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HIGH FREQUENCY TRANSMISSION SYSTEM

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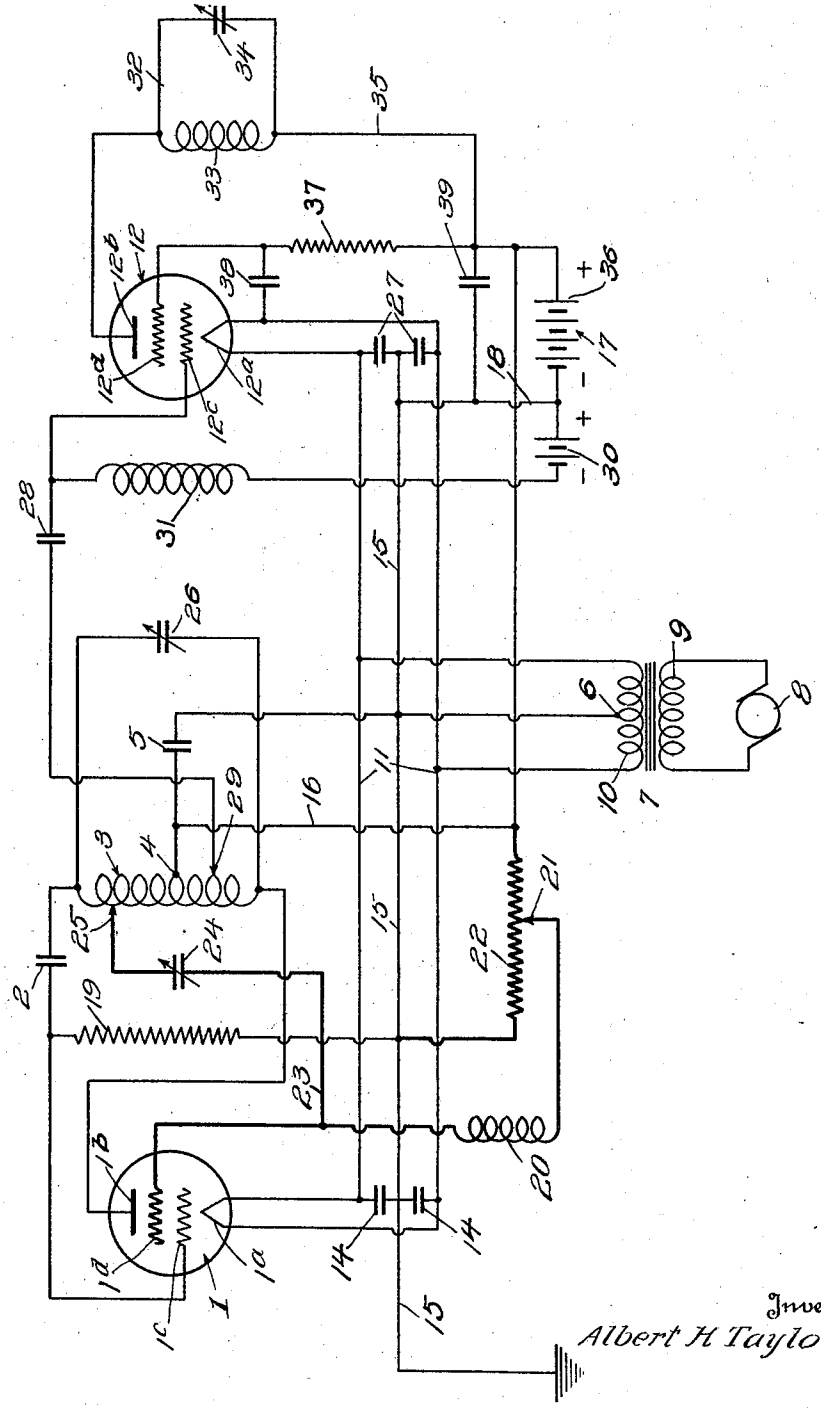

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HIGH FREQUENCY TRANSMISSION SYSTEM

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My invention relates broadly to high frequency transmission systems and more particularly to an arrangement of high frequency oscillator and power amplifier having means for preventing reactionary effects between the power amplifier and high frequency oscillator circuits.

