Jan. 18, 1955 L. H. HUCKABEE 2,700,153

LOW WATER WARNING SIGNAL AND CUTOFF SYSTEM

Filed Sept. 22, 1952

FIG. 1.

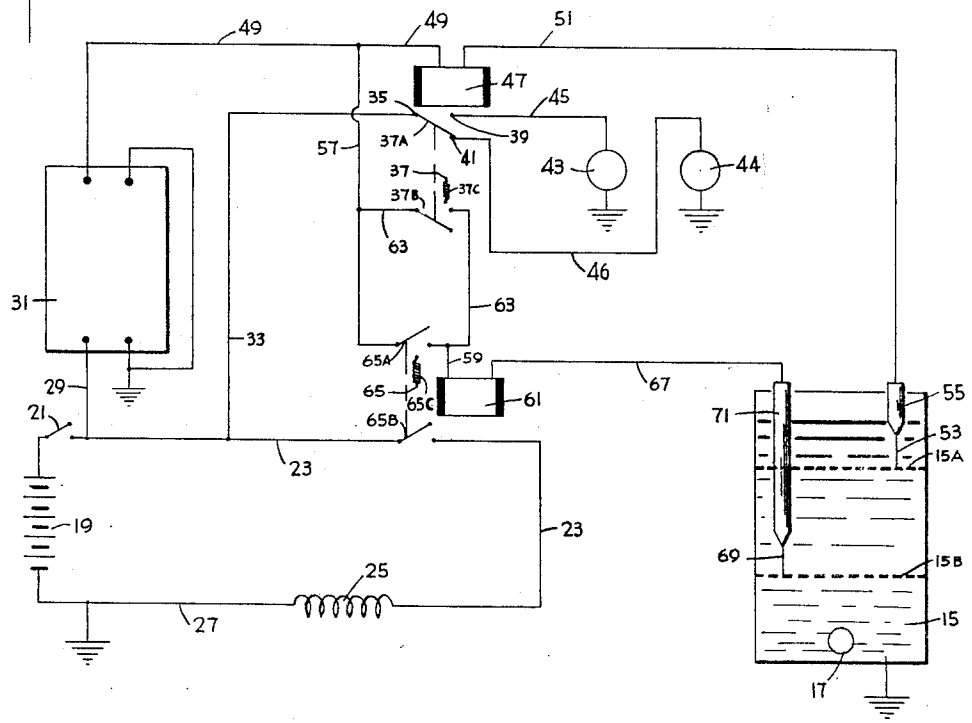


FIG. 2.

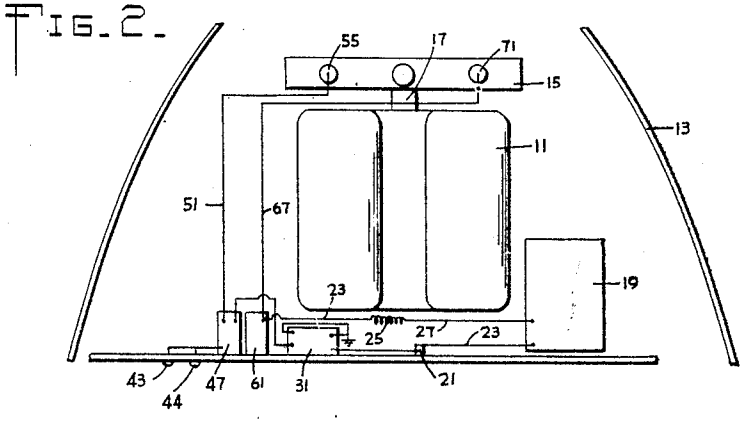
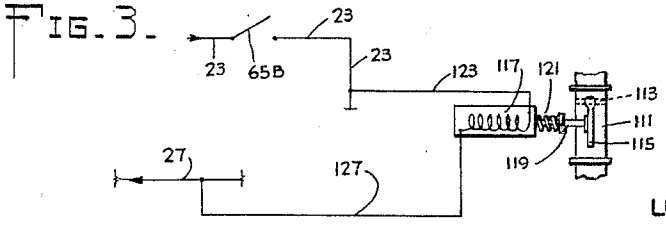


FIG. 3.



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LOW WATER WARNING SIGNAL AND CUTOFF SYSTEM

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1 Claim. (Cl. 340—244)

This invention relates to new and useful improvements in safety devices, particularly for use with liquid cooled engines of either the automotive or stationary types, and particularly relates to a system adapted to indicate the loss of coolant from the reservoir of cooling systems for such engines and to effect cut-off of such engine when the coolant level in such reservoir has dropped below the danger level, the point and beyond at which continued operation of the engine would result in damage thereto.

