July 9, 1940. R. H. PRATT 2,207,023

VOLUME CONTROL FOR RADIO RECEIVERS

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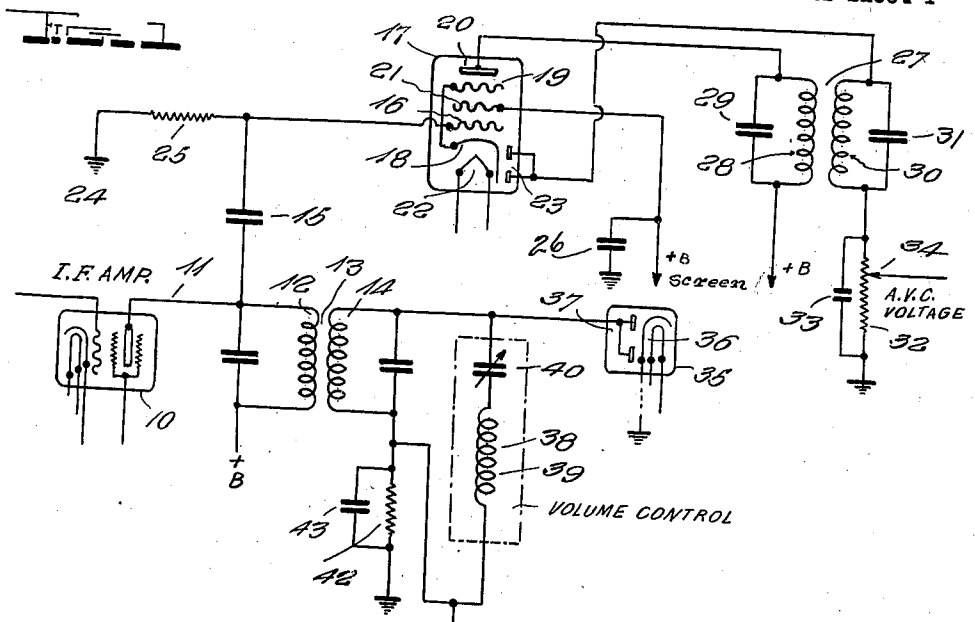



FIG. 4

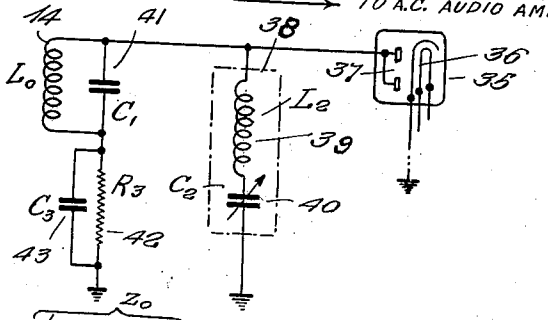


FIG. 5

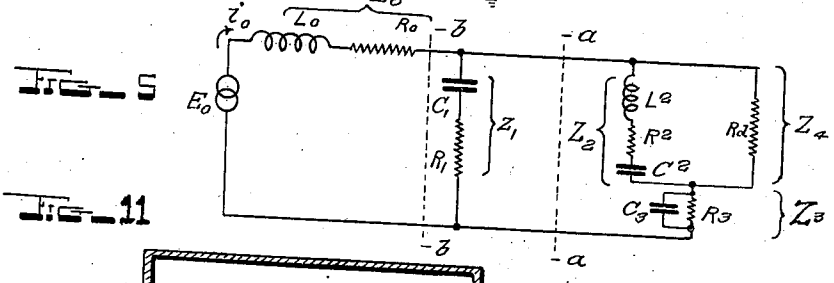
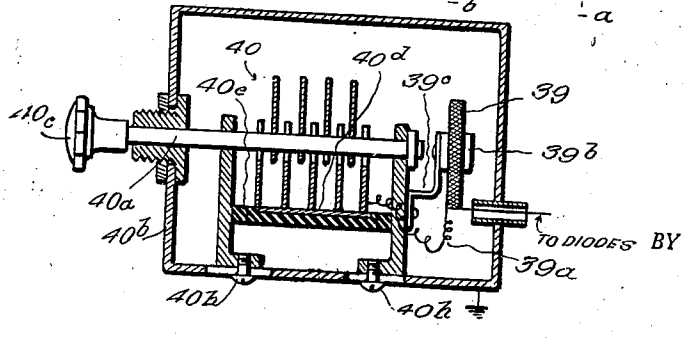


