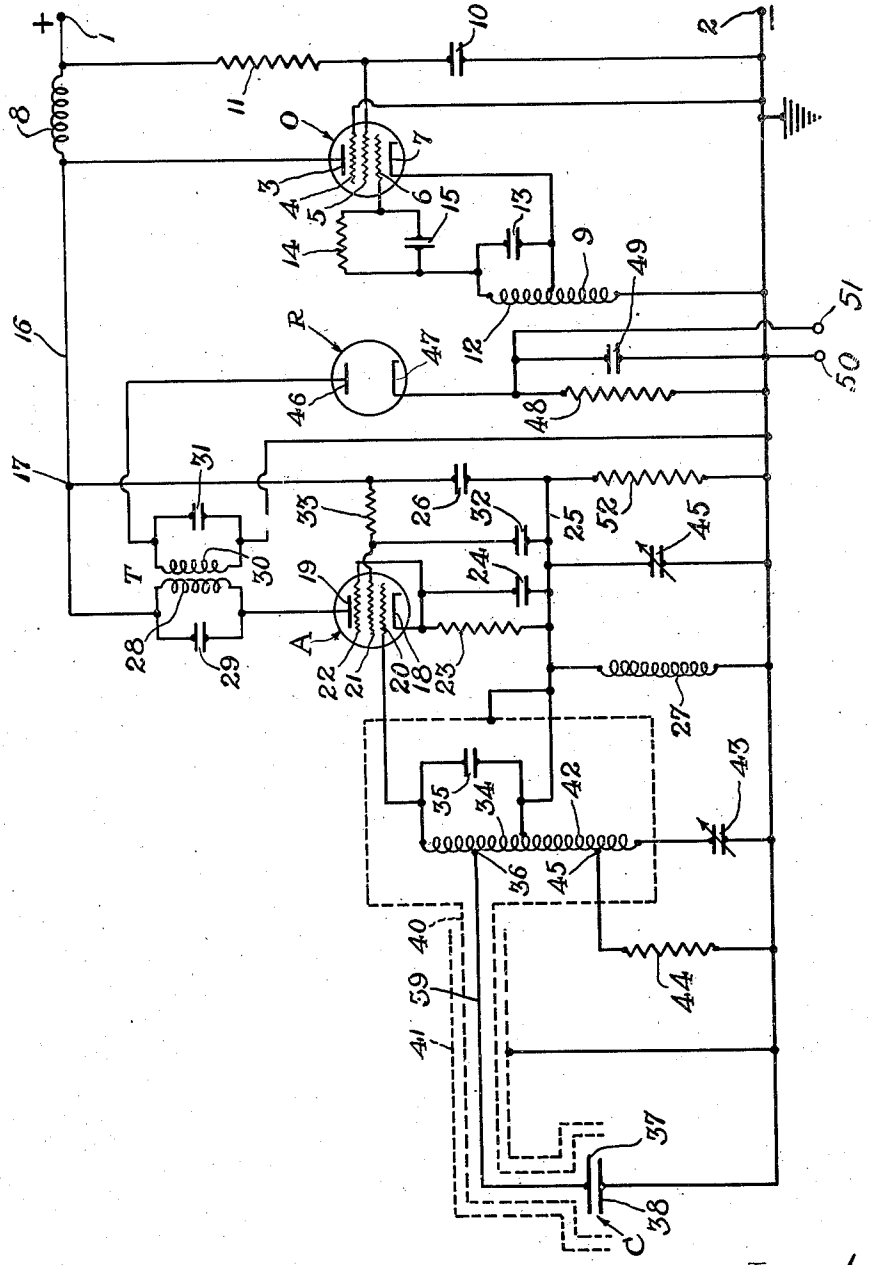
Aug. 7, 1945. J. C. FROMMER 2,381,155

ELECTRIC CIRCUIT

Filed Feb. 18, 1943



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Patented Aug. 7, 1945

2,381,155

UNITED STATES PATENT OFFICE

2,381,155

ELECTRIC CIRCUITS

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Application February 18, 1943, Serial No. 476,361

31 Claims. (Cl. 250—27)

This invention relates to electrical circuits in which use is made of small changes of a capacitance as a means for influencing an amplifying system which in turn acts upon a further circuit belonging to an indicating, measuring, controlling, recording or similar device.

One object of this invention is the provision of an electrical circuit of the kind referred to in which the controlling effect upon the amplifying system is dependent on the changes of said capacitance alone in spite of accidental variations of other capacitances or inductances in the circuit.

A further object of this invention is the provision of an electrical circuit of the kind referred to, in which the cathode and preferably also the whole plate supply system of a vacuum tube amplifier (or the cathode and plate supply system of at least the first tube of such an amplifier if the latter is composed of a plurality of stages) is kept at high frequency potential with respect to ground derived from an oscillator tube, one side of the capacitance mentioned being connected to ground.

