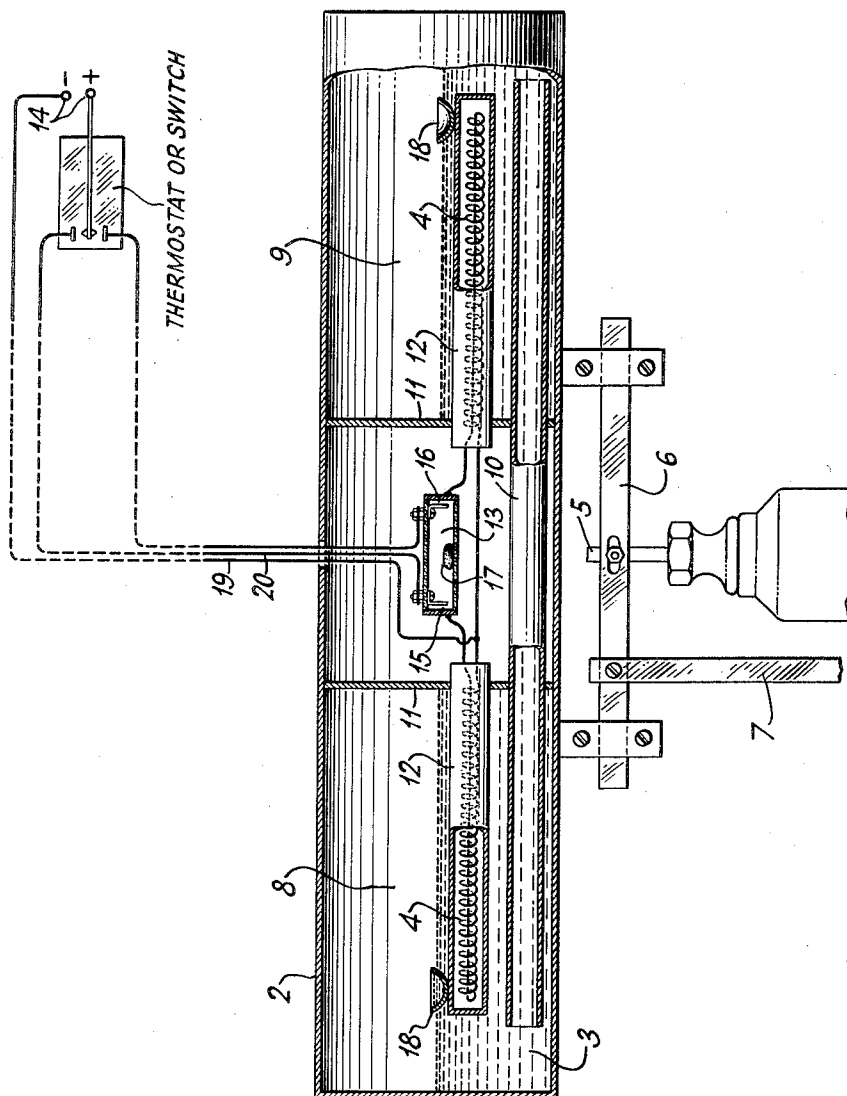


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AUTOMATIC CONTROL DEVICE
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AUTOMATIC CONTROL DEVICE

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4 Claims. (Cl. 236—68)

This invention relates to improvements in automatic temperature regulators, and has for one of its objects to provide an improved positive-acting temperature regulator suitable for use in opening and closing valves, dampers, switches, etc. A specific use for the invention, though not limited thereto, is to regulate the temperature of a room by the change in temperature therein.

In order to achieve temperature regulation, I make use of the bodily movement of a confined body of volatile liquid caused by the pressure of vapor generated above the surface of that liquid by the passage of an electric current through a coil placed in heating proximity to said liquid. Heretofore, this general principle of using a confined body of volatile liquid has been utilized to tip a balanced or pivoted receptacle in one direction, while the cooling of the liquid with the aid of gravity has been relied upon to restore the receptacle to its original position. Such known arrangements suffer from the following two important disadvantages, among others: First, they are slow to function because of the time required for the liquid to cool before the receptacle can resume its original position; and secondly, they are costly to operate because power is continuously being expended during the entire time the receptacle is tipped out of its normal position.

