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No. 856,944. PATENTED JUNE 11, 1907.

STITUTE FOR MISSING XR

S. W. CRAMER.

HYGROMETER FOR REGULATING HUMIDIFYING AND HEATING SYSTEMS.

APPLICATION FILED MAR. 9, 1906.

3 SHEETS—SHEET 1.

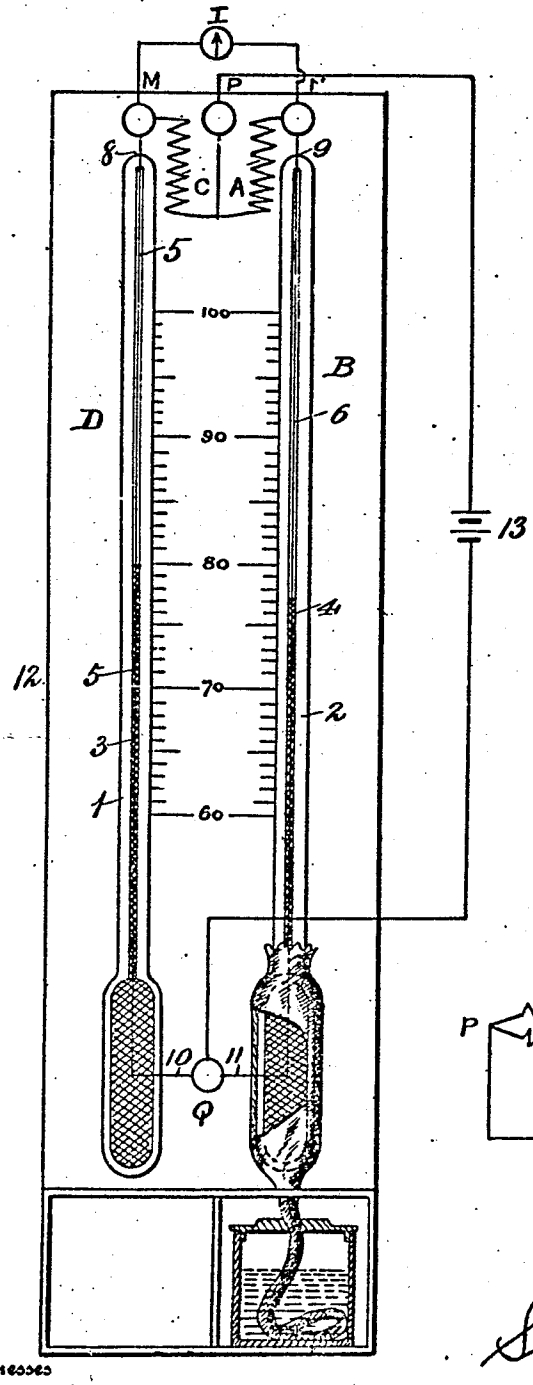
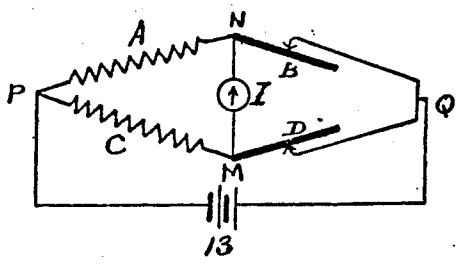


Fig. 1.

Fig. 3.



