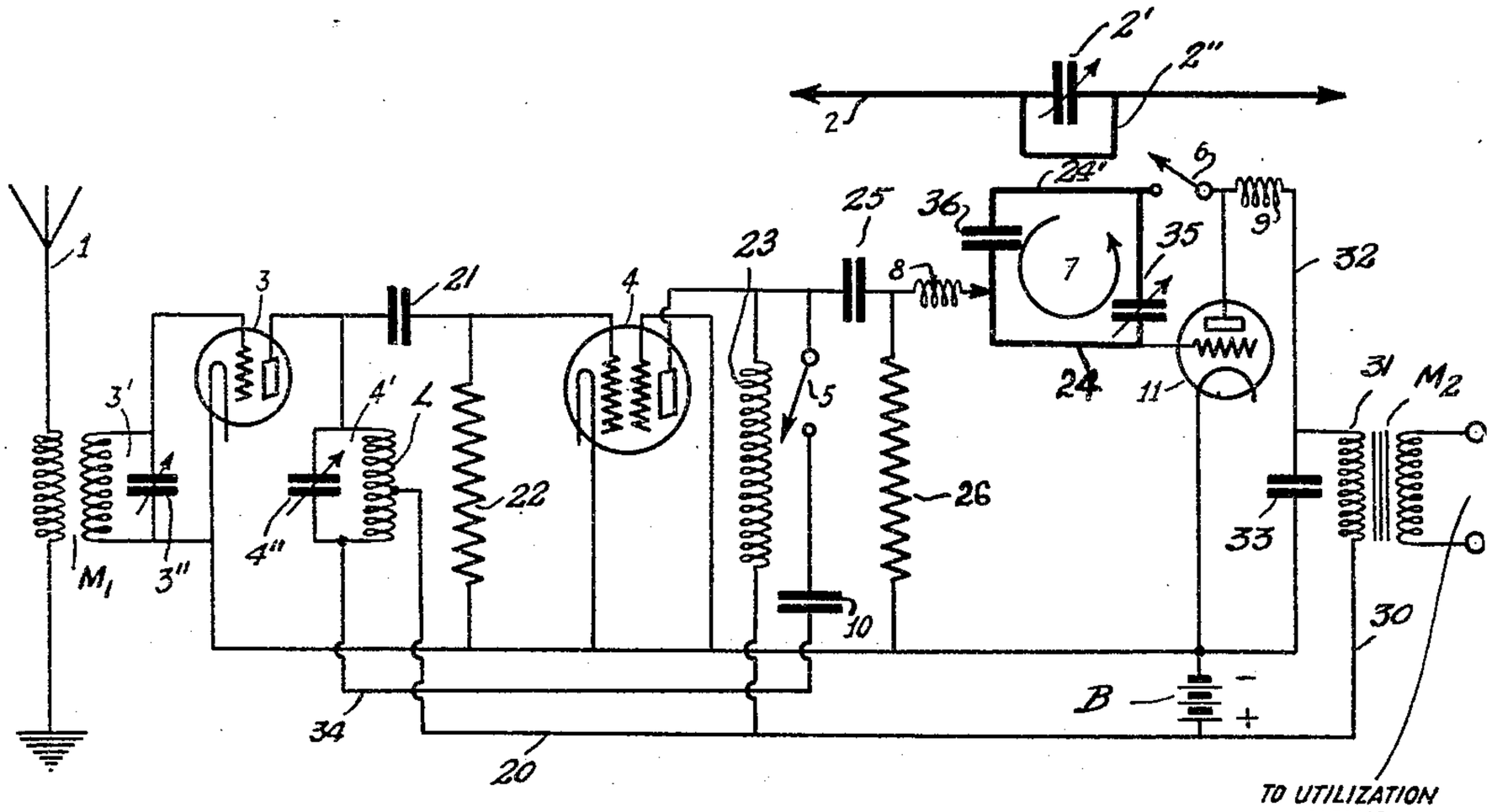

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MULTIPLE RANGE RADIO RECEIVING SYSTEM

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This invention relates to radio receiving systems of the multiple range type adapted to selectively receive signal modulated carrier waves of widely separated frequency ranges; e. g. waves from 1000 to 2000 meters and ultra-short waves from 3 to 6 meters.

It is an object of this invention to utilize the same radio frequency amplifier in the reception of the carrier waves within both of said ranges instead of employing separate receivers; one of the super-regenerative type for the short waves and the other of the superheterodyne or radio frequency amplifier type for the long waves, as has heretofore been the practice so far as applicant is aware.

