June 14, 1927. 1,632,729

E. B. FOOTE ET AL

HYGROMETRIC APPARATUS

Filed Jan. 11. 1926

Fig. 1

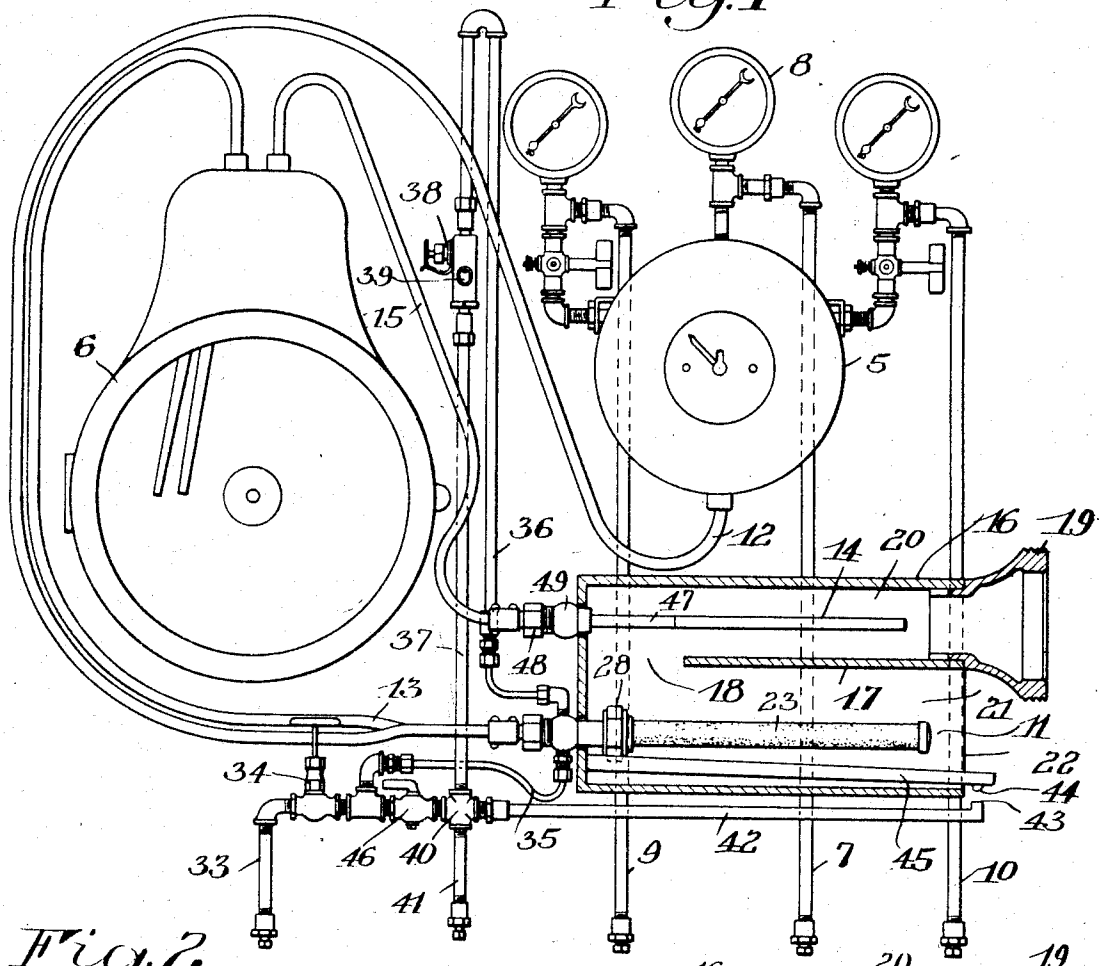
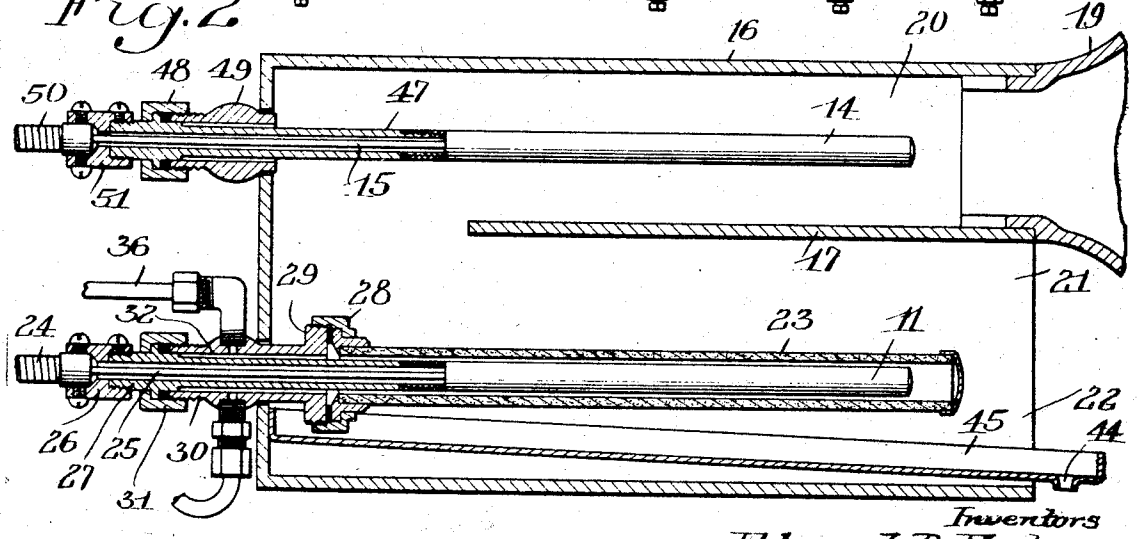



