

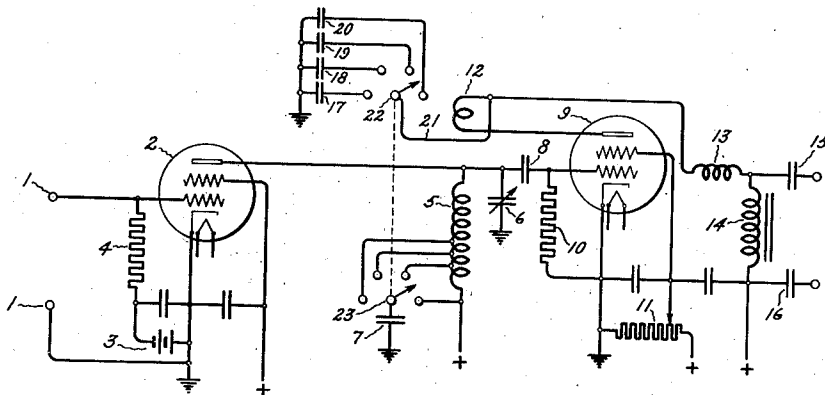
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HIGH FREQUENCY CIRCUIT

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HIGH FREQUENCY CIRCUIT

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My invention relates to high and ultra-high frequency receivers, and more particularly to a tuning unit and circuit for a multi-range receiver.

In radio receivers for high and ultra-high frequencies it has been customary to provide plug-in inductors so that the various frequency ranges may be covered efficiently, but such an arrangement is inconvenient and uneconomical. Tapped inductors generally have been avoided because the unused portions thereof reduce the efficiency of the inductors to such a degree as to be undesirable. In accordance with my invention, a single inductor is employed for a plurality of high frequency ranges without materially sacrificing efficiency. This is accomplished by maintaining in the tuning circuit a high inductance to capacitance or L/C ratio, by connecting a portion of the tuning inductor in a manner to form one of a plurality of circuits having a low L/C ratio, thereby reducing the effective inductance in the tuning circuit sufficiently to alter the tuning range thereof.

An object of my invention is to provide an improved multi-range tuning element which will be simple, efficient and economical.

A further object of my invention is to provide a tuning circuit having a high L/C ratio and means for reducing the inductance therein by connecting in succession the unused portion of a tuning inductor in a manner to form a plurality of circuits having a low L/C ratio whereby a plurality of tuning ranges are obtained.

A still further object of my invention is to provide a tuning unit for a regenerative receiver wherein the effectiveness of the regeneration or reaction inductor is adjusted simultaneously with the adjustment of the tuning inductor for the different frequency ranges, wherein the unused portion of the tuning inductor is connected to form a low L/C ratio circuit, as compared to the tuning circuit having a high L/C ratio.

The novel features which I believe to be characteristic of my invention are set forth with particularity in the appended claims. My invention itself, however, both as to its organization and method of operation, together with further objects and advantages thereof, may best be understood by reference to the following description taken in connection with the accompanying drawing in which the figure shows a radio receiver embodying my invention.

Referring to the figure in the drawing, I have illustrated therein a radio receiver having input terminals 1 which may be connected to an antenna and ground or any other source of high

