

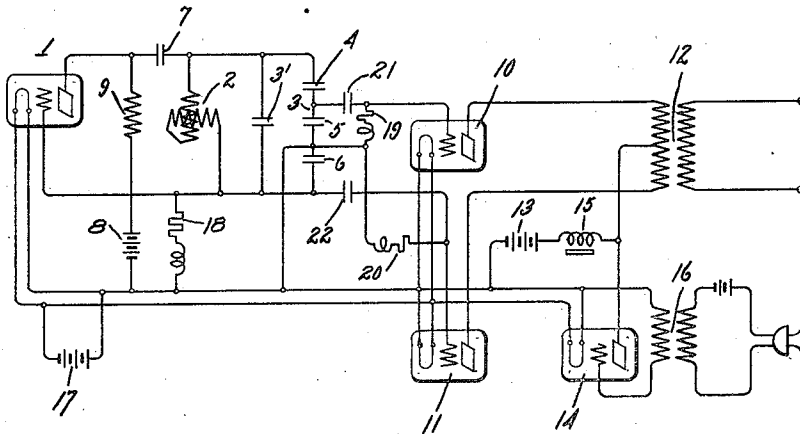
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COUPLING CIRCUITS

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UNITED STATES PATENT OFFICE

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COUPLING CIRCUITS

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My invention relates to improved means whereby the input circuit of an electron discharge amplifier, and particularly a push-pull amplifier may be connected to a supply oscillation generator. It has for its purpose to provide coupling means whereby the above mentioned connection can be made without encountering undesirable effects, which will later be pointed out, and which result from the use of coupling means of known form.

In systems of the prior art coupling means of various forms have been employed for the purpose mentioned. More commonly these means employ transformers, or other form of inductance devices, connected in the grid circuit of the amplifier whereby alternating potential from the oscillatory circuit of the generator is supplied to the grid of the amplifier. This inductance must necessarily be of a magnitude such that a reactive effect between the grid and anode circuits of the amplifier is likely to result producing regeneration of the amplifier and unstable operation. In other forms of coupling, resistances are connected in shunt with the oscillatory circuit and a portion of the potential on the resistance is supplied to the grid of the amplifier, the resistance acting as a potentiometer. While this form of coupling obviates the difficulty resulting from the tendency of the amplifier to regenerate it possesses the disadvantage that considerable loss of high frequency energy is occasioned in the resistance. Still other forms of coupling have been used including that of connecting the grid and cathode circuit of the amplifier directly in shunt with the single condenser of the oscillatory circuit. This expedient results in the necessity for using separate filament batteries for the discharge devices of the amplifier and oscillation generator.

Accordingly the purpose of my invention is to provide means whereby the desired coupling may be effected without encountering the disadvantages mentioned and which has the further advantage that a constant alternating electromotive force may be supplied to the grid, or grids, of the amplifier over a range of frequencies of the oscillation generator. Thus with electron discharge de-

vices of the proper capacity all of the devices will receive the grid excitation necessary for their proper excitation; this excitation being automatically maintained over a range of frequencies by the grid excitation assumed by the oscillator.

The novel features which I believe to be characteristic of my invention will be set forth with particularity in the appended claims. My invention itself, however, both as to its organization and method of operation, together with further objects and advantages thereof may best be understood by reference to the following description taken in connection with the accompanying drawing, in which the single figure represents an embodiment of my invention.

Referring to the drawing I have shown an electron discharge oscillation generator comprising an electron discharge device 1 of the usual three element type having an oscillatory circuit comprising parallel connected branches 2 and 3. The branch 2 of the oscillatory circuit comprises an inductance which may comprise that of the usual variometer. The branch 3 comprises a plurality of series connected condensers 4, 5 and 6 having values adjusted as will later be explained. While the entire capacity of the oscillatory circuit is preferably included in the branch 3 additional capacity may, of course, if desired, be connected in shunt with the oscillatory circuit as is indicated at 3'. This oscillatory circuit is connected in the usual way between the grid and anode of the discharge device 1 through the usual blocking condenser 7. The anode circuit of the oscillation generator is energized from a source of potential 8 through a feed circuit including the choke coil 9.

