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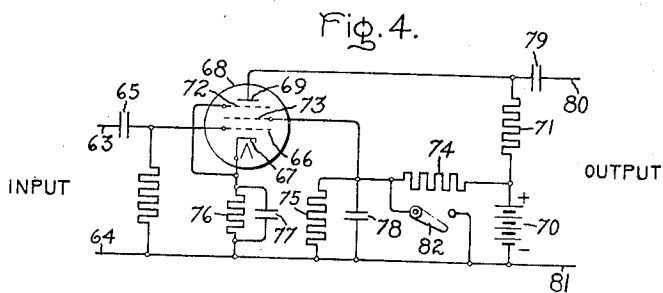
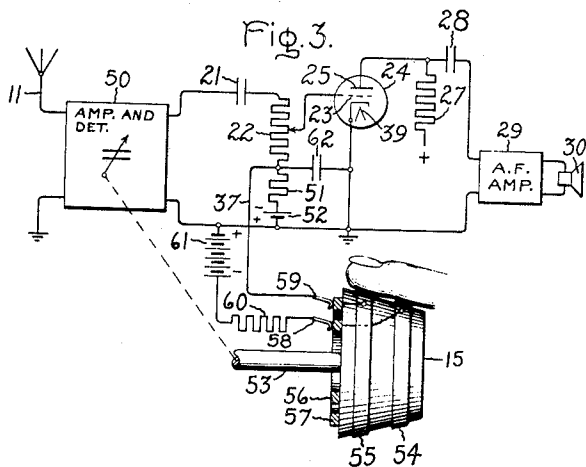
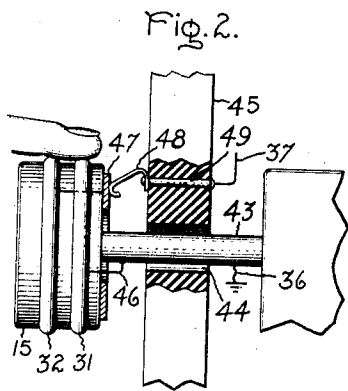
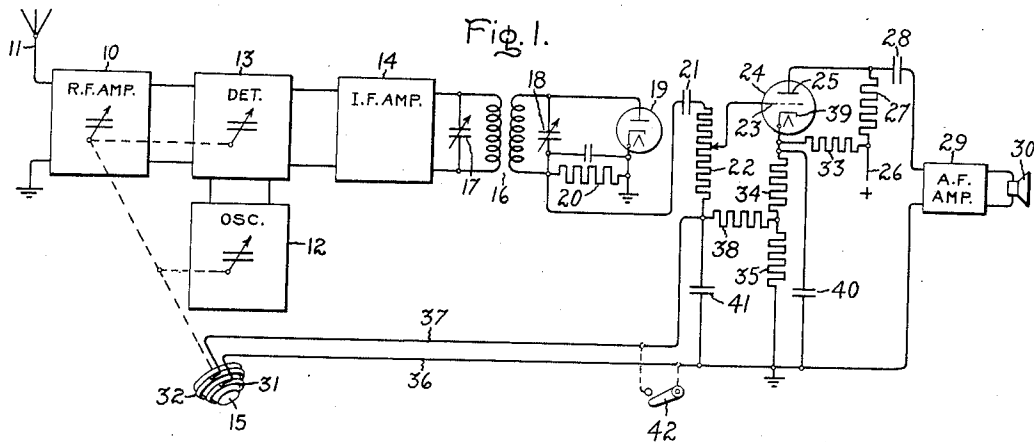
R. B. DOME

