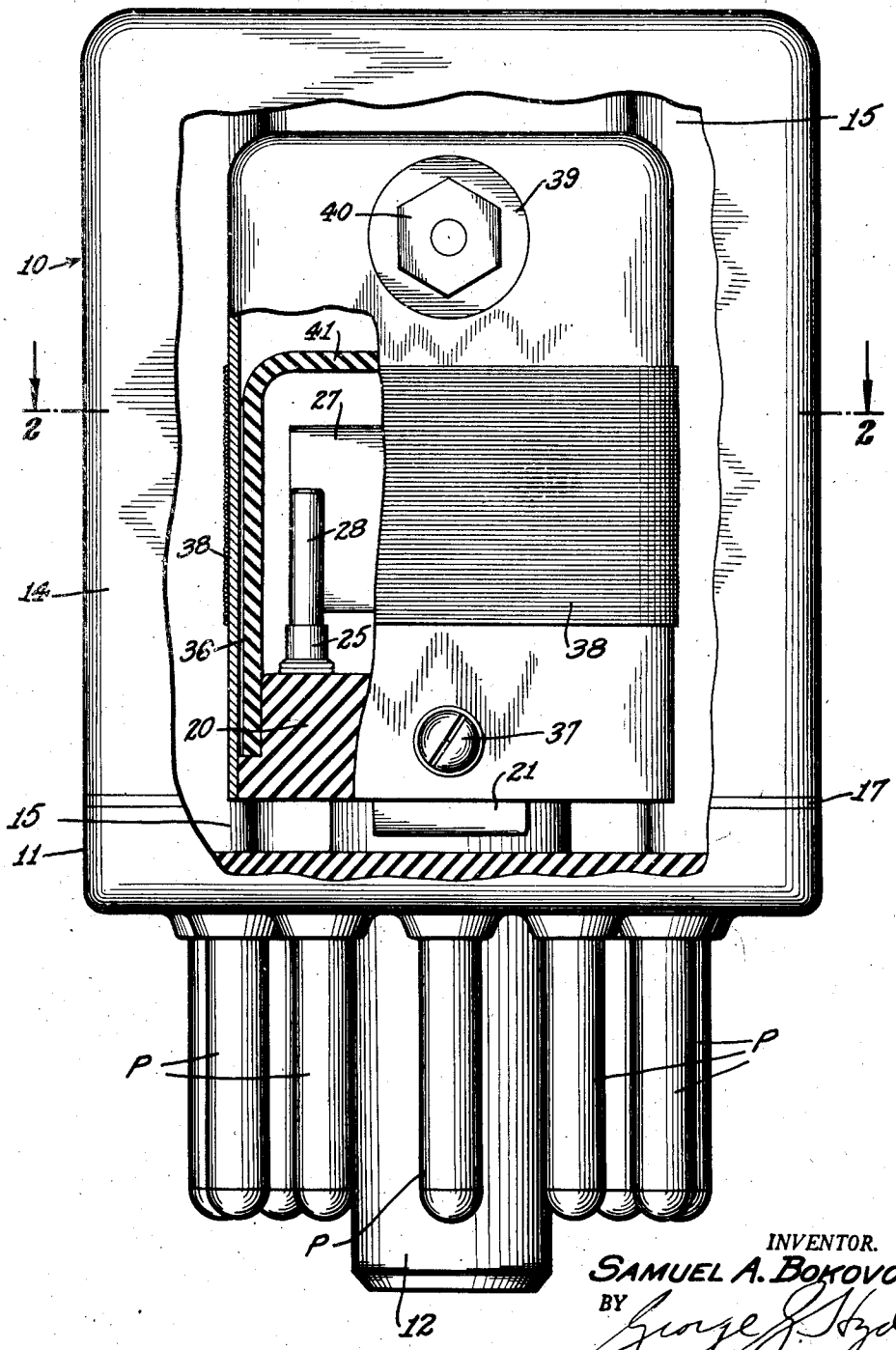
Oct. 29, 1946. S. A. BOKOVOY 2,410,041

PIEZOELECTRIC CRYSTAL CABINET

Filed April 1, 1943 4 Sheets-Sheet 1

Fig. 1.



INVENTOR.
SAMUEL A. BOKOVOY
BY George J. Hyde
ATTORNEY

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Fig. 2.

