No. 766,820. PATENTED AUG. 9, 1904.

W. M. FULTON.

THERMOSENSITIVE DEVICE.

APPLICATION FILED APR. 8, 1903.

NO MODEL.

FIG. 1.

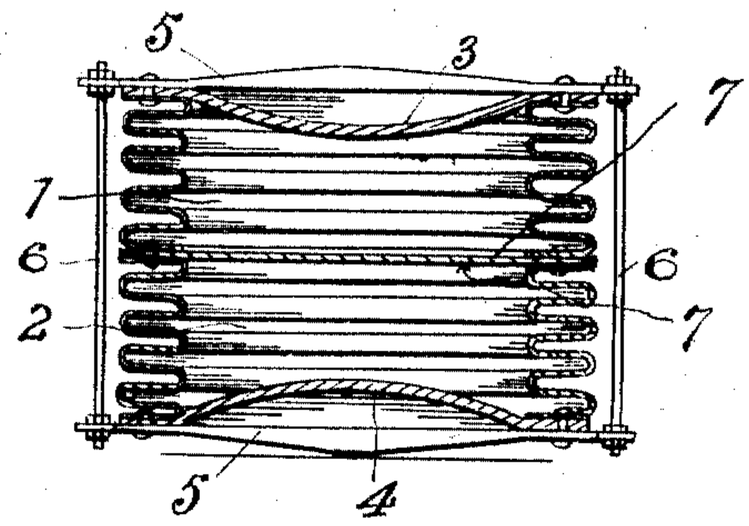


FIG. 2.

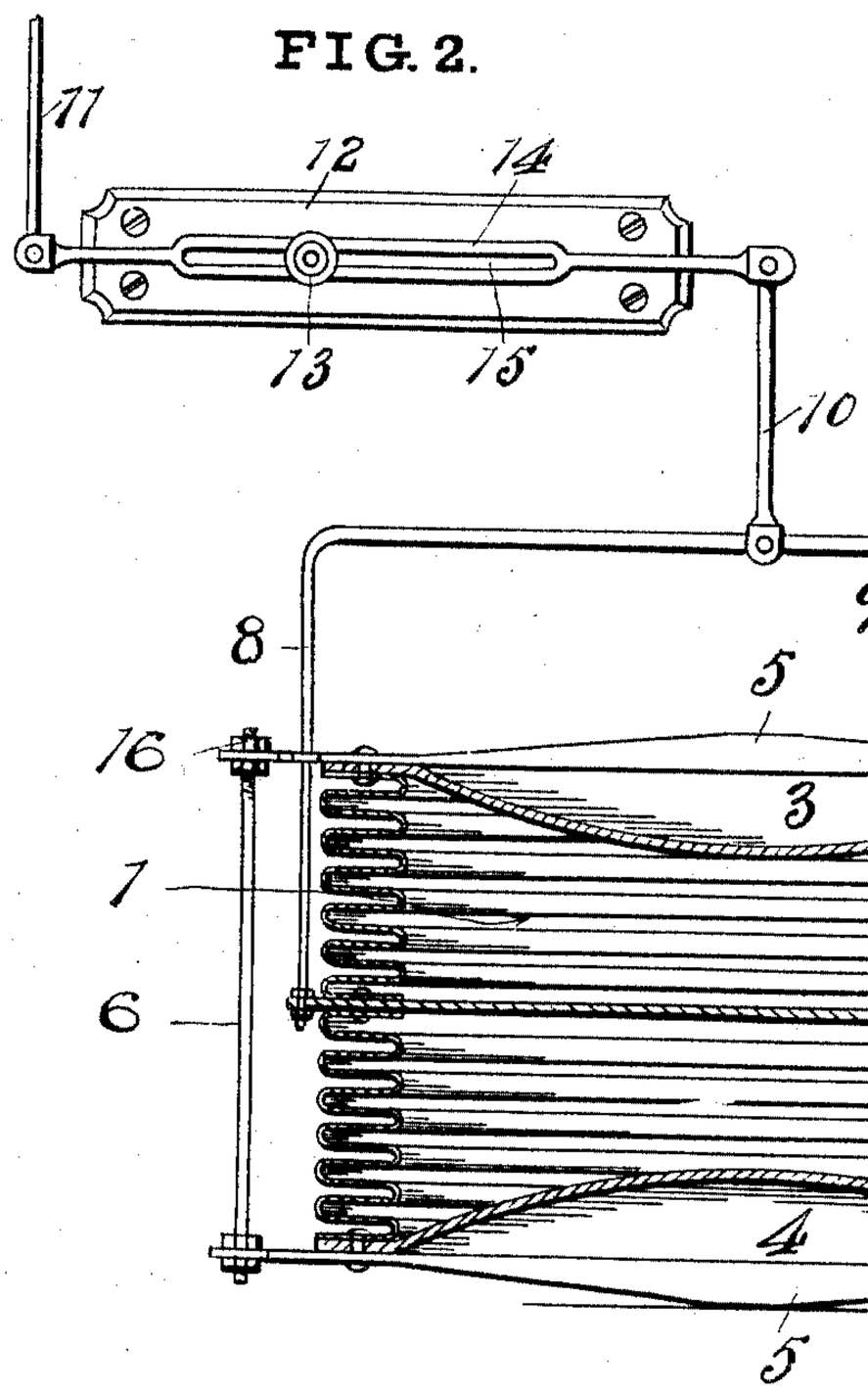
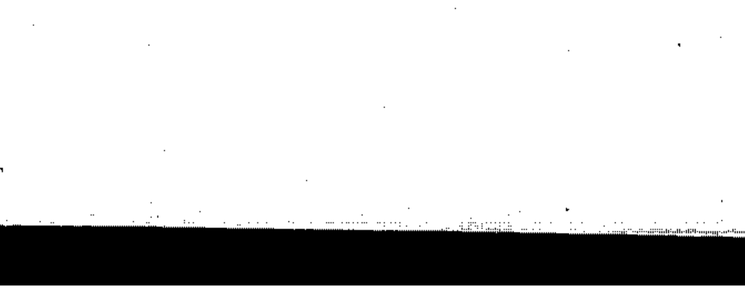