FIG. 11




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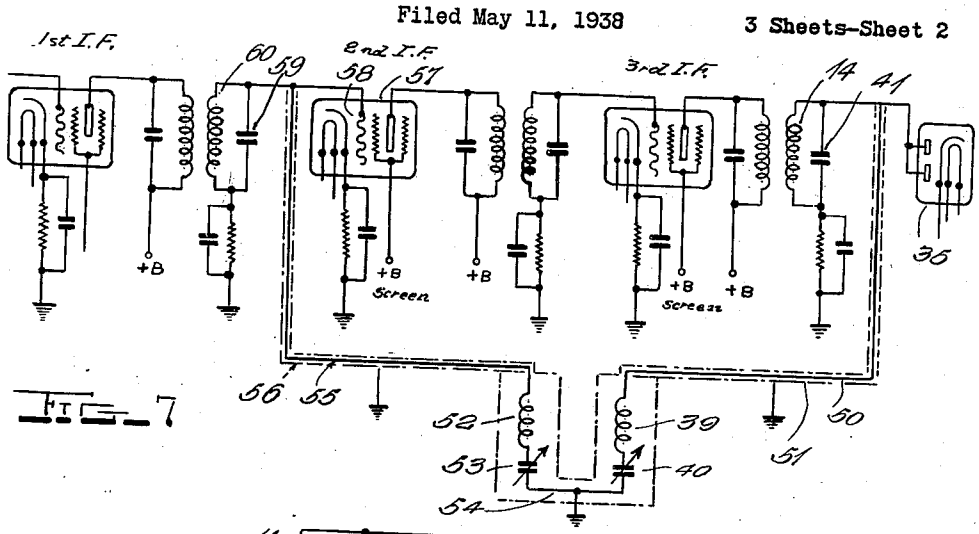