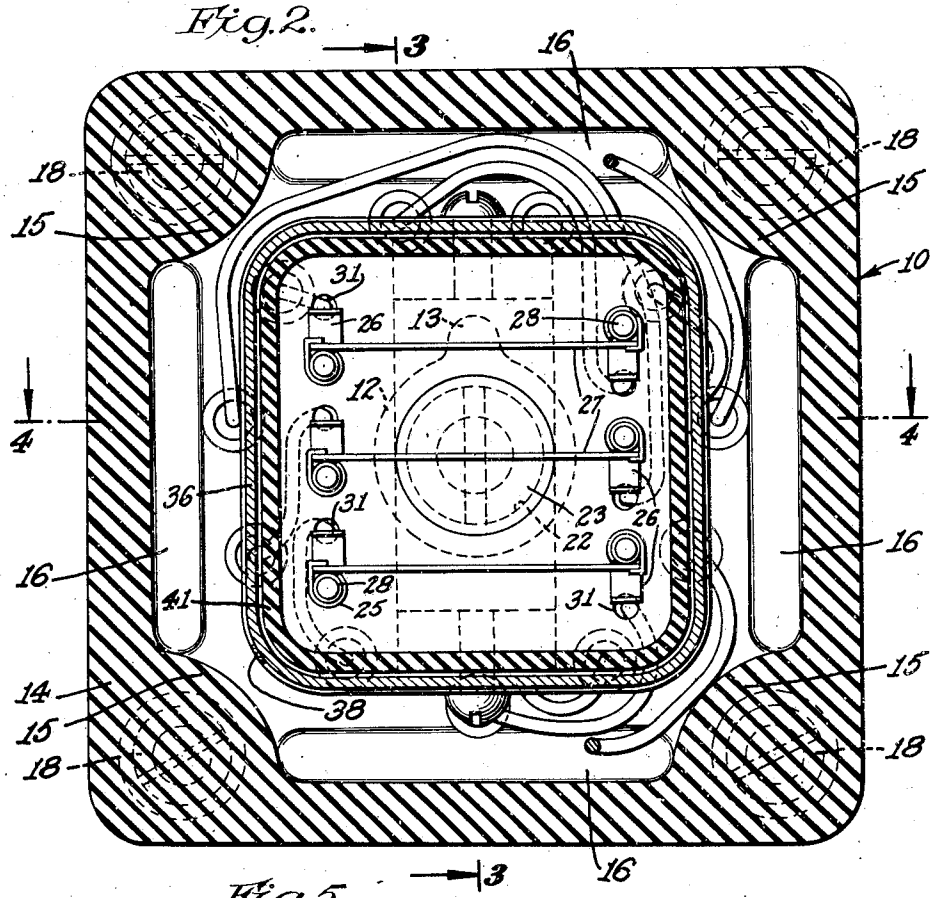
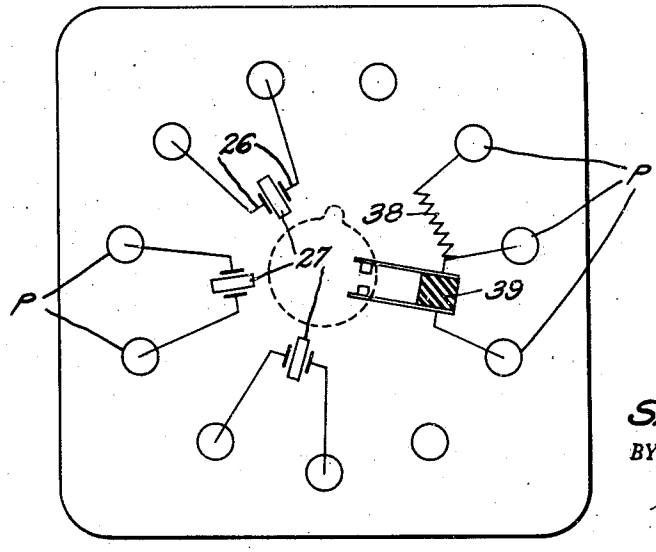


Fig. 5.



