

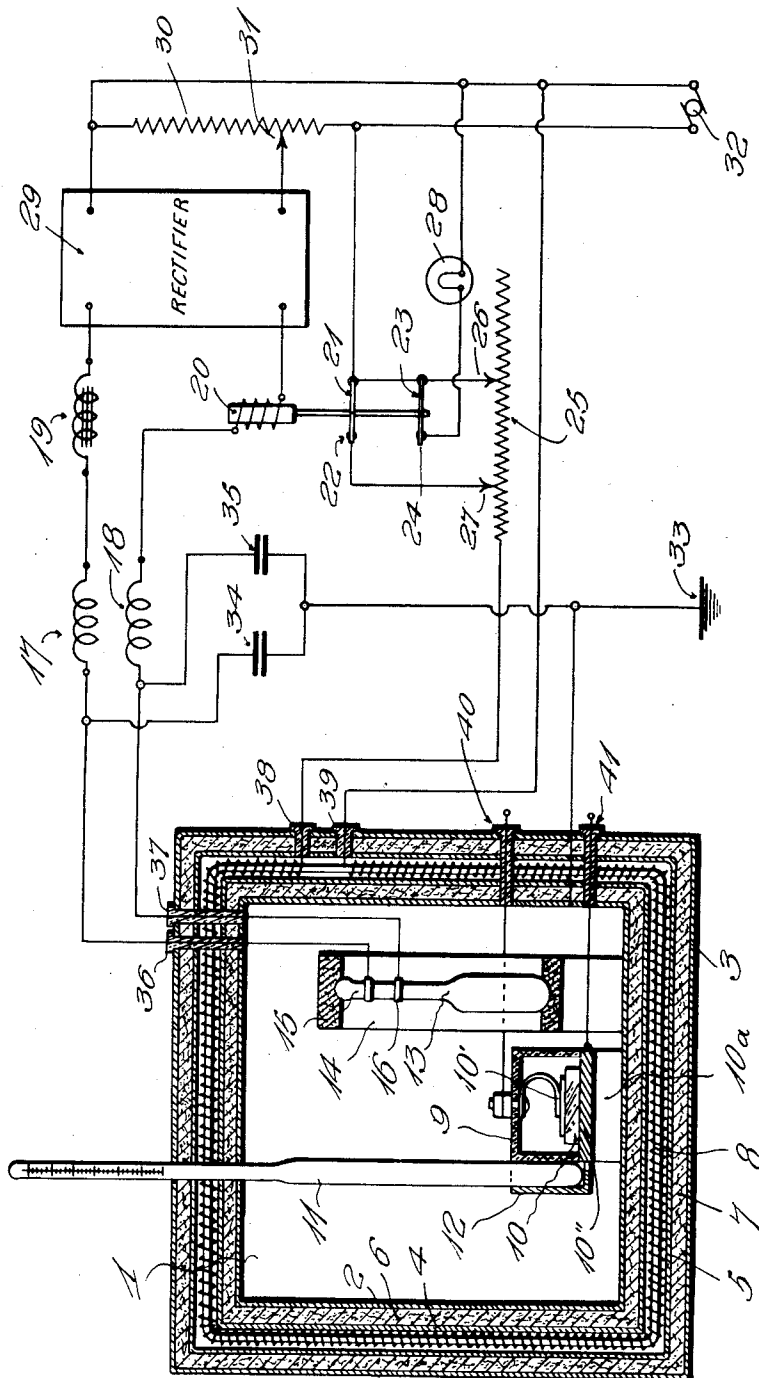
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TEMPERATURE CONTROL SYSTEM

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TEMPERATURE CONTROL SYSTEM

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This invention relates broadly to temperature control systems. More specifically our invention relates to temperature control of piezo electric crystal systems.

One of the objects of our invention is to provide a system whereby the operating temperature of a piezo electric crystal may be maintained constant.

Another object of this invention is to provide an arrangement which is adapted to be operated on an alternating current power supply circuit for controlling the temperature of operation of piezo electric elements.

Still another object of this invention is to provide a system adapted for use in intense radio frequency fields for maintaining the operating temperature of a piezo electric element substantially uniform independent of external temperature variations.