FIG. 3.

FIG. 4.



Witnesses
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No. 766,820. Patented August 9, 1904.

UNITED STATES PATENT OFFICE.

WESTON M. FULTON, OF KNOXVILLE, TENNESSEE.

THERMOSENSITIVE DEVICE.

SPECIFICATION forming part of Letters Patent No. 766,820, dated August 9, 1904.

Application filed April 8, 1903. Serial No. 151,666. (No model.)

To all whom it may concern:

Be it known that I, WESTON M. FULTON, of Knoxville, Tennessee, have invented a new and useful Improvement in Thermosensitive Devices, which invention is fully set forth in the following specification.

This invention relates to heat-regulators, heat-indicators, and allied structures. In devices of this character there is usually employed an index or other mechanism which is operated by a thermosensitive device. In the construction of thermosensitive devices it has heretofore been proposed to employ rubber and various metals or to confine liquids in tubes made of some metal whose coefficient of expansion is less than that of the liquid. Others have proposed to confine gaseous bodies in rigid vessels having a thin sheet-metal diaphragm in one wall of the vessel, said diaphragm being designed to be pressed in and out by the contraction and expansion of the gaseous body within the vessel. These devices are all subject to various objections, among which may be mentioned the fact that they give very slight motion in response to changes in temperature, and hence possess little power. It follows, therefore, that the mechanism which they are to operate has to be of very delicate and expensive construction, the action of which has to be reinforced by electrical or other power, especially where it is required to control the temperature of a room or building by regulating the source of heat. The present invention is designed to overcome these objections; and to this end it consists in certain details of construction and combinations of elements hereinafter described and then pointed out in the claims.

In the accompanying drawings, Figure 1 is a vertical section of a thermosensitive device, illustrating the invention broadly. Fig. 2 is a like view, with parts in elevation, of one application of the invention. Fig. 3 shows still another application thereof, and Fig. 4 is a perspective of a detail of Fig. 3.