In particular this system relates to electrical means including contacts extending into the coolant reservoir, such as the water radiator of a motor vehicle, with the contacts being arranged at different levels in the reservoir and being coupled to a signal device and a cut-off device in the manner hereinafter described to sequentially effect basic purposes of the invention. The coolant of the reservoir is employed as a portion of the respective circuits involved and the present invention utilizes the lowering of the coolant level below contact with the respective contacts to effect interruption of the individual circuits.

Multi-level electrical signalling devices have heretofore been contemplated and attempted, but these devices have proven ineffective and inefficient, and in addition have not provided for insurance against restarting of the engine with an inadequate supply of coolant on hand, nor have such prior devices taken into account the condition obviously present in moving engines, such as those of motor vehicles, in which the water in the reservoir by sloshing through physical movements and change of attitude of the reservoir could intermittently reestablish the original circuits and thus permit the undesired re-operation of the engine and resultant damage.

The principal object of the present invention is to provide in combination with an engine having a liquid cooling system an electrical system for signalling a preliminary loss of coolant from such cooling system and for effecting cut-off of the engine operation upon substantial loss of coolant from the system below a level of safe operation.

A further object of the invention is to provide in connection with such engine cut-off means, means for maintaining the engine in cut-off condition during the absence of adequate coolant supply in the cooling system reservoir.

A further object of the invention is to provide a water loss signalling and cut-off system of efficient character which may readily and simply be installed upon conventional engines without the necessity of substantial modification thereof.

A further object of the invention is to provide a signal circuit coupled to a contact maintained in the coolant reservoir of the cooling system at an upper level to signal the condition of a loss of coolant in or below said upper level and a cut-off circuit coupled to a contact extending into the reservoir to a lower level adapted to effect cut-off of the engine operation through interrupting the ignition circuit thereof, interruption of the ignition circuit being accomplished through a relay normally maintaining the circuit in closed condition, the same operation interrupting electrical supply to the relay, insuring maintenance of cut-off condition in the absence of adequate coolant in the cooling system reservoir.

Other and further objects of the invention will become apparent from a consideration of the attached specification upon reference to the accompanying drawings, in which:

Fig. 1 is a schematic wiring diagram illustrating the arrangement of the present invention.

Fig. 2 is a somewhat schematic plan view illustrating a typical installation of the invention in connection with a motor vehicle.

Fig. 3 is a fragmentary diagram illustrating a modification in installation of the invention.

Referring now to the drawings in which the various parts are indicated by numerals, the present invention is adapted for use in connection with an engine such as the engine **11**, which, in the typical installation shown in the drawings, form a part of an automobile **13**.

Engine **11** is of the liquid cooled variety, including a liquid circulating system which includes a source of supply, such as the radiator **15**, which is connected in conventional manner as by hose **17** to the water jacket of engine **11**.

As is conventional automobile **13** includes a source of electrical power supply such as the battery **19** which provides electrical current to the various instrumentalities of the vehicle, including the ignition circuit of the vehicle, which ignition circuit in conventional manner includes igniton switch **21**, which is interposed in the line **23** which is connected to one side of battery **19** leading to various electrically operated instrumentalities connected with the automotive vehicle, such as symbolized by the ignition coil **25** which may be connected to the opposite side of the battery **19** as by lead **27**.

By a line **29** branching from line **23** current from battery **19** is delivered to a synchronous vibrator power pack **31** by which power pack the voltage of the current from battery **19** is stepped up to approximately 250 volts. A lead **33** is connected to line **23** beyond ignition switch **21** and is connected to a terminal **35**, to which is electrically coupled a shiftable switch arm **37A** forming one side of a double pole switch **37**, switch arm **37A** being adapted to be shifted and make contact alternately with the contacts **39**, **41**, the contacts **39**, **41** being respectively connected to suitable signals such as lights **43**, **44** as by leads **45**, **46**. Lights **43**, **44** may be conveniently mounted as upon the dash-board of automobile **13**. Shift of switch arm **37A** to and from contact **39**, from and to contact **41** is controlled by a relay **47**, which is connected as by lead **49** to the secondary of the power pack **31**. The opposite side of relay **47** is connected as by lead **51** to a contact **53** carried by a suitable fitting **55** which is adapted to be engaged into an opening formed in the shell of radiator **15**, with the contact **53** extending into the interior of radiator **15** and being arranged so as to normally extend into the water contained in the radiator when the radiator is filled to capacity, contact **53** terminating at an upper level of radiator **15** indicated by the dotted line **15A**, which, while a safe operating level is undesirable because the supply of water will have diminished in order to be lowered to such level indicating the imminence of danger.