2,186,825

AMPLIFIER MUTING CIRCUIT

Filed April 23, 1938

2 Sheets-Sheet 1



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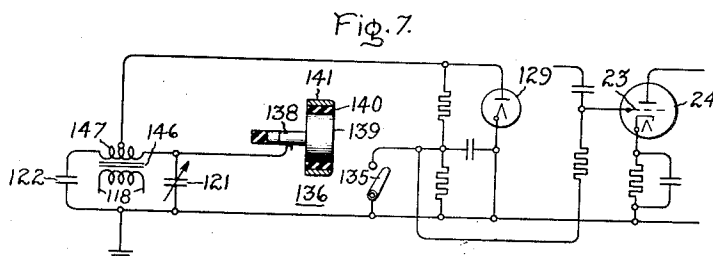
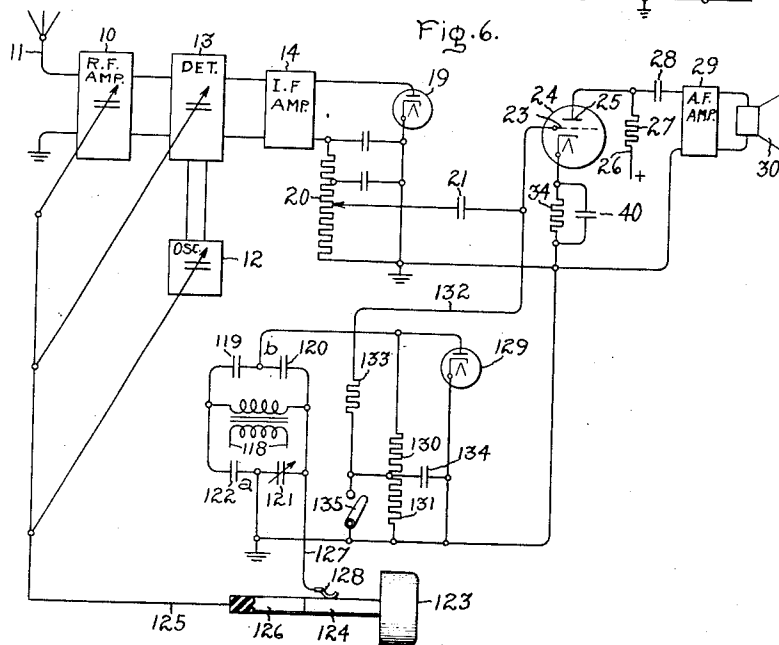
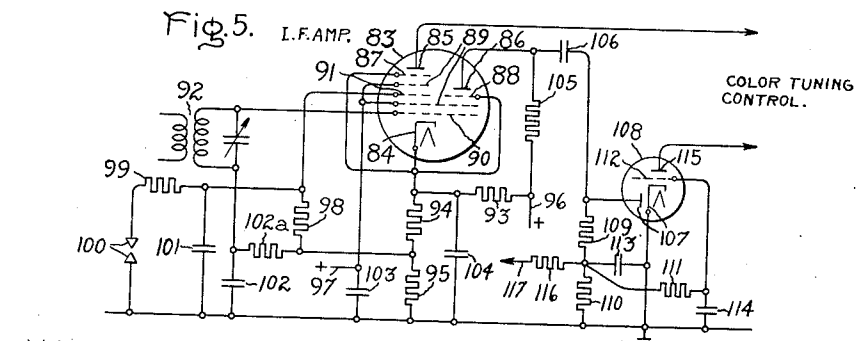
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2 Sheets-Sheet 2



UNITED STATES PATENT OFFICE

2,186,825

AMPLIFIER MUTING CIRCUIT

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New York

Application April 23, 1938, Serial No. 203,935

15 Claims. (Cl. 250—20)

My invention relates to an improved control for a signal amplifier and more particularly to an improved control for muting or silencing the output of a signal amplifier. While not limited thereto, my invention is particularly suited for muting the output of a radio receiver during the time when the receiver is being tuned between stations.

The tuning of a radio receiver from one signal frequency to another is often accompanied by a certain amount of undesirable noise and other disturbing sounds. This is especially true when the receiver is provided with an automatic volume control which operates to increase the sensitivity of the receiver to a high value whenever the receiver is not tuned to a reasonably strong signal. It is desirable that this noise, which occurs principally between received stations, be eliminated while effecting a tuning of the receiver from station to station over a frequency spectrum.

It is therefore an object of my invention to silence the output of a signal amplifier during a tuning operation by an arrangement wherein the muting circuit is completed by a person while grasping a tuning knob to effect the tuning adjustment.

