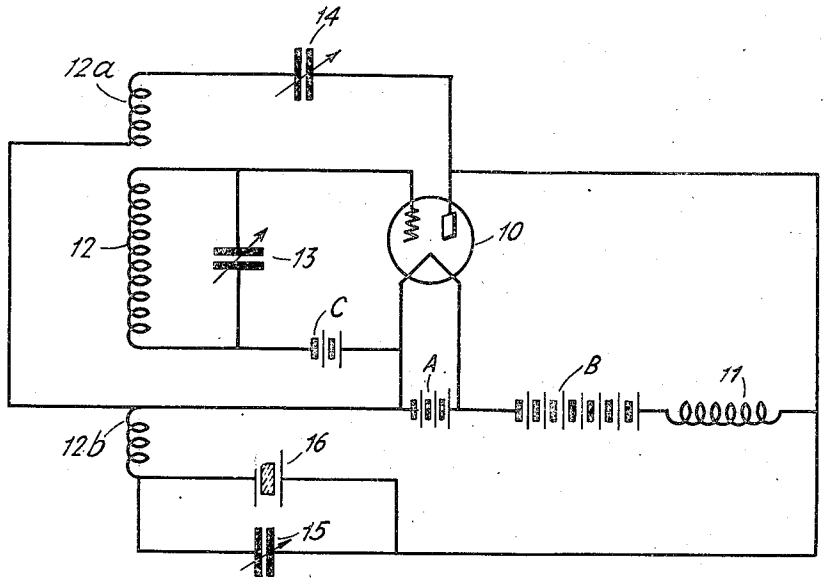
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CRYSTAL CONTROLLED OSCILLATION GENERATOR

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CRYSTAL CONTROLLED OSCILLATION GENERATOR

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8 Claims. (Cl. 250—36)

The present invention is a continuation-in-part of my United States Patent No. 2,027,448, granted January 14, 1936, on an application filed March 21, 1927.

This invention relates to the piezo-electric art and deals more specifically with a piezo-electric crystal controlled oscillator.

It has been found that certain piezo-electric crystals when cut in accordance with the specifications now well known relative to the preparation of such crystals, are set into oscillation only with great difficulty.

It is, therefore, an object of this invention to devise a circuit which is more forceful in causing a piezo-electric crystal to oscillate.

It has also been found that the degree of control exercised by a crystal upon an oscillating circuit is an inverse function of the amount of regeneration necessary to make the crystal oscillate.

These and other objects of the invention will be readily apparent to those skilled in the art from a reading of the following description taken in connection with the accompanying drawing, in which the single figure illustrates a preferred embodiment of my present invention.

Referring to the drawing, there is shown a vacuum tube 10 having the usual filament, grid and plate and also the usual A, B and C batteries connected as shown there being provided a coil 11 in the plate circuit. The input circuit of the vacuum tube 10 comprises the coil 12 and the variable condenser 13 connected in parallel relationship between the grid and filament. A variable condenser 14 in series with a coil 12*a* is connected between the plate and the negative terminal of the filament. Similarly, a neutralizing variable condenser 15 and a coil 12*b* are connected in series between the negative terminal of the filament and the plate of the vacuum tube.

The piezo-electric crystal 16 is shunted across the variable condenser 15.

One possible adjustment is as follows. With the crystal removed from circuit, condensers 15 and 14 and the coupling between coils 12*a*, 12*b* and coil 12 should be such as to completely neutralize the circuit. Oscillation of the crystal will cause a sufficient unbalance such that the crystal acts as a filter, passing energy into the tickler coil 12*b* and causing the production of oscillations at the crystal frequency.

Having thus described my invention, what I claim is:

1. A high frequency oscillation generator comprising an electron discharge device having an anode, cathode, and control electrode, a parallel tuned circuit comprising a first inductance and a capacity between said cathode and said control electrode, a source of anode potential in series with a second inductance located between said cathode and anode, a circuit including a piezo-electric crystal in series with a third inductance between said cathode and that terminal of said second inductance which is connected to said anode, and a neutralizing condenser in parallel relationship to said crystal, and a circuit including a fourth inductance in series with a condenser between said anode and that terminal of said third inductance which is directly connected to said cathode, both said third and fourth inductances being magnetically coupled to said first inductance.

