R. W. KING.

THERMO-ELECTROSTAT.

APPLICATION FILED JUNE 11, 1909.

974,157. Patented Nov. 1, 1910.

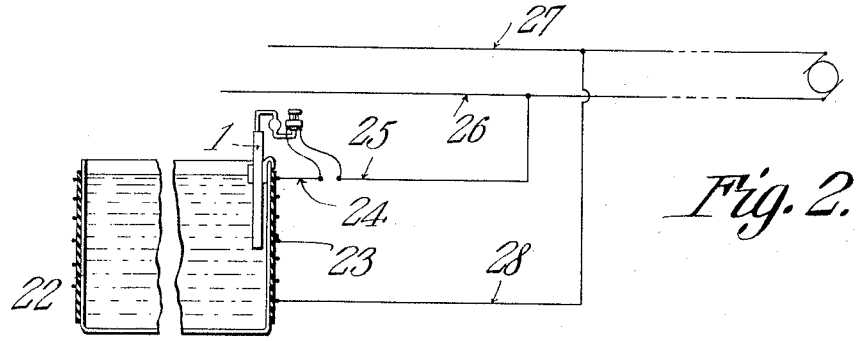

Fig. 2.

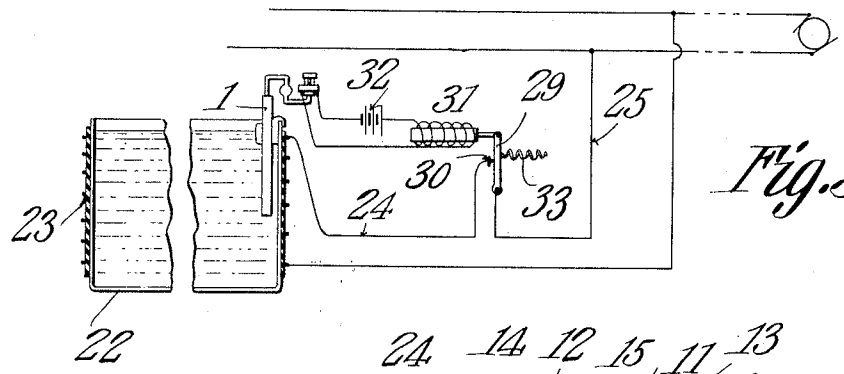

Fig. 3.

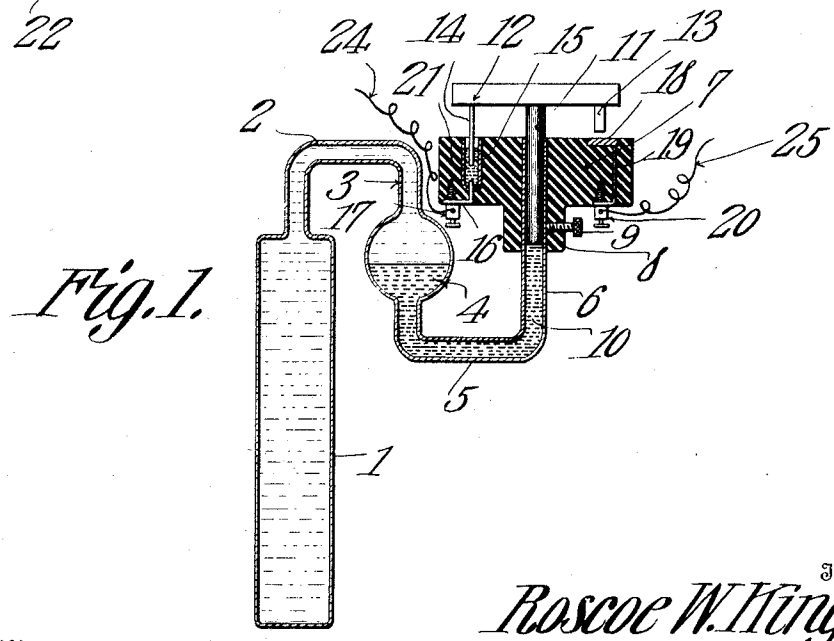

Fig. 1.

Witnesses

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UNITED STATES PATENT OFFICE.

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THERMO-ELECTROSTAT.

974,157. Specification of Letters Patent. Patented Nov. 1, 1910.

Application filed June 11, 1909. Serial No. 501,638.

To all whom it may concern:

Be it known that I, ROSCOE WILLIAM KING, a citizen of the United States, residing at Las Animas, in the county of Bent and State of Colorado, have invented a new and useful Thermo-Electrostat, of which the following is a specification.

The invention has reference to improvements in thermo-electrostats designed particularly for the regulation of temperature by the cutting in and out of an electric heater by means of instrumentalities responsive to variations in the heat generated.

