

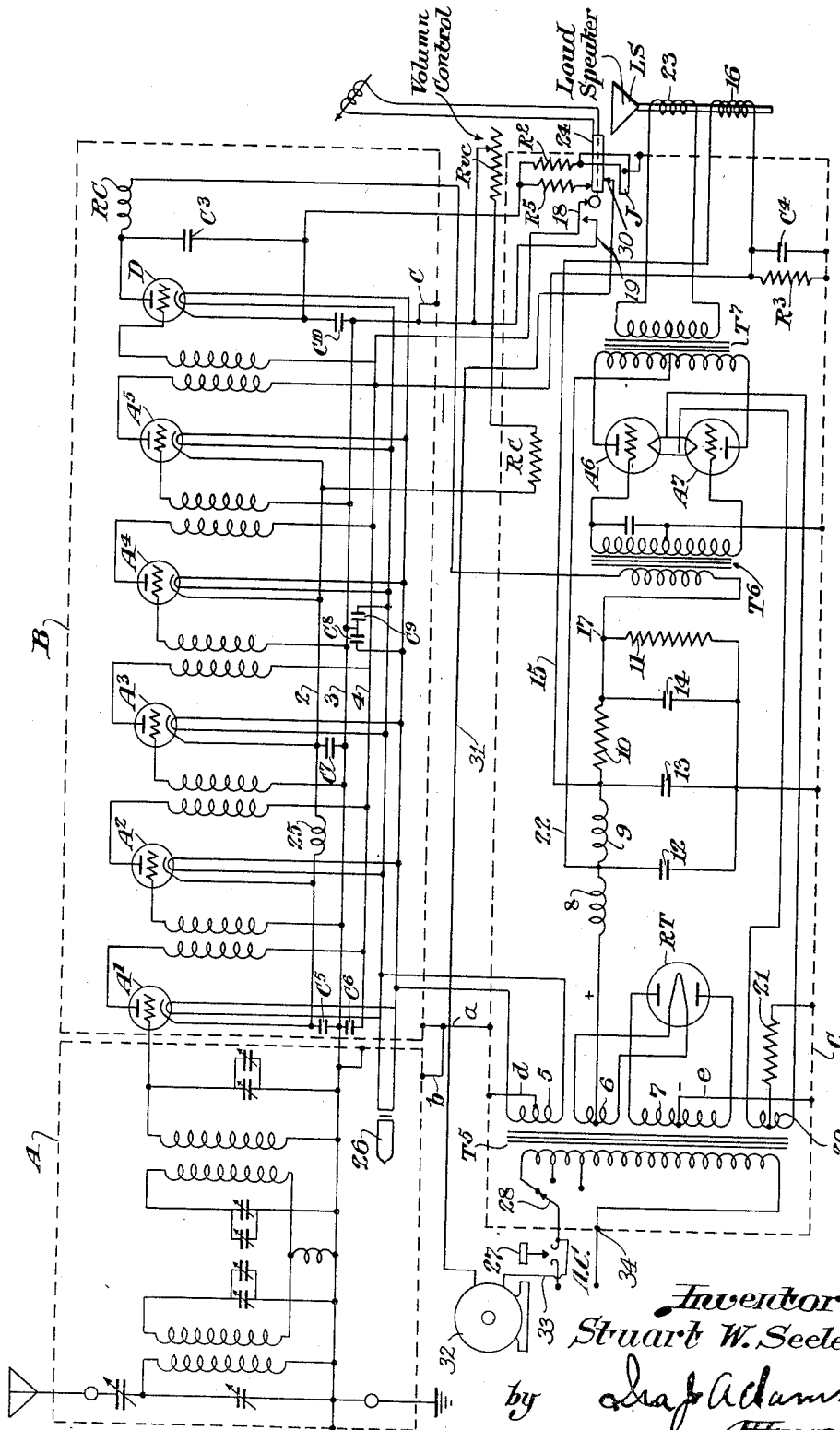
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RADIO PHONOGRAPH AMPLIFIER

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1 Claim. (Cl. 179—100.11)

My invention relates to a sound reproducing system, and in particular to a system for the electric reproduction of sound from either radio waves or phonograph records at will.

