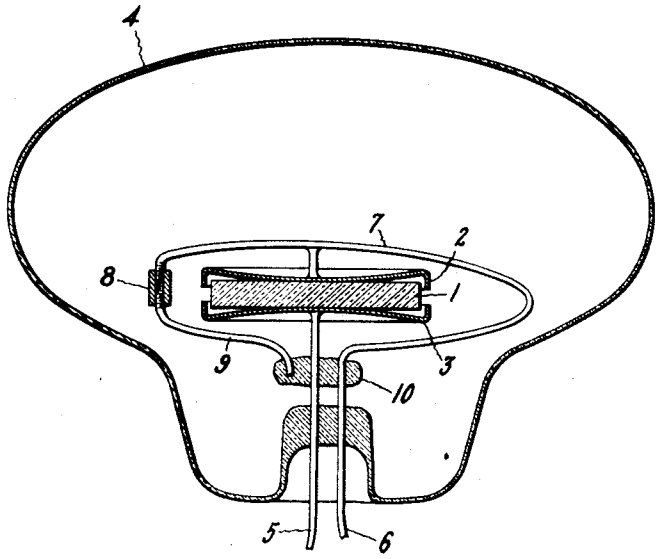
Feb. 27, 1934. A. L. R. ELLIS 1,949,149

VACUUM MOUNTED OSCILLATOR

Filed July 14, 1925



Inventor:
Alvarado L.R. Ellis,

by Alexander S. Lowe
His Attorney

Patented Feb. 27, 1934 1,949,149

UNITED STATES PATENT OFFICE

1,949,149

VACUUM MOUNTED OSCILLATOR

Alvarado L. R. Ellis, Swampscott, Mass., assignor to General Electric Company, a corporation of New York

Application July 14, 1925. Serial No. 43,629

5 Claims. (Cl. 171—327)

My invention relates to devices comprising a piezo-electric member interposed between a pair of electrodes and mounted within a casing, and has for its principal object the provision of means for minimizing the effect of the mounting and casing on the free vibration period or resonance frequency of the piezo-electric member.

The free vibration period of a piezo-electric oscillator, such as a slab or disk of quartz for example, is determined to a large extent by the dimensions of the slab but is affected to some extent by the conditions under which the oscillator is operated. If it were possible to suspend the slab or crystal in air so that it could be made to vibrate freely, a layer of air adjacent the oscillating surfaces of the crystal would vibrate just as though it formed an integral part of the crystal. The resonance frequency of the crystal under these conditions would depend to a large extent on its dimensions and to a lesser extent on the density and elasticity of the air vibrating in unison with the crystal surfaces. Changes in temperature, however, produce variation in the resonance frequency of the crystal both due to change in the size of the crystal and to change in the density and elasticity of the ambient air.

It is of course necessary that the oscillator be provided with some sort of a mounting and it is very desirable that it be protected from dust and moisture by a suitable casing. Variation in the resonance frequency of the oscillator with changes in temperature is likely to be accentuated by contraction or expansion of the mountings and by the effect of the casing on the movement of the air surrounding the oscillator. These combined effects are not serious at low frequencies but become of great importance at frequencies of a million cycles or more. It so happens that utilization of the quartz oscillator is very desirable in this range of frequencies. Constancy of resonance frequency on these short wave lengths is extremely important for the reason that a variation of less than one percent may be sufficient to carry the beat note entirely through the limits of audition, thus rendering the piezo-electric crystal entirely unsatisfactory as a means of frequency control. In accordance with my invention, this difficulty is avoided by mounting the oscillator in an evacuated vessel by which its air loading is substantially eliminated and by which it is protected from the deleterious effects of dust, moisture and temperature changes.

My invention will be better understood from the following description when considered in connection with the accompanying drawing and its scope will be pointed out in the appended claims.

The single figure of the drawing shows one embodiment of my invention.

This embodiment comprises a piezo-electric oscillator 1 interposed between electrodes 2 and 3 and located within an evacuated vessel 4 of glass or other suitable material. The electrode 3 is connected directly to the terminal 5 and the electrode 2 is connected to the terminal 6 through the right hand end of a resilient member 7 which is threaded at its left hand end to cooperate with a bolt 8 and member 9 for maintaining the electrodes properly positioned with respect to the oscillator. The member 9 and terminals 5 and 6 are shown as spaced apart from one another by means of an insulation member 10. It will be observed that the electrode surfaces adjacent the oscillator are convex and that the spring 7 functions to maintain the proper spacing between the electrodes.

With this construction, the effect of air loading on the oscillator is practically eliminated, temperature variations in the oscillator mountings are greatly reduced or altogether eliminated due to the fact that the vessel 4 is evacuated, the oscillator is entirely protected from the deleterious effects of moisture and dust, and the free vibration period of the oscillator is maintained within narrow limits.

The embodiment of the invention illustrated and described herein has been selected for the purpose of clearly setting forth the principles involved. It will be apparent, however, that the invention is susceptible of being modified to meet the different conditions encountered in its use. I therefore aim to cover by the appended claims all modifications within the true spirit and scope of my invention.

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

1. The combination of two electrodes, a piezo-electric oscillator interposed between said electrodes, an evacuated vessel surrounding said oscillator and electrodes, and electrode supporting means comprising a resilient member adapted to maintain a predetermined relation between the positions of said oscillator and electrodes.

2. A piezo-electric crystal holder comprising in combination a hermetically sealed container, a piezo-electric crystal centrally positioned in said container and resilient means for establishing electrical connection with said piezo-electric crystal within said container for permitting the

free mechanical vibration thereof with substantially no restriction.

3. Piezo-electric crystal apparatus comprising a lower electrode, a piezo-electric crystal resting upon said lower electrode, an upper electrode, resilient means tending to maintain said upper electrode spaced away from said crystal and lower electrode, and means opposing said resilient means, for bringing said upper electrode closer to said piezo-electric crystal and lower electrode.

4. Apparatus as claimed in claim 3 characterized in addition by the fact that said electrodes comprise convex surfaces to said piezo-electric crystal.

5. In combination, a lower piezo-electric crystal electrode, a piezo-electric crystal resting upon said electrode, an upper electrode, a cantilever support for said upper electrode, and means for varying the distance between said upper and lower electrodes.

ALVARADO L. R. ELLIS.