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WIRELESS RECEIVING SET

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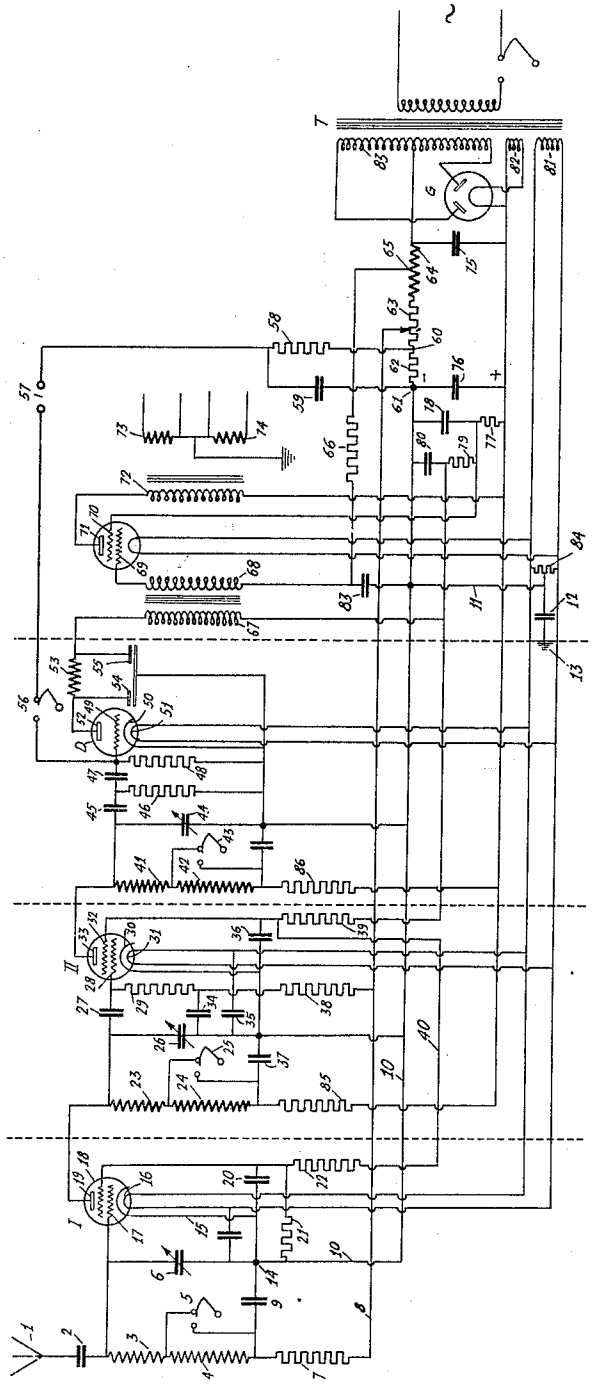

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WIRELESS RECEIVING SET

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An application for this invention has been filed in the Netherlands, Sept. 3, 1928.

The invention relates to wireless receiving sets in which a detector is preceded by one or more high frequency amplification stages and is followed by one or more low frequency amplification stages and in which the apparatus for the supply of the anode voltages and the grid biases are incorporated in the set.

The invention concerns an improvement in the mutual arrangement and screening of the various parts, owing to which independently of the number of amplification stages and of the degree of amplification of each of the said stages, reception without distortion and stability are secured.

The invention consists firstly in that the apparatus for supplying the anode voltages and the grid biases are combined with the low frequency amplifier (which for itself may consist of one or more stages) so as to form a mechanical unit which is separated and screened from the high frequency amplifiers and the detector which together form a second mechanical unit.

The relatively large anode currents which flow in the low-frequency amplifier and which have to be supplied by the high tension supply unit are thus kept within shortest possible paths and as far as possible outside the said stages owing to which undesirable reaction effects are entirely avoided.

According to the invention, both the high frequency amplifier and the detector are mounted within a metal case which is divided by metal partitions into compartments in such manner that each of the said stages is screened with relation to the others. Besides, within each of the said compartments are preferably mounted separate smoothing members constituted, for example by combinations of resistances or inductances and condensers, owing to which the feeding currents coming from the high tension supply unit are smoothed once more for each of the said stages separately, which prevents in conjunction with the electrostatic screening by the compartments, any undesired mutual action of these stages on each other, by stray fields as well as through the feeders.

In modern receiving sets the cathodes are usually heated from the electric lighting means which mostly affords alternating current. In that case the production of a humming noise is best avoided by having the cathode of the detector and preferably also the cathodes of the high frequency amplifiers indirectly heated by the alternating current.

