Jan. 31, 1928. 1,657,794

M. S. ELTON ET AL

CIRCUIT CLOSER FOR FLUID LEVEL INDICATING DEVICES

Filed Feb. 10, 1925

Fig. 1

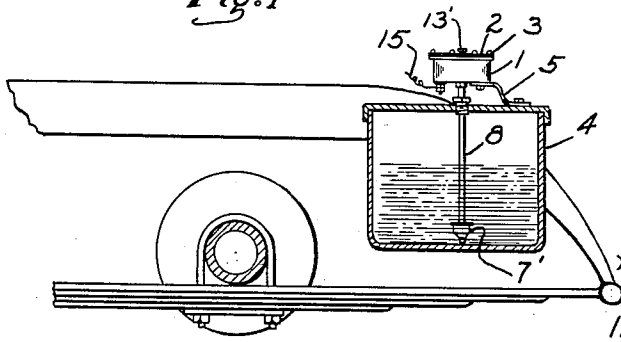


Fig. 2

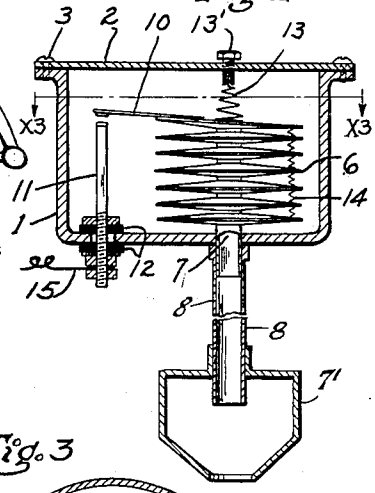


Fig. 4.

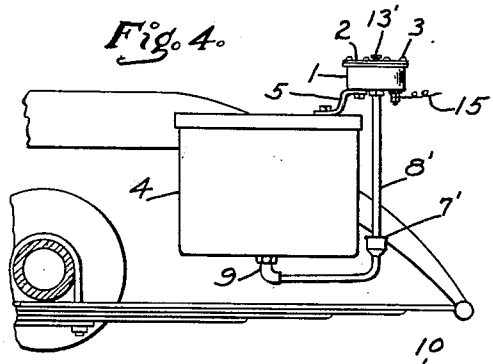


Fig. 3

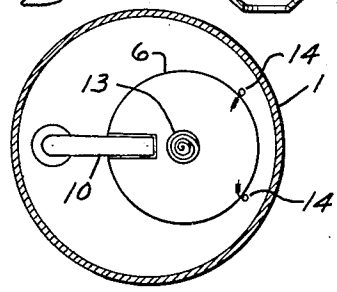


Fig. 5

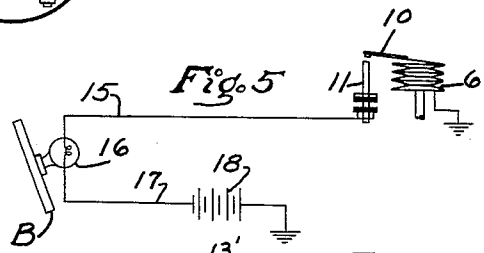


Fig. 6

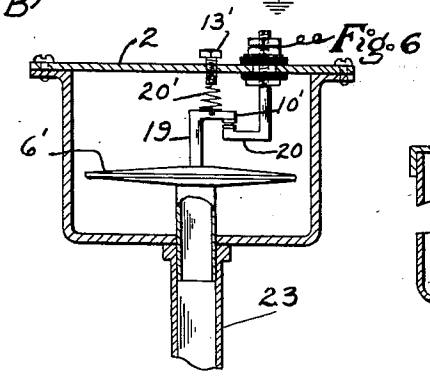
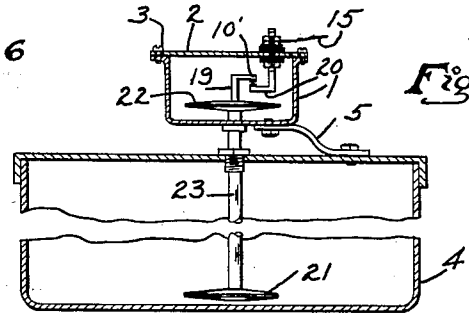


Fig. 7



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Patented Jan. 31, 1928. 1,657,794

UNITED STATES PATENT OFFICE.

