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COMBINED FLUID PUMP AND INDICATOR

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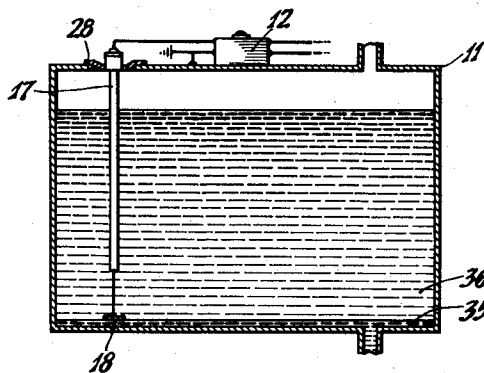


Fig. 1.

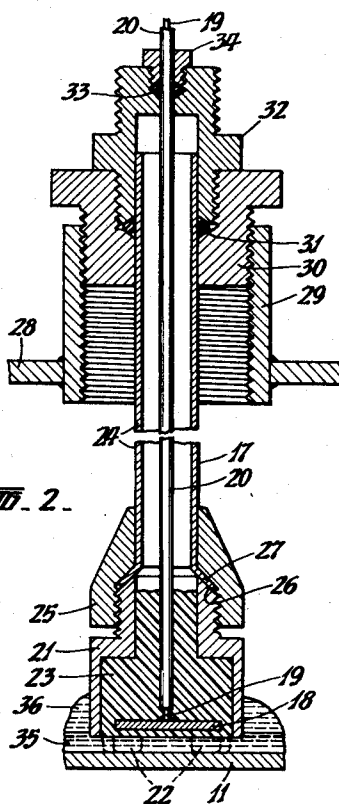


Fig. 2.

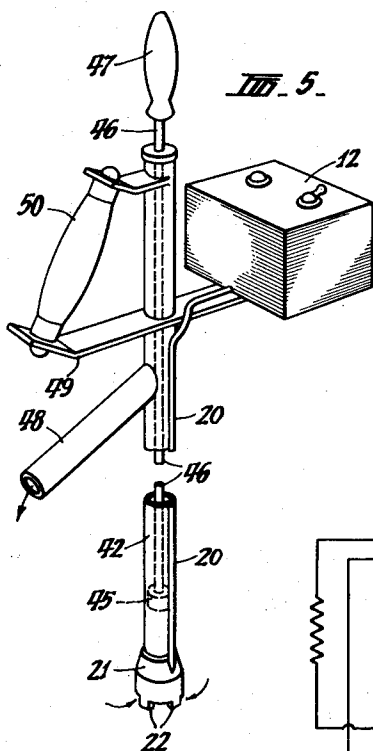


Fig. 5.

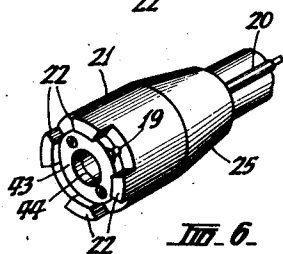


Fig. 6.

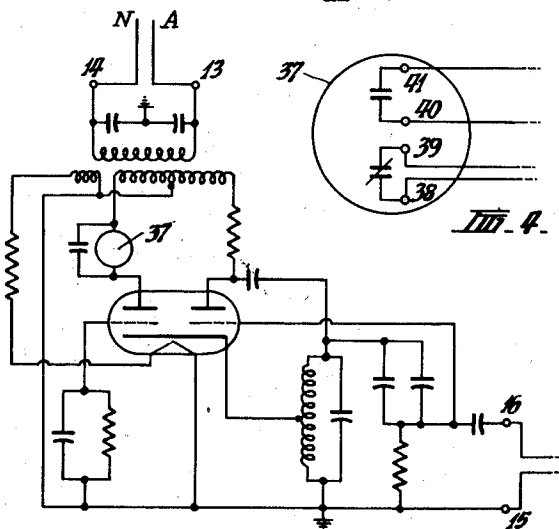


Fig. 3.

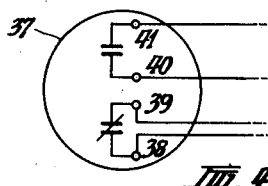


Fig. 4.

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COMBINED FLUID PUMP AND INDICATOR

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2 Claims. (Cl. 103—1)

This invention relates to a method of and means for indicating the presence of water in petrol tanks and it refers particularly to means for indicating the presence of water in underground petrol tanks (such as are customarily installed at garages, airports and other locations) and in other petrol tanks where the contents are not normally visible.

