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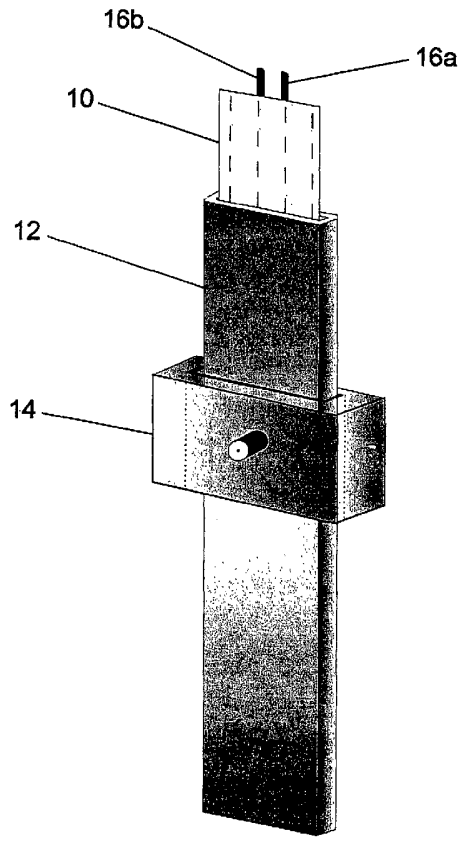
(54) Title: DEVICE FOR LEVEL DETECTING



(57) Abstract: Device for level detection of fluid in a container, comprising a magnetic float (14) arranged around an extended main body (10), to which an electric current is applied. The main body (10) comprises a number of current strips (16a, 16b) and a magnetic band (22), arranged to be activated by the magnetic float (14), whereby contact is made between the electric current strips (16a, 16b) so that a closed circuit with a certain resistance characteristic is provided. In an alternative embodiment, the magnetic float and the magnetic band are not included, but the fluid pressure is used to force the current strips against each other.

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Device for level detecting.

The present invention relates to a device for level detection of a fluid in a container, comprising a magnetic float arranged around an extended main body, to which is supplied an electric current, where the main body comprises a membrane with a number of longitudinal current strips that are separated by between-lying spacers, and that the electric current strips are arranged to mutually connect.

The present invention provides an explosion-proof liquid measuring device, as the live part of the device is not in contact with the liquid in the tank. The problems with the present day solutions, for example for measuring the fuel level in the tank of a vehicle, are that the live part of the sensor is in direct contact with the fuel or the gas. This leads to a danger of explosion arising if electrical charges are discharged so that, for example, the gas is set on fire.

From today's solution, when it comes to the use of electrical equipment, it is known that a device with a plate with variable wound resistance, which is connected to a mechanical arm with floats, is used for level detection. It is also known to use a device with a transmitter of ultrasonic pulses that are reflected by a magnet for level detection.

For detection of liquid level in a tank it is known to use magnetic force. DE 3428132 discloses a solution where a vertical pipe is fitted in a tank. The pipe carries a magnetic float that moves with the liquid level. The magnetic float is arranged to move another magnet placed inside the pipe, so that the latter magnet is at the same level as the float. The position of the magnet, and thereby the liquid level, is measured by means of an ultrasonic sensor which sends out signals to the magnet.

The way the present invention is designed, the inventive concept is not known from prior art technology.

detection is carried out electrically or magnetically, will not be obvious to an expert either.

Disadvantages with the solution in which a device with a plate with variable wound resistance, which is connected to a mechanical arm with floats being used for level detection, are that it is not explosion proof and that it is inaccurate. With regard to the device with a transmitter of ultrasonic pulses that are reflected by a magnet for level detection, the disadvantages are, among other things, that a separate transmitter of pulses must be used and that it is costly.

Advantages with the present solution are that a detection tool is provided which can easily be placed in the tank where the fluid level is to be detected. The invention is simple to manufacture and will thereby also represent a cost saving, for example for a car manufacturer and/or manufacturer of containers/tanks. It gives increased safety against danger of explosion in a tank with flammable fluids and can thus be relevant for use in a fuel tank in a vehicle, oil tanks, petrol drums, gas containers, etc.

The object of the invention is to provide a device which is designed to detect the level of different fluids in containers and storage tanks in a safe, accurate and explosion-proof way, and where the current carrying parts do not come into contact with the fluid or gas in the container.