MURRAY S. ELTON AND GEORGE EDWARD BARNHART, OF PASADENA, CALIFORNIA; SAID ELTON ASSIGNOR TO SAID BARNHART.

CIRCUIT CLOSER FOR FLUID-LEVEL-INDICATING DEVICES.

Application filed February 10, 1925. Serial No. 8,167.

This invention relates to a circuit closer in which the fluid pressure is utilized to make or break an electrical circuit that is connected to an audible or visible signal and thus give an alarm when the fluid is at a predetermined level.

Our invention is particularly applicable to fuel tanks for motor vehicles, but may also be applied to any tank to indicate a predetermined level of the fluid therein.

It has oftentimes occurred that automobile drivers will fail to replenish the supply of fuel in the fuel tank with the result that many times while on a trip the supply will be exhausted many miles from a supply station, and an object of our invention is to provide novel means whereby an alarm will be given in the driver's compartment to apprise the driver that the fuel supply is getting low, but is not entirely consumed.

An object is to provide a novel indicator that is controlled by the fluid pressure, a predetermined height of which is adapted to be indicated.

Another object is to provide novel means which may be readily connected to the tank and which will indicate to a person some distance from the tank a predetermined level of the fluid therein.

Another object is to provide novel means whereby an alarm is operated when the fluid in the tank is at a low level.

A feature of our invention is that we provide an expansible and contractable diaphragm that is actuated by the pressure of the fluid in the tank, to make or break an electrical circuit, and thus operate an alarm connected to said circuit, and which alarm may be located at some point removed from the tank.

A feature of our invention is in the provision of an electrically controlled indicator for gas tanks and in which the gas is in no danger of being ignited from sparks that may be made at the switch controlling the indicator.

A further object is to provide an indicator in which the low level warning is given at a distance from the tank.

Other objects, advantages and features of invention may appear from the accompanying drawing, the subjoined detailed description and the appended claims.

The accompanying drawing illustrates the invention.

Figure 1 is a transverse sectional view of a vehicle fuel tank having an indicator constructed in accordance with our invention mounted thereon. A fragment of the vehicle to which said tank is connected is shown.

Fig. 2 is a transverse sectional view of the circuit closer shown in Fig. 1, parts are broken away to contract the view, and the diaphragm is expanded and the switch open.

Fig. 3 is a sectional view taken on line $x3$, Fig. 2.

Fig. 4 is an end elevation of an indicator and tank showing a modified form of installation of the indicator. A fragment of the vehicle to which the tank is connected is shown in dotted lines.

Fig. 5 is a more or less diagrammatic illustration showing the wiring diagram for connecting the circuit closer to an electric circuit and a visible signal.

Fig. 6 is a view analogous to Fig. 2, showing a modified form of diaphragm.

Fig. 7 is a view analogous to Figs. 2 and 6, showing a further modification of the diaphragm used for operating the switch.

Although we have shown our indicator means applied to the fuel tank of a vehicle, we do not wish to limit ourselves to this application as it may be applied to any fluid containing tank. The indicator includes switch operating means A comprising a housing 1, and a cover 2, secured to the top thereof, by screws 3.

The housing 1 is supported adjacent the fuel tank 4 by any suitable means such as the bracket 5 which may be mounted on top of the tank as shown, or mounted upon any convenient part of the vehicle or support adjacent the tank, a predetermined fluid level of which is to be indicated.

An expansible element such as a sylphon or a multiple diaphragm 6 is positioned within the housing 1, and is supported by a tube 7 extending into the bottom thereof.