5 An object of my invention is to devise an electric reproducing system for phonographs in which the audiofrequency stages of a radio receiver are employed for the amplification of the phonograph pick-up currents.

10 A further object of my invention is to devise a phonograph reproducing system in which the phonograph pick-up element is connected in series with the input circuit of the detector tube in a radio receiver.

15 Still another object is to devise an electric reproducing system in which the audio stages of a radio receiver are employed for amplifying the pick-up current, and in which the pick-up element is connected into the input circuit of the detector tube by a plug and jack connection which automatically changes the operation of the detector tube from that of a detector to that of an amplifier. More specifically, my invention provides means for connecting a phonograph pick-up device to the input circuit of a detector tube which is normally maintained at a high negative potential for detector action, and which upon the insertion of the pick-up device into the circuit automatically changes the biasing potential to cause the detector tube to function as an amplifier.

The single figure of the drawing illustrates my invention as applied to a commercial radio receiver which comprises a tuner compartment A, an amplifying and detecting compartment B, and a compartment C containing the audio frequency amplifiers and the power supply units. Compartments A, B and C comprise metallic casings which are connected together by suitable bonding connections indicated at (a) and (b).

40 The tuning compartment A contains suitable tuning apparatus for selecting the desired wave, which apparatus forms no part of the present invention, and it is not described in this application.

45 Compartment B contains a radio frequency amplifier comprising five transformer-coupled vacuum tube amplifiers A1, A2, A3, A4 and A5, and a vacuum tube detector D. The vacuum tubes employed are of the uni-potential cathode type with heater. The uni-potential cathodes of the amplifiers are connected to a common connection 2 which is grounded to the metallic casing of compartment B as at (c) through a connection including a fixed resistance Rc in com-

partment C and the volume control resistance Rvc. The cathode-return terminals of the input circuits of the amplifiers are connected to a common connection 3 which is connected to the metallic casing of compartment B as indicated at (c). The heaters of the amplifier and detector tubes are supplied with heating current from secondary winding 5 of transformer T5. The midpoint of secondary winding 5 is grounded to the metallic casing C as indicated at (d). The plate current supply source for the amplifier and detector tubes includes a full wave rectifier tube RT, the filament of which is heated from winding 6, and the plate elements of which are connected to opposite terminals of winding 7. The midpoint of winding 7, which constitutes the negative terminal of the plate current supply, is grounded to the metallic casing C as indicated at (e). The midpoint of winding 6, which constitutes the positive terminal of the rectifier, is connected to a filter unit including choke coils 8 and 9, resistance 10 and 11, and condensers 12, 13 and 14. Choke coils 8 and 9 and resistances 10 are included in series in the positive side of the plate supply circuit, while resistance 11 and condensers 12, 13 and 14 are connected in shunt to the plate supply circuit as shown. The plate circuit for the radio frequency amplifiers A1 to A5 is completed from the positive side of the rectifier filter through wire 15 to winding 16 of the loud speaker LS, and through winding 16 to a common wire 4, to which the plate circuits of the radio frequency amplifiers are connected. The plate circuit of the detector D is completed from positive terminals 17 of the rectifier filter through primary winding of transformer T6, through radio frequency choke coil RC, to the plate element of the detector. The cathode of detector D is grounded to the metallic casing C by a connection including biasing resistance R2 which is connected to the frame of a jack J mounted on metallic compartment C. A by-pass condenser C3 is connected between the plate and cathode elements of detector D to by-pass the radio frequency current, and a by-pass condenser C10 is connected from the detector cathode to the conductor 3 and to the casing B by connection C. The cathode-return terminal of the input circuit of detector D is grounded to metallic compartment B and to wire 3 through normally closed jack contacts 18 and 19. The midpoint of the secondary winding of transformer T6 is grounded to metallic casing C, and the end terminals of the winding are connected, respectively, to the grids of a push-pull

