March 5, 1929. G. MUFFLY 1,704,141

THERMOSTATIC SWITCH

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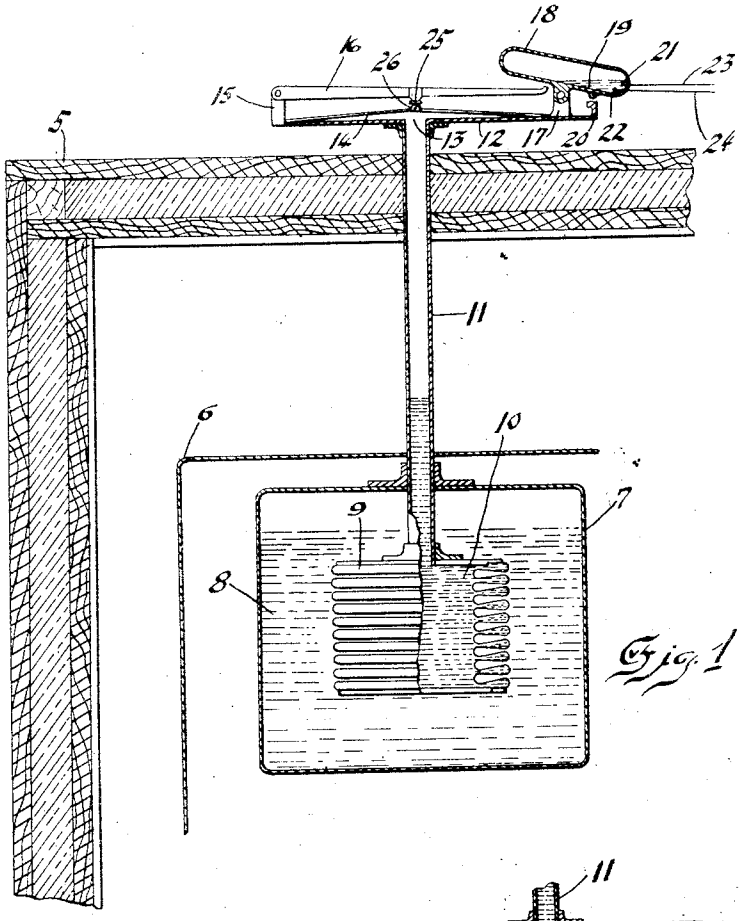


Fig. 1

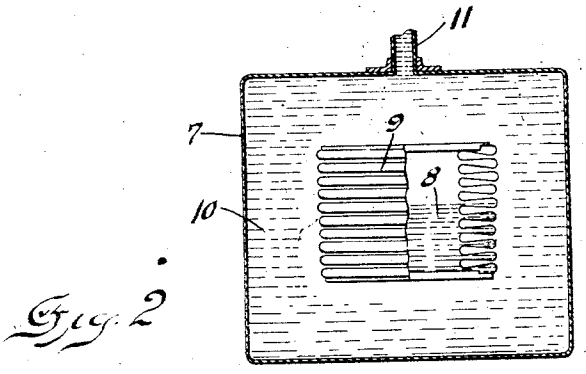


Fig. 2

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# UNITED STATES PATENT OFFICE.

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## THERMOSTATIC SWITCH.

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One of the objects of my invention is to provide a thermostatically controlled switch for use in connection with mechanical refrigerators, which will act to control the electrical operation of the refrigeration machine to maintain the different temperatures which are desired in the different parts of the refrigerator.

Another object of my invention is to provide a thermostatic switch which will be controlled and operated by temperatures within the expansion chamber of the refrigerating machine, as well as by temperatures without the freezer chamber and within the storage compartment of the refrigerator.

With these and other objects in view, my invention consists in the arrangement, combination and construction of the various parts of my improved device, as described in the specification, claimed in my claims and shown in the accompanying drawings, in which:

Fig. 1 is a partial sectional elevation of a refrigerator cabinet and my improved device.

Fig. 2 is a partial sectional elevation of one modification of my device.

I have shown the upper portion of a refrigerator cabinet 5, having the freezer or expansion chamber 6 of a mechanical refrigeration system (not shown) positioned therein. Within the freezer chamber 6 is positioned a container 7 which may contain a predetermined quantity of methyl chloride 8. Within the container 7 and wholly or partly submerged in the methyl chloride 8 is a sylphon bellows 9 which may contain a predetermined quantity of $SO_2$ 10. Secured in the upper end of the sylphon bellows 9 and leading therefrom through the container 7 and the freezer chamber 6 is a tube 11 which extends through the top of the refrigerator cabinet 5. Secured to the upper end of the tube 11 is a plate 12 which has an opening therein corresponding with the opening 13 in the tube 11. Secured to the plate 12 and covering the opening 13 in tube 11 is a tensioned diaphragm 14.