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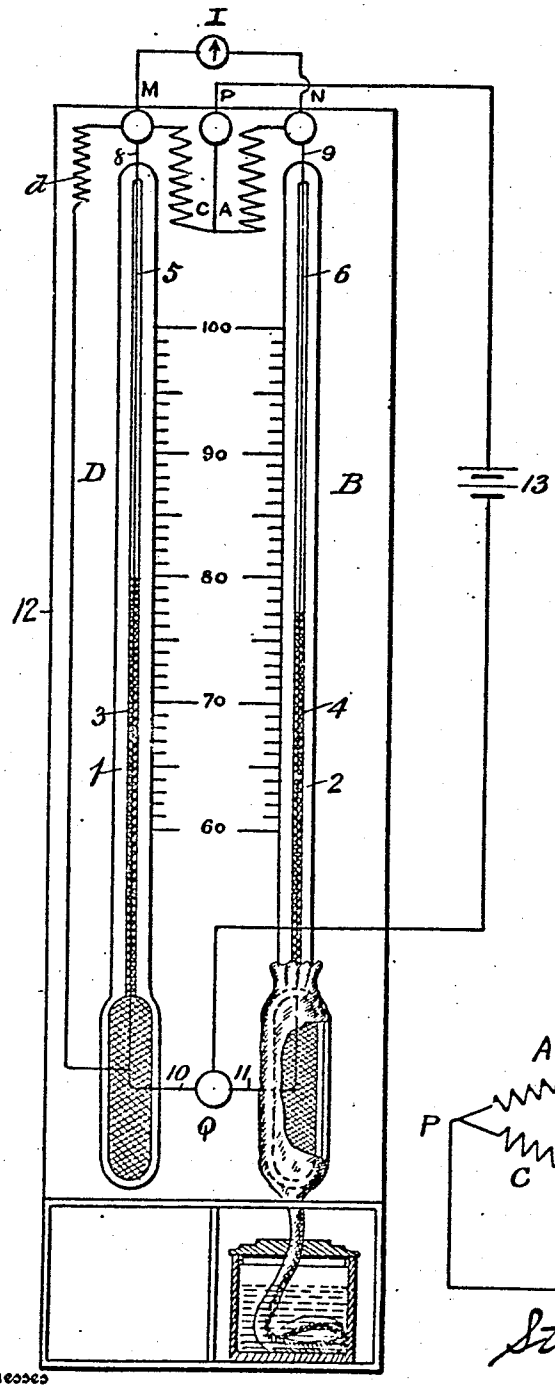
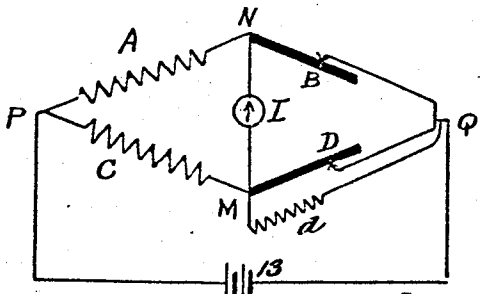


Fig. 2.

Fig. 4.



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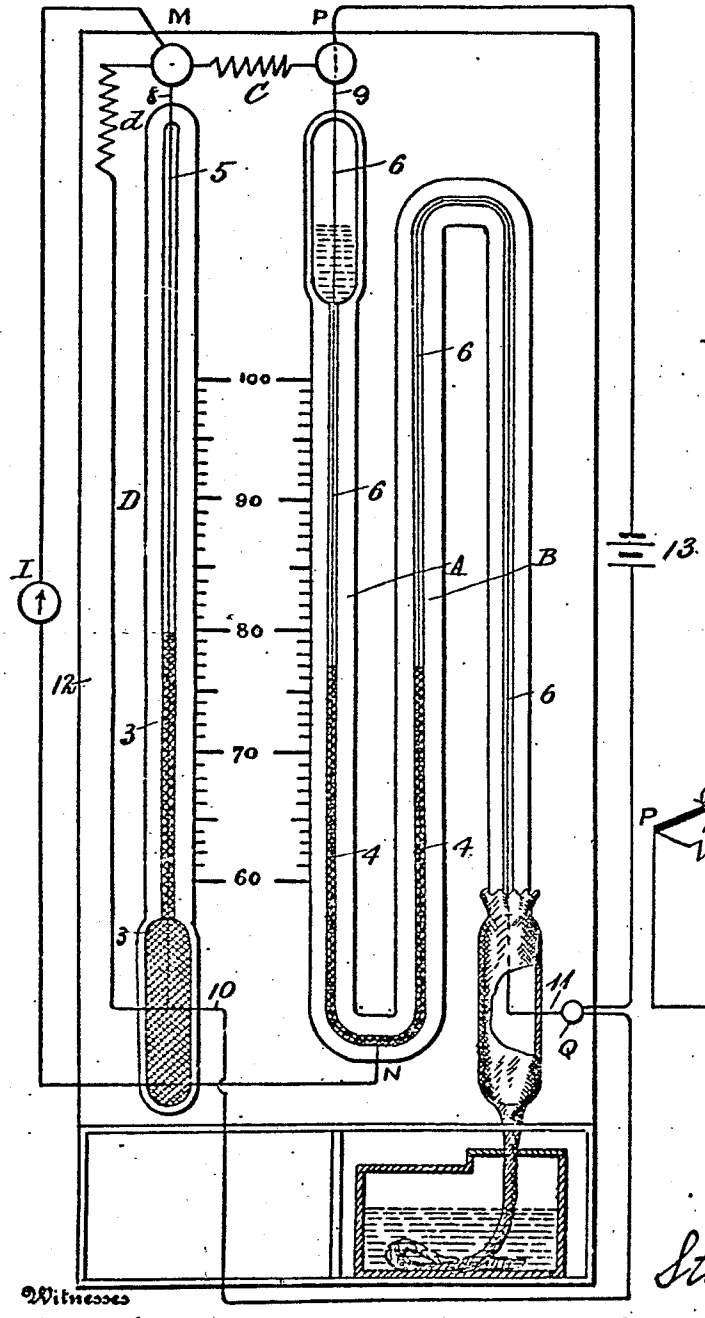
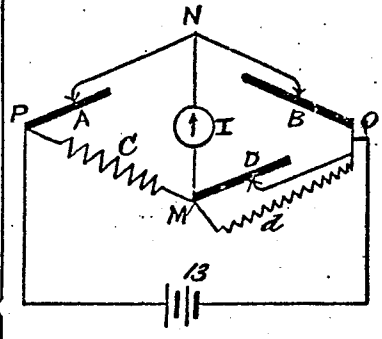


Fig. 5.