Coupled to the line **49** is a line **57** which is connected as by lead **59** to the input of a second relay **61**. Branching from line **57** is a supplemental line **63** which is likewise coupled to lead **59** and thus to relay **61**. Interposed in line **57** between the connection of line **63** to the line **57** and the connection of line **57** to lead **59** is a switch **65A** forming one side of a double-pole switch **65**, the operation of the switch **65** being controlled by relay **61**. Interposed in line **63** is switch arm **37B** forming the other side of the first double-pole switch **37**, the movement of which is controlled by the relay **47**. The opposite side **65B** of the double-pole switch **65** is interposed in ignition circuit line **23**. A lead **67** is connected from the relay **61** to a second and lower level reservoir contact **69** which is provided with a suitable fitting **71** by which the contact is mounted in radiator **15** and extended through the shell of the radiator into the interior thereof, the contact **69** being disposed to extend to a low or danger water level, indicated by the dotted line **15B**, at or below which operation of the engine **11** will subject the engine to potential danger.

It thus will be seen that the radiator **15** properly filled with water or other suitable coolant to a level at or above the upper signal level **15A**, the entire device will permit the ignition circuit of the automobile to be opera-

tive. Thus when the switch 21 is closed the power from battery 19 is delivered to the vibrator pack 31 and a circuit is then completed through lead 49 to relay 47, thence through lead 51 to the contact 53, the water in the reservoir with which the contact 53 is intimately associated, becoming a part of the circuit and completing same.

With the circuit through relay 47 thus complete, upon the closure of switch 21 the relay 47 is effective to shift double-pole switch 37 so as to swing switch arm 37A from light contact 41 to light contact 39, thus energizing light 43, which preferably is a green light indicating that the water level in radiator 15 is at a satisfactory level. Simultaneously switch arm 37B of the switch 37 is moved to closed position and effects connection through lines 49, 57 and 63 into lead 59 and relay 61, this circuit being completed through lead 67 to contact 69, the water in radiator 15 again serving as an element of the circuit and completing the same. With the circuit thus completed relay 61 is effective to shift the double-pole switch 65, moving the switch arm 65B to closed position, thus completing the ignition circuit through line 23, switch 21, the instrumentalities of the motor vehicle, as the ignition coil 25, and line 27 back to the battery 19.

The shift of switch 65 by relay 61 is also effective to close switch arm 65A, completing an additional circuit into relay 61 through line 57, switch 65A, and lead 59.

If during the operation of the engine the water level in radiator 15 falls below the upper signal level 15A it will immediately be seen that contact with contact 53 is broken, thus interrupting the circuit through the relay 47 and releasing switch 37 from the effect of the relay. It will be seen that the switch 37 is preferably urged toward open position, spring 37C being indicated in Fig. 1 for this purpose, and the effect of relay 47 upon switch 37 being released, the switch will be shifted to the opposite position in which switch arm 37A is moved into contact with contact terminal 41, effecting through lead 46 a complete circuit into the light 44, which is preferably a red light, thus immediately indicating by a visual signal that the water in radiator 15 has fallen below the level 15A.

Simultaneously with this shift of the switch 37, the switch arm 37B is swung to open position interrupting the circuit into relay 61 through line 63. This opening of switch 37B, however, does not interrupt the operation of relay 61 inasmuch as the circuit through line 57, and switch 65A continues complete. If during continued operation of the engine the water level in radiator 15 should continue to fall to a point below the level 15B, beyond which point further operation of the engine will be dangerous due to the probable over heating as a result of inadequacy of coolant supply, the circuit into relay 61 will be broken by removal of the water below the contact point of contact 69. With the circuit to relay 61 thus broken the effect of the relay upon the switch 65 is released and as this switch preferably is normally spring-urged toward open position, a spring 65C being indicated in Fig. 1, the switch 65 moves from the circuit closing position in which the switch arm 65B completes the ignition circuit through line 23, thus interrupting that circuit and interrupting engine operation.

