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2,762,218

LIQUID HYGROMETER

Filed May 14, 1954

2 Sheets-Sheet 1

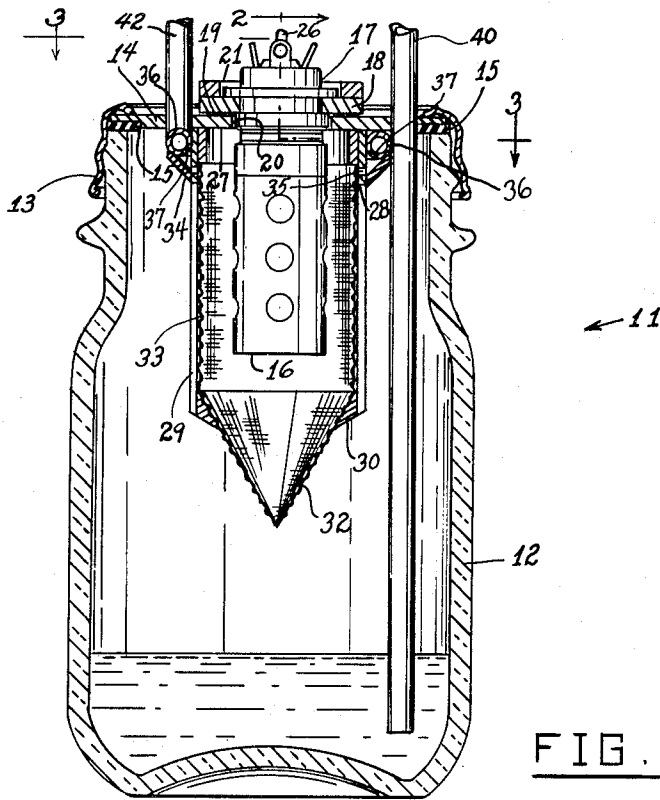


FIG. 1

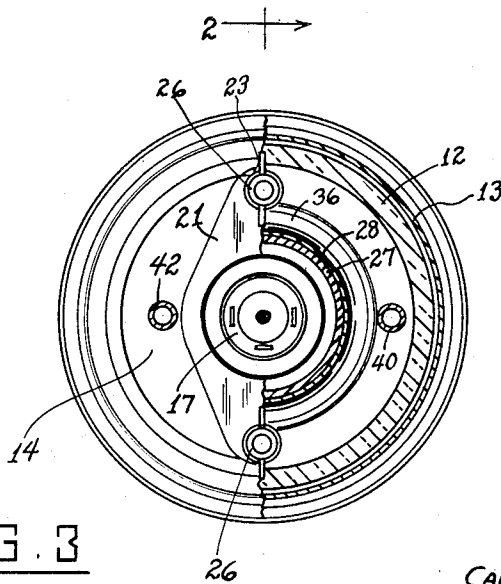


FIG. 3

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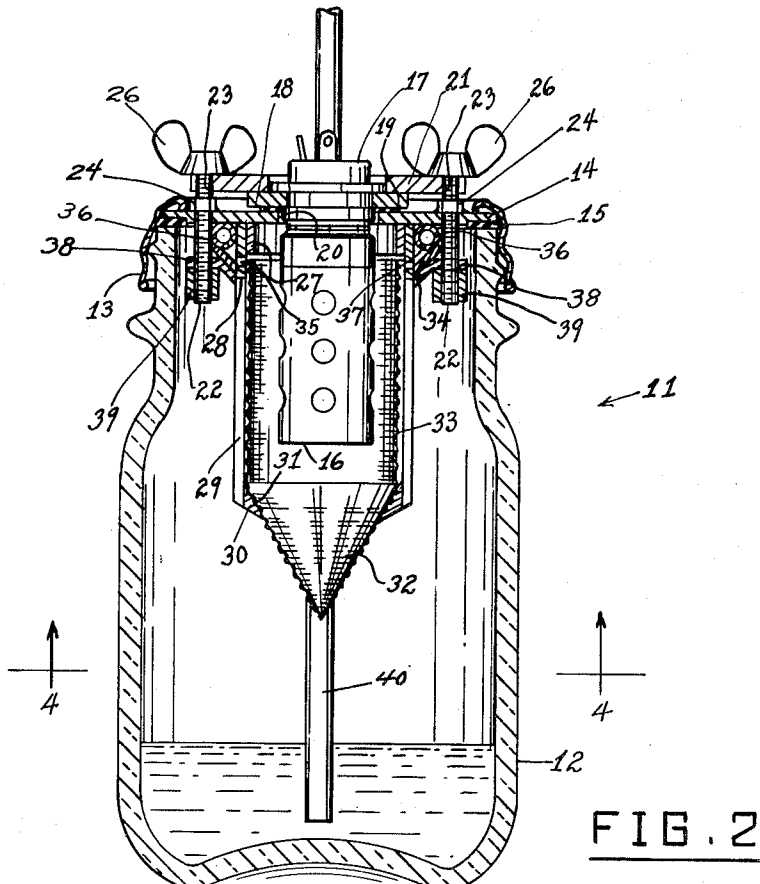


