Sept. 24, 1968 E. W. KRAFT ETAL 3,403,376

FUEL DEPLETION ALARM CIRCUIT UTILIZING BIMETAL

Filed Nov. 12, 1964

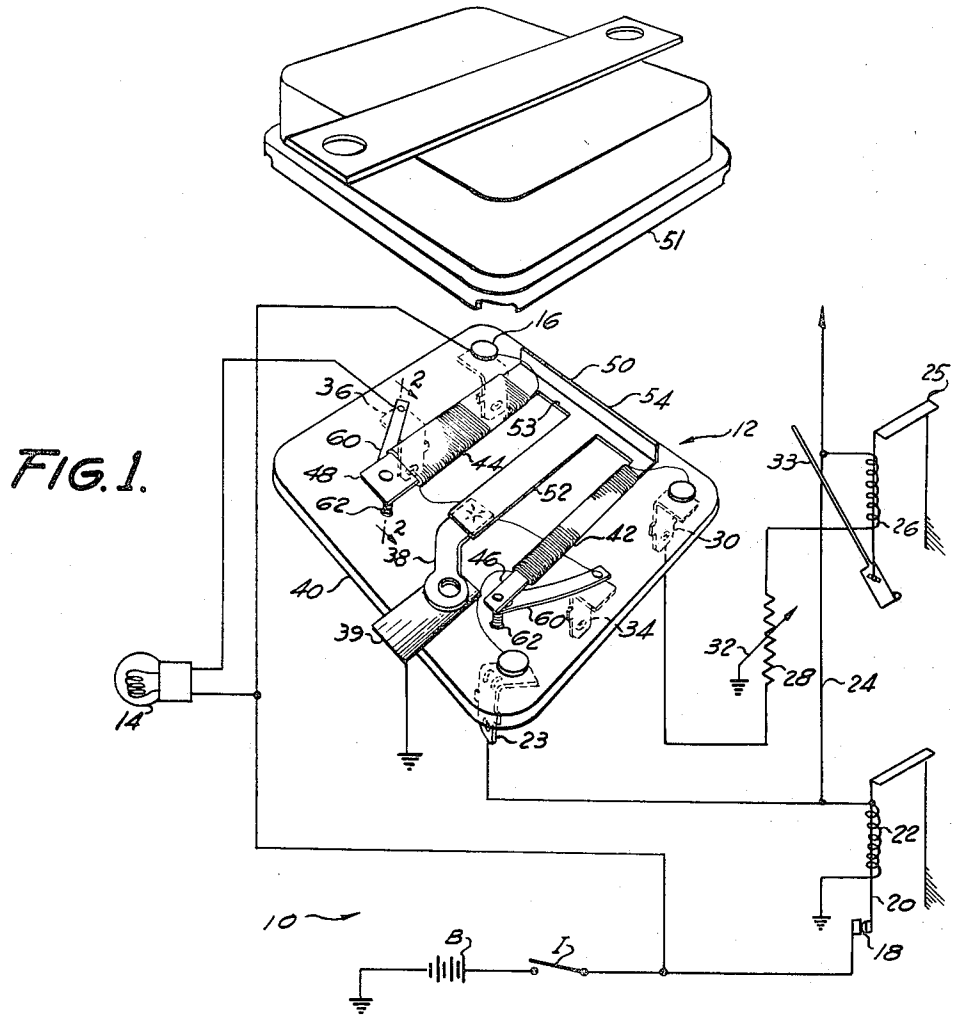

FIG. 1.

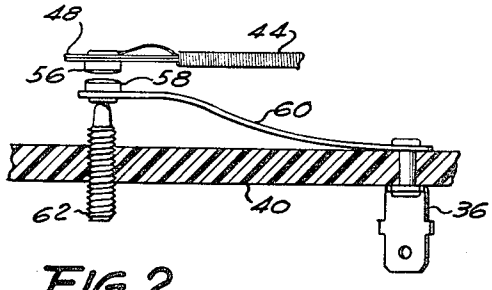

FIG. 2

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3,403,376

Patented Sept. 24, 1968

3,403,376

FUEL DEPLETION ALARM CIRCUIT UTILIZING BIMETAL

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Filed Nov. 12, 1964, Ser. No. 410,689
6 Claims. (Cl. 340—59)

ABSTRACT OF THE DISCLOSURE

The following specification describes a circuit using a bimetal switch of E-shaped construction with one end leg having a winding controlled by a fuel level rheostat with a normally open contact on the one end leg controlling a winding on the other end leg which has a normally open contact for lighting an alarm lamp in the event both windings are energized to indicate the fuel level has fallen below a predetermined value.

The present invention relates in general to an improved alerting system for indicating fuel depletion, and more particularly to a circuit assembly employing bimetal switching elements for indicating an alarm condition such as occurs on fuel depletion in a motor vehicle.

