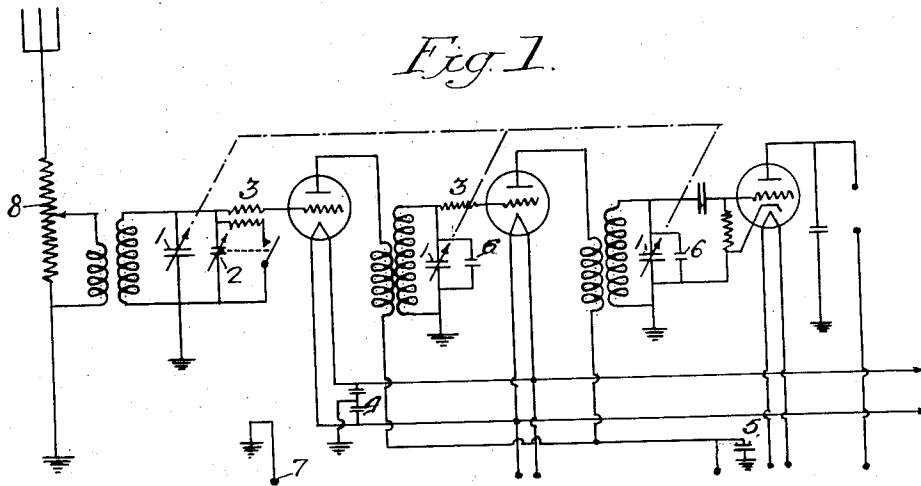
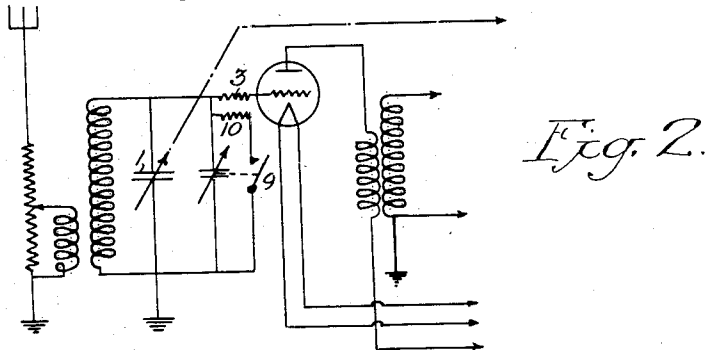
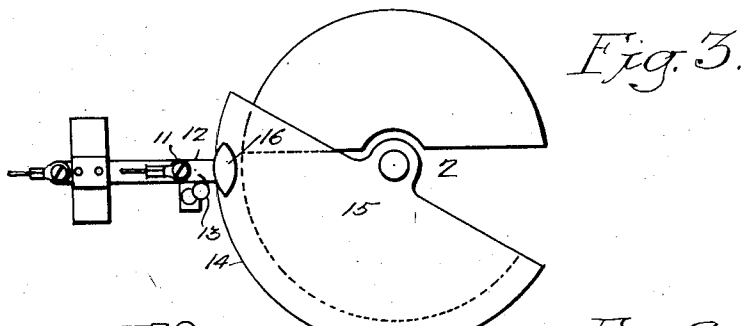
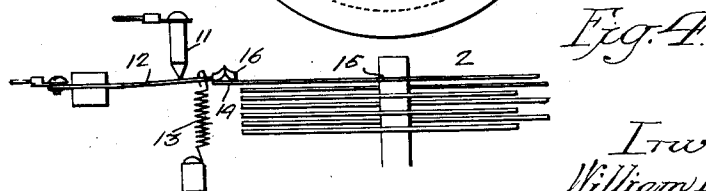


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W. H. GRIMDITCH
RADIO RECEIVER CONTROL
Filed May 23, 1928

1,718,138

2 Sheets-Sheet 1



Inventor:
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June 18, 1929.

