PATENT SPECIFICATION

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PROVISIONAL SPECIFICATION.

Improvements in Liquid Level Indicators.

I, GEORGE CONSTANTINESCO, of "Carmen Sylva", Beechwood Avenue, Oatlands Park, Weybridge, in the County of Surrey, a subject of the King of Great Britain and Ireland, do hereby declare the nature of this invention to be as follows:—

The present invention relates to liquid level indicators of the type in which a gauge containing a liquid column is employed to indicate the level of liquid in a tank or other container situated at a distance from the gauge and in which the height of the liquid column in the gauge is determined by the air pressure in an air chamber in the gauge, this air chamber being connected to a pipe which is in open communication with the tank or the like at or near its bottom so that when air is compressed in the air chamber and fills the pipe in the tank the air pressure supporting the liquid column in the gauge is substantially the same as the pressure at or near the bottom of the tank or container in which the liquid level is to be measured.

It will be seen that in such apparatus, since the indication of level depends on the pressure existing at the bottom of the tank; if a liquid of specific gravity equal to that of the liquid in the tank is used in the gauge the height of the liquid column in the gauge will be equal to the depth of the liquid in the tank and in some cases this will involve a gauge of excessive length.

The object of the present invention is to construct the apparatus in such a manner that the gauge may be made of any desired length; so that for a deep tank a gauge of comparatively short length may be employed.

The invention consists in a liquid level indicator of the type described having the upper and lower parts of the gauge tube of different diameters, the lower end of the tube being of larger diameter and dipping into mercury on the surface of which the indicating air pressure is caused to act while above the mercury the gauge tube contains a suitable indicating liquid resting on the surface of the mercury below it.

The invention further consists in a gauge of the type described having a gauge tube of smaller bore at the top than at the bottom, containing mercury at its lower end and a suitable indicating liquid of lower specific gravity in its intermediate portion with paraffin or other non-readily vaporisable liquid on the surface of the indicating liquid.

The invention also consists in the improved liquid level indicators hereinafter described.

In carrying the invention into effect, for example as applied to a gauge of the type described in Patent Specification No. 189,234, the gauge chamber communicates through a passage with a pipe leading to the bottom of the tank in which it is desired to determine the liquid level. Projecting into the gauge chamber there is provided a gauge tube to the lower end of which is fitted a rubber extension of internal diameter larger than the internal diameter of the gauge tube and with walls of such thickness that they will not collapse under the air pressure, to which they may be subjected. At the lower end of the rubber extension a notch is cut to allow communication between the interior of the tube and the space of the gauge chamber on the tank side of a rubber diaphragm which serves as a non-return valve. This diaphragm is provided with a clean cut as described in the patent specification above mentioned and air can be forced into the chamber through the cut by means of a second rubber diaphragm and press button. The gauge tube at its upper end opens into a small pocket and when in operation this pocket is in communication with the

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atmosphere through an aperture in the gauge cap, or if the tank is at a pressure different from atmospheric pressure, in communication with the tank.

The bottom of the gauge chamber contains a small quantity of mercury and above the mercury in the gauge tube there is provided a column of any suitable indicating liquid. Above the indicating liquid the gauge tube and the pocket at its upper end may contain paraffin or other liquid which is not readily evaporated.

With the above described device it will be seen that if there is no liquid in the tank connected to the gauge on pressing the button, air is forced through the cut in the rubber diaphragm and passes freely out through the pipe in the tank so that the pressure in the gauge chamber is atmospheric and no rise of the column of liquid in the gauge takes place. If there is liquid in the tank air is forced into the gauge chamber by the press button and diaphragm, the pressure in this chamber increases until it is equal to the pressure due to the height of liquid in the tank above the outlet of the pipe. This air pressure acts on the mercury in the gauge tube and forces it up to a certain level in the rubber extension of the gauge tube; consequently the indicating liquid rises in the gauge tube. The rise of the mercury level will be small but the rise of the indicating liquid will be greater and will be proportional to the relative sectional areas of the rubber extension and the upper part of the gauge tube so that by suitably dimensioning the relative diameters in these two tubes the rise of liquid in the gauge relative to the depth of liquid in the tank can be given any desired value. There will be a slight change in the level of the paraffin in the pocket at the top of the gauge, but as the specific gravity of paraffin and the indicating liquid may be small relatively to the specific gravity of mercury, very accurate readings may be obtained. In order to make the gauge readily adaptable for tanks of different depths keeping the same length of scale there may be provided at the bottom of the gauge tube a cylindrical pillar passing up into the extension of the gauge tube. A number of such pillars may be provided of different diameters thus affording a ready means by which the gauge may be manufactured of standard dimensions, the adjustment of the gauge to suit various depths of tank being made merely by inserting a pillar of suitable diameter.

