

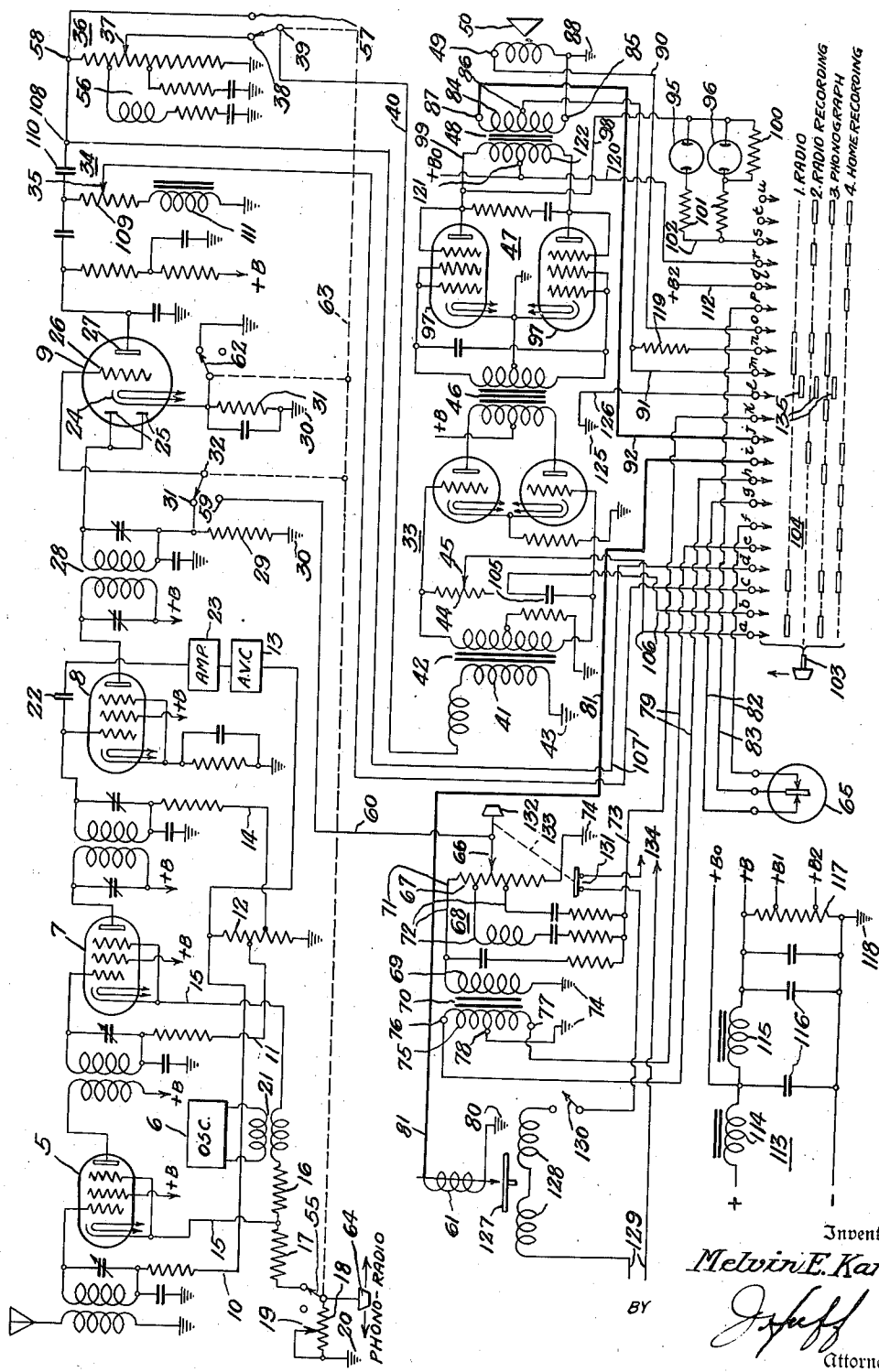
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COMBINATION RADIO-PHONOGRAPH SYSTEM

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COMBINATION RADIO-PHONOGRAPH
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The present invention relates to combination radio-phonograph systems of the type comprising radio receiving apparatus provided with suitable switching means whereby the audio frequency amplifier and loud speaker may be utilized for the amplification, reproduction and recording of phonograph records and the like. Systems of this general type are disclosed in the patent to Goldsmith, 1,724,191, and the patent to Sinnett and Karns, 1,951,175.