A further object of my invention is to provide a muting arrangement in which a muting potential is applied to a grid of an electron discharge signal amplifier during an adjusting operation of the receiver, the potential being obtained from the capacitive unbalance of a Wheatstone bridge resulting from the hand capacity of a person in grasping a control knob to effect the desired adjustment.

Another object of my invention is to provide in a radio receiver a silencing circuit arrangement wherein an alternating current Wheatstone bridge is unbalanced during a tuning operation of the receiver and the voltage appearing across the bridge as a result of the unbalance is applied after rectification as a bias to the grid of an amplifier tube to render the tube unresponsive to signal currents appearing in the input circuit thereof.

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 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 drawings in which Figs. 1, 3, 4 and 5 illustrate embodiments of my invention wherein the electrical conductivity of the human body is employed in arrangements for silencing a radio receiver output. Fig. 2 shows a partially sectioned elevation of a tuning knob especially suitable for use with the foregoing embodiments of my invention. Figs.

6 and 7 illustrate modifications of my invention which utilize the electrical capacity of the human body to mute or silence a radio receiver output, and Fig. 8 shows in cross-section a tuning knob particularly suited for use with the latter modifications.

Referring to Fig. 1 of the drawings, my invention is illustrated as embodied in a superheterodyne type of radio receiver having a radio frequency amplifier 10 connected to an antenna ground system 11, a first detector 13, a local oscillator 12 and an intermediate frequency amplifier 14. The several tunable circuits of the radio frequency amplifier 10, the first detector 13, and the local oscillator 12 are connected, as indicated by the broken line of the drawing, for uni-control operation from a manually actuable knob 15 which may be grasped by a person operating the receiver to effect a desired tuning adjustment.

The output of the intermediate frequency amplifier 14 is coupled through a transformer 16, having primary and secondary windings respectively tuned by condensers 17, 18 to the intermediate frequency, to the elements of a diode rectifier 19. The signal oscillations are rectified by the diode rectifier 19 and the modulation components of the signal oscillation appearing across the resistor 20 are coupled through a condenser 21 to a voltage divider resistance 22 and to the grid 23 of an electron discharge device 24. The electron discharge device 24 has an anode 25 which is energized from a source of high potential 26 through a resistor 27. The amplified audio frequency signal appearing in the anode circuit of the device 24 is coupled through a condenser 28 to an audio frequency amplifier 29 where the audio frequency signal is further amplified for reproduction by a translating device 30.

The operation of the Fig. 1 circuit arrangement thus far considered is well understood in the art and will not be described in detail.

During the time when the tunable circuits of the receiver are being adjusted to receive a selected station, it is desirable that the output of the receiver be muted to avoid the reception of interstation noise, undesired signals, distorted signals caused by an improper tuning, etc., and to this end my invention contemplates the provision on the periphery of the manually actuable tuning knob 15 of a pair of current conducting rings 31, 32 arranged to be grasped by an operator in effecting the desired adjustment of the tunable circuits. The ring 31 may be connected by a conductor 36 to one end of a voltage divider comprised by the resistors 33, 34 and 35 while the ring 32 may be connected through a conductor 37 and a resistor 38 to a point on the voltage divider between the resistors 34 and 35. A nor-

mal biasing potential for the grid 23 is obtained by connecting the lower end of the voltage divider 22 through the resistor 36 to the lower end of the resistor 34 and by connecting the cathode 39 to the junction between the resistors 33 and 34, the magnitude of the bias being determined by the voltage drop across the resistor 34. The cathode 39 of the electron discharge device 24 is maintained at ground potential for alternating currents by the condenser 40 while the lower terminal of the voltage divider 22 is maintained at ground potential for alternating currents by the condenser 41.

It will now be evident that a person in grasping the knob 15 completes an electrical circuit from the ring 31 to the ring 32 through one or more fingers of his hand. The completion of this circuit connects the conductor 37 through the rings 31 and 32 with the conductor 36 and thereby connects the left hand end of the resistor 38 to the lower end of the voltage divider resistor 35. Current now flows from the high voltage source 26 through a series circuit comprised by the resistors 33, 34 and 38 to the negative terminal of the high voltage source, not shown, which is at ground potential. This causes a voltage drop to appear across the resistor 38 with a polarity such that the grid 23 of the electron discharge device 24 is driven substantially to cut-off thereby to reduce the gain of the amplifier by rendering the discharge device 24 unresponsive to signal potentials impressed through the condenser 21 upon the grid 23. The output of the receiver is thus effectively silenced and remains muted as long as the operator's fingers complete a circuit from the ring 31 to the ring 32.

