

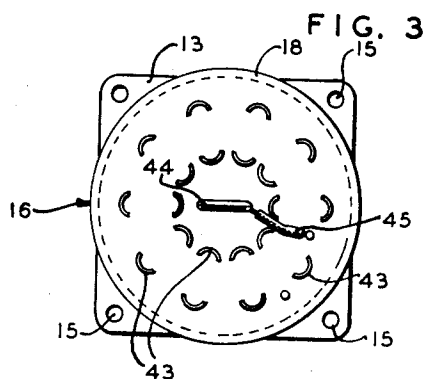
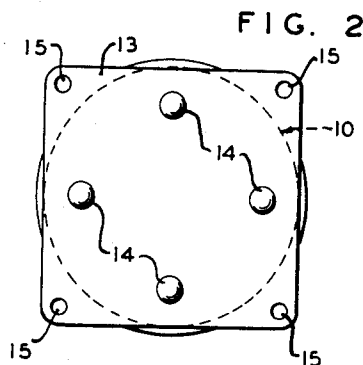
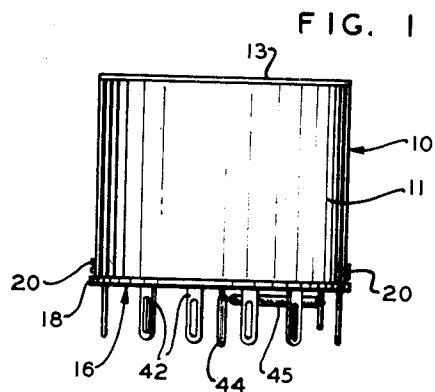
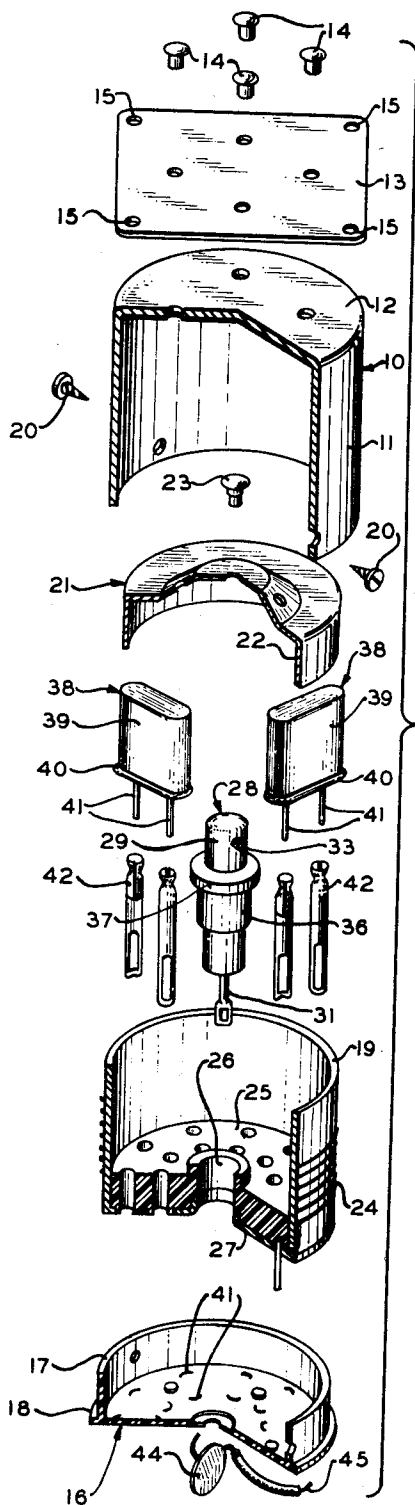
May 24, 1960

