

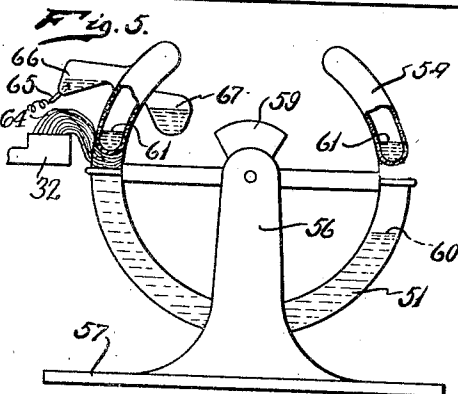
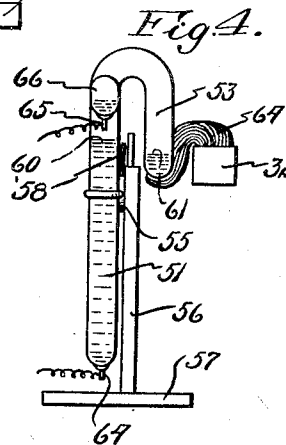
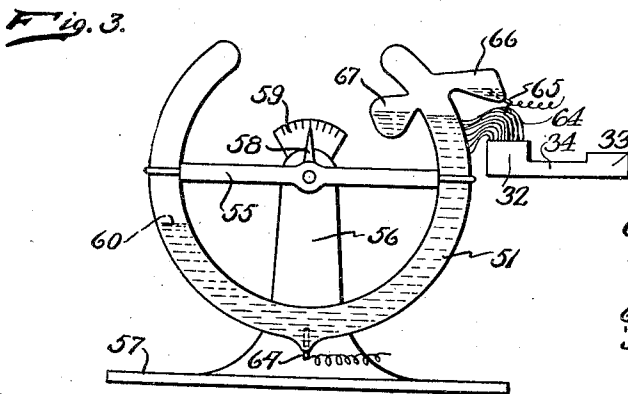
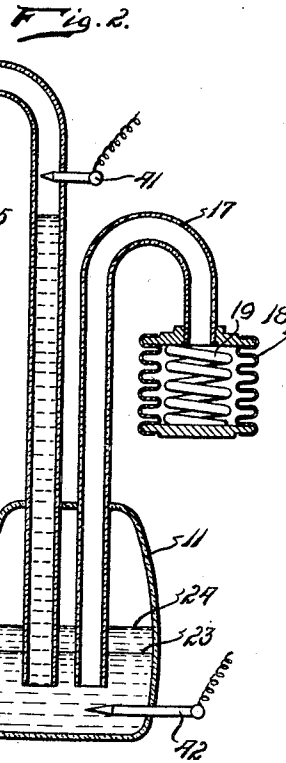
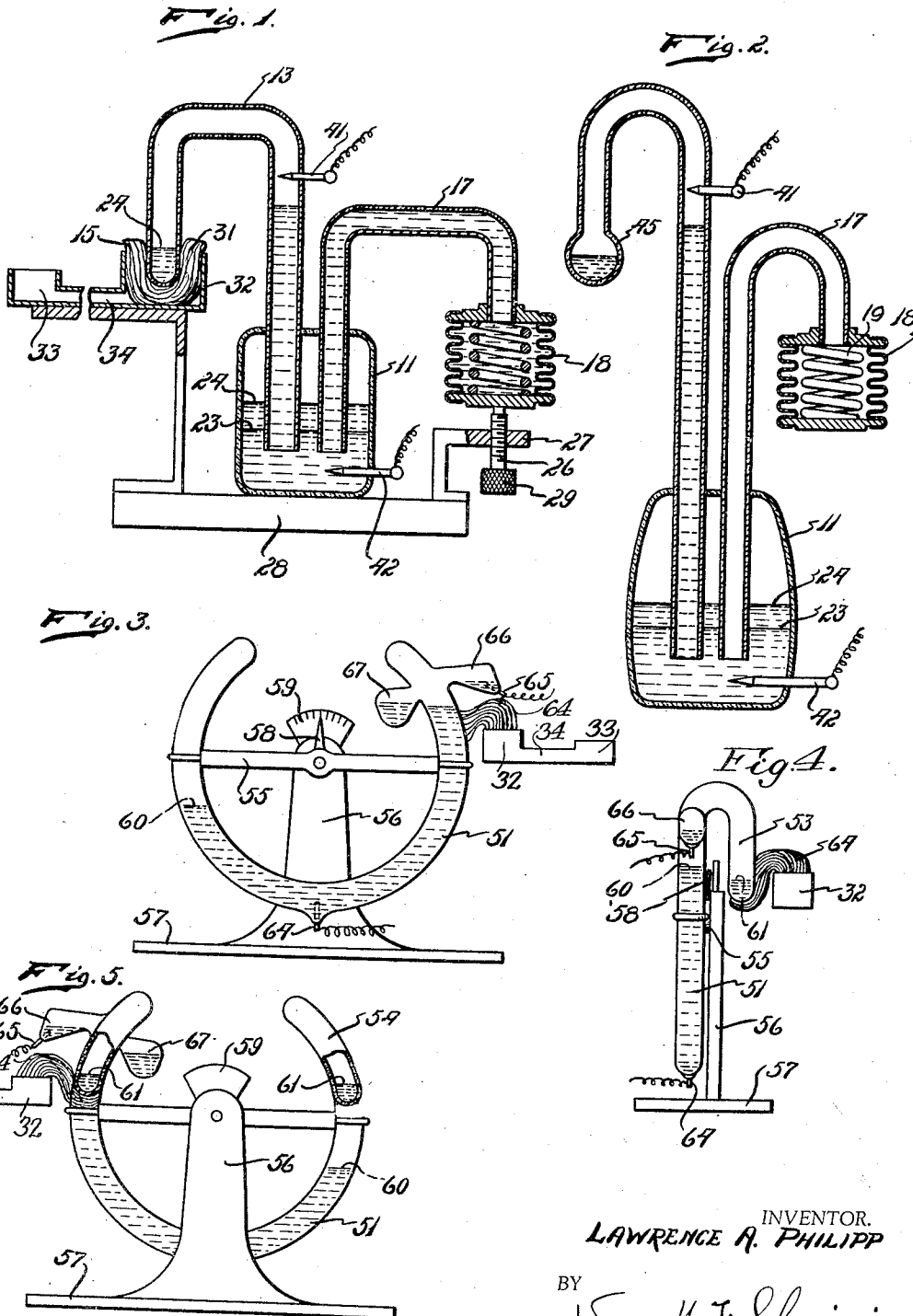
Aug. 3, 1937.

