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G1S
G1X
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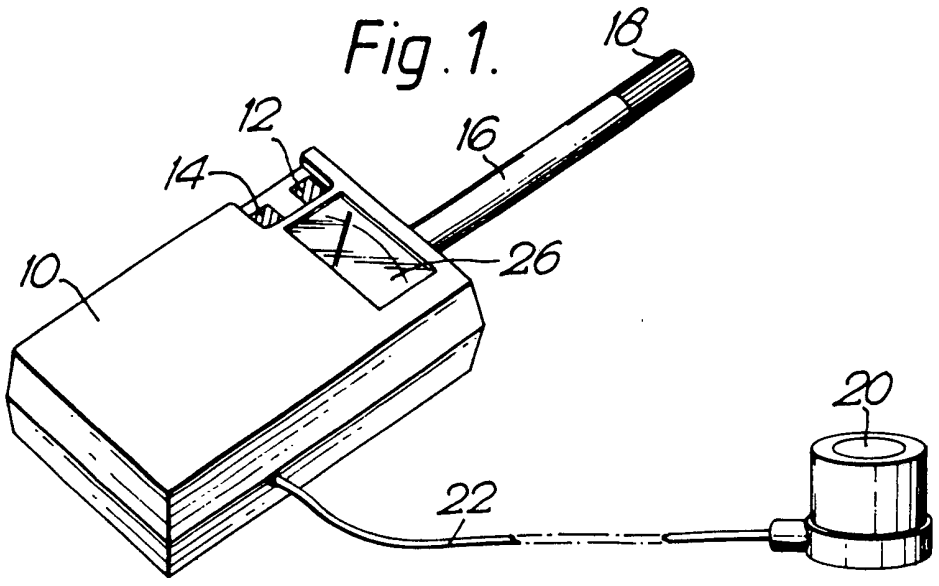
(54) Apparatus for use in diagnosing condensation or the likelihood thereof

(57) Apparatus for determining when conditions are such as to produce condensation on a surface from the atmosphere includes a temperature sensor and a humidity sensor exposed to the atmosphere in a portable unit 10, and electronic circuitry within the unit for calculating, from the sensed air temperature and humidity, the dew-point. The apparatus further includes another temperature sensor 20 which may be placed on the surface for sensing the temperature of the surface, and the unit 10 includes a display 26 whereby the unit can indicate the difference between the surface temperature and the dew-point. The display may be analogue or digital. Analogue signals from the sensors may be used directly to actuate the display or may be converted into digital signals which are digitally processed prior to display. A similar apparatus may be used to indicate the possibility of the occurrence of fog or mist, the difference in dew point temperature and the air temperature measured by an external thermometer being measured and displayed.

Fig. 1.



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The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

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Fig.1.

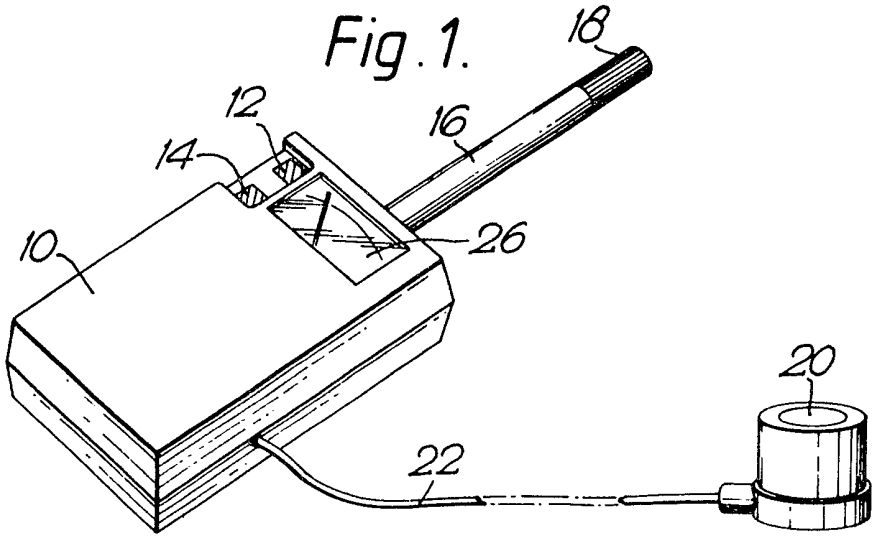


Fig.2.

