July 31, 1934. M. OSNOS 1,968,617

CRYSTAL FREQUENCY ADJUSTMENT

Filed June 30, 1932

Fig. 1

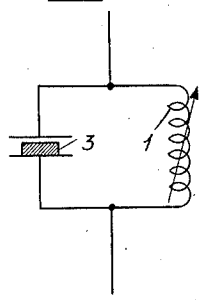
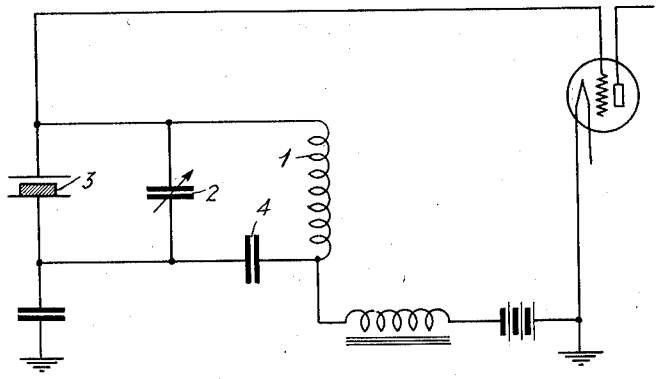


Fig. 2



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CRYSTAL FREQUENCY ADJUSTMENT

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2 Claims. (Cl. 250—36)

The precise adjustment of the natural wave length of a piezo-electric crystal so as to give it the desired frequency has in the past been attended with serious difficulties, especially in the case of crystals cut out of the mother piece at right angles to the electrical axis. Adjustment of the natural frequency according to the prior art has been attempted by grinding the crystals and parallel and series connection of capacities or else by series inductance coils. However, accurate grinding is very hard, for even the removal of relatively little material means a marked alteration of the natural frequency of the crystal. Removing too little material by abrasion the natural frequency may turn out too low, while if too much is removed, the natural period may be too high and the result is that the crystal is no longer serviceable for the desired wave length.

Fundamentally speaking, it is possible, to be sure, to diminish an unduly high frequency by a condenser connected in parallel relation to the crystal, while a too low frequency of the crystal may be raised by a series capacity. In practice, however, this is unfeasible for the reason that the addition of capacities tends to reduce the performance of the crystal to a more or less marked degree.

Now, according to this invention for the purpose of finer adjustment of the natural period of a piezo-electric crystal, an inductance which optionally may be of the variable kind, is connected in parallel to the piezo-electric crystal.

The addition of suitable inductance coils in parallel relation to the crystal offers the following advantage. Each crystal holder involves a certain self-capacitance which acts like a parallel capacity to the crystal and which diminishes its power or performance. By the addition of a parallel inductance the effect of the parallel (shunt) capacity is diminished and this is conducive to an improvement in the performance of the crystal. Attention must be given, however, so that the inductance is so high that the frequency of the circuit which consists of the parallel inductance and the parallel capacity of the crystal holder remains higher than the desired natural frequency of the crystal lest frequency fluctuation might happen.

Instead of making the inductance variable, also a fixed inductance coil could be used with an additional variable parallel capacity.

The accompanying drawing by way of example shows two embodiments of the invention wherein Figure 1 shows an arrangement utilizing a variable inductance connected in shunt to the crystal and Figure 2 shows an arrangement having a fixed inductance connected in shunt to the crystal.

Referring to the drawing wherein like characters represent like elements, 1 is the parallel inductance coil, 2 the additional variable parallel capacity, 3 the crystal holder with crystal, and 4 a blocking condenser which might be necessary in a case where the oscillation circuit in which the scheme is to be used is included in the grid circuit of a thermionic tube in order to prevent the leaking away of the grid D. C.

The capacities 2 and 4 must be so chosen that the reactance connected in parallel to the crystal and consisting of elements 1, 2 and 4 remains inductive with reference to the natural period of the crystal.

I claim:

1. Circuit means for accurately adjusting the frequency of a piezo-electric crystal comprising a variable reactance circuit connected in parallel with said crystal including an inductance of such value that the natural frequency of said variable reactance circuit in combination with the capacity of said crystal is higher than the desired natural frequency of said crystal for overcoming frequency fluctuation.

2. An oscillation generator comprising a vacuum tube having a grid, cathode and plate, said cathode being connected to ground, the series combination of a two electrode piezo-electric crystal and a blocking condenser connected between said grid and ground, a variable condenser connected in shunt to said two electrode crystal, an inductance coil in series with a blocking condenser shunting said variable condenser and, the series combination of a choke and a source of potential connected between said coil and cathode for applying to said grid a suitable biasing potential.

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