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2,088,718

REFRIGERATING APPARATUS

Filed Sept. 1, 1934



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2,088,718

REFRIGERATING APPARATUS

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Application September 1, 1934, Serial No. 742,420

11 Claims. (Cl. 200—52)

My invention pertains to humidostats and more particularly to humidity responsive devices especially suitable for regulating mechanism in accordance with humidity conditions.

It is an object of my invention to provide an accurate, simple humidostat comprising a pair of interconnected bulbs each of which contains a variable pressure or volatile liquid in conjunction with associated means for wetting one of the bulbs and pressure responsive means actuated by the pressure differential between the bulbs.

It is also an object of my invention to provide an adjustable humidostat comprising separated quantities of a volatile liquid enclosed in a pair of movably mounted hermetically interconnected bulbs, one of which has an associated wick for continuously wetting it and a pressure responsive gravity biased device actuated in accordance with the pressure differential between the bulbs.

Another object of my invention is to provide a humidostat comprising separated quantities of a volatile refrigerant enclosed in a wet bulb and a dry bulb which are hermetically interconnected through a conduit including pressure responsive means actuated in accordance with the pressure differential between the bulbs and adjustable means whereby the operating characteristics of the device may be varied as desired.

It is a further object of my invention to provide a humidostat control which is accurate, readily adjustable, of simple construction and especially suitable for low temperature operation to regulate the conditions maintained in a refrigerated compartment.

The invention itself, however, both as to its organization and its method of operation, together with additional objects and advantages thereof, will best be understood from the following description of specific embodiments, when read in conjunction with the accompanying drawing, in which:

Figure 1 is an elevational view partly in section showing a low temperature humidostat constructed in accordance with my invention;

Figure 2 is an elevational view showing a similar form of my device comprising various modified features thereon;

Figure 3 is a front elevational view showing another embodiment of my invention;

Figure 4 is a side elevational view thereof; and

Figure 5 is a rear view in elevation of the embodiment shown in Fig. 3.