The present invention relates more particularly to the application of phonograph record reproduction and recording connections to a radio receiving system having a diode type of second detector, in connection with which there is provided a direct connected first stage audio frequency amplifier, and to the problem of applying phonograph and recording connections to modern multi-band radio receiver systems involving tone compensation with volume control, for both radio and phonograph operation.

It is, therefore, an object of the present invention to provide an improved radio-phonograph system, wherein the radio receiver portion thereof is adapted for phonograph reproduction and recording without loss of tonal qualities necessary for improved operation in connection with phonograph or radio signals.

It is also an object of the present invention, to provide a radio-phonograph system which is readily changed from radio or phonograph operation to recording operation, and which at the same time provides normal connections for the radio receiving apparatus, with a minimum of circuit changes.

It is a still further object of the present invention, to provide an improved and simplified combination radio and phonograph system wherein a plurality of operations are controllable simultaneously by single means, whereby the change from phonograph to radio operation is greatly simplified.

In accordance with the invention, the radio-phonograph switching operation in connection with a radio receiver is arranged to provide a simplified control of radio and phonograph volume and recording levels by the same means, common radio and phonograph tone modifying means, selective microphone and phonograph pick-up connections with an input circuit, and selective loud speaker and pick-up connections with the audio frequency output circuit of the receiver, together with automatic control of the motor operation, and an improved recording level indicator adapted to be connected with the audio

frequency output circuit through a simplified circuit.

It is also a further object of the present invention to provide a simplified control circuit for effecting a change of connections with a minimum number of contacts, in accordance with the above.

It is also an object of the present invention to provide an improved sound recording level indicator means, in a radio-phonograph system, adapted for recording.

The invention will be better understood from the following description, when considered in connection with the accompanying drawing, and its scope will be pointed out in the appended claims.

In the drawing, the figure is a schematic circuit diagram of a radio-phonograph system embodying the invention, and referring thereto, the radio receiving system comprises a high frequency amplifier channel having a radio frequency amplifier 5, an oscillator 6, a first detector 7, an intermediate frequency amplifier 8, and a detector device 9.

The radio frequency amplifier 5 is provided with a grid circuit 10, and the first detector 7 is provided with a control grid circuit 11, connected with the output resistor 12 of the automatic volume control means 13. Likewise, the intermediate frequency amplifier 8 is provided with a grid circuit 14, in connection with the resistor 12. The cathodes of the radio frequency amplifier and first detector are connected, through cathode leads 15, with bias resistors 16 and 17, providing self-biasing potentials, and a further biasing resistor 18 which is manually controllable to adjust the sensitivity of the receiving system through the operation of a contact 19. The resistor 18 is connected with the chassis or ground indicated at 20, which is also the negative B supply lead of the receiving system.

The oscillator 6 is coupled with the detector 7 through a coupling transformer 21. The automatic volume control means 13 is coupled to the input circuit for the amplifier 8, through a coupling capacitor 22 and an intermediate amplifier 23.

The second detector 9 comprises a cathode 24, a pair of diode anodes 25 associated therewith, a control grid 26, and an output anode 27. The anodes 25 are connected through the intermediate frequency output transformer, indicated at 28, with a diode output resistor 29, which is connected through ground 30 with the cathode 24, whereby the diode circuit is completed.