According to another modification of the invention instead of providing a rubber extension to the gauge tube, the gauge tube itself may be made completely of glass, the lower end being of larger diameter than the upper end so as to give the relative variation of cross section required. In this case also a pillar of suitable diameter may be employed the diameter of the pillar selected depending on the depth of the tank with which the gauge is to be used. If the gauge tube is narrow some difficulty may be experienced in separating the liquids and in removing air bubbles. In order to avoid this a thin wire may be provided extending along the whole length of gauge tube. This wire has the effect of causing the paraffin and indicating liquid to separate and remain in unbroken columns one above the other by capillary action and also causes any air bubbles which may be formed to travel up through the liquids and escape.

Adjustable indicating clips may be provided on the gauge tube or casing and the gauge may be calibrated for any particular tank by properly setting these clips.

Dated the 22nd day of October, 1921.

W. GRYLLS ADAMS,
87, Victoria Street, London, S.W. 1,
Chartered Patent Agent.

COMPLETE SPECIFICATION.

Improvements in Liquid Level Indicators.

I, GEORGE CONSTANTINESCO, of "Carmen Sylva", Beechwood Avenue, Oatlands Park, Weybridge, in the County of Surrey, a subject of the King of Great Britain and Ireland, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

The present invention relates to liquid level indicators of the type in which a gauge containing a liquid column is employed to indicate the level of liquid in a tank or other container situated at a distance from the gauge and in which the height of the liquid column in the gauge is determined by the air pressure in an air chamber in the gauge, this air chamber being connected to a pipe which is in open communication with the tank or the like at or near its bottom so that when

air is compressed in the air chamber and fills the pipe in the tank the air pressure supporting the liquid column in the gauge is substantially the same as the pressure at or near the bottom of the tank or container in which the liquid level is to be measured.

It will be seen that in such apparatus, since the indication of level depends on the pressure existing at the bottom of the tank; if a liquid of specific gravity equal to that of the liquid in the tank is used in the gauge the height of the liquid column in the gauge will be equal to the depth of the liquid in the tank and in some cases this will involve a gauge of excessive length.

The object of the present invention is to construct the apparatus in such a manner that the gauge may be made of any desired length; so that for a deep tank a gauge of comparatively short length may be employed while ready means of adjustment are provided so that the same gauge scale may be employed for tanks of different depths.

The liquid level indicators to which the invention relates are of the type having the upper and lower parts of the gauge tube of different diameters, the lower end of the tube being of larger diameter and dipping into mercury on the surface of which the indicating air pressure is caused to act while above the mercury the gauge tube contains a suitable indicating liquid resting on the surface of the mercury below it.

The invention consists in a gauge of the type described having a pillar of any desired section inserted inside the gauge tube at its lower end so that by selecting a suitable diameter of pillar a gauge with a given scale may be made suitable for any depth of tank.

The invention further consists in increasing the diameter of the gauge tube at its lower end or diminishing the diameter of the pillar at its lower end so as to obtain more accurate readings at the lower end of the gauge when the tank is nearly empty.

The invention also consists in the improved liquid level indicator hereinafter described.

Referring to the accompanying drawings:—

Figure 1 is a section of a gauge according to one form of the invention; while

Figure 2 is a part section of another example of the invention.

In the form of the invention illustrated in which a gauge of the type described in Patent Specification No. 189,234 is employed, the gauge chamber *a* communicates through a passage *c* with a pipe leading to the bottom of the tank in which it is desired to determine the liquid level. Projecting into the gauge chamber there is provided a gauge tube *b* to the lower end of which is fitted a rubber extension *p* of internal diameter larger than the internal diameter of the gauge tube and giving space for a pillar *t* for the purpose hereinafter described.

The walls of the extension are of such thickness that they will not collapse under the air pressure to which they may be subjected. At the lower end of the rubber extension a notch *q* is cut to allow communication between the interior of the tube and the part of the gauge chamber *a* in which the mercury *r* is contained. The diaphragm *e* is provided with a clean cut *g* as described in the patent specification above mentioned and serves as a non return valve, air being forced in through the cut *g* by means of a second rubber diaphragm *h* and press button *n*. The gauge tube at its upper end opens into a small pocket and when in operation this pocket is in communication with the atmosphere through an aperture in the gauge cap, or if the tank is at a pressure different from atmospheric pressure, in communication with the top of the tank.

In order to make the gauge readily adaptable for tanks of different depths keeping the same length of scale there is provided at the bottom of the gauge tube a cylindrical pillar *t* passing up into the extension of the gauge tube. A number of such pillars may be provided of different diameters thus affording a ready means by which the gauge may be manufactured of standard dimensions, the adjustment of the gauge to suit various depths of tank being made merely by inserting a pillar of suitable diameter.

Above the mercury in the gauge tube there is provided a column of any suitable indicating liquid. Above the indicating liquid the gauge tube and the pocket at its upper end may contain paraffin or other liquid which is not readily evaporated.

With the above described device it will be seen that if there is no liquid in the tank connected to the gauge on pressing the button *n*, air is forced through the cut in the rubber diaphragm *e* and passes freely out through the pipe in the tank so that the pressure in the gauge chamber is atmospheric and no rise of the column of liquid in the gauge takes place. If there is liquid in the tank and air is forced into the gauge chamber *a* by the press button and diaphragm the pressure in this chamber increases until it is equal to the pressure due to the height of liquid in the tank above the outlet of the pipe.

