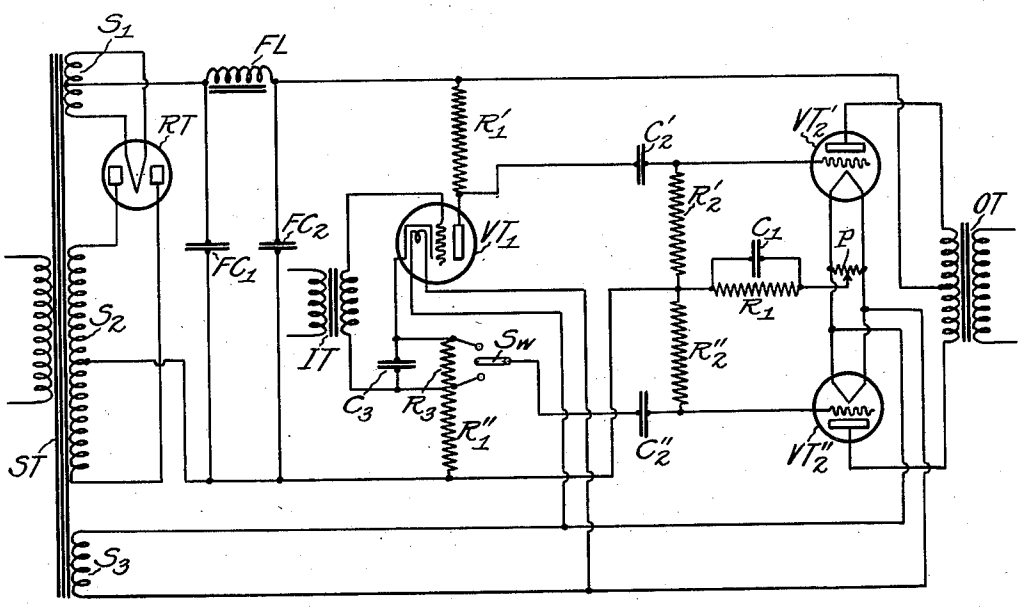
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AMPLIFIER SYSTEM

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AMPLIFIER SYSTEM

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My present invention relates generally to amplifier systems, and in particular to amplifier systems of the push-pull type.

An object of my invention is the provision of an impedance coupled amplifier, a common form of which is the so-called resistance coupled type in which a single three or other plural electrode tube and output connections are caused to supply the desired potentials for a pair of succeeding tubes connected for push-pull operation, this to accomplish a result with impedance or resistance couplings now generally practiced only with transformer coupling.

Referring to the figure of the drawing, tubes VT_2' and VT_2'' are shown as push-pull connected three electrode vacuum tubes in the output end of an amplifier system supplying a usual push-pull output transformer OT. The plate circuits of these tubes are shown energized for example from an alternating current rectifying and filtering system comprising power transformer ST, secondaries S_1 and S_2, full-wave rectifier tube RT, filter choke FL and filter condensers FC_1 and FC_2, all connected in a manner well understood and practiced, and forming no part of the present invention.

The grid circuits of tubes VT_2' and VT_2'' are shown energized in a conventional manner by the potential developed in a grid-biasing resistance R_1, which resistance may be by-passed by a condenser C_1 of low impedance to signal currents and energy supply hum currents. The filaments are shown energized through connections to the filament heating secondary S_3.

Resistances R_2' and R_2'', connecting the grids to the filament system through potentiometer P and resistance R_1, are the usual high resistances or so-called grid leaks. The grids of VT_2' and VT_2'' are isolated from the high value plate potential of the preceding tube by so-called blocking condensers C_2' and C_2'' usual to resistance and like impedance coupled amplifiers.

Tube VT_1 is shown as the ordinary three electrode tube indicated by way of example as being of the so-called indirectly heated cathode type, the heater being supplied with heating current through connections to the filament heating secondary S_3. The input circuit of VT_1 is shown supplied with signal current or other currents to be amplified through an input transformer IT, and this circuit energized or biased in a conventional manner by the potential developed in a resistance R_3 by-passed, if desired, by a low impedance condenser C_3.

The plate circuit of VT_1 is shown energized from the same supply source as the push-pull tubes. It is seen that the plate circuit of VT_1 includes two resistances R_1' and R_1'' "in series," with the plate circuit energy supply system, of which filter condenser FC_2 is a part, interposed therebetween. Since the filament system of the push-pull tubes is connected to the energy supply system and therefore to an intermediate point in the plate (or output) circuit of tube VT_1, it is now apparent that if the grids of the push-pull tubes be connected to the extremities of this output circuit—i. e., respectively to the plate side of resistance R_1' and to the cathode side of resistance R_1'' (or of R_3) through the switch SW, the signal current polarities impressed upon these grids will be opposite in phase and therefore capable of producing push-pull action as usually accomplished in tubes connected as are VT_2' and VT_2''.

Obviously, resistances R_1' and R_1'' can be chosen of such relative values as to distribute in desired manner the magnitudes of the potentials impressed on the grids of VT_2' and VT_2''. It is obvious that some allowance must be made for the potential taken up in biasing resistance R_3, if switch SW is connected to the lower one of the contacts, and for the impedance of the energy supply system if it is desired to impress equal and opposite potentials on the grids of VT_2' and VT_2'', the condition of operation most usually sought in practice. It is a simple matter to have either one or both resistances R_1' and R_1'' variable to accomplish any desired potential distribution.

Although I have shown and described a specific form of my invention as a resistance coupled amplifier, it is to be understood that the resistances therein shown and described may be replaced with choke coils of suitable impedance without departing from the spirit of my invention as defined in the claims appended hereto.