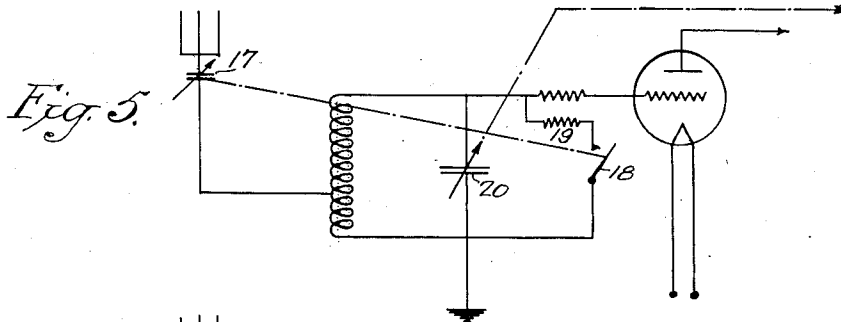
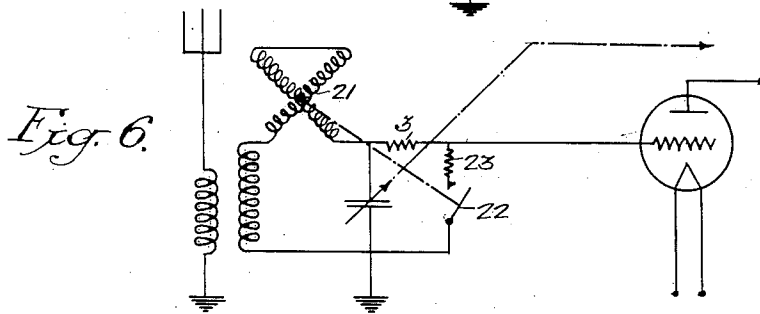
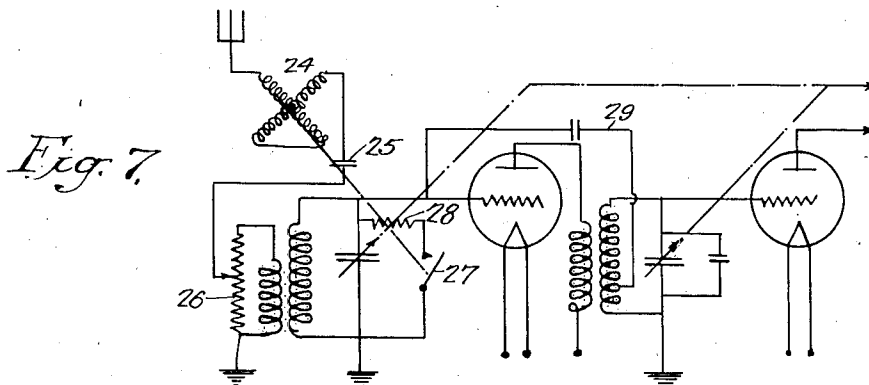
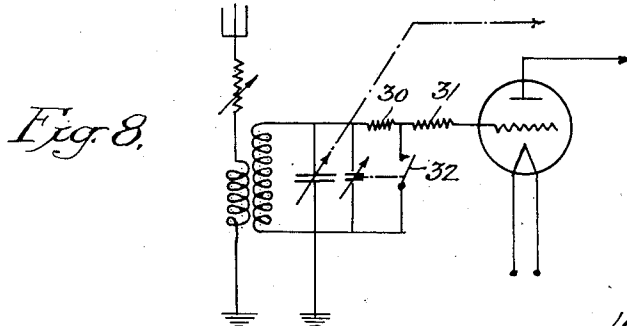
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RADIO RECEIVER CONTROL

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2 Sheets-Sheet 2



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1,718,138

UNITED STATES PATENT OFFICE.

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RADIO RECEIVER CONTROL.

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This invention relates to improvements in devices for controlling the output signal volume of electrical signalling systems such as used for example in radio receiving apparatus, and has a particularly valuable application to such systems having multiple stage tuned radio frequency amplification with a single tuning control for all stages, and in which also an auxiliary tuning device is used to bring the antenna coupling stage to resonance.

While the invention in its broader aspects is applicable in general to systems having tuned amplification, it is of particular advantage in apparatus employing tubes adapted for filament energization from a low potential alternating current source of commercial frequency.

The principal object of this invention then is to provide novel and improved means for controlling the output signal volume of electrical signalling systems of the general character set forth above.

In the attached drawings:

Figure 1 shows a typical radio receiving system to which the invention is applicable and illustrates one embodiment of my device; Fig. 2 is an enlarged diagram showing the electrical details of the invention;

Figs. 3 and 4 are enlarged views illustrating the mechanical details of the apparatus;

Figs. 5, 6 and 7 are diagrams illustrating several alternative methods of auxiliary tuning control to which the invention is applicable, and

Fig. 8 is a diagram showing one of the alternative types of volume control with which the device of the present invention may be employed.

The methods heretofore employed for controlling the output volume of radio receiving apparatus are generally undesirable for use in receivers employing vacuum tubes whose filaments are energized by alternating current. Practical results have been obtained, however, by means of a resistor system associated with the antenna circuit in conjunction with an auxiliary tuning device capable of compensating for any detuning effects caused by the use of antennas and antenna circuit elements of varying capacities. This method of control, however, while generally satisfactory has been found to possess an inherent defect, in that the output signal of the

receiver, when tuned to a powerful station at a moderate distance, is of such high intensity that a satisfactory minimum of signal strength may be unobtainable in spite of the fact that the primary of the first radio frequency transformer may be practically short-circuited at the minimum setting of the volume control.