Signals rectified by the diode are applied to the

control grid 26 through a switch connection 31, 32, and the amplified signals therefrom are supplied to a second stage audio frequency amplifier 33 through a coupling network comprising a bass tone control circuit 34, having a variable control element 35, and a tone compensated volume control circuit 36, having a variable control contact 37. The connection with the contact 37 is completed through a switch 38, 39 and a connection lead 40, with the primary 41 of an interstage coupling transformer 42 for the second stage amplifier 33. The audio frequency return is made through ground connection 43.

The tone control means 34 and the volume control means 36, preferably aurally or tone compensated, may be of any suitable type. A further tone control means 44 is provided in the amplifier stage 33, for treble tone control. A variable contact device or resistor of this control is indicated at 45.

The audio frequency amplifier 33 is coupled through a second interstage coupling transformer 46, with an output amplifier stage 47, also of the push-pull type; and the output transformer thereof, indicated at 49, is arranged to be connected with a plurality of circuits including an output circuit, in connection with the voice coil 49 of a sound reproducer or loud speaker 50.

The radio receiving system thus far described may be considered as representing any suitable radio receiving system having the features described. A radio receiving system having a manually operable sensitivity control in the cathode lead of one or more of the high frequency amplifying stages, has been found to be adapted readily to cut off the radio signal when control operation is desired, by merely opening the cathode circuit, or placing a high resistance therein.

In the present example, this is provided by a switch 55, which when opened causes the cathodes to rise to anode potential and cuts off the radio signal. This is found to be effective to cut off the radio signals, and has the advantage that the tubes cut off do not draw anode current from the B supply means, the current being available for other purposes as will appear. The switching operation is relatively simple, and may be performed at substantially ground potential.

For radio operation, the diode rectifier and second detector 9 is preceded by automatic volume control means, which tends to place on the grid 26 of the amplifier portion substantially a constant signal voltage, which is not the case when this grid is utilized for an input grid in connection with phonograph signals.

It will further be noted that the volume control means 36 follows the detector and amplifier 9 in circuit, whereby the audio frequency volume is controlled in a circuit succeeding the detector and amplifier 9. Furthermore, this volume control device is tone compensated by suitable shunt connections, indicated at 56, and being of a well known type, to provide aural audio frequency compensation with volume control adjustment by the output contact 37.

For phonograph operation, this volume control device may be removed from active control, while remaining in circuit, by the switch means 38, 39 having an additional contact 57 connected with the high potential input terminal 58 of the volume control means 36, so that audio frequency signals delivered to the volume control device 36 are bypassed through the connection provided between the terminal 58 and the contact

57 when the switch 39 is moved to the contact 57.

At the same time that the switching operation in connection with the switch 39 and the switch 55 is effected for phonograph operation, the grid 26 of the first audio amplifier is connected, through an additional contact 59 and an input lead 60, with a phonograph pick-up device 61, and the cathode 24 is connected to ground 30 through the self-bias resistor 31, this last named connection being provided by a switch 62 which removes a short circuit from the resistor 31. All of the aforementioned switches are suitably interconnected by mechanical means, represented by the dotted connection 63, for simultaneous operation by a single control means, such as a manual control knob 64, whereby the system may readily be changed from radio and radio-recording to phonograph and home recording operation, and vice versa.

The switching operation for changing the first stage amplifier portion of the tube 9 to self-bias operation is necessary for the reason that the radio signal which normally supplies bias potential is cut off by operation of the switch 55. For the purpose of bias supply, the diode output circuit and the cathode of the diode biased amplifier are both connected to ground, the first circuit being connected through the output resistor 29 for the diode, and the cathode being connected through the self-bias resistor 31 which is normally short-circuited.

The phonograph signal input and recording circuits will now be considered. Phonograph input signals, to be amplified in the amplifying channel of the receiver, are applied to the input lead 60 and are reproduced in the loud speaker 50 when the voice coil 49 is connected with the output transformer 48. In the reproduction of phonograph signals, and in recording, the loud speaker and pick-up circuits in connection with the output transformer 48 are selectively changed. In addition, a microphone of the two-button type, indicated at 65, is also arranged to be connected with the input lead 60 in a manner which will be hereinafter described.