According to the invention, when following this method a rapid and distortionless control of the volume of the sound-reproduced is obtained by making variable the grid biases applied to the control grids of the high frequency tubes.

If these high frequency tubes are provided with screening grids, which for reducing the capacity existing between the anode and the control grid of these tubes is frequently the case, a progressive potential is applied to the said screening grids, i. e., the screening grid potential of the first high frequency tube is lower than that of the second and so on. This is desirable in order to avoid distortion as otherwise it might occur that the second high frequency tube would be "pinched off" to such an extent that it would no longer be able to amplify the oscillation amplitudes supplied by the preceding high frequency valve without causing distortion.

The novel features which we believe to be characteristic of my invention are set forth in particularity in the appended claim, the invention itself, however, as to both its organization and method of operation will best be understood by reference to the following description taken in connection with the drawing in which we have indicated diagrammatically one circuit arrangement whereby our invention may be carried into effect.

The invention will be explained more fully by referring to the accompanying drawing which represents, by way of example, a diagram of connections of a wireless receiving set according to the invention.

In the diagram, 1 denotes an aerial which is connected through a small aerial condenser 2 to the first tunable high frequency circuit.

This circuit consists of two coils 3 and 4 connected in series, of which the latter may be short-circuited by a switch 5, of a variable condenser 6 and a large condenser 9. At the aerial end the circuit is connected to the control grid 17 of the first high frequency tube I and at the other end it is connected on one hand through a resistance 7 and a lead 8 to a slider adapted to be moved along a resistance 63 to be further described and on the other hand, beyond a condenser 9, at 14 to a lead 10 which is earthed at 13, through a lead 11 and a large condenser 12.

The high frequency tube I comprises a cathode 15 which is connected to earth through the lead 10, said cathode being indirectly heated by a heating element 16 which is supplied by an auxiliary winding 81 of a transformer T. In addition, the tube I contains a screening grid 18 and an anode 19. The feeding of the screening grid is effected through a resistance 22, a lead 40, a resistance 39, a resistance 79, and a resistance 77 from a high tension supply unit which will hereinafter be described more fully. The upper end of the resistance 22 is connected through a resistance 21 and further through a large condenser 20 to the earthed lead 10.

The anode 19 is connected to the upper end of the second tunable high frequency circuit which similarly consists of coils 23, 24, a short-circuiting switch 25, a variable condenser 26 and a fixed condenser 37. The anode end of this circuit is connected through a grid condenser 27 to the control grid 28 of the second high frequency tube II, said grid being connected through a leakage resistance 29 and a resistance 38 to the lead 8. Furthermore, the lower end of the resistance 29 is connected through a large condenser 34 to the earth lead 10. The grid biases to be applied to the control grids of the tubes I and II can consequently be controlled by the displacement of the slider at the end of the lead 8 along the resistance 63 when the latter is traversed by current.

The tube II further comprises a cathode 30 with heating element 31 which is fed by the above-mentioned auxiliary winding 81 of the transformer T. The cathode 30 is directly connected to the earth lead 10 to which the heating element 31 is connected through a large condenser 35.

The tube II further comprises a screening grid 32 and an anode 33. The screening grid is fed through resistances 39, 79, 77 from the high tension supply unit, from which it is obvious that the potential of the grid 32 is constantly as much higher as that of the grid 18 as is the voltage drop across the resistance 22, the purpose thereof being already above mentioned.

The anode 33 of the tube II is connected to the upper end of the third tunable high frequency circuit 41, 42, 43, 44 whose anode end is connected to the grid 49 of the detector D through two grid condensers 45 and 47 connected in series. Leakage resistances 46 and 48 ensure in this case the dissipation of undesired charges on the condensers 45 and 47.

The detector D further comprises a cathode 50 indirectly heated by an element 51 which is also fed from the winding 81. The anode 52 of the detector is connected through a choke coil 53 and the primary winding 67 of a low frequency transformer to the upper end of the resistance 79 which is connected through the resistance 77 to the plus pole of the high tension supply unit. The two ends of the choke coil 53 are connected through relatively small condensers (telephone-condensers) 54 and 55 to the earth lead 10 so that high frequency currents are thus kept outside the low frequency transformer.

One of the ends of the secondary winding 68 of the low frequency transformer is connected to the control grid 69 of the final tube, which further comprises a screening grid 70 and an anode 71. The other end of the winding 68 is connected through a resistance 66 to a stationary point 65 of a choke coil 64 of the high tension supply unit and is further connected through a large condenser 83 to the earth lead 10. The screening grid 70 is fed from the connecting points of the two resistances 77 and 79.