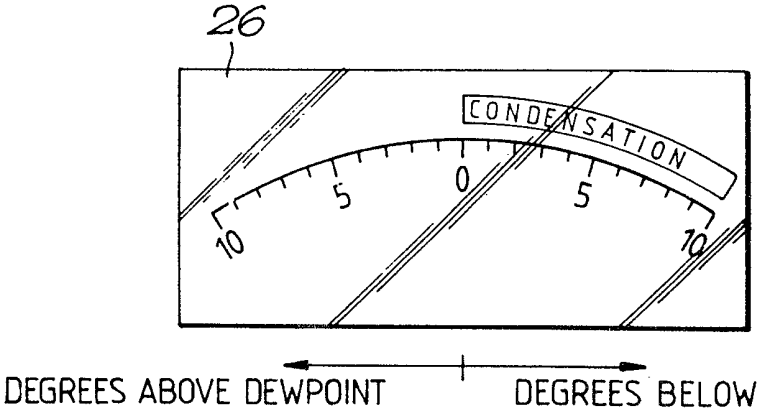


Fig.3.

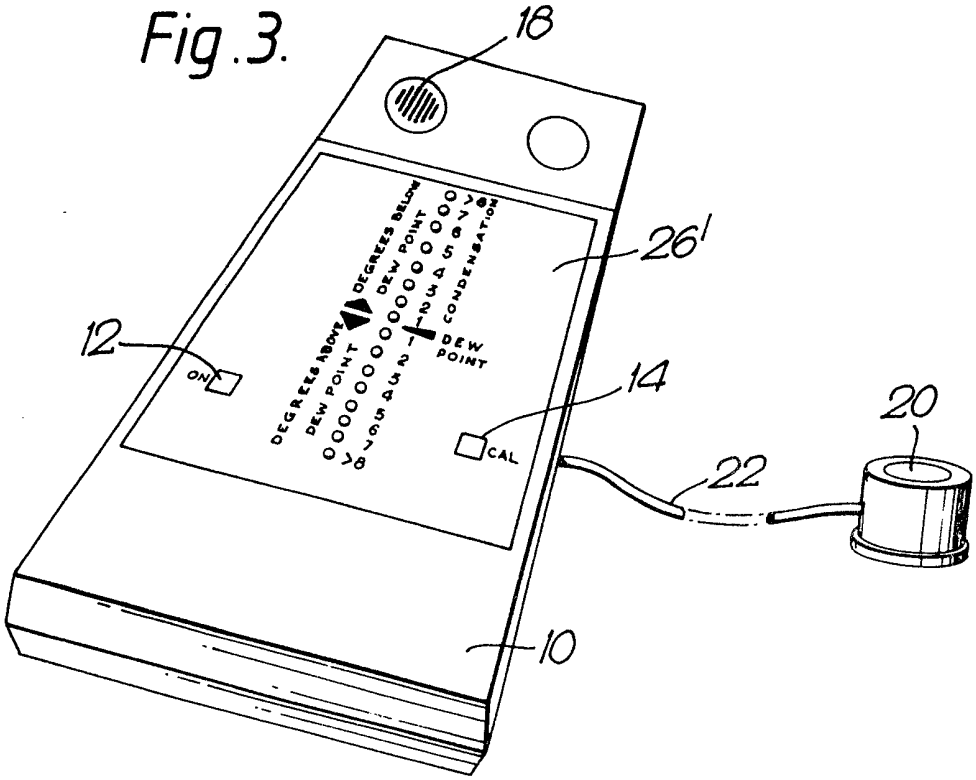
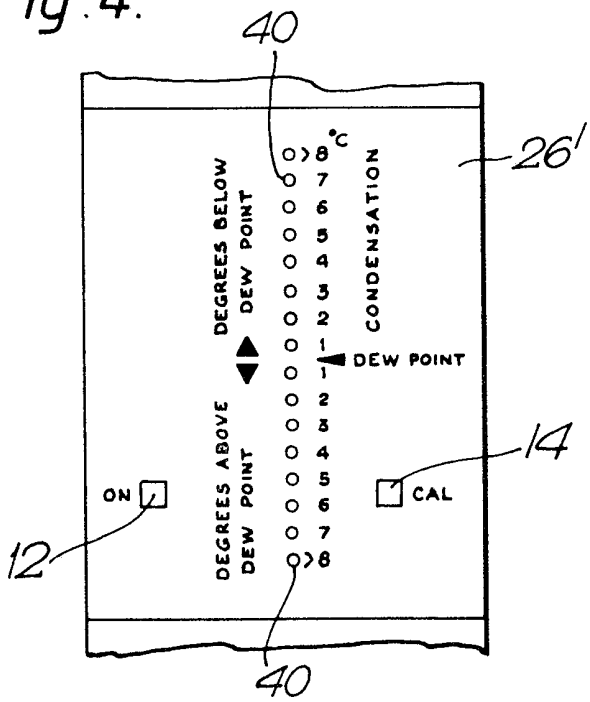