Referring more particularly to Fig. 1 of the drawing, my humidostat comprises a large vessel or bulb 11 which receives the downwardly di-

rected end of one branch of an inverted U shaped conduit 13 which is hermetically sealed into the bulb 11 with its open end directed toward the bottom thereof. The outer downwardly directed end of the U shaped conduit 13 is closed thereby providing a receptacle or bulb 15 at its outer end which is interconnected with the larger bulb 11 through the conduit 13. A second U shaped adjusting conduit 17 is mounted with one of its downwardly directed legs hermetically sealed in the upper wall of the bulb 11 with its open end projecting downwardly toward the bottom of the bulb. The other downwardly projecting branch of the adjusting conduit 17 is hermetically sealed to a resilient pressure varying device comprising a flexible metal bellows 18. A helical compression spring 19 is preferably provided within the bellows 18 to cause it to be continuously biased to its extended position.

Within the large bulb 11 is disposed a quantity of a dense electrically conductive liquid 23, such as mercury for example, which is provided to a level substantially above the downwardly projecting open ends of the conduits, and the second or adjusting conduit 17 and its associated bellows 18 are preferably also completely filled therewith. A small quantity of a light volatile liquid 24 is also provided in the large bulb 11 where it normally floats on the dense liquid. A small quantity of a similar volatile liquid is also provided in the small bulb 15 on the closed end of the first or interconnecting conduit 13. Any volatile liquid may be used for this purpose which has characteristics suitable for the range of temperatures to which it will be exposed when in operation, and for use in refrigerated compartments I have found that the low pressure volatile refrigerants, such as ethyl chloride for example, are especially satisfactory.

In order to provide for adjusting the pressure within the large bulb 11 and the height of the mercury column which will be thereby elevated in the interconnecting conduit member 13, in response to a predetermined temperature difference between the large bulb and the small bulb, I have provided an adjustable screw 26 which is threadably supported in abutting engagement with the end of the bellows 18 by a bracket 27 rising from a base plate 28. A knurled knob 29 is preferably provided on the end of the threaded screw 26 to facilitate adjusting the same.

The quantities of the volatile liquid 24 provided in the two bulbs 11 and 15 are separated by the mercury 23 which surrounds and seals

the low ends of the conduit members and, it will be apparent that, as different pressures are set up by vaporization of the volatile liquid a mercury column will be forced up into the first or interconnecting conduit 13. As the conduit 13 is vertically disposed in bulb 11 and the mercury column moves in gravity biased relation its height will be such that it will balance on the pressure differences to which the opposite ends of the conduit 13 are subjected.

The bulbs 11 and 15 are enclosed in the same compartment both are exposed normally to the same temperatures. However, by continuously wetting the small bulb 15 temperature differences are established which vary in accordance with the humidity of the atmosphere or gases to which the bulbs are exposed in the refrigerated compartment. To continually wet the small bulb 15, on the closed end of the interconnecting conduit 13, I have provided a wick 31 which envelops the bulb and extends into an adjacent water dish 32. The water dish 32 is continuously supplied with water from an adjacent basin 33 which is connected thereto through an elongated pipe 34. The upper lip of the basin 33 is substantially lower than the upper lip of the water dish 32 whereby water added to the basin will not pass directly to the bulb. Only a sufficient quantity of water passes from the basin 33 to the water dish 32 to replenish the water which evaporates from the wick. By this arrangement the bulb 15 is protected from the direct effect of the temperature of the water which is added to the catch basin 33. This is particularly advantageous when the device is used in a refrigerated compartment where the catch basin may be so positioned that it will catch the drip moisture from the cooling unit to provide a continuous supply of water, and when so used, in accordance with my arrangement, the temperature of drip water cannot directly affect the wet bulb 15 and thereby cause an inaccurate operation of the humidostat.

In operation the two bulbs are normally exposed in the same compartment, and temperatures of the two bulbs vary only in accordance with the humidity of the surrounding space. The height of the mercury column thus constitutes an indication of humidity variations in the surrounding space, and to provide for automatically regulating in response to the position of the mercury I have inserted an electrical contact member 41 which extends through the walls of the conduit member 13 above the mercury column for conductive engagement therewith when it rises to a predetermined level. A second electrical contact member 42 extends into the large dry bulb vessel 11 and provides continual electrical conductive contact with the mercury 23 therein.

