

Nov. 24, 1953

G. R. SANTOS
POWER GENERATOR

2,660,030

Filed July 21, 1951

2 Sheets-Sheet 1

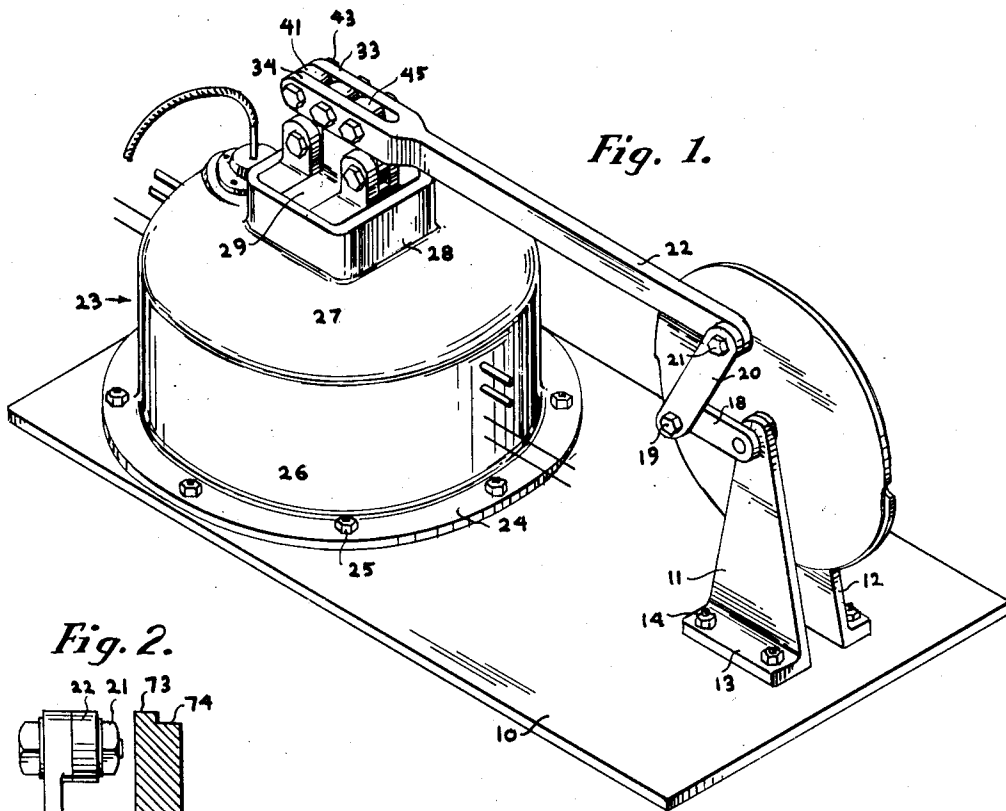


Fig. 2.

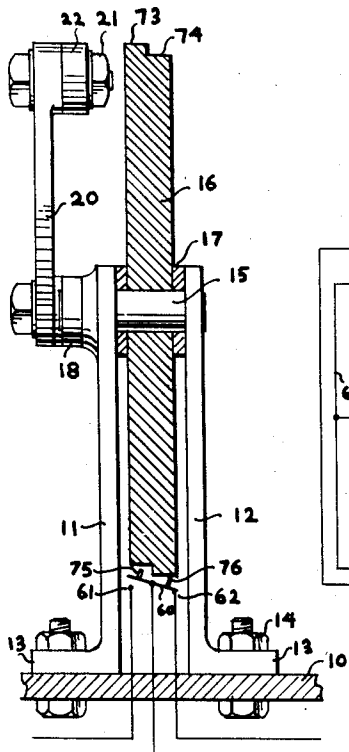
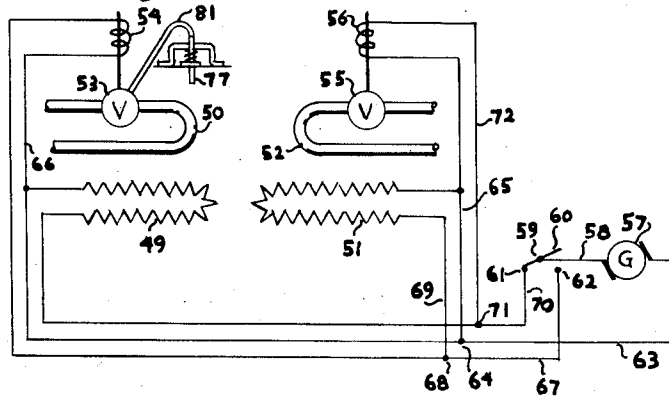


Fig. 3.



