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(56) Documents Cited
DE 019709738 A **FR 002675898 A**
US 4641122 A

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(54) Abstract Title
A fuel level sender for a vehicle fuel tank

(57) A fuel level sender 12 for immersion in a vehicle fuel tank 10, comprises a variable rheostat having a contact which is moved by a first arm 14 pivoted to the sender by a pin 15, and a second arm 21 pivotally connected at a convenient mid-point 22 to the distal end portion of the first arm 14. The second arm has a float 23, 24 located at each of its ends and is preferably readily attachable and detachable to the first arm 14. The pivotal connection 22 can also be connected off centre relative to the second arm 21 with between 55% and 60% of the second arm lying to one side of the connection 22.

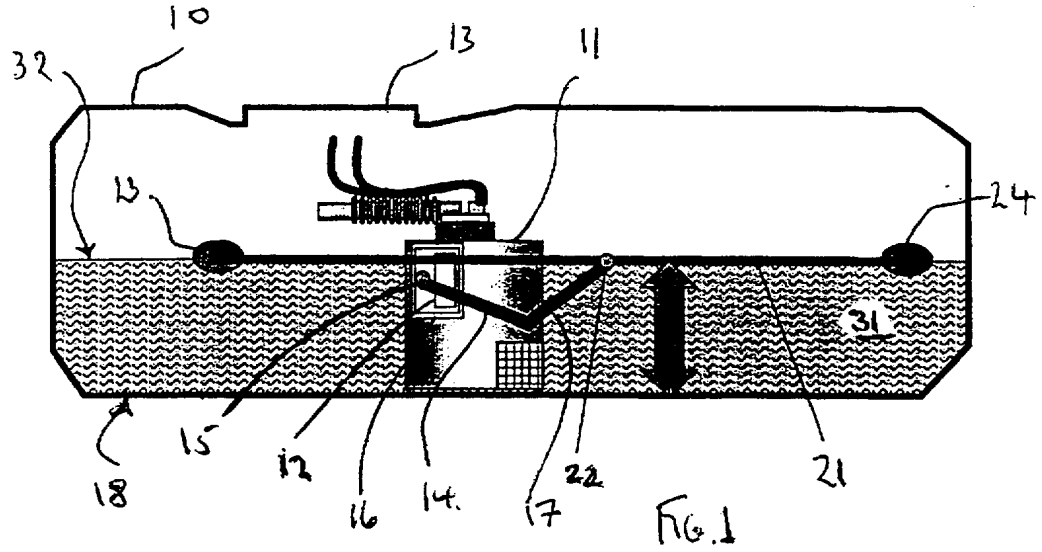

FIG.1

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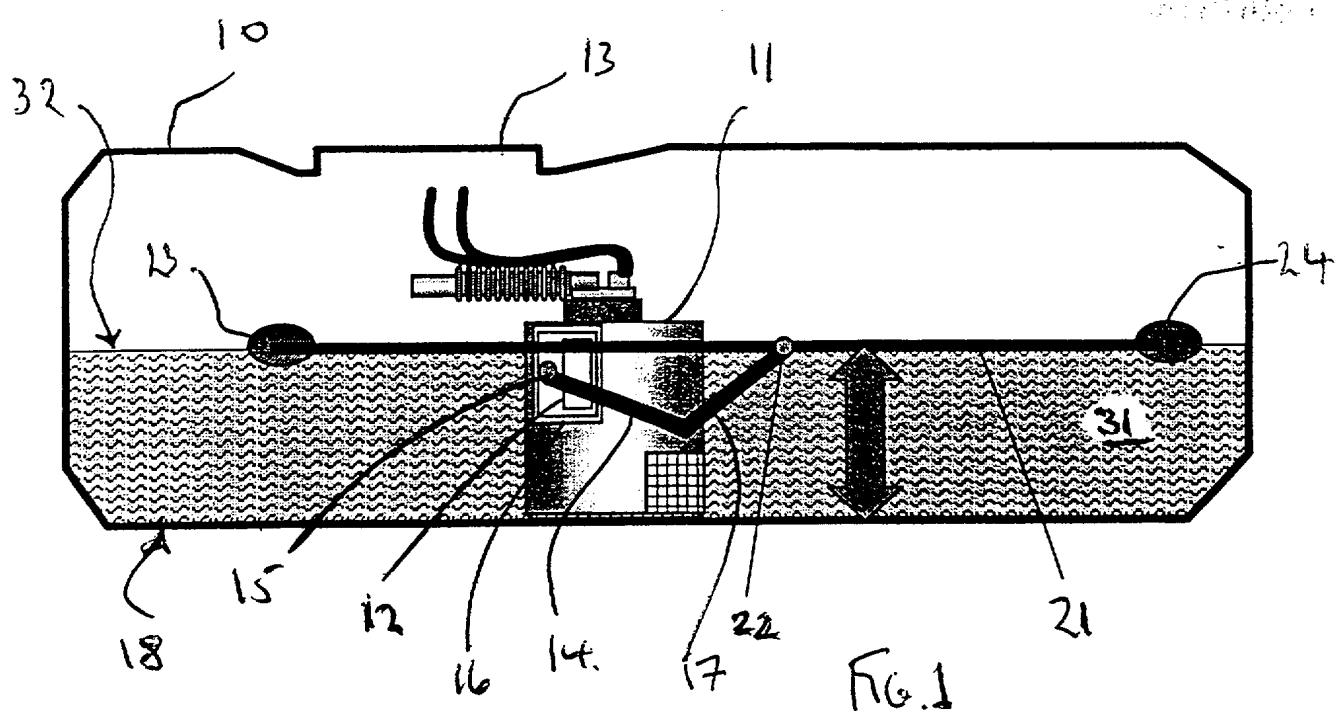