For the purpose of silencing the receiver at other times than during a tuning operation, a switch 42 may be connected as indicated by the broken lines with the conductors 36, 37 to provide when the switch is closed a completion of the circuit between the conductors 36, 37 at a point other than at the rings 31, 32.

A more detailed drawing of my tuning knob construction is shown in Fig. 2 wherein elements corresponding to like elements of Fig. 1 are designated by like reference characters. The manually actuatable tuning knob 15, with the current conducting rings 31 and 32 mounted on the periphery thereof, is supported on the right-hand end of a condenser shaft 43 which extends through an aperture 44 provided in a panel 45. The current conducting ring 31 is connected by a conductor 46, the condenser shaft 43 and a flexible conductor 36 to ground. The current conducting ring 32 is connected to a collector ring 47 arranged to be contacted by a collector brush 48 which is secured to the panel 45 by a pin 49. A person in grasping the knob 15 to effect an adjustment of the tuning condenser silences the output of the receiver by completing through one or more fingers of his hand an electrical connection between the ring 31 and the ring 32 thereby to change the bias on the grid of a signal amplifier as explained with reference to Fig. 1.

Fig. 3 illustrates a modification of the Fig. 1 muting circuit. Like reference characters are used to designate elements of this figure corresponding to like elements of Fig. 1, and the rectangle 50 represents conventionally the combined apparatus represented by the rectangles 10, 12, 13, 14 and the second detector circuit of Fig. 1. This arrangement is particularly suited for radio receivers in which the power for operating the receiver is furnished from batteries. The grid

23 of the electron discharge device 24 is connected through the voltage divider resistance 22 and the resistor 51 to a source of biasing potential 52 which provides the grid with a normal biasing potential. The manually actuatable tuning control knob 15 is supported on the right-hand end of a tuning condenser shaft 53, the knob having on the periphery thereof a pair of current conducting rings 54, 55 which are respectively connected to current collecting rings 56, 57 secured to the inner face of the knob. A pair of brushes 58, 59 engage the collector rings 56, 57 respectively and complete a circuit for the ring 55 through a conductor 37 to the junction between the voltage divider 22 and the resistor 51 and from the ring 54 through a resistor 60 and a source of potential 61 to the grounded cathode 39 of the discharge device 24. The potential of the source 61 is sufficient to bias the grid 23 of the discharge device 24 substantially to cut-off, and thereby silence the output of the receiver, whenever an electrical circuit is completed between the current conducting rings 54 and 55 as by an operator in grasping the knob 15 to tune the receiver to a desired station. A condenser 62 maintains the lower end of the voltage divider 22 at ground potential for alternating currents. The purpose of the resistor 60 is to limit the current flow from the potential source 61 when an electrical circuit is completed from the ring 54 to the ring 55. The operation of this modification is very similar to that of Fig. 1 as will be readily apparent from the above description.

The muting circuit of Fig. 4 differs from that of Figs. 1 and 3 in that the screen grid of an electron discharge device is used in the Fig. 4 arrangement for muting purposes rather than a control grid as in the Figs. 1 and 3 arrangements. Signal oscillations, which may be either of audio or radio frequency, are coupled from an input circuit 63, 64 through a condenser 65 to the grid 66 and cathode 67 of an electron discharge device 68. The electron discharge device 68 is provided with an anode 69, which is energized from a high potential source 70 through a resistor 71. The device 68 is also provided with a suppressor grid 72, which is connected directly to the cathode 67, and a screen grid 73 which is connected to an intermediate point on a voltage divider comprised by the resistors 74, 75 connected across the high potential source 70. A normal biasing potential is impressed on the grid 72 by a cathode biasing resistor 76 and parallel connected condenser 77. The screen grid 73 is maintained at ground potential for alternating currents by a condenser 78. Amplified signal oscillations appearing in the anode circuit of the device 68 are coupled through a condenser 79 to an output circuit 80, 81.