I have discovered satisfactory and inexpensive means for controlling the volume whereby the signalling intensity may be reduced to a desirable minimum without adversely affecting the action of the receiver.

With reference to the drawings, Figure 1 shows a wiring diagram of the tuned radio frequency system of a radio receiver in which the various main tuning elements are actuated from a single or common control and in which the vacuum tube cathodes are energized by low potential alternating current. The main tuning means consists of a plurality of condensers 1 associated respectively with the grid or input circuits of the various tubes, and these condensers as indicated in broken lines are operatively connected so as to be adapted for simultaneous operation from a single control element. Means is also provided for bringing the antenna circuit into exact resonance, this consisting in the present instance of an auxiliary tuning device in the form of a condenser 2 paralleling the condenser 1 in the input circuit of the first radio frequency amplifying tube.

In addition to the normal system of the aforementioned type, the diagram shows suppressor resistors 3 that may be included to reduce the oscillation tendencies of the amplifier tubes, a filament bypass condenser system 4 and a plate circuit bypass condenser 5 being included for a similar purpose, and to reduce any extraneous disturbance occurring in this part of the circuit. Condensers 6 are added to equalize any irregularities of the circuit capacities which might otherwise cause the tuned circuits to tune to frequencies differing among the various stages, and a terminal 7 is associated with the external energizing circuits so as to apply the desired direct current cathode-grid and cathode-plate potentials in the customary manner. The volume control consists of a resistor system 8 preferably in the form of a potential divider associated with the antenna and with the primary of the first or input radio frequency

transformer in the manner illustrated. In so far as described above, the system illustrated in Fig. 1 of the drawings presents no novelty over prior practice relating to radio receiving apparatus of this general character, and no more detailed description of the system as a whole is necessary.

In accordance with the present invention, I associate with the auxiliary tuning condenser 2, as illustrated in Fig. 2 of the drawings, a switch 9 and a suitable resistor 10 in such manner that in certain positions of adjustment of the auxiliary tuning condenser the resistor is connected from the grid of the first radio frequency amplifying tube to the grounded or zero-potential side of the circuit, while in other positions of this condenser, the resistor is disconnected from one or other of the above connections, with the result that the auxiliary tuning device functions in a normal manner to bring its associated tuning circuit into close resonance. The switch 9 when closed operates to apply a resistive load of experimentally determined value to the tuned grid circuit of the first radio frequency amplifying tube, thereby reducing the radio frequency voltage and, therefore, the output volume to a desired extent and allowing the regular volume control 8 to control the volume of the reduced signal in the normal manner. It will be apparent, therefore, that the device provides two distinct ranges of operation, in each of which the volume control 8 is operative to regulate the volume as required, the output signals in one of these ranges varying from a desired minimum to a moderate intensity, and in the other between a moderate intensity and maximum volume.

In Figs. 3 and 4, I have illustrated one form of mechanical means for carrying out my invention. In this instance, I provide a switch consisting of a contact member 11 and a blade 12 which is normally held out of contact with the member 11 by means of a spring 13. The blade 12 projects into the path of a contact flange 14 on the rotor 15 of the condenser 2 and is provided at its outer end with a shoe 16, which may be of insulating material, so formed that when the contact flange comes in contact therewith, the blade 12 is elevated into contact with the point 11. It will be noted that the flange functions to close the switch 11—12 through an angular movement of the rotor of approximately 180° during which the capacity of the condenser increases from zero to a maximum, and that by reversing the rotative movement of the rotor from the zero capacity position, the capacity may be increased to the maximum without affecting the switch which remains normally open. The condenser 2 is thus made effective for both ranges of control.

In Figs. 5, 6 and 7, I have illustrated circuits similar in part to that shown in Fig. 1, but differing from the latter in the method of

auxiliary tuning control. In each instance, the circuit includes the device of the present invention. In Fig. 5, for example, I have shown the antenna connected through a tap directly to the grid tuning coil of the first stage of radio frequency amplification. In this instance, the auxiliary tuning device takes the form of a variable condenser 17 in series with the antenna, and this auxiliary tuning control is operatively connected with a switch 18 which with a resistor 19 shunts the main tuning condenser 20, the operative connection being similar to that illustrated in Figs. 1 and 2 whereby in certain positions of the antenna condenser 17, the switch is closed, thereby shunting the resistor 19 across the main tuning condenser 20. In Fig. 6, the auxiliary tuning device takes the form of a variometer 21 in series with the secondary of the input transformer, this variometer being operatively connected with a switch 22 arranged in series with a resistor 23 so that in given positions of the variometer, the switch 22 is closed to connect the grid to ground through the resistor 23. In this instance it will be noted that the resistor 23 is connected between the grid of the tube and the suppressor 3 as an alternative to the connection directly in parallel with the main tuning control, as shown in Fig. 2. In Fig. 7, a variometer 24 is in series with the antenna, which latter is connected through a condenser 25 directly to the volume control variable resistor 26. A switch 27 is provided which is operatively associated with the variometer and so arranged that when closed the grid is connected through a resistor 28 with the ground. In this instance the suppressor resistor has been removed and the oscillation tendency reduced by a balancing system 29 connected in accordance with one of the well known neutralizing methods. Another variation resides in the resistor 26 so connected as to vary the proportion of the antenna current flowing in the primary of the first radio frequency transformer thereby regulating the volume.