A further object of this invention is the provision of a shielding device for a conductor arranged between the capacitance mentioned and an amplifier having its cathode on high frequency potential with respect to ground.

A still further object of the invention is the provision of means for feeding to the amplifier a high frequency potential which is opposite in phase to that derived from the capacitance mentioned.

My invention, both as to its organization and operation, together with further objects and advantages thereof may be best understood by reference to the following description taken in connection with the accompanying drawing which represents by way of example an embodiment of my invention.

In the drawing, 1 and 2 denote the terminals of a direct current power supply, the negative terminal being grounded. A tube O, represented in the drawing as being of the pentode type is used as an electron-coupled oscillator, having its plate 3 connected across a choke coil 8 to the positive terminal 1, whereas its cathode 7 is connected through a coil 9 to ground and its suppressor grid 4 to ground. The second grid 5 is connected through a condenser 10 to ground and across a resistor 11 to the positive terminal 1 of the power supply. Closely coupled to coil 9 is a tuned circuit 12, 13 which has its one end connected to the cathode 7 and its other end to the control grid 6 of the oscillator, the latter connection being made across a resistor 14 which lies parallel to a condenser 15. The oscillator tube O generates between its control grid and screen grid high frequency oscillations in a well known manner so that a high frequency (H. F.) potential will exist along the lead 16 and in particular also at the point 17 of this lead.

C denotes the capacitance whose changes are intended to be indicated, measured, recorded or otherwise to be utilized for influencing a controlled circuit. While in the drawing this capacitance is indicated by the symbol of a condenser having two plates; I wish it to be understood that this capacitance may be in the form of any device capable of producing a change of capacitive reactance, e. g. as the consequence of a change of position of a moveable element relative to one or more fixed elements.

The capacitance C is connected in a manner to be presently described into the input circuit of a vacuum tube amplifier A. The amplifier is illustrated in the drawing as a single stage amplifier; it should be noted, however, that a multiple stage or multiple tube amplifier could be used in which case the tube A shown in the drawing should be regarded as representing the first tube of such an amplifier. The tube A has a cathode 18, a plate 19, and between said cathode and plate at least one grid electrode. In the example shown, the tube A is of the pentode type having a control grid 20, a screen grid 21 and a suppressor grid 22. The cathode 18 is connected to a lead 25 through a bias generating resistor 23 which is shunted by a by-pass condenser 24. The lead 25 is connected across a condenser 26 to the point 17 of the lead 16 and across a coil 27 to ground. Thus the cathode 18 is receiving the H. F. potential existing at point 17.

A load impedance, which in the example shown is constituted by a coil 28 in parallel to a condenser 29, is connected between the plate 19 and the point 17 so that the plate supply is at the same H. F. potential as the cathode 18. The coil 28 forms the primary winding of an H. F. transformer T which has its secondary winding 30 connected in parallel to a condenser 31 and which, by means of the two tuning circuits 28, 29 and 30, 31, may be tuned to the frequency generated by the oscillator O. It is preferable to make the coupling between the two tuned circuits 28, 29 and 30, 31 close.

The screen grid 21 is connected through a condenser 32 to the lead 25 and through a resistor 33 to point 17. Thereby also the screen grid 21 is held at the H. F. potential of the cathode 18.

A tuned circuit 34, 35 is inserted into the control grid circuit of the amplifier having its one end connected to the control grid 20 and its other end to the lead 25. A conductor 39 connects the one plate 37 of the capacitance C to the control grid 20, preferably not directly but, as shown, via a portion of the inductance 34, the conductor 39 being attached to a tap point 36 of said inductance 34. The other plate 38 of the capacitance is connected to ground.

The cathode 18 of the amplifier tube A being on H. F. potential with respect to ground, any variations of the capacity occurring between the conductor 39 and ground or nearby grounded conductors would materially affect the input of the amplifier. To prevent unwanted interference, I surround the conductor 39 by shielding means comprising a shield 40 connected to the H. F. lead 25 and concentrically thereto a second shield 41 connected to ground. With such a shielding arrangement it will be unobjectionable to make the connection between the capacitance C and the amplifier input flexible where such a flexible connection may be desirable. The conductor 39 as well as both shields 40 and 41, at least as far as these shields surround the conductor 39, may be made of flexible material and these parts may be combined so as to form a flexible cable.

