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THERMIONIC VALVE CIRCUITS

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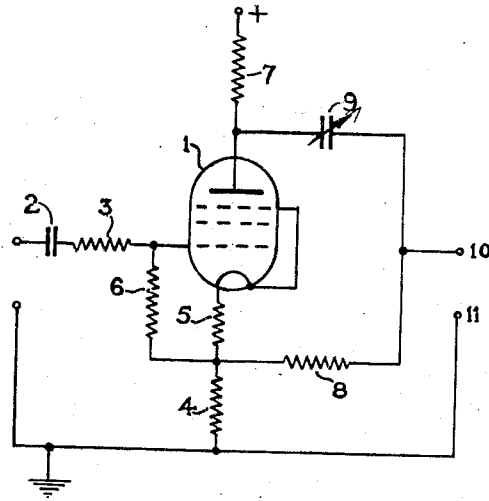


Fig. 1.

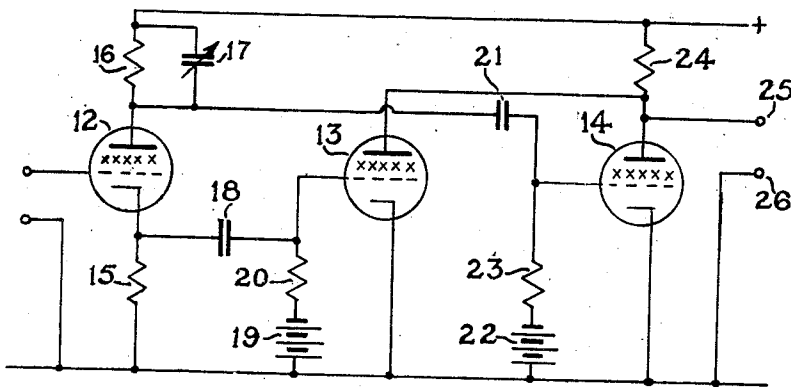


Fig. 2.

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THERMIONIC VALVE CIRCUITS

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5 Claims. (Cl. 178-44)

This invention relates to thermionic valve circuits and has particular reference to circuits for correcting phase distortion which may occur in high frequency signal transmitting or receiving circuits.

The phase of alternating potentials may be altered selectively without affecting their relative amplitudes by a form of circuit arrangement including a resistance in series with a reactance and connected across the source of alternating potentials the phase of which it is desired to alter. A connection enabling a potential mid-way between that of the supply leads is provided and the output is taken from this connection and the junction of the resistance and reactance. Conveniently, the primary winding of a transformer is connected across the source of potential and a centre tapping taken from the secondary winding provides the midpoint of potential. Such a circuit is only suitable for use with relatively narrow frequency bands and is not practical for use with frequency bands of the width required in television and similar systems.

The object of the present invention is to provide an improved phase adjusting or correcting circuit in which the degree of correction can easily be adjusted, this feature being particularly applicable to the phase correction of television signals subsequent to their transmission through phase distorting amplifiers or cable.

According to the present invention, a circuit arrangement for modifying the phase of signal potentials includes a thermionic valve, the potential of the cathode of which varies with that of the control grid, said thermionic valve having in its anode/cathode circuit a reactive impedance which is selected to modify the phase of the output potentials with respect to the input potentials. The valve may be arranged to provide symmetrical input potentials for a phase modifying circuit including a resistance and a reactance, or the valve may provide potentials for the input circuits of further valves, said potentials having relative phase differences and being combined in the output circuits of said further valves, the resultant output potentials being modified in phase in the desired manner. The reactance, which may comprise capacity or inductance, or a combination of these, is selected to effect any desired possible modification of the phase of the input alternating potentials, and may be made variable for this purpose.

In a particular circuit arrangement according to the invention, the thermionic valve is of

the high impedance type such as a screen grid valve or pentode, and the phase modifying circuit comprises a condenser in series with a resistance connected between the anode and cathode of the valve, the output from the valve being taken from the junction between the condenser and resistance and the low potential end of a resistance connected in the cathode lead.

