May 7, 1935. C. L. WATSON 2,000,266

CONSTANT TEMPERATURE OVEN

Filed April 18, 1932

Fig. 1.

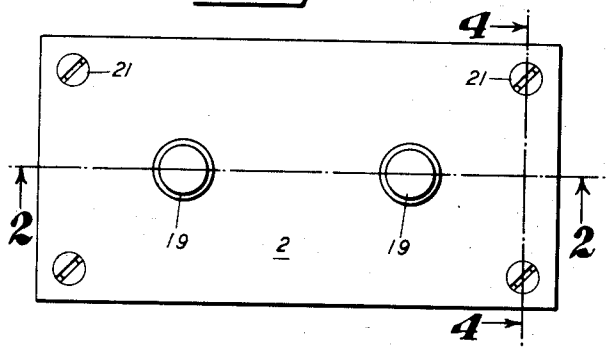


Fig. 4.

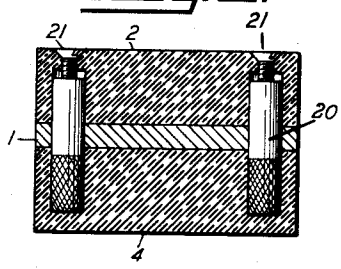


Fig. 2.

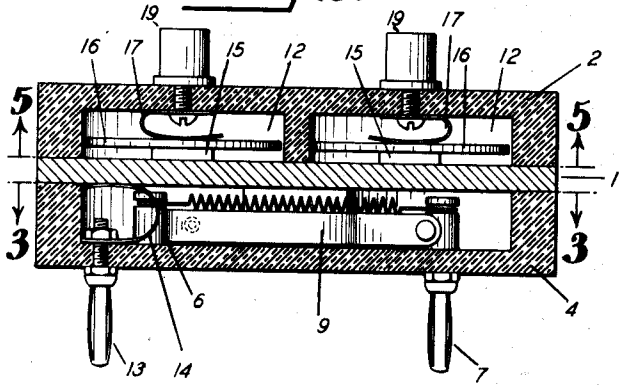


Fig. 5.

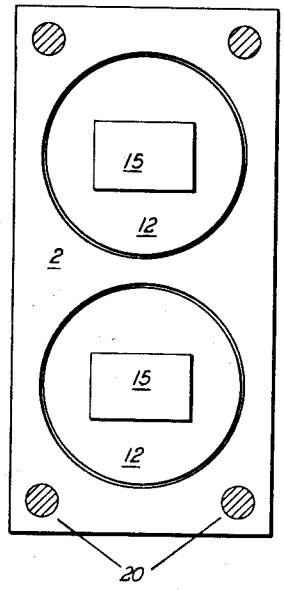
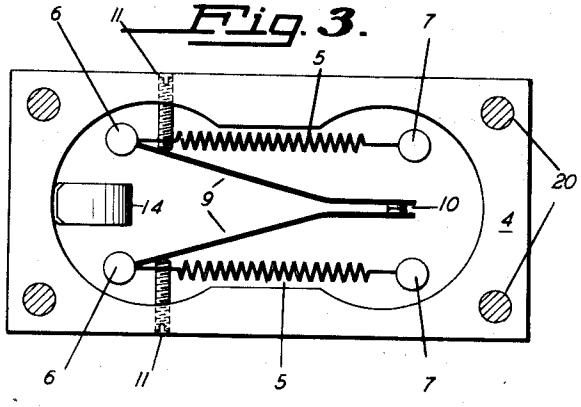


Fig. 3.



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UNITED STATES PATENT OFFICE

2,000,266

CONSTANT TEMPERATURE OVEN

Charles L. Watson, San Francisco, Calif.

Application April 18, 1932, Serial No. 606,062

5 Claims. (Cl. 219—19)

My invention relates to ovens used to keep an article at a substantially constant temperature over long periods of time, and more particularly to an oven used to keep a piezo-electric crystal at a substantially constant temperature while being employed to stabilize the frequency of an oscillating circuit.