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SAMUEL A. BOKOVOY
BY George J. Hyde
ATTORNEY

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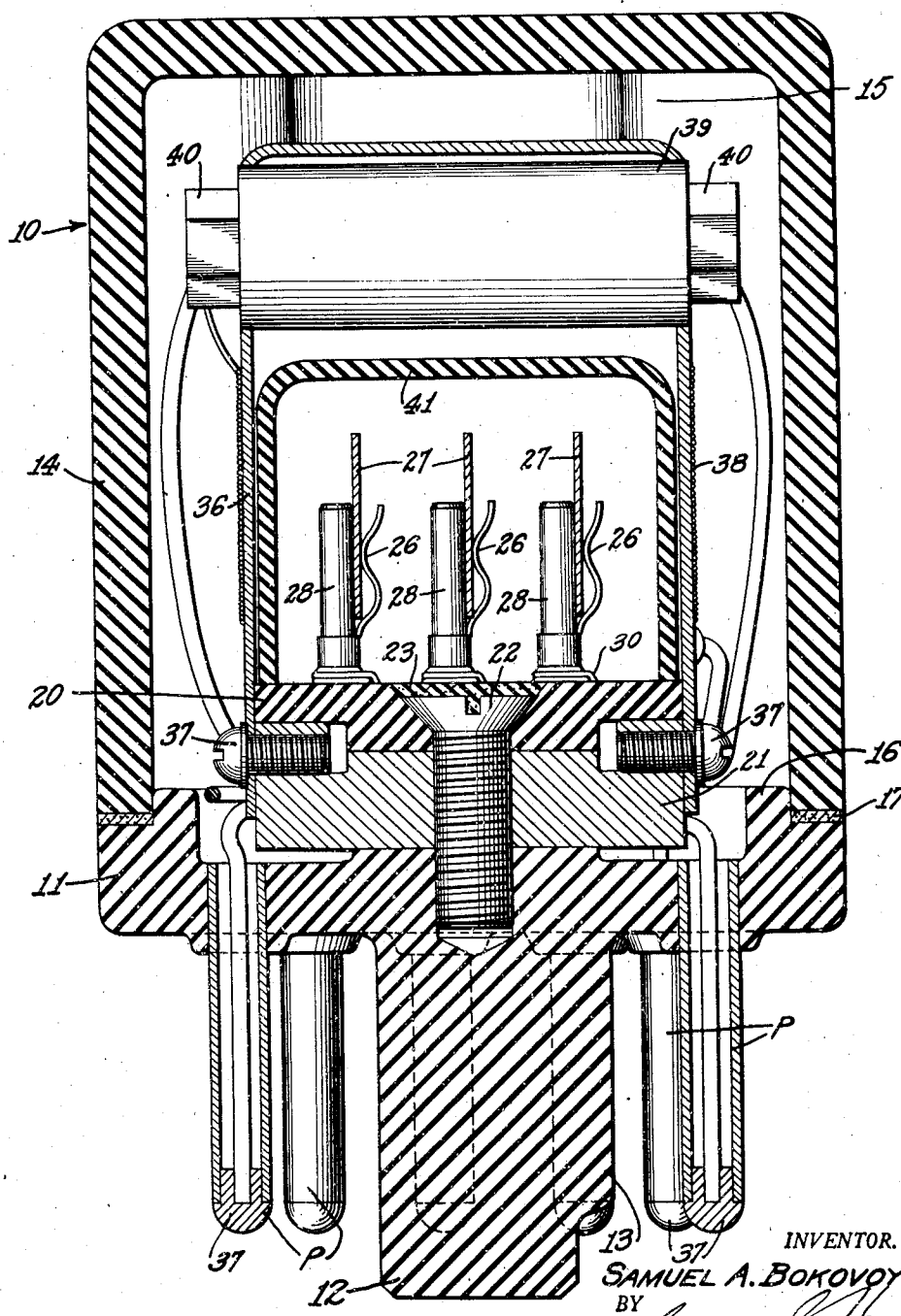
Fig. 3.