In an alternative form of circuit embodying the invention, the phase modifying circuit includes a resistance and a reactance connected in the anode lead of said thermionic valve, the anode and cathode of which feed the input circuits of two further valves, the output circuits of which are connected to common output terminals.

In order that the invention may be more clearly understood and readily carried into effect, two separate arrangements embodying the invention will now be described in greater detail with reference to the accompanying drawing in which:

Figure 1 shows a simple circuit which is effective for altering the phase of signals over a range of from 10 to 100 kilocycles, and

Figure 2 shows an alternative form of circuit.

Referring to Figure 1 of the drawing, signal potentials are applied to the grid of a pentode valve 1 through a coupling condenser 2 of 0.1 microfarad and a resistance 3 of 250 ohms and to an earthed terminal connected to the cathode of the valve through a resistance 4 of 1,000 ohms in series with a second resistance 5 of 70 ohms. The insertion of the resistance 4 causes the cathode of the valve to follow the potentials applied to the control grid, thus enabling drive potentials to be taken from the cathode. The control grid of the valve 1 is suitably biased relatively to the cathode by the insertion of a resistance 6 of 100,000 ohms connected between the junction point of resistances 4 and 5 and the control grid of the valve 1. In the anode lead of the valve 1 is connected a resistance 7 of 1,000 ohms, that is to say, equal to the resistance 4 in the cathode lead. A further resistance 8 of 10,000 ohms in series with a condenser 9 of 0.0004 microfarad is connected directly between the anode and the cathode of the valve 1. A connection is taken from the junction of the series connected resistance 8 and condenser 9 to one of two output terminals 10 and 11, the latter being connected to the earthed end of the resistance 4. The output terminals 10 and 11 may be connected to a load impedance which is preferably high relatively to that of either the re-

sistance 8 or the condenser 9. The load may consist of a further phase correcting stage having the same or a different phase characteristic from the preceding stage. The condenser 9 may be selected to compensate for a known phase distortion which occurs in the channel, or it may be made variable to provide for changes in the form of phase distortion which may occur. The circuit described enables phase correction to be effected without modification of the relative amplitudes of the input alternating potentials.

There is an upper limit to the frequency with which the circuit described can deal effectively owing to the fact that the nature of the load impedance must be taken into consideration. This load impedance may be constituted for example by the grid capacity of a following valve. When the upper limit of frequencies with which it is desired to work is of the order of four megacycles it is difficult to maintain the value of the resistance 7 connected in the anode lead small compared with the values of the series connected resistance 8 and condenser 9 and yet maintain a reasonable output.

In the modified circuit arrangement shown in Fig. 2 a high impedance valve, such as a screened grid valve 12 as shown, or a pentode, provides from its anode and cathode the inputs to a pair of following valves 13 and 14 having equal mutual conductances. The potential, the phase of which it is desired to modify, is applied to the grid of the valve 12 and a terminal which is connected as before to the cathode through a resistance 15. A resistance 16 the value of which is double the resistance 15 is connected in the anode lead and a condenser 17 is connected across the resistance 16. The value of the resistance 15 is selected on the assumption that little or no screen grid current will flow but since in practice the screen grid current is proportional to the anode current, the value of the resistance 15 may be reduced in the ratio of the anode current to the sum of the anode and screen grid currents.

The upper end of the resistance 15 is connected through a coupling condenser 18 to the grid of the screened grid valve 13 which is suitably biased by a battery 19 connected to the grid through a resistance 20. The lower end of the anode resistance 16 is similarly connected through a coupling condenser 21 to the grid of the screened grid valve 14, the grid of which is biased by a battery 22 connected to the grid through a resistance 23. The anodes of the valves 13 and 14 are connected directly together and through a fixed resistance 24 to a high tension source of supply not shown in the drawing. A connection is taken from the lower end of the resistance 24 to one of two output terminals 25 and 26, the latter being connected to the low potential terminal of the circuit. It will thus be seen that the varying potential at the cathode of the valve 12 is applied to the grid of the valve 13 and the varying potential at the anode of the valve 12 is applied to the grid of the valve 14. The outputs of the valves 13 and 14 are combined and thus the input potentials are passed on with any desired phase correction, introduced by the condenser 17 without modification of the relative amplitudes of those potentials.