frequency signals. These terminals are connected to the grid and cathode of an electron discharge device 2. A source of biasing potential 3 and a coupling resistor 4 are connected between the cathode and the grid of the discharge device. The discharge device may be of the three or four-element type. If a four-element type is used, as is shown in the figure, the screen grid is supplied with a suitable source of potential connected between the screen grid lead and the ground. The anode circuit of the discharge device 2 is connected through an inductor 5 to the positive terminal of a source of potential which has its negative terminal connected to ground. A variable capacitor 6 is arranged to be effective across the entire inductor 5. The circuit comprising the inductor 5 and the variable capacitor 6 constitutes an arrangement having a high inductance to capacitance or L/C ratio. The lower extremity of the inductor 5 is provided with a plurality of taps which may be connected to a fixed capacitor 7, which in turn is connected to ground. The circuit comprising a portion of the inductor 5 and the capacitor 7 has a low inductance to capacitance or L/C ratio. The upper extremity of the tuning circuit comprising the inductor 5 and the capacitor 6 is coupled by a coupling or grid capacitor 8 to the control grid of a second electron discharge device 9. A grid leak resistor 10 connected between the control grid and the cathode of the discharge device completes the grid circuit thereof. If the discharge device 9 is of the four-element type a screen grid may be connected to a potentiometer 11 which is bridged across a suitable potential and adjustment of this potentiometer will operate as a regeneration control device. The anode of the electron discharge device 9 is connected to a regeneration or reaction inductor 12 which is arranged in fixed relation to the tuning inductor 5. A radio frequency choke 13 connected in series with the reaction inductor 12 serves to prevent the radio frequency currents from being impressed upon the output coupling circuit which comprises an inductor 14 and capacitors 15 and 16. The anode of the discharge device is supplied with potential from a source connected between ground and one extremity of the inductor 14. A plurality of fixed capacitors 17, 18, 19 and 20 having different capacity values are arranged with a common connection to ground. It is to be understood that the capacitors 17, 18, 19 and 20 may be of the adjustable type which when adjusted are fixed compared to the usual variable capacitor. A conductor 21 which is connected to the high potential side of

the reaction inductor 12 is connected to a switch 22 whereby any one of the capacitors 17 to 20 may be connected between the reaction coil and ground to vary the regenerative effect thereof.

5 The switch 22 is mechanically linked for simultaneous operation with a switch 23 which serves as a means for selectively connecting the capacitor 7 to the various taps of the tuning inductor 5.

A receiver as described embodies a coupling stage 2, which, while preferable, is not essential and does not constitute a part of applicant's invention. This coupling stage, comprising a discharge device 2 and associated elements, is an aperiodic circuit having no frequency characteristic. In order to tune the detector circuit 9 through any one of a plurality of high frequency ranges the proper range is selected by the switches 22 and 23 which simultaneously provide the proper reaction effect of the inductor 12 and the corresponding frequency range of the inductor 5 and the tuning element 6. As the switch 23 is rotated counter-clockwise circuits having different values of inductance and capacitance are coupled to the normal tuning circuit comprising the inductor 5 and the capacitor 6. The capacitor 7 however has a capacity value relatively large compared to the variable capacitor 6, and thus the circuit comprising a portion of the inductor 5 and the capacitor 7 has a relatively low L/C ratio. The effect of coupling a low L/C ratio circuit to a tuning circuit having a high L/C ratio in this arrangement is such that while reducing the effective inductance of the tuning circuit no material losses are introduced such as would be encountered if the tap portion of the tuning inductor 5 were merely short circuit or left unused. Such unused portions ordinarily have the detrimental effect of permitting parasitic circulating currents to be set up in the unused inductor portion thereby reducing the efficiency of the useful circuit by such an amount as to seriously reduce the sensitivity of the receiver.

It will be apparent that an arrangement comprising the inductor 5 and the capacitors 6 and 7 of themselves without the reaction inductor 12 may be utilized as coupling members in a cascade radiofrequency amplifier as well as in the circuit shown in the drawing. Applicant's arrangement has the advantage that a single inductor and a simple switching mechanism provides a compact economical tuning element suitable for operation at high and ultra-high frequencies such as are received on the multi-range receivers.

While I have shown and described my invention in connection with certain specific embodiments, it will, of course, be understood that I do not wish to be limited thereto, since it is apparent that the principles herein disclosed are susceptible of numerous other applications, and modifications may be made in the circuit arrangements and in the instrumentalities employed without departing from the spirit and scope of my invention as set forth in the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In radio apparatus, a circuit for tuning over a plurality of frequency ranges including an inductor and a variable capacitor, a relatively large capacitor connected to one extremity of said inductor, and means for selectively connecting said relatively large capacitor to one of a plurality of intermediate points on said inductor to reduce the effective inductance thereof whereby the frequency range of said circuit is changed.