One of the objects of my invention is to provide a circuit arrangement for a high frequency signal transmission system employing tetrodes in the oscillator and power amplifier stages with coupling means between the oscillator and power amplifier arranged to prevent reactionary effects from the power amplifier upon the oscillator.

Another object of my invention is to provide a circuit arrangement for coupling tetrode tubes in the master oscillator and power amplifier stages of a signal transmission system with means compensating for reactionary effects arising in the power amplifier with respect to the master oscillator.

Still another object of my invention is to provide a circuit arrangement for a signal transmission system employing multiple electrode electron tubes in the master oscillator and power amplifier stages with circuits coupling the output of the oscillator with the input of the power amplifier including a connection extending to one of the electrodes of the oscillator and operating to compensate for reactionary effects occurring in the power amplifier stage for stabilizing the frequency of operation of the oscillator circuit.

A further object of my invention is to provide a circuit arrangement for coupling a master oscillator with the power amplifier of a signal transmission system having means for maintaining the frequency of operation of the oscillator system substantially constant without the employment of any form of electromechanical vibrator.

Other and further objects of my invention reside in a constant frequency signal transmission system which operates independently of piezo electric or electromechanical control as set forth more fully in the specification hereinafter following by reference to the accompanying drawing which diagrammatically illustrates the principle of my invention.

Referring to the drawing in detail, the system of my invention employs a master oscillator tube 1 which includes a cathode 1*a*, an anode 1*b*, a control grid 1*c* and an auxiliary grid 1*d*. The input circuit of the master oscillator tube 1 is completed from the control grid 1*c* through condenser 2 and inductance 3, to the mid-tap 4 thereof and thereafter through condenser 5 to the mid-tap 6 of the cathode power supply transformer 7. I have diagrammatically illustrated the cathode circuit as supplied from the alternating current generator 8 which connects to the primary winding 9 of the power transformer 7. The secondary winding 10 of the power transformer 7 is connected to the cathode circuit 11 of the master oscillator tube 1 and the power amplifier tube 12. The cathode circuit has balanced condensers 14 connected in each side thereof, the center point being grounded through lead 15 as shown. The output circuit of the master oscillator 1 extends from the anode 1*b* to one end of the inductance 3 and to the midpoint 4 thereof and through lead 16 to the positive side of the source of high potential designated at 17. The negative side of the source of high potential connects through lead 18 to the midconductor 15 of the cathode returning to the mid-tap 6 of the cathode heating circuit power transformer. The control grid 1*c* receives a predetermined potential through high resistance path 19 which connects to the midconductor 15 of the cathode heating circuit which connects to the negative side of the high potential source 17. The auxiliary grid 1*d* receives a predetermined potential through the choke coil 20 connected to the tap 21 on the potentiometer 22. The potentiometer 22 is connected across the high potential source 17. Tap 21 is adjustable along the potentiometer 22 for selectively impressing the desired operating potential upon the auxiliary grid 1*d*. A connection 23 extends from the auxiliary grid 1*d* through an adjustable balance condenser 24 to an adjustable tap 25 on the inductance 3. The tap 25 is shiftable along the inductance 3 to a position which brings about the compensating action which will be hereinafter described, for ob-

taining the stabilized operation of the master oscillator. The master oscillator 1 is adjusted to the required frequency by means of the tuning condenser 26.

The power amplifier tube 12 includes a cathode 12*a*, an anode 12*b*, a control grid 12*c* and an auxiliary grid 12*d*. The cathode 12*a* is heated from the filament heating circuit 11, the bypass condensers 27 being connected across the cathode circuit and the midpoint connected to the mid-conductor 15 as shown. The control grid 12*c* is connected through condenser 28 with the adjustable tap 29 on the inductance 3, the tap being disposed between the midpoint 4 and the end of the inductance 3 which connects to the anode 1*b*. The desired negative potential is supplied to the control grid 12*c* from suitable source 30 through the choke coil 31 to the grid 12*c* as shown. The output circuit of the power amplifier includes a connection from the anode 12*b* to resonant circuit 32 which contains inductance 33 shunted by a variable capacity 34. The opposite end of the resonant circuit 32 is connected to lead 35 to the positive terminal 36 of the source of potential 17. The auxiliary grid 12*d* is supplied with positive potential from the source of potential 17 through a resistor or impedance 37. Radio frequency bypass condenser 38 connects between the cathode circuit and the auxiliary grid 12*d*. Radio frequency bypass condenser 39 connects across the source of high potential 17 in the position shown.