To connect the conductor 39, as before stated, to the tap point 36 instead of to the upper end of the coil 34 (i. e., instead directly to the grid 20) makes for a considerable improvement in the ratio between the wanted effect of variations of the capacitance C and the unwanted effect of accidental variations of capacity between the conductor 39 and the inner shield 40. Presuming that the tap point 36 is at

$$\frac{1}{n}\text{th}$$

of the total number of turns of the coil 34 both effects will be diminished, compared with the effects which would occur if the conductor 39 were connected to the top of the coil 34, but whereas the effect of variations of the capacitance C is reduced to

$$\frac{1}{n}$$

the effect of variations of capacity between the conductor 39 and the inner shield 40 is reduced to

$$\frac{1}{n^2}$$

The mentioned loss of sensitivity towards the changes of the capacitance C can obviously easily be made up by increasing the amplification.

In many cases the initial value of the capacitance C may be so high that the input derived from said capacitance would overload an amplifier which is sensitive enough to indicate small enough changes of said capacitance. This difficulty may be overcome by injecting into the grid circuit of the amplifier an H. F. of opposite phase position to that derived from said capacitance. This may be done in the manner shown in the drawing according to which a coil 42 is closely coupled with the coil 34 of the tuned circuit 34, 35 and connected through an adjustable condenser 43 to ground. The condenser 43 supplies to the coil 42 an H. F. current which will create at the opposite end of the coil 34 a voltage having a phase difference of approximately 180° towards the voltage derived from the current flowing across the capacitance C. Thus the control grid 20 of the amplifier A is fed by the difference of these two voltages. By proper adjustment of the compensating condenser 43 the initial influence of the capacitance C upon the control grid 20 may be compensated fully or to a desired degree. An additional compensating measure, however, will be necessary if a phase shift of the input is caused by currents of ohmic character, such as, e. g., creeping currents existing between the plates of the condenser 43. In such cases the combination of the transformer 34, 42 with the condenser 43 would not bring about a complete compensation and, therefore, I provide an ohmic resistor 44 between ground and a tap point of one of the coils 34 or 42. Whether the coil 34 or the coil 42 is to be tapped, will depend on the direction in which the ohmic phase compensation has to be achieved; in the example shown the resistor 44 is connected to a tap point 45 of the coil 42.

Since the H. F. oscillations are generated in an electron-coupled oscillator O the frequency of the oscillations will be independent of the load on the plate 3 of the oscillator O. The amplitude of the H. F. voltage obtained at the plate 3, however, will depend on the impedances which are connected to this plate. Such impedances are: the choke coil 8, the coil 27 via the condenser 26, the capacitance between the inner shield 40 and the outer shield 41, and all stray capacitances. If, for instance, the flexible cable 39, 40, 41 mentioned before is moved, there will occur some change in the capacitance between the two shields 40 and 41. Without any further precaution such a change of capacitance would affect the resulting impedance on the plate 3 of the tube O, and accordingly the H. F. voltage obtained there. I have found that I can reduce the unfavorable effect of such undesired changes to a negligible degree by rendering the resultant impedance on the plate 3 purely ohmic in phase. This can be achieved by tuning to resonance with the frequency of the oscillations generated in the tube O the capacitive and inductive reactances active between point 17 and ground, for which purpose I provide an adjustable condenser 46 between the H. F. lead 25 and ground. A further improvement in this direction can be achieved by keeping the Q value of the tuned circuit comprising the impedances just mentioned appreciably below the usual values, preferably not higher than 5, e. g. by arranging a resistor 52 between lead 25 and ground.

While the measures just described keep the H. F. voltage obtainable from the oscillator practically unaffected by unwanted impedance variations in the amplifying system, the described arrangement of this amplifying system lends itself very readily to known measures for obtaining a flat frequency response, such as a close coupling between the transformer coils 28, 30 and a sufficiently high ratio between inductance and capacitance of the tuned circuits 28, 29; 30, 31; and 34, 35, keeping thereby the amplifying system substantially insensitive towards slight accidental changes of the oscillator frequency or of a capacitance or inductance of the tuned circuits mentioned.

The output of the amplifier tube A may be further amplified, converted and rectified for being used for the desired purpose. In the example shown in the drawing the output of the tube A is brought without further amplification or conversion to a diode rectifier R by means of the transformer T. The plate 46 of the diode is connected to the tuned circuit 30, 31 whereas the cathode 47 is connected to ground through a resistor 48 shunted by condenser 49. The rec-

tified output is available at terminals 50, 51 and may be brought from there to the grid of another tube (not shown).

What I claim is:

1. In an electric circuit to be influenced by small changes of a capacitance, an oscillator tube, a point supplied with high frequency potential from said oscillator tube, a vacuum tube amplifier having at least one discharge system which comprises a cathode, an anode and at least one grid electrode, said cathode being connected to said point of high frequency potential for maintaining said cathode at a high frequency potential with respect to ground, a conductor connecting one plate of said capacitance to a point of the input circuit of said vacuum tube amplifier the other plate of said capacitance being connected to ground, and shielding means for said conductor connected to said point of high frequency potential.