amplifier A6—A7. The cathodes of amplifiers A6 and A7 are heated by current supplied from winding 20 of transformer T5. The midpoint of winding 20 is grounded to casing C through a biasing resistance 21. The plate elements of amplifiers A6 and A7 are connected respectively to opposite terminals of the primary winding of transformer T7, and plate current is supplied to these amplifiers by a connection 22 from between choke coils 8 and 9 on the rectifier filter to the midpoint of the primary winding of transformer T7. The secondary of transformer T7 is connected to the operating winding 23 of loud speaker LS. A resistance R3 shunted by a condenser C4 is connected from one terminal of magnetizing winding 16 of loud speaker LS to metallic casing C for the purpose of supplying additional magnetizing current to winding 16 over that supplied by the plate currents of amplifiers A1 to A5.

24 indicates a plug the leads of which are connected to a phonograph pick-up device PC whereby the audiofrequency stages of the radio receiver may be employed for the electric reproduction of phonograph records. The sleeve of plug 24 is adapted to make connection with a jack contact to connect resistance R5 in parallel with resistance R2. The tip of plug 24 makes contact with spring contact 18 of jack J to complete the grid circuit of detector D through the phonograph pick-up device and to open contact between contacts 18 and 19.

Operation of the arrangement is as follows: With the plug 24 removed from jack J, contacts 18 and 19 are closed, and the grid-cathode circuit of detector D includes resistance R2. The drop in potential across resistance R2, due to the space current flowing through it, maintains the grid highly negative with respect to the cathode, so that the tube operates on the lower bend of its characteristic curve. This operation is commonly referred to as plate-circuit detection. Incoming radio waves selected by tuner A are amplified by radio amplifier stages A1 to A5, detected by D, and the resultant audiofrequency currents are amplified by the push-pull amplifier A6—A7, and reproduced in the loud-speaker LS. The volume of the reproduction is controlled by regulating resistance R_{vc}, which is included in the input circuits of the radio-frequency amplifiers and determines the value of the negative bias.

Upon inserting plug 24 into jack J for phonographic reproduction, the input circuit of detector D is broken at contacts 18—19 and the phonograph pick-up device PC is connected in series with the grid circuit by the tip and sleeve

of the plug. Resistance R5 is automatically connected in parallel with biasing resistance R2 upon the insertion of the plug, and the effective or combined biasing resistance thereby produced is such that the tube D operates as an amplifier on the straight line portion of its characteristic curve. For example, in one commercial embodiment of my invention, resistance R2 is of the order of 20,000 ohms while resistance R5 is of the order of 1000 ohms. It will be understood, however, that the values of these resistances will be determined by the characteristic of the detector tube employed.

The currents generated in the pick-up PC are amplified by tube D and again amplified by the push-pull stage A6—A7 before being transmitted to the loud-speaker LS. The volume of the reproduction may be controlled in any desired manner, preferably by the usual control incorporated in the pick-up device.

While I have described but one commercial embodiment of my invention, it is obvious that certain other arrangements could be substituted without departing from the spirit of the invention. For instance, a switch may be substituted for a jack in cases where the phonograph and radio apparatus are incorporated in a single instrument. It is desirable in such a case to combine the motor control switch or the main phonograph controlling means with my bias controlling switching means so that as the turntable is thrown into operation change in biasing resistance adapting the detector for audio amplifying is accomplished in a single control. Switch contact 30 on the phonograph jack 24 is connected in a general manner at 32. The conductor 33 connects the supply voltage main with the other side of the motor. The other side of the supply line is grounded at 34 so that when the phonograph jack is inserted the phonograph motor switch is closed simultaneously with the changing of the bias above referred to.

What I claim is:

In a radio phonograph combination, a radio receiver including a vacuum tube detector, an audiofrequency amplifier, and a sound reproducer, said vacuum tube detector being provided with input and output circuits, and a resistance common to said circuits, a phonograph pick-up device, a turntable, an electric motor for operating said turntable, and means provided to control simultaneously the connection of said phonograph pick-up, the value of said common resistance and the supply circuit for said phonograph motor.

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