It is commonly known that water does collect in petrol tanks, particularly in underground petrol tanks. Such water as does collect in a petrol tank remains at the bottom of the tank and the volume of water in said tank gradually increases, due largely to condensation of moisture from the air. As a result, it is generally considered necessary to have the outlet opening of the petrol tank located a distance above the bottom of the tank so that the petrol drawn from the tank will be free of water. But the presence of such water at the bottom of a petrol tank has serious disadvantages and it is generally considered advisable, especially when the petrol is to be used in aircraft, to clear out any water from a petrol tank as soon as it collects.

Furthermore, water sometimes collects in the petrol tanks of aircraft—either from condensation or as a result of being pumped into the aircraft petrol tank with petrol from a tanker. The presence of water in an aircraft petrol tank can have very serious results, and in the past it has been the cause of many serious accidents.

It has been well known for many years that the problem created by the presence of water in petrol is a serious one, but as yet no generally acceptable solution to the problem has been formed as far as we are aware. It has been proposed to provide apparatus for the detection of water in petrol tanks—as underground tanks, tankers, aircraft petrol tanks and so on—such apparatus operating on the principle of variation in electrical resistance to the flow of a current between two terminals located in the tank due to changes in the liquid between the terminals, the resistance of water or a petrol-water mixture differing from that of petrol. However, this apparatus has not been acceptable for the reason that it can prove to be dangerous, and the likelihood of sparking—and consequent explosion of the petrol—is relatively high.

This invention has been devised particularly with the object of providing improved apparatus for use in detecting, and indicating, the presence of water in petrol. A further object of the invention is to provide apparatus for the purpose stated which will be extremely effective and safe in operation, relatively economical to manufacture and to install, and of relatively simple construction.

Yet another object is to provide apparatus for the purpose stated which will be usable in petrol tanks made of non-metallic material. A still further object is to devise apparatus usable for detecting, and indicating, the presence of water in suspension in petrol, or the presence of water in a petrol pipeline.

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And another object is to provide means for detecting the presence of water in a petrol tank or container and for ejecting the accumulated water from the container.

The invention devised with these and other objects in view resides, broadly, in the provision of proximity relay apparatus responsive to capacitance changes and a sheathed cable, the cable being connected to one terminal of the proximity relay apparatus and adapted to be mounted in a petrol tank so as to be spaced a relatively short distance from one side of the tank, or a complementary member connected electrically to another terminal of the proximity relay apparatus so that variations in the dielectric constant of the material in the tank and between the sheathed cable and the side of the tank (or the complementary member) will be indicated by the proximity relay apparatus.

When the apparatus is to be installed in an underground petrol tank the sheathed cable is connected to a sensing element and the proximity relay is also connected electrically to the tank itself (if the tank be made of an electrical conducting material), or to a second element held in spaced relationship with the sensing element (if the tank be made of a non-conductor). The sensing element is so mounted that when fitted in an underground petrol tank the element is supported a relatively short distance from the bottom of the tank. Further, there may be provided a support for the cable and/or any suitable mounting for the sensing element. Further, there may be employed any suitable electrical connections and, if required, any suitable electrical equipment for amplifying signals.

The electrical apparatus may be connected to pumping apparatus in such manner that when the presence of water is detected the pump apparatus will be set in operation to eject the accumulated water. Alternatively, there may be provided pumping apparatus operable independently when the presence of water is indicated.

In order that the invention may be clearly understood and readily put into practical effect we shall now describe, with reference to the accompanying drawings, a general form of the apparatus and several particular applications of the invention. In these drawings:

Fig. 1 is a diagrammatic illustration of apparatus according to the invention for detecting the presence of water in a petrol tank;

Fig. 2 shows, in vertical cross-section, the sensing head in relation to the bottom of a petrol tank;

Fig. 3 is a circuit diagram of the proximity relay;

Fig. 4 depicts the connections for use when the apparatus is to be used for operating a motor or other apparatus;

Fig. 5 illustrates a form of apparatus made according to the invention and incorporating a hand pump;

Fig. 6 is a perspective view of the lower end of the apparatus illustrated in Fig. 5.