FIG. 7

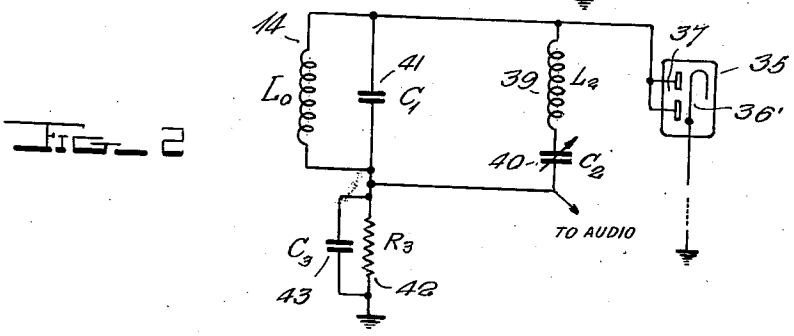



FIG. 2

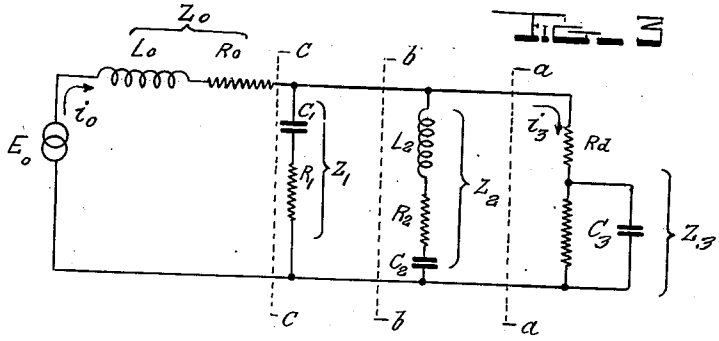



FIG. 3

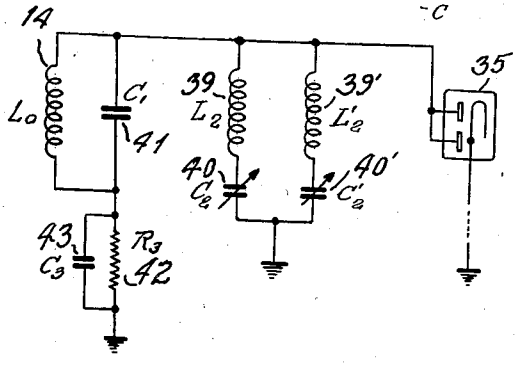



FIG. 6

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FIG. 8

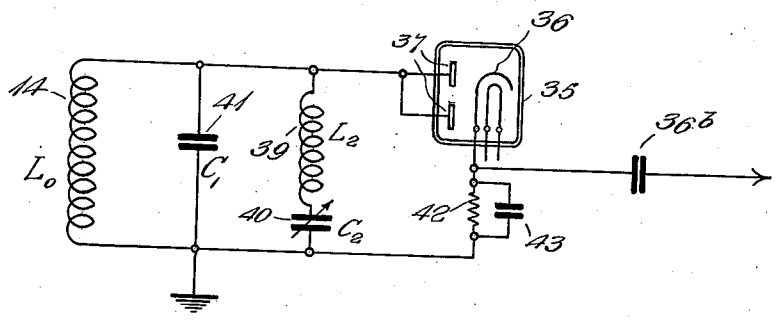



FIG. 9

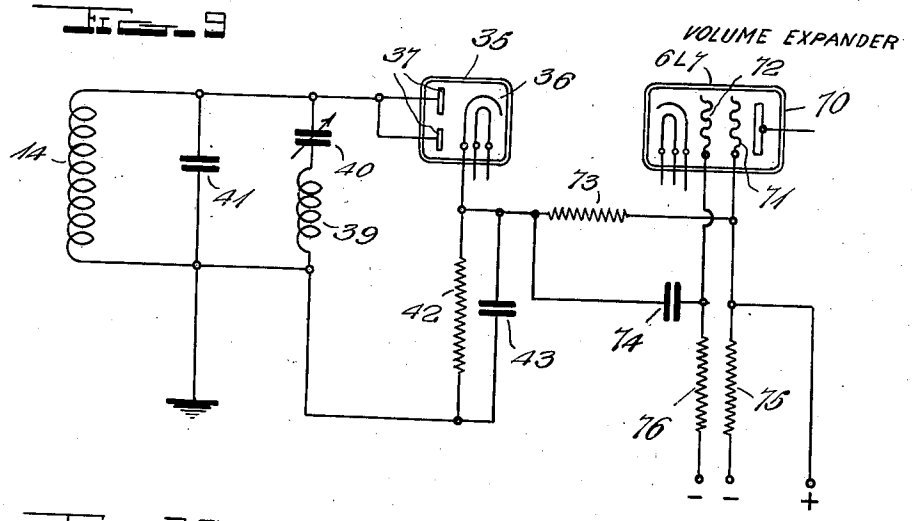
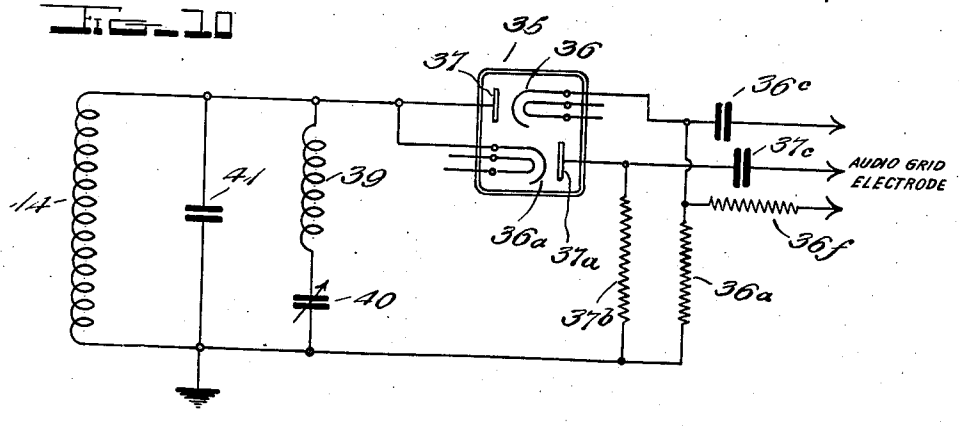



FIG. 10




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Patented July 9, 1940 2,207,023

# UNITED STATES PATENT OFFICE

2,207,023

## VOLUME CONTROL FOR RADIO RECEIVERS

Robert H. Pratt, Milwaukee, Wis.

Application May 11, 1938, Serial No. 207,357

14 Claims. (Cl. 250—20)

This invention relates to electrical apparatus generally. More particularly this invention relates to devices for controlling the output or volume of a signal receiving or other apparatus in which alternating current is being transmitted.

An object of this invention is to provide a volume control device for signal receiving apparatus, said volume control device employing a series circuit of capacity and inductance which may be tuned to resonance or near resonance to control the volume of an alternating or periodic current having a frequency corresponding to said resonance frequency.

Another object of this invention is to provide an adjustable volume control device for signal transmitting circuits, said volume control device employing an adjustable resonant circuit adapted to control the signal volume in a continuous and gradual manner not accompanied by disturbances introduced into the circuit by conventional variable resistance type controls.

A further object of this invention is to provide a volume control adapted to be employed with a pretuned amplifier, such as, the intermediate frequency amplifier of a superheterodyne receiver, said volume control consisting of a series resonant circuit adapted to be adjusted to be resonant at or near the signal frequency so that the output of said amplifier may be easily and efficiently controlled without introducing undesirable disturbances into the circuits of the amplifier.

Other and further objects of this invention will be apparent from the following specification and claims.

In accordance with this invention I provide a volume control which may be used conveniently with amplifiers and signal transmission systems of the high frequency type which are tuned or adjusted to amplify or transmit a predetermined set of high frequencies or band of frequencies. The volume control of my invention consists essentially of one or more series resonant circuits, each of which consist of an inductance and an adjustable condenser. The inductance may, of course be made variable, one form which may be variometer or a variable core inductance if desired, although I prefer to employ a variable condenser and a set inductance coil.

I am aware of the numerous uses to which series resonant circuits have been placed since the phenomenon of resonance in electrical circuits including inductance and capacity was discovered. I am also familiar with the various types of devices used for volume controls in radio receivers. The manualy adjustable types of volume controls generally employ a variable resistor connected as a potentiometer into different parts of the amplifier circuit. This type of volume control has numerous disadvantages a number of which my invention has overcome. For example, the volume control of my invention does not require the use of sliding contacts as does a variable resistance device. Consequently the likelihood of producing poor and noisy contacts is avoided even in cases where the volume control has been in long and continuous use. The volume control of my invention also may be employed as a tone compensating device since altering the LC ratio may be made to eliminate, first the high frequencies and then the low frequencies of one of the side bands, gradually as the value of the capacity C is increased.