In the present example, and as a preferred embodiment of the invention, the phonograph input lead 60 is connected with the volume control tap 66 of a separate volume control potentiometer 67, having a tone compensating network 68 in connection therewith, across the secondary 69 of a combined phonograph pick-up and microphone input transformer 70.

The tone compensating network 68 and the volume control potentiometer 67 are connected together on the high potential side 71 of the phonograph input circuit. The tone compensating network, comprising three branches 72, are separately connected to a control lead 73, whereby the compensation may be removed from or added to the phonograph input circuit as desired, by connecting the lead 73 with ground, since the secondary 69 and the volume control device 67 are both grounded as indicated at 74. It should be understood, however, that the ground connection, while preferable, represents any suitable common circuit return means that may be used in a radio receiving apparatus as a common circuit connection for the negative anode and cathode circuit leads.

The primary of the phonograph input transformer 70 is indicated at 75, and is provided with terminals 76 and 77 and a center tap terminal 78, which is also connected to ground 74 or the com-

mon chassis return circuit. The terminals 76 and 77 are connected with input leads 79.

For connection with the input leads 79, and as a permanent connection to the center tap 78, the phonograph pick-up device 61 is provided with a ground connection indicated at 80, and with a high potential output lead 81. Likewise, for connection with the input lead 79, the microphone 65 is provided with two output leads 82 and a return lead 83.

The secondary of the output transformer 48 is provided with a grounded common output terminal 85 and two output taps 86 and 87 for two differing output impedance ratios. In a similar manner to the pick-up device as connected with the center ground tap 78 of the phonograph input transformer, the voice coil 49 of the sound reproducer is connected at one ground terminal. The remaining terminal of the voice coil 49 is provided with an input lead 90, and the taps 86 and 87 on the output transformer 48 are provided with output leads 91 and 92.

The output amplifier stage 47 is also provided with a voltage output level indicating means, whereby the amplitude level of sounds to be recorded, may be indicated electrically.

In the present example, this comprises a pair of indicating lamps 95 and 96, which may be of the neon type, adapted to glow when the voltage impressed across them reaches a predetermined level. The lamps are arranged to be connected in parallel with the primary of the output transformer 48, or a portion thereof, and in connection with the output circuit of the amplifier devices 97 in the output stage 47. This connection includes a lead 98 connected with the anode end of the output circuit 99 of one of the amplifiers 97, to which lead the devices 95 and 96 are connected in parallel, with a shunting resistor 100 connected across one of the devices 96. The parallel connection for the indicator devices is completed, through a resistor 101, with a control lead 102, and switching means hereinafter described.

The various control leads are arranged for simultaneous switching operations to complete radio, phonograph, and radio or home recording connections, through the medium of a switch having a control element, indicated at 103, and a plurality of contact bars 104 movable simultaneously thereby successively into connection with a series of terminal contacts, indicated by the letters *a* to *u* inclusive, providing a sequence of operations as indicated by the dotted lines and the legends at the right hand ends thereof. These connections will be described as follows:

The contacts *a* and *b* are connected with the treble or high frequency tone control means 45 through leads 106, and in the radio and phonograph positions of the switching means 103, operate through the contact bars to connect the variable resistor 44—45, in series with a tone control capacitor 105, for variably controlling the treble or high frequency tone response of the amplifier for phonograph and radio operation. In the radio recording and home recording positions, this connection is open and the tone control means is ineffective.

The contacts *c* and *d* are arranged to be connected together in the radio, phonograph, and home recording positions, to provide control of the bass tone characteristic of the amplifier, and are connected with leads 107, whereby the contact 35 is connected with a point 108 on the audio frequency output circuit, whereby the bass tone response may be adjusted.

The adjustment is effected by the contact 34 which is movable along a resistor 109 to control the connection in circuit of a tone control capacitor 110 and reactor 111. As the bass tone control system shown, represents any suitable bass tone control means, and is well known and understood, further description is believed to be unnecessary.

