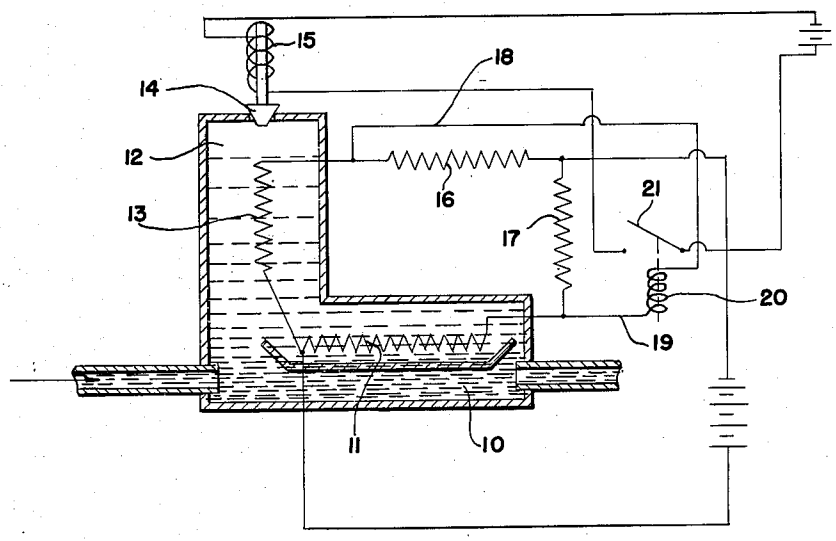
Dec. 25, 1951 S. W. GILBERT 2,580,016

VAPOR TRAP

Filed Jan. 2, 1945



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Patented Dec. 25, 1951 2,580,016

UNITED STATES PATENT OFFICE

2,580,016

VAPOR TRAP

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Application January 2, 1945, Serial No. 571,079

4 Claims. (Cl. 137—68)

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This invention relates to vapor traps and particularly to a trap for vapor accumulating in the liquid fuel line of an aircraft engine.

An object of the invention is to provide an efficient vapor trap that operates to release vapor accumulating in a supply line without requiring a float to actuate the trap and release accumulated vapor.

A feature that enables the above object to be accomplished is that a bridge circuit is provided for operating a vapor trap, one branch of the circuit being constantly submerged within the liquid and another branch disposed in the space within which vapor accumulates so that when these two coils are at different temperatures the circuit will be unbalanced and a vapor releasing valve will be moved to its open position.

Another feature which enables the above object to be accomplished is that the bridge circuit controls a solenoid operated vapor release valve through a relay circuit, the valve being maintained closed until sufficient vapor accumulates about one coil of the circuit to vary its temperature from that of the submerged element, thus changing its electrical characteristics to unbalance the circuit sufficiently to energize a relay circuit.

With the above and other objects in view the invention includes the features of construction and operation set forth in the following specification and illustrated in the accompanying drawing.

In the accompanying drawing annexed hereto and forming a part of this specification, I have shown diagrammatically the invention embodied in a vapor trap for the fuel line of an internal combustion engine using a liquid fuel, but it will be understood that the invention can be otherwise embodied and that the drawing is not to be construed as defining or limiting the scope of the invention, the claims appended to this specification being relied upon for that purpose.

In the drawing, a diagram of an electric circuit only is shown in connection with a conventional showing of a fuel line having a chamber formed therein within which vapor may accumulate.

In the above mentioned drawing there has been diagrammatically shown a single embodiment of the invention which is now deemed preferable, but it is to be understood that changes and modifications may be made within the scope of the appended claims without departing from the spirit of the invention.

Briefly, and in its preferred aspect, the invention may include the following principal parts:

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First, chambers within a liquid supply line in which are disposed elements of a bridge circuit and into one chamber vapor may accumulate to expose the element to the vapor; second, balancing elements for said bridge circuit outside said chambers; third, a relay circuit energized when said bridge circuit is unbalanced; and fourth, a solenoid operated vapor releasing valve moved to its open position when said relay circuit is energized.

Use is made in this vapor trap of the difference between the heat radiating qualities of a liquid and that of its vapor so that when an appreciable amount of vapor has accumulated within a chamber formed in the trap one element of a bridge circuit will be exposed to the vapor and the circuit unbalanced thereby. A valve opened thereby, preferably through a relay circuit, releases the vapor so that liquid again entirely fills the trap. As soon as the liquid again fills the trap both elements of the bridge circuit will be submerged and thereby brought to equal temperature so that the valve will be closed.

