

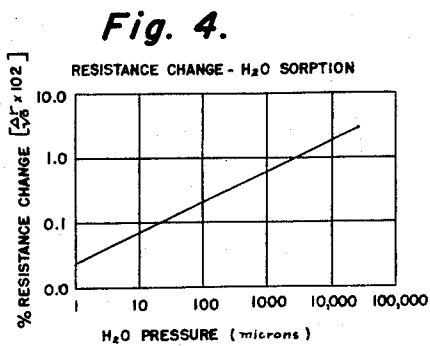
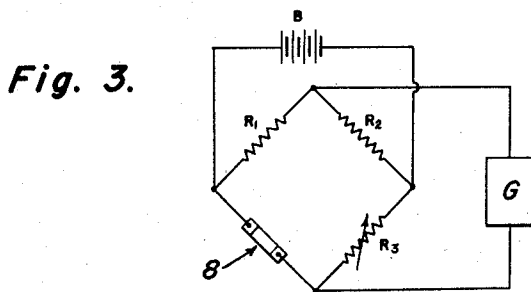
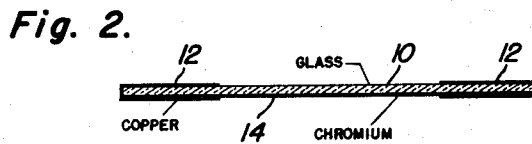
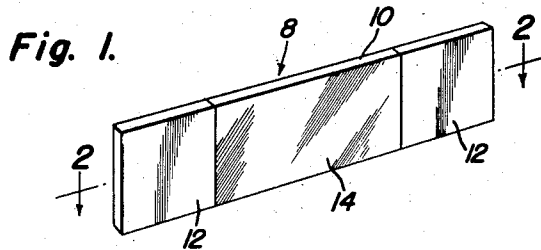
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2,904,765

FAST RESPONSE RECORDING HYGROMETER

Filed Oct. 17, 1955



$R_0 = 194,000$ ohms
 $t = 27^\circ \text{C.}$
 amount Cr deposited =
 $.005 \text{ mg Cr/cm}^2$ slide surface

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2,904,765

FAST RESPONSE RECORDING HYGROMETER

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Application October 17, 1955, Serial No. 541,102

5 Claims. (Cl. 338—35)

(Granted under Title 35, U.S. Code (1952), sec. 266)

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment to us of any royalty thereon.

This invention relates to a fast response hygrometer. More particularly it relates to an instrument for measuring the water vapor pressure in the air by determining the variation in the electrical resistance of a unit exposed to the vapor pressure in question.

Specifically, the invention relates to a vitreous glass or ceramic unit having chromium deposited thereon, which unit has a resistance varying with the water vapor pressure.

It has been known to determine vapor pressure in the atmosphere by the variation in resistance of a ceramic or other resistance unit when exposed to the variable vapor pressure. A difficulty often associated with such units is that they display an increasing lag in response when the units are exposed to a series of vapor pressure changes. This resulting irreversibility usually coupled with a lag in response time detracts greatly from the value of the units.

Figure 1 is a view of the hygrometer.

Figure 2 is a section along the line 2—2.

Figure 3 is a Wheatstone bridge circuit.

Figure 4 is a graph of the vapor/resistance relation.

The present unit is shown in Fig. 1 and consists of a glass plate 10, which in this case, is a microscope slide on which chromium metal has been deposited by high vacuum evaporation. The metal was deposited to the extent of about .0017 to .045 mg. Cr/cm.² and is quite invisible. Contact is made to each end of the slide by means of a heavier layer of chromium coupled with a heavy deposit of copper 12. This prepared slide is fixed in a Wheatstone bridge circuit shown in Fig. 3. By balancing resistance R-3 in against the element 8 in the circuit it is possible to determine the resistance of the element. The resistance of such a slide, 25 mm. wide and 50 mm. effective length, varies from about 10 megohms to 80 ohms, within the aforementioned thickness range, and was found to increase irreversibly upon exposure to water vapor for periods of over a week. To eliminate the slow irreversible increase in resistance due probably to water vapor and possibly air, the slide was preconditioned by boiling for two hours in distilled water. Upon

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removal and drying, this slide was found to reach resistance equilibrium within an hour. The resistance of the slide in vacuo was found to be 190,000 ohms. Upon the admission of water vapor to the extent of 6 mm. Hg vapor pressure, the resistance increased 1.4%. For 12 mm. Hg vapor pressure, it increased 2% and with 18 mm. Hg vapor pressure, it increased to 3%. This equilibrium was established within five minutes and about 80% of the rise took place within the first twenty seconds. This process is completely reversible which was demonstrated by repeated cycles of adsorption-desorption with identical results. No effect upon resistance results from the admission of 1 atmosphere of dry air.

Fig. 4 shows graphically the relation between water vapor pressure in microns and percent resistance change. When plotted logarithmically the result is a straight line as shown.

This chromium deposited element makes possible an extremely reliable and effective method of determining water vapor pressure. When the element is prepared by conditioning it in boiling water it is found to be completely reversible and to provide a quick and accurate determination of water vapor pressure. This sensing element, by virtue of its mechanical and electrical stability and its rapid and reversible response, can be conveniently connected to various types of servo mechanisms, recorders or transmitters.

We claim:

1. A vapor pressure sensitive resistance element comprising a glass surface covered with a thin invisible layer of vacuum deposited chromium having spaced apart contact terminals for making electrical connections to the element.

2. An element in accordance with claim 1 wherein the chromium is deposited to the extent of about .0017 to .045 mg. Cr/cm.².

3. A vapor pressure sensitive resistance element comprising a vitreous surface covered with a thin invisible layer of vacuum deposited chromium having spaced apart contact terminals for making electrical connections to the element.

4. An element in accordance with claim 3 wherein the chromium is deposited to the extent of about .0017 to .045 mg. Cr/cm.².

5. An element in accordance with claim 2 wherein the glass surface is in the form of a microscope slide.

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