Having fully described my invention, and not intending any limitations by reason of the particular system chosen for explanatory and descriptive purposes, I claim:

1. In an amplifier system, in combination, a plurality of electron tubes; a series circuit connected between the output electrodes of one of said tubes, said circuit comprising two impedances and therebetween a source of unidirectional current; and means connected with said output electrodes for applying the alternating potentials of said electrodes respectively to the control electrodes of a pair of said tubes.

2. Apparatus of the kind described comprising a repeating tube equipped with an output circuit having two impedance elements arranged in series, said output circuit including a power supply inserted between said elements, two additional tubes for providing a push-pull stage, each of said last-mentioned tubes being provided with an input circuit, the input circuit of one of said tubes in said push-pull stage being arranged to include one of said elements and the input circuit of the other tube in said push-pull stage

being arranged to include the other of said elements.

3. Apparatus of the character described comprising a repeating tube, two additional repeating tubes for providing a push-pull stage, an output circuit for the first-mentioned repeating tube, said output circuit comprising two serially connected impedance sections and including a power supply inserted between said sections, an input circuit for each of the tubes of the push-pull stage, means whereby a change in voltage in one of said sections is impressed upon the input circuit of one of said tubes of the push-pull stage, and means whereby a change in voltage across the other of said sections is impressed upon the input circuit of the other tube of said push-pull stage.

4. Apparatus of the kind described comprising a repeating tube equipped with an output circuit having two resistance elements arranged in series, said output circuit including a power supply inserted between said resistance elements, two additional tubes for providing a push-pull stage, each of said last-mentioned tubes being provided with an input circuit, the input circuit of one of said tubes in said push-pull stage being arranged to include one of said resistance elements and the input circuit of the other tube in said push-pull stage being arranged to include the other of said resistance elements.

5. An amplifying system comprising a vacuum tube, a suitable power device for operating the vacuum tube, a signal consisting of varying electrical impulses impressed upon the controlling element of the vacuum tube, a resistance unit connected between the anode of the vacuum tube and a high voltage positive terminal of the power device, a similar resistance unit connected between a corresponding negative terminal of the power device and the cathode terminal of the vacuum tube, a coupling device connected to the anode of the vacuum tube, a similar coupling device connected to the conductor leading to the cathode terminal of the vacuum tube, the parts of the apparatus cooperating to permit the reproduced signal to be obtained at two points simultaneously by means of the two coupling devices, the signals obtained at the two points being similar in character, but opposite in phase.

6. In an amplifier system, the combination of a pair of electron tubes; a push-pull output circuit for said tubes; a source of unidirectional current connected to energize the space discharge paths of said pair of tubes; a third electron tube; impedances connecting the two output electrodes of said third tube respectively to points of different potential in said source; and reactances connecting the output electrodes of said third tube respectively to the control electrodes of said pair of tubes.

7. In an amplifier system, the combination of a pair of electron tubes; a push-pull output circuit for said tubes; a source of unidirectional current connected to energize the space discharge paths of said pair of tubes; a third electron tube; resistances connecting the two output electrodes of said third tube respectively to points of different potentials in said source; and reactances connecting the output electrodes of said third tube respectively to the control electrodes of said pair of tubes.

8. In an amplifier system, the combination of a plurality of electron tubes; a series circuit connected between the output electrodes of one of said tubes, said circuit comprising two impedances and therebetween a source of unidirectional current; means connected with the output electrodes of said one tube for applying the alternating potentials of said electrodes respectively to the control electrodes of a pair of said tubes; and a circuit connecting the cathodes of said pair of tubes to a point in said source.

9. In an amplifier system, the combination of a plurality of electron tubes; a series circuit connected between the output electrodes of one of said tubes, said circuit comprising two resistances and therebetween a source of unidirectional current; means connected with the output electrodes of said one tube for applying the alternating potentials of said electrodes respectively to the control electrodes of a pair of said tubes; and a circuit connecting the cathodes of said pair of tubes to a point in said source.

10. In an amplifier system, the combination of a plurality of electron tubes, a signal input circuit for one of said tubes, fixed impedance coupling units coupling the input electrodes of a pair of said tubes to the output electrodes of said one tube, means for energizing the space discharge paths of said pair of tubes to operate as amplifiers from a source of unidirectional current, and connections for energizing the electrodes of said one tube to operate as an amplifier from said source, said connections including a pair of impedance means for maintaining the output electrodes of said one tube at potentials substantially symmetrical about the mid-potential of said source, whereby the signal current potentials developed in said impedance means are impressed upon the input electrodes of said pair of tubes.

11. In an amplifier system, the combination of a plurality of electron tubes, a signal input circuit for one of said tubes, fixed resistance-condenser coupling units coupling the input electrodes of a pair of said tubes to the output electrodes of said one tube, means for energizing the space discharge paths of said pair of tubes to operate as amplifiers from a source of unidirectional current, and connections for energizing the electrodes of said one tube to operate as an amplifier from said source, said connections including a pair of resistances for maintaining the output electrodes of said one tube at symmetrical potentials substantially symmetrical about the mid-potential of said source, whereby the signal current potentials developed in said resistances are impressed upon the input electrodes of said pair of tubes.

12. In an electrical circuit having repeating tubes for transmitting signals, a set of anode, cathode and grid elements, an input circuit operatively connected to said cathode and grid elements, an output circuit operatively connected to said anode and cathode elements, said input and output circuits having a common load, a second set of anode, cathode and grid elements, a second input circuit including said load connected to the second grid and the second cathode, and a second output circuit connected to the second anode and the second cathode, said second output circuit being adapted to operate means responsive to signals transmitted from the first set of elements to said second set of elements.

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