2. In an electric circuit to be influenced by small changes of a capacitance, an oscillator tube, a point supplied with high frequency potential from said oscillator tube, a vacuum tube amplifier having at least one discharge system which comprises a cathode, an anode and at least one electrode, said cathode being connected to said point of high frequency potential for maintaining said cathode at a high frequency potential with respect to ground, a flexible conductor connecting one plate of said capacitance to a point of the input circuit of said vacuum tube amplifier the other plate of said capacitance being connected to ground, and flexible shielding means for said conductor connected to said point of high frequency potential.

3. In an electric circuit to be influenced by small changes of a capacitance, an oscillator tube, a point supplied with high frequency potential from said oscillator tube, a vacuum tube amplifier having at least one discharge system which comprises a cathode, an anode and at least one grid electrode, said cathode being connected to said point of high frequency potential for maintaining said cathode at a high frequency potential with respect to ground, a conductor connecting one plate of said capacitance to a point of the input circuit of said vacuum tube amplifier, shielding means surrounding said conductor and comprising two concentric shields, the inner of said shields being connected to said point of high frequency potential and the outer to ground, the other plate of said capacitance also being connected to ground.

4. In an electric circuit to be influenced by small changes of a capacitance, an oscillator tube, a point supplied with high frequency potential from said oscillator tube, a vacuum tube amplifier having at least one discharge system which comprises a cathode, an anode and at least one grid electrode, said cathode being connected to said point of high frequency potential for maintaining said cathode at a high frequency potential with respect to ground, a flexible conductor connecting one plate of said capacitance to a point of the input circuit of said vacuum tube amplifier, shielding means surrounding said conductor and comprising two concentric flexible shields, the inner of said shields being connected to said point of high frequency potential and the outer to ground, the other plate of said capacitance also being connected to ground.

5. In an electric circuit to be influenced by small changes of a capacitance, an oscillator tube, a point supplied with high frequency potential from said oscillator tube, a vacuum tube amplifier having at least one discharge system which comprises a cathode, an anode and at least one grid electrode, said cathode being connected by means of a coil to ground and being further connected to said point of high frequency potential for maintaining said cathode at a high frequency potential with respect to ground, a conductor connecting one plate of said capacitance to a point of the input circuit of said vacuum tube amplifier, shielding means for said conductor comprising two concentric shields, the inner of said shields being connected to high frequency potential and the outer to ground, the other plate of said capacitance also being connected to ground.

6. In an electric circuit to be influenced by small changes of a capacitance, an oscillator tube, a point supplied with high frequency potential from said oscillator tube, a vacuum tube amplifier having at least one discharge system which comprises a cathode, an anode and at least one grid electrode, said cathode being connected to said point of high frequency potential for maintaining said cathode at a high frequency potential with respect to ground, a conductor connecting one plate of said capacitance to a point of the input circuit of said vacuum tube amplifier the other plate of said capacitance being connected to ground, shielding means for said conductor connected to said point of high frequency potential, and a load impedance connected between said anode and a point having the same high frequency potential as said cathode.

7. In an electric circuit to be influenced by small changes of a capacitance, an oscillator tube, a point supplied with high frequency potential from said oscillator tube, a vacuum tube amplifier having at least one discharge system which comprises a cathode, an anode and at least one grid electrode, said cathode being connected to said point of high frequency potential for imparting to said cathode high frequency potential with respect to ground, a conductor connecting one plate of said capacitance to a point of the input circuit of said vacuum tube amplifier, shielding means for said conductor comprising two concentric shields, the inner of said shields being connected to said point of high frequency potential and the outer to ground, the other plate of said capacitance also being connected to ground, and a load impedance connected between said anode and a point having the same high frequency potential as said cathode.

8. In an electric circuit to be influenced by small changes of a capacitance, an oscillator tube, a point supplied with high frequency potential from said oscillator tube, a vacuum tube amplifier having at least one discharge system which comprises a cathode, an anode and at least one grid electrode, said cathode being connected to said point of high frequency potential for imparting to said cathode high frequency potential with respect to ground, a flexible conductor connecting one plate of said capacitance to a point of the input circuit of said vacuum tube amplifier, shielding means for said conductor comprising two concentric flexible shields, the inner of said shields being connected to said point of high frequency potential and the outer to ground, the other plate of said capacitance also being connected to ground, and a load impedance connected between said anode and a point having the same high frequency potential as said cathode.