Fig. 2




Inventors

Edward B. Foote

Frederick W. Stalker

By Crampton & Griffith

Their Attorneys

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# UNITED STATES PATENT OFFICE.

EDWARD B. FOOTE AND FREDERICK W. STALKER, OF ROCHESTER, NEW YORK, ASSIGNORS TO TAYLOR INSTRUMENT COMPANIES, OF ROCHESTER, NEW YORK, A CORPORATION OF NEW YORK.

## HYGROMETRIC APPARATUS.

Application filed January 11, 1926. Serial No. 80,448.

This invention relates to hygrometric apparatus of the so-called "wet and dry bulb" type, and, more particularly, to means for maintaining the wet bulb in a moist condition, the chief object of the invention being to provide a simple, reliable and effective device for moistening the wet bulb comprising a water-pervious or porous casing or sleeve for the bulb, such as described for example in the patent to Hermann et al. No. 1,484,129. From a more specific aspect, the invention comprises an efficient moistening system for a porous bulb sleeve of the character described whereby water is supplied to the interior of the porous sleeve for the bulb under a suitably controlled pressure, and in such a manner as to vent the sleeve and maintain the same at all times filled with water.

To these and other ends the invention resides in certain improvements and combinations of parts, all as will be hereinafter more fully described, the novel features being pointed out in the claims at the end of the specification.

In the drawings:—

Figure 1 is an elevation of a hygrometric apparatus embodying the present invention with parts of the same shown in section; and

Figure 2 is an enlarged sectional elevation of the bulb casing and associated parts shown in Figure 1.

Similar reference numerals throughout the several views indicate the same parts.

The invention is embodied in the present instance in conjunction with wet and dry bulb regulating and recording apparatus of known variety comprising a regulating instrument indicated at 5 and a recording instrument 6. These instruments may be of the usual or any suitable variety. The regulating instrument 5 is shown in the present instance as supplied with air under pressure through a pipe 7, the pressure of which is indicated by a gauge 8. The pressure thus supplied is transmitted under automatic control by the instrument through one or more operating relay lines 9 and 10 to the apparatus to be regulated. The automatic control of these lines 9 and 10 is responsive to a thermostatic wet bulb member indicated generally at 11, which is of the variety filled with an expansible fluid, as well understood in the art, and connected by a capillary line 12 with suitable mechanism in the regulating instrument 5 for controlling valves regulating the supply of pressure through lines 9 and 10. Bulb 11 is provided with means for maintaining the same in a moistened condition as hereafter described and is utilized also by the recording instrument 6 for making a record of wet bulb temperatures, the capillary of the bulb for this purpose having a branch 13 leading to the recorder 6 as shown, in addition to the regulator branch 12. The recorder has also a thermostatic dry bulb member 14 connected by a capillary 15 for operating the second recording pen thereof to record a curve of dry bulb temperatures. The above mechanism may have any known or suitable construction as already stated and the details of such construction form no part of the present invention.