Another object of this invention is to provide a radio receiver which is capable of operating either as a receiver of the tuned radio frequency amplifier type, such a receiver comprising at least two stages of tuned radio frequency amplification and a detector stage, or as a receiver of the super-regenerative type, the receiver being so constructed that loss in amplification arising when changing over from super-regenerative reception to tuned radio frequency reception is partly compensated by utilizing the interruption frequency tube of the super-regenerative arrangement as a radio frequency amplifier in the tuned radio frequency amplifier arrangement.

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 one circuit organization whereby my invention may be carried into effect.

Considering the diagrammatic embodiment of the present invention shown on the drawing, the reference numeral 1 designates the usual grounded antenna circuit employed for the reception of signal modulated carrier waves ranging from 1000 to 2000 meters. The reference numeral 2 designates in a conventional manner the usual linear, or dipole, collector employed for receiving ultra-short waves ranging from 3 to 6 meters. As is well known to those skilled in the art such a linear collector includes a variable tuning condenser 2′, and a conductor 2″ functioning, in the ultra-short wave range, as an inductance in shunt with the tuning condenser 2′. The long wave antenna circuit 1 is coupled, as at M_1, to the tunable input circuit 3′ of the first stage of tuned radio frequency amplification. This stage includes an electron discharge tube 3 whose input circuit is tuned by a variable tuning condenser 3″ to the desired wave frequency of the 1000 to 2000 meter range.

The source B supplies positive potential for the anode of tube 3 through a path which includes the conductor 20 connected to an intermediate point of coil L disposed in the input circuit 4′ of the second tuned radio frequency amplifier tube 4. The coil L is shunted by a variable tuning condenser 4″. A direct current blocking condenser 21 is connected in series between the control electrode of tube 4 and the anode of tube 3, while a grid bias resistor 22 is connected between the control electrode of tube 4 and its cathode to provide the proper bias for the said control electrode. The anode of tube 4 has positive potential applied to it from the source B through a path which includes the conductor 20, and the radio frequency choke coil 23.

The tube 11 is disposed in a detector stage, the grid of the detector tube 11 being connected to the anode of radio frequency amplifier tube 4 through a path which includes the conductor 24, the ultra-short wave choke 8, and the radio frequency by-pass condenser 25. A grid leak resistor 26 is connected from a point intermediate the condenser 25 and the choke 8 to the cathode of tube 11 in the usual manner to provide detection by grid rectification. The anode of detector tube 11 is supplied with positive potential from the source B through a path which includes the conductor 30, the primary 31 of the radio frequency transformer M_2,

the conductor 32, and the ultra-short wave choke coil 9.

A radio frequency by-pass condenser 33 is connected between the high potential side of the primary 31 and the negative side of the source B. The output of the radio frequency transformer M_2 may be connected to any desired type of utilization means. The circuit described heretofore comprises a conventional tuned radio frequency type of receiver well adapted for the reception of waves in the 1000 to 2000 meter range.

When it is desired to receive ultra-short waves from 3 to 6 meters, a switch 5 is closed, one side of the switch being connected to a point intermediate the anode of tube 4 and one side of the condenser 25, and the other side of the switch being connected through a condenser 10, having a low impedance to radio frequencies of the 1000 to 2000 meter range. The condenser 10 has one of its terminals connected by means of a conductor 34 to the low potential side of the circuit 4′.

Additionally, a switch 6, provided between the choke coil 9 and the high potential side of the ultra-short wave tuning circuit 7, is closed. The circuit 7 comprises a variable tuning condenser 35 connected in series with the conductor 24, and a fixed condenser 36 connected in series with both the conductor 24 and the tuning condenser 35. The tuning condenser 35, for ultra-short wave reception is to be considered as connected in shunt with an inductive path comprising the conductor 24, the condenser 36 and a conductor 24′. The inductance 2″ and the conductor 24′ are coupled, thus providing a coupling path between the dipole 2 and the grid of tube 11.

It is believed that the operation of the present invention will now be readily understood from the drawing and the aforegoing description. When waves in the 1000 to 2000 meter range are to be received, the switches 5 and 6 are opened, as shown, and tubes 3 and 4 function as radio frequency amplifier tubes, the tube 11 functioning as a simple detector tube, the radio frequency energy being transmitted to the grid of tube 11 from the anode circuit of tube 4 through a path including the condenser 25, the choke 8, and the conductor 24. In other words, the ultra-short wave signal circuit 24, 36, 24′ and 35 functions as a simple conductive path for the low frequencies of the 1000 to 2000 meter range.