The contacts *e*, *f*, *g*, and *h* are utilized to connect the microphone leads 82 with the phonograph input transformer leads 79 in the home recording position. In the phonograph position, the contacts *h* and *i* are inter-connected to provide a connection from the phonograph pick-up output lead 81, through one of the leads 79, to the input terminal 76 on the transformer primary 75. Since the phonograph pick-up 61 and the transformer are both connected to ground or chassis, the pick-up device is then connected across the primary winding included between the center tap terminal 78 and the input terminal 76, or across substantially one-half of the winding which matches the impedance of the pick-up device.

The impedance of the primary winding 75 also matches the microphone 65, and a potential is introduced into the microphone circuit through a supply lead 112 connected with the contact *q* and a connection is made in the home recording position with the contact *p* for the lead 83. With a grounded power supply unit represented at 113, the potential is thus applied to the microphone circuit between the center tap 78 of the input transformer and the center button of the microphone. The power supply device is represented only in part by the filter section of the usual rectifier circuit for alternating current, and includes a pair of choke coils 114 and 115, provided with suitable bypass capacitors 116 and output potential supply resistor or divider 117, to which the various B+ leads throughout the system may be connected, as indicated at +B₀, +B₁, and +B₂, the negative lead being grounded as indicated at 118. The connections for the various supply leads are indicated. The actual leads for these connections are broken to simplify the drawing. With this arrangement, it will be seen that the voltage supply to the microphone is obtained between the lead +B₂ and ground.

For the radio and home recording positions, the contacts *i* and *j* are inter-connected, as indicated, to provide a connection between the output terminal 87 of the amplifier and the pick-up device, through the leads 92 and 81, whereby the output of the amplifier is applied to the pick-up device 61 for recording purposes at the proper impedance, the lead 92 being connected with the contact *j*.

At the same time, the lead 91, connected with the contact *m*, and with the contact *n* through a resistor 119, is connected to the contact *o* and the lead 90 in the radio receiving position, whereby the loud speaker device 50 may receive energy from the output transformer 48 through the tap 86, the lead 91, and the series resistor 119, for low voltage operation as a monitoring device, while the pick-up device 61 receives the full output with proper impedance matching across the entire winding 84 for radio recording.

The indicator devices 95 and 96 are connected through the lead 102, with the contact *s* which, in the radio recording and in the home recording positions of the switch 103, is connected with the contact *r* for the lead 120, and to a center tap connection 121 on the output transformer primary 122. This is also the high voltage positive

B supply lead, as indicated by the connection +B_o.

Since the lead 98 is connected with both of the indicating devices in parallel, and is connected with the output circuit 99, the indicating lamps are, in effect, connected across the output anode circuit of the output amplifier to receive the output voltage therefrom developed across the primary, or in this case one-half of the primary winding.

The output voltage is relatively high, and accordingly the series resistors 101 are utilized to cut down the voltage effective on the lamps or indicating devices to such a value that one is caused to glow when a suitable amplitude is developed in the output circuit, sufficient for recording purposes when applied to the pick-up device 61, and this may be in the region of maximum undistorted power output for the stage 47. In order that one of the lamps may indicate the application of excessively high signal potentials to the output circuit, and to the pick-up device when recording, the same is provided with the shunt resistor 100, and in the present example this is applied to the device 96 whereby the latter device will glow, or indicate the presence of higher voltage signals, subsequent to the operation of the device 95 on the lower voltage signals.

In practice, the resistors 100 and 101 are so adjusted that, for best recording results, the device 95 is glowing fully while the device 96 is just below the point of glowing. Thus the signal level applied to the recording device may be brought to the same value for effective recording operation in connection with any of the various sources of signals, such as a radio program tuned in, or a home recording program comprising speech or music applied to the microphone 65.

In combination with the indicating devices and the output circuit of the amplifier stage preceding the output connection for the pick-up device, the volume control device 66 for the control operation is maintained in circuit between the microphone and the input circuit of the amplifier as a microphone level control device, to provide a degree of amplification from the microphone sufficient to meet the varying sound levels provided by differing types of sound picked up by the microphone, which may not be controlled with best effect by placing the microphone in any one position.