The anode 71 of the final tube E leads through the primary winding 72 of an output transformer directly to the plus pole of the high tension supply unit. This output transformer is provided with two secondary windings 73 and 74 which may be differently dimensioned in order to be able to operate different loudspeakers and whose point of connection is earthed.

Finally, the grid 49 of the detector is connected through a switch 56 to plug bushes 57 between which a so-called gramophone adapter can be connected, the other pole of this adapter being connected in this case through a resistance 58 to the connecting point of two resistances 62 and 63 of the high tension supply unit and through large condensers 59 to the earth lead 10.

The high tension supply unit which is also adapted to supply the required grid potentials comprises a power transformer T whose primary winding can be fed directly from the lighting mains and which is provided with three secondary windings 81, 82 and 83. As described, the winding 81 serves to feed the heating elements of the tubes I, II and D and the cathode of the final valve E. In parallel with the winding 81 is connected a potentiometer 84 the middle of which is earthed at 13 through a condenser 12.

The winding 82 is used for the heating of the cathode of a rectifier G. This rectifier has two anodes which are each connected to one of the ends of the secondary winding

83. The middle of the winding 83 is connected through a large smoothing condenser 75 to the cathode of the rectifier and further through the choke coil 64 and through the resistances 63 and 64 connected in series therewith to the minus pole of the high tension supply unit. Finally, this pole is connected through a large condenser 76 to the plus pole which is connected in its turn to the cathode of the rectifier, the minus pole being connected to the earthed lead 10.

With the described circuit arrangement the highest positive potential occurs at the plus pole which is connected through the transformer winding 72 to the anode 71 of the final tube. The anode 52 of the detector is connected through coils 53 and 67 to the upper end of the resistance 79 so that the voltage applied to the anode 53 is as much lower as that of the anode 71 as is the voltage produced in the resistances 77 and 79. The screening grid 70 has a potential lying between those of the anodes 52 and 71 as it is connected to the connecting point of the resistances 77 and 79. The anodes 19 and 33 of the high frequency tubes are connected to the plus pole through the coils 23, 24 and 41, 42 respectively and through resistances 85 and 86 respectively. The potentials of these two anodes are consequently determined inter alia by the value of the latter resistances.

The screening grids 18 and 32 of the two high frequency tubes are connected to different points of the following circuit: plus pole, resistance 77, resistance 79, resistance 39, resistance 22, resistance 21, lead 10, minus pole, so that the positive potential of the grid 32 is always as much higher as that of the grid 18 as is the voltage drop across the resistance 22.

The biases applied to the two control grids 17 and 28 which are both connected to the lead 8, can be varied, with the aid of the slider of the resistance 63, said slider being connected to the lead 8. When the cathodes are indirectly heated this manner of volume control affords the advantage, that, contrary to the more usual manner in which the heating current is regulated, the volume control is effected without inertia and distortion. In that case the minimum negative grid bias to be applied is obviously equal to the voltage drop in the resistance 62. This is also the negative grid bias applied to the grid 49 of the detector when a gramophone-adapter is connected between the bushes 57 and the switch 56 is inserted. In that case the detector D acts as first-stage low frequency amplification. When, however, the switch 56 is opened, the leakage resistance 58 ensures that the average potential of the grid 49 remains equal to that of the cathode 50.

The vertical dotted lines in the drawing between the tubes I, II, D and E indicate the electrostatic separation between the various stages. Moreover, all that is located on the left hand of the dotted line between D and E is united to form a mechanical unit, this being also the case with all that is lying at the right of the said dotted line. These two units are subsequently mounted within the same case and electrically connected to each other by the eight leads that are shown.

While we have indicated and described one arrangement for carrying our invention into effect, it will be apparent to one skilled in the art that our invention is by no means limited to the particular organization shown and described, but that many modifications may be employed without departing from the scope of our invention as set forth in the appended claim.

We claim:

A radio receiver including a radio frequency amplifier provided with a plurality of screen grid tubes arranged in cascade, a power supply source, a path, including a resistor of predetermined magnitude, connected between said source and the screen electrode of one of said tubes for maintaining said electrode at a predetermined positive potential, and a path, including a second resistor of predetermined value, connected between the screen electrode of a tube preceding said last named tube and the low potential terminal of said first resistor for maintaining the screen electrode of said first tube constantly higher in potential than the screen electrode of the preceding tube by a value equal to the potential drop across said second resistor.

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