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APPARATUS FOR COMPARATIVE INDICATION OF THE MOISTURE CONTENTS IN TWO GASEOUS MEDIUMS

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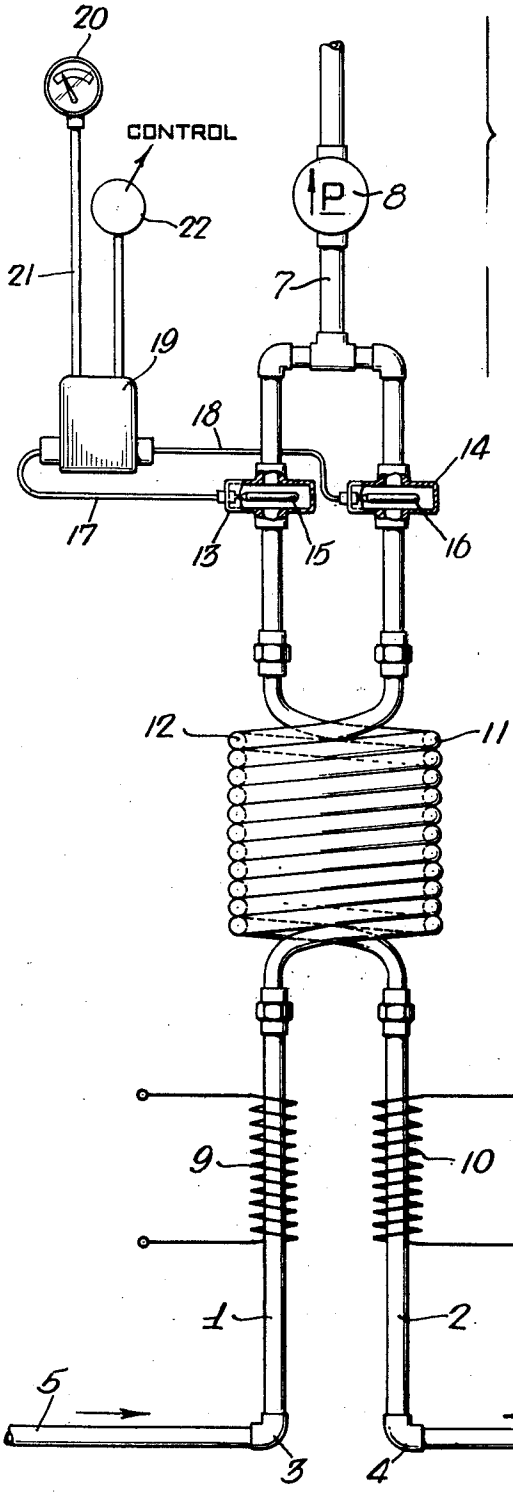


FIG. 1.

FIG. 2.

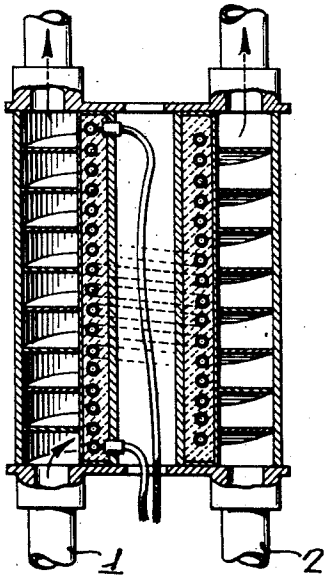
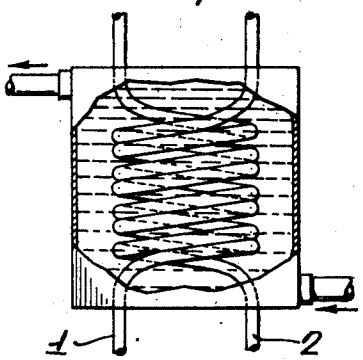


FIG. 3.



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APPARATUS FOR COMPARATIVE INDICATION OF THE MOISTURE CONTENTS IN TWO GASEOUS MEDIUMS

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9 Claims. (Cl. 73—29)

1

Within the technique of air conditioning the problem often arises to keep the air in rooms and other premises below a determined maximum relative or absolute moisture content. The simplest and in many cases the cheapest way of attaining this object is to ventilate the room or the premises with fresh air from outside, as long as it has a lower water content than the air of the room. However, it involves certain difficulties to establish in a simple manner what kind of air has the highest water content, and consequently also automatically to control such a ventilation.

The present invention relates to an apparatus, the object of which is to provide a comparative indication between two gaseous mediums and establish which of them has the highest moisture content, and indicate the same or, as the case may be, give the impulse to automatic regulators controlling dampers, which determine the additional amount of the drier medium to be added to the damper one.