F. J. CHELI
CRYSTAL OVENS

2,938,099

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2 Sheets-Sheet 1



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2 Sheets-Sheet 2

FIG. 5

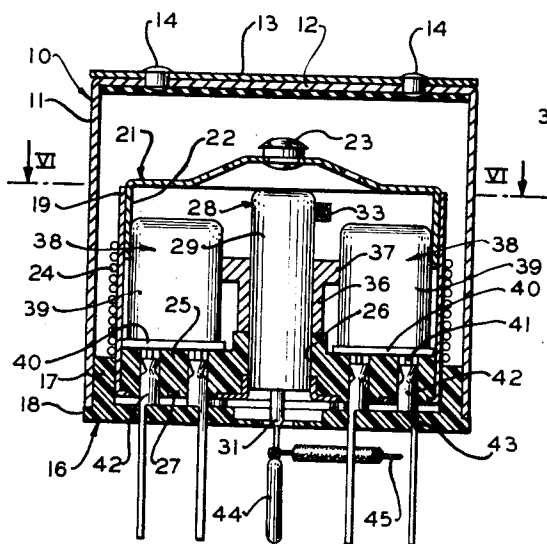


FIG. 6

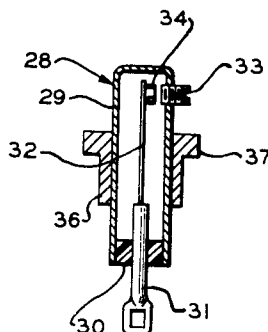
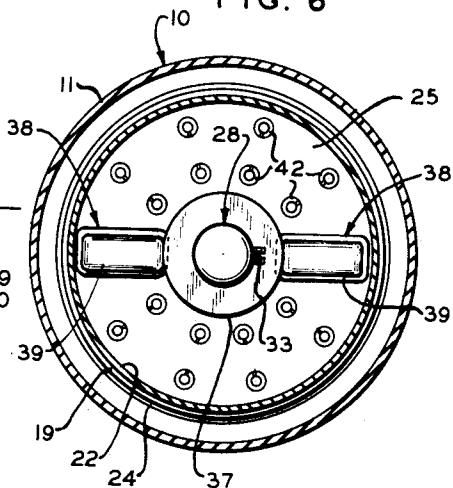


FIG. 7

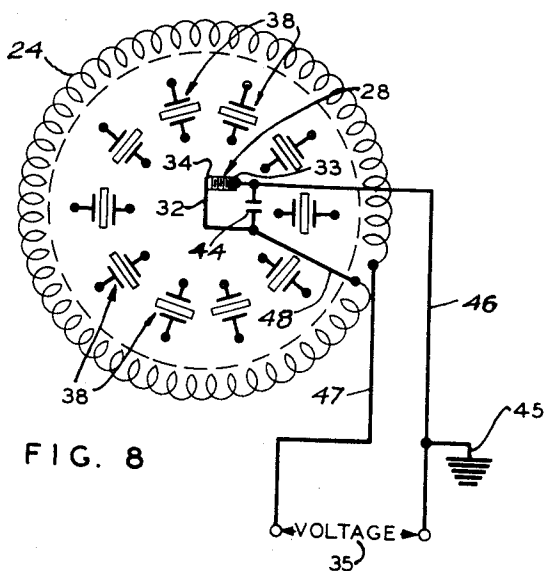


FIG. 8

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2,938,099

CRYSTAL OVENS

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4 Claims. (Cl. 219-19)

This invention relates to a crystal oven, and more particularly to temperature-controlled ovens for piezo-electric crystals and the like, such as inductances, capacitors, transistors or similar components which have to be maintained at a substantially constant temperature for most effective operation.

It is recognized in the art, for instance, that crystal-controlled oscillator circuits, which are utilized in radio and radar equipment, are subject to wide variations in temperature, particularly when employed on aircraft. It is desirable, and usually essential, that the crystal or crystals used in oscillating circuits be stabilized with respect to the oscillating frequency. One of the factors that affects the frequency of oscillation of a piezo-electric crystal is the temperature condition of the crystal. Efforts have been made in the past to provide means for maintaining the crystal at a predetermined operating temperature, but too great temperature variation and lag in response to temperature changes have presented problems not satisfactorily solved prior to this invention.

In its broad aspect, the present invention contemplates improving upon prior-art crystal ovens and to provide a crystal oven overcoming defects of the previously known ovens.