This object is achieved with the present invention in that a preferred embodiment of the invention is characterised by a magnetic band being arranged in connection to one of the electric current strips, adapted to be actuated by the magnetic float, and that a mixture of silver and carbon is deposited onto the current strips, whereby the electric current strips are arranged to provide a closed circuit with a certain resistance characteristic, dependent on where in the longitudinal direction of the membrane the contact is made between said current strips.

In alternative preferred embodiments, the main body can comprise a membrane that contains the electric current strips and where the current strips are arranged in the longitudinal direction of the membrane and separated by spacers placed between them. A mixture of silver and carbon can be deposited onto the current strips, whereby the electric current strips provide different resistance characteristics dependent on where in the longitudinal direction of the membrane the contact between the current strips is made. The current strips can be in the form of a foil. The foil is preferably a Pet foil, where silver and carbon are deposited in liquid form, and where the deposited mass is arranged to harden when exposed to air to provide a solid resistance material. The conductive foil can also have a length of between 100 and 1000 mm, preferably between 200 and 600 mm.

The magnetic band can be arranged longitudinally in the main body so that the magnetic band is adapted to lead/force the upper current strip against the lower current strip when under the influence of the magnetic float.

The membrane with the electric current strips and the magnetic band can be arranged in a sealed housing, and the magnetic float can be fitted around the housing and be arranged to be moved in the longitudinal direction of the housing with the aid of buoyancy.

The main body can preferably be made up of a metallic strip, a first electrically conductive foil, a number of spacers, a second electrically conductive foil and a securing means, such as a tape, fitted to the one side of the main body, and connecting means for the reading equipment for reading of the fluid level in the container. Furthermore, one of the electrically conductive foils and the magnetic band can be integrated with each other.

Dependent on the resistance characteristic that is provided when contact is made between the current strips, the fluid level in the container can be read by means of

In an alternative embodiment of the present invention, a device for level detection of a fluid in a container is provided, comprising an elongated main body, to which an electric current is applied, where the main body comprises a membrane with a number of longitudinal current strips which are separated by between-lying spacers, and where the electric current strips are arranged for mutual contact. A mixture of silver and carbon are preferably deposited onto the current strips, and the current strips are arranged to be influenced by pressure from the surrounding fluid in the container so that mutual contact is made, whereby the electric current strips, dependent on the fluid pressure, are arranged to provide a closed circuit of a certain resistance characteristic, dependent on where in the longitudinal direction of the membrane contact between the mentioned current strips is made.

Furthermore, the current strips in the main body can be connected to reading equipment for reading of the fluid level in the container.

The device according to the invention can be applied by placing the device in the fuel tank of a vehicle and arranged to be coupled to the fuel gauge of the vehicle, for reading of the fuel level in the tank. The device can also be used for reading of fluid level in other containers.

The invention shall now be described with the help of the enclosed figures, in which;

Figure 1 shows an embodiment of a device for level detection according to the invention.

Figure 2 shows a membrane which is arranged in the device according to figure 1.

Figure 3 shows a section of the membrane and a magnetic band along the line A-A in figure 2.

As figure 1 shows, the device according to the invention comprises a longitudinal main body 10. An extended housing 12 can be arranged around the main body

housing can also be used for centring of a surrounding magnetic float 14, which has buoyancy in the fluid that is to be measured. Furthermore, the housing can comprise, for example, of a plastic material and, besides, it can also be sealed. In the example shown in figure 1, the housing 12 is rectangular, but it can also have other external shapes.

As mentioned, a magnetic float 14 is placed around the main body 10 and the housing 12, with the float containing a magnet that is arranged to actuate the electric current strips 16a,16b.

The main body 10 comprises a membrane 11 and a magnetic band 22. The membrane 11 is further comprised of an upper electric current strip 16a and a lower electric current strip 16b. Spacers 18a and 18b are arranged between the current strips. The spacers are, off course, not electrically or magnetically conductive. Furthermore, securing means, such as a glue connection, tape or the like, can be arranged to one of the current strips for securing the membrane 11 to the housing 14 or to another fastening base. A magnetic band 22, which, for example, can be comprised of a band of metal, is also arranged adjacent to one of the current strips. The expressions "upper" and "lower" refer only to how the membrane is shown in figure 3 and are not meant to be absolute designations.

Furthermore, the membrane, or the electric current strips, comprises connecting means (not shown) for reading equipment that indicates the level detection.