The wet and dry bulbs 11 and 14 in the present embodiment are arranged in a casing 16 of any suitable shape as shown. Between opposite sides of this casing is a partition 17 discontinued adjacent one end of the casing to leave an opening 18. The air of which the hygrometric condition is to be measured is supplied to one of the compartments formed by partition 17, for example, through a pipe connection 19, with the upper compartment 20, such air passing through compartment 20 in which the dry bulb is located, through the opening 18 and thence through the other compartment 21 containing the wet bulb 11. By this arrangement the air to be measured is first brought in contact with the dry bulb and thereafter in contact with the wet bulb just prior to its discharge at 22 from the casing.

The means for maintaining the wet bulb in a moistened condition is preferably of the character disclosed in said Letters Patent No. 1,484,129, comprising a water-pervious or porous envelope or sleeve 23 for the wet bulb adapted to be supplied internally with water which penetrates through the walls of the sleeve and is evaporated from its external surface to produce the well known cooling effect.

It has been found important in the use of such bulb moistening means to regulate the supply of water to the interior of the porous sleeve to afford a suitable water pressure in the same and to provide suitable venting of the sleeve to prevent the formation of an

air pocket at any portion thereof, which might interfere with evaporation and the desired cooling effect. These results are accomplished by the present invention through the provision of a water supply and discharge means for the bulb sleeve so constructed and arranged that the pressure within the sleeve may be controlled and the sleeve completely vented to provide at all times for the escape of air therefrom. To this end the armor or casing 24 of the wet bulb capillary 25 described above as having the branches 12 and 13, is secured in one end of the sleeve 26, the other end of which receives and is fixed to a tube 27. The latter extends into the porous sleeve 23 and carries at its inner end the wet bulb 11 with which the capillary 25 communicates. Tube 27 and bulb 11 are somewhat smaller than the interior diameter of the porous sleeve, as shown, to leave space therebetween for the circulation of water to all portions of the porous sleeve. The porous sleeve is supported as by means of the union nut 28 on a threaded flange 29 at the inner end of a sleeve 30 extending through the wall of the casing 16. The other or outer end of sleeve 30 is provided with a union nut 31 by means of which the sleeve is connected with and supports the tube 27. Tube 27 extends through the supporting sleeve 30, as shown, and is reduced in diameter through a portion of its extent as at 32 to provide clearance between the tube and supporting sleeve for the circulation of water to and from the interior of the sleeve 23. The connections for supplying and discharging the water for moistening the sleeve are made with the supporting sleeve 30 as will now be described.

The means for supplying water to the porous sleeve preferably comprises a pipe 33 connected with a source of water under pressure and controlled by a valve 34 by means of which the pressure may be throttled. The valve is connected by a pipe 35 with a lateral port in sleeve 30, so that water under pressure is thus supplied to the space within sleeve 30 which communicates with the interior of the porous sleeve to provide a continuous supply of water under pressure for the same.

In addition to the provision of a continuous supply of water under pressure to maintain the porous sleeve moist, there is provided also a discharge pipe communicating with the sleeve in such a manner and so arranged as to vent the sleeve and maintain a gravity head of water on the same. This is preferably accomplished as shown by providing supporting sleeve 30 with a port located in the uppermost portion of the same and connecting with this port an upwardly extending discharge pipe 36 having a return bend 37. It will be seen from this construction that the discharge pipe 36 communicates with the uppermost portion of the sleeve so as to completely vent the same, any air which may become pocketed in the sleeve being inevitably forced to the top of the discharge pipe 36. For this purpose the bulb sleeve 23 is arranged either horizontally or with its terminal slightly depressed to facilitate the escape of the air.