The tetrode 1 constituting the master oscillator is not used as a screen grid tube as is the case of the tetrode which constitutes the power amplifier 12. It will be observed that the auxiliary grid 1*d* of the master oscillator tube 1 does not have a connection to the cathode through a bypass condenser but is independently supplied with potential through the choke coil 20 from the tap 21 on the potentiometer 22. The power amplifier tube 12 functions as a screen grid tube by virtue of the connection of the auxiliary grid 12*d* as shown.

When the load circuit of a power amplifier is tuned to resonance corresponding in frequency to that frequency determined by the adjustment of the elements 3 and 26 in the coupling circuit between the master oscillator and the power amplifier, there is a tendency for a small change of the frequency of the master oscillator circuit to take place when the power amplifier passes through the resonance point due to unbalanced load reactions.

In the system of my invention, this tendency is compensated by placing an opposing radio frequency voltage on the auxiliary grid 1*d* and this is accomplished by connecting the grid through the balancing condenser 24 to a source of potential at tap 25 on inductance 3. A variation of the potential on the auxiliary grid 1*d* also manifests itself in the master oscillator by changing the frequency of oscillation thereof, and this phenomenon is utilized to compensate for the change of frequency of the master oscillator due to disturbances in the coupling inductance by applying to the auxiliary grid 1*d* a potential proportional to that of the disturbances and of such polarity as to neutralize or compensate for the frequency change tendency in the master oscillator due to such disturbances. The opposing radio frequency voltages which are imposed upon the auxiliary grid 1*d* are chosen to be of such amplitude and polarity as to compensate for the frequency change tendency caused by the surges which are introduced in the resonant coupling circuit 3—26 under conditions of tuning resonant circuit 32 in the power amplifier system. By shifting the tap 25 along the inductance 3 and varying the effective capacity of the balancing condenser 24, a slight disturbance in inductance 3 brought about by tuning the resonant circuit 32 through resonance is caused to slightly change the potential of auxiliary grid 1*d* of the tetrode 1 which operates as the master oscillator to partially compensate for the resonance reaction. Where such surges are of relatively large amplitude, the compensating potential is increased by shifting the tap 25 along inductance 3 to a position where a greater potential is introduced upon the auxiliary grid 1*b* and where the surges due to changes in resonance conditions are of smaller amplitude, the position of the tap 25 is shifted along inductance 3 to introduce a proportionate amount of compensating voltages in the auxiliary grid 1*d*.

While I have described my invention in one of its preferred embodiments, I desire that it be understood that modifications may be made and that no limitations upon my invention are intended other than are imposed by the scope of the appended claims.

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

1. In a high frequency transmission system, a master oscillator circuit, a power amplifier circuit, said circuits each including a tetrode, input and output circuits interconnecting the electrodes of said tetrodes. a resonant coupling circuit disposed between the circuits of said master oscillator and the input circuit of said power amplifier, a resonant circuit connected with the output of said power amplifier, and means connecting one of the electrodes of the tetrode constituting said master oscillator with a point in said resonant coupling circuit for compensating for reactionary effects developed by changing the resonant condition in the resonant circuit in the output of said power amplifier.

2. In a high frequency transmission system, a master oscillator circuit, a power amplifier circuit, said circuits each including a tetrode, input and output circuits interconnecting the electrodes of said tetrodes, a resonant coupling circuit disposed between the circuits of said master oscillator and the input circuit of said power amplifier, a resonant circuit connected with the output of said power amplifier and a tap on said resonant coupling circuit connected to one of the electrodes in the tetrode comprising said master oscillator for establishing a current path to said master oscillator for compensating for reactionary effects developed by changing the resonant condition in the resonant circuit in the output of said power amplifier.