Referring initially to Figs. 1, 2, 3 and 4 the apparatus for detecting the presence of water in a petrol tank 11 includes a flame proof box 12 containing a capacity-operated proximity relay apparatus, the circuit of which is shown in Fig. 3. This apparatus has terminals 13 and 14 to which may be connected the active and neutral wires of an alternating current supply source, the terminals 15 and 16 for connection to the tank 11 and the probe—indicated generally in Fig. 1 by the reference 17. When a shielded cable is used for connecting to the probe one end of the shield may be connected to terminal 15 (the other end being earthed or connected to the tank 11) and the inner wire is connected to the terminal 16.

The probe 17 comprises a sensing element 18 to which is connected a cable 19 covered with insulating material 20. The element 18 is located within a probe head 21

having at its lower end a series of spaced lugs 22, and it is held in place, and insulated from the probe head 21, by a filling 23 of insulating material—as a synthetic resin or plastic insulating material.

The probe head 21 is fastened to one end of a length of tube 24 made of a conducting material, as a length of copper tube. The upper end portion of the probe head 21 is screw-threaded to receive a flare nut 25, and it is chamfered at 26. The lower end of the tube 24 is flared or swaged outwardly at 27 so that it is conveniently clamped between the chamfered end 26 of the probe head 21 and the tapered surface of the flare nut 25.

Fastened to a manhole cover 28 mounted in the top of the tank 11 is an internally screw-threaded socket 29. A reduction bush 30, having an axial opening of such a size as to be adapted to receive neatly the upper end portion of the tube 24, is screwed into the socket 29. The upper end portion of the tube 24 is clamped firmly in the reduction bush 30 by means of a ring seal 31 and a bush 32 which is screwed into the upper end portion of the reduction bush 30, and the insulation-covered cable 19 is clamped firmly within the bush 32 by means of a second ring seal 33 and a nut 34, the latter being screwed into the upper end of the bush 32.

The probe head 21 is thus held in fixed relationship with the cover 28, and the cable 19 is securely held at its lower end and where it passes through the top of the tube 24. Thus, there is no strain on the cable 19.

The tube 24 is of such a length that the sensing element 18 is held a short distance from the bottom of the tank 11. The lugs 22 act as locators to ensure that the sensing element 18 is held a desired distance from the bottom of the tank, the apparatus being set up with the lugs 22 in contact with the tank bottom.

When the apparatus is set up in the manner illustrated in Fig. 1, with the sensing element 18 correctly located near the bottom of the tank, the terminal 15 of the proximity relay apparatus connected to the tank 11 (either directly or by both the terminal 15 and the tank being earthed) and the terminal 16 connected to the cable 19, then any variation in capacitance between the sensing element 18 and the tank 11 will be indicated by the capacity-operated proximity relay apparatus within the box 12. Thus, if there be an accumulation of water—indicated by the reference 35—in the petrol 36, the presence of the water between the element 18 and the bottom of the tank will be indicated.

The proximity relay apparatus has the circuit indicated in Fig. 3. The relay indicated by the reference 37 has terminals 38, 39, 40 and 41, of which the terminals 38 and 39 may be connected to a motor for driving a pump in such manner that when the relay is operative to indicate the presence of water in the petrol the motor will be set in operation to drive the pump so as to eject the water from the tank 11. The terminals 40, 41 may be connected to any suitable indicating means—as an electric light globe, or a buzzer. Alternatively, the apparatus may be set up so that a pump will be shut off when the presence of water is detected in the petrol. This will be done when the apparatus is included in a pipe line through which petrol is being fed to the petrol tank.

Referring now to Figs. 5 and 6 the apparatus depicted therein comprises a tubular member 42 having a probe head 21 fastened to its lower end by means of the nut 25. This probe head has lugs 22 at its lower end but whereas the sensing element in the construction previously described, is in the form of a disc, the sensing element in this construction is in the form of a flat ring 43 fastened to, but insulated from, the probe head 21. The cable 19 is secured to the outer surface of the member 42 and it fits through an opening provided in the nut 25, being secured at its lower end to the ring 43.

The opening 44 in the ring 43 permits flow of liquid to the interior of the tubular member 42, wherein is fitted

a pump plunger 45 of any suitable type. This plunger 45 is fastened to one end of a rod 46 and a handle 47 is secured to the other end of that rod. Thus, the rod 46 may be moved vertically relative to the tubular member 42. An outlet nozzle 48 is provided near the upper end of the tubular member 42 so that liquid pumped upwardly through that member 42 by the operation of the pump plunger 45 may escape from within the member 42.

The proximity relay apparatus 12 is mounted on a bracket 49 fastened to the tubular member 42 near its upper end and a handle 50 is connected to the bracket 49 so as to provide a convenient means of holding the apparatus.