This air pressure acts on the mercury *r* in the gauge tube and forces it up to a certain level in the rubber extension *p* of the gauge tube; consequently the indicating liquid rises in the gauge tube *b*. The rise of the mercury level will be small but the rise of the indicating liquid will be greater and will be proportional to the relative sectional areas occupied by liquid in the rubber extension *p* and the upper part of the gauge tube *b* so that by suitably dimensioning the relative areas occupied by liquid in these two tubes the rise of liquid in the gauge relative to the depth of liquid in the tank can be given any desired value. There will be a slight change in the level of the paraffin in the pocket at the top of the gauge, but as the specific gravity of paraffin and the indicating liquid may be small relatively to the specific gravity of mercury, very accurate readings may be obtained.

Instead of providing a rubber extension to the gauge tube, the gauge tube itself may be made completely of glass, the lower end *u* being of larger diameter than the upper end so as to give the relative variation of cross section required, the pillar *t* of suitable diameter being provided for the purpose above described, and the diameter of the pillar selected depending on the depth of the tank with which the gauge is to be used.

In some cases, for example in aeroplane tanks, it is desired to know very accurately the level of petrol when the tank is nearly empty and in such case an extended scale at the lower end of the gauge may be obtained by increasing the diameter of a portion of the gauge tube at the level to which the mercury reaches when the tank is nearly empty or if desired the pillar may be decreased in diameter at its lower end for the same purpose.

If the gauge tube is narrow some difficulty may be experienced in separating the liquids and in removing air bubbles. In order to avoid this a thin wire may be provided extending along the whole length of gauge tube. This wire has the effect of causing the paraffin and indicating liquid to separate and remain in unbroken columns one above the other by capillary action and also causes any air bubbles which may be formed to travel up through the liquids and escape.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. A gauge tube of the type described having a pillar or the like of any desired section inserted inside the gauge tube at its lower end so that by selecting a suitable diameter of pillar a gauge with a given scale may be made suitable for any depth of tank, substantially as described.

2. A liquid level indicator as claimed in Claim 1 having the diameter of the gauge tube enlarged at its lower end, or having the diameter of the pillar diminished at its lower end so as to obtain more accurate readings at the lower ends of the gauge when the tank is nearly empty, substantially as described.

3. The improved liquid level indicator hereinbefore described and illustrated in the accompanying drawings.

Dated the 14th day of November, 1921.

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87, Victoria Street, London, S.W. 1,
Chartered Patent Agent.

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[This Drawing is a reproduction of the Original on a reduced scale]

Fig.1.

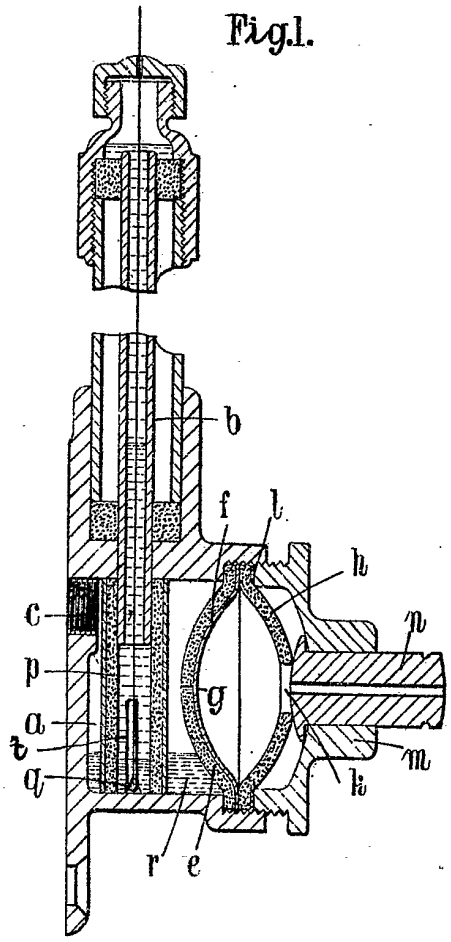
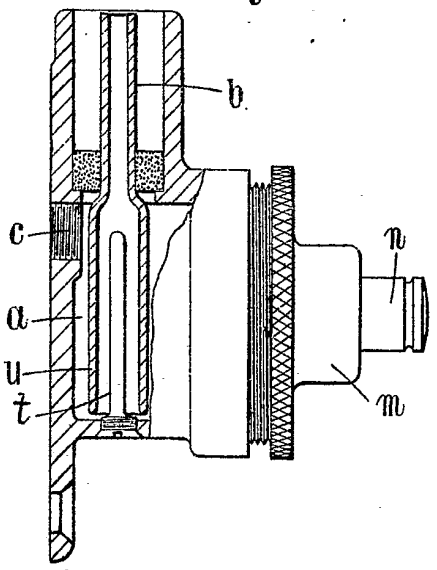


Fig.2.



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