INVENTOR.
GÉRARD R. SANTOS
BY *Joseph and Brune*
Joseph and Brune
ATTORNEYS.

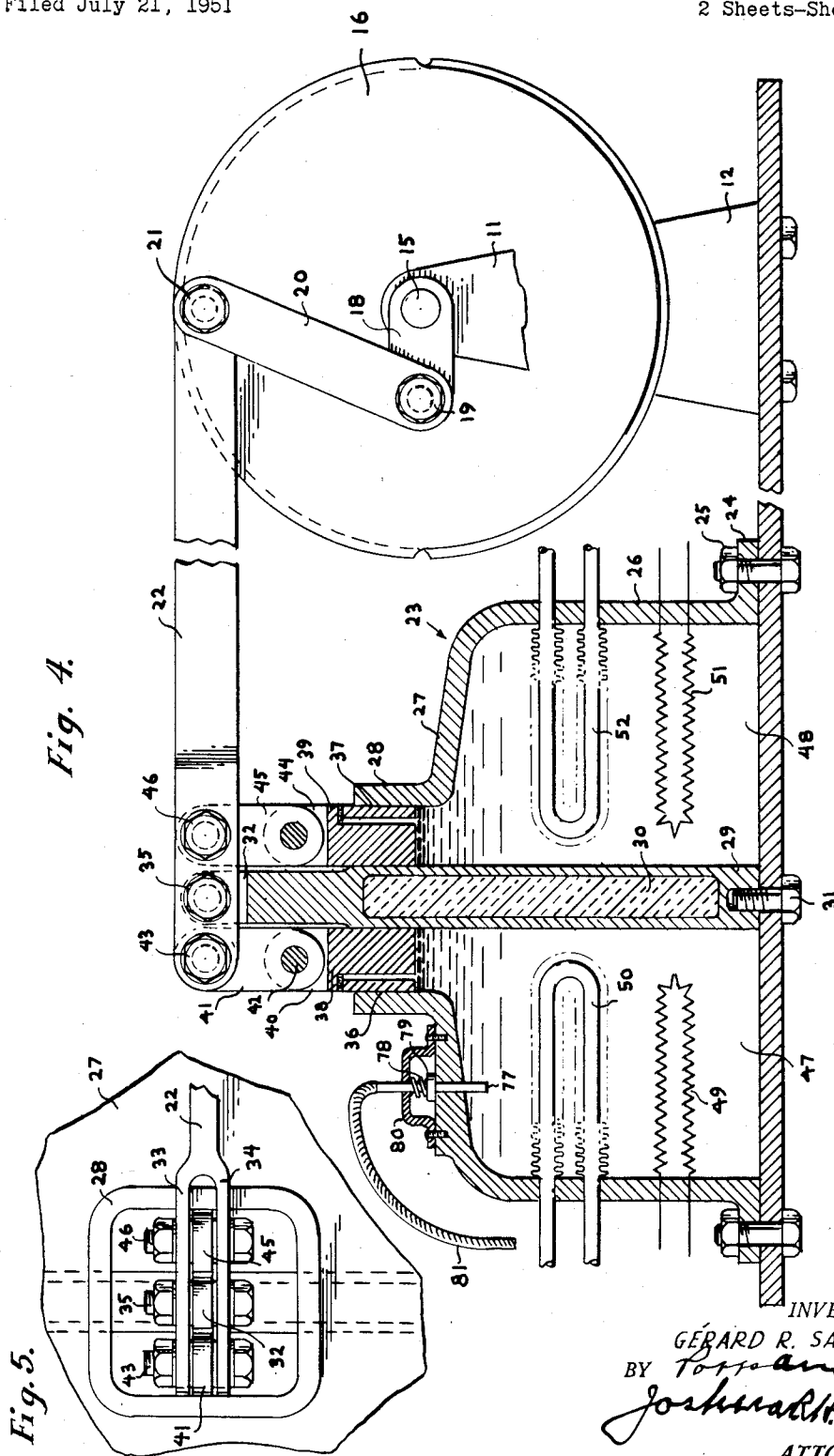
Nov. 24, 1953

G. R. SANTOS
POWER GENERATOR

2,660,030

Filed July 21, 1951

2 Sheets-Sheet 2



UNITED STATES PATENT OFFICE

2,660,030

POWER GENERATOR

Gérard R. Santos, Philadelphia, Pa.