In accordance with the present invention there is provided a container for a fluid readily expansible under the action of heat, and this fluid by expansion and contraction acts upon a circuit controller in such manner as to open the circuit when the heat exceeds a predetermined limit and to close the circuit when the heat falls to a predetermined lower limit, while provision is made for adjusting the apparatus to maintain chosen degrees of heat.

The invention will be best understood from a consideration of the following detail description taken in connection with the accompanying drawings forming a part of this specification, in which drawings, Figure 1 is a view in central longitudinal section of a thermo-electrostat constructed in accordance with the present invention. Fig. 2 is a diagram showing the application of the invention to an electric circuit. Fig. 3 is a similar diagram showing another application of the invention.

Referring to the drawings there is shown a vessel or container 1, which may be made of any suitable material, the container being closed at each end except that at one end there leads off a conduit 2 returned on itself as indicated at 3 and there formed into a bulb 4. From the end of the bulb remote from that entered by the conduit extension 3 there leads another conduit 5 also returned on itself as indicated at 6 and extending parallel with the upright portions of the members 2 and 3 to a point as high as or higher than the top of the connecting portion of the member 2 leading to the member 3.

Mounted on the conduit member 6 is a block 7 of hard rubber or other suitable insulating material which block is provided with a neck 8 and through the neck and block there is provided a passage for the conduit member 6 to which latter the block 7 is secured by means of a set screw 9 extending through the neck 8.

The container 1 is designed to be filled with some fluid of which alcohol may be taken as an example and this fluid extends into the bulb 4 where it engages the surface of a column 10 of mercury partly filling the bulb 4 and rising in the upright member 6 of the conduit. Entering the open end of the member 6 of the conduit is a plunger 11 carrying at its upper end a cross-head 12 which latter may be of electrically conducting material and this cross head carries at one end a contact terminal 13 and at the other end another contact terminal 14 both directed toward the block 7. Mounted in the block 7 in line with the terminal 14 is an open-ended vessel or container 15 preferably in the form of a short glass tube and entering the closed end of this vessel 15 is a conductor 16 which may be made of suitable material and is secured to a binding post 17 fast on the block 7.

In the path of the terminal 13 is a plate 18 seated in the upper face of the block 7 and preferably made of platinum. This plate 18 is connected by a conductor 19 to a binding post 20 which binding post as well as the binding post 17 is shown as secured to the under surface of the block 7.

The vessel or container 15 may have within it a small quantity of mercury such as indicated at 21.

In Figs. 2 and 3 there is shown a device to be heated and the heat of which is to be regulated. This device may be of any suitable character and is typified by a vessel 22 which may be considered as containing a volume of water which it is desirable to maintain at a constant heat. The water is heated by an electric heater typified by a coil of wire 23 wound about the vessel 22. This showing is to be taken only as illustrative and not as showing any particular structure, but it will be sufficient to show the operation of the present invention.

The container 1 is assumed to be inserted into the liquid within the vessel 22, and one side of the electric heater 23 is connected by a conductor 24 to one of the binding posts on the block, say the binding post 17. The other binding post 20 is connected by a conductor 25 to one lead 26 of a power circuit

while the other lead 27 of the power circuit is connected by a conductor 28 to the other side of the heating coil 23.

The proportions of alcohol and mercury within the container 1 and conduit 5—6 are such that at ordinary temperatures the plunger 11 is at its lowermost position with the contacts 13 and 14 in engagement with the plate 18 and mercury 21 respectively. Under these conditions current will flow through the heating coil 23 and the contents of the vessel 22 are heated until finally the heat generated so expands the alcohol within the container 1 that the mercury is forced outward from the bulb 4 through the conduits 5 and 6 and acting on the plunger 11 will raise the latter until the terminal 13 is moved out of contact with the plate 18 and so the power circuit through the coil 23 is broken and the generation of heat by the heater ceases.

Since the source of heat is no longer active, the heat stored within the liquid in the vessel 22 ultimately becomes dissipated to such an extent that the temperature is lowered sufficiently so that the alcohol within the container 1 contracts and the mercury within the conduits 5 and 6 approaches a common level, following the retreating alcohol into the bulb 4. The result of this is that the plunger 11 will fall with the falling mercury within the conduit 6 and ultimately the contact 13 is again brought into engagement with the plate 18 and the circuit is again established causing the generation of heat within the coil 23. When the temperature of the fluid within the vessel 22 again rises sufficiently the contact 13 is once more moved away from the plate 18 and the heating circuit is again ruptured.