Numerous other advantages are inherent in my invention. These will be apparent from the following specification including the description of the drawings in which, briefly, Fig. 1 illustrates a schematic diagram of an embodiment of my invention; Figs. 2, 3, 4 and 5 are schematic diagrams used to facilitate the explanation of this invention; Fig. 6 is a modified form of my invention; Fig. 7 is another modified form of my invention; Fig. 8 illustrates another embodiment of this invention; Fig. 9 shows an embodiment of this invention applied to energize and control potentials on grid electrodes of a volume expander tube; Fig. 10 shows another embodiment of this invention in which the manual volume control device is employed to control the potential across a rectifier or detector tube arranged to provide both a positive and a negative bias or potential derived from a signal; and Fig. 11 illustrates a practical embodiment of a condenser and inductance unit which may be employed in accordance with this invention.

Referring to Fig. 1 of the drawings in detail reference numeral 10 designates one of the intermediate frequency amplifier tubes of a superheterodyne receiver. This tube may be of the type sold under the designation 6K7 or 58. It is of course obvious that the receiver may employ one or more tubes in the intermediate frequency amplifier and that this amplifier is designed to amplify a certain frequency band selectively as is well known in the art. The anode of the tube 10 is connected by the wire 11 to the primary inductance 12 of the transformer 13, and to the condenser 15. This condenser 15 is connected to the grid 16 of the tube 17 which is

of the duplex diode pentode type sold as type 2B7 and is in this case employed as a separate automatic volume control. This tube is provided with the grid electrode 16, screen electrode 21, suppressor electrode 19, plate electrode 20, cathode 18, diodes 23 and cathode heater 22. The grid 16 is also connected to one end of the resistor 25, the other end of which is connected to the chassis or ground 24. A positive potential is applied to the screen electrode 21 and this potential may be derived from a source of rectified alternating current which also may be employed for energizing anode, screens and grid bias circuits of various tubes of the superheterodyne receiver, if desired.

A by-pass condenser 26 is connected to the screen electrode 21 and to the chassis, that is, the common ground to by-pass signal alternating currents from the power supply circuit. The anode 20 is connected to the primary 28 of the transformer 27 and the primary and secondary are tuned, the former by the condenser 29 and the latter by condenser 31.

The diodes 23 are employed in this case as part of the rectifier for rectifying the current flowing through the potentiometer 32 of the automatic volume control circuit. A variable contact 34 is provided to the potentiometer 32 and this contact is connected to the grid circuits of tubes of the superheterodyne receiver which are to have grid electrodes biased in accordance with potential derived from the automatic volume control circuit. One end of the potentiometer 32 is connected to the inductance 30 and the other end is connected to the common ground or chassis. A condenser 33 is connected across the resistance element of the potentiometer to by-pass high frequency currents across the element and thereby prevent high potential high frequency currents from affecting the operation of the device.

A positive potential source is connected to the inductance 28 to energize the anode of the tube 17. This source of current supply may be the same as that employed for the screen 21.

The detector tube 35, employing a pair of diodes 37 and an indirectly heated cathode, is connected to the secondary 14 which is shunted by a tuning condenser 41. A resistor 42, by-passed with a condenser 43, is connected to one end of the tuned circuit including the secondary 14 and condenser 41, and the other end of this tuned circuit is connected to the diodes 37 and the variable condenser 40 of the volume control circuit 38. The condenser 40 is connected to the inductance 39 which in turn is connected to the resistor 42 and the secondary 14. The cathode of the tube 35 is connected to the chassis as is also the resistor 42.

The portion of the receiving circuit showing the principal connections of the diode detector 35 and the volume control circuit employing the condenser 39 and the capacity 40 are illustrated in Figs. 2 and 4. The equivalent electrical network diagram shown in Fig. 3 illustrates the operation of this volume control when employed in the circuit arrangement shown in Fig. 2. When the volume control circuit is modified as shown in Fig. 4 the equivalent electrical network shown in Fig. 5 applies. In Fig. 3, $E_0$ designates the input voltage impressed upon the secondary 14. The inductance of this secondary is indicated by $L_0$ and the resistance is indicated by $R_0$. The condenser 41 which is connected across the secondary 14 is designated by $C_1$ and the resistance of this condenser is designated by $R_1$; the impedance of this branch is designated by $Z_1$. The volume control branch of the circuit including the inductance 39 and the condenser 40 is divided into inductance $L_2$, resistance $R_2$ and capacity $C_2$; the impedance of this combination is designated as $Z_2$. The diode detector 35 having impedance $R_d$ is in effect connected in series with the resistance and capacity parallel circuit 42, 43. Thus the diode detector and the parallel circuit 42, 43 form a shunt across the inductance-capacity volume control circuit 39, 40.