The principle of the invention, as shown in the figures 1-3, is application of a magnetic field force. When the float 14 is moved along the main body 10, and the housing 12, by the buoyancy, the magnetic band 22 is actuated by the magnet in the float. Thereby, the magnetic band actuates the membrane 11 in that the magnetic band is moved/forced against the upper current strip 16a, i.e. the upper foil with the deposited current strip, so that the

current strip 16b. Thus, electrical contact is made between the current strips.

The current strips 16a, 16b, can, as mentioned, comprise, for example, a foil which is put together as a membrane 11, onto which a mixture of silver and carbon is deposited to provide different resistance characteristics. Dependent on where in the longitudinal direction of the membrane the contact between the current strips is made, the signal, which is sent out, i.e. measured resistance in the circuit, will indicate a certain fluid level in the tank.

The resistance characteristic, which is based on different mixtures of silver and carbon, can be made for different resistance ranges and can be linear, non-linear or logarithmic functions. The resistance characteristic stays reasonably accurate within temperature ranges from, for example, -40 to +80 degrees Celsius.

In an alternative embodiment, only the membrane with the current strips can be used, i.e. neither the housing around the main body nor the magnetic float is used. Then, the device for level detection of a fluid in a container will preferably comprise an extended main body 10, to which an electric current is applied, where the main body 10 comprises the longitudinal, separated current strips 16a,16b. The current strips will be arranged to be actuated by the surrounding fluid pressure in the container, and dependent on the fluid pressure, contact is made between the electric current strips 16a,16b so that a closed circuit of a certain resistance characteristic is formed.

Corresponding to the previously described embodiment, the main body will comprise a membrane 11 that contains the electric current strips 16a,16b, and the current strips will be arranged in the longitudinal direction of the membrane 11 and separated by spacers 18a,18b arranged between them.

A mixture of silver and carbon can correspondingly be

electric current strips are arranged to provide different resistance characteristics dependent on where in the longitudinal direction of the membrane the contact between the current strips is made.

Thus, it can be ascertained that the present invention provides a measuring tool which, depending on where in the longitudinal direction of the main body the float is at any given time, provides a safe and accurate detection of the fluid level in a container.

The concentration of silver and carbon influences the resistance characteristic. As mentioned, the conductive material comprises silver and carbon. It is preferred that silver and carbon is presented in a liquid state, which thereafter can be deposited onto a Pet foil by means of, for example, screen-printing. The mass is hardened after being exposed to air and thus makes a solid resistance material. Varying the proportion of silver and carbon ensures that resistance characteristics with different functions can be developed. Dosing with different resistance values can be adapted to different lengths of Pet materials. Thus, dosing and resistance values are independent of the length of the Pet foil.

Furthermore, it shall be mentioned that by using a mixture of silver and carbon, i.e. preferably silver and carbon ink deposited onto a Pet foil as the conductive material, characteristics with a series of different forms can be developed. The resistance values can be of the order of Kohm to Mohm. This means that the level detector can be used in small volume tanks, where the length of the detector can, for example, be 200 mm to 600 mm.

Claims

1. Device for level detection of a fluid in a container, comprising a magnetic float (14) arranged around an extended main body (10), to which an electric current is applied, where the main body (10) comprises a membrane (11) with a number of longitudinal current strips (16a,16b) which are separated by between-lying spacers (18a,18b), and that the electric current strips (16a,16b) are arranged to mutually make contact, characterised in that a magnetic band (22) is arranged in connection to one of the electric current strips, adapted to be actuated by the magnetic float (14), and that a mixture of silver and carbon is deposited onto the current strips (16a,16b), whereby the electric current strips are arranged to provide a closed circuit with a certain resistance characteristic, dependent on where in the longitudinal direction of the membrane (11) the contact between the mentioned current strips (16a,16b) is made.

2. Device in accordance with claim 1, characterised in that the magnetic band (22) is arranged longitudinally in the main body (10), and that the magnetic band is adapted to lead the upper current strip (16a) against the lower current strip (16b), under the influence of the magnetic float.

3. Device in accordance with claim 2, characterised in that the current strips (16a,16b) are in the form of a foil.

4. Device in accordance with claim 3, characterised in that the foil is a Pet foil, where silver and carbon are deposited in liquid state, and that the deposited mass is arranged to harden when exposed to air to provide a solid resistance material.

5. Device in accordance with claims 2-4, characterised in that the conductive foil has a length of between 100 and 1000 mm, preferably between 200 and 600 mm.