An essential object of the invention is to provide an oven affording more perfect control of applied heat from the actual temperature of the crystal.

A further object of the invention is to provide a construction that will function effectively and efficiently by use of a single heating coil in conjunction with control therefor directly affected by the crystal temperature.

More specifically, the invention proposes direct heat-conductive transfer of temperature of the crystal to the thermostat and thereby reduce lag in response to temperature change in the crystal.

Another object of the invention is to provide a crystal oven wherein the crystals may be readily removed and replaced.

While certain outstanding objects of the invention are mentioned above, other objects, advantages and beneficial constructional features will appear to persons skilled in the art to which the invention appertains as the description proceeds, both by direct recitation thereof and by implication from the context.

Referring to the accompanying drawings, in which like numerals of reference indicate similar parts throughout the several views;

Figure 1 is an elevational view of the completely assembled crystal oven constructed in accordance with the present invention;

Figure 2 is a plan of the crystal oven of Fig. 1;

Figure 3 is a view looking upwardly toward the bottom of Fig. 1;

Figure 4 is an exploded view in perspective showing the several constituent parts of the invention;

Figure 5 is a longitudinal section on a diametric plane of the completely assembled crystal oven;

Figure 6 is a cross-sectional view substantially on line VI-VI of Fig. 5;

Fig. 7 is a longitudinal section of the thermostat; and

Figure 8 is a circuit diagram of the electrical connections of the thermostat and heater.

Before entering upon the detailed description of the invention, mention is made of the fact that the position of the oven is entirely a matter of choice, so that the directional designations of top, bottom, sides, front and back and so forth are to be understood as arbitrary and used only as applying to the oven or its parts in the position selected for illustration in the drawing as a matter of convenience in description, and are not to be considered restrictive as to construction or positioning of the oven or its parts.

Resorting to the use of such arbitrary terminology, the oven as illustrated comprises an outer can or casing 10 shown as having a cylindrical side wall 11 and an integral top wall 12. A square attaching plate 13 is shown riveted, as by rivets 14, symmetrically to said top wall, the projecting corners of said plate having holes 15 therein for conveniently attaching the oven in place of use. At the bottom end of said can or casing is a closure or base 16 which has a cylindrical flange 17 frictionally entering the mouth or open end of the can and has a peripheral rim 18 which will engage against the end edge of the can as a limitation to insertion of the base in the can. Said flange 17 projects only a short distance within the can or casing. Received within the said flange is the end margin of a cylindrical oven body 19. Both the can or casing 10 and oven body 19 may be metal and constitute a cylinder within a cylinder in coaxial relation with flange 17 interposed between marginal ends thereof and otherwise separated by air space. The closure or base 16 is electrical insulative material and conveniently is a hardened plastic.

When the oven is assembled at the factory, the body 19 and base 16 are in permanently secured relation to each other, but the casing or can 10 is removable, being held in use by diametrically opposite screws 20 which screw into said flange 17. In an axial direction, said body 19 is shorter than the can or casing 10 so there is space between the inner end of said body and the top wall 12 of the can. Said body is provided with a removable cover 21 shown as somewhat dome shape and having a peripheral skirt 22 properly proportioned to frictionally enter the upper end of said body. A shouldered rivet 23 is secured at the top center of said cover, the shoulder spacing the rivet head above the cover material so as to afford a finger-hold for removing the cover when desired.

Wound upon the outside surface of the cylindrical side wall of the oven body 19 is a heating coil 24 for an electric heating current. The wire comprising said coil is appropriately insulated electrically from the metal of said body so the heating current travels in series through the several convolutions of the coil. Since the coil is wound tightly upon the oven body, the heat developed will be directly applied to the oven body which will therefore be promptly heated thereby. The air space around and over the oven body, within the can, enables the can to be at a considerably lower temperature than the oven body.