The U-shaped discharge pipe 36—37 is provided with a valve 38, preferably of the needle type, and the valve or the depending leg 37 is provided with a glazed side opening 39 through which the amount of water discharged through the valve may be observed as an indication of the circulation of water in the system. Pipe 37 is connected at its lower end with a cross joint 40 with which is connected a drain pipe 41. Cross joint 40 also carries a branch pipe 42 extending under the bulb casing 16 and having an upwardly opening end 43 beneath a drip opening 44 in a trough 45 arranged at an inclination as shown under the wet bulb sleeve to catch any drippings therefrom and carry the same to the discharge pipe 41. A valve 46 preferably connects the water supply line 33 with the drain pipe 41 for flushing out the drain connection. The discharge pipe for the wet bulb sleeve is thus of a closed character which obviates clogging by dust, lint and the like, encountered in some applications.

The dry bulb 14 is similarly carried at the end of a tube 47 supported by means of a union nut 48 in a supporting sleeve 49 having its opposite end inserted through an opening in the wall of the bulb casing 16, as shown. The armor 50 of the dry bulb capillary 15 is fixed in one end of a connecting sleeve 51, the other end of which is fixed to the tube 47. The two supporting sleeves 30 and 49 for the wet and dry bulbs, respectively, are supported by any suitable clamp or bracket means (not shown) on the instrument board which carries the whole apparatus. The opening in the wall of the casing 16 which receives the supporting sleeve 30 of the wet bulb is preferably in the form of a slot extending inwardly from the front of the casing 16 and it will be apparent from the above description that both the wet and dry bulbs are conveniently detachable and removable from the casing 16 for cleaning, repair and replacement.

It is apparent from the above description that the supply and discharge valves 34 and 38, respectively, may be adjusted to regulate the pressure at which water is supplied to the porous sleeve and the rate of discharge therefrom, to thereby control the pressure in the sleeve, as may be found suitable to maintain the desired penetration of moisture to and evaporation from its outer surface. The rate of circulation and discharge of the

water may be observed at side opening 39 in the discharge pipe and the upwardly extending arrangements of the latter provides for the escape of air from the uppermost portion of the bulb sleeve with which it communicates. The upward extension of the discharge pipe and its connection with the bulb sleeve also provide a gravity head of water for supplying the porous sleeve in case it is desired at any time to close the water supply valve 34. The invention thus provides a simple, reliable and efficient moistening system for the wet bulb by means of which its porous sleeve 23 is constantly maintained filled with water under suitable pressure.

We claim as our invention:

1. In a hygrometric apparatus, the combination of a temperature sensitive element, a water-pervious envelope defining a closed chamber about said element, means for supplying water under pressure to the interior of said envelope, and an upwardly extending discharge conduit connected with said envelope to provide for the escape of air from said envelope and maintain the same filled with water.

2. In a hygrometric apparatus, the combination of a temperature sensitive element, a water-pervious envelope defining a closed chamber about said element, means for supplying water under pressure to the interior of said envelope, an upwardly extending discharge conduit connected with said envelope to vent the same and valve means for said conduit for maintaining water pressure in said envelope.

3. In a hygrometric apparatus, the combination of a temperature sensitive element, a water-pervious envelope defining a closed chamber about said element, means for supplying water under pressure to the interior of said envelope, a closed conduit connected with and rising above said envelope and provided with a sight opening, and a valve for said conduit for regulating the discharge of water therethrough and maintaining water pressure in said envelope.

4. In a hygrometric apparatus, the combination of a thermometer bulb, a sleeve of porous material defining a closed chamber about said bulb, means for supplying water under pressure, to the interior of said sleeve, and a pipe connected with the uppermost portion of said sleeve to vent the same and maintain it full of water.

5. In a hygrometric apparatus, the combination of a thermometer bulb, a sleeve of porous material defining a closed chamber about said bulb, means for supplying water under pressure to the interior of said sleeve, a pipe connected with the uppermost portion of said sleeve to vent the same, and a valve means provided with a sight opening for regulating the discharge of water through said vent pipe.

6. In a hygrometer apparatus, a casing, a pair of thermometer bulbs detachably inserted through the casing wall, a sleeve of porous material defining a closed chamber about one of said bulbs, means for supplying water under pressure to the interior of said sleeve, a closed discharge conduit connected with and rising above said sleeve to vent the same, and a valve in said conduit provided with a sight opening for regulating the discharge of water through said conduit and the pressure in said sleeve.

EDWARD B. FOOTE.
FREDERICK W. STALKER.