Instead of including the device shown in Fig. 1 directly in the power circuit to the coil 23, the conductor 25 may include a switch 29 and the conductor 24 may include a contact terminal 30 in the path of the switch 29. In this case the switch arm 29 is under the control of an electro-magnet or solenoid 31 in a local circuit including a battery 32 or other suitable source of electric current and the terminals of the local circuit may be connected respectively to the binding posts 17 and 20. Under these circumstances when the contact 13 is brought into engagement with the plate 18 then the local circuit charges the magnet or solenoid 31 and the switch lever 29 is moved into engagement with the contact terminal 30 against the action of a spring 33. When the contact 13 is moved away from the plate 18 and the local circuit is broken then the magnet 31 is deënergized and the spring 33 will draw the switch 29 out of engagement with the terminal 30 thus rupturing the charging circuit of the coil 23.

Any suitable fluid may be used within the receptacle 1 but it is preferred to use some readily volatilized liquid like alcohol or some of the lighter hydro-carbons and in order to seal the conduit leading to the plunger 11 against the escape of any vapors generated in the container 1, it is preferred to use mercury within the conduit branches 5 and 6 and the bulb 4 is provided so that no mercury may escape over the conduit 2 and into the container 1.

The plunger 11 with the circuit terminal carried thereby is exceedingly delicate in operation and in order to prevent any interference with the delicacy of operation one side of the circuit is maintained by the circuit terminal 14 dipping in the mercury 21, this side of the circuit being always maintained and not interfering in any manner with the ready movement of the plunger 11.

The present invention is designed for use in connection with heating coils or electric heaters for heating incubators, hot air ovens, water and paraffin baths, and for all such purposes where it is necessary or desirable to maintain a uniform temperature for varying periods of time ranging from hours to years. This is particularly valuable in bacteriological laboratories and especially in localities where electric current only is available, and the present invention provides a cheap, efficient, and very delicate means for controlling electric current to produce very sensible uniformity of heat. While in fact there must be a variation in the heat to cause the operation of the device, the temperature has been found in actual tests to vary not more than one-half a degree centigrade during long intervals of time.

While alcohol has been mentioned as the specific expanding and contracting fluid to be used in the receptacle 1, it will be understood that other like fluids such as chloroform, acetone, benzin, mercury, air, or any other suitable substance may be employed.

The structure may be made of different sizes with the vessel or container 1 of different shapes for different purposes and the fluid containing portions may be made either entirely of glass or of metal or of a combination of the two.

The sensitiveness of the instrument will depend, in a measure, upon the relative proportions of the container 1 and the conduit leading therefrom, and especially the portion 6 of the conduit in which the plunger 11 fits.

What is claimed is:—

1. A thermo-electrostat comprising a container, a fluid therein readily responsive to heat variations, a conduit leading from said container, a plunger in said conduit in operative relation to said fluid, a conducting cross head fast on said plunger, two electric contacts carried by said cross head, a block of insulating material on the end of the con-

duit having the plunger therein and in the path of the contacts on the cross head on the movement of the latter toward the conduit, a circuit terminal carried by the insulating block in make and break relation to one of the contacts, and a mechanically non-resisting terminal also carried by the insulating block in constant electric relation to the other contact carried by the cross head.

2. A thermo-electrostat comprising a container, a fluid therein readily responsive to heat variations, a conduit leading from said container and including an expansion chamber, a plunger movable in the outer end of the conduit in operative relation to said fluid and provided with a conducting cross head, an insulating block carried by the outer end of the conduit and provided with circuit terminals, and electric contacts carried by the cross head, one of said contacts being in constant electrical relation to one of the circuit terminals and the other contact being in make and break relation to the other of the circuit terminals, the circuit terminal on the insulating block in make and break relation to the co-acting contact on the cross head being engaged by the said co-acting contact on the movement of the plunger into the conduit.

3. A thermo-electrostat comprising a container, a fluid therein readily responsive to heat variations, a conduit leading from said container and including an expansion chamber, mercury in the outer end of the conduit and in the expansion chamber, a plunger in the outer end of the conduit and engaged by the mercury, a conducting cross head carried by the plunger, an insulating block carried by the outer end of the conduit in adjustable relation thereto, a contact terminal carried by the block on one side of the conduit, a mercury cup carried by the block on the other side of the conduit, and electric contacts carried by the cross head, one in constant relation to the mercury cup and the other in make and break relation to the contact terminal carried by the block, the plunger moving into the conduit to bring the contacts and terminals into electrical engagement.

In testimony that I claim the foregoing as my own, I have hereto affixed my signature in the presence of two witnesses.

ROSCOE WILLIAM KING.

Witnesses:
G. M. NICHOLSON,
H. P. PHILLIPS.