Fig. 6.



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UNITED STATES PATENT OFFICE.

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HYGROMETER FOR REGULATING HUMIDIFYING AND HEATING SYSTEMS.

No. 856,944. Specification of Letters Patent. Patented June 11, 1907.

Application filed March 9, 1906. Serial No. 305,139.

To all whom it may concern:

Be it known that I, STUART W. CRAMER, a citizen of the United States, residing at Charlotte, in the county of Mecklenburg and State of North Carolina, have invented certain new and useful Improvements in Hygrometers for Regulating Humidifying and Heating Systems; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to instruments for regulating and indicating the degree of moisture in the atmosphere and the temperature of the atmosphere automatically in a factory or other building and in separate compartments thereof.

The invention consists of certain improvements in construction on the device shown in my Patent #811,383, bearing date of January 30th, 1906, which will be fully disclosed in the following specification and claims.

In the accompanying drawings, which form part of this specification:—Figure 1 represents a front elevation of an apparatus embodying my invention. Fig. 2 represents a like view of a modification of the same. Fig. 3 a diagrammatic view of the electrical conductors shown in Fig. 1. Fig. 4 a like view of the electrical conductors shown in Fig. 2. Fig. 5 a front elevation of another modification of the apparatus, and Fig. 6 a diagrammatic view of the electrical conductors shown in Fig. 5.

Reference being had to the drawings and the designating characters thereon, the numeral 1 indicates a dry-bulb thermometer, 2 a wet-bulb thermometer, 3 and 4 indicate the columns of mercury contained in said thermometers respectively.

5 and 6 indicate wires connected with the tubes of the thermometers, extending either through the tubes, or at least through that part of the tubes which is required for indicating purposes. As shown in the drawings the wires 5 and 6 extend through the tubes, emerging from them at the points 8, 10, 9 and 11 respectively.

M. N. P and Q represent terminals attached to the board or support 12, on which the thermometers are also mounted.

The manner in which the thermometers are connected together, is by what is well known in the electrical industry as the Wheatstone "bridge," it will suffice for the purpose of this description therefore, to simply state that a Wheatstone "bridge" is a device used for the measurement of resistances, so called because the "balance" between the resistances to be measured is indicated by the absence of a current in a certain wire forming the "bridge" or connection between two points of the apparatus. Fig. 3 illustrates diagrammatically how the principle of the Wheatstone "bridge" is applied to my invention.

Referring specifically to Figs. 1, 2 and 3 it will be seen that the resistance of the dry-bulb thermometer 1 corresponds to the arm D of the "bridge," and the resistance of the wet-bulb thermometer 2 corresponds to the arm B of the "bridge;" the wires through the thermometers are connected in series to two fixed resistances A and C forming the other "arms" of the "bridge." The source of electrical energy 13 is connected to the circuit at the two points P and Q. The electric indicator I, (in this case a relay adapted to make and break an electric circuit) is connected across the circuit at the two points M and N. It is thus seen that if the ratio of resistance C, to the resistance D be equal to the ratio between the resistance A and the resistance B, then there will be no current through the indicator between M and N. In the construction of the instrument such a ratio is provided for, so that when the electrical "balance" is maintained there is no current through the indicator or relay. When the rise or fall of the column of mercury in either the wet or dry-bulb thermometer takes place however, the "balance" in the "bridge" is disturbed and a current flows through the indicator or relay causing it to make and break an electric circuit, as the case may be.

In the diagram shown in Figs. 3 and 4, I have chosen to illustrate the resistance of the thermometers by heavy straight lines, and to illustrate the changes in those resistances by arrow points, this being the customary way for indicating variable resistances. I have shown these thermometer resistances by heavy straight lines to indicate at a glance the difference between them and the fixed resistances of wire that are indicated in the usual conventional manner in the circuit in the same diagram. So far it will be observed that any fixed change in the resistance of one thermometer would require a corresponding and equal change in the resistance of the other thermometer. In other words, this would cor-

respond to a fixed depression of the wet-bulb thermometer. Whereas, as a matter of fact the fixed depression of the wet-bulb thermometer is not all that is desired, a variable depression of said thermometer must be provided for. This is accomplished by introducing a shunt *d*, around one of the thermometers so that the total resistance in D, varies according to any predetermined scale and consists of the total resistance of the shunt *d*, and the variable resistance of the thermometer due to atmospheric changes. This shunt *d*, is shown in Figs. 2, 4, 5 and 6. It will thus be seen that any predetermined scale of depression of the wet-bulb thermometer can be provided for in the construction of the instrument.