9. In an electric circuit to be influenced by

small changes of a capacitance, an oscillator tube, a vacuum tube amplifier having at least one discharge system which comprises a cathode, an anode and at least one grid electrode, a connection between said cathode and said oscillator tube for imparting high frequency potential with respect to ground to said cathode, a tuned circuit inserted into the grid circuit of said vacuum tube amplifier, said capacitance being connected to a tap point of the inductance of said tuned circuit and a load impedance connected between said anode and a point having the same high frequency potential as said cathode.

10. In an electric circuit to be influenced by small changes of a capacitance, an oscillator tube, a point supplied with high frequency potential from said oscillator tube, a vacuum tube amplifier having at least one discharge system which comprises a cathode, an anode and at least one grid electrode, a connection between said cathode and said point of high frequency potential imparting high frequency potential with respect to ground to said cathode, a conductor connecting one plate of said capacitance to a point of the input circuit of said amplifier, shielding means for said conductor comprising two concentric shields, the inner of said shields being connected to said point of high frequency potential and the outer to ground, the other plate of said capacitance also being connected to ground, and a condenser arranged between said cathode and ground for tuning to resonance with the frequency of said oscillator tube the reactances existing between said point of high frequency potential and ground.

11. In an electric circuit to be influenced by small changes of a capacitance, an oscillator tube, a point supplied with high frequency potential from said oscillator tube, a vacuum tube amplifier having at least one discharge system which comprises a cathode, an anode and at least one grid electrode, said cathode being connected by means of a coil to ground and being further connected to said point of high frequency potential for maintaining said cathode at a high frequency potential with respect to ground, a conductor connecting one plate of said capacitance to a point of the input circuit of said amplifier, shielding means for said conductor comprising two concentric shields, the inner of said shields being connected to said point of high frequency potential and the outer to ground, the other plate of said capacitance also being connected to ground, and a condenser arranged between said cathode and ground for tuning to resonance with the frequency of said oscillator tube the reactances existing between said point of high frequency potential and ground.

12. In an electric circuit to be influenced by small changes of a capacitance, an oscillator tube, a point supplied with high frequency potential from said oscillator tube, a vacuum tube amplifier having at least one discharge system which comprises a cathode, an anode and of grid electrodes at least a control grid and a screen grid, a connection between said cathode and said point of high frequency potential for imparting high frequency potential with respect to ground to said cathode, a load impedance connected between said anode and a point having the same high frequency potential as said cathode, said screen grid being connected so as to receive the same high frequency potential as said cathode, a tuned circuit inserted into the control grid circuit of said vacuum tube amplifier, a conductor connecting one plate of said capacitance to a point of the inductance of said tuned circuit, and shielding means for said conductor comprising two concentric shields, the inner of said shields being connected to said point of high frequency potential and the outer to ground, the other plate of said capacitance also being connected to ground.

13. In an electric circuit to be influenced by small changes of a capacitance, an oscillator tube, a point supplied with high frequency potential from said oscillator tube, a vacuum tube amplifier having at least one discharge system which comprises a cathode, an anode and of grid electrodes at least a control grid and a screen grid, a connection between said cathode and said point of high frequency potential for imparting high frequency potential with respect to ground to said cathode, a load impedance connected between said anode and a point having the same high frequency potential as said cathode, said screen grid being connected so as to receive the same high frequency potential as said cathode, a conductor connecting one plate of said capacitance to a point of the control grid circuit of said amplifier, shielding means for said conductor comprising two concentric shields, the inner of said shields being connected to said point of high frequency potential and the outer to ground, the other plate of said capacitance also being connected to ground, and a condenser arranged between said cathode and ground for tuning to resonance with the frequency of said oscillator tube the reactances existing between said point of high frequency potential and ground.

14. In an electric circuit to be influenced by small changes of a capacitance, an oscillator tube, a point supplied with high frequency potential from said oscillator tube, a vacuum tube amplifier having at least one discharge system which comprises a cathode, an anode and of grid electrodes at least a control grid and a screen grid, a connection between said cathode and said oscillator tube for imparting high frequency potential with respect to ground to said cathode, a load impedance connected between said anode and a point having the same high frequency potential as said cathode, said screen grid being connected so as to receive the same high frequency potential as said cathode, a tuned circuit inserted into the control grid circuit of said vacuum tube amplifier, a conductor connecting one plate of said capacitance to a tap point of the inductance of said tuned circuit, shielding means for said conductor comprising two concentric shields, the inner of said shields being connected to said point of high frequency potential and the outer to ground, the other plate of said capacitance also being connected to ground, and a condenser arranged between said cathode and ground for tuning to resonance with the frequency of said oscillator tube the reactances existing between said point of high frequency potential and ground.