The present invention overcomes the foregoing disadvantages, first by providing positive acting means to tip the receptacle in its two directions of travel, thus reducing considerably the amount of time elapsing between movements; and secondly, by enabling the power to be cut off when the receptacle has changed its position, until such time as it is necessary to again heat the liquid to restore the receptacle to its previous position.

A feature of the present invention comprises the two heating coils located within the receptacle and oppositely disposed with respect to the center thereof for influencing movement of the receptacle by positive action.

Other objects, advantages, and features will appear from a reading of the following description, which is accompanied by a drawing illustrating diagrammatically and partly in section my improved automatic temperature regulator.

In the drawing, which is given by way of example only, there is shown a closed receptacle 2 containing within it a volatile liquid 3, in turn arranged to be heated by a pair of coils 4, 4 oppositely disposed with respect to the center of the receptacle. Receptacle 2 is pivoted on a pin and cross-bar arrangement 5, 6 and is capable of being tipped to the right or left for lifting or low-

ering a rod 7, in turn linked to a damper or valve, not shown, for controlling the draft in a furnace or for suitably regulating the admission of steam or hot air through a pipe.

Receptacle 2, in effect, consists of two sealed chambers 8 and 9, which are flow-connected by a hollow tube 10 communicating with both containers. Walls 11, 11 prevent the volatile liquid 3 from entering the central portion of the receptacle. Sealed in each chamber 8, 9 is a hollow enclosed tube 12 having within it a coil or resistance 4 capable of being heated by an electric current, and connected with wires to a mercury switch 13 and to the terminals of a source of heating energy 14. Volatile liquid 3 may comprise carbon tetrachloride, ether, methyl chloride, or any other suitable liquid which, upon an increase of temperature, will produce a vapor to exert a pressure on the liquid.

The mercury switch 13 includes two pairs of contacts 15 and 16, disposed at opposite ends of a sealed metallic tube in whose interior is a bubble of mercury 17. When the receptacle is tipped in one direction or the other, the mercury will slide down the sealed metallic tube and cause an electrical connection to be made between the contacts of the pair which is located at the lower end of the tube. Since a heating coil 4 is connected to each of said pairs of contacts, the mercury will enable an electrical current from source 14 to flow through that coil 4 which is associated with the electrically closed contacts, provided also that the proper contacts are closed at the remotely located thermostat 18.

Although the receptacle is shown in the drawing as being in the horizontal plane for the sake of simplicity of explanation, it should be distinctly understood that the receptacle 2 is so designed that it is always tipped either to the right or to the left, and is never balanced in the horizontal plane. The reason for this is that the device is not operative in the horizontal plane, inasmuch as the mercury bubble 17 could not in that position cause closure of either of the pairs of contacts 15 and 16 of the switch 13. To insure tipping of the receptacle in one direction or the other, about the pivot 5, 6, there may be provided a small container 18 which traps and retains a small amount of the volatile liquid 3 after the main body of the liquid is forced out of one chamber into the other. This small amount of liquid that is trapped is vaporized by the residue heat of the heating coil 4 and its tube 12 after the current is shut off, thus producing pressure that will

force out any liquid remaining in the chamber to which the heat is being applied.