Among the objects of my invention are: to provide an oven having a substantially constant temperature node; to provide an oven having a constant temperature node without resorting to the use of large amounts of heat insulating material; to provide a constant temperature oven which is highly compact; to provide a constant temperature oven which is light in weight; to provide an oven which may conveniently be used in aircraft; and to provide a simple and economical oven wherein a piezo-electric crystal control element of a high frequency alternating current circuit may be kept at a substantially constant temperature over long periods of time.

Other objects of my invention will be apparent or will be specifically pointed out in the description forming a part of this specification, but I do not limit myself to the embodiment of my invention herein described, as various forms may be adopted within the scope of the claims.

Referring to the drawing:

Figure 1 is a top view of a preferred form of oven.

Figure 2 is a cross sectional view taken through lines 2—2 in Figure 1.

Figure 3 is an inside surface view of the lower part of Figure 2 as designated at line 3—3.

Figure 4 is a sectional view taken through line 4—4 in Figure 1.

Figure 5 is an inside surface view of the upper portion of Figure 2 as designated at line 5—5.

It is well known in the art that piezo-electric crystals are used to control the frequency of oscillators, and it is also well known that changes in temperature of the crystals will change their response frequency. It has heretofore been necessary to enclose such crystals in ovens, surrounded by multiple heat insulating coatings, sometimes several feet in thickness, in an endeavor to shield the crystal and associated elements from all influence of ambient air temperatures. Such ovens are obviously expensive, bulky, and totally unsuited for use in aircraft. Many of them take several hours to reach equilibrium.

My invention makes direct use of contact with ambient air temperatures, has no thick insulating coverings, is small, compact and ideally suited for airplane use. Broadly considered it comprises a flat metal plate acting as a thermal transmission line having its periphery exposed to the surrounding air, a casing containing a heater and a thermostat, on one side of the metal plate, and a casing containing the object to be maintained at a constant temperature on the other side. The thermal transmission line receives heat near its center and radiates this heat into the ambient air through the exposed periphery.

A preferred form of my invention is shown in the drawing. It comprises a thermal transmission line 1 preferably a flat plate of copper or other heat conducting material. This plate preferably has its lower surface blackened, and its upper surface highly polished, and plated with chromium or silver, for purposes hereinafter described. Mounted on the upper surface of the plate is a crystal casing 2, and on the lower surface is a heater casing 4. These casings are preferably of moulded "Bakelite" or other material of a semi-heat insulating character.

The heater casing has contained therein two heater coils 5 of resistance wire, stretched between studs 6 and contact pins 7 which are secured to the bottom of the casing. Between these coils, and mounted on studs 6 are two thermostat arms 9, of bimetallic material, carrying at their extremities electrical contact points 10. These are normally held in contact by adjustment screws 11. When current is applied to the circuit, heat from coils 5 causes the arms to separate, breaks the circuit, and allows the coils to cool. Circuit is thereupon reestablished and the cycle is repeated, the off and on periods being conveniently adjusted by screws 11. During the heating period, the central portion of plate 1 is also exposed to heat from coils 5. The blackening of the lower portion of plate 1 as described above, prevents heat reflection and promotes absorption by the plate. The thermostat arms are exposed to the temperature of the plate as well as to that of the coils. Also contained in this casing is the contact post 13 which makes connection to plate 1 by means of spring 14.

Crystal casing 2 has two compartments 12 moulded therein. Each compartment contains a piezo-electric crystal 15, one face resting directly on the polished surface of plate 1, which thereby becomes one electrode in the crystal circuit. This surface as described above should be highly polished and may be plated with chromium or silver in order to preserve the sur-

face. Many crystals refuse to oscillate if the electrode surfaces are rough. On the opposing face of the crystals is placed an electrode **16**, also polished and plated at the plane of contact, held with light pressure by springs **17**, which in turn are attached to connecting posts **19**. The piezo-electric crystals may be identical or responsive to different frequencies.