Application July 21, 1951, Serial No. 237,926

9 Claims. (Cl. 60—23)

1

The present invention relates to power generators and is concerned primarily with a generator which transforms the expansive movement of fluid into rotary motion.

In accordance with the now well accepted principles of physics certain fluids such as pure water expand when heated and contract when cooled. The power generator of this invention is based on this principle.

An important object of the invention is to provide a power generator which consists essentially of a main casing that is divided into two chambers, each of which is filled with an appropriate expansive fluid. Each of these chambers terminates at its upper end in a cylinder with each cylinder receiving a piston. A lever is pivotally mounted between these pistons and each piston is operatively connected to the lever by a link. The other end of the lever is connected through the medium of a crank arm to a shaft so that oscillating movement of the lever is transformed into rotary motion of the shaft.

An important object of the invention is to provide each of the chambers aforesaid with means for heating the liquid therein and also with means for cooling the liquid. The respective means are used alternatively and when the liquid in one chamber is being heated the liquid in the other chamber is cooled and vice versa. The respective heating means may take the form of electric resistance coils while the cooling means may comprise tubes through which a cooling medium is circulated.

Inasmuch as the operation of the power generator is directly dependent on the alternate heating and cooling of the liquid in the two chambers an important object of the invention resides in the provision of mechanism for controlling the heating and cooling means in the respective chambers in proper synchrony.

In carrying out this idea each cooling tube is provided with a valve which controls the flow of the cooling medium therethrough. When the valve is closed the cooling medium cannot circulate and when it is opened the circulation is permitted. These valves are operated by a solenoid which is placed in a circuit which also includes the heating coils and a cam operated switch. The shaft which is rotated by the oscillating motion of the lever is provided with a cam which operates the switch. Thus, when the circuit to the heating coil in one chamber is completed the circuit to the solenoid for the control valve of the cooling medium in the other chamber is completed to hold that valve open.

2

Thus, the water in one chamber is heated while the other is cooled and this condition obtains for one stroke of the lever or for one hundred eighty degrees of revolution of the shaft. This means that the piston in the heated chamber has moved outwardly while the piston in the cooled chamber is drawn inwardly. After the cam on the shaft moves to one hundred eighty degrees the switch is operated to reverse the conditions above described.

It is recognized that excessive pressure in either of the chambers might create a dangerous condition. Accordingly, a further object of the invention is to provide a safety device which takes the form of an auxiliary piston which extends into one of the chambers and which is spring biased. Excessive pressure will cause this auxiliary piston to be moved against the influence of the spring and through an appropriate mechanical connection operate the control valve for the cooling tube of the chamber in which the piston is located.

From the nature of the operation of the power generator it is important that heat transfer between the two chambers be maintained at a minimum. Thus, another object of the invention is to provide an insulated partition which separates the two chambers with the insulation preventing to a high degree the heat transfer.

Various other more detailed objects and advantages of the invention such as arise in connection with carrying out the above noted ideas in a practical embodiment will, in part become apparent, and in part be hereinafter stated as the description of the invention proceeds.

The invention, therefore, comprises a power generator consisting essentially of a casing divided into two chambers by an insulated partition with each chamber formed with a cylinder. A piston is located in each chamber and each piston is connected to a lever that is pivotally mounted between the two pistons. The other end of the lever is connected by a crank arm to a shaft which carries a cam. A heating coil is located in each chamber and a cooling tube is located in each chamber. Each cooling tube is provided with a solenoid actuated control valve and the solenoids together with the heating coils are included in an electric circuit which also includes a switch that is operated by the cam.

For a full and more complete understanding of the invention, reference may be had to the following description and accompanying drawings wherein:

Figure 1 is a perspective view of a power gen-

3

erator that is designed in accordance with the precepts of this invention.

Figure 2 is a vertical section through the switch actuating cam and associated instrumentalities.

Figure 3 is a schematic illustration depicting the wiring diagram and associated mechanical instrumentalities.

Figure 4 is a longitudinal vertical section through the casing and supporting platform; and

Figure 5 is a fragmentary top plan view.

Referring now to the drawing and first more particularly to Figures 1 and 2 the power generator of this invention is shown as mounted on a platform or bottom plate 10. Secured to the upper face of the plate 10 are two uprights 11 and 12 which are arranged in spaced relation. Each of these uprights 11 and 12 is formed with a bottom flange 13 which is bolted to the plate 10 as indicated at 14.

