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CRYSTAL MOUNTING WITH TEMPERATURE COMPENSATION

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Fig. 1

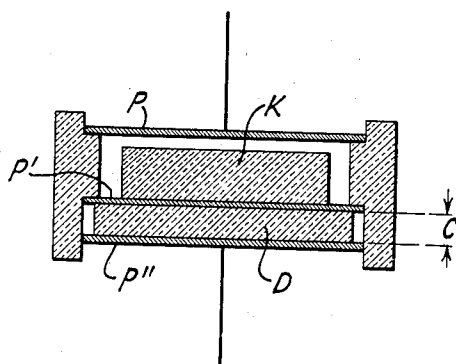
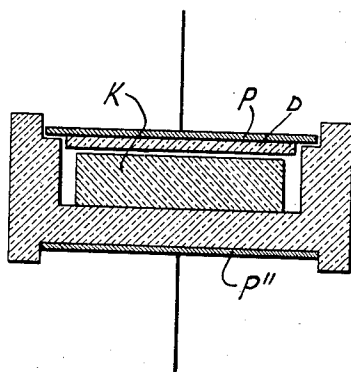


Fig. 2



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CRYSTAL MOUNTING WITH TEMPERATURE
COMPENSATION

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13 Claims. (Cl. 171—327)

This invention relates to a novel type of piezo-
electric crystal mounting having temperature
compensation.

In the stabilization of the frequency of electric
oscillations by means of piezo crystals which are
inserted in any transmitting circuit arrangement
as frequency-controlling oscillation devices, there
occurs, as is known, the disadvantage that the
controlling crystal absorbs considerable power if
the transmitter is to deliver an efficient high-
frequency output. The result thereof is a notice-
able heating up of the control crystal, also a more
or less large frequency distortion occurs which
assumes a stable state only some time after the
starting up when a temperature balance has been
established. In case of irregular keying of trans-
mitter or in telephonic modulation, a stable state
of balance cannot be obtained. This is particu-
larly true in ultra-short wave quartz or turmalin
resonators, where constancy of frequency is of
prime importance, in such resonators relatively
strong heating occurs due primarily to the small
mass of the crystal and the frequency distor-
tion. These unfavorable conditions are so large
that the success of the stabilizing measure is put
in complete jeopardy.

The prior art has disclosed several methods for
the purpose of eliminating these disturbing fre-
quency effects aiming in principle at keeping the
temperature of the controlling crystal as constant
as possible by means of thermostats. However
such thermostats have the basic disadvantage
that their inertia increase as their sensitiveness
decreases, in other words, the smaller the energy
changed to heat in the crystal, which is exactly
the case in the small crystals for ultra-short
waves. Aside from that, the great expense for
the apparatus is unwarranted, exceeding in some
cases even the cost for the transmitter itself.

Now, it is known that it is possible to vary by
purely electric means the frequency of a piezo-
crystal within certain limits by connecting a var-
iable capacity in series with the crystal. In place
of a special series condenser, the distance between
a crystal surface and the auxiliary electrode lo-
cated over it can also be varied directly which
likewise results in a variation of the series ca-
pacity. If the size of this series capacity is
brought in direct relationship to the tempera-
ture of the crystal, for instance by automatically
varying the distance between crystal and elec-
trode by means of a bimetallic strip, the auto-
matic compensation of the frequency distortion,
due to heating of the crystal, can easily be ac-

complished by a corresponding variation of the
series capacity.

This thermo-mechanical compensation method
has still a disadvantage common to all thermo-
stats for the reason that sufficient heat quantities
must be available to render effective the com-
pensation. For the removal of this difficulty the
present invention proposed to combine the con-
trol crystal by means of a common casing used
in its mounting with a suitable series capacity,
whose dielectric has according to the temperature
coefficient a positive or negative temperature co-
efficient, to a thermic unit so that with the heat-
ing of the crystal a quick heat exchange takes
place with the series condenser. In accordance
with the invention, the temperature coefficient
and the size of the series condenser are balanced
in the manner that the purely thermic capacity
variation just compensates the frequency distor-
tion of the control crystal.

This invention will best be understood by refer-
ring to the accompanying drawing, in which:

Fig. 1 is a sectional view of a crystal holder
of this invention;

Fig. 2 is a sectional view of a crystal holder of
this invention in which the crystal and the con-
denser dielectric are combined.

Fig. 1 illustrates a practical embodiment of the
invention by way of example, showing in section
a crystal mounting or casing having an internal
rim forming a support for a plurality of elec-
trodes, which arrangement, according to the in-
vention, makes the crystal in series with a con-
denser. K is the crystal disposed in the casing
between the two electrodes P and P'. The lower
electrode on which the crystal rests is kept as thin
as possible with a view to facilitate the passage
of heat and represents at the same time the one
coating or electrode of series condenser C which
is completed by the solid dielectric D interposed
between electrode P' and auxiliary electrode P''.
According to whether the temperature coefficient
of crystal K is positive or negative, D must be
selected of a material with negative or positive
temperature coefficient, such as is available for
instance in ceramic substances. This mounting
may be simplified by the elimination of interme-
diate coating P', placing the crystal directly on
the solid dielectric D, thus further facilitating
the temperature compensation. In order to ren-
der the course of the heat as uniform as possible
through the entire mounting, it appears suitable
to place the mounting under vacuum.

Fig. 2 finally shows a simplification of the prac-
tical application of the principle of the invention,

that is a crystal mounting, whose housing consists of a casing of ceramic material exclusively, the bottom being depressed forming at the same time the dielectric for the compensating capacity.