FIG. 1

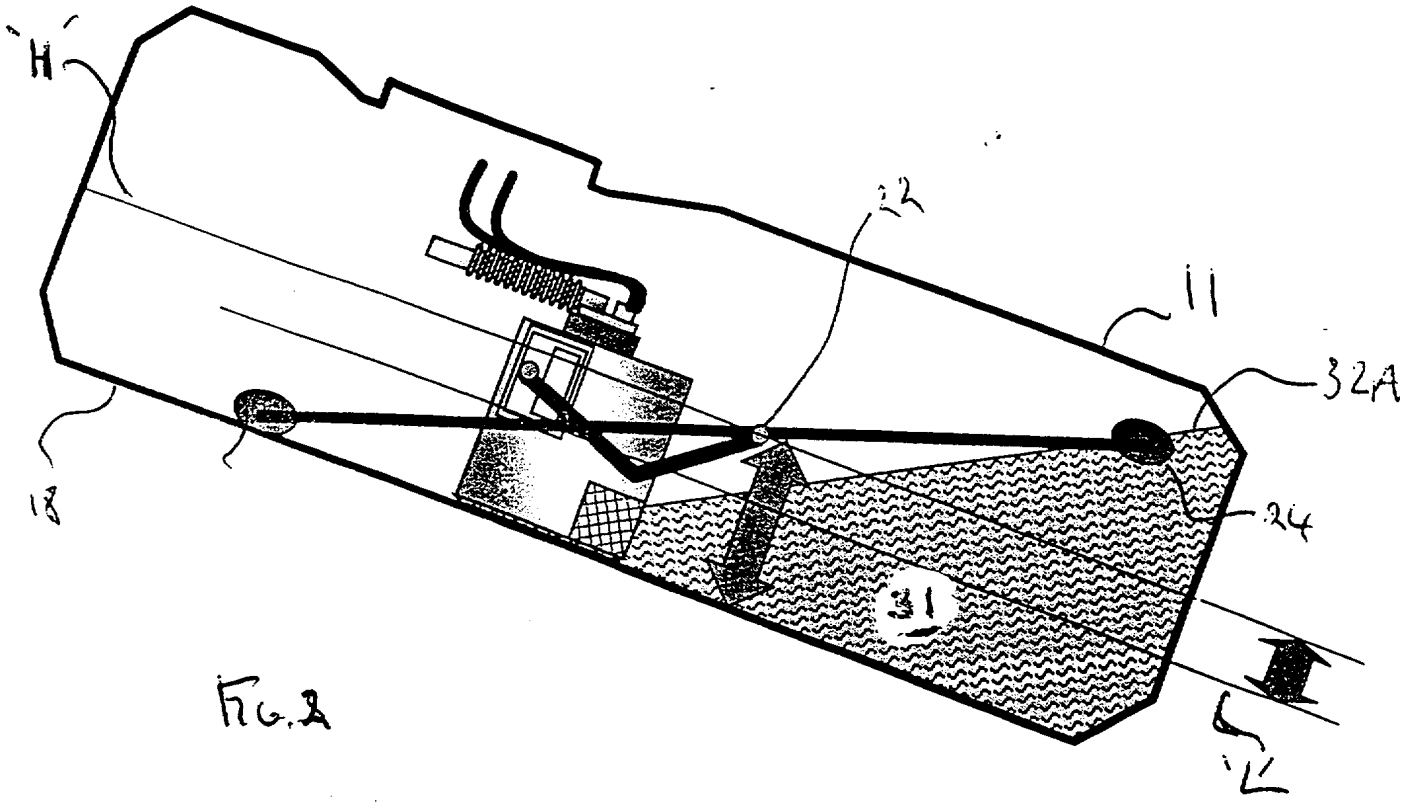

FIG. 2

A Fuel Level Sender

Field

This invention relates to fuel level senders and in particular to senders, sometimes called sensors, which are used in the fuel tanks of vehicles to indicate the relative content of fuel in the tank.