3. In a high frequency transmission system, a master oscillator circuit, a power amplifier circuit, said circuits each including a tetrode, input and output circuits interconnecting the electrodes of said tetrodes, a resonant coupling circuit disposed between the circuits of said master oscillator and the input circuit of said power amplifier, a resonant circuit connected with the output of said power amplifier, and a radio frequency path extending from a tap on said resonant coupling circuit to one of the electrodes of the tetrode constituting said master oscillator for establishing a current path to said master oscillator for compensating for reactionary effects developed by changing the resonant condition in the resonant circuit in the output of said power amplifier.

4. In a high frequency transmission system, a master oscillator circuit, a power amplifier circuit, said circuits each including a tetrode, input and output circuits interconnecting the electrodes of said tetrodes, a resonant coupling circuit disposed between the circuits of said master oscillator and the input circuit of said power amplifier, a resonant circuit connected with the output of said power amplifier, and a selectively tuned path interconnecting said resonant coupling circuit and one of the electrodes of the tetrode constituting said master oscillator for establishing a current path to said master oscillator for compensating for reactionary effects developed by changing the resonant condition in the resonant circuit in the output of said power amplifier.

5. In a high frequency transmission system, a master oscillator circuit, a power amplifier circuit, said circuits each including an electron tube having a cathode, an anode, a control grid and an auxiliary grid, input and output circuits interconnecting said control grid, said cathode and said anode, a resonant coupling circuit disposed between the output circuit of said master oscillator and the input circuit of said power amplifier, a resonant circuit connected with the output of said power amplifier, and a connection extending between a selected point in said resonant coupling circuit to the auxiliary grid of said master oscillator tube for compensating for reactionary effects developed by changing the resonant condition in the resonant circuit in the output of said power amplifier.

6. In a high frequency transmission system, a master oscillator circuit, a power amplifier circuit, said circuits each including an electron tube having a cathode, an anode, a control grid and an auxiliary grid, input and output circuits interconnecting said control grid, said cathode and said anode, a resonant coupling circuit disposed between the output circuit of said master oscillator and the input circuit of said power amplifier, a resonant circuit connected with the output of said power amplifier, and a tuned radio frequency path between a point in said resonant coupling circuit to said auxiliary grid for compensating for reactionary effects developed by changing the resonant condition in the resonant circuit in the output of said power amplifier.

7. In a high frequency transmission system, a master oscillator circuit, a power amplifier circuit, said circuits each including an electron tube having a cathode, an anode, a control grid and an auxiliary grid, input and output circuits interconnecting said control grid, said cathode and said anode, a resonant coupling circuit disposed between the output circuit of said master oscillator and the input circuit of said power amplifier, a resonant circuit connected with the output of said power amplifier, a tuned radio frequency path extending between a point in said resonant coupling circuit to said auxiliary grid of said master oscillator tube for establishing a current path to said master oscillator for compensating for reactionary effects developed by changing the resonant condition in the resonant circuit in the output of said power amplifier, a source of potential for energizing the circuits of said electron tubes, a potentiometer connected across said source of potential, and a connection leading from an adjustable tap on said potentiometer to the auxiliary grid of the tube constituting said master oscillator.

8. In a high frequency transmission system, a master oscillator circuit, a power amplifier circuit, said circuits each including an electron tube having a cathode, an anode, a control grid and an auxiliary grid, input and output circuits interconnecting said control grid, said cathode and said anode, a resonant coupling circuit disposed between the output circuit of said master oscillator and the input circuit of said power amplifier, a resonant circuit connected with the output of said power amplifier, a tuned radio frequency path extending between a point in said resonant coupling circuit to said auxiliary

grid of said master oscillator tube for establishing a current path to said master oscillator for compensating for reactionary effects developed by changing the resonant condition in the resonant circuit in the output of said power amplifier, a source of potential for energizing the circuits of said electron tubes, a potentiometer connected across said source of potential, a connection leading from an adjustable tap on said potentiometer to the auxiliary grid of the tube constituting said master oscillator, and means in said last mentioned connection for excluding surges of radio frequency currents through said potentiometer.

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