INVENTOR.
SAMUEL A. BOKOVOY
BY
George J. Hyde
ATTORNEY

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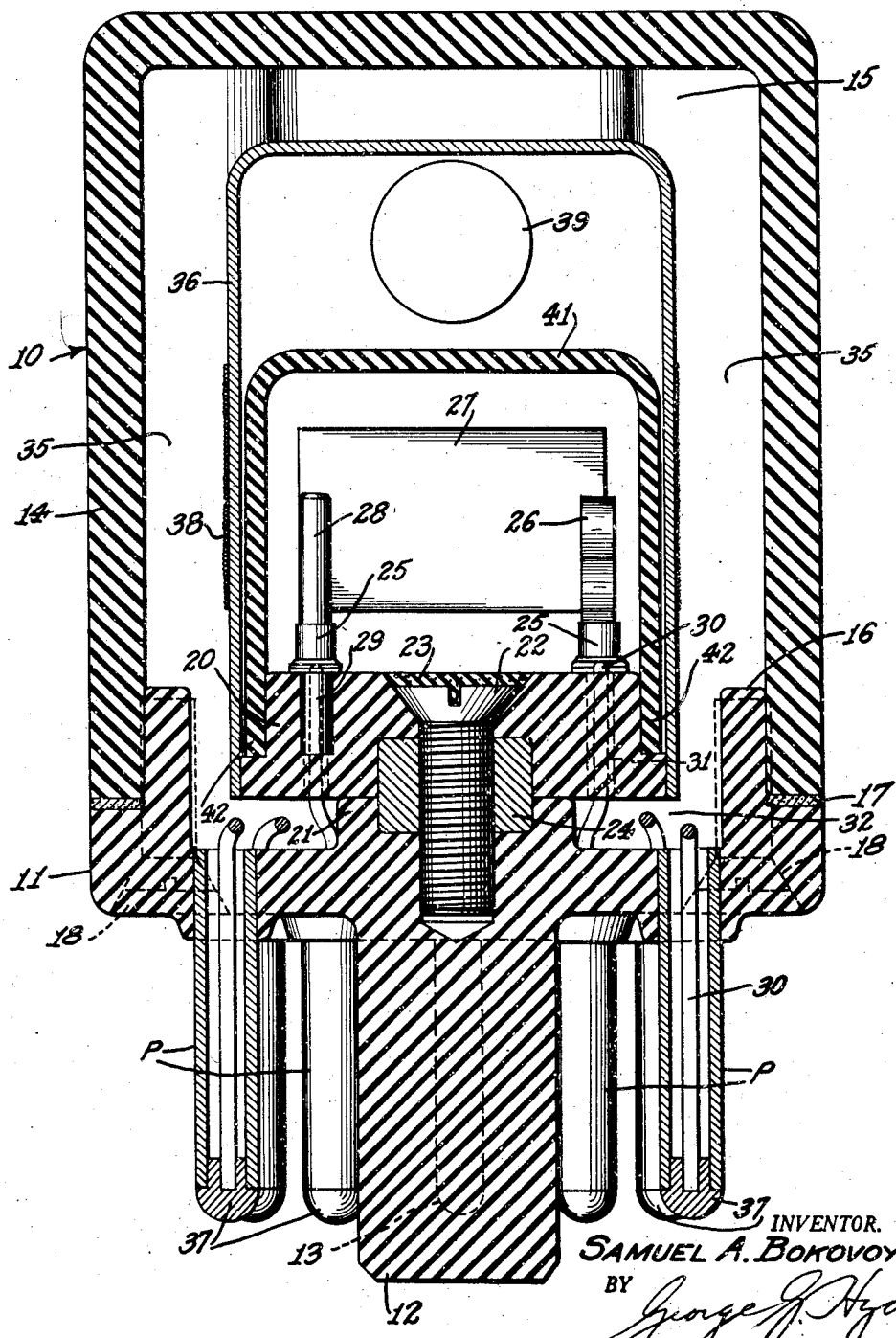
Fig. 4.



INVENTOR.
SAMUEL A. BOKOVOY
BY George J. Hyde
ATTORNEY

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PIEZOELECTRIC CRYSTAL CABINET

Samuel A. Bokovoy, Verona, N. J., assignor to Federal Telephone and Radio Corporation, New York, N. Y., a corporation of Delaware

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7 Claims. (Cl. 171—327)

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This invention relates to enclosed cabinet mountings especially adapted for piezo-electric crystals and provided with an improved arrangement for maintaining the crystals at uniform temperature during wide changes in circumambient temperatures.