During the operation of a receiving apparatus employing the arrangement shown in Fig. 4, occasions may demand that the output of the electron discharge device 68 be muted. To this end, my invention contemplates the provision of a switch 82 which operates to change the bias on the screen grid 73 of the device 68 from a normal positive bias, with the switch in open position, to a small negative bias, when the switch is in closed circuit position. The negative bias is provided by the potential drop across the resistor 76 and appears on both the grid 66 and the screen grid 73. This has the result that the current flowing from the anode 69 to the cathode 67 is reduced substantially to zero thereby to render the device 68 unresponsive to signal oscillations impressed on the grid 66. The output of the signal amplifier

arrangement shown in Fig. 4 is thus effectively muted or silenced by closure of the switch 82 which, in practice, is preferably positioned to be operated by manual manipulation. My preferred embodiment replaces the switch 82 with a pair of current conducting rings arranged on a tuning knob in the manner of Fig. 2 whereby the positive potential on the screen grid 73 is reduced merely by the act of a person in grasping the tuning knob to effect a desired tuning adjustment of the receiver with which the Fig. 4 arrangement may be used.

Fig. 5 illustrates a modification of my invention in which the muting of the radio receiver output is accomplished in an intermediate frequency amplifier stage by the introduction of a muting potential to the admission grid of an electron discharge device. The intermediate frequency amplifier stage here shown includes an electron discharge device 83 provided with a cathode 84, a pair of anodes 85 and 86, suppressor grids 87 and 88 positioned respectively adjacent the anodes 85, 86, a screen grid 89 common to both anodes 85, 86, a control grid 90 common to the anodes 85, 86, and an admission grid 91 positioned to control the electron stream to the anode 85. The control grid 90, which is connected to receive oscillations of intermediate frequency from a tuned intermediate frequency transformer 92, is provided with a normal operating bias by the connection of the cathode 84 and the control grid (through the transformer 92 and the resistor 102a) to spaced apart points on a voltage divider comprised by the resistors 93, 94 and 95 connected across a high voltage source 96. A suitable potential is impressed on the screen grid 89 from a high potential source 97. The anode 85 circuit of the electron discharge device 83 is not shown completed, but it is understood that this circuit is connected to an intermediate frequency output transformer to which may be connected additional stages of intermediate frequency amplification, a second detector, an audio frequency amplifier connected to a speaker, a frequency discriminator network supplying potential to an automatic frequency control circuit, etc., as is well understood in the art. The admission grid 91 of the device 83 is connected through a resistor 98 to the junction between the voltage divider resistors 94, 95 and is also connectible through a resistor 99 and a pair of circuit closing elements 100 to the negative terminal, not shown, of the high potential source 96 which is at ground potential. By-pass condensers 101, 102, 103 and 104 are employed to maintain the elements to which they are connected at ground potential for currents of alternating frequency.

The anode 86 of the electron discharge device 83 is connected to the high potential source 96 through a resistor 105 and oscillations of intermediate frequency which appear in the circuit of anode 85 are coupled through a condenser 106 to the diode elements 107 of the electron discharge device 108 which may constitute a control tube for a tuning indicator, not shown. Resistors 109 and 110 are connected in series across the diode elements 107 of the device 108 and a portion of the uni-directional pulsating potential which appears across resistors 109, 110 as a result of the rectifying action of the diode elements 107, is connected through a resistor 111 to a control grid 112 provided in the discharge device 108. A condenser 113 is connected between the left-hand end of resistor 111 and

ground while a condenser 114 is connected between the right-hand end of resistor 111 and ground, the two condensers 113, 114 and the resistor 111 acting as a filter to smooth out the pulsating uni-directional potential appearing across the resistors 109, 110 before applying this potential to the grid 112. The anode 115 of electron discharge device 108 is connected in a circuit, not shown, which controls a suitable tuning indicator in a manner to indicate the relative intensity of a received signal oscillation. The voltage appearing across the resistor 112 may be supplied through a resistor 116 to an automatic volume control circuit 117 for the purpose of automatically controlling the amplification of preceding radio frequency amplifier stages, not shown.