The upper ends of the uprights 11 and 12 are formed with aligned openings in which is journaled a shaft 15. Drivably mounted on this shaft 15 is a cam 16 for a purpose to be later described and washers 17 may be positioned on either side of the cam 16 to space the latter from the uprights 11 and 12. The shaft 15 is continued through the upright 11 and drivably secured to the projecting portion of the shaft is a crank arm 18. Pivotally connected to the free end of the crank arm 18 as indicated at 19 is a link 20. The other end of the link 20 is pivotally connected as indicated at 21 to one end of a lever 22.

Referring now more particularly to Figure 4 which may be considered along with Figure 1 a casing 23 is shown as being of substantially cylindrical formation and having a flange 24 extending outwardly from the lower edge thereof. This flange 24 is bolted to the upper face of the plate 10 as indicated at 25. The casing 23 includes a cylindrical wall 26 and a top wall 27 which is integrally joined to the cylindrical wall. This top wall 27 terminates at the center in a substantially square-shaped upturned flange or wall 28.

A central partition 29 is shown as including a layer of good heat insulating material 30. This partition is located centrally of the casing 23 and its lower edge is bolted to the upper face of the plate 10 as indicated at 31. The upper edge of the partition 29 has a shape corresponding to the rectangular wall 28 in which it is snugly received. Above the walls 28 the partition 29 is reduced in thickness as shown in Figure 4 and carries an upwardly extending ear 32.

The lever 22 at the end remote from the pivotal connection 21 is bifurcated providing two side parts 33 and 34. The ear 32 is received in this bifurcated construction and a pivot pin 35 extends through aligned openings in the ear 32 and side parts 33 and 34. Thus, the lever 22 is pivotally mounted on this ear 32 that is carried by the partition 29.

The upper portion of the partition 29 together with the respective wall sections of the flange 28 define what are in effect two cylinders (though not of circular shape) 36 and 37. A piston 38 is received in the cylinder 36 and another piston 39 in the cylinder 37. Extending upwardly from the top of the piston 38 are a pair of ears 40 to which one end of a link 41 is pivotally connected by a pivot pin 42. The other end of the link 41 is received in the bifurcated end of the lever 22 and a pivot pin 43 extends through aligned openings in the link 41 and side parts 33 and 34.

Likewise, the piston 39 carries a pair of ears 44

4

to which is pivotally connected one end of a link 45. The other end of this link 45 is received in the bifurcated end of the lever 22 and connected thereto by a pivot pin 46.

It is evident that the partition 29 divides the casing 23 into two chambers. These are designated 47 and 48. The chamber 47 communicates with the cylinder 38 while the chamber 48 communicates with the cylinder 37. A heating coil 49 and a cooling tube 50 are located in the chamber 47 while a second heating coil 51 and a cooling tube 52 are located in the chamber 48.

Referring now more particularly to Figure 3 the circuit which controls the operation of the heating coils 49 and 51 and cooling tubes 50 and 52 will be described. The tube 50 is provided with a control valve 53 which is normally closed but which may be moved into open position by a solenoid 54. Likewise, the tube 52 is provided with a control valve 55 which is normally closed but which may be biased into open position by a solenoid 56. A source of electric power is represented by a generator at 57. From one side of the generator 57 a line 58 extends to the midpoint 59 of a double throw switch arm 60. This switch arm 60 is adapted to contact either of the terminals 61 or 62. From the other side of the generator 57 a line 63 extends. This line 63 is continued out and connects to one side of the heating coil 49. However, at a junction 64 a line 65 extends to one side of the heating coil 51 and is continued up to one side of the solenoid 56. From the connection of the line 63 to the heating coil 49 a line 66 extends to one side of the solenoid 54.

From the terminal 62 a line 67 extends to the other side of the solenoid 54 and from the junction point 68 a line 69 extends to the other side of the heating coil 51.

From the terminal 61 a line 70 extends to the other side of the heating coil 49 and from a junction point 71 a line 72 extends to the other side of the solenoid 56.

Referring now more particularly to Figure 2 the cam 16 is shown as formed with two cam tracks 73 and 74. The switch blade 60 carries two cam engaging members 75 and 76. The member 75 is adapted to be engaged by the cam track 73 to move the blade 60 into engagement with the terminal 61 while the member 76 is adapted to be engaged by the track 74 to move the blade 60 into engagement with the terminal 62.

That portion of the casing 23 which defines the chamber 47 is shown as formed with an opening which receives an auxiliary piston 77. This piston 77 is normally biased into a fully inserted position by a spring 78 which bears against the flange 79 on the piston and a retaining cap 80 that is bolted to the outer face of the casing. This piston 77 may be mechanically connected in any desired way such as by the cable 81 to the control valve 53 for the cooling tube 50.