From a mathematical analysis of this circuit it can be shown that the volume of the high frequency signal across the output impedance $Z_3$ can be controlled by the volume control circuit forming the impedance $Z_2$. The attenuation obtained for different settings of the variable condenser 40 can be predetermined and attenuation curves of any desired shape or shapes can be obtained simply by changing the shape of the rotor and stator plates of the condenser 40.

The values of the volume control elements 39 and 40 depend, of course, upon the frequency to which the intermediate frequency amplifier, or other substantially fixed frequency amplifier with which the invention is employed, is tuned. Various values of capacity and inductance have been employed in the volume control disclosed herein with a superheterodyne receiver having an intermediate frequency of 465 kilocycles. The best results were obtained using a radio frequency choke coil having an inductance of 2.5 millihenrys as the inductance 39. This choke coil was made up of four spaced honey-comb wound coil sections connected in series. A 150 micro-microfarad variable condenser was employed as the capacity 40. By employing this combination series resonant could be readily obtained at the intermediate frequency of 465 kilocycles and the volume of the superheterodyne receiver could be accurately and easily controlled from low to high intensities and also intermediate intensities.

In order to simplify the installation of this volume control device the circuit illustrated in Fig. 4 was developed. This circuit is substantially the same as the circuit shown in Fig. 2 except that the volume control is connected across the diode detector 35, the inductance 39 being connected to the diodes 37 and the rotor plates of the condenser 40 being connected to the chassis and the cathode 36 of the tube 35. By employing this connection the operator can adjust the variable condenser 40 without introducing the effects of body capacity inasmuch as the rotor of this condenser is connected to the metal chassis of the radio receiver direct. The equivalent electrical network that is applicable to this circuit is shown in Fig. 5 and from this it will be observed that the parallel circuit formed by the volume control and the diode detector 35 is connected in series with the parallel circuit formed by the resistance 42 and the condenser 43. This complex series circuit is connected across the tuned secondary 14. The output circuit is connected across the impedance $Z_3$ as before.

The circuit illustrated in Fig. 4 requires a condenser 40 of larger size than that required in the arrangement shown in Fig. 2 to produce minimum volume in the output of the radio receiver. The circuit illustrated in Fig. 4 however results in a simpler device as far as its electrical connections are concerned since the condenser shaft can be grounded to the chassis of the radio receiver and the condenser and inductance arrangement

placed in a single shield container. The inductance is then connected to the diodes 37 by a single wire which may be shielded if necessary.

In the development of the embodiment of this invention shown in Fig. 4 the inductance 39 was made substantially larger than that employed in the embodiment shown in Fig. 2. The purpose of making the inductance 39 as large as possible, consistent with producing the desired results, is to permit the use of a relatively small capacity condenser 40. By making the inductance 39 approximately twice as large as that described in preceding paragraphs in connection with the description of Fig. 2, a condenser of approximately 50 micro-microfarad maximum capacity was found to be sufficient to produce a condition of series resonance at the intermediate frequency of the superheterodyne amplifier. Thus this volume control would produce a condition of minimum output in the radio receiver when the condenser 40 is adjusted substantially to maximum capacity, that is, when a condition of series resonance was obtained. Maximum output would therefore be produced when the volume control condenser was adjusted to substantially minimum capacity. This is desirable since the value of the tuning condenser 40 connected across the secondary 14 can be adjusted to "peak" the intermediate frequency transformer at the intermediate frequency more readily under these conditions. It should be borne in mind that the tuning of this intermediate frequency transformer secondary 14 must be adjusted after the volume control 38 is connected into the circuit. After the volume control is connected into circuit and the secondary 14 is tuned, adjustment of the condenser 40 may be necessary to compensate the variations in inductance and capacity of the elements of the volume control, however this is accomplished in a simple manner by mounting the volume control in a metal can to shield the control effectively. Means is also provided for changing the relation of the stator plates of the condenser with respect to the metal shield to adjust the maximum capacity. If desired the inductance also may be made adjustable with respect to the metal shield.

It will be observed that various values have been given for the inductance and capacity of the volume control elements. These are, of course, given only for the purpose of illustration and it is not intended that this invention is operable only when those values are employed. The values of inductance and capacity employed depend upon the range of control desired and the frequency at which the control is to be operated. Furthermore it may be desirable to employ inductance units provided with cores of magnetic material, such as are now employed in intermediate frequency transformers. On the other hand the inductance unit 39 may be made variable instead of the condenser 40 and a suitable variometer construction employed. If desired the condenser 40 may be divided into two sections, only one of which is variable, and these two sections connected in series, one on each side of the inductance 39. Other combinations may include the use of the inductance 39 and the capacity 40 circuit as shown in Figs. 2 and 4 and another condenser of suitable size may be shunted across both the inductance 39 and the capacity 40. It will therefore be observed that various combinations may be employed in the volume control of my invention.