The operation of the muting arrangement shown in Fig. 5 will now be explained. The circuit closing elements 100 may take the form of concentric metal rings mounted on a manually actuable control knob in the manner shown in Figs. 2 and 3. When an electrical circuit is completed across the elements 100, as by a direct metallic connection or by the fingers of the human body grasping the knob to effect a desired adjustment, the bias on the admission grid 91 of the electron discharge device 83 increases to a sufficient negative potential, by virtue of the connection of the admission grid 91 through the resistor 99 and elements 100 to the lower end of the voltage divider resistor 95, to terminate the flow of current from the anode 85 to the cathode 84 and thereby reduce to zero the output of signal energy in the anode 85 circuit. The muting of an intermediate frequency amplifier stage in this manner is especially valuable since the arrangement not only silences the output of the receiver, but simultaneously deenergizes the automatic frequency control circuit in radio receivers provided with automatic frequency control.

It may be noted that the admission grid 91 controls only the current flow from the anode 85 to the cathode 84. Further, the bias for the control grid 90 is unaffected by the increased potential applied to the admission grid 91 since the resistor 98 has a high value of resistance in the order of several megohms. The control of the grid 90 over the current in the anode circuit 86 is, therefore, unaffected by changes of potential on the admission grid 91 and the elements 86, 88, 89, 90 and 84 of the electron discharge device 83 continue, after completion of the muting circuit at the contact elements 100, to amplify the intermediate frequency oscillations supplied through the intermediate frequency transformer 92 and to supply the oscillations thus amplified to the diode elements 107 of the discharge device 108. The potential which results from the rectification of the intermediate frequency oscillations by the diode elements 107 is supplied to the automatic volume control circuit 117 and is impressed on the grid 112 of the device 108 to control the current in the circuit of the anode 115 and thereby control the operation of the tuning indicator, not shown, for purposes of providing an indication that a desired tuning of the receiver has been accomplished.

The muting circuit shown in Fig. 6 is similar to that shown in Fig. 1 except that a normally balanced Wheatstone bridge is unbalanced during a tuning operation to provide the necessary potential for biasing the grid of a signal amplifier

beyond cut-off thereby to silence the output of the receiver. Elements in Fig. 6 corresponding to like elements of Fig. 1 are designated by like reference characters. In this arrangement, a source of alternating current 118 supplies an alternating current potential to opposite arms of a capacitive Wheatstone bridge comprised by the condensers 119, 120, 121 and 122. This bridge is normally balanced and no potential therefore appears across the bridge at points *a* and *b*. A manually actuatable tuning control knob 123, constructed of a metallic material, is secured to the right-hand end of a metallic shaft 124 which in turn is supported from a condenser shaft represented generally at 125. The knob 123 and shaft 124, which are insulated from the shaft 125 by an insulating segment 126, are connected by a conductor 127 and brush 128 to a point on the bridge between the condensers 120 and 121. Points *a* and *b* of the bridge are connected across both the diode rectifier 129 and the series connected resistors 130, 131. The grid 23 of the electron discharge device 24 is connected through a conductor 132 and a resistor 133 to the junction between the resistors 130 and 131, a condenser 134 maintaining the lower end of the resistor 133 at ground potential for alternating currents. A switch 135, when closed, maintains the junction point between the resistors 130 and 131 at ground potential for both direct and alternating currents.