The invention is characterized particularly by the fact that the apparatus comprises two pipes or the like arranged for the passing through of the mediums to be compared, arrangements to impart the same temperature to the mediums passing through the pipes at a point of each pipe and a sensitive body placed at that point, respectively, of each pipe, which sensitive bodies are adapted to indicate the wet temperature or heat contents of the air currents and are connected to a common differential thermostat, to which is further connected a measuring instrument, indicator or regulating device. Other features characterising the invention will be seen by the example described more fully hereinafter and with reference to some embodiments shown in the annexed drawing, in which:

Fig. 1 is a diagrammatic illustration of one embodiment of the apparatus made according to the present invention; and

Figs. 2 and 3 are fragmentary views, partially in section, respectively illustrating modifications of a portion of the apparatus in which a combined common heating arrangement is provided for the two mediums and with heat exchange therebetween.

The annexed drawing shows diagrammatically an embodiment of an apparatus according to the invention. It comprises two pipes 1 and 2, which at one end are each provided with connecting members 3 and 4, respectively, for the connection by means of pipes or the like 5 and 6, respectively, to the gaseous mediums whose moisture content is to be compared. The pipes 1 and 2

2

have their opposite ends joined in a common pipe 7, in which a suction device 8, for instance in form of a suction fan, is arranged. The direction of flow of the mediums is indicated by arrows for the case, when the apparatus is in operation. Reference numerals 9 and 10 designate electric heating devices for heating the mediums passing through the pipes 1 and 2, respectively, when the apparatus is in operation. The zigzag lines 11 and 12 denote portions of the pipes 1 and 2 which are arranged to provide for heat exchange between the mediums in these portions of the pipes. The pipe portions 11 and 12 are preferably very close wound in parallel contiguous relation to each other about a shaft so that the best heat balance is obtained between mediums passing through these portions of the pipes. The direction of flow must in this case be the same in both pipes. Numerals 13 and 14 designate expansions or special chambers in the pipes 1 and 2, in which wet sensitive bodies 15 and 16 are located and connected, by means of lines 17 and 18, to a differential thermostat 19 of some known kind. One well-known type of differential thermostat is manufactured and sold by Minneapolis-Honeywell Regulator Company, of Minneapolis, Minnesota, and is shown and described in their publication entitled "Air Conditioning Controls (Electric), Reference Manual for the Installer and Service Man" dated August 15, 1946. Numeral 20 designates a measuring instrument or an indicator connected to the differential thermostat 19 by means of the line 21, and 22 designates the regulator of a damper motor or the like which is connected to the differential thermostat 19 by means of the line 23.

Instead of two heating devices 9 and 10, a common heating arrangement may be placed for the simultaneous heating of the mediums passing through the pipes 1 and 2 in this part of the pipes. Those portions of the pipes 1 and 2 containing the heating devices 9 and 10 and the heat exchanger 11, 12, may also be made in such a way that, for instance as shown in Fig. 2 of the drawing, an electric heating battery is located in a sleeve, and that two parallel sheet metal strips are wound helically edgewise around the same, which strips are externally surrounded by another sleeve, so that two parallel pipe lines are formed for the mediums between the two sleeves and the strips, which pipe lines each are connected to the pipes 1 and 2, respectively. Another method is to enclose the parallel wound and contiguous pipes 11 and 12 in a box through which a heating medium passes or to

which heat is supplied in any other way, for instance as shown in Fig. 3 of the drawing.

The device for comparing the wet temperatures of the air currents may, for instance, comprise moistened or dry sensitive bodies in front of which humidifying devices equivalent with one another are placed, that is to say humidifying devices effecting the same degree of moisture.

The following example elucidates the function of the apparatus.

Atmospheric air is sucked in through the pipe 5 with 10 kilos/hr. plus 10° C. temperature, 90% relative moisture or 0.0068 kilo/kilo absolute moisture and is heated to plus 30° C. temperature by the device 9. Simultaneously workshop air is sucked in through the pipe 6 with 10 kilos/hr. plus 25° C. temperature, 40% relative moisture or 0.0078 kilo/kilo absolute moisture and is heated in the device 10 to a temperature of 45° C. In the heat exchanger 11, 12 the air temperature is equalized in the two pipes without letting the mediums mix, so that the medium in the line 11 leaves it at a temperature of plus 37.4° C. and unchanged absolute moisture, while the medium in line 12 leaves it at a temperature of plus 37.6° C. and unchanged absolute moisture. The wet sensitive body 15 will then register plus 19.3° C. wet temperature, and the sensitive body 16 a wet temperature of plus 20.3° C. This difference in temperature is registered by the differential thermostat 19, and can be read on the instrument 20, so that in accordance with said indication it is possible to shift dampers manually for the regulation of the air moisture in the workshop premises or it will be transmitted to the regulator 22 which effects the corresponding damper control automatically.

The heating device or devices have the purpose of heating the air, so that no condensation of water may take place in the heat exchanger, and the wet temperature is prevented from sinking below zero, where difficulties in the measurement would arise.