15. In an electric circuit to be influenced by small changes of a capacitance, an oscillator tube, a point supplied with high frequency potential from said oscillator tube, a vacuum tube amplifier having at least one discharge system which comprises a cathode, an anode and at least one grid electrode, said cathode being connected to said point of high frequency potential for maintaining the cathode at a high frequency potential with respect to ground, a tuned circuit inserted into the control grid circuit of

said vacuum tube amplifier, a conductor connecting one plate of said capacitance to a point of the inductance of said tuned circuit, phase shifting means connected between ground and said grid electrode and including at least a part of the inductance of said tuned circuit for supplying to said grid electrode a high frequency potential approximately opposite in phase to that derived from said capacitance, and shielding means for said conductor connected to said point of high frequency potential.

16. In an electric circuit to be influenced by small changes of a capacitance, an oscillator tube, a point supplied with high frequency potential from said oscillator tube, a vacuum tube amplifier having at least one discharge system which comprises a cathode, an anode and at least one grid electrode, said cathode being connected to said point of high frequency potential for maintaining the cathode at a high frequency potential with respect to ground, a tuned circuit inserted into the control grid circuit of said vacuum tube amplifier, a conductor connecting one plate of said capacitance to a point of the inductance of said tuned circuit, phase shifting means connected between ground and said grid electrode and including at least a part of the inductance of said tuned circuit for supplying to said grid electrode a high frequency potential approximately opposite in phase to that derived from said capacitance, and shielding means for said conductor comprising two concentric shields, the inner of said shields being connected to said point of high frequency potential and the other to ground, the other plate of said capacitance also being connected to ground.

17. In an electric circuit to be influenced by small changes of a capacitance, an oscillator tube, a point supplied with high frequency potential from said oscillator tube, a vacuum tube amplifier having at least one discharge system which comprises a cathode, an anode and at least one grid electrode, said cathode being connected to said point of high frequency potential for maintaining the cathode at a high frequency potential with respect to ground, a tuned circuit inserted into the control grid circuit of said vacuum tube amplifier, a conductor connecting one plate of said capacitance to a tap point of the inductance of said tuned circuit, phase shifting means connected between ground and said grid electrode and including at least a part of the inductance of said tuned circuit for supplying to said grid electrode a high frequency potential approximately opposite in phase to that derived from said capacitance, and shielding means for said conductor comprising two concentric shields, the inner of said shields being connected to said point of high frequency potential and the other to ground, the other plate of said capacitance also being connected to ground.

18. In an electric circuit to be influenced by small changes of a capacitance, an oscillator tube, a point supplied with high frequency potential from said oscillator tube, a vacuum tube amplifier having at least one discharge system which comprises a cathode, an anode and at least one grid electrode, said cathode being connected by means of a coil to ground and being further connected to said point of high frequency potential for maintaining the cathode at a high frequency potential with respect to ground, a tuned circuit inserted into the control grid circuit of said vacuum tube amplifier, a conductor connecting one plate of said capacitance to a point of the inductance of said tuned circuit, compensating means comprising a condenser connected between ground and a coil coupled to the inductance of said tuned circuit, shielding means for said conductor comprising two concentric shields, the inner of said shields being connected to said point of high frequency potential and the other to ground, the other plate of said capacitance also being connected to ground.

19. In an electric circuit to be influenced by small changes of a capacitance, an oscillator tube, a point supplied with high frequency potential from said oscillator tube, a vacuum tube amplifier having at least one discharge system which comprises a cathode, an anode and at least one grid electrode, said cathode being connected by means of a coil to ground and being further connected to said point of high frequency potential for maintaining the cathode at a high frequency potential with respect to ground, a tuned circuit inserted into the control grid circuit of said vacuum tube amplifier, a conductor connecting one plate of said capacitance to a point of the inductance of said tuned circuit, compensating means comprising a condenser connected between ground and a coil coupled to the inductance of said tuned circuit and a resister connected with one end to a point between grid and ground adapted to provide a compensation out of phase with the compensating effect provided by said condenser, shielding means for said conductor comprising two concentric shields, the inner of said shields being connected to said point of high frequency potential and the other to ground, the other plate of said capacitance also being connected to ground.

20. In an electric circuit to be influenced by small changes of a capacitance, an oscillator tube, a point supplied with high frequency potential from said oscillator tube, a vacuum tube amplifier having at least one discharge system which comprises a cathode, an anode and at least one grid electrode, said cathode being connected to said point of high frequency potential for maintaining the cathode at a high frequency potential with respect to ground, a tuned circuit inserted into the control grid circuit of said vacuum tube amplifier, a conductor connecting one plate of said capacitance to a point of the inductance of said tuned circuit, shielding means for said conductor connected to said point of high frequency potential, and a condenser arranged between said cathode and ground for tuning to resonance with the frequency of said oscillator tube the reactances existing between said point of high frequency potential and ground.