Background of the Invention

Fuel level senders or sensors typically comprise a variable electrical resistor which is operatively connected to a pivotable lever which bears a float at its free end. The lever is moved in the fuel tank as the fuel level rises and falls, and an associated resistor generates a signal which operates an optical fuel level indicator. In motor vehicle fuel tanks the contents are subjected to uncontrolled motion as the vehicle accelerates, decelerates, corners, and is driven or parked on variable terrain.

The movement or tilting of the liquid in the tank can give rise to incorrect level indications especially when the fuel content of the tank is minimal. The position of the float for the sender is important in ensuring that the displayed level indication is accurate. Ideally the optimum position is at the centre of the tank as less variation is fuel height is experienced in this location. As fuel containers become irregular, asymmetric in shape, elongate, the problem becomes more acute giving rise to many occasions when an artificially low indication is given.

One means of overcoming this problem may be to use two senders located at different parts of the tank and averaging the readings from both senders. However such a solution is expensive and may cause diagnostic problems if faults arise.

The present invention provides an improved fuel level sender which is simple in construction.

Statements of Invention

According to a first aspect of the present invention there is provided a fuel level sender, or sensor, for immersion in a fuel tank and which comprises a signal generator, a first arm pivoted for movement relative to the signal generator, and a second arm pivotally connected at a mid-point to the distal end portion of the first arm and has a float located at each end thereof.

The reduced fluctuating movement of the sender arm reduces resistor wear and produces an accurate stable signal from only a single sender.

The second arm may be removably connected to the first arm by a resilient snap fit pivotal engagement between the two arms. This allows the whole unit to be dismantled, inserted into the tank through a relatively small 120mm diameter aperture, and reassembled. The smaller aperture, although

subsequently sealed, helps reduce potential fuel emissions from the tank.

The second arm preferably extends substantially parallel to the first arm.

The distal end portion of the first arm is inclined relative to the rest of said first arm away from the base of the tank and the pivotal connection located at its free end, providing improved accessibility into the tank.

The second arm is pivoted to the first arm at a location on the second arm which is off-centre relative thereto for example 55 - 60% of the second arm may be to one side of the connection.

Said second arm may be between 3 to 4 times the length of the first arm, and may be upto between 70-80% of the length of the tank.

The sender is preferably mountable on a fuel pump located substantially at the centre of the tank.

A second aspect of the present invention a comprises a motor vehicle fuel tank including a fuel level sender according the first aspect of the present invention.

According to yet another aspect of the present invention

there is provided a method of determining the relative content of fuel in a motor vehicle fuel tank wherein the tank is provided with a level sender having a first arm pivoted for movement relative to a signal generator, a second arm is pivotally connected at a mid-point to the first arm and having a float located at each end thereof, the sender generating a fuel content signal which is a reflection of the position of the two float in the tank.

Preferably the signal is a direct indication of the level of the pivotal connection between the first and second arms.

Description of Drawings

The invention will be described by way of example and with reference to the accompanying drawings in which:

Fig.1 is a section through a fuel tank in a level condition showing a fuel level sender according to a first aspect of the invention, and

Fig. 2 shows the tank of Fig.1 in an inclined condition.

Detailed Description of the Invention

With reference to Fig.1, there is shown a typical motor vehicle fuel tank 10 having fuel pump 11 mounted within the tank 10 at a central location on the bottom 18 of the tank.

A fuel level sender 12 is mounted to one side of the pump 11. The pump 11 and fuel level sender 12 are typically located in the tank 10 through an opening 13 which is then subsequently sealed. The opening 13 is typically 120mm in diameter.

The sender typically comprises a variable rheostat having a contact which is moved by first arm 14 pivoted to the sender by a pin 15. The arm 14 can move freely in a single vertical plane around the pin 15 without interference with either the pump 11 or sender housing 16. The distal end portion 17 of the arm 14 away from the pin 15 is bent, or inclined, relative to the proximal portion adjacent the pin, within said plane, so that it extends away from the bottom 18 of the tank.