6. Device in accordance with claims 2-3, characterised in that the membrane (11), with the electric current strips (16a,16b) and the magnetic band (22), is arranged in a sealable housing (12), and that the magnetic float is arranged around the housing (12) and adapted to be moved in the longitudinal direction of the housing with the aid of buoyancy.

7. Device in accordance with one of the preceding claims, characterised in that the main body (10) is made up of the metal strip (22), a first electrically conductive foil (16a), a number of spacers (18a,18b), a second electrically conductive foil (16b) and a securing means (20) such as tape, fitted to the one side of the main body.

8. Device in accordance with claim 7, characterised in that the current strips in the main body are connected to reading equipment for reading of the fluid level in the tank.

9. Device in accordance with claim 7, characterised in that one of the electrically conductive foils and the magnetic band are integrated with each other.

10. Device in accordance with one of the preceding claims, characterised in that dependent on the resistance characteristic that is provided when contact is made between the current strips, the fluid level can be read with the aid of the reading equipment.

11. Device for level detection of a fluid in a container, comprising an extended main body (10), to which an electric current is applied, where the main body (10) comprises a membrane (11) with a number of longitudinal current strips (16a,16b) that are separated by between-lying spacers (18a,18b), and that the electric current strips (16a,16b), are arranged to mutually make contact, characterised in that a mixture of silver and carbon is deposited onto the current strips (16a,16b), and that the current strips are arranged to be actuated by the surrounding fluid pressure in the container so that mutual contact is made, whereby the electric current strips (16a,16b), dependent on the fluid pressure, are arranged to provide a closed circuit with a certain resistance characteristic, dependent on where in the longitudinal direction of the membrane (11) the contact between said current strips (16a,16b) is made.

12. Device in accordance with claim 11, characterised in that the current strips in the main body are connected to reading equipment for reading of the fluid level in the container.

13. Use of a device according to claims 1-10, whereby the device is arranged in the fuel tank of a vehicle and adapted to be connected to the fuel gauge of the vehicle for reading of the fuel level in the tank.

14. Use of a device according to claims 11-12, whereby the device is arranged in the fuel tank of a vehicle and adapted to be connected to the fuel gauge of the vehicle for reading of the fuel level in the tank.