It is obvious that when pressure in the chamber 47 becomes excessive the piston 77 will be moved against the influence of the spring 78 to actuate the cable 81 and thus open the valve 53 and permit the cooling medium to circulate through the tube 50 and thus relieve the pressure.

Operation

With the switch blade 60 in the position depicted in Figure 3 the circuit to the heating coil 49 is completed and the circuit to the solenoid 56 is also closed. Thus, current is delivered to

5

the heating coil 49 to heat the liquid (preferably pure H₂O) in the chamber 47. At the same time the solenoid 56 opens the valve 55 to permit the cooling medium to circulate through the tube 52. This means that the liquid in the chamber 48 is cooled.

The expansive action of the heated liquid in the chamber 47 moves the piston 38 upwardly while the tendency of the cooled liquid in the chamber 48 will tend to draw the piston 39 inwardly. Thus, the right hand side of the lever 22 (speaking with reference to the showing of Figure 4) is moved downwardly. This movement continues through one hundred eighty degrees whereupon the cam track 73 releases the cam engaging member 75 on the switch blade 60 and the cam track 74 engages the member 76 to move the other end of the switch blade 60 into engagement with the terminal 62. This breaks the circuit to the heating coil 49 and solenoid 56 and completes circuit to the heating coil 51 and solenoid 54.

The liquid in the chamber 47 is now cooled and the liquid in the chamber 48 is heated. Thus, the piston 38 is drawn inwardly and the piston 39 moved outwardly to move the right hand side of the lever 22 upwardly and thus complete one cycle of operation which imparts one full revolution to the shaft 15. Obviously, power may be taken from this shaft 15 to serve any purpose desired.

While a preferred specific embodiment of the invention is hereinbefore set forth, it is to be clearly understood that the invention is not to be limited to the exact mechanisms, devices, and circuits illustrated and described because various modifications of these details may be provided in putting the invention into practice within the purview of the appended claims.

What is claimed is:

1. In a power generator, a pair of chambers each having a cylinder communicating therewith, a piston in each of said cylinders, a lever pivotally mounted on a fixed axis between said pistons, operative connections between each of said pistons and said lever on opposite sides of said pivotal mounting, an expansive liquid in each of said chambers, a heating device in each of said chambers, a cooling device in each of said chambers, and control mechanism for causing the heating device in one chamber to be effective at the same time that the heating device in the other chamber is ineffective while the cooling device in said other chamber is effective at the same time that the cooling device in the first said chamber is ineffective.

2. In a power generator, a pair of chambers each having a cylinder communicating therewith, a piston in each of said cylinders, a lever pivotally mounted on a fixed axis between said pistons, operative connections between each of said pistons and said lever on opposite sides of said pivotal mounting, an expansive liquid in each of said chambers, a heating coil in each of said chambers, a cooling tube in each of said chambers, there being a solenoid actuated control valve operatively associated with each cooling tube, and a control circuit for said heating coils and the solenoids of said valves whereby the heating coil in one chamber is activated at the same time that the heating coil in the other chamber is inactive while the control valve for the cooling tube in said other chamber is open at the same time that the control valve for the cooling tube in the first said chamber is closed.

6

3. In a power generator, a pair of chambers each having a cylinder communicating therewith, a piston in each of said cylinders, a lever pivotally mounted on a fixed axis between said pistons, operative connections between each of said pistons and said lever on opposite sides of said pivotal mounting, an expansive liquid in each of said chambers, a heating coil in each of said chambers, a cooling tube in each of said chambers, there being a solenoid actuated control valve operatively associated with each cooling tube, and a control circuit for said heating coils and the solenoids of said valves whereby the heating coil in one chamber is activated at the same time that the heating coil in the other chamber is inactive while the control valve for the cooling tube in said other chamber is open at the same time that the control valve for the cooling tube in the first said chamber is closed, and a double throw switch included in said circuit and operatively connected to said lever, said double throw switch controlling the delivery of electric current to said heating coils and solenoids.

4. In a power generator, a casing, an insulated partition in said casing dividing said casing into two chambers each having a cylinder communicating therewith, a lever pivotally mounted on said partition, a piston in each of said cylinders, links connecting said pistons to said lever on opposite sides of said pivotal mounting, an expansive liquid in each of said chambers, a heating device in each of said chambers, a cooling mechanism in each of said chambers, and control mechanism for causing the heating device in one chamber to be effective at the same time that the heating device in the other chamber is ineffective while the cooling device in said other chamber is effective at the same time that the cooling device in the first said chamber is ineffective.