18
26'
12
ON
14
CAL
20
22
10
DEGREES BELOW DEW POINT
CONDENSATION
DEGREES ABOVE DEW POINT
DEW POINT

Fig.4.


40
26'
°C
>8
7
6
5
4
3
2
1
DEW POINT
1
2
3
4
5
6
7
>8
DEGREES BELOW DEW POINT
CONDENSATION
DEGREES ABOVE DEW POINT
ON
CAL
14
12
40

SPECIFICATION

Apparatus for use in diagnosing condensation or the likelihood thereof

This invention relates to the diagnosis of condensation or the likelihood thereof, and particularly, although not exclusively, to apparatus for determining when conditions are such as to produce condensation on a surface or are such that the occurrence of fog or mist is likely.

There are many applications in which it is necessary for the occurrence or the likelihood of the occurrence of condensation on surfaces to be monitored, for example in avoiding or rectifying dampness in buildings, or in ensuring that items or materials are stored under conditions such that they will not be subject to deterioration as a result of condensation. Various forms of apparatus for use in conducting such monitoring are known, but where it is necessary to conduct such monitoring in such a way that the existence of the conditions which will produce condensation, or the approach of such conditions, is detected before substantial condensation has occurred, which may already be sufficient to cause significant undesired damage or deterioration, it is generally necessary to resort to relatively elaborate and time-consuming testing procedures, requiring a number of saparate measurements and comparisons to be made. Typically, in such procedures, the dew point temperature of the atmosphere is determined by measuring the ambient temperature and the relative humidity and by using conversion charts to compute the dew point temperature, which is then compared with the temperature of the environment to be monitored. Where a surface is being monitored, if the surface temperature is lower than the dew point temperature, condensation will be present. The human effort involved in such procedure can be reduced by using automatic apparatus to determine the dew point temperature, although such apparatus is generally complex and expensive.

It is an object of the present invention to provide an apparatus for use in determining when conditions are such as to produce condensation, whereby monitoring of such conditions can be facilitated.

According to this aspect of the invention there is provided apparatus for determining when conditions are such as to produce condensation on a surface from the atmosphere, including means for determining the dew point temperature of the atmosphere, means for sensing the temperature of said surface, means for determining at least the algebraic sign of the difference between said surface temperature and said dew point temperature and for providing at least an indication of whether the surface temperature is above or below the dew point temperature.

It is an object of the invention, in another of its aspects, to provide improved apparatus for determining the possibility of fog or mist occurring.