The mounting includes a cabinet construction comprising a plurality of nested chambers with the crystals in the central chamber, provided with a thermostat-controlled heating element. A feature of the invention is a provision of a novel construction and arrangement of the chambers, thermostat and heater which will effectively retard the transfer of outside temperature changes to the crystal chamber and facilitate the operation of the heater to compensate for such changes before they can reach the crystal chamber. The invention includes the use of an improved internal chamber wall construction made of metal having good thermal conductivity arranged to provide uniformity of heat transfer to the thermostat and from the heater.

A further purpose is to provide a temperature-controlled cabinet suitable for mounting a plurality of piezo-electric crystals arranged so that the various crystals can be connected into circuits in any desired manner without disturbing the cabinet. Another object is the provision of an improved crystal cabinet of the indicated type which is adapted for mounting in a standard type of pin socket.

Other objects and advantages will appear from the following description considered in connection with the accompanying drawings, in which:

Fig. 1 is a front elevation of a cabinet embodying the invention with parts broken away, the connecting leads being omitted;

Fig. 2 is a transverse section on line 2—2 of Fig. 1;

Fig. 3 is a vertical section on line 3—3 of Fig. 2;

Fig. 4 is a vertical section on line 4—4 of Fig. 2; and

Fig. 5 is a diagram of circuit connections.

The cabinet 10 comprises an outer base 11 of insulating material provided with a plurality of hollow contact pins P set into the lower face of the base, together with a positioning stud 12 provided with a longitudinal lug 13, said contact pins, stud and lug being of the type usually employed on radio tube bases, arranged for insertion in tube sockets of the type ordinarily employed in radio apparatus.

An outer housing or hollow cover 14 of insulating material is fitted to base 11 to form a completely enclosed chamber. In the form illustrated

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the housing 14 is generally rectangular in cross-section, being provided with enlarged vertical corner portions 15 (Fig. 2); and the base 11 is provided with housing positioning lugs 16 fitting against the side walls of housing 14 intermediate the enlargements 15. A suitable gasket 17 which may be of natural or synthetic rubber or the like is interposed between base 11 and housing 14, the latter being held in place by screws 18 extending upwardly through the corners of base 11 into the enlarged corner portions 15 (Fig. 4).

The piezo-electric crystals are mounted on inner base 20 which is formed of insulating material and mounted on a pedestal 21 by screw 22 (Fig. 3) which is preferably countersunk and covered with insulating material 23 such as glyptal resin. A rectangular positioning bar 24 may be fitted into registering slots in the contiguous faces of the inner base 20 and pedestal 21.

Suitable crystal supports are mounted on inner base 20 and are advantageously arranged to provide proper support for a plurality of piezo-electric crystals, together with the appropriate electrodes and leads which advantageously extend through the base 20 and are connected to the contact pins P. In the form illustrated three sets of crystal mounting spring clips 25 are supported on base 20, each including a contact spring 26 engaging one face of a crystal 27, and a non-conducting post 28 engaging the opposite face and extending into a socket 29 (Fig. 4) in base 20. The clips 25 are arranged to support three crystals 27 in parallel position equally spaced from each other and from parallel margins of base 20. The clips for each crystal are arranged with the contact springs 26 engaging opposite faces of the crystal, which is provided with metallic surface contact elements such as metal plating extending over the opposite sides of the crystal in known manner. A lead 30 extends from each contact spring 26 through a registering hole 31 in base 20 into the channel 32 extending around and beneath the lower margin of the base 20 and communicating with the upper ends of hollow pins P into which the leads 30 pass, each lead being connected to the associated pin by a solder tip 33 in the usual manner.

A wall made of a metal having good thermal conductivity is mounted on inner base 20 surrounding the crystals, and forms with outer housing 14 an outer compartment 35. The wall carries a suitable thermostat and a heater located in the outer compartment. In the form illustrated the wall is in the form of a metal housing

36 advantageously made of aluminum and fitting over the outer face of base 20, being suitably held in place thereon as by screws 37. The heater consists of a winding 38 of suitable heater wire such as nichrome wound on the outer face of housing 36, and may be held in place by insulating varnish. The thermostat 39 is of the standard enclosed bimetallic type with terminals at opposite ends and is mounted on the upper part of housing 36, extruding through openings at opposite sides of the housing with its terminals 40 projecting into the outer compartment 35.