Other and further objects of our invention reside in the circuit arrangement for a frequency control system for high frequency transmitters having means for maintaining the frequency controlling element at constant temperature as set forth more fully in the specification hereinafter following by reference to the accompanying drawing which diagrammatically shows the circuit arrangement of our invention.

According to this invention a very sensitive thermostat of the mercury column type is employed in conjunction with a relay, which normally requires a relatively small operating current of only a few milliamperes, for controlling the temperature of a compartment having a piezo electric element therein. Heretofore relays of the type suitable for use in conjunction with mercury column thermostats have not been satisfactory in operation for controlling an alternating current power supply to a heating system. In this invention we provide a circuit arrangement whereby the heating system for the piezo electric crystal compartment is energized by an alternating current supply, such as is usually available in most radio stations and the temperature control system is operated from a direct current obtained by an associated rectification system from the alternating current source.

In the figure of the drawing, reference numeral 1 designates a container having inner and outer walls 2 and 3 of heat conducting material, walls 4 and 5 of heat resisting material, such as mica, and walls 6 and 7 of heat retaining material, such as wood fiber or composition of cellular material. The walls 6 and 7 are positioned between the walls 2 and 4 and 3 and 5, respectively. A heating unit 8 is positioned between the heat resisting walls 4 and 5. This heating unit may be made up of a winding of high resistance wire, made of materials such as alloys of nickel, chromium and iron, mounted upon a sheet of heat resisting material, such as mica. A holder 9 for an electromechanical vibrator element 10, having contact plate 10' associated therewith, is supported within the container 1 by members 10a of cellular material, such as pulp composition.

The bottom 10'' of the holder 9 is made of relatively heavy conducting material to maintain the electromechanical vibrator at uniform temperature and also to function as a contacting plate for the electromechanical vibrator. A thermometer 11, having its indicating scale exposed to view from the exterior of the container 1, is supported in the socket 12 with its bulb against the holder 9. A thermostat 13, having electrodes 15 and 16 positioned thereon, is supported within the container 1 by the members 14 of cellular material. The thermostat 13 may be positioned within the wall 6 or adjacent to the heating unit 8 if desired. In case the thermostat is positioned within the container 1 the wall 6, which is of cellular material, should be made of the proper thickness in order that too great a time period does not elapse before the heat from the heating unit 8 is transmitted to the interior of the container. Choke coils 17 and 18 are connected to the electrodes 15 and 16 to prevent excessive high frequency currents, which are picked up by the circuits associated with the thermostat, from being impressed upon the circuit within the thermostat and interfering with the proper operation thereof. The choke coils 17 and 18 are selected of such size that they are effective over the band of

frequencies on which the transmitter operates. Condensers 34 and 35 are connected across the choke coils 17 and 18 and to the ground connection 33 to provide a low impedance bypass circuit for any radio frequency energy transmitted through the choke coils 17 and 18. A relay 20 is connected in series with the rectifier 29 and the choke coils 17, 18, 19 to the electrodes of the thermostat. The input circuit of the rectifier 29 is connected to a power source of alternating current 32 across the potentiometer 30 as shown.

A variable connection 31 is provided on the potentiometer 30 to vary the current to the rectifier 29. Movable contacts 21 and 23, carried by the movable element of relay 20 are adapted to engage the fixed contacts 22 and 24. The movable contacts 21 and 23 are connected together to a variable connection 26 associated with the resistance unit 25 and the source of alternating current power supply 32. Contact 24 is connected to control the energization of indicator device 28 which consists of a lamp, buzzer, or similar alarm device. Contact 22 is connected to the variable connection 27 associated with resistance unit 25. Unipotential connections are also provided between the walls 2 and 3 of the container 1 and the ground connection 33. Bushings 36, 37, 38, 39, 40 and 41 are provided in the walls of the container for the lead-in connections to the thermostat 13, the heating unit 8, and the electromechanical vibrator element 10, respectively.

In the operation of this system rectified alternating current is supplied by the rectifier 29, which may be of any of the conventional types well known in the art, to the thermostat and relay circuit. Alternating current is supplied to the circuit of the heating unit 8. When the temperature within the container 1 reaches a predetermined value the circuit within the thermostat 13 is completed and rectified direct current flows from the output circuit of the rectifier 29 through the winding of relay 20 and the movable contacts 21 and 23 are caused to disengage the contacts 22 and 24. The portion of the resistance unit 25 between taps 26 and 27 is inserted into the heating unit circuit in series therewith, whereupon less heat is produced in the heating unit 8.