According to this aspect of the invention there is provided apparatus for use in determining the possibility of fog or mist occurring, including means for determining the dew point temperature of the atmosphere, means for sensing the actual temperature of the atmosphere and means for providing an indication of said possibility on the basis of the difference between the determined dew point temperature of the atmosphere and the sensed actual temperature of the atmosphere.

An embodiment of the invention is described below by way of example with reference to the accompanying drawings in which:–

Figure 1 is a perspective view of apparatus embodying the invention,

Figure 2 is a detailed view of a scale incorporated in the apparatus of Fig. 1,

Figure 3 is a perspective view of a variant apparatus, and

Figure 4 is a detailed view of a scale or display of the apparatus of Fig. 3.

Fig. 1 illustrates an electronic instrument for determining when conditions are such as to produce condensation on a surface from the atmosphere. The apparatus may, as illustrated, comprise a unit which can be held in the hand and which includes a casing 10, for example of plastics, which houses electronic circuitry and a battery (not shown) providing power therefor, the casing being provided with control switches 12, 14 and having a probe 16 extending therefrom and carrying sensing means (not shown) for sensing the relative humidity of the atmosphere and sensing means for sensing the temperature of the atmosphere, such sensing means being, for example, housed within a hollow end part 18 of the probe 16 provided with perforations through which the surrounding air has access to said sensing means. The electronic circuitry within the casing 10 is arranged to receive electrical signals from the relative humidity sensor and the temperature sensor and to compute from these signals, and from information stored in the instrument in convenient form, the dew point temperature corresponding to the temperature and relative humidity sensed. In the embodiment shown, the dew point temperature thus arrived at is represented by the value of an analog electrical signal provided at a point in the electronic circuitry within the casing. This signal is compared with a another analog electrical signal, the value of which corresponds with the temperature of the surface to be checked, the last-noted temperature being sensed by a sensor unit 20 which may, as illustrated, be connected with the circuitry within casing 10 by way of a flexible lead 22. The device 20 con-

veniently comprises a thermally insulated handle portion by which the device can be gripped and a flat sensing surface, the device, in use, being held by its handle portion, and pressed into engagement, by way of its flat sensing surface, with the surface to be checked, whereby an electrical signal corresponding with the temperature of the surface to be checked is provided to the circuitry within casing 10 by way of lead 22.

The circuitry within casing 10, by comparison of the dew point temperature-representing signal and the signal representative of the temperature of the surface to be checked, produces a difference signal the value of which corresponds with the temperature difference between the dew point temperature and the surface to be checked and the sign of which corresponds with the sign of such difference. The resultant signal may be applied, for example, to a centre-zero galvanometer 26, the scale of which is illustrated in detail in Fig. 2. The scale of the galvanometer is conveniently marked in degrees of temperature with the portion of the scale to the left of the zero point as viewed in Fig. 2 corresponding with temperature of the surface being checked above the dew point temperature, and with the portion of the scale to the right of the zero point as viewed in Fig. 2 corresponding with temperature of the surface being checked below the dew point temperature. Thus, when the galvanometer needle is at the centre point on the scale, the surface being checked is at the dew point temperature whilst if the surface to be checked is below the dew point temperature the galvanometer needle is displaced to the right as viewed in Fig. 2. The scale is preferably marked to indicate that, over this region, condensation will occur.

Using this instrument, not only can existence of the conditions for the occurrence of condensation be detected, but also, by taking one of the extent of displacement of the galvanometer needle to the left of the zero marking in Fig. 2, the closeness of the surface temperature to that temperature at which condensation will occur can be determined so that areas most likely to be affected by condensation can be readily found because in these areas the difference between the sensed temperature and the dew point temperature will be smaller than in others.