The operation of my automatic temperature regulator will now be described. Assuming that the receptacle is tipped to the left so that the left hand end hangs lower than the right hand end, it will be evident that the mercury bubble 13 will cause an electrical connection to take place between the pair of contacts 15. If at this time the thermostat switch 14 closes the upper contact thereof with its armature, then an electrical circuit will be closed over leads 19 and 20 to source of heating supply 14 for heating the coil 4 in the lower end of the receptacle. The heat produced by the coil 4 will cause the liquid in chamber 8 to vaporize, thus producing a pressure on the liquid to force the same out of chamber 8 and into chamber 9 over the intercommunicating tube 10. The flow of the liquid into chamber 9 will tilt receptacle 2 in the other direction, thus raising chamber 8 and lowering chamber 9, with a consequent raising of the lever 7 controlling the damper or valve. This movement of the receptacle 2 will also cause the mercury bubble to leave the contacts 15, thus opening same, and to slide over to contacts 16, thus closing the latter to the electrical circuit. It will thus be evident that the movement of the receptacle automatically cuts off the heating supply 14 from the coil which caused the movement. In the new position of the receptacle 2, however, there will be no heating energy supplied to the coil in chamber 9 until such time as the thermostat closes its lower contact with its armature. In other words, once the receptacle has changed its position, it will maintain this position indefinitely without any further use of electrical power, until the thermostat responds to a difference in room temperature to cause reverse movement of the automatic regulator. Upon closure of the lower contacts of the thermostat 14, the liquid 3 will be forced back into chamber 8 in the same manner described above in connection with the flow of the liquid in the reverse direction.

Some of the advantages of my improved device are: (1) It provides quick action, (2) it gives closer regulation of the room temperature, and (3) it is cheap to operate.

It will be understood, of course, that the invention is not limited to the precise arrangement of parts shown, since various modifications can be made without departing from the spirit and scope of the appended claims. Moreover, the device of the invention is not necessarily a temperature controlling device, since it can be used for time delay switch operation, and for advertising schemes; in fact, wherever there is need for a power controlling device.

What is claimed is:

1. The combination with a pivoted receptacle having within it two chambers partly filled with a volatile liquid and connected by a passageway, one of said chambers being temporarily on a

higher level than the other, and vice versa, of a heating coil in each of said chambers adapted to force the liquid from the one chamber to the other to cause movement of said receptacle about said pivot, a control arm linked to said receptacle and responsive to movement thereof, and means for supplying electrical energy to that heating coil which is in the lower chamber, and for cutting off said energy from said heating coil when said last chamber reaches the higher level, said means including a mercury switch located within said receptacle and another switch located externally of said receptacle.

2. An arrangement as defined in claim 1, including a liquid trap in each of said chambers for insuring a difference in level between said chambers.

3. An automatic temperature regulator for a furnace comprising a pivoted receptacle having within it two sealed chambers partly filled with a volatile liquid and connected by a passageway, a heating coil in each of said chambers adapted to give rise to a bodily movement of said liquid from one chamber to the other to cause movement of said receptacle about its pivot, a control arm for the furnace linked to said receptacle and responsive to movement thereof, and means including a switch movable with said receptacle and a thermostat removed from said receptacle for alternately heating said coils, said movable switch comprising first and second contacts electrically connected to said thermostat, and other contacts adjacent to said first and second contacts and adapted to be operatively associated therewith, said other contacts being electrically connected to different terminals of said heating coils.

4. The combination with a pivoted receptacle having within it two chambers partly filled with a volatile liquid and connected by a passageway, one of said chambers being temporarily on a higher level than the other, and vice versa, of a heating coil in each of said chambers adapted to force the liquid from the one chamber to the other to cause movement of said receptacle about said pivot, a control arm linked to said receptacle and responsive to movement thereof, and means for supplying electrical energy to that heating coil which is in the lower chamber, and for cutting off said energy from said heating coil when said last chamber reaches the higher level, said means including a mercury switch located within said receptacle and movable therewith and a thermostat remotely located with respect to said receptacle, said switch comprising a container having therein a small amount of mercury and also a pair of contacts located at each end thereof, one contact of each pair being connected to a contact of said thermostat, the other contacts of said pairs being connected to different terminals of said heating coils, the remaining terminals of said heating coils being connected together and to one terminal of a source of electric energy.

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