21. In an electric circuit to be influenced by small changes of a capacitance, an oscillator tube, a point supplied with high frequency potential from said oscillator tube, a vacuum tube amplifier having at least one discharge system which comprises a cathode, an anode and at least one grid electrode, said cathode being connected by means of a coil to ground and being further connected to said point of high frequency potential for maintaining the cathode at a high frequency potential with respect to ground, a load impedance connected between said anode and said point of high frequency potential, a tuned circuit inserted into the control grid circuit of said vacuum tube amplifier, a conductor connecting one plate of said capacitance to a point of the inductance of said tuned circuit, shielding means for said conductor comprising two concentric shields, the inner of said shields being connected to said point

of high frequency potential and the other to ground, the other plate of said capacitance also being connected to ground, and a condenser arranged between said cathode and ground for tuning to resonance with the frequency of said oscillator tube the reactances existing between said point of high frequency potential and ground.

22. In an electric circuit to be influenced by small changes of a capacitance, an oscillator tube, a point supplied with high frequency potential from said oscillator tube, a vacuum tube amplifier having at least one discharge system which comprises a cathode, an anode and at least one grid electrode, said cathode being connected by means of a coil to ground and being further connected to said point of high frequency potential for maintaining the cathode at a high frequency potential with respect to ground, a load impedance connected between said anode and said point of high frequency potential, a tuned circuit inserted into the control grid circuit of said vacuum tube amplifier, a conductor connecting one plate of said capacitance to a point of the inductance of said tuned circuit, phase shifting means connected between ground and said grid electrode and including at least a part of the inductance of said tuned circuit for supplying to said grid electrode a high frequency potential approximately opposite in phase to that derived from said capacitance, shielding means for said conductor comprising two concentric shields, the inner of said shields being connected to said point of high frequency potential and the other to ground, and a condenser arranged between said cathode and ground for tuning to resonance with the frequency of said oscillator tube the reactances existing between said point of high frequency potential and ground.

23. In an electric circuit to be influenced by small changes of a capacitance, an oscillator tube, a point supplied with high frequency potential from said oscillator tube, a vacuum tube amplifier having at least one discharge system which comprises a cathode, an anode and at least one grid electrode, said cathode being connected by means of a coil to ground and being further connected to said point of high frequency potential for maintaining the cathode at a high frequency potential with respect to ground, a load impedance connected between said anode and said point of high frequency potential, a tuned circuit inserted into the control grid circuit of said vacuum tube amplifier, a conductor connecting one plate of said capacitance to a tap point of the inductance of said tuned circuit, phase shifting means connected between ground and said grid electrode and including at least a part of the inductance of said tuned circuit for supplying to said control grid a high frequency potential approximately opposite in phase to that derived from said capacitance, shielding means for said conductor comprising two concentric shields, the inner of said shields being connected to said point of high frequency potential and the other to ground, the other plate of said capacitance also being connected to ground, and a condenser arranged between said cathode and ground for tuning to resonance with the frequency of said oscillator tube the reactances existing between said point of high frequency potential and ground.

24. In an electric circuit to be influenced by small changes of a capacitance, an oscillator tube, a point supplied with high frequency potential from said oscillator tube, a vacuum tube amplifier having at least one discharge system which comprises a cathode, an anode and at least one grid electrode, said cathode being connected to said point of high frequency potential for maintaining the cathode at a high frequency potential with respect to ground, a tuned circuit inserted into the control grid circuit of said vacuum tube amplifier, a conductor connecting one plate of said capacitance to a point of the induction of said tuned circuit, shielding means for said conductor connected to said point of high frequency potential, and a transformer coupling the output of one discharge system of said amplifier to a following tube.

25. In an electric circuit to be influenced by small changes of a capacitance, an oscillator tube, a point supplied with high frequency potential from said oscillator tube, a vacuum tube amplifier having at least one discharge system which comprises a cathode, an anode and at least one grid electrode, said cathode being connected to said point of high frequency potential for maintaining the cathode at a high frequency potential with respect to ground, a tuned circuit inserted into the control grid circuit of said vacuum tube amplifier, a conductor connecting one plate of said capacitance to a point of the inductance of said tuned circuit, shielding means for said conductor comprising two concentric shields, the inner of said shields being connected to said point of high frequency potential and the other to ground, the other plate of said capacitance also being connected to ground.