By turning the knurled knob 29 to adjust the pressure within the large bulb 11 the height of mercury column may be adjusted to engage the electrical contact 41 therein at any degree of humidity desired. Suitable electrical circuit connections may be provided to extend from the contact members 41 and 42 to accomplish any desired control or regulation.

Under certain conditions of operation it is desirable to provide a wet bulb of greater volume which may be accomplished by providing an enlarged bulb 45 on the closed end of the interconnecting conduit member 13, as shown in Fig. 2 wherein a higher vertical mercury column is also provided by restricting the U curvature of the

conduit 13. As shown, the mercury may be omitted from the adjusting conduit 17 and the associated expansible bellows 18, and the gaseous pressure in the large bulb 11 may be controlled directly from the gas contained therein as shown in Fig. 2.

A somewhat simplified embodiment of my humidostatic control device comprises a tubular member of glass which may be bent into the form of an open circular loop 51, as shown in Figs. 3 and 4. In this embodiment the ends 53 and 54 of the tubular member 51 adjacent the open loop are turned back to follow the curvature of the tube, as more clearly shown in Fig. 4. The turned ends 53 and 54 of the tube 51 are sealed to provide liquid receiving receptacles for a purpose which will be subsequently set forth. In this embodiment the curved tubular member 51 is supported by a cross bar 55 which is pivotally mounted upon a stationary bracket 56 rising from a suitable base plate 57. The pivotal mounting preferably has sufficient friction to maintain any adjusted position, and it is provided with an indicator pointer 58 which is disposed to move adjacent the stationary scale 59 which is supported upon the stationary bracket member 56. A dense electrically conductive liquid 60, such as mercury for example, is provided in the loop portion of the conduit, as shown in Fig. 3.

A volatile liquid 61 which may be a low pressure refrigerant, or other liquid of suitable characteristics for the operating temperatures desired, is provided in the liquid receptacles 53 and 54 provided on the downturned ends of the curved conduit 51. For continuously wetting one of the liquid receptacles means is provided comprising a wick 64 which extends from a suitable water dish 32, as in the embodiment previously described.

In operation the mercury column will be balanced at various positions around the loop of the curved tubular member 51 in accordance with the pressure differences set up by the separated quantities of volatile liquid in response to varying humidity conditions. In accordance with my invention this phenomenon is utilized to accomplish any desired regulation or control by providing a pair of insulated electrical contact member 64 and 65 extending through the walls of the glass tube 51 for conductive engagement with the mercury 16, as shown in Figures 3 and 4. One of the contact members 64 may extend through the walls of the tube 51 for continuous conductive engagement with the mercury 60 and the second electrical contact member 64 may enter in a mercury well 66 provided adjacent the upper portion of the loop. A mercury reservoir 67 may also be provided adjacent the electrical contact at the upper portion of the loop comprising a bulb which is adapted to receive or discharge a quantity of mercury into the main portion of the curved tube 51. The present embodiment of my invention is very conveniently adjustable for causing the mercury to establish an electrical circuit between the contact members 64 and 65 at any desired degree of humidity. Adjustment is readily accomplished by rotating the tube 51 on its pivoted arm 55 until the indicator pointer 58 is properly positioned with reference to the scale 59 which is suitably calibrated.

It will be seen that I have provided a humidostat which is accurate, of simple construction, conveniently adjustable, and which is especially

suitable for low temperature operation. It will be readily understood that the operating characteristics of my humidostat may be readily adjusted by selecting a volatile liquid having suitable characteristics and that it may be readily applied for various control and regulating purposes.

Aside from the specific embodiments of the invention herein shown and described, it will be understood that numerous details of the construction may be altered or omitted without departing from the spirit and scope of the invention as disclosed and claimed, and that I do not desire to limit the invention to the exact constructions herein set forth.

I claim as my invention:

1. A humidostat comprising a pair of bulbs, a variable pressure fluid in said bulbs, means for wetting one of said bulbs, pressure responsive means actuated by the pressure differential between said bulbs, a resilient member hermetically sealed to one of said bulbs and adjustable means for variously distorting said member to vary the relative pressure differential to a predetermined value for a predetermined humidity condition.