For example, it may be found that the best recording for voice may be obtained by holding the microphone relatively close to the speaker or singer, and reducing the volume level of the output by the volume control means 66, to obtain the desired sound level at the output, as indicated by the lamps 95 and 96, whereas for other types of sound an increase in the volume setting of the device 66, with wider separation between the microphone and the sound source, may be desirable.

It will be noted that for the recording of radio programs, the radio-phonograph switch 65 and its associated contacts are maintained in the radio receiving position, whereby the radio volume control 37 may be utilized for adjusting the output level to cause the lamps 95 and 96 to glow, as above pointed out, to indicate the proper adjustment of the output level for best recording volume. Thus in recording, as well as in the reproduction of radio and phonograph programs, the separate volume controls are utilized, the adjustment of the one in no way affecting the adjustment of the other.

In connection with the home recording operation, it will be noted that the lead 73 for the tone compensating network, which is connected with the contact *k*, is connected to a ground 125 through the contact *l* and a lead 126, only in the phonograph position of the switch 103, whereby the circuits 72 of the network are connected with ground 24 and rendered effective across the volume control resistor 67. This connection in the radio receiving and recording positions, is open, whereby the tone compensation means is rendered ineffective.

The phonograph motor for driving a record turntable 127, is indicated at 128 and is supplied with alternating current through leads 129 under control of a start-stop switch 130. In accordance with the invention, the control circuit for the motor is further extended to include a switch element 131, associated with the volume control device 66—67 and controlled by the knob 132, as indicated by the dotted connection 133 to open the switch 131 when the volume control is moved to zero volume position. By a further connection through leads 134 and contacts *t* and *u* on the switch 103, the phonograph motor may be operated only in the recording and phonograph positions, and then only with the phonograph and recording volume control device 66 is operative as a control means. It will be seen that this is a desirable control feature, since the control motor may be stopped automatically, either by moving the control switch 103 back to radio operation, or by turning the phonograph volume control to zero, without changing the phonograph connections to the apparatus.

This control arrangement is desirable when changing records, or during an interval in a phonograph reproduction or recording operation. For example, in the home recording operation, by moving the control knob 132 to the zero volume position, the microphone is cut off and the motor is de-energized, without de-energizing the remainder of the apparatus, which is maintained in readiness for operation as soon as the sound output is brought up to the desired level by operating the control knob 132 and observing the indicator lamps 95 and 96.

It will be noted that intermediate contact segments or elements 135 are provided in connection with the contacts *l* and *m*, to provide intermediate connections between the radio recording, phonograph, and home recording positions. This serves to connect the lead 91 to ground, and since the lead 89 is already grounded at 88, this operation further serves to short-circuit the output winding of the transformer 48 between the terminals 85 and 86, thereby cutting off the loud speaker, to prevent noise in the output which may be occasioned by the change of contact connections in the switch 103.

From the foregoing description, it will be seen that the present radio-phonograph system is adapted for radio and radio-recording operation in one position of adjustment, and for phonograph and home-recording operation in another condition of adjustment, and under each condition of operation a separate volume and recording level control means is provided.

Furthermore, the system is arranged in such a manner that the normal radio volume control means and the phonograph volume control means, as separate elements, are also utilized for recording level adjustments for the apparatus in the radio and home recording operations.

In connection with indicating means, comprising—

ing two indicating lamps, which receive the output energy from the output amplifier in parallel and in such a manner that the one requires a higher voltage to operate it than does the other, the output impedance of the amplifier is then designed to apply to the recording stylus the proper signal amplitudes when the lower voltage indicating lamp is operated by the signal energy, while the other is at or below the point of operating.

The volume control and recording level control arrangement is also such that radio and phonograph signals are applied to the same initial amplifier device, permitting, for radio operation, the control of volume following the said amplifier, since the radio system is provided with automatic volume control means. This control is replaced by the manual phonograph volume and home recording level control. The radio volume control means is arranged to become inoperative, although it is maintained in the audio frequency circuit to prevent any change in load thereon.