I have shown the oscillatory circuit of the generator 1 as coupled to the grids of a push-pull amplifier comprising electron discharge devices 10 and 11, these devices being likewise of the usual three element type. Connected to the anodes of the push-pull amplifiers 10 and 11 in the usual way is the primary winding of an output transformer 12, the secondary winding of which may be connected to any suitable load circuit, such for

example, as a radiating system. The anode circuit of the amplifiers is energized by means of a suitable energy source 3 connected between the midpoint of the primary winding of transformer 12 and the cathode of the electron discharge devices in series with a suitable reactor 15. For the purpose of modulating the high frequency currents produced an electron discharge device 14 is utilized. The space between the anode and cathode of this device is connected in shunt with the modulation reactor 15 and the source 13 in a manner such that the anode circuit of this device and those of the amplifiers are energized from the same source. Voice or other signal potential will be supplied to the grid of this device through a suitable transformer 16 and will thereby be caused to modulate the high frequency current produced by the oscillation generator 1 in the manner well known in the art.

The cathodes of all the electron discharge devices of the system are connected together and are energized from a single source of potential 17. Suitable grid leak resistance 18, 19 and 20 are connected between each of the grids of the devices 1, 10 and 11 respectively in series with the usual choke coil.

As thus arranged high frequency currents are produced in the oscillatory circuit of the oscillation generator and are supplied to the grids of the push pull amplifier 10, 11 where they are modulated by the device 14 and supplied through the transformer 12 to the output circuit.

It will be noticed that the capacity of the oscillatory circuit is divided into a number of separate condensers which are connected in series with each other and in shunt with the variometer 2. The condenser 6 is connected between the grid of the oscillation generator and the cathode and is of magnitude such that proper excitation is supplied to the grid of the oscillation generator. The condenser 5 is of capacity equal to that of the condenser 6, so that the potentials across these two condensers are equal. The capacity of the condenser 4 is such that the potential across the series combination 4, 5, 6 at the frequency of the oscillations to be produced is equal to the rated potential of the oscillation generator. As thus arranged the grid of the oscillation generator will, of course, assume the necessary potential for excitation and, as characteristic of oscillation generators of this type, the potential across the oscillatory circuit will be maintained about equal over the entire range of frequencies produced. Thus if the inductance 2 or condenser 3' be used to vary the frequency the potential will remain substantially constant throughout the entire range of adjustment of either of these elements. The grids of the push-pull amplifiers 10 and 11 are connected through suitable coupling condensers 21 and

22 to points on the oscillatory circuit, the former to the point between the condensers 4 and 5 and the latter to the grid connection of the oscillation generator. As thus arranged equal potentials will be produced upon each of the grids of the amplifiers, these potentials being displaced in phase by 180 degrees, as is required for excitation of the push-pull arrangement. If all of the electron discharge devices be of proper rated capacity then the proper excitation will be supplied to all of the grids throughout the entire range of frequencies.

It will be observed that no inductance is included in the grid circuits of either of the amplifiers which is of magnitude such that regeneration of the amplifier is likely to result. Similarly any losses which might be occasioned by resistance potentiometer connected in shunt with the oscillatory circuit are obviated, the resistance of the grid leaks 19 and 20 being sufficiently great to render the losses therein negligible. At the same time the cathodes of all of the discharge devices are maintained at the same potential and may be energized from a common source.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. In combination, an electron discharge oscillation generator having an anode, a cathode and a grid, an oscillatory circuit comprising an inductance and a capacity connected in parallel between said anode and grid, a pair of push-pull connected electron discharge amplifiers, each of said amplifiers having an anode, a cathode and a grid, a connection from the cathode of said amplifiers and said oscillation generator to an intermediate point on said capacity and non-inductive connections from the grids of said amplifiers to opposite points on said capacity from said intermediate point.

2. The combination of an electron discharge oscillation generator having an anode, a cathode and a grid, an oscillatory circuit comprising an inductance and a capacity connected in parallel between said anode and grid, a pair of push pull connected electron discharge amplifiers, each of said amplifiers having an anode, a cathode and a grid, a connection from the cathodes of said generator and amplifiers to an intermediate point on said capacity, a connection from the grid of one of said amplifiers to a point between the grid of the generator and said intermediate point and a connection from the grid of the other amplifier to a point on said capacity opposite said last mentioned connection such that the voltages supplied to the grids of both amplifiers are of equal magnitude and opposite phase.

In witness whereof, I have hereunto set my hand this 21st day of August, 1928.

HENRY R. BUTLER.

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