A tube section 8, which may be suitably secured to the tube 7, or if desired it may be

an extension of the tube 7, extends into said tank through the top thereof and terminates adjacent the bottom thereof, and is provided at its lower end with a hydrostatic box 7'.

The hydrostatic box consists of an enlarged chamber interposed in the tube 8 or 8' and into which the fluid expands, and in which the pressure of the air therein is increased or decreased to positively actuate the diaphragm 6 at a predetermined height of liquid in the tank. The operating pressure of the air in the tube is increased by the liquid building up in said chamber, and decreased by lowering the height of the liquid in the chamber.

In the form shown in Fig. 4, the tube 8' does not extend into the tank, but is secured to the bottom of the tank 4 by an outlet union 9, and said tube 8' extends upward outside the tank and communicates with the diaphragm 6 through the above-mentioned tube 7. The hydrostatic box 7' in Fig. 4 is interposed at any suitable point in the tube 8'.

A switch comprising a movable contact or finger 10 is secured, as by soldering, to the top of the diaphragm 6, and is adapted to make and break contact with a stationary contact or post 11, which is secured to and extends through the wall of the housing 1, and is insulated therefrom by insulating washers 12.

A compression spring 13 operates between the top of the diaphragm 6 and the cover 2 to compress the diaphragm and force the finger 10 against the post 11.

The finger 10 is grounded through the metallic diaphragm 6, housing 1 and vehicle frame, and a lead 15 extends from the post 11 to an alarm 16 which may be a lamp or other signal means located at some distance from the tank 4 as on the vehicle instrument board B, a fragment of which is shown in Fig. 5. A lead 17 extends from the alarm 16 to one terminal of a battery 18, the other terminal of which is grounded to the vehicle frame.

Springs 14 are fixed to the various units of the diaphragm 6 by any well known means such as by soldering, and are positioned opposite to the finger 10 as shown in Fig. 3. By thus connecting the diaphragm units the action of the diaphragm is toward greater expansion at the contact 10 and restricted expansion at the connected points, thereby tilting the diaphragm when expanded, as shown in Fig. 2. The springs 14 unite in providing a hinge for the movable contact and insures such contact being withdrawn from the stationary contact when the diaphragm is expanded.

In the form shown in Fig. 6 we have shown a modified form of switch which in this figure is operated by a single diaphragm 6'. The movable contact 10' extends upward from the diaphragm 6' and has a lateral extension 19 that engages a stationary contact 20 that is insulated from and supported by the cover 2. The spring 20' operates between the cover and contact 10' for the purpose above specified. The adjusting screw 13' is threaded in the cover 2 and increases or decreases the tension of the spring 20.

In Fig. 7 we have shown a modified form of the expansible element or switch operating means and in this figure the expansible element is hermetically sealed and the pressure of the fluid in the tank on the lower diaphragm 21 causes expansion of the upper diaphragm 22 which is connected to the diaphragm 21 by a tube 23, and consequent opening of the switch contact.

When the pressure on the lower diaphragm is removed the tendency is for the pressure in the hermetically sealed diaphragm unit to equalize and consequently the upper diaphragm will contract and close the switch contacts.

It is understood that any suitable arrangement of the switch contacts may be made and in Fig. 7 the diaphragm units may each be either a single diaphragm, as shown, or a multiple diaphragm or sylphon or said diaphragms 21, 22 may be single and multiple, respectively or vice versa or both be multiple.

It is understood that the term diaphragm includes a sylphon.

In operation the diaphragm is connected to the fluid tank 4 by the tube 8 or 8' which extends into or is connected to the tank 4, respectively. When the fluid in the tank is of sufficient height it seals the inlet end of the tube 8 or 8' thereby trapping air in said tube and diaphragm.

As the tank is filled with fluid it will rise in the tube 8 or flow into the tube 8' and the fluid in the tubes will rise to approximately the same height as the fluid in the tank, and as the fluid rises in the tube it compresses the air therein and causes the diaphragm to expand against the tension of the spring 13, and forces the finger 10 away from the post 11 to break the electrical circuit to which the post 11 is connected. As the fluid level in the tank lowers, the fluid level in the tubes 8 or 8' and the pressure therein and in the diaphragm 6 will be correspondingly decreased, and at a predetermined height of the fluid the pressure in the tube will not be sufficient to counteract the tension of the spring 13 and such spring will force the finger 10 against the post 11 to close the electrical circuit to the alarm.

