THEORY, CONSTRUCTION AND WORKING OF MAHAJAN'S HUMIMETER

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ABSTRACT. A new type of hygrometer (Mahajan's Humimeter) has been devised. It has simple costruction and works on the principle of balance. The readings of percentage humidity are indicated by its pointer directly on the scale marked on its dial.

It is a portable instrument of the size of a small table clock, and is useful for factories, offices, workshops and observatories where and when approximate value of the relative humidity of the surrounding atmosphere is required in a short time.

It is not as accurate as the Mahajan's Optical hygrometer but is, however, much more accurate than many other types of hygrometers, such as, hair hygrometer, paper hygrometer, etc, Its aproximate percentagge of error is ± 2.

The details of its construction, working and theory are given below.

INTRODUCTION

In 1941, the author devised an Optical hygrometer (later on called the Mahajan's optical hygrometer, (Mahajan, 1941*a*), Government of India patent No. 30221), which works on the principle of balance, and the observations of which are recorded by means of lamp and scale arrangement ; This instrument proved a most sensitive and accurate hygrometer, it is used in observatories and laboratories where and when very accurate observations are required, or when very minute changes of humidity are to be detected. But this has its own difficulties, such as, long time in setting, extra care to look after it, and not easily portable due to lamp and scale arrangement. It is why it cannot be used in factories and offices where rough values of the relative humidity or percentage humidity of the surrounding air is required. In view of all these difficulties, the author has now devised another type of hygrometer (called Mahajan's Humidity meter, in brief, Humimeter) which will serve the above mentioned purposes.

It is a portable instrument of the size of a small table clock. It indicates directly on its dial, the approximate value of the percentage of humidity of its surrounding atmosphere in a short time. Its construction and theory are simple and are given below in detail:

CONSTRUCTION

Its complete construction is given in figure 1, where E G and F H are two thin circular discs of any light metal, and diameter about 10 cms. They

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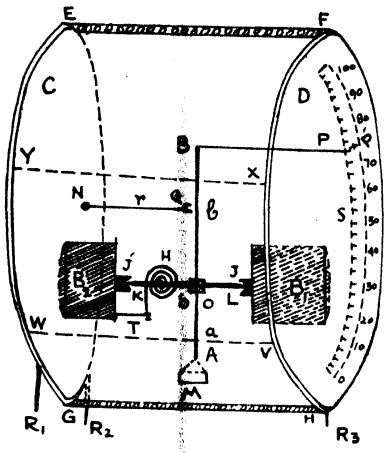

FIG: 1.

are joined together by means of four rods E F, Y X, W V, and G H, each about 2 mm. thick and about 5 cms. long. Each disc has a small cylindrical block of iron, B_1 or B_2, rigidly attached to it. In the centre of each block, there is a small groove J or J'. These grooves are fitted with jewels as shown in the figure. The hard ends K and L of a strong steel rod about 3 cms. long rest in those grooves. To this revolving rod KL is attached rigidly a balancing rod AB, by means of two small screws O and O'.

The balancing rod AB is made of a light metal and is about 6 cms. long, 2 mm. broad and 0. 5 mm. thick. It rests edgewise on the revolving rod, and has two unequal arms *a* and *b*. The arm *a* is about 1. 5 cms. long, and supports a pan M, while the other arm which is about 3 times longer, has no such pan, but is bent twice at right angles at B and P. The end P' of this arm forms the pointer which moves on the scale S.

On its front, there is a circular dial. On one side of it, there is a half circular slit S, about 3 mm. wide, cut into it. It runs from its bottom to top and is shown in the figure by dotted lines. The arm BP of the pointer after passing through the slit moves on the scale S which is marked on one side of this slit. The slit is graduated in terms of percentage of humidity from 0 to 100%. This scale is coverd with a transparent glass plate, about 2 mm. above it.

The free movement of the revolving rod KL is controlled by means of a fine hair spring H, one end of which is fixed to it, and the other to the support T, The pan M hangs freely from the end A of the balancing rod. It contains some substance which absorbs moisture from the atmosphere surrounding it, and gives out moisture accordingly when the moisture content of the atmosphere decreases. In this case, the same substances were used which had been tested and utilized in the Mahajan's optical hygrometer (Mahajan, 1944*a*).

The whole of its cylindrical side is perforted with small holes for free circulation of air inside it. The whole instrument is supported by the levelling screws R_1, R_2 and R_3, and is always kept in horizontal position. On its back, there is a disc C having a screw N connected to a thin rod *r*. It has a fine jaw Q at its other end. On screwing it in, the jaw holds the balancing rod in position and does not allow it to move. On screwing it out, it loosens the balancing rod, and allows it to move freely. Thus it controls its movements, and makes it convenient for protable purposes.

The quantity of the substance put into the pan M is just sufficient to bring the pointer P′ at zero % humidity when the air is absolutely dry and it points 100% when the surrounding air is fully saturated. This scale is then calibrated by comparison with a standard wet and dry bulb hygrometer.

The figure 1 is not according to any scale, but has been made such that it depicts all the parts of the instrument.

THEORY

The main principle of working is the same as that of Mahajan's optical hygrometer. But it differs in construction from it in some respects, namely:—

(*i*) Instead of two pans in the optical hygrometer, there is only one in the Humimeter.

(*ii*) In place of the second pan, there is a long pointer which moves on the scale S marked on the dial,

(*iii*) The two arms of the balancing rod are not equal. The pointer arm is about three times longer than the pan arm.

(*iv*) There is a hair spring attached to the revolving rod to control its movements.

(*v*) The external shape is cylindrical.

When the humidity of the air increases, the substance in the pan absorbs more moisture, and when the humidity decreases, it gives out some of its moisture to the surrounding air. This increase or decrease in weight is directly proportional to the increase or decrease of % humidity of the air. This variation in the weight of moisture content affects the balancing beam. By increase of weight, the pan M goes down, and the pointer P′ goes up, and the reverse takes place, when there is decrease of weight. This movement of the pointer P′ has been calibrated with a standard wet and dry bulb hygrometer. Thus the scale on the dial gives the direct reading of the % humidity of the surrounding air or vapours.

SENSITIVENESS

It is not so sensitive as the optical hygrometer (Mahajan, 1944*b*). But it indicates approximate % humidity in a much shorter time than the optical hygrometer.

It is, however, much more sensitive than many other types of hygrometers which are commonly used for approximate value of relative humidity, such as, hair hygrometers, paper hygrometers, chemical hygrometers, etc. The average percentage of error of these hygrometers is ± 5 while that of the Humimeter is ± 2 only.

USES

It is a useful instrument for the factories, workshops and offices, where high accuracy is not needed. It can be used for all other general purposes as well.

PRECAUTIONS

The author has already published some precautions (Mahajan, 1941*b*) for the working of the optical hygrometer. The same precautions should also be observed in its working.

CONCLUSIONS

It is hoped that this instrument will prove useful to the scientific world as well as to the public in general.

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