Fig. 5 shows a modified form of the apparatus, using a straight tube of the usual form for the dry-bulb thermometer, and for the wet-bulb thermometer a bent tube of the form known to the trade as a "Sixe" thermometer. Fig. 6, shows a diagrammatic illustration of this modified form. It will be observed that one of the fixed resistances A is cut out and that the resistance of the wet-bulb thermometer is divided, a part of it being substituted for the fixed resistance A shown in Figs. 3 and 4. The object of this construction is to magnify the sensitiveness of the apparatus by doubling the variation of resistance for each degree changed in temperature.

It is obvious that there are many minor modifications of the Wheatstone "bridge" or "balance" method of connecting thermometers by which these results may be accomplished. I do not, therefore limit myself to any particular method of connections, as my invention relates broadly to actuating indicating means by the disturbances of a prearranged scale of balanced resistances of the thermometers.

It is well known that there are other types of means for indicating temperature and humidity than the glass tube type of thermometer, and it is obvious that such other types may be connected up to indicate according to a predetermined scale variations in the humidity by the disturbance of the electrical balance of Wheatstone bridge connections. I do not, therefore, limit myself to any particular type of thermometer, but, as stated above, that my intention includes any type of means for indicating temperature and humidity by the disturbance of an electrical balance arranged according to a predetermined scale.

Having thus fully described my invention, what I claim is

1. The combination with a source of electrical energy, of means for indicating temperature and means for indicating humidity, each of the means being adapted to complete an electric circuit, electrical conductors connecting said source of electrical energy with each of said means, and means for indicating a predetermined relationship between said indicating means by electrically balancing the resistances of said indicating means.

2. The combination with a source of electrical energy, of a dry-bulb thermometer and a wet-bulb thermometer, each of said thermometers being adapted to complete an electric circuit, electrical conductors connecting each of said thermometers in circuit with resistance to form the arms of an electric bridge, electrical conductors connecting said source of electrical energy to the arms of said electric bridge, and means for indicating relative changes in the temperatures as shown by the two thermometers, said means consisting of an electric indicator suitably connected between said arms of said electric bridge.

3. The combination with a source of electrical energy, of means for indicating temperature and means for indicating humidity, each of said means being adapted to complete an electric circuit, a fixed resistance, an electric indicator, and electrical conductors connecting up the said indicating means with said source of electrical energy and said resistance and said electric indicator, said connections including a Wheatstone "bridge," in which the electric indicator consists of a relay adapted to make and break an electric circuit.

4. A hygrometer comprising a dry bulb thermometer and a wet bulb thermometer electrically connected; in combination with a source of electrical energy, and means for indicating differences in resistances of said thermometers according to a predetermined scale.

5. The combination with a source of electrical energy, of two thermometers, one for indicating temperature and the other for indicating humidity, each of said thermometers being adapted to complete an electric circuit, separate electrical conductors connecting said source of electrical energy with each of said thermometers and each thermometer with the other, one of said conductors containing an electro-magnetic device.

6. The combination with a source of electrical energy, of a dry-bulb thermometer and a wet-bulb thermometer, each of said thermometers being adapted to complete an electric circuit, separate electrical conductors connecting said source of electrical energy with each of said thermometers and each thermometer with the other, one of the conductors containing an electro-magnetic device.

7. The combination with a source of electrical energy, of means for indicating temperature, and means for indicating humidity, variations in the indications of each of the means being adapted to disturb an electrical balance, electrical conductors connecting said source of electrical energy with each of the said means, and means for indicating a pre-

determined relationship between said indicating means by said disturbance of the electrical balance.

8. A source of electrical energy, two thermometers, each of said thermometers being adapted to complete an electric circuit, an electro-magnetic device which in its normal position indicates a predetermined scale of humidity at different temperatures, electrical conductors connecting said source of electrical energy, said thermometers and said electro-magnetic device; and means for actuating the electro-magnetic device, adapted to be operated by disturbances in the electrical charteristics of the thermometers produced by changes in temperature and causing said electro-magnetic device to indicate any departure from said predetermined scale of humidity.

In testimony whereof I affix my signature, in presence of two witnesses.

STUART W. CRAMER.

Witnesses:
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A. BOOZER.