Normally, that is while both branches of the circuit are submerged within the liquid, both coils or elements will be maintained at the same temperature and there will be no resultant flow of current. The opposite ends of these elements in the circuit are in opposed relation to each other and are energized by a suitable source of current, such as a battery, and the other terminals of the elements within the trap will have no resultant voltage. However, when vapor accumulates in the space occupied by one of the elements, the amount of heat radiated therefrom will be different from the heat radiated from the submerged coil. The temperature of the two coils, therefore, will be different and their electrical characteristic such as resistance will be different. This serves to unbalance the bridge circuit and the resultant voltage in the secondary circuit will energize the coil of a relay and close its contactor, which actuates a valve by means of a solenoid within a power circuit.

The trap comprises a relatively large horizontal chamber 10 within which a coil 11 or other electrical element is mounted, and a vertical chamber 12 communicating with the horizontal chamber within which a second coil or element 13 is mounted. At the upper end of this vertical chamber 12 of the trap is a valve 14 normally held in closed position by gravity or a spring but moved to its open position when solenoid 15 is energized.

The two coils or elements 11 and 13 within the

trap form adjacent branches of the bridge circuit, there being two corresponding coils or elements 16 and 17 outside the trap having their opposite ends connected to the ends of the coils 11 and 13 within the trap as shown. The connected ends of the two coils or elements 11 and 13 within the chambers of the trap are connected to a source of energy such as a battery, the opposite terminal of the battery being connected to the connected ends of the two outside coils 16 and 17. From the other corners of this bridge circuit are leads 18 and 19 of a relay circuit which, when both coils or elements 11 and 13 within the trap are submerged within the liquid and at equal temperature, do not produce any voltage in the relay circuit. As soon, however, as vapor accumulates within the upper part of the chamber 12 the heat is not radiated from element 13 as fast as from submerged element 11, and its temperature and electrical resistance or other characteristic is thereby varied so that the bridge circuit is unbalanced. This produces a voltage passing through the coil 20 of the relay circuit which closes a switch 21 in the circuit which energizes the solenoid 15, by means of which the trap valve 14 is opened.

As soon as vapor is released and liquid again fills the chamber 12 the two elements 11 and 13 are again subjected to similar temperature and radiation and therefore when they have reached the same temperature the bridge circuit is balanced and no current flows in the relay circuit. The valve 14 therefore closes until vapor again accumulates and the bridge circuit becomes again unbalanced.

It should be apparent that my invention could be readily applied to any system for maintaining a liquid in a closed chamber at a predetermined level, although it is shown as applied to a specific form of such a system.

If desired, the relay may be eliminated and the solenoid 15 placed directly in the bridge circuit, if the various electrical quantities are properly designed so that the valve may be operated by the unbalance current obtained.

What I claim is:

1. Apparatus for separating a vapor or gas from a liquid comprising a trap chamber, a vapor relief valve at the top of said chamber, an inlet near the bottom of said chamber, a first electrical resistance element submerged in said chamber near the bottom thereof, a second electrical resistance element mounted in said chamber near the top thereof, a normally balanced electrical bridge circuit including said first and second resistances, said circuit being unbalanced upon the formation of vapor or gas adjacent said second resistance due to the different thermal conduction characteristics of said vapor and said liquid,

and means responsive to unbalance of said circuit for opening said vapor relief valve.

2. Apparatus for separating vapor or gas from a liquid comprising a trap chamber, a vapor relief valve at the top of said chamber, a liquid inlet at the bottom of said chamber, a liquid outlet at the bottom of said chamber, a first electrical resistance element submerged in said chamber near the bottom thereof, shield means for protecting said first resistance element from the current of liquid flowing between said inlet and outlet, a second electrical resistance element mounted in said chamber near the top thereof, a normally balanced electrical bridge circuit including said first and second resistances, said circuit being unbalanced upon the formation of vapor or gas adjacent said second resistance due to the different thermal conduction characteristics of said vapor and said liquid, and means responsive to unbalance of said circuit for opening said vapor relief valve.

3. An apparatus according to claim 1, wherein the first electrical resistance is disposed in the trap chamber so as to be always completely submerged in liquid, and the second electrical resistance is disposed so as to be completely submerged in liquid only when the trap chamber is substantially filled with liquid, and is progressively uncovered by liquid as the liquid level in the trap chamber falls, whereby the normal balance in the electrical bridge circuit is increasingly unbalanced by increasing energization of said circuit as said level falls, until a sufficient current is generated in said circuit to operate the vapor relief valve.

4. An apparatus according to claim 2, wherein the electrical bridge circuit is balanced only when both electrical resistance elements in the trap chamber are completely submerged in liquid, and said electrical bridge circuit becomes increasingly unbalanced and energized as the second electric resistance element is partially uncovered by the falling of the liquid level in said chamber, owing to the accumulation of vapor of gas therein.

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