The apparatus is based on the known principle that the air having the highest water content of two kinds of air with the same temperature also has the highest wet temperature. The two kinds of air to be compared are thus heated to the same or approximately the same temperature and are then caused to effect one wet sensitive body each in a differential thermostat.

Having now described my invention, what I claim as new, and desire to secure by United States Letters Patent, is:

1. Apparatus for the comparative determination of the moisture content of two gaseous mediums comprising a pipe for the passage of each gaseous medium, means to heat the gaseous medium in each pipe to a predetermined temperature sufficient to maintain the temperature of each medium above its dew point, means to substantially equalize the temperatures of the gaseous mediums in the pipes, wet temperature sensitive devices responsive to the wet temperature of each gaseous medium, a differential thermostat connected to said devices and responsive to the difference between the wet temperatures of said gaseous mediums, and indicator means connected to said thermostat operable to indicate said temperature difference.

2. Apparatus for the comparative determination of the moisture content of two gaseous mediums comprising a pipe for the passage of each gaseous medium, means to heat the gaseous medium in each pipe to a predetermined temperature sufficient to maintain the temperature of each medium above its dew point, the pipes each having a portion of their length disposed in heat exchange relation to each other to substantially equalize the temperatures of the gaseous mediums in the pipes, wet temperature sensitive devices responsive to the wet temperature of each gaseous medium, a differential thermostat connected to said devices and responsive to the difference between the wet temperatures of said gaseous mediums, and indicator means connected to said thermostat operable to indicate said temperature difference.

3. Apparatus for the comparative determination of the moisture content of two gaseous mediums comprising a pipe for the passage of each gaseous medium, means to heat the gaseous medium in each pipe to a predetermined temperature sufficient to maintain the temperature of each medium above its dew point, means to substantially equalize the temperatures of the gaseous mediums in the pipes, wet temperature sensitive devices responsive to the wet temperature of each gaseous medium, a differential thermostat connected to said devices and responsive to the difference between the wet temperatures of said gaseous mediums, and motor control means connected to said thermostat operable in response to the temperature difference recorded thereby.

4. Apparatus for the comparative determination of the moisture content of two gaseous mediums comprising a pair of pipes arranged respectively for the passage of one of said gaseous mediums through each pipe, means to initially heat the gaseous medium in each pipe to a predetermined temperature, means to substantially equalize the temperatures of said gaseous mediums, wet temperature sensitive devices in each pipe responsive to the wet temperature of the gaseous medium therein, and a differential thermostat connected to both of said sensitive devices and responsive to the difference in the wet temperatures of the gaseous mediums, and indicator means connected to said thermostat operable to indicate said temperature difference.

5. Apparatus for the comparative determination of the moisture content of two gaseous mediums comprising a pair of pipes arranged respectively for the passage of one of said gaseous mediums through each pipe, means to initially heat the gaseous medium in each pipe to a predetermined temperature, means to substantially equalize the temperatures of said gaseous mediums, wet temperature sensitive devices in each pipe responsive to the wet temperature of the gaseous medium therein, a differential thermostat connected to both of said sensitive devices and responsive to the difference in the wet temperatures of the gaseous mediums, and motor control means connected to the differential thermostat operable in response to the temperature difference recorded thereby.

6. Apparatus for the comparative determination of the moisture content of two gaseous mediums comprising a pair of pipes arranged respectively for the passage of one of said gaseous mediums through each pipe, means to initially heat the gaseous medium in each pipe to a predetermined temperature, means to substantially equalize the temperatures of said gaseous mediums, wet temperature sensitive devices in each pipe responsive to the wet temperature of the gaseous medium therein, a differential thermostat connected to both of said sensitive devices and responsive to the difference in the wet temperatures

of the gaseous mediums, and indicator means connected to said thermostat operable to indicate said temperature difference.

7. Apparatus for the comparative determination of the moisture content of two gaseous mediums comprising a pair of pipes arranged respectively for the passage of one of said gaseous mediums through each pipe, the pipes each having a portion of their length disposed in heat exchange relation to each other to substantially equalize the temperature of said gaseous mediums, means to initially heat the gaseous medium in each pipe to a predetermined temperature sufficient to maintain the temperature of each medium above its dew point, wet temperature sensitive devices in each pipe responsive to the wet temperature of the gaseous medium therein, a differential thermostat connected to both of said sensitive devices and responsive to the difference in the wet temperatures of the gaseous mediums, and motor control means connected to the differential thermostat operable in response to the temperature difference recorded thereby.

8. Apparatus as claimed in claim 1 wherein the pipes each have an outlet connected to a common line in which is provided a suction device operable to cause flow of the gaseous mediums through said pipes.

9. Apparatus as claimed in claim 4 wherein the pipes each have an outlet connected to a common line in which is provided a suction device operable to cause flow of the gaseous mediums through said pipes.

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