

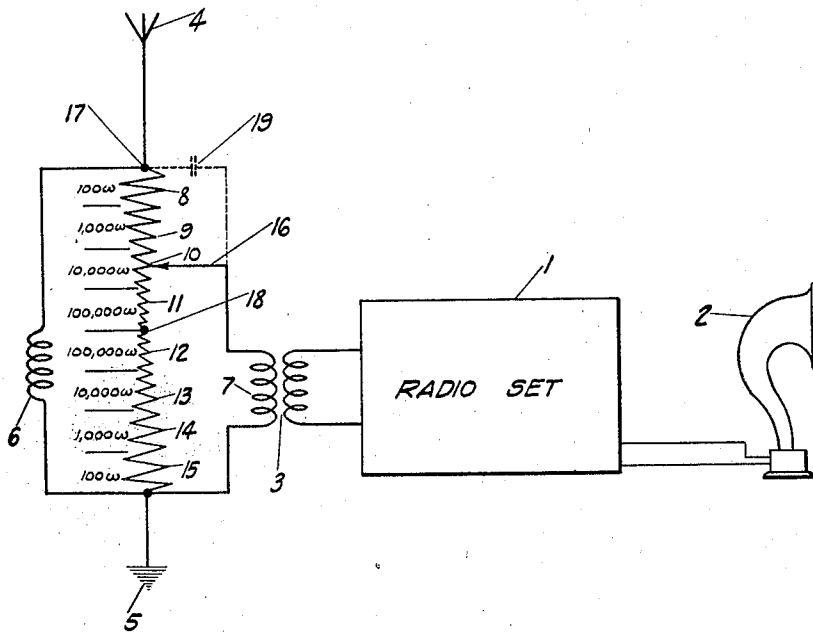
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RADIO SIGNAL VOLUME CONTROL

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RADIO SIGNAL VOLUME CONTROL

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This invention relates to radio communication, and especially to the reception of radio signals.

Many radio sets are provided with a number of amplifiers in cascade, whereby the loudness of the received signals can be built up to a desired value. However, when signals from near-by or powerful stations are being received, the volume may become objectionably large.

Various schemes have been suggested and used to control the volume, but all such prior schemes I believe have serious disadvantages, which it is my aim to overcome. For example, it has been proposed to provide a variable coupling between the pick-up circuit that includes the antenna or loop, and the set, the looser the coupling the less being the energy transferred to the set. This has the serious disadvantage of varying the tuning of the set, as is well understood.

Another means for controlling the volume that has been suggested is to control the temperature of one or more of the filaments that provide the electron emissions in the amplifier tubes used in the sets. This can be accomplished by the provision of a variable resistance in the filament heating circuit. When the set is operated however from an ordinary alternating current house lighting circuit, the fluctuations in voltage thereof produce undesired variations in the signal volume, since the filament emission is critical with filament temperatures.

Still another means for controlling volume that has been suggested is by the aid of a potentiometer for dividing the electromotive forces produced by the signaling energy; but this arrangement has been found to give but a limited control range.

It is thus an object of my invention to provide a simple and inexpensive volume control not subject to any of the foregoing disadvantages, and yet capable of manipulation by a single knob or dial.

Another object is to provide a novel volume control means adapted to be associated with the input circuit of a radio receiver and arranged so that equal increments of movement of the control means produce an even gradation

of control throughout the volume control range.

My invention possesses many other advantages, and has other objects which may be made more easily apparent from a consideration of one embodiment of my invention. For this purpose I have shown a form in the drawings accompanying and forming part of the present specification. I shall now proceed to describe this form in detail, which illustrates the general principles of my invention; but it is to be understood that this detailed description is not to be taken in a limiting sense, since the scope of my invention is best defined by the appended claims.

Referring to the drawings:

The single figure is a diagram showing the application of my invention to a radio receiving system.

In the example illustrated, I show a radio set 1, preferably of the kind that utilizes a plurality of electronic emission amplifiers. It is shown as connected to supply energy to a loud speaker 2 or equivalent translating device. The set 1 is shown as supplied through a transformer 3 from a pick-up circuit. Such a pick-up circuit can be a loop or an open circuit, formed for example by elevated conductors or antenna 4, and ground 5.

The manner in which the pick-up circuit 4-5 is coupled to transformer 3 forms an important part of the volume control. In general, it may be stated that the primary coil 7 of coupling transformer 3 is provided with a series energy consuming device and a parallel energy consuming device, the relative effects of which can be controlled to secure the volume control. Thus a series of resistances labelled 8 to 15 is connected between the antenna 4 and ground 5; one terminal of coil 7 is connected to ground 5, and the other is variably connected to any desired intermediate point on the series of resistances, by the aid of contact device 16.

Before proceeding further with the description of the apparatus, it is advisable to point out the various effects taking place as the variable contact 16 is moved. When the contact 16 is at an intermediate point such for example as indicated, the pick-up circuit

is in series with the coupling transformer 3 as well as with that portion of the series of resistances which extends between contact 16 and antenna 4. This series resistance cuts
 5 down the available energy passed to set 1. In addition, there is a resistance paralleling the pick-up circuit as well as transformer 3, and includes that section of the resistances which extends between contact 16 and ground
 10 5. This parallel resistance by-passes some of the energy and also serves to reduce the volume.