A modified form of this volume control arrangement is illustrated in Fig. 6 in which two series resonant circuits connected in parallel are employed. The purpose of this arrangement is to lower the resistance of the volume control circuit to the radio frequency potential when the volume control is in a condition of series resonance to the frequency of the radio frequency potential. When the volume control circuit is in resonance with the signal frequency the signal voltage across the volume control circuit will be the potential drop due to the ohmic resistance of the coils or inductance windings at the signal frequency. In order to obtain as great a range of control as possible the ohmic resistance of these coils should be made as low as possible consistent with proper design. It is of course possible and in some cases may be desirable to make each of the series circuits comprising the parallel volume control circuit arrangement shown in Fig. 6, of slightly different frequency characteristics so that only one of the parallel branches will actually be in series resonance at any particular frequency and it is of course not desired to limit this invention to an arrangement in which the parallel branches are exactly alike since a condition such as this might be difficult to obtain in practice.

Where it is desired to be able to control the volume of radio stations of substantial power located in close proximity to the radio receiving set employing the volume control of my invention, a circuit such as illustrated in Fig. 7 has proved very satisfactory. This circuit employs a series volume control, such as shown in Fig. 4 including an inductance coil 39 and a variable condenser 40 connected by means of a wire 50, which is provided with a grounded shield 51, to the diodes of the tube 35. In this case the volume control includes another series resonant circuit made up of the inductance 52 and the variable condenser 53. The variable condenser 53 is connected to the variable condenser 40 and to the metal chassis of the radio receiving apparatus by means of the wire 54. The inductance 52, is connected by the wire 55 which is shielded by the hollow conductor 56, to the grid 58 of the second intermediate frequency amplifier 57. The condensers 40 and 53 may be controlled by a single shaft or other gang control arrangement, if desired. It will be observed from the circuit diagram illustrated in Fig. 7 that the intermediate frequency amplifier of the superheterodyne receiver consists of the first, second and third intermediate frequency amplifier tubes which are of the screen grid type and which are connected in cascade.

The condensers 40 and 53 are preferably of the twin straight line frequency type each having a maximum capacity of 150 micro-microfarads and the inductance units 37 and 52 each consist of multi-section windings in which each section is a small honey-comb coil. The inductance of each of the inductance units is slightly over 2 millihenrys. These values are satisfactory where the intermediate frequency to which the amplifier is adjusted is 465 kilocycles.

In operation the secondary 14 should be tuned by the condenser 41 to the maximum volume, that is the circuit including this secondary 14 and the condenser 41 should be tuned to parallel resonance at the intermediate frequency so that the output of the amplifier will be substantially maximum when the condenser 40 is set at minimum capacity. The circuit of the secondary 60 and the condenser 59, on the other hand should be

tuned so that maximum volume is obtained when the condenser 53 is set at about one-half of its full capacity. If this procedure is not followed side band interference may be obtained when signals from a weak station are being received and a strong station is transmitting on a frequency adjacent to that of the weak station. This is caused by detuning influence of the condenser 53 on the tuned circuit including the condenser 59 and secondary inductance 60. In practice it was found that the capacity of the condensers 40 and 53 affected less detuning of the secondary circuits of the intermediate frequency transformers to which the volume control is connected when condensers of 50 micro-microfarad capacities were employed as the condensers 40 and 53 than when these condensers were of 150 micro-microfarad capacity.

The volume control connected as shown in Fig. 7 affects the separate automatic volume control apparatus inasmuch as it decreases the action of the automatic control as the signal volume is lowered. No unsatisfactory results appeared from this however, and it is therefore possible that the automatic volume control and detection can be combined in the same tube. The volume control of this invention may of course be arranged in the circuit of the receiver so that reducing the signal voltage with the manually operated volume control would have no effect on the automatic volume control voltage and the amplification of the set would not increase, through the operation of the automatic volume control, as the manual volume control is operated. This may be accomplished by taking the automatic volume control voltage from the plate of the last intermediate frequency amplifier, rectifying this voltage by one diode and using it in the conventional manner. The other diode in this case is used as a signal detector with the resonant volume control of my invention connected across it. In this case reducing the signal voltage by the manual volume control would have no effect on the automatic volume control voltage.

In the arrangement of my invention shown in Fig. 2, for example, the resistor 42 connected between the secondary 14 and the metal chassis of the receiving set may be connected between the diodes 37 and the volume control inductance 39 so current passing through the diode circuit would have to pass through this resistance. In this case the secondary 14 is connected direct to the metal chassis and a coupling condenser is provided between the audio frequency amplifier and the conductor connecting the inductance 39 to the condenser 41 and the secondary 14. This arrangement is very desirable inasmuch as the size of the condenser 40 of the volume control may be reduced considerably.