Cases **2** and **4** together with their respective contents, are held against the opposite faces of plate **1** by bolts **20** and screws **21**, thereby forming the complete oven assembly. It is important that the periphery of plate **1** be left exposed to the surrounding air.

Convenient dimensions of the complete oven in its preferred form are as follows:

	Inches
Length	6
Width	3
Thickness	2
Thickness of plate	¼

When connected to a source of current the thermostat operates to maintain the temperature within the casing **4** constant between the predetermined limits for which it is set. Heat is lost from this casing through the transmission line, and also through the wall of the casing. The heat is supplied to the plate primarily by radiation and the heating elements are closely adjacent the transmission line, while the thermostat is more closely adjacent the outer wall of the casing. It follows that convection is low, and that the maximum temperature of the plate is maintained higher with low ambient temperatures than with high, giving a steeper temperature gradient along the line.

There will, however, be a temperature node in the line, whose temperature remains substantially constant, when the temperature of the periphery rises or falls and that closest to the heating coils falls or rises. Ambient air temperatures may vary widely without substantially changing the temperature of this node. I prefer to place the piezo-electric crystals in the locality of this node. Equilibrium is established in from 10 to 15 minutes and thereafter crystals or other objects placed on the constant temperature node will be maintained at a substantially constant temperature as long as heating current is supplied.

Casings **2** and **4** being semi-insulators of heat merely act to prevent drafts and sudden changes of temperature from affecting the apparatus directly.

Oscillating circuits controlled by crystals kept in the oven of my invention have maintained a frequency with a variation of less than 10 cycles per million over long periods of time. This variation is less than that required by present government regulations.

I claim:

1. In combination, a plate of heat conducting material, a block of heat insulating material, having a recess therein, disposed on each side of said plate to provide a pair of opposed fluid tight chambers separated by said plate, a thermostat and a heater controlled thereby enclosed in one of said chambers, the other of said chambers adapted to contain an object to be heated, said plate having areas thereof exposed to the air in said chambers, an area exposed to ambient air, and areas intermediate said exposed areas shielded from the air in said chambers and from ambient air.

2. In combination, a plate of heat conducting material, a block of heat insulating material, having a recess therein, disposed on each side of said plate to provide a pair of opposed fluid tight chambers separated by said plate, a thermostat and a heater controlled thereby enclosed in one of said chambers, the other of said chambers adapted to contain an object to be heated, said plate having areas thereof exposed to the air in said chambers, the periphery thereof exposed to ambient air, and areas adjacent said periphery shielded by portions of said blocks from the air in said chambers and from ambient air.

3. In combination, a plate of heat conducting material having a portion thereof exposed to ambient air, a block of heat insulating material, having a recess therein, disposed on each side of said plate to provide a pair of opposed fluid tight chambers separated by said plate, a thermostat and a heater controlled thereby enclosed in one of said chambers, the other of said chambers adapted to contain an object to be heated, said blocks contacting areas of said plate adjacent the periphery thereof to establish a heat transmission line through said plate between portions thereof adjacent said chambers and the periphery thereof, said transmission line being shielded from the air in the chambers and from ambient air.

4. In combination, a pair of blocks of heat insulating material having recesses therein facing each other, a plate of heat conducting material between said blocks, opposed surfaces of said plate forming a closure for said recesses to provide a pair of oppositely disposed fluid tight chambers, a thermostat and a heater controlled thereby enclosed in one of said chambers, an object to be heated enclosed in the other of said chambers, and said plate having a relatively small area thereof exposed to ambient air to permit heat drainage from said chambers.

5. In combination, a pair of blocks of heat insulating material having recesses therein facing each other, a plate of heat conducting material between said blocks, opposed surfaces of said plate forming a closure for said recesses to provide a pair of oppositely disposed fluid tight chambers, a thermostat and a heater controlled thereby enclosed in one of said chambers, an object to be heated enclosed in the other of said chambers, said plate having a relatively small area thereof exposed to ambient air to permit heat drainage from said chambers, and portions of opposed areas of said plate being shielded by said blocks from the air in said chambers and from ambient air.

CHARLES L. WATSON.