The capacitive bridge is initially balanced by adjusting the condenser 121 with the hand off of the tuning knob 123. When a balance of the bridge has been established, no voltage is impressed across the diode 129 and the electron discharge device 24 operates with a normal bias on its grid 23 determined by the voltage drop across the cathode biasing resistor 34. If now a finger of the human body touches the knob 123, as during a tuning operation, the property of electrical conductivity of the human body causes the body to act as one electrode of a capacitor whose other electrode is ground and the bridge becomes unbalanced by the added capacity of the hand. The alternating potential appearing in the unbalanced bridge between the points *a*, *b* is impressed across the diode 129 and resistors 130, 131. The positive half cycles of current produced by this potential flow substantially in their entirety through the diode 129; the negative half cycles cannot, however, flow through the diode but flow only through the resistors 130, 131 and a uni-directional potential therefore appears across the resistors 130, 131. When the switch 135 is open, the potential across the resistor 130 is impressed through the resistor 133 and the conductor 132 upon the grid 23 of the electron discharge device 24 to drive the grid beyond cut-off and thereby silence the output of the receiver. When the tuning adjustment has been completed and the tuning knob 123 is released, the capacitive bridge becomes again balanced whereupon the muting potential is removed from the grid 23 of the electron discharge device 24 to allow the device 24 to operate once more with normal output. A time delay in the removal of the muting potential from the grid 23 may be effected by varying the time constant of the circuit comprised by the resistor 131 and condenser 134. The closing of the switch 135 serves to maintain the grid 23 always at its normal bias irrespective of the condition of balance of the bridge and thus enables the receiver to be tuned without silencing the receiver output.

The knob 123 preferably has a construction like that of the knob 136 shown in Fig. 7. This knob is suitably mountable on a metal shaft 138 and consists of an insert 139, a thin insulating strip 140 and an outside metal band 141. A knob constructed in this manner has the advantage that one finger tip or the whole hand of the human body causes the same capacity change so that a good capacity change is always effected. The capacity of an adult person is estimated to be of the order of 50 microfarads, a capacity easily sufficient to unbalance the bridge even though the frequency of the alternating current supply source to the bridge is as low as 60 cycles per second.

An additional modification of the knob construction is shown in Fig. 8. A metal insert 142 is provided with a socket 143 in which may be inserted the end of a tuning condenser shaft, not shown, the insert 142 being secured to the condenser shaft by a set screw 144. Surrounding the insert 142 is a body of insulating material 145 which may be grasped by a person in effecting a desired adjustment of the tuning condenser to which the knob is secured.

The muting circuit of Fig. 7 is similar in arrangement and operation with that of Fig. 6 except that the purely capacitive bridge of the Fig. 6 arrangement is replaced in the circuit of Fig. 7 with a combined capacitive and inductive Wheatstone bridge. Elements in this figure corresponding to like elements of Fig. 6 are designated by like reference characters. The input and output circuits of the electron discharge device 24 are shown incomplete but it is understood that the circuits are the same as those shown in the arrangement of Fig. 6. The power supply transformer 146 has a primary connected to the power supply lines 118 and a center tapped secondary winding 147 which constitutes a pair of inductive arms in a bridge comprised by the transformer winding 147 and the condensers 121 and 122. The bridge is balanced by the condenser 121 while the hand is off of the tuning control knob 136. With the bridge balanced, no potential appears across the diode 129 and the electron discharge device 24 operates with a normal bias on its control grid 23. When, however, a finger of the human hand touches the metallic ring 141 of the knob 136, the balance of the bridge is destroyed and a muting potential is impressed upon the grid 23 of the electron discharge device 24 to reduce the output of the device 24 to zero and thereby silence the output of the radio receiver. The normal balance of the bridge is restored when the knob 136 is released by the hand, the muting potential thereupon disappearing from the grid 23, and the electron discharge device 24 once more operates with normal output.

While I have shown a particular embodiment of my invention, it will of course be understood that I do not wish to be limited thereto since many modifications may be made both in the mechanical arrangement and the instrumentalities employed, and I therefore contemplate by the appended claims to cover any such modifications as fall within the true spirit and scope of my invention.

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

1. The combination, in a signalling system, of means for receiving signal impulses, means for amplifying received signal impulses, means for reducing the amplification of said amplifying

means, and means responsive to the electrical conductivity of the human body for actuating said last named means.

2. In a signalling system, the combination of means for receiving signal impulses, means including an electron discharge device having a grid for amplifying received signal impulses, means for biasing said grid to selectable values of potential for controlling the amplification of said device, and means responsive to the electrical conductivity of the human body for actuating said last named means.