While only the use of a condenser with a resistance in the phase correcting circuit has been referred to, it is to be understood that an in-

ductance may be employed or a combination of resistance, inductance and capacity. Again, while the use of screen grid valves has been described, it will be understood that triode valves may be employed.

I claim:

1. In a system for obtaining alternating potentials of a phase which can be varied through a wide range without modifying the amplitude of the potentials, an electron discharge device having a control electrode and a cathode and an output electrode, a pair of input elements one of which is at a relatively fixed alternating current potential, means for impressing alternating potentials thereon, a pair of output elements one of which is connected to said input element of relatively fixed potential, an impedance connecting said last named element to said cathode, means for impressing potentials from said other input element on said control electrode, a phase shifting circuit including an impedance and a reactance connected between said output electrode and cathode, and a connection between a point on said phase shifting circuit and the other of said output elements.

2. In a system for obtaining alternating potentials of a phase which can be varied through a wide range without modifying the amplitude of the potentials obtained, a pair of input elements one of which is at a relatively fixed potential, means for impressing alternating potentials thereon, a pair of output elements one of which is connected to said one of said input elements, and means for impressing from the other input element on the other output element potentials the phase of which is the resultant of two potentials of phases which are substantially symmetrical relative to the phase of said potential on said other input element comprising an electron discharge device having a cathode connected to said input element of relatively fixed potential, said discharge device having a control electrode and an anode, a connection between said other input element and the control electrode of said device and between said other input element and the cathode of said device, a circuit including phase regulating means connected between said anode and cathode, and a connection between said last circuit and said other output element.

3. In a system for obtaining alternating potentials of a phase which can be varied through a wide range without modifying the amplitude of the potentials, an electron discharge device having a control grid, a cathode, and an output electrode, a pair of input elements one of which is at a relatively fixed potential, means for impressing alternating potentials thereon, a pair of output elements one of which is connected to said input element of relatively fixed potential, resistances connecting said elements of relatively fixed potential to the cathode of said device, an impedance coupling said other input element to the control grid of said device, a connection between said last named connection and a point on said resistances, a reactance and an impedance coupled between the anode and cathode of said device, and a connection between said reactance and said other output element.

4. In a system for obtaining alternating current potentials of a phase which can be varied through a wide range without substantially modifying the amplitude of the potentials, a pair of input terminals one of which is at substantially fixed alternating current potential, means for

impressing alternating current potentials thereon, a pair of output terminals one of which is connected to said input terminal of substantially fixed alternating current potential, an electron discharge device having input electrodes coupled to said input terminals, said device having output electrodes, a phase shifting circuit including a reactance and a resistance connected between said output electrodes, and a connection between a point on said phase shifting circuit and the other output element.

5. In a system for obtaining alternating potentials of a phase which can be varied through a wide range without modifying the amplitude of the potentials obtained, a pair of input terminals, one of which is of relatively fixed potential, means for impressing alternating potentials thereon, a pair of output terminals one of which

is at relatively fixed potential, an electron discharge device having an output electrode, a cathode, and a control grid, a connection between the cathode of said device and said input element of relatively fixed potential, a connection between the control grid of said device and said other input element, a phase adjusting circuit connected with the output electrode of said device, a pair of electron discharge devices having output electrodes coupled to the other of said output elements, said pair of discharge devices having input electrodes, and a connection between the input electrode of one of said pair of devices and the cathode of said first named device and between the input electrode of the other of said pair of devices and the output electrode of said first named device.

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