5. In a power generator, a casing, an insulated partition in said casing dividing said casing into two chambers each having a cylinder communicating therewith, a lever pivotally mounted on said partition, a piston in each of said cylinders, links connecting said pistons to said lever on opposite sides of said pivotal mounting, an expansive liquid in each of said chambers, a heating coil in each of said chambers, a cooling tube in each of said chambers, there being a solenoid actuated control valve operatively associated with each cooling tube, and a control circuit for said heating coils and the solenoids of said valves whereby the heating coil in one chamber is activated at the same time that the heating coil in the other chamber is inactive while the control valve for the cooling tube in said other chamber is open at the same time that the control valve for the cooling tube in the first said chamber is closed.

6. In a power generator, a casing, an insulated partition in said casing dividing said casing into two chambers each having a cylinder communicating therewith, a lever pivotally mounted on said partition, a piston in each of said cylinders, links connecting said pistons to said lever on opposite sides of said pivotal mounting, an expansive liquid in each of said chambers, a heating coil in each of said chambers, a cooling tube in each of said chambers, there being a solenoid actuated control valve operatively associated with each cooling tube, and a control circuit for said heating coils and the solenoids of said valves whereby the heating coil in one chamber is activated at the same time that the heating coil for the other chamber is inactive while the control

7

valve for the cooling tube in said other chamber is open at the same time that the control valve for the cooling tube in the first said chamber is closed, and a double throw switch included in said circuit and operatively connected to said lever, said double throw switch controlling delivery of electric current to said heating coils and solenoids.

7. In a power generator, a main supporting plate, a casing mounted on said plate, a partition on said plate within said casing dividing the interior of said casing into two chambers with a cylinder communicating with each chamber, a piston in each of said cylinders, a lever pivotally mounted adjacent one end on said partition, a pair of links operatively connecting said pistons to said lever on opposite sides of said pivotal mounting, an expansive liquid in each of said chambers, an electric heating coil in each of said chambers, a cooling tube through which a cooling medium is adapted to be circulated in each of said chambers, a valve associated with each tube controlling the flow of said medium therethrough, a solenoid operatively connected to each valve, and a control circuit for said coils and solenoids.

8. In a power generator, a main supporting plate, a casing mounted on said plate, a partition on said plate within said casing dividing the interior of said casing into two chambers with a cylinder communicating with each chamber, a piston in each of said cylinders, a lever pivotally mounted adjacent one end on said partition, a pair of links operatively connecting said pistons to said lever on opposite sides of said pivotal mounting, an expansive liquid in each of said chambers, an electric heating coil in each of said chambers, a cooling tube through which a cooling medium is adapted to be circulated in each of said chambers, a valve associated with each tube controlling the flow of said medium therethrough, a solenoid operatively connected to each valve, a control circuit for said coils and solenoids, a crank arm operatively connected to the other end of said lever, a shaft drivably connected to said

8

crank arm, a cam carried by said shaft and having two cam tracks, and a double throw switch included in said circuit and in operative engagement with said cam.

9. In a power generator, a main supporting plate, a casing mounted on said plate, a partition on said plate within said casing dividing the interior of said casing into two chambers with a cylinder communicating with each chamber, a piston in each of said cylinders, a lever pivotally mounted adjacent one end on said partition, a pair of links on opposite sides of said pivotal mounting with each link connecting one of said pistons to said lever, an expansive liquid in each of said chambers, an electric heating coil in each of said chambers, a cooling tube through which a cooling medium is adapted to be circulated in each of said chambers, a valve associated with each tube controlling the flow of said medium therethrough, a solenoid operatively connected to each valve, a control circuit for said coils and solenoids, an auxiliary piston mounted in said casing and extending into one of said chambers, a spring normally biasing said auxiliary piston into a fully inserted position, a cup carried by said casing and backing said spring, and an operating connection between said auxiliary piston and the valve for the cooling tube in the chamber into which said auxiliary piston extends.

GÉRARD R. SANTOS.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,068,881	Fortoul	July 29, 1913
1,289,435	Fulton	Dec. 31, 1918
1,314,376	Swan	Aug. 26, 1919
1,826,273	Christiansen	Oct. 6, 1931
2,512,212	Molotzak	June 20, 1950

FOREIGN PATENTS

Number	Country	Date
474,510	France	Dec. 8, 1914