The indicating and pump apparatus illustrated in Figs. 5 and 6 may be conveniently carried by an operator and used to test for the presence of water in petrol containers—as 44 gallon drums—and to eject water which may have accumulated in such containers.

It is to be noted that in this apparatus the tubular member 42 will be connected to the terminal 15 of the apparatus 12 and when the apparatus is in use the lugs 22 at the end of the probe head 21, in making contact with the bottom of the container, will also effect the electrical connection of the apparatus 12 to the petrol container.

If desired, a spacing member may be adjustably fitted to the lower end of the probe head 21 so that the distance between the sensing element 18 and the bottom of the petrol tank 11, when the apparatus is fitted in position, may be adjusted to suit any particular requirements. We have found that a distance of $\frac{1}{2}$ " between the sensing element and the bottom of the tank is suitable for most purposes.

In another embodiment of the invention two sensing elements are fitted to the same pipe, so that they are spaced a short distance apart. The terminals 15, 16 of the proximity relay apparatus are then connected to the two sensing elements. This apparatus may be mounted so that the two sensing elements are a suitable distance from the bottom of the tank. The device may then be used to detect water suspended in the petrol, as it has been found that suspended water provides a sufficient change in dielectric constant to operate the level control unit.

In another embodiment of the invention two sensing elements are mounted in a pipe or hose which is used in the delivery of the petrol from the tank, so as to indicate the presence of water in the petrol flowing through the pipe or hose.

The device has been found suitable for use in the detection of water or other foreign substances in other media, such as kerosene or white spirit, and hence the word "petrol" should be taken to include all petroleum products, and the term "water" to include all such foreign substances of dielectric constant appreciably different from that of "petrol."

It is to be noted that in the form of the invention illustrated in Fig. 2 the sensing element 18 is provided with a covering of insulating material. This is done to reduce the risk of fire due to an insulation failure in the external circuit, which failure could cause a spark between the element and the tank.

If apparatus according to the invention be incorporated in a tank at a location whereat the electricity supply is not at the normal A.C. mains voltage, then it may be necessary to modify the apparatus. For example, if it be desired to build water detection apparatus into the petrol tanks of aircraft, then the capacity operated relay devices will have to be modified to make them suitable for operation on direct current—from the aircraft supply system—and there will be incorporated in the circuit from the valve of the capacity operated relay devices to the solenoid type relay a current amplifying valve of standard type so as to provide for a sufficiently high value of current. A single sensing element may be used if the tank be of

metal, but if the tank be non-metallic on the inside then two sensing elements will be required, one connected to the plate or the grid of the oscillator valve and the other to the cathode circuit.

It will be appreciated that the manner of installing the apparatus in a petrol tank will depend largely upon the nature of the tank and upon the location thereof. All such modifications are to be deemed to be included within the ambit of the invention.

What we claim is:

1. Apparatus for detecting the presence of water in petrol including a petrol tank, proximity relay means responsive to capacitance changes and having an earth terminal and an active terminal, the earth terminal being connected electrically to the bottom of the tank, a pump including a cylinder projecting into the tank, said pump having an outlet near its upper end and an inlet near the lower end, a piston adapted to draw water upwardly within the cylinder and to expel it through such outlet, a probe housing at the lower end of the cylinder, a probe mounted in said housing and electrically insulated therefrom, lugs projecting from the lower end of the probe housing to contact the bottom of the tank, the thus mounted probe thereby being held a short distance above the bottom of the tank, and an electrical connection between the active terminal and the probe, the proximity relay means being adapted to detect water in the lower portion of the tank and the pump being operable to expel the same.

2. Apparatus for detecting the presence of water in petrol including a petrol tank, proximity relay apparatus responsive to capacitance changes and having an earth terminal and an active terminal, the earth terminal being connected electrically to the bottom of the tank, a probe

housing mounted within the tank at the lower end of a pump, the pump having a cylinder to which the probe housing is fitted, an outlet near the upper end of the cylinder, an inlet near the lower end of the cylinder, and a piston adapted to draw water upwardly from the lower end of the cylinder and to expel it through that outlet, a probe mounted in the probe housing and electrically insulated therefrom, lugs projecting from the lower end of the probe housing into contact with the bottom of the tank so that the probe is spaced a set distance from the bottom, and an electrical connection between the active terminal and the probe, the apparatus being so arranged that the proximity relay apparatus is adapted to indicate variations in dielectric constant of the material in the tank between the probe and the bottom of the tank.

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