Referring to Fig. 1 of the drawings, 1 and 2 are two hermetically-sealed vessels having collapsible side walls, preferably made of corrugated sheet metal with the corrugations composed of planes substantially normal to the line of collapse of the vessel, which planes are connected by curved non-angular portions, as shown. The vessel 1 has a rigid end wall 3 and vessel 2 a rigid end wall 4, and a wall 7 is placed intermediate the vessels and forms a partition between them. The vessels thus constructed are mounted in any suitable frame or support, here shown as composed of the rigid cross-bars 5 5, connected by the links 6 6, the ends 3 and 4 of the vessels 1 and 2 being secured to the bars 5 5, but with the partition 7 free to move with the collapsible walls of the vessels. If now the vessels 1 and 2 be filled with equal quantities of some gas, vapor, liquid, or mixture, it is apparent that variations in atmospheric pressure or temperature will not operate to shift the position of the partition, since the effect of such variations on the expansive agent would be the same in the two vessels and they would neutralize each other. If, however, we employ in one vessel an expansive agent whose coefficient of expansion is greater than that of another expansive agent employed in the other vessel, then we shall find that while the partition 7 is not affected by variations in atmospheric pressure it is affected and caused to shift its position by variations in atmospheric temperature. For example, if vessel 1 be charged with air and saturated vapor of benzene and vessel 2 be charged with dry air the pressure of the mixture of air and benzene in vessel 1 will change under variations of temperature more rapidly than the pressure of dry air in vessel 2, and the rise and fall of temperature will cause the partition-wall 7 to move down and up, while said partition-wall will not be affected in any way by changes in atmospheric pressure. The vessels thus constructed and containing expansive agents of different coefficients of expansion form an extremely-sensitive thermostatic device or element, operating with very considerable power and capable of use in a great variety of ways. For example, I have illustrated in Fig. 2 a construction whereby the movements of the partition 7 may be communicated to a reciprocatory bar or rod 11, whose movements may be utilized to perform any desired work in connection with heat controlled or operated

mechanism. One means for operatively connecting the partition 7 to the rod 11 is shown in the form of a bail-piece composed of the side bars or members 8 8, united by the member 9, which is flexibly connected by a link 10 to a lever 14, pivotally mounted by means of pivot 13, secured to any suitable support 12. The lever 14 preferably has a slot 15, through which the pivot 13 passes, so that the relation between the two arms of lever 14 may be adjusted to suit different requirements. For reasons which will appear hereinafter the length of side bars 6 6 is made adjustable by means of nuts 16 16 on the screw-threaded ends of said bars 6 6, so that by adjusting the nuts 16 16 the vessels 1 and 2 may be more or less compressed or expanded. It will be apparent that the amount of expansion and contraction of said vessels will be to a large extent dependent upon the length of the collapsible walls thereof, and by making such walls of sufficient length a large amount of expansion and contraction in response to slight changes in temperature may be had where this is found desirable. Moreover, by a proper selection of the expansive agents used in the two vessels the degrees of temperature between which the device will be most sensitive to variations of temperature may be regulated. For example, suppose it is desired that the device be used to control the heat in a building so as to maintain the temperature of the building about 70° Fahrenheit. In order to best accomplish this result, it is necessary that the device should be most sensitive to heat and cold between the temperatures of 60° and 80° Fahrenheit. This can be attained by a proper selection of expansive agents for vessels 1 and 2. Thus if one vessel be charged with a saturated vapor of ether and the other with air at a pressure of about one-half an atmosphere the device will be very sensitive to changes in temperature between 60° and 80° Fahrenheit and will also respond to changes above and below these limits, though less decidedly. The sensitiveness of the device may be still further regulated by collapsing or expanding the vessel by adjusting the nuts 16 16 on the rods 6 6. This is due to the fact that when the pressure on a gaseous body is changed its density changes, and hence its degree of expansion and contraction under variations of heat and cold also change. If it be compressed, its change in volume per degree of temperature is lessened. If it be rarefied, (as by expansion,) its change in volume per degree of temperature is increased. From the foregoing it will be apparent that the degrees of temperature between which the device will be most sensitive can be regulated by a proper selection of the expansive agents employed in the two vessels, the degree of sensitiveness may be regulated by regulating the pressure of the expansive agents, and the extent of motion imparted to the device or mechanism to be operated by the movements of partition 7 may be regulated by adjusting the leverage between said partition and the operated part represented by rod 11. The movements of the rod 11 may be utilized to operate a damper, a valve for controlling steam or other heat, or in connection with an automatic fire-alarm and fire-extinguisher, the connections being made in ways that will readily suggest themselves to those skilled in the art, and therefore need not be specifically herein described.