Positioned upon one edge of the plate 12 is a bracket 15 in one end of which is pivoted the end of a lever 16. Positioned adjacent the opposite edge of plate 12 from bracket 15 is a second bracket 17 in the upper end of which is pivoted a glass tube 18 containing a small amount of mercury 19; and formed upon the edge of plate 12 adjacent the bracket 17 is an upwardly extending flange 20 positioned to stop at a predetermined point the downward movement of the outer end of the tube 18. Inserted within the outer end of tube 18 and extending therefrom are two electrodes 21 and 22 to which are attached wires 23 and 24 respectively. Wire 23 leads to a source of electric power (not shown) which is connected with the motor (not shown) of a refrigerating machine (not shown), and wire 24 leads to the said motor of the refrigerating machine. Thus, when contact is made between the electrodes 21 and 22, the circuit is closed through the motor and the refrigerating machine is operated, and when the contact between electrodes 21 and 22 is broken the circuit through the motor is broken and the operation of the refrigerating machine is stopped.

Attached to the arm 16 at a point above the center of the diaphragm 14 is a downwardly extending projection 25 which contacts with an upwardly extending projection 26 on the diaphragm 14. The free end of the arm 16 extends across the diaphragm 16 to a point beneath the inner end of the tube 18 and has an upwardly extending projection thereon which is normally in contact with the inner end of tube 18.

In operation, when the temperature within the freezer chamber 6 rises to a predetermined degree, the methyl chloride 8 within the container 7 will expand and gasify, thus causing a contraction of the sylphon bellows 9 and forcing the $SO_2$ contained therein upwardly through the tube 11. A rise in temperature in the upper portion of the refrigerator cabinet 5 outside the freezer chamber 6 will be coincident with a rise in temperature within the expansion chamber and will cause the $SO_2$ in tube 11 to expand and gasify thus exerting pressure against the diaphragm 14 at the top of tube 11 and cause it to expand outwardly and by means of projections 25 and 26 to force the lever 16 upward which will tilt the tube 18 outwardly and cause the mercury therein to flow to the outer end thereof and establish a contact between electrodes 21 and 22 and thus close the circuit which operates the motor and refrigerating machine. When the operation of the refrigerating machine has reduced the temperature within the freezer chamber, and the temperature in the upper portion of the refrigerator cabinet outside the freezer chamber each to a predetermined degree, the methyl chloride within the container 7 and the $SO_2$ within the sylphon bellows 9 and the tube 11 will condense and

liquefy, thus relieving the upward pressure against the diaphragm 14 which will permit it to resume its normal position and thus relieve the pressure of lever 16 against the inner end of tube 18. The tube 18 being pivoted to one side of its longitudinal center of gravity with the heavy end of the tube extending inwardly, will tilt inwardly and cause the mercury therein to flow to the inner end thereof and away from the electrodes 21 and 22, thus breaking the circuit which operates the motor, and stopping the operation of the refrigerating machine.

It is usually desired to have the temperature within the freezer chamber maintained at a lower degree than the temperature in the food compartment outside the freezer chamber in order that ice and frozen foods may be formed and preserved in compartments within the freezer chamber, while ordinary foods which are not frozen may be preserved in the space outside the expansion chamber. To accomplish this purpose methyl chloride which is of a more volatile nature and expands at a lower temperature than sulphur dioxide, is used to control the operation of the switch for the purpose of maintaining the desired temperature within the freezer chamber, while the sulphur dioxide which is not wholly contained within the freezer chamber but extends upwardly in the tube 11 to a level above the top of the expansion chamber, is used to control the switch for the purpose of maintaining the higher temperatures desired in the compartment outside the freezer chamber. A dual switch control is thus provided which insures the maintenance of the desired temperatures both within and without the freezing compartment. That is to say, the temperature in both the freezer and cabinet proper must be brought to a desired low level before the operating circuit will be broken. For instance, if a material to be frozen is placed in the freezer, raising its temperature, the operating circuit will be made through the gasification of the methyl chloride even though the temperature in the box proper is down to its usual level.

In Fig. 2 I have shown a modification of my device in which the container 7 is filled with sulphur dioxide 10 and the sylphon bellows 9 contains a predetermined quantity of methyl chloride 8 and is sealed and floated in the sulphur dioxide 10 in the container 7. The tube 11 leads from the container 7 to the diaphragm 14 and is also filled with sulphur dioxide to a level above the top of the expansion chamber 6. The rising temperature within the freezer chamber 6 will cause the methyl chloride in the sylphon bellows 9 to expand and consequently expand the sylphon bellows and force the sulphur dioxide in container 7 and tube 11 upward against diaphragm 14. Rising temperature in the space above the freezer chamber 6 will cause the sulphur dioxide in tube 11 to expand and exert pressure against the diaphragm 14 thus operating the switch mechanism as above described.