In Fig. 8 I have shown a slightly modified form of this invention in which the LC circuit including the secondary 14 and the tuning condenser 41 is connected to the chassis or ground as shown and the cathode 36 of the tube 35 is connected to the chassis or ground through the resistance 42 shunted by the condenser 43. The cathode 36 is connected to the intermediate frequency or audio or low frequency circuits of the signal apparatus through the coupling condenser 36a. The circuit arrangement shown in Fig. 9 illustrates an embodiment similar to that shown in Fig. 8 adapted for use with a volume expander circuit employing a 6L7 type of tube 70. The grid electrodes 71 and 72 of the tube 70 are coupled to suitable current supply sources for biasing or other purposes by the resistors 75 and 76, respectively. The resistor 73 and condenser 74 are employed for coupling or connecting the electrodes 71 and 72, respectively, to the cathode 36 of the detector or rectifier tube 35. The circuit shown in Fig. 10 illustrates an embodiment of this invention employing a tube 35 in which the anode 37, associated with the cathode 36, is connected to the cathode 36a which is associated with the anode 37a. The anode 37 and cathode 36a are connected together and to the inductance 39 of the volume control. This circuit is particularly adapted for use in cases where it is desired to impress positive and/or negative potentials derived from a signal upon amplifier circuits. A coupling condenser 36c and resistors 36e and 36f are connected to the cathode 36 for this purpose and a coupling condenser 37c and resistor 37b are connected to the anode 37a for this purpose. The rectified voltages derived from the detector which are proportional to the signal intensity and the position of the volume control may be used to operate or control other devices which may be used to effect control of volume, tone, fidelity, or anywhere a voltage proportional to signal intensity and volume are desired.

In Fig. 11 I have illustrated an embodiment of this volume control which is adapted for use in a circuit such as illustrated in Fig. 4 wherein the condenser 40 may be grounded to the metal chassis of the radio receiving apparatus. The arrangement shown in Fig. 11 employs a condenser 40 having a shaft 40a connected to the metal shield 40b which is connected to the metal chassis of the receiving set. The rotor plates of the condenser are mounted on the shaft 40a and may be rotated by manipulating the knob 40c. The stator plates are carried by a suitable metallic member 40d which is attached to the insulation strip 40e.

Where desired the bolts 40h which fasten the condenser frame to the bottom of the can may be made slidable in slots provided in said can and by loosening these bolts the condenser may be slidably adjusted with respect to the can to adjust the maximum capacity of the condenser. It is of course obvious that various expedients may be employed to adjust the maximum and minimum capacities of this condenser; different methods may be found more desirable in different arrangements and I do not therefore desire to limit this invention to use with condensers of the type illustrated in Fig. 8.

In manufacturing the volume control of my invention to be sold as a unit it may of course be desirable to mount the inductance coil 39 inside of the same shielding can with the condenser and in that case a small bracket 39c may be attached to the frame of the condenser for holding the insulation support 39b of the inductance coil. Where desired the support 39b may include a metallic core of magnetic material such as is now provided to intermediate frequency transformer windings. Furthermore this support 39b may be made longer in order to receive a plurality of coil sections which are to be connected in series. One end of the coil 39 is connected by means of the wire 39a to the stationary plates of the condenser and the other end of the coil is connected to the diodes of the tube 35.

Numerous modifications within the spirit and scope of my invention may of course be made and I do not therefore desire to limit this invention

to the exact details shown except in so far as those details may be defined by the claims.

I claim:

1. A volume control for a radio receiver of the superheterodyne type, comprising: an inductance element and a capacity element connected in series, an intermediate frequency amplifier for the superheterodyne receiver, a rectifier connected to the output of said intermediate frequency amplifier, means for connecting said inductance and capacity elements across said rectifier, and means for varying the impedance of one of said elements whereby the ratio of the impedances of said elements to one another may be changed gradually for varying the output of the circuit of said rectifier.

2. A volume control for a radio receiver of the superheterodyne type, comprising: an inductance element and a capacity element connected in series, means for connecting said series connected inductance and capacity elements to the intermediate frequency amplifier of the superheterodyne receiver for impressing signal potentials across said series connected elements, means for varying one of said elements for gradually varying the ratio between the impedances of said elements whereby the impedances of said elements may be gradually brought into a predetermined ratio such that the output of the intermediate frequency amplifier may be controlled.

3. A volume control for a radio receiver of the superheterodyne type, comprising: an inductance element and a capacity element connected in series, an intermediate frequency amplifier for the superheterodyne receiver, said amplifier comprising at least one amplifier tube and a tuned transformer connected to the output of said amplifier tube, a rectifier connected to the secondary of said tuned transformer, means for connecting said inductance and capacity elements across said rectifier, and means for varying the impedance of one of said elements whereby the ratio of the impedances of said elements to one another may be changed gradually for varying the output of the circuit of said rectifier.

4. A volume control for a radio receiver of the superheterodyne type, comprising: an inductance element and a capacity element connected in series, means for connecting said series connected inductance and capacity elements to the intermediate frequency amplifier of the superheterodyne receiver for impressing signal potentials across said series connected elements, means for varying one of said elements for gradually varying the ratio between the impedances of said elements whereby the impedances of said elements may be gradually brought into series resonance at the intermediate frequency of said amplifier whereby the output of the intermediate frequency amplifier may be controlled.