A second arm 21 extends substantially parallel to said plane and is connected at a mid-point by pivotal connection 22 to the free end of the distal portion 17. The arm 21 is preferably readily detachable from the first arm 14 by use a resilient snap fit pivotal connection 22, for example a pin snapping into a pair of spaced lugs. This enables the whole unit to be assembled after placement in a tank. The second arm 21 extends for a maximum length which is largely determined by the access of the assembled pump 11 and sender 12 into the tank, in this example the length is about 70% to 80% of the length of the tank. (By length is meant the longest dimension taken either longitudinally or

transversely of the vehicle). The second arm 21 has a float 23 24 attached at each end thereof and its pivotal connection 22 to the first arm is located at a convenient mid point, no necessarily the middle point. In this case the pivotal connection 22 is slightly off centre, 55% of said second arm lying between the connection 22 and float 23, and 45% between the connection 22 and float 24.

Fig.1 illustrates a tank 10 in a substantially horizontal condition having a tank which is about half full with liquid fuel 31. In this condition the floats 23,24 are located on the surface 32 and the second arm 21 including the pivotal connection 22 lies on the surface.

With reference now to Fig 2, the tank 11 is shown in an inclined condition and the mid-height line H of the tank 11 is shown for convenience, together with the surface 32A of the fuel for a half full tank in the inclined condition.

A conventional fuel level (not shown) sender having a single arm with a float at its free end would indicate a fuel level associated with the surface 32A of the fuel. In the present example if a float was located at the end of the first arm 14 then the single float on the surface 32A would indicate a fuel level L which is below that of the actual fuel content, which corresponds with level H, by about 30%.

In the inclined condition shown, the sender 11 according to the present invention has one float 23 located on the tank bottom 18 and its other float 24 on the surface 32A of the fuel. The float 23 could lie on the surface of the fuel for a lesser tank inclination and the conditions of the floats 23 & 24 would be reversed for a reverse inclination. As can be seen the pivotal connection 22 is held by the second arm 21 above the actual fuel level 32A at a height above the level L and at a height which lies substantially on the tank mid-height line H. In this condition the sender is sending a signal which more accurately reflects the fuel contents of the tank even when inclined.

When both floats 23 and 24 are on the surface 32 then an accurate reading is obtained at all times, and with one float 23 & 24 exposed at any time then the sender reading will be more accurate that it would have been with a single float sender. The accuracy improves with the relative length of the second arm.

Claims

1. A fuel level sender for immersion in a fuel tank, has a signal generator, a first arm pivoted for movement relative to the signal generator, and a second arm pivotally connected at a mid-point to the distal end portion of the first arm and has a float located at each end thereof.

2. A sender as claimed in claim 1 wherein the second arm is readily connectable and disconnectable to the first arm.

3. A sender as claimed in Claim 2 wherein the first arm is connected to the second arm through a resilient snap fit pivotal engagement.

4. A sender as claimed in Claims 1 to 3 wherein the second arm extends substantially parallel to the first arm.

5. A sender as claimed in any one of Claims 1 to 4 wherein the distal end portion of the first arm is inclined relative to the rest of said first arm away from the base of the tank and the pivotal connection located at its free end.

6. A sender as claimed in any one of Claims 1 to 5 wherein the second arm is pivoted to the first arm at a location on the second arm which is off-centre relative thereto such that between 55 - 60% of the length of second arm is to one side of the connection.

7. A sender as claimed in any one of Claims 1 to 6 wherein the second arm may be between 3 to 4 times the length of the first arm.

8. A sender as claimed in any one of Claims 1 to 7 wherein the second arm has a length of upto between 80% of the length of the tank.

9. A sender as claimed in Claim 8 wherein the length of the sender is between 70%-80% of the length of the tank.

10. A motor vehicle fuel tank including a fuel level sender according to any one of Claims 1 to 7.

11. A fuel tank as claimed in Claim 10 and further including a fuel pump wherein the sender is mounted on the fuel pump.

12. A method of determining the level in a motor vehicle fuel tank wherein the tank is provided with a sender having a signal generator with a first arm pivoted for movement relative to a signal generator, and a second arm pivotally connected at a mid-point to the first arm and having a float located at each end thereof, the sender generating a signal which is a reflection of the two float levels in the tank.

13. A method as claimed in Claim 12, wherein the signal is a direct indication of the level of the pivotal connection between the first and second arms.

INVESTOR IN PEOPLE

Application No: GB 0129673.0 **Examiner:** Kevin Hewitt
Claims searched: 1-13 **Date of search:** 17 April 2002

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.T): G1H

Int Cl (Ed.7): G01F 23/30, 23/32, 23/34, 23/36, 23/56, 23/58, 23/60

Other: Online WPI, EPODOC, JAPIO

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
A	US 4641122 A	(HENNEQUIN) See in particular Figs 1 and 2 and abstract.	-
A	DE 19709738 A	(ROBERT BOSCH) See abstract and Fig.1	-
A	FR 2675898 A	(PEUGEOT; CITROEN) See abstract and Fig.4.	-

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
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