It will be seen that as the fluid level in the tank 4 is lowered, the pressure in the diaphragm is lowered and the finger 10 will engage the post 11 and close the electrical circuit to light the lamp shown at 16 and

thus give the alarm that the liquid in the tank is at a low level.

The level at which the alarm will be operated is predetermined by the resiliency of the diaphragm and the tension of the spring 13 and the position of the hydrostatic box 7′ in the tube, and the resulting amount of compression of air in said diaphragm by the liquid in the tank. By predetermining the tension of the spring by the set screw 13′, and positioning the box 7′ in the tube at a certain point such predetermined level may be at a point when the tank holds say, two gallons, more or less.

The hydrostatic box 7′ serves to make a positive break of the circuit at a particular fluid level in the tank. This is because the box 7′ is of greater diameter than the tube 8 or 8′ and is of such length as to give a sufficient compression of air in the diaphragm to operate the same when the fluid level in the tube is above the top of the box 7′. It will thus be seen that by positioning the box 7′ at a predetermined height in the tube 8 or 8′ the diaphragm 6 will be positively operated when the fluid level is above the box 7′ because the amount of air displaced from the diaphragm is sufficient to operate the diaphragm and overcome the tension of the spring.

At higher fluid levels it is apparent that the finger will not engage the post and the alarm is not operated.

If it is desired to indicate a high level in the tank it is apparent that the post 11 may be reversed, that is, mounted in the cover 2 so that when the liquid is at a predetermined height the circuit to the alarm 16 will be closed.

We claim:

1. In combination with a tank having a cover and adapted to normally contain fluid; of a circuit closer having a stationary and a movable contact connected to an electrical circuit; a multiple diaphragm consisting of a series of superimposed units; springs connecting the units together and providing a hinge for one side of said diaphragm and adapted to move said movable contact out of contact with said stationary contact; a tube open to said diaphragm and to said tank; and a hydrostatic box interposed in said tube, said diaphragm being operated to move said movable contact into engagement with the stationary contact when the fluid in said tank is at a predetermined point which is determined by the relative position of said hydrostatic box in said tube and a spring connected to said cover and uppermost diaphragm unit adapted to force the movable contact into engagement with the stationary contact when the fluid in said tank is at a predetermined level.

2. A circuit closer comprising a housing having a cover; a multiple diaphragm disposed in said casing; springs fixed to the various units of said diaphragm at one side thereof; a stationary contact; a movable contact fixed to the upper surface of the uppermost diaphragm unit of said multiple diaphragm and adapted to contact with said stationary contact; a tube open to said diaphragm and adapted to be connected to a fluid tank normally containing fluid, said diaphragm being adapted to be expanded to move said contacts out of engagement with each other when the liquid in said tank is at a predetermined level; and a spring connected to said cover and uppermost diaphragm unit adapted to force said contacts into engagement with each other when the fluid in said tank is at a predetermined level.

3. A circuit closer comprising a housing having a cover; a multiple diaphragm in said housing; springs fixed to the various units of said diaphragm and on one side of the central axis of said diaphragm; a stationary contact; a movable contact fixed to said multiple diaphragm, on the side opposite said springs, said movable contact adapted to contact with said stationary contact; a tube open to said diaphragm and adapted to be connected to a fluid tank normally containing fluid, said diaphragm being adapted to be expanded to move said contacts out of engagement with each other when the liquid in said tank is at a predetermined level; and a spring connected to said housing cover and upper unit of said diaphragm adapted to force said contacts into engagement with each other when the fluid in said tank is at a predetermined level.

In testimony whereof, we have hereunto set our hands at Los Angeles, California, this 2nd day of February, 1925.

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