Within the oven body, at the bottom thereof, is a plastic or other socket 25 of insulating material, said socket being permanently located in that position. At the middle of said socket is a thermostat-receiving hole 26. The metal of the bottom wall 27 of the oven body flares at its middle upwardly inwardly coaxial with said hole and with appropriate diameter, slightly less than that of hole 26 of the insulator socket so as to make

grounding contact with the thermostat shell when the thermostat is inserted therein.

The thermostat, designated generally by numeral 28 and shown in detail in Fig. 7, conveniently comprises a closed-end cylindrical shell 29 of suitable metal of appropriate diameter to engage within the afore-mentioned flare of the bottom wall 27 of the oven body. The other- 5 wise open bottom end of the shell has an insulative plug 30 therein through which projects a lead-in post 31 which fixedly carries the bottom end of a bi-metal element 32 10 that extends upwardly centrally of said shell but out of contact therewith. Near the top of the shell is an adjustable contact member 33 directed radially inwardly of the shell and normally contacted by a contact element 34 carried by the bi-metal element. The relation of 15 parts is such that when the bi-metal becomes heated it will automatically bow away from the adjustable contact member and break the electrical circuit. That circuit includes a source of voltage supply 35 in series with said contact elements 33, 34 and heater coil 24. On the out- 20 side of shell 29 is secured, by soldering or otherwise, a metal sleeve 36 the lower end of which constitutes a limiting stop for engagement against the socket 25 thereby determining the distance of insertion of the thermostat into said socket. At the upper end of said sleeve is an 25 outwardly projecting peripheral flange 37 the purpose of which will presently be explained. It may be stated here, however, that said sleeve in its entirety constitutes a heat sink for keeping the thermostat contacts closed within the desired range of temperatures notwithstanding slight variations of applied heat. 30

The piezo-electric crystals or other components that require heat for proper operation are designated in general by numeral 38, and since they are of known structure available on the market, detail showing and description is not deemed necessary. Suffice it to say, that they in- 35 clude a metallic, somewhat oblong metallic enclosure 39 at the bottom of which is an insulator base 40 with contact pins 41 depending therethrough. It is the purpose of the oven to keep said enclosures at a predetermined and substantially constant temperature. Said compo- 40 nents are removable and replaceable in the oven by provision of resilient elongated pin receptacles 42 embedded in the insulating material of socket 25 in proper location to receive the pair of pins depending from said components. It is appropriate to point out that the structure 45 herein shown provides receptacles 42 the lower ends of which are approximately semi-cylindrical, and these project through correspondingly semi-cylindrical slots 43 in the insulative oven base 16 for attachment of wires of the service circuits. A condenser 44 is shown attached to the lower protruding end of the lead-in post 31 to the thermostat and a connection 45 to ground is provided 50 from that condenser.

An essential feature of the present invention is the location of metallic enclosures 39 of the piezo-electric or other components 38 in direct physical contact with the heat sink or sleeve 36. Each pair of pin receptacles 42 are 55 therefore located on a line radial to the thermostat and its sleeve and at proper distance from the thermostat to assure engagement of a side edge of the enclosure 39 against flange 37 of said sleeve. Direct heat transfer is consequently obtained so the heat condition of the component 38, by conduction, will constantly and im- 60 mediately influence the heat condition of the heat sink, which in turn acts upon the thermostat and thereby controls current to the heating coil.

The circuit for controlling the heating current to coil 24 is shown in Fig. 8, where it will be noted that one lead-in connection 47 attaches to one end of heating coil 24 and that the other end of the heating coil has connec- 65 tion 48 to one side of the thermostat 28 and indicated by the present showing as going to the bi-metal element 32. The other element of the thermostat represented by the adjustable contact member 33, which is grounded, is 70

shown having connection 46 to the source of voltage 35. It is appropriate to here emphasize that the piezo-electric or other components 38 are located around the thermostat and are housed in the same chamber in which the thermo- 5 stat is housed so that the heat affecting said components also affects the thermostat, and this community applica- tion of heat is increased by conduction from the chamber wall to the components and from the components to flange 37 directly in contact with the thermostat 28. To 10 at least reduce and in most instances to prevent sparking when the thermostat contacts open, condenser 44 is lo- cated in parallelism to the make-and-break circuit.