FIG. 2

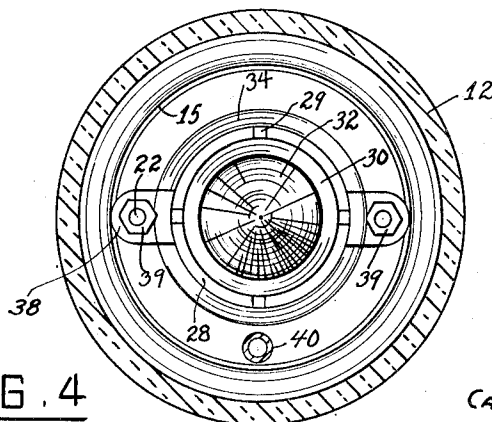


FIG. 4

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LIQUID HYGROMETER

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7 Claims. (Cl. 73—53)

This invention relates to hygrometers, and more particularly to a device for determining the amount of water contained in a liquid.

A main object of the invention is to provide a novel and improved hygrometer for determining the water content of liquids, said hygrometer being simple in construction, being reliable in operation, and being arranged so that it can be employed with conventional electrical humidity indicating and/or control apparatus.

A further object of the invention is to provide an improved device for measuring the water content of liquids by causing the water in a liquid under test to be vaporized and to produce a water vapor pressure in a substantially closed vessel, said device being inexpensive to manufacture, being relatively compact in size, being easy to assemble and to disassemble, and providing a means of measuring the water content in a liquid by the use of conventional electrical humidity sensing elements and a conventional electrical humidity indicating instrument.

Further objects and advantages of the invention will become apparent from the following description and claims, and from the accompanying drawings, wherein:

Figure 1 is a vertical cross-sectional view taken through an improved liquid hygrometer constructed in accordance with the present invention.

Figure 2 is a vertical cross-sectional view taken on the line 2—2 of Figure 1.

Figure 3 is a horizontal cross-sectional view of the liquid hygrometer, taken on line 3—3 of Figure 1.

Figure 4 is a horizontal cross-sectional view taken on the line 4—4 of Figure 2.

Referring to the drawings, the improved liquid hygrometer is designated generally at 11. The hygrometer 11 comprises a vessel 12, for example, a Mason jar, having a removable annular screw top ring 13 which is clampingly engageable on the marginal portion of a circular cover plate 14, a conventional annular sealing gasket 15 of resilient deformable material being disposed between the cover plate 14 and the top rim of vessel 12.

Designated at 16 is a conventional pronged electrical hygrometer element which is supported in depending position in the upper portion of the vessel 12 by a socket 17 secured centrally in the cover plate 14. Said cover plate is formed with a central aperture 20 through which the socket extends. A flat metal ring 18 is secured to the socket 17 and engages a flat sealing gasket 19 disposed on cover plate 14 around aperture 20. A centrally apertured generally oval, rigid clamping plate 21 is disposed over the ring 18, the socket 17 extending through the central aperture in plate 21. The opposite ends of the plate 21 are formed with U-shaped notches 23, 23 through which extend the upper portions of respective studs 22, 22 threadedly engaged through cover plate 14 and through respective nuts 24, 24 welded on said cover plate. Respective wing nuts 26, 26 are engaged on the studs 22, 22 for clamping plate 21 against ring 18.

Secured to the bottom surface of cover plate 14 concentrically with aperture 20 is a depending annular guide

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flange 27. Engaged around flange 27 is the annular ring member 28 formed with the equally spaced depending vertical fingers 29. Secured to the lower ends of fingers 29 is a ring 30 formed with the inner conical seat 31. Supported on seat 31 is the conical bottom 32 of a cylindrical foraminous screen 33, of wire mesh, or the like, whose top end is received in the ring member 28.

Secured to ring member 28 is the conical trough member 34. Ring member 28 is formed with apertures 35 in its lower portion which communicate with the lower portion of trough member 34.

Designated at 36 is an annular conduit which is disposed around ring member 28 and which is received in the upper portion of trough member 34. Conduit 36 is formed with apertures 37 directed downwardly and inwardly toward the bottom of trough member 34. Connected to conduit 36 is a vertically extending liquid inlet conduit 42 which extends through and is sealingly secured to cover plate 14. The annular trough member 34 has secured thereto opposed apertured lugs 38, 38 through which the studs 22 extend and which are secured to said studs by respective nuts 39, 39.

Designated at 40 is a vertical liquid outlet conduit which extends through and is sealingly secured to cover plate 14. As shown, outlet conduit 40 extends downwardly to a point close to the bottom of vessel 12.

In operation, a sample of the liquid to be tested for water content is admitted into conduit 42 and flows into annular conduit 36. The liquid then passes through apertures 37 into the trough member 34 and thence through the apertures 35 onto the foraminous screen 33. The liquid drips downwardly over the surface of screen 33, and, because of the large surface area of said screen, the water in the liquid is vaporized and diffuses into the upper space in the vessel 12 adjacent the electrical humidity sensing element 16. The remainder of the liquid drips down from the conical screen element 32 and collects in the bottom of the vessel. The liquid leaves the vessel through the outlet conduit 40.