2. In multi-range radio apparatus, the combi-

nation of a tapped tuning inductor arranged in parallel with a variable capacitor, said circuit having a high L/C ratio, wherein L is inductance and C is capacitance, a fixed capacitor connected to one extremity of said inductor, and means for connecting selectively said fixed capacitor to the taps of said inductor, said fixed capacitor and the portion of said inductor in shunt therewith constituting a circuit having a low L/C ratio, whereby said circuits cooperate efficiently to change the normal frequency range of the circuit comprising said inductor and variable capacitor.

3. In a multi-range regenerative radio receiver, the combination of a tapped grid circuit inductor having a variable tuning capacitor connected across said inductor, a fixed capacitor connected to one extremity of said inductor, a regeneration inductor coupled in fixed relation to said first inductor, means for selectively controlling the effect of said regeneration inductor, and a common means for controlling said last mentioned means and for selectively connecting said fixed capacitor to said taps on said grid circuit inductor whereby different frequency ranges are obtained for said grid circuit inductor together with a corresponding regenerative effect.

4. In a regenerative radio receiver, the combination of a tapped grid circuit inductor, a reaction inductor, a plurality of fixed capacitors having a common connection, a uni-control means for connecting selectively said reaction inductor to different fixed capacitors and for connecting one of said fixed capacitors to a corresponding one of said taps on said grid circuit inductor whereby different frequency ranges are obtained, and a variable capacitor connected in shunt to said grid circuit inductor for tuning said circuit through each frequency range, said variable capacitor and said grid circuit inductor being connected to the common connection of said fixed capacitors.

5. In a radio apparatus, a tuned circuit comprising an inductor and a variable capacitor and having a high inductance to capacitance ratio, a reaction inductor arranged in fixed relation to said first inductor, a plurality of different fixed capacitors having a common connection, means for connecting selectively said reaction inductor to a different one of said fixed capacitors whereby the effect of said reaction inductor may be controlled, a second tuned circuit closely coupled to said first tuned circuit and having a low inductance to capacitance ratio, said variable capacitor and said second tuned circuit being connected to said common connection of said fixed capacitors, means for varying the inductance in said second circuit, and means for actuating simultaneously said latter means and said reaction inductor controlling means whereby said first tuned circuit and said reaction inductor are adjusted for operation over a plurality of frequency ranges.

6. In a multi-range regenerative radio receiver, the combination of a grid circuit inductor having a variable tuning capacitor connected across said inductor, a large capacitor connected to one extremity of said inductor, a regeneration inductor coupled to said first inductor, means for selectively controlling the effect of said regeneration inductor, and a common means for controlling said last-mentioned means and for selectively connecting said second capacitor to different points on said inductor whereby different frequency ranges are obtained for said grid circuit inductor together with a different regenerative effect.

7. In multi-range radio apparatus, the combination of a circuit having a high inductance to capacitance ratio and comprising a tapped inductor and a variable capacitor, a second capacitor connected to one extremity of said inductor, and means for connecting selectively said capacitor to the taps of said inductor, said second capacitor and the portion of said inductor in shunt therewith constituting a circuit having a low inductance to capacitance ratio, whereby said circuits cooperate efficiently to change the normal frequency range of the circuit comprising said inductor and variable capacitor.

8. In combination, a tuned circuit comprising an inductance and capacitance, said circuit having a large ratio of inductance to capacitance, a large capacitance, and means to connect said large capacitance across a variable portion of said

inductance, said capacitance being sufficiently large to produce with the portion of inductance across which it is connected a circuit having small inductance to capacitance ratio.

9. In combination, an inductor, a variable capacitor and a fixed capacitor, means to connect said fixed capacitor across a variable portion of said inductor, thereby to adjust said inductance for operation in different frequency ranges, said capacitor having such large capacitance that the circuit formed by said capacitor and the portion of the inductor across which it is connected has a low ratio of inductance to capacitance, and means including said variable capacitance to form with said inductance a circuit having high inductance to capacitance ratio, said circuit being tuned to the operating frequency.

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