2. A humidostat comprising a pair of bulbs, means for wetting one of said bulbs, conduit means hermetically interconnecting the bulbs, a variable pressure fluid in the bulbs, pressure responsive means associated with said conduit means for actuation by the pressure differential between said bulbs, and means hermetically associated with the bulbs and conduit means for varying the relative pressure differential set up by a predetermined humidity condition.

3. A humidostat comprising a pair of bulbs, means for wetting one of said bulbs, conduit means hermetically interconnecting the bulbs, a variable pressure fluid in the bulbs, pressure responsive means associated with said conduit means for actuation by the pressure differential between said bulbs, a resilient member hermetically sealed to one of said bulbs and adjustable means for variously distorting said member.

4. A humidostat comprising a pair of bulbs, means for wetting one of said bulbs, conduit means hermetically interconnecting said bulbs, a small quantity of volatile liquid in each of said bulbs, a dense electrically conductive liquid disposed in said conduit means for movement in accordance with the pressure differential between said bulbs, electrically insulated contact members disposed in said conduit for conductive association by said dense liquid, a resilient member hermetically sealed to one of said bulbs and adjustable means for variously distorting said member for varying the pressure differential set up by a predetermined humidity condition.

5. In humidostat the combination of a bulb, a dense electrically conductive liquid therein, a conduit member having an open end sealed in said bulb below the level of the dense liquid and a closed end extending therefrom, a quantity of volatile liquid disposed in the closed end of said conduit and a quantity of volatile liquid in said bulb on the dense liquid whereby said dense liquid is forced through the conduit in accordance with the pressure differences set up by the separately disposed quantities of volatile liquid and means for wetting the closed end of said conduit.

6. In a humidostat the combination of a bulb, a dense electrically conductive liquid therein, a conduit member having an open end sealed in said bulb below the level of the dense liquid and a closed end extending therefrom, a quantity of volatile liquid disposed in the closed end of said conduit and a quantity of volatile liquid in said bulb on the dense liquid whereby said dense liquid is forced through the conduit in accordance with the pressure differences set up by the separately disposed quantities of volatile liquid, a second conduit member having an open end sealed in said bulb below the level of the dense liquid and its other end hermetically connected with a resilient pressure varying device, adjustable means for variously distorting said device, and means for wetting the closed end of said first conduit member.

7. In an humidostat the combination of a conduit of open loop formation, receptacles on the ends of the conduit adjacent the open portion of the loop, means for pivotally supporting said conduit member with the loop portion thereof in a substantially vertical plane, a dense liquid disposed in said conduit and separated quantities of a volatile liquid disposed in the receptacles on the ends of the conduit whereby the dense liquid is subjected to varying pressures in accordance to the varying temperatures of the receptacles and means for wetting one of said receptacles.

8. A humidostat comprising a pair of bulbs, variable pressure fluid in each of said bulbs, pressure responsive means actuable by the pressure differential between said bulbs, a wick for applying water to one of said bulbs, a water dish for supplying water to said wick, a catch basin disposed with its upper lip substantially lower than the upper lip of said water dish, and means for conducting water from said basin to said dish.

9. A hermetically sealed adjustable humidostat comprising a sealed system including a pair of bulbs, variable pressure fluid within said bulbs, an upwardly extending conduit interconnecting the bulbs and containing a liquid, means for wetting one of said bulbs, said liquid being movable by the pressure difference in said bulbs, and means for adjustably varying the relative position of the liquid and the upwardly extending conduit for a predetermined humidity condition.

10. A hermetically sealed adjustable humidostat comprising a sealed system including a pair of bulbs, variable pressure fluid within said bulbs, an upwardly extending conduit interconnecting the bulbs and containing a liquid, means for wetting one of said bulbs, said liquid being movable by the pressure difference in said bulbs, and means for adjustably varying the height of the liquid level in the conduit for a predetermined humidity condition.

11. A hermetically sealed adjustable humidostat comprising a sealed system including a pair of bulbs, variable pressure fluid within said bulbs, an upwardly extending conduit interconnecting the bulbs and containing a liquid, means for wetting one of said bulbs, said liquid being movable by the pressure difference in said bulbs, means for shifting the position of the bulbs and the connecting conduit, and an indicator shiftable with the bulbs and connecting conduit.

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