2. In a high frequency oscillation generator comprising an electron discharge device having an anode, cathode, and control electrode, a parallel tuned circuit comprising a first inductance and a capacity between said cathode and said control electrode, a source of anode potential in series with a second inductance located between said cathode and anode, a circuit including a piezo-electric crystal in series with a third inductance between said cathode and that terminal of said second inductance which is connected to said anode, and a neutralizing condenser in parallel relationship to said crystal, and a circuit including a fourth inductance in series with a condenser between said anode and that terminal of said third inductance which is directly connected to said cathode, both said third and fourth inductances being magnetically coupled to said first inductance, the method of operation which includes adjusting the capacities of said neutralizing condenser and said last condenser and adjusting the coupling between said first inductance and said third and fourth inductances such that the circuits are completely neutralized in the absence of said crystal, and then unbalancing said circuit by connecting said crystal.

3. A crystal controlled oscillation generator comprising an electron discharge device having a cathode an anode and a grid, a tuned circuit including a coil and a condenser connected in parallel, connected between said grid and said cathode, a coil physically separated from said first coil serially connected with a crystal connected between said anode and said cathode, said coils being coupled together, and means connected between said anode and cathode and coupled to said tuned circuit for reducing anode to grid feed-back.

4. A high frequency oscillator comprising a vacuum tube having cathode, grid and plate electrodes, a parallel tunable circuit comprising an inductance coil shunted by a condenser connected between said grid and cathode electrodes, an impedance and a source of potential serially connected between said plate and cathode electrodes, and the series combination of a coil and a two electrode piezo-electric crystal connected between the cathode and the plate electrode end of said impedance, said last mentioned coil and the coil of said parallel tunable circuit being physically separated and magnetically coupled together, and means separate and apart from said crystal for preventing the effect of inter-electrode capacity in said tube, whereby the generation of oscillations is prevented in the absence of said crystals.

5. A high frequency oscillator comprising a vacuum tube having cathode, grid and anode electrodes, a parallel tunable circuit comprising an inductance coil shunted by a condenser connected between said grid and cathode electrodes, an impedance and a source of potential serially connected between said anode and cathode electrodes, and the series combination of a coil physically independent of said parallel tuned circuit, and a two electrode piezo-electric crystal shunted by a neutralizing condenser connected between the cathode and the anode electrode end of said impedance, said last mentioned coil and the coil of said parallel tunable circuit being magnetically coupled together, said neutralizing condenser being adjusted to prevent the generation of oscillations in the absence of said crystal.

6. An oscillation generator comprising a vacuum tube having an anode, a grid, and a cathode, a source of anode potential and a coil connected between the anode and cathode, a two electrode piezo-electric crystal, another coil, means for serially connecting said piezo-electric crystal and said last mentioned coil between the anode end of said first mentioned coil and said cathode, a tunable circuit comprising another coil physically independent of said other coils shunted by a condenser connected between the grid and cathode, the coil of said tunable circuit being magnetically coupled to the coil connected in series with said piezo-electric crystal, and a variable condenser connected in shunt with said crystal, said variable condenser being adjusted to prevent the generation of oscillations in the absence of said crystal.

7. A high frequency oscillation generator comprising a balanced bridge arrangement having four arms, two of said arms comprising inductance coils directly connected together, and the other two of said arms comprising capacitors directly connected together and to said coils, a vacuum tube having input electrodes coupled to said coils, and output electrodes connected to the junction point of said capacitors, and an electromechanical oscillator connected in shunt with one of said arms for unbalancing said bridge arrangement.

8. A high frequency oscillation generator comprising a balanced bridge arrangement having four arms, two of said arms comprising inductance coils directly connected together, and the other two of said arms comprising capacitors directly connected together and to said coils, a vacuum tube having input electrodes coupled to said coils, and output electrodes connected to the junction point of said capacitors, and a piezo-electric crystal connected in shunt with one of said capacitors for unbalancing said bridge arrangement.

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