I claim as my invention:

1. In a radio-phonograph system, the combination of separate phonograph and radio volume control means, a first stage audio frequency amplifier having an audio frequency output circuit connected with said radio volume control means to apply amplified signals therethrough, selective switching means for rendering said radio volume control means inoperative to control the amplitude of said signals and for applying signals from said phonograph volume control means to said amplifier, recording level indicating means connected with said output circuit, an output audio frequency amplifier in said connection and selective switching means for rendering said radio and phonograph volume control means effective selectively as recording level control means.

2. Radio phonograph volume control system in accordance with claim 1, further characterized by the fact that the phonograph and recording volume control means is provided with tone compensation for phonograph operation.

3. Radio phonograph volume control system in accordance with claim 1, further characterized by the fact that the phonograph and recording volume control means is provided with tone compensation for phonograph operation and phonograph motor control means.

4. Radio phonograph volume control system in accordance with claim 1, further characterized by the fact that the radio receiving system is provided with radio frequency and intermediate frequency amplifier stages having a common cathode circuit, and means for opening said cathode circuit to render the radio system inoperative for recording operation.

5. In a radio-phonograph system having separate radio and phonograph volume control means, the combination of means for rendering said volume control means each separately effective selectively to control radio and voice recording levels, said phonograph volume control means having tone compensation, means for removing said compensation for voice transmission, an audio frequency amplifier common to said radio and phonograph circuits including said radio volume control means, a phonograph pickup device, a loudspeaker device and means for connecting said devices with said amplifier comprising an impedance matching output transformer having secondary taps for said pickup and loudspeaker devices.

6. In a radio-phonograph recording system

having separate radio and phonograph volume control means and variable tone control means, the combination of means for rendering said volume control means each separately effective selectively to control radio and voice recording levels, said phonograph volume control means having tone compensation, means for removing said compensation for voice transmission, means for rendering said tone control means ineffective for radio recording, an audio frequency amplifier common to said radio and phonograph circuits including said radio volume control means, a phonograph pickup device, a loudspeaker device and means for connecting said devices with said amplifier comprising an impedance matching output transformer having secondary taps for said pickup and loudspeaker devices.

7. In a radio-phonograph signal amplifying system, radio volume control means, phonograph volume control means, a first stage audio frequency amplifier, selective switching means for interposing said amplifier stage between said phonograph volume control means and said radio volume control means, an output audio frequency amplifier stage connected to receive amplified audio frequency signals through said radio volume control means, said last named amplifier having an output circuit, a pair of indicating glow discharge lamps connected in parallel across at least a portion of said output circuit, a phonograph pickup device, a loudspeaker device, impedance matching means connected with said output circuit, and means for selectively connecting said devices with said impedance matching means, said impedance matching means providing a signal output potential of a predetermined amplitude for recording through said pickup device, in predetermined relation to the potentials applied to said indicating lamps.

8. The combination with a radio receiving system having a diode detector, automatic volume control means preceding said detector, and first stage audio frequency amplifier means connected with said detector, of a combined phonograph pickup and microphone input coupling transformer, volume control means including a potentiometer device connected with said transformer, means for connecting said first stage amplifier means with said potentiometer device to the exclusion of said detector, and motor means for phonograph record recording and reproduction, and switching means connected with said phonograph volume potentiometer for controlling said motor means.

9. The combination with a radio receiving system having a diode detector, automatic volume control means preceding said detector, and first stage audio frequency amplifier means connected with said detector, of a combined phonograph pickup and microphone input coupling transformer, volume control means including a potentiometer device connected with said transformer, means for connecting said first stage amplifier means with said potentiometer device to the exclusion of said detector, audio frequency volume control means connected with said amplifier means to control the radio signal output of said amplifier, means for deriving signals from said amplifier device selectively directly therefrom and through said volume control means, means for amplifying the derived signals, and means for reproducing said signals.