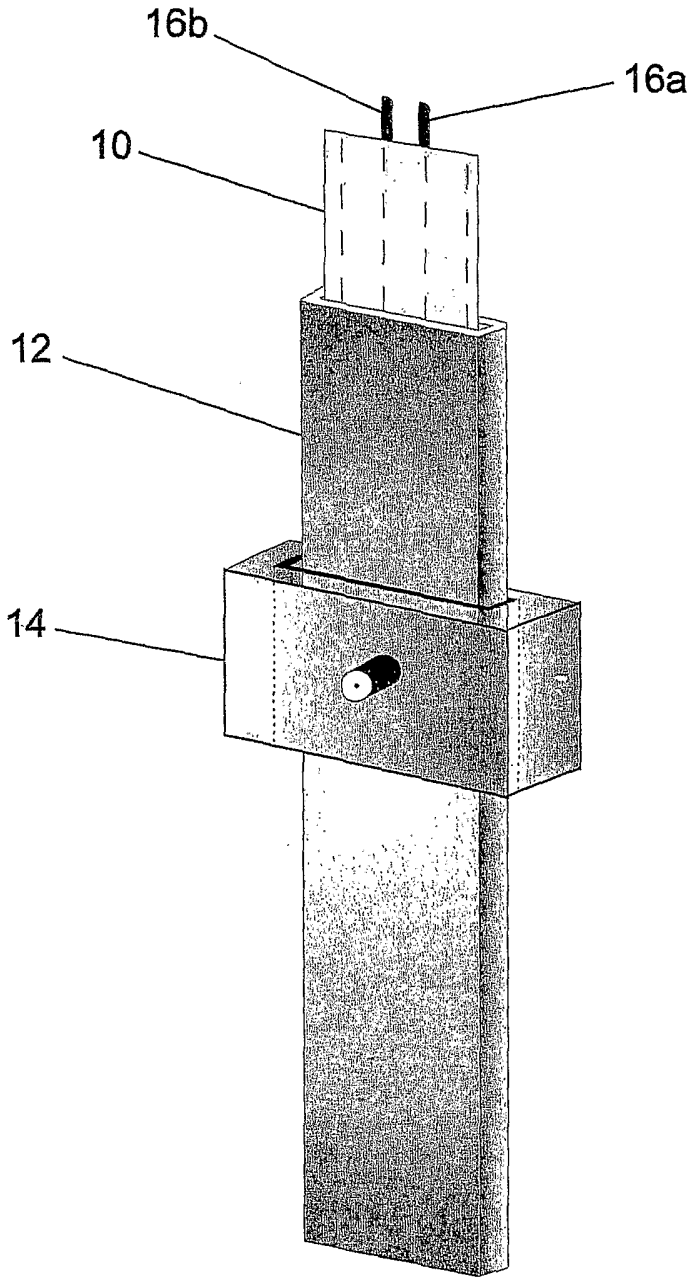

FIG. 1

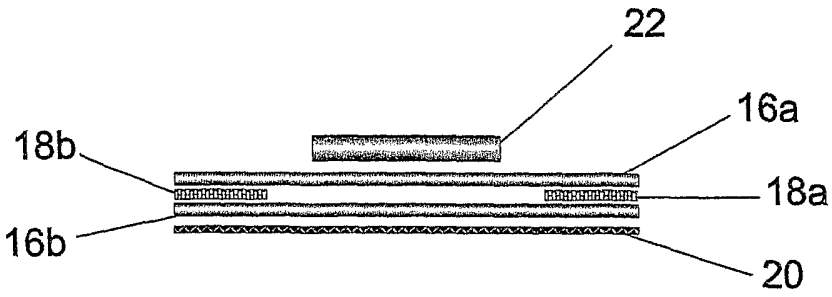

FIG. 3

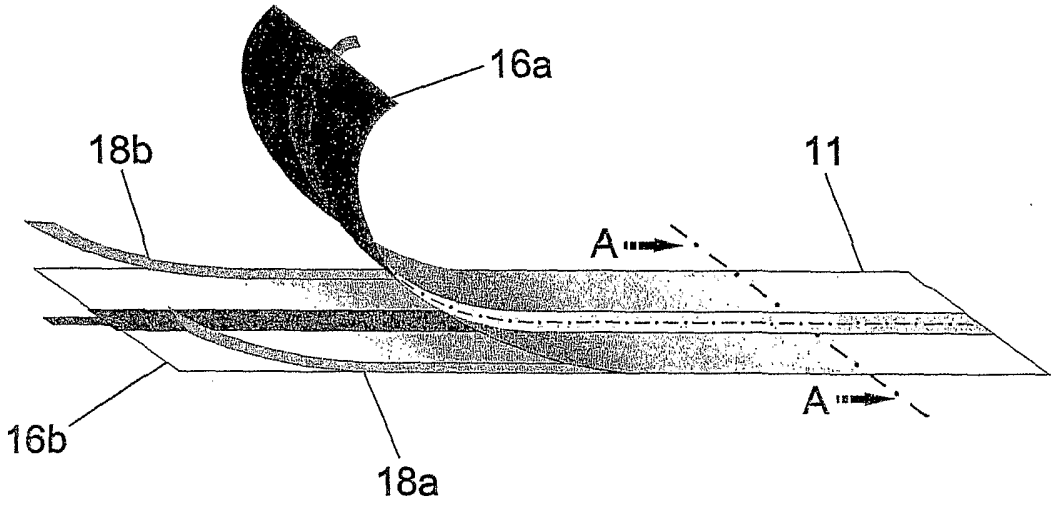

FIG. 2

INTERNATIONAL SEARCH REPORT

International application No.
PCT/NO 02/00429

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: G01F 23/24, G01F 23/30
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: G01F, G01D, H01H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI DATA, PAJ, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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X	US 4890492 A (RAYMOND J. ANDREJASICH ET AL), 2 January 1990 (02.01.90), column 1, line 56 - column 2, line 34; column 5, line 40 - column 6, line 1 --	11,12,14
X	GB 2484690 A (C.A DE GIERS), 11 October 1949 (11.10.49), column 4, line 51 - column 5, line 7, claim 7 --	1-10,13

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents:
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"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
17 February 2003	18-02-2003
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Gordana Ninkovic/MN Telephone No. +46 8 782 25 00

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/NO 02/00429

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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INTERNATIONAL SEARCH REPORT

Information on patent family members

30/12/02

International application No.
PCT/NO 02/00429

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