When the signals are weak, of course very little resistance should be in series relation
 15 with the coil 7, and a high resistance should be in parallel relation. Thus the contact 16 should be placed on post 17, reducing the series resistance to zero, and raising the shunt resistance to a high value. Now as the signal
 20 gets louder, the volume can be reduced by moving contact 16 downward. This inserts resistance in the series circuit, and reduces the parallel resistance.

In order to obtain an even gradation of
 25 control, it is preferred to arrange the sections of the resistances in such a way that equal movements of the contact 16 as it moves away from post 17 will introduce larger and larger increments of resistance in series, until
 30 a mid-point 18 is reached, when the effect is reversed, and the increments become smaller and smaller. In this way, the series resistance is being rapidly increased at first, while the parallel resistance is but little decreased.
 35 This is a desirable condition for weak signals, as the volume control is practically entirely by variations in series resistance.

The insertion of additional series resistance can be continued, but it is found that its effectiveness is very much reduced as soon as the
 40 series resistance is of about the same order of magnitude as the reactance due to the leakage capacitance of the system. This leakage capacitance is illustrated at 19. Any further
 45 attempt materially to reduce the volume for a very strong signal by the insertion of additional series resistance is found to be ineffective. It is then necessary to reduce the shunt
 50 resistance by large amounts to effect the desired diminution in volume. This is automatically effected by my control, for as contact 16 moves downward from its central position, the reduction in shunt resistance becomes faster and faster.

The values of the resistance sections can be
 55 about of the order shown on the drawing; that is, the outside sections 8 and 15 can be about 100 ohms; the next sections 9 and 14 about 1000 ohms; the next sections 10 and 13
 60 about 10,000 ohms; and the center sections 11 and 12, about 100,000 ohms. However, these values can of course be departed from. The number of sections can also be varied; but
 65 all of them should be substantially non-inductive, so that whatever detuning of the first

radio frequency amplifier stage results from the use of the control is so small that it is not objectionable. Theoretically, the values of resistances 8 to 15 should taper in accordance
 70 with a logarithmic function, but in practice an even and smooth control can be obtained by providing the stepped resistances of about the order indicated.

It is seen that the resistance variation due to the tapering of the resistance values of the
 75 sections 8 to 15 is such as to produce the proper variations in the shunt and series resistances of the volume control. The total resistance is very high as compared with the resistance of the associated parts, but the portions making up the series and shunt resistances can be varied between very high and
 80 very low values.

Although I have described the system of control as applied to an antenna pick-up system, it is possible to utilize it with other
 85 forms. For example, a pick-up system can be coupled instead to coil 6, connected to the extreme terminals of the series of resistances.

It is also to be noted that the volume control is effected before the signaling energy
 90 enters the set 1, whereby all danger of overloading any of the tubes is overcome. Furthermore, the control is not critical, and can be easily manipulated by a single control
 95 member, such as by movable contact 16.

I claim:

1. In a radio signal receiving system having a pick-up circuit transferring energy to the input side of a receiver, and a translating
 100 device to which the receiver transmits the signaling currents, the process of controlling the energy utilized in the translating device, which comprises simultaneously varying a pair of resistances in opposite senses, one of
 105 said resistances being in series with the input to the receiver, and the other in shunt thereto.

2. In a radio signal receiving system having a pick-up circuit transferring energy to the input side of a receiver, and a translating
 110 device to which the receiver transmits the signaling currents, the process of controlling the energy utilized in the translating device, which comprises oppositely varying resistances in series and in parallel to the input
 115 of the receiver, the variations in the resistances being such that the series resistance is at first slowly increased and then rapidly increased as its value increases; and the shunt resistance is then rapidly decreased and later
 120 slowly decreased as its value decreases.

3. In a radio signal receiving system, the process of controlling the transfer of energy from one portion of the system to another portion, said other portion having an input circuit to which the energy is to be passed, which
 125 comprises varying a series and a shunt resistance in said input circuit, the variation being such that as the series resistance increases from a low value, its increase is low; 130

and said increase becomes more rapid as the resistance is further increased; and as the shunt resistance decreases from a high value, its decrease is low, and said decrease becomes larger as the resistance is further decreased.

5 4. In combination, a radio receiving system having a portion that has an input circuit and another portion arranged to pass energy thereto, means for controlling the amount of
10 energy passed between the two portions, comprising a variable resistance in series with the input circuit a variable resistance in parallel therewith, and a single means for simultaneously varying said resistances in op-
15 posite senses, the rates of increase and decrease of said resistances progressively varying as their values vary.

5 5. In combination, a radio receiving system having a portion that has an input circuit
20 and another portion arranged to pass energy thereto, means for controlling the amount of energy passed between the two portions, comprising a series resistance in the input circuit, a shunt resistance across said circuit,
25 and means for varying said resistances simultaneously in opposite sense, the resistances being so arranged that as the series resistance is increased from a low value, its increments are relatively large and decrease as the re-
30 sistance increases; and that as the shunt resistance is decreased from a high value, the decrements are relatively small and increase as the shunt resistance decreases.

6. In combination, a radio receiving system
35 having a portion that has an input circuit and another portion arranged to pass energy thereto, means for controlling the amount of energy passed between the two portions, comprising a series of resistances arranged so
40 that relatively small ones are at the two ends, and progressively larger ones as the central portion is reached, the portion arranged to pass energy connecting across said series of resistances, and a movable contact arranged
45 to connect to any intermediate point in the series, said contact being connected to one side of the input circuit, the other side of said circuit being connected to one of the ends of the series.

50 In testimony whereof I have hereunto set my hand.

HAROLD F. ELLIOTT.

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