Simultaneously with this shift of spring 65 the switch arm 65A forming a part of the remaining circuit into relay 61 is similarly shifted to open position, thus interrupting the circuit into relay 61 in addition to the interruption from drop in the water level. As a result it will be seen that it is impossible to again start the engine until such time as the water level has been restored to the upper signal level 15A or above, it being observed that merely filling the radiator with water to the level 15B and below the level 15A will be ineffective to reestablish the circuit due to the open condition of switch 65A, preventing the energizing of relay 61 and consequently preventing the closure of switch 65B, thus maintaining the ignition circuit through line 23 in open condition.

It thus will be seen that if the water level has dropped below the level 15B the ignition circuit is effectively interrupted and maintained in interrupted condition, with the result that accidental tilting of the reservoir 15, shifting the water level in the reservoir, will not be effective to reset the ignition circuit for further operation. As a result sloshing of the water in radiator 15 will not be effective to reestablish the circuit intermittently and in undesired manner. It will be observed, however, when the water level is again raised to the level 15A, or above, the initial circuit into relay 47 will be reestablished and with ignition switch 21 closed the sequence of operation which occurs substantially simultaneously will result, as heretofore set out.

In Fig. 3 a variation in application of the invention is illustrated and the installation is there shown as directly operating upon a fuel cut-off device. Fuel delivery means are symbolically illustrated by the fragmentary induction pipe 111 in which is mounted a butterfly valve 113, the movement of the butterfly valve being controlled as by an arm 115 swingably supported in usual fashion from the induction pipe. A solenoid 117 is provided with a plunger core 119, the solenoid being adapted when energized to withdraw the plunger core 119 into retracted position and when the solenoid is deenergized the core is urged outwardly into extended position as by a compression spring 121. The solenoid and core are positioned adjacent the valve arm 115 so that upon extension of plunger core 119 it is moved into abutment with the valve arm effecting shift of the valve arm to closed position when the solenoid is deenergized as illustrated in Fig. 3. Solenoid 117 is electrically connected as by a lead 123 to power line 23 and the opposite side of the solenoid is connected as by a lead 127 into the return line 27.

It will be seen that the operation of the installation illustrated in Fig. 3 is accomplished in substantially the same manner as that described heretofore for the installation of Fig. 1, and that upon the closing of switch 65B in the manner heretofore described, completing the circuit through lines 23 and 27, the circuit into the solenoid 117 is completed through leads 123, 127, energizing the solenoid and effecting retraction of plunger core 119, removing the restraint upon valve arm 115 and permitting free operation of the valve arm 115 and of the valve 113. When the circuit is broken by the opening of switch 65B, in the manner heretofore described as a result of the loss of coolant in reservoir 15, solenoid 117 is deenergized, the plunger 119 extended and restraint upon valve arm 115 holding valve 113 in closed position is effected.

It will be understood that the induction pipe and butterfly valve is intended as symbolical of fuel induction means and that the solenoid cut-off will be effective with other types of fuel induction means.

It will further be understood, and is believed to be apparent, that the invention may be equally applied to other forms of electrically controlled cut-off means, such as for example electrically operated valves or the like.

I claim:

A liquid-level responsive safety device for an engine which includes a liquid cooling system having a liquid reservoir, comprising a pair of contacts disposed in said reservoir respectively at upper and lower reservoir levels, a source of low voltage, direct current, electrical power, electrical circuit means connecting said source of power respectively to said contacts, said circuit means including a first relay connected to the upper level said contact, a second relay connected to the lower level said contact, first switch means interposed in said circuit means between said source of power and said second relay, said first relay being positioned to operate said first switch means and complete the circuit to said second relay when said first relay is energized, a bypass relay circuit connecting said source of power to said second relay independently of said first relay, said bypass circuit including a normally open switch, a main engine power circuit connected to said source of power including a switch, said bypass circuit switch and said power circuit switch being coupled for concurrent circuit closing movement upon energizing of said second relay to complete said main power circuit and said bypass circuit, a danger signal, signal circuit means connecting said signal to said main power circuit, said signal circuit means including a signal switch coupled to said first switch means for operation concurrently therewith and positioned to complete said signal circuit on deenergizing of said first relay, loss of liquid in said reservoir below said upper level deenergizing said first relay to complete said signal circuit and interrupt the first mentioned circuit to said second relay, said bypass circuit maintaining energizing connection of said second relay to said source of power

and concurrently maintaining said main power circuit, loss of liquid in said reservoir below said lower level interrupting the second relay circuit releasing said bypass switch and said power circuit switch to interrupt said main power circuit.

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