3. The combination, in a radio receiver, of means for tuning said receiver to a desired signal frequency, said means having an actuator arranged for manual manipulation, means for amplifying received signals, and means responsive to the electrical conductivity of the human hand in grasping said actuator to effect a desired tuning adjustment for reducing the amplification of said last named means.

4. The combination, in a radio receiver, of means for tuning said receiver to a desired signal frequency, said means having an actuator arranged for manual manipulation, means for amplifying received signals, said last named means including an electron discharge device having a grid, and means responsive to the electrical conductivity of the human hand in grasping said actuator to effect a desired tuning adjustment for biasing said grid toward cut-off whereby the output of said receiver is reduced.

5. In a signalling system, the combination of means for receiving signal impulses, means for amplifying received signal impulses, a normally balanced Wheatstone bridge having capacitive arms, means responsive to the unbalancing of said bridge for reducing the amplification of said amplifying means, an electric current conducting member and means responsive to the proximity of the human body to said member for adding the electrical capacity of the body to one arm of said bridge whereby said bridge is unbalanced and a reduction in amplification is effected.

6. In a signalling system the combination of means for receiving signal impulses, means for amplifying received signal impulses, a normally balanced Wheatstone bridge having a capacitive arm, means responsive to the unbalancing of said bridge for reducing the amplification of said amplifying means, a circuit control element having an actuator arranged for manual manipulation, and means responsive to the electrical capacity of the human body in proximity to said actuator for unbalancing said bridge.

7. The combination, in a signalling system, of means for receiving signal impulses, means for amplifying received signal impulses, a circuit control element having an actuator arranged for manual manipulation, a pair of electrical current conducting members electrically insulated from each other and coaxially mounted in spaced apart relation on said actuator, means including said conducting members for reducing the amplification of said amplifying means, and means responsive to the completion of an electrical circuit between said members through the human hand while grasping said actuator for energizing said last named means.

8. The combination in a control for a radio receiver having a tunable element, of a manual knob for actuating said tunable element, an electrical current conducting member on said

knob arranged to be grasped by an operator in using said knob, means for amplifying received signal impulses, said means including an electron discharge device having a grid, means for impressing a normal biasing potential on said grid, and means including said conducting member for increasing the bias on said grid when said knob is grasped to effect a tuning operation, said last named means biasing said grid toward cut-off for reducing the output of said amplifier.

9. A knob for manually actuating an adjustable circuit element of a radio receiver, said knob having a body of insulating material and a pair of current conducting members thereon arranged to be grasped by an operator in effecting an adjusting operation, and means carried by said knob for completing an electrical connection between each of said current conducting members and stationary electrical conductors.

10. A knob comprising, in combination, a metallic insert, means for securing said insert to a shaft, a metallic band concentrically positioned about said insert, and means for electrically insulating said band from said insert.

11. The combination, in a signaling system, of an adjustable circuit element for said system, means for manually adjusting said element, means including an electron discharge relay having a control electrode for controlling an operating condition of said system, and means responsive to the electrically conductive property of the human body in close proximity to said first named means for changing the potential on said control electrode thereby to effect a change by said relay in the operating condition of said system during the time that said first named means is manually grasped in effecting a manual adjustment of said circuit element.

12. The combination, in a signaling system, of means for controlling an operating condition of said system, an adjustable circuit element for said system, means for manually adjusting said element, and means responsive to the electrically conductive property of the human hand for effecting control of said system by said first named means while the human hand is at least in proximity to said second named means.

13. In a signaling system, the combination of an amplifier, means for controlling the gain of said amplifier, an adjustable circuit control element having a manual actuator, and means responsive to the immediate proximity of the human body to said manual actuator for energizing said first named means to control the gain of said amplifier.

14. In a signaling system, the combination of an amplifier, means for controlling the amplification of said amplifier, an adjustable circuit control element having a manual actuator therefor, and means responsive to the electrical conductivity of the human body for energizing said first named means to control the amplification of said amplifier while said manual actuator is grasped in effecting an adjustment of said circuit control element.

15. In combination, a receiver having a tuning device and an audible output device, a manual actuator for said tuning device, and means responsive to the conductivity of the human body during manipulation of the manual actuator to reduce the output from said output device.

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