The upper portion of the vessel contains water vapor under a water vapor pressure which depends on the amount of water content of the liquid. The electrical sensing element 16, which may be of the type whose resistance varies in accordance with humidity, is connected to a conventional electrical indicating instrument, which thus provides a reading in accordance with the amount of water vapor in the upper space in the vessel 12. From this data, the relative amount of water in the liquid under test can be determined.

The device may be connected in any suitable manner so as to sample liquid flowing in a conduit to determine the water content of the liquid. For example, the device may be connected in an oil line to determine the water content of the oil flowing in the line.

While a specific embodiment of an improved liquid hygrometer has been disclosed in the foregoing description, it will be understood that various modifications within the spirit of the invention may occur to those skilled in the art. Therefore it is intended that no limitations be placed on the invention except as defined by the scope of the appended claims.

What is claimed is:

1. A device for determining the amount of water contained in a liquid comprising a container, a humidity sensing element secured to the top portion of said container and extending therein, a screen surrounding and spaced from the sensing element, a liquid inlet conduit extending into said container and being adapted to receive a sample of liquid to be tested, means arranged to discharge liquid from said conduit onto said screen and to form a thin film of liquid on the screen, whereby said sensing element will be exposed to water vapor from the

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water contained in said thin film of liquid, and a liquid outlet conduit extending upwardly from the lower portion of said container.

2. A device for determining the amount of water contained in a liquid comprising: a container, a humidity sensing element secured to the top portion of said container and extending therein, a foraminous sleeve surrounding and spaced from the sensing element, means arranged to admit a sample of liquid to be tested into said container and onto said sleeve and to form a thin film of liquid on the sleeve, whereby said sensing element will be exposed to water vapor from the thin film of liquid, and outlet conduit means connected to said container and extending into the lower portion thereof.

3. A device for determining the amount of water contained in a liquid comprising: a container, a humidity sensing element mounted in the upper portion of the container, a screen surrounding and spaced from the sensing element, means arranged to admit a sample of liquid to be tested into said container and onto said screen and to form a thin film of liquid on the screen, whereby said sensing element will be exposed to water vapor from the water contained in said thin film of liquid, and outlet conduit means connected to said container and extending into the lower portion thereof.

4. A device for determining the amount of water contained in a liquid comprising a container, a humidity sensing element mounted in the upper portion of the container, a foraminous sleeve surrounding and spaced from the sensing element, a liquid inlet conduit extending into said container and being adapted to receive a sample of liquid to be tested, an annular perforated conduit arranged around said sensing element, said annular conduit being connected to said inlet conduit and being arranged to discharge liquid onto said sleeve and to form a thin film of liquid on the sleeve, whereby said sensing element will be exposed to water vapor from the water contained in said thin film of liquid, and a liquid outlet conduit extending from the lower portion of said container.

5. A device for determining the amount of water contained in a liquid comprising a container, a humidity sensing element mounted in the upper portion of the container, a screen surrounding and spaced from the sensing element, a liquid inlet conduit extending into said container and being adapted to receive a sample of liquid to be tested, an annular perforated conduit arranged around said sensing element and being connected to said inlet conduit, an annular trough disposed below said annular conduit and being located adjacent the top portion of said screen, said trough being formed with apertures located

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ed to discharge liquid onto said screen and to form a thin film of liquid on the screen, whereby said sensing element will be exposed to water vapor from the water contained in the thin film of liquid, and a liquid outlet conduit extending from the lower portion of said container.

6. A device for determining the amount of water contained in a liquid comprising a container, a humidity sensing element mounted in the upper portion of the container, a screen surrounding and spaced from the sensing element, a liquid inlet conduit extending into said container and being adapted to receive a sample of liquid to be tested, an annular perforated conduit arranged around said sensing element and being connected to said inlet conduit, an annular trough disposed below said annular conduit and being located adjacent the top portion of said screen, said trough being formed with apertures located to discharge liquid onto said screen and to form a thin film of liquid on the screen, whereby said sensing element will be exposed to water vapor from the water contained in said thin film of liquid; said screen having a downwardly tapered bottom end, whereby liquid may drip into said container from said screen, and a liquid outlet conduit extending from the lower portion of said container.

7. A device for determining the amount of water contained in a liquid comprising a container, a humidity sensing element secured to the top wall of the container and extending into the upper portion of said container, a screen surrounding and spaced from the sensing element, a liquid inlet conduit extending through said top wall into the container and being adapted to receive a sample of liquid to be tested, an annular perforated conduit arranged around said sensing element and being connected to said inlet conduit, an annular trough disposed below said annular conduit and being located adjacent the top portion of said screen, said trough being formed with apertures located to discharge liquid onto said screen and to form a thin film of liquid on the screen, whereby said sensing element will be exposed to water vapor from the water contained in said thin film of liquid, said screen having a downwardly tapered bottom end, whereby liquid may drip into said container from said screen, and a liquid outlet conduit extending through said top wall to the lower portion of said container.

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