26. In an electric circuit to be influenced by small changes of a capacitance, an oscillator tube, a point supplied with high frequency potential from said oscillator tube, a vacuum tube amplifier having at least one discharge system which comprises a cathode, an anode and at least one grid electrode, said cathode being connected by means of a coil to ground and being further connected to said point of high frequency potential for maintaining the cathode at a high frequency potential with respect to ground, a tuned circuit inserted into the control grid circuit of said vacuum tube amplifier, a conductor connecting one plate of said capacitance to a point of the inductance of said tuned circuit, phase shifting means connected between ground and said grid electrode and including at least a part of the inductance of said tuned circuit for supplying to said control grid a high frequency potential approximately opposite in phase to that derived from said capacitance, shielding means for said conductor comprising two concentric shields, the inner of said shields being connected to said point of high frequency potential and the other to ground, the other plate of said capacitance also being connected to ground.

27. In an electric circuit to be influenced by small changes of a capacitance, an oscillator tube, a point supplied with high frequency potential from said oscillator tube, a vacuum tube amplifier having at least one discharge system which comprises a cathode, an anode and at least one grid electrode, said cathode being connected by means of a coil to ground and being further connected to said point of high frequency potential for maintaining the cathode at a high frequency potential with respect to ground, a tuned circuit inserted into the control grid circuit of said vacuum tube amplifier, a conductor connecting one plate of said capacitance to a point of the inductance of said tuned circuit, phase shifting means connected between ground

and said grid electrode and including at least a part of the inductance of said tuned circuit for supplying to said control grid a high frequency potential approximately opposite in phase to that derived from said capacitance, shielding means for said conductor comprising two concentric shields, the inner of said shields being connected to said point of high frequency potential and the other to ground, the other plate of said capacitance also being connected to ground, a condenser arranged between said cathode and ground for tuning to resonance with the frequency of said oscillator tube the reactanaces existing between said point of high frequency potential and ground, and a transformer coupling the output of one discharge system of said amplifier to a following tube, both windings of said transformer forming parts of tuned circuits.

28. In an electric circuit to be influenced by small changes of a capacitance, an oscillator tube, a point supplied with high frequency potential from said oscillator tube, a vacuum tube amplifier having at least one discharge system which comprises a cathode, an anode and at least one grid electrode, said cathode being connected by means of a coil to ground and being further connected to said point of high frequency potential for maintaining the cathode at a high frequency potential with respect to ground, a load impedance connected between said anode and said point of high frequency potential, a tuned circuit inserted into the control grid circuit of said vacuum tube amplifier, a conductor connecting one plate of said capacitance to a point of the inductance of said tuned circuit, phase shifting means connected between ground and said grid electrode and including at least a part of the inductance of said tuned circuit for supplying to said control grid a high frequency potential approximately opposite in phase to that derived from said capacitance, shielding means for said conductor comprising two concentric shields, the inner of said shields being connected to said point of high frequency potential and the other to ground, the other plate of said capacitance also being connected to ground, a condenser arranged between said cathode and ground for tuning to resonance with the frequency of said oscillator tube the reactances existing between said point of high frequency potential and ground, and a transformer coupling the output of one discharge system of said amplifier to a following tube, both windings of said transformer forming parts of tuned circuits, of which the one which includes the primary winding of said transformer is used as said load impedance.

29. In an electric circuit to be influenced by small changes of a capacitance, an oscillator tube, a point supplied with high frequency potential from said oscillator tube, a vacuum tube amplifier having at least one discharge system which comprises a cathode, an anode and at least one grid electrode, a connection between said cathode and said oscillator tube imparting high frequency potential with respect to ground to said cathode, a conductor connecting one plate of said capacitance to a point of the input circuit of said amplifier, shielding means for said conductor comprising two concentric shields, the inner of said shields being connected to said point of high frequency potential and the outer to ground, the other plate of said capacitance also being connected to ground, a condenser arranged between said cathode and ground for tuning to resonance with the frequency of said oscillator tube the reactances existing between said point of high frequency potential and ground, the circuit tuned by said condenser having a Q value not higher than 5.

30. In an electric circuit to be influenced by small changes of a capacitance, an oscillator tube, a point supplied with high frequency potential from said oscillator tube, a vacuum tube amplifier having at least one discharge system which comprises a cathode, an anode and at least one grid electrode, said cathode being connected to said point of high frequency potential for imparting to said cathode high frequency potential with respect to ground, and a tuned circuit having connected one end of its inductance to said grid and a point of this inductance to said point of high frequency potential, of the two plates of said capacitance one being connected to another point of said inductance and the other to ground.

31. In an electric circuit to be influenced by small changes of a capacitance, an oscillator tube, a point supplied with high frequency potential from said oscillator tube, a vacuum tube amplifier having at least one discharge system which comprises a cathode, an anode and at least one grid electrode, said cathode being connected to said point of high frequency potential for imparting to said cathode high frequency potential with respect to ground, and a tuned circuit having connected one end of its inductance to said grid and the other end of this inductance to said point of high frequency potential, of the two plates of said capacitance one being connected to a tap point of said inductance and the other to ground.

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