However, when it is desired to receive ultra-short waves of the 3 to 6 meter range, the switches 5 and 6 are closed, the tube 4 and its associated input circuit 4′ functions as a simple oscillator of the Hartley type, the path including the condenser 10 providing the radio frequency feed-back path between the anode and grid of tube 4. The adjustment of condenser 4″ then regulates the frequency of oscillations produced by tube 4, and such oscillation frequency will, of course, be in the 1000 to 2000 meter range. Such oscillations are impressed upon the grid of tube 11 through the path including the condenser 25, the choke 8 and the conductor 24.

The ultra-short wave energy, of a frequency determined by the settings of condenser 2′ and the condenser 35, is impressed upon the grid of tube 11, and the ultra-short wave energy is then detected and utilized. It is not believed necessary to consider in detail the function of the oscillations produced by tube 4 in the super-regenerative reception, except to point out that the oscillations produced by tube 4 function as interruption oscillations. The incoming ultra-short wave signals are gradually built up by resonance in the circuit 7, owing to the periodic gain due to the interrupting oscillation frequency. In fact, the gain is increased to such value that the two missing stages of radio frequency amplification, which were employed in the long wave reception arrangement, are compensated for. It should be noted that the ultra-short wave choke coils 8 and 9 are provided for positively feeding the ultra-short wave energy to the grid of tube 11. Those skilled in the art are well aware of the super-regenerative operation described herein, and it is believed necessary to only point out that the oscillations from tube 4 periodically vary the grid potential of the super-regenerative detector 11, thus periodically throwing it into and out of the oscillation state.

While I have indicated and described one arrangement 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 organization 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 combination with a long wave multistage radio receiver having at least a radio frequency amplifier stage and a detector stage, a feed-back path between the output and input of the amplifier stage, a resonant circuit in the input of the amplifier stage, a path for transmitting radio frequency energy from the amplifier output to the detector input, an oscillatory circuit, resonant to frequencies in the short wave range, connected to the detector input and including a portion of said transmitting path, means in the feed-back path for rendering the same inoperative when receiving long waves, and means for selectively connecting the said oscillatory circuit to the detector output when said feed-back path is operative.

2. In combination with a long wave multi-stage radio receiver having at least a radio frequency amplifier stage and a detector stage, a feed-back path between the output and input of the amplifier stage, a resonant circuit in the input of the amplifier stage, a path for transmitting radio frequency energy from the amplifier output to the detector input, an oscillatory circuit, resonant to frequencies in the short wave range, connected to the detector input and including a portion of said transmitting path, means in the feed-back path for rendering the same inoperative when receiving long waves, means for selectively connecting the said oscillatory circuit to the detector output when said feed-back path is operative, and a linear short wave energy collector coupled to said oscillatory circuit.

3. In combination with a long wave multi-stage radio receiver having at least a radio frequency amplifier stage and a detector stage, a feed-back path between the output and input of the amplifier stage, a resonant circuit in the input of the amplifier stage, a path for transmitting radio frequency energy from the amplifier output to the detector input, an oscillatory circuit, resonant to frequencies in the short wave range, connected to the detector input and including a portion of said transmitting path, means in the feed-back path for rendering the same inoperative when receiving long waves, means for selectively connecting the said oscillatory circuit to the detector output when said feed-back path is operative, said amplifier and detector stages each including an electron discharge tube, and a common source of anode potential supply for said tubes.

4. In combination with a long wave multi-stage radio receiver having at least a radio frequency amplifier stage and a detector stage, a feed-back path between the output and input of the amplifier stage, a resonant circuit in the input of the amplifier stage, a path for transmitting radio frequency energy from the amplifier output to the detector input, an oscillatory circuit, resonant to frequencies in the short wave range, connected to the detector input and including a portion of said transmitting path, means in the feed-back path for rendering the same inoperative when receiving long waves, means for selectively connecting the said oscillatory circuit to the detector output when said feed-back path is operative, said resonant circuit including a variable condenser for tuning the amplifier input through the 1000 to 2000 meter range, and said oscillatory circuit including a variable condenser for tuning the detector input through the 3 to 6 meter range.

5. In combination with a long wave multi-stage radio receiver having at least a radio frequency amplifier stage and a detector stage, a feed-back path between the output and input of the amplifier stage, a resonant circuit in the input of the amplifier stage, a path for transmitting radio frequency energy from the amplifier output to the detector input, an oscillatory circuit, resonant to frequencies in the short wave range, connected to the detector input and including a portion of said transmitting path, means in the feed-back path for rendering the same inoperative when receiving long waves, means for selectively connecting the said oscillatory circuit to the detector output when said feed-back path is operative, and at least one tuned stage of radio frequency amplification connected to said amplifier resonant circuit, said one stage being inoperative during short wave reception.

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