It is not necessary in all instances that the partition should be free to move as a whole, as in Figs. 1 and 2. It may be pivoted at one side and oscillate about its pivot. This construction is shown in Fig. 3, where the partition 17 is pivoted at 18 to one of the bars 6 and is provided with an arm 19, which may be utilized in any desired way either to impart motion to suitable mechanism similar to partition 7 in Fig. 2 or as an index or pointer in conjunction with a scale, as in Fig. 3.

The examples herein described will be sufficient to illustrate the inventive idea; but it will be understood that many changes in the form, proportion, and arrangement of the parts may be made without departing from the inventive idea involved. The collapsible vessels may be of any size desired and any suitable form, and when the collapsible vessel is a corrugated one the number of the corrugations may be increased or diminished as the circumstances of the particular case may require. It is therefore to be understood that the limits of the invention are intended to be defined in the claims rather than in the illustrative examples herein shown and described. It will also be understood that the two vessels 1 and 2 may be regarded as two chambers of a single vessel, the chambers being separated by the intervening partition.

What is claimed is—

1. In a thermosensitive device, a plurality of expansible and collapsible vessels having expansive agents therein, and a rigid partition-wall between said vessels, the expansion agent in one vessel having a different coefficient of expansion from that in the other vessel.

2. The combination of a plurality of collapsible vessels, expansive agents of different coefficients of expansion in said vessels, and a vibratory partition between the vessels.

3. The combination of two collapsible vessels having fixed end walls, a vibratory partition between said vessels, expansive agents in said vessels, the expansive agent in one vessel having a greater coefficient of expansion than the agent in the other vessel.

4. The combination of two collapsible vessels arranged in juxtaposition, a vibratory partition between said vessels, a fixed rigid end wall to each vessel, means adjusting said end walls to increase or diminish the volume of said vessels, and an expansive agent in each

vessel, the coefficient of expansion of the agent in one vessel being greater than that in the other.

5. The combination of a vessel having corrugated side walls and fixed rigid end walls, a vibratory partition in said vessel, means adjusting the distance between said end walls, an expansive agent in each vessel, said agents having different coefficients of expansion, and means operated by the movements of said vibratory partition.

6. The combination of a plurality of corrugated vessels separated by a vibratory partition and each having a fixed end wall, means adjusting the distance between said end walls, and an expansive agent in each vessel, said agents having different coefficients of expansion.

7. The combination of a plurality of corrugated vessels separated by a vibratory partition and each having a fixed end wall, means adjusting the distance between said end walls, and an expansive agent in each vessel, said agents having different coefficients of expansion.

8. The combination of a plurality of corrugated vessels separated by a vibratory partition and each having a fixed end wall, means adjusting the distance between said end walls, an expansive agent in each vessel, said agents having different coefficients of expansion, and means operated by said vibratory partition.

9. The combination of two corrugated metallic vessels separated by a rigid vibratory partition, a rigid end wall for each vessel, a frame embracing said vessels and fixed to each of said end walls, and an expansive agent in each vessel, the agent in one vessel having a greater coefficient of expansion than that in the other vessel.

10. In a thermosensitive device, two collapsible vessels separated by a rigid vibratory partition, and different expansive agents in said vessels of such character that they are most sensitive to variations in temperature between given degrees of temperature.

11. In a thermosensitive device, two collapsible vessels separated by a rigid vibratory partition, one vessel containing saturated vapor of ether and the other vessel air at a pressure of about one-half an atmosphere.

12. In a thermosensitive device, two collapsible vessels separated by a rigid vibratory partition, different expansive agents in said vessels of such character that they are most sensitive to variations in temperature between given degrees of temperature, and means regulating the density of said agents.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

WESTON M. FULTON.

Witnesses:
J. T. GRITMAN,
C. R. BURRIER.