The instrument in the form described is conveniently an analog device, in which, in effect, the stored information as to the correlation between relative humidity, temperature and dew point temperature is stored in the form of component values and circuit arrangements in the circuitry used. However, it will be appreciated that digital electronic techniques may be used with, for example, analog signals from the temperature and relative humidity sensors being converted within the instrument to corresponding digital signals which then form the basis of a digital determination of dew point temperature by reference to tabulated data stored in a read-only memory, (ROM) in the apparatus and the sign and magnitude of any difference between the temperature of the surface to be checked and the dew point temperature being likewise calculated digitally. In the latter case the instrument may be provided with a digital display rather than with a galvanometer display, the use of which would necessitate a digital-to-analog converter, the digital display including the facility for indicating a plus or minus value according to whether the said surface temperature is above or below the dew point temperature.

A further variant is illustrated in Figs. 3 and 4 in which parts corresponding to those indicated in Figs. 1 and 2 have corresponding references. In this variant, in place of the centre-zero galvanometer 26, the instrument of Fig. 3 has, as shown in greater detail in Fig. 4, an indicator display 26′ which comprises a row of light emitting diodes (LEDs) 40 associated with circuitry within the casing 10 which, in operation, illuminates a single LED in the row, selected in accordance with the calculated temperature difference between the dew-point temperature and that of the surface to be checked. Thus, in the arrangement shown in Figs. 3 and 4 the illuminated LED will be further above the 'zero' position in the row (which 'zero' position is marked as corresponding to the dew point) the higher the surface temperature above the dew-point temperature, or will be further below the 'zero' position, the lower the surface temperature below the dew point temperature. The row of LEDs thus performs the same function as the galvanometer needle in the embodiment of Figs. 1 and 2 and the panel of the casing 10 in which the LEDs are disposed is correspondingly marked with an appropriate scale. In the example shown, there is one LED for every C° above or below the dew point temperature from 8C° below to 8C° above. Any other arrangement considered suitable may, of course, be adopted. The LED for zero difference may, if desired, be arranged behind a differently shaped translucent panel from the others, or may be of a different colour from the others, or displaced laterally from the row, or otherwise distinguished visually from the others. The invention is not, of course, limited to any particular form of scale or display.

In the arrangement shown in Fig. 3, the probe 16 is dispensed with and the sensing means for sensing the relative humidity of the atmosphere is housed in the rectangular casing 10 of the instrument, within a chamber covered by a perforated grille 18′.

Furthermore, whilst the device has been described as sensing relative humidity and air temperature and calculating dew point temperature therefrom, the device may, of course, be arranged to measure the dew point tempera-

ture directly, for example by refrigerating electrically a test surface within the instrument and detecting the occurrence of condensation thereon, although the indirect determination of dew point temperature is preferred as being less expensive to realise and making possible a more compact and lightweight construction.

Instruments similar to those described may be utilised for determining the possibility of the occurrence of fog or mist, the instruments in such use determining the difference between the air temperature as measured by an external thermometer and the dew point temperature, so that if the measured temperature is close to the dew point temperature the possibility of mist or fog occurring is high, particularly if the difference between the air temperature, as measured by the external thermometer, and the dew point temperature is decreasing.

CLAIMS

1. Apparatus for determining when conditions are such as to produce condensation on a surface from the atmosphere, including means for determining the dew point temperature of the atmosphere, means for sensing the temperature of said surface, means for determining at least the algebraic sign of the difference between said surface temperature and said dew point temperature and for providing at least an indication of whether the surface temperature is above or below the dew point temperature.

2. Apparatus for use in determining the possibility of fog or mist occurring, including means for determining the dew point temperature of the atmosphere, means for sensing the actual temperature of the atmosphere and means for providing an indication of said possibility on the basis of the difference between the determined dew point temperature of the atmosphere and the sensed actual temperature of the atmosphere.

3. Apparatus according to claim 1 or claim 2 including means for sensing the relative humidity of the atmosphere, means for sensing the temperature of the atmosphere and means for calculating the dew point temperature from the relative humidity and temperature of the atmosphere.

4. Apparatus according to claim 1 or claim 2 incuding means for determining the dew point temperature of the atmosphere directly.

5. Apparatus substantially as hereinbefore described with reference to, and as shown in, the accompanying drawings.

6. Any novel feature or combination of features described herein.

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