The lamp 28 is illuminated when the portion of the resistance unit between connections 26 and 27 is short circuited and the heating unit is being operated full capacity. The connections 26 and 27 are adjusted to permit accurate temperature control within the container over wide changes in ambient temperature caused by daily and seasonal variations or change of climate. By adjusting the position of variable connection 27 along resistance 25 the portion of the resistance unit 25 in circuit with heater 8 while the

circuit of relay 20 is deenergized may be governed. By adjusting the position of variable connection 26 on resistance 25 the portion of the resistance unit 25 in the heating unit circuit when the circuit of the relay 20 is energized, may be varied. The choke coils 17 and 18 and the condensers 34 and 35 may be mounted within the container 1 in order that the connections between the electrodes 15 and 16 may be made as short as possible. In case the choke coils 17 and 18 are mounted on the outside of the container, the portions of the connections between the electrodes 16 and 15 and the choke coils outside the container are made as short as possible in order to prevent large radio frequency potentials from being developed in these connections. The neck of the thermostat 13 may be made to protrude outwardly of the container so that the electrodes 15 and 16 are on the outside of the container, in which case the choke coils are connected directly to the electrodes.

The frequency control element must be closely associated with the oscillator and power amplifier and radiation circuits of the transmitter and is normally in an intense radio frequency field. However the protection which is offered to the thermostat circuit against the effects of radio frequency currents by the provision of choke coils 17, 18 and 19, and the condensers 34 and 35 enables the heater circuit to be actuated with substantially no inertia for accurately maintaining the temperature of the frequency control element substantially constant.

While we have described our invention in one of its preferred embodiments, we desire it understood that modifications thereof may be made and that no limitations upon our invention are intended other than are imposed by the scope of the appended claims.

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

1. In a temperature control system, a constant temperature cabinet, a thermostat element mounted in said cabinet and provided with contact members adapted to open and close an electric circuit according to the temperature in said cabinet, a source of alternating current, a rectifier having its input terminals connected to said source of alternating current, a relay, the actuating winding of said relay being connected in series between the output terminals of said rectifier and the contact members of said thermostat element, an electric heating element mounted in said cabinet, a tapped variable resistor having two variable taps and having one terminal connected to one terminal of said heating element, the other terminal of said heating element being connected to one terminal of said source of alternating current, one tap of said resistor being connected to one contact of said relay and the other terminal of said source,

and the other contact of said relay being connected to the other tap of said variable resistor.

2. In a temperature control system, a constant temperature cabinet, a thermostat element mounted in said cabinet and provided with contact members adapted to open and close an electric circuit according to the temperature in said cabinet, a source of alternating current, a rectifier having its input terminals connected to said source of alternating current, a relay, the actuating winding of said relay being connected in series between the output terminals of said rectifier and the contact members of said thermostat element, a plurality of radio frequency choke coils, at least one of said choke coils being connected in series in the lead of each contact member of said thermostat element, an electric heating element mounted in said cabinet, a tapped variable resistor having two variable taps and having one terminal connected to one terminal of said heating element, the other terminal of said heating element being connected to one terminal of said source of alternating current, one tap of said resistor being connected to one contact of said relay and the other terminal of said source, and the other contact of said relay being connected to the other tap of said variable resistor.

3. In a temperature control system, a constant temperature cabinet, a thermostat element mounted in said cabinet and provided with contact members adapted to open and close an electric circuit according to the temperature in said cabinet, a source of alternating current, a rectifier having its input terminals connected to said source of alternating current, a relay cooperatively controlling two sets of contacts, the actuating winding of said relay being connected in series between the output terminals of said rectifier and the contact members of said thermostat element, an electric heating element mounted in said cabinet, a tapped variable resistor having two variable taps and having one terminal connected to one terminal of said heating element, the other terminal of said heating element being connected to one terminal of said source of alternating current, one tap of said resistor being connected to one contact of each set of contacts of said relay and the other terminal of said source, and the other contact of the first set of contacts of said relay being connected to the other tap of said variable resistor, and a signal device connected in series between the other contact of said second set of contacts of said relay and the first named terminal of said source.

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