10. In a radio phonograph system, the combination with an audio frequency amplifier, of recording level indicating means, separate radio

and phonograph volume control means, selective switching means for rendering said volume control means effective to control recording level amplitudes, said amplifier having a first stage amplifier device, an output circuit therefor connected with said radio volume control means, and selective switching means for simultaneously connecting said phonograph volume control means to apply signals to said amplifier stage and to render said radio volume control means ineffective as volume control means while maintaining the same in circuit to provide a load on said output circuit.

11. In a radio-phonograph system, the combination of radio signal amplifying means including a plurality of electric discharge amplifier devices, certain of said devices having a grounded cathode circuit, automatic volume control means therefor, an audio frequency amplifier for said system comprising a first stage electric discharge device and an output amplifier stage coupled thereto, audio frequency volume control means interposed between said first stage amplifier device and said output amplifier stage, a phonograph volume control device, means for selectively connecting said first stage amplifier therewith and simultaneously raising said amplifier cathodes substantially to anode potential to cut off radio signals from said amplifier, and an output circuit for said amplifier stage.

12. In a radio-phonograph system, the combination of radio signal amplifying means including a plurality of electric discharge amplifier devices, certain of said devices having a grounded cathode circuit, automatic volume control means therefor, an audio frequency amplifier for said system comprising a first stage electric discharge device and an output amplifier stage coupled thereto, audio frequency volume control means interposed between said first stage amplifier device and said output amplifier stage, a phonograph volume control device, means for selectively connecting said first stage amplifier therewith and simultaneously raising said amplifier cathodes substantially to anode potential to cut off radio signals from said amplifier, an output circuit for said amplifier stage, recording level indicating means therefor, a phonograph pickup device, a loudspeaker device, means for selectively connecting said devices with said output circuit, means for connecting said phonograph pickup device with the phonograph volume control means, phonograph motor means, and means for controlling said last named means in response to operation of said phonograph volume control device.

13. In a radio-phonograph system, the combination of a radio receiving channel comprising detecting, amplifying and volume control means, said volume control means being located in an audio frequency output circuit of said amplifying

means, means for applying phonograph pickup signals to said amplifying means and through said audio frequency output circuit to the exclusion of the volume control means therein, means providing a separate phonograph volume control device, signal level indicating means connected with the output circuit of said amplifying means, and selective switching means for rendering said radio and phonograph volume control devices effective to control the audio frequency recording sound level in conjunction with said indicating means.

14. In a radio-phonograph system, the combination of a radio receiving channel comprising detecting, amplifying and volume control means, said volume control means being located in an audio frequency circuit of said amplifying means, means for applying phonograph pickup signals to said amplifying means through said audio frequency circuit to the exclusion of the volume control means therein, means providing a separate phonograph volume control device, signal level indicating means connected with the output circuit of said amplifying means, and selective switching means for rendering said radio and phonograph volume control devices effective to control the audio frequency recording sound level in conjunction with said indicating means, said indicating means including a pair of glow discharge lamps connected in parallel with at least a portion of the output circuit, a limiting resistor in series with each lamp, and a third resistor in parallel with one of said lamps.

15. The combination with a radio receiving system having a plurality of high frequency amplifier devices, a diode second detector, and an audio frequency output amplifier stage, of means for operating said system for phonograph recording and reproduction, comprising a phonograph pickup input circuit having volume control means connected therewith, radio volume control means connected with the output circuit of said detector, means for applying signals through said detector output circuit from said pickup input circuit independently of the adjustment of said radio volume control device, means for applying amplified audio frequency signals to said output stage means, a microphone, a pickup device, and means for interchangeably connecting said microphone and pickup device with said phonograph input circuit, the one to the exclusion of the other, said means being adapted to connect said pickup device with the output circuit of said amplifier, means for indicating the output signal level applied to said pickup device, and means for causing said phonograph volume control device to be effective in connection with said microphone thereby to control the output level therefrom.

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