- 5 The crystal rests directly on the bottom of the housing, whose underside is provided with a ridge to secure and support a metallic coating P". No deviation from the principle of the invention occurs if also above the crystal there is disposed
10 another solid dielectric forming a second compensating capacity, for instance in the manner that the mounting according to Fig. 2 in addition to the bottom portion of the casing is closed with an insulating cover, which acts otherwise
15 exactly as the bottom portion.

These examples may suffice for the practical visualization of the idea of the invention which, of course, is subject to numerous variations.

What is claimed is:

- 20 1. A piezo-electric crystal holder comprising a casing of dielectric material, a crystal within the holder, a condenser incorporated in the holder, a portion of said casing constituting the condenser dielectric, said dielectric material having a tem-
25 perature coefficient of specific inductive capacity determined by the temperature coefficient of frequency of the crystal, electrodes for said crystal and condenser, at least one of the electrodes being located at the top of the casing and another
30 at the bottom thereof.

2. A piezo-electric crystal holder comprising a casing of dielectric material, a crystal within the holder, a condenser incorporated in the holder, the bottom portion of said casing constituting
35 the condenser dielectric, said dielectric material having a temperature coefficient of specific inductive capacity determined by the temperature coefficient of frequency of the crystal, electrodes for said crystal and condenser, at least one of the
40 electrodes being located at the top of the casing and another at the bottom thereof.

3. A piezo-electric crystal holder comprising a casing of dielectric material, a crystal within the holder, a condenser incorporated in the holder,
45 at least one of the end portions of said casing constituting the condenser dielectric, said dielectric material having a temperature coefficient of specific inductive capacity determined by the temperature coefficient of frequency of the crystal, electrodes for said crystal and condenser, at
50 least one of the electrodes being located at the top of the casing and another at the bottom thereof.

4. A piezo-electric crystal holder comprising a casing of ceramic dielectric material, a crystal within said holder, a condenser incorporated in the holder, a portion of said casing constituting
55 the condenser dielectric, said dielectric material having a temperature coefficient of specific inductive capacity determined by the temperature coefficient of frequency of the crystal, electrodes for said crystal and condenser, at least one of the
60 electrodes being located at the top of the casing and another at the bottom thereof.

5. A piezo-electric crystal holder comprising a casing having its walls and bottom portion of a solid dielectric material, a crystal within the holder, a condenser incorporated in the holder,
70 said bottom portion of said casing constituting the condenser dielectric, said dielectric material having a temperature coefficient of specific inductive capacity determined by the temperature coefficient of frequency of the crystal, electrodes
75 for said crystal and condenser, at least one of

the electrodes being located at the top of the casing and another at the bottom thereof.

6. A piezo-electric crystal holder comprising a casing having a rim portion of dielectric material, a crystal within the holder, a condenser incorporated in the holder, a portion of said casing constituting the condenser dielectric, said dielectric material having a temperature coefficient of specific inductive capacity determined by the temperature coefficient of frequency of the crystal, electrodes for said crystal and condenser, and a plurality of said electrodes supported by said rim portion, one of said electrodes being located at the top of the casing and another at the bottom thereof.

7. A piezo-electric crystal unit comprising a holder of dielectric material, a crystal in said holder, a condenser incorporated in the holder, a portion of said holder constituting the condenser dielectric, said dielectric material having a temperature coefficient of specific inductive capacity determined by the temperature coefficient of the frequency of the crystal, electrodes for said crystal and condenser, at least one of said electrodes being located adjacent one face of said crystal, and another electrode adjacent another face of said crystal.

8. A piezo-electric crystal holder comprising a casing, a crystal within said holder, a condenser incorporated in said holder, two electrodes forming walls of said casing, a solid dielectric for said condenser in series with said crystal and said electrodes, the material of said dielectric having a temperature coefficient of specific inductive capacity determined by the temperature coefficient of the frequency of the crystal.

9. A piezo-electric crystal holder comprising a casing, a crystal within said holder, a condenser incorporated in said holder, two electrodes forming walls of said casing, a solid dielectric of ceramic material for said condenser in series with said crystal and said electrodes, the material of said dielectric having a temperature coefficient of specific inductive capacity determined by the temperature coefficient of the frequency of the crystal.

10. A piezo-electric crystal holder comprising a casing, a crystal within said holder, a condenser incorporated in said holder, a first and a second electrode located at the ends of said casing, a solid dielectric, and a third electrode for said condenser in series with said crystal and said first and second electrodes, the material of said dielectric having a temperature coefficient of specific inductive capacity determined by the temperature coefficient of the frequency of the crystal.

11. A piezo-electric crystal holder comprising a casing, a crystal within said holder, a condenser incorporated in said holder, a first and a second electrode located at the ends of said casing, a solid dielectric for said condenser, a thin metallic coating on at least one side of said crystal forming a third electrode, said solid dielectric and said third electrode being in series with said crystal and said first and second electrodes, the material of said dielectric having a temperature coefficient of specific inductive capacity determined by the temperature coefficient of the frequency of the crystal.

12. A piezo-electric crystal unit comprising a holder, a crystal within said holder, a condenser incorporated in said holder, electrodes for said crystal and condenser, at least one of the electrodes being located adjacent one face of said

crystal and another electrode adjacent another face of said crystal, and a solid dielectric for said condenser in series with said crystal and said electrodes, the material of said dielectric having a temperature coefficient of specific inductive capacity determined by the temperature coefficient of the frequency of the crystal.

13. A piezo-electric crystal holder comprising a casing of dielectric material, a crystal within the holder, a condenser incorporated in the holder, said condenser having two solid dielec-

trics, one of which is disposed on a face of said crystal, a portion of said casing constituting the other condenser dielectric, the material of said dielectrics having a temperature coefficient of specific inductive capacity determined by the temperature coefficient of frequency of the crystal, electrodes for said crystal and condenser, at least one of the electrodes being located at the top of the casing and another at the bottom thereof

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