5. A volume control for a radio receiver of the superheterodyne type, comprising: an inductance element and a capacity element connected into a series circuit, an intermediate frequency amplifier for the superheterodyne receiver, a rectifier connected to the output of said intermediate frequency amplifier, means for connecting said series circuit across said rectifier, and means for tuning said series circuit whereby the ratio of the impedances of said elements to one another may be changed gradually up to a condition of series resonance for varying the output of the circuit of said rectifier.

6. A volume control for a radio receiver of the superheterodyne type, comprising: an inductance element and a capacity element connected in series, means for connecting said series connected inductance and capacity elements to a tuned stage of the intermediate frequency amplifier of the superheterodyne receiver for impressing signal potentials across said series connected elements such that the output of said amplifier may be determined by the overall impedance of said series circuit, and means for varying one of said elements for gradually varying the ratio between the impedances of said elements whereby the impedances of said elements may be gradually brought into a predetermined ratio.

7. A volume control for an amplifier of the type adapted to amplify desired signals in a set frequency band, comprising: an inductance element and a capacity element connected into a series circuit, means included in one of said elements for varying the ratio between the impedances thereof whereby said series circuit may be brought to series resonance at a frequency in the band to which said amplifier is adjusted and connections for impressing desired-signal currents having frequencies within said band upon said series circuit whereby the effective potential of said desired-signal currents may be controlled.

8. A volume control for an amplifier of the type adapted to amplify desired signals in a set frequency band, comprising: an inductance element and a capacity element connected into a series circuit, means for varying said capacity whereby said series circuit may be brought to series resonance at a desired-signal frequency in the band to which said amplifier is adjusted and connections for impressing desired-signal currents having frequencies within said band upon said series circuit whereby the effective potential of said desired-signal currents may be controlled.

9. A volume control for an amplifier of the type adapted to amplify desired signals in a set frequency band, comprising: an inductance and a capacity, connections for connecting said inductance and said capacity into a series circuit and for connecting said series circuit across a portion of the circuit of the amplifier having a desired-signal potential difference thereacross corresponding to at least one of the frequencies of the set frequency band, and means for adjusting said series circuit to resonance to control the magnitude of said desired-signal potential difference.

10. A volume control for an amplifier of the type adapted to amplify desired signals in a set frequency band, comprising: an inductance element and a capacity element connected into a series circuit, means included in one of said elements for varying the ratio between the impedances thereof whereby said series circuit may be brought to series resonance at a desired-signal frequency in the band to which said amplifier is adjusted and means for connecting said series circuit to said amplifier for impressing desired-signal currents having frequencies within said band upon said series circuit for controlling the effective potential of said desired-signal currents across the output circuit of said amplifier.

11. A volume control for an amplifier of the type adapted to amplify desired signals in a set frequency band, comprising: an inductance and a capacity, connections for connecting said inductance and said capacity into a series circuit and for connecting said series circuit across a portion of the circuit of the amplifier having a desired-signal potential difference thereacross corresponding to at least one of the frequencies of the set frequency band, and means for con-

trolling the overall impedance of said series circuit whereby the magnitude of said desired-signal potential difference across said series circuit and the output of said amplifier may be controlled.

12. A volume control for a radio receiver of the superheterodyne type, comprising: a pair of series circuits each including an inductance element and a capacity element, an intermediate frequency amplifier for the superheterodyne receiver, a rectifier connected to the output of said intermediate frequency amplifier, means for connecting one of said series circuits across said rectifier, means for connecting the other of said series circuits across a tuned circuit of said intermediate frequency amplifier, means for varying the impedance of one of said elements in each of said series circuits whereby the ratio of the impedances of said elements to one another, in each of said circuits, may be changed gradually for varying the output of said amplifier.

13. A volume control for a radio receiver of the superheterodyne type, comprising: a pair of series circuits each including an inductance element and a capacity element, means for connecting each of said series connected circuits to the intermediate frequency amplifier of the superheterodyne receiver for impressing signal potentials from different circuits of said amplifier across each of said series circuits, means for varying one of said elements in each of said circuits whereby said circuits may be gradually brought into series resonance at the intermediate frequency of said intermediate frequency amplifier to control the output thereof.

14. A volume control for a radio receiver of the superheterodyne type, comprising: a pair of series circuits each including an inductance element and a capacity element, an intermediate frequency amplifier for the superheterodyne receiver, said amplifier including at least one amplifier tube and tuned input and output circuits, a rectifier connected to said output circuit, connections for connecting one of said pair of series circuits to said rectifier, and connections for connecting the other of said series circuits to one of said tuned circuits connected to said amplifier whereby the output of said amplifier may be gradually and uniformly controlled when said series circuits are adjusted to a condition of series resonance at the intermediate frequency of said intermediate frequency amplifier.

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