I desire it to be understood that other materials than methyl chloride and sulphur dioxide may be used without departing from my invention and that my mention of them is purely illustrative.

In both forms of my device I prefer to have the normal level of the sulphur dioxide close to the wall of the refrigerator cabinet so that expansion of the methyl chloride will raise the level of the sulphur dioxide to a point outside of the food chamber, where the temperature (which is usually higher than the temperature in the cabinet) will cause gasification of the sulphur dioxide and operation of the switch to make the electrical circuit.

What I claim is:

1. A control of the class described comprising a chamber having a liquid therein which gasifies at a predetermined temperature, a second chamber extended partly within and partly without said first chamber and containing a liquid which gasifies at a predetermined temperature, and means whereby gas formed in the first chamber may act on the other to raise the liquid in the second.

2. A control of the class described comprising a chamber having a liquid therein which gasifies at a predetermined temperature, a second chamber extended partly within and partly without said first chamber and containing a liquid which gasifies at a predetermined temperature, the said liquids gasifying at different temperatures and creating different pressures at the same temperatures.

3. A control of the class described comprising a chamber containing a liquid which gasifies at a predetermined temperature, a second chamber in the first comprising a bellows having a liquid therein which gasifies at a predetermined temperature, and an extended connection leading from one of said chambers and a diaphragm bellows being adapted to expand under pressure from gasified liquid therein to assist in exerting pressure on said diaphragm whereby to cause movement of the same.

4. A control of the class described comprising a chamber having a liquid therein which gasifies at a predetermined temperature, a second chamber within the first containing a liquid which gasifies at a predetermined temperature, an extended connection leading from one of said chambers to a movable member adapted to be operated by pressure in the connection, the gasification, at a predetermined temperature, of the liquid in the container which is not connected to said movable member operating to move the liquid

in the one which is so connected and cause movement of said member.

5. A control of the class described comprising two chambers, a container in one chamber having a liquid therein which gasifies at a predetermined temperature, a second container in the other chamber, a liquid in said second container which gasifies at a predetermined temperature, a movable wall connected with the second container and adapted to be operated by the pressure therein and a connection between the two containers providing means whereby the gasification of the liquid in the first container will act to move the level of the liquid in the second container to cause an increase of the pressure therein.

6. A control of the class described comprising two chambers, a container in one chamber having a liquid therein which gasifies at a predetermined temperature, a second container in the other chamber, a liquid in said second container which gasifies at a predetermined temperature, said second container having a movable wall portion adapted to be operated by the pressure therein, and a connection between the two containers providing means whereby the gasification of the liquid in the first container will act to bring the liquid within said second container into a zone of higher temperature and thereby cause an increase in the vapor pressure within the second container, which pressure will in turn act to move said wall.

7. In combination with a pair of chambers of different temperatures, a container within the colder of said chambers, a volatile liquid within said container, a second container within the warmer of said chambers, a less volatile liquid within said second container, fluid pressure means actuated by the vapor pressure of the volatile liquid in the first of said containers acting upon the liquid level in the second container to raise said liquid level when the temperature within said colder chamber rises.

8. In combination, a pair of chambers, a temperature responsive device in each of said chambers, said devices co-acting through a pressure responsive element whereby the action of one of said devices in response to temperature change combines with the other of said devices to produce a result dependent upon the action of both of said devices.

9. In combination, a pair of chambers adapted to be maintained at different temperatures, a device in each of said chambers actuated by a change of temperature in its respective chamber to produce a change of pressure therein, and means comprising a pressure responsive element in one of said devices connected to the other of said devices whereby the action of either of said devices combines with the action of the other of said devices to produce a single result common to both of said devices.

10. In combination, a pair of chambers, a closed container in one of said chambers containing a volatile liquid, a closed container in the other of said chambers containing a volatile liquid, one of said containers being provided with an extension terminating in a pressure responsive element within the other of said chambers, and a second pressure responsive element connected to one of said containers and actuated by the combined action of said volatile liquids in both of said chambers.

11. In combination, a pair of containers each containing a fluid, and a pressure responsive member actuated by one of said containers connected with the interior of the other of said containers whereby a change of pressure in one of said containers will effect a change of pressure in the other of said containers, the changes in pressure in one of said containers being adapted to actuate switch actuating mechanism.

12. In combination, a pair of closed containers the pressures within which are adapted to vary upon change of temperature thereof, a pressure responsive element actuated by one of said containers connected to the other of said chambers whereby to be affected by a change of pressure in either of said containers, and a second pressure responsive element connected to one of said containers and actuated by the variations of pressure therein.

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