An inner crystal housing 41 of insulating material is advantageously mounted on inner base 20 surrounding the crystals 27 and located within the metal housing 36. In the form illustrated the inner housing 41 has a lower edge fitting snugly against the base 20 and is held removably in place thereon by downwardly projecting tongues 42 (Fig. 4) at opposite sides fitting snugly against the inner walls of registering recesses in the outer portions of base 20. The walls of the inner housing 41 are advantageously spaced from the metal housing 36 and form an inner or central crystal compartment 42 and an intermediate or central compartment 43 between housings 41 and 36.

One end of the heater winding 38 is connected to one terminal 40 of the thermostat 39 while the other end of said winding as well as the opposite terminal 40 of the thermostat are connected by suitable leads extending downwardly through the outer chamber 35 and channel 32 to appropriate contact pins P to which they are electrically connected in the manner already indicated. The terminal 40 of thermostat 39 to which the winding 38 is connected may also be connected through a suitable lead to another pin P in similar manner to facilitate the connection of a condenser across the thermostat. A suitable arrangement for connecting the crystals 27, heater winding 38 and thermostat 39 to the various contact pins is shown diagrammatically in Fig. 5.

In the arrangement described and illustrated the crystals 27 are located in an insulating dead air chamber 42 surrounded by a dead air chamber 43. Any change in the ambient temperature outside of the outer housing 14 will be conducted gradually to the outer compartment 35 where it will affect thermostat 39 promptly through conduction from both ends of the thermostat and through the metal housing 36. This will result in prompt energizing of the heater winding 38 when the temperature drops below the normal temperature for which the thermostat is set and promptly corrects the temperature drop in the outer compartment 35 before it has an opportunity for appreciable transmission through the intermediate compartment 43 and inner housing 41 to the crystal compartment 42. The transmission of temperature changes to the latter compartment through the bases is negligible owing to the very thick base construction, the reductions in the conducting path by the use of a restricted pedestal 21 and the absence of good thermally conducting parts.

The arrangement has been found so effective in practice that it has proven to be capable of limiting the variations in the rate of crystal oscillation caused by changes in temperature to not more than about 10 cycles per million during

ambient temperature changes between —48° and +60° Fahrenheit and even with substantial variations in heater voltages, such as changes between 22 and 28 volts. The cabinet is extremely compact and small, and is arranged for ready construction and assembly as well as convenient installation and replacement.

The parts referred to as made of insulating material are formed from materials having not only the necessary electrical insulating properties but also high thermal insulating value. Various synthetic resins have the requisite qualities and are adapted for ready molding or pressing into parts of the types illustrated and described.

What is claimed is:

1. A temperature-controlled piezo-electric crystal mounting comprising a base, an outer housing mounted on the base, said base and housing being formed of thermal insulating material, a thermally conducting metal housing spaced from the outer housing, a heater and a heater-controlling thermostat mounted on the metal housing, and an inner housing enclosing the crystal supports located within and spaced from the metal housing.

2. A temperature-controlled piezo-electric crystal mounting that comprise a base, an inner housing formed of insulative material mounted on said base and defining a crystal chamber, an outer housing disposed in spaced relationship to the inner housing and defining therewith a heat-insulated space, a heat-conducting housing within said space disposed in spaced relationship to the inner housing, an electric heater supported upon the heat-conducting housing, and a thermostat supported upon the heat-conducting housing controlling operation of the heater and responsive to temperature variations within the outer housing.

3. A temperature-controlled piezo-electric crystal mounting that comprises a base, an inner housing formed of insulative material mounted on said base and defining a crystal chamber, an outer housing disposed in spaced relationship to the inner housing and defining therewith a heat-insulated space, a heat-conducting housing within said space disposed in closely spaced relationship to the inner housing, an electric heater supported upon the heat-conducting housing, and a thermostat supported upon the heat-conducting housing controlling operation of the heater and responsive to temperature variations within the outer housing.

4. A mounting according to claim 2 in which the inner and outer housings are formed of heat-insulating material.

5. A mounting according to claim 2 in which the base is supported upon a pedestal formed on an inner portion of the outer housing.

6. A mounting according to claim 2 in which a central portion of the base is supported upon a pedestal formed on an inner portion of the outer housing.

7. A mounting according to claim 2 in which only a central portion of the base is supported upon a pedestal formed on an inner portion of the outer housing, while a remaining portion of said base forms, in conjunction with the portion adjacent said pedestal, a channel for leads connecting contact pins with associated crystals.

SAMUEL A. BOKOVOY.