The device of the invention is applicable also to other types of volume control, one such application being illustrated in Fig. 8 in which a variable resistor is placed in series with the antenna and with the primary of the input transformer. In this instance, the auxiliary tuning device is similar to that illustrated in Fig. 2 and is operatively associated with a switch 32 in the manner previously set forth. This diagram also shows a further variation from the circuit shown in the other figures in that it shows a suppressor resistor which is formed in two sections 30 and 31. The switch 32 is connected between the ground and a point intermediate the resistors 30 and 31.

The invention is applicable in principle to many forms of electrical signalling appa-

ratus, and is not limited to the particular form of radio receiving apparatus herein described. The device is applicable, for example to receivers employing loop antennas. 5 The device also may vary widely as to detailed form and as to its position in the electrical system with which it may be associated.

I claim:

1. In a signalling system, a tuned circuit 10 including a tuning element, an auxiliary tuning element, a resistor, and means associated with said auxiliary tuning element for causing the resistor to be connected to dissipate a predetermined part of the energy of said 15 tuned circuit.

2. In a signalling system, a tuned circuit including a tuning element, an auxiliary tuning element, and means associated with said auxiliary tuning element for short-circuiting a 20 part of said tuned circuit.

3. In a signalling system, a plurality of tuning elements, an element auxiliary to one of said tuning elements, a resistor associated with one of said tuning elements, and means 25 associated with said auxiliary element for causing said resistor to be made effective or ineffective.

4. In a signalling system, a plurality of tuned circuits, a plurality of tuning elements associated therewith, a tuning element auxiliary to one of said tuning elements, a resistor, and means associated with said auxiliary tuning element whereby said resistor 30 may be connected to dissipate a predetermined part of the energy of one of said tuned circuits.

5. In a signalling system, a plurality of tuned circuits, a plurality of tuning elements associated therewith and actuated by a common control means, a tuning element auxiliary to one of said tuning elements, a resistor, and means associated with said auxiliary tuning element whereby said resistor may be connected to dissipate a predetermined part of 35 the energy of one of said tuned circuits.

6. In a signalling system, a tuned circuit including a tuning element, an auxiliary tuning element, means for reducing signal intensity comprising a resistor system associated with said tuned circuit, and means associated 40 with said auxiliary tuning element for causing said signal-reducing means to be rendered effective or ineffective.

7. In a signalling system, a plurality of

tuned circuits each including a tuning element, said tuning elements being actuated by 55 a common means, a tuning element auxiliary to one of said tuning elements, a vacuum tube having a grid and a plate, associated with one of said tuned circuits, a suppressor resistor 60 connected between the grid and the tuned circuit, a resistor associated with the grid and the tuned circuit and adapted to reduce the intensity of signal applied to the grid, and means associated with said auxiliary tuning 65 element for causing said resistor to be made effective or ineffective.

8. In a device for the reception of radio signals, a plurality of cascaded amplifying tubes, a plurality of tuned circuits associated 70 with said amplifying tubes, each circuit including a tuning element, said tuning elements being actuated by a common means, a tuning element auxiliary to one of said tuning elements, a resistor adapted to dissipate 75 a predetermined part of the energy of one of said tuned circuits, and means associated with said auxiliary tuning element whereby said resistor may be rendered effective or ineffective. 80

9. In a signalling system, a tuned circuit including a tuning element, an auxiliary tuning element, a resistor system adapted to reduce the intensity of signal applied to the tuned circuit, a resistor associated with said 85 tuned circuit, and means associated with said auxiliary tuning element for causing the resistor to be connected to dissipate a predetermined part of the energy of said tuned circuit. 90

10. In a signalling system, a plurality of tuned circuits each including a tuning element, said elements being actuated by a common means, a tuning element auxiliary to one of said tuning elements, a resistor system 95 adapted to reduce the intensity of signal applied to one of the tuned circuits, a vacuum tube having a grid and a plate associated with one of said tuned circuits, a suppressor resistor connected between the grid and the 100 tuned circuit, a resistor associated with the grid and the tuned circuit and adapted to reduce the intensity of signal applied to the grid, and means associated with said auxiliary tuning element for causing said resistor 105 to be made effective or ineffective.

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