The invention claimed is:

1. An electric oven for maintaining substantially con- 15 stant temperature for elongated metal-encased compo- nents contained therein, comprising a hollow cylindrical oven body having an electric heater coil therearound as the sole heating means for the oven and its contents, a thermostat in electrical series with said coil, said thermo- 20 stat having a cylindrical encasement located coaxially within the hollow of said oven body, means for mounting said components in said hollow of the oven body as an annular series around said encasement in parallelism thereto and at equal radial spacing therefrom, and a 25 cylindrical heat sink girding said thermostat in engage- ment with said encasement circumferentially thereof, said heat sink having a flange protruding radially therefrom and located intermediate of the ends of said encasement, said flange making physical contact at its outer periphery 30 with each of said components thereby effecting heat ex- change between mid-length parts of said components and mid-length part of said thermostat encasement.

2. An electric oven comprising in combination with a plurality of elongated metal-encased components of 35 relatively flat character thereby having longitudinal edges and flat faces, a hollow cylindrical oven body containing said components, said body having an electric heater coil therearound as the sole heating means for the oven and its contents, a thermostat having a cylindrical encasement 40 located coaxially within the hollow of said body, means for mounting said components in said hollow of the oven body each with one of its said longitudinal edges proximate to and equally spaced from said encasement and each with its other said longitudinal edge radially remote 45 from said encasement and with said flat faces approxi- mately radial to said encasement, and a cylindrical heat sink girding said thermostat in engagement with said en- casement circumferentially thereof, said heat sink having a flange protruding radially therefrom and located inter- 50 mediate of the ends of said encasement, said flange mak- ing physical contact at its outer periphery with a part of each of said proximate longitudinal edges of said compo- nents thereby effecting heat exchange between said proximate narrow edges of said components and said 55 thermostat encasement.

3. An electric oven comprising an inverted cup-shaped casing thereby providing a top wall for said casing, a 60 bottom closure for said casing, a hollow oven body with- in said casing and spaced evenly therefrom throughout its circumference, a removable cover for said oven hav- ing frictional engagement therewith and located inwardly of said casing from said top wall, whereby air space is provided around and above said oven within said 65 casing, a heater coil around said oven within said casing and air space, said coil being readily accessible by re- moval of said casing from its bottom closure and said cover being thereby exposed and readily removable for access to the interior of said oven, and a finger-piece on 70 said cover for lifting said cover from its frictional en- gagement with said oven.

4. An electric oven comprising an inverted cup-shaped cylindrical casing thereby providing a top wall for said casing and a cylindrical wall depending at the periphery 75 of said top wall, a disk-shaped bottom closure for and located in the bottom end of said cylindrical wall and

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spaced evenly therefrom throughout its circumference, a removable cover for said oven having a peripheral skirt insertable into and making frictional engagement with said oven body, said cover being located inwardly of said casing from its said top wall, whereby air space is provided around and above said oven within said casing, a heater coil around said oven within said casing and air space, said coil being readily accessible by removal of said casing from its bottom closure and said cover being thereby exposed and readily removable for access to the interior of said oven, a plurality of elongated metal-encased components of relatively flat character thereby having longitudinal edges and flat faces, a thermostat having a cylindrical encasement located coaxially within the hollow of said body, means for mounting said components in said hollow of the oven body each with one of its said longitudinal edges proximate to and equally spaced from said encasement and each with its other said longitudinal edge radially remote from said encasement and with said flat faces approximately radial to said encasement, and a cylindrical heat sink girdling said thermostat in engagement with said encasement circumferentially thereof, said heat sink having a flange protruding radially therefrom and located intermediate of the ends of said encasement, said flange making

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physical contact at its outer periphery with a part of each of said proximate longitudinal edges of said components thereby effecting heat exchange between said proximate narrow edges of said components and said thermostat encasement, and said cover skirt upon insertion into said oven body engaging said remote edges of said components and pressing said components against said heat sink flange.

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