Bimetal type switches are usually employed with 12 volt automobile ignition and lamp systems for transmitting a constant voltage of 5 or 6 volts to various bimetal gauges. The bimetal gauges are utilized for indicating, for example, fuel volume, oil pressure, or temperature and/or other conditions. Although the bimetal fuel gauge, for example, may indicate fuel depletion to be a low level, it is desirable to call the operator's attention to his gauge, since he may neglect to look at same. For this purpose it is necessary to employ some lighting or alarm system for alerting the operator so that he will examine his gauge and note the fuel situation.

Since the lighting system will conventionally employ the full battery voltage while the bimetal gauge operates from the 5 or 6 volt constant voltage supply, a problem arises in operating both the bimetal gauge and a lamp under control of the same sensing element which detects the fuel level.

It is, therefore, one object of the present invention to provide an improved automotive alarm system for signaling a fuel depletion condition through a 12 volt lamp from a sensing source adapted to simultaneously control a bimetal gauge operating on substantially 5 volts.

It is another object of the present invention to provide an improved and more reliable arrangement for operating an alarm signal responsive to a fuel depletion condition in an automobile whereby either of two different indicators may be independently operated to signal said condition.

It is yet another object of the present invention to employ a 12 volt alarm system for indicating fuel depletion condition in an automobile without altering the conventional parameters of a 5 volt bimetal gauge or the sender associated therewith.

It is also an object of the present invention to introduce a simple and economical arrangement for delaying the operation of a fuel depletion alarm system to ensure that the depletion actually exists.

It is still a further object of the present invention to provide an improved bimetal construction for enabling a plurality of bimetal switches to be operated on a single bimetal structure.

Other objects and features of the present invention will become apparent upon examination of the following specification and claims together with the drawings, wherein:

FIG. 1 illustrates a circuit arrangement incorporating the principles of the present invention together with a perspective view of a plurality of bimetal switches arranged on a unitary bimetal structure; and

FIG. 2 is a fragmentary sectional view taken through the line 2—2 in FIG. 1.

In FIG. 1 a circuit for accomplishing the purposes of the present invention is indicated generally by the reference character 10 with a unique bimetal assembly for use with the circuit 10 indicated by character 12. The circuit 10 includes a conventional nominal 12 volt battery indicated at B and normally supplying as much as 14 volts. The output of battery B is passed through an ignition switch indicated at I to one terminal of a lamp 14; to a terminal 16 on the assembly 12 and also to a set of normally closed contacts 18 of a conventional bimetal constant voltage switch 20. The switch 20 has a coil 22 which is energized through contacts 18 and the bimetal for periodically opening the contacts 18 to thereby supply a substantially constant 5 volts through the contacts 18 to terminal 23 on assembly 12 and over lead 24 to one or more conventional bimetal gauges such as fuel gauge 25.

The bimetal fuel gauge 25 includes a coil 26 having one terminal connected to contacts 18 over lead 24 and the other terminal connected to one end of a sender or rheostat 28. The other end of rheostat 28 is connected to a terminal 30 on assembly 12. The rheostat has an arm 32 connected to ground, and the arm 32 varies the resistance of the rheostat with respect to coil 26 in response to the movement of the conventional float arm in the fuel tank as the fuel level varies. The resistance values of the rheostat and coil 26 may thus be maintained at their conventional values irrespective of the potential at terminal 30 for controlling the indicating pointer 33 of the fuel gauge in accordance with the fuel level.

The assembly 12 includes terminals 34, 36 and 38 in addition to terminals 14, 16 and 30, all mounted on an electrically insulating card 40. Terminals 23 and 16 are connected to one end of a respective coil 42 and 44, while terminals 30 and 34 are connected to the other end of coils 42 and 44 respectively. Terminal 36 is connected to the other terminal of lamp 14, and terminal 38 is connected to ground through a metal foil 39. The resistance of coils 42 and 44 is in the order 35 ohms and 235 ohms respectively, and each is mounted on a respective end leg 46 and 48 of an E-shaped bimetal lamination or structure 50. Terminal 38, which is an L-shaped grounding strip eyeleted or riveted to card 40, has one end welded to structure 50. The foil 39 is sandwiched between card 40, and strip 38 projects beyond the end of the card to establish a ground connection to a cover 51 which is assembled to the card and easily folds the foil into a clamped secure position.

The structure 50 includes a center leg 52 and all three legs 46, 48 and 51 are interconnected by a back leg 53 having a transverse rib section 54. Practical dimensions for legs 46, 48 and 52, excluding normal tolerances, are .1" wide for leg 46, .290" wide for leg 48, and ¼" for leg 52. The bimetal structure 50 is approximately .02" thick with the space between legs 46 and 52 in the order of .290" and that between legs 48 and 52 being ¼". The length of the legs 46, 48 and 52 to leg 53 is in the neighborhood of 1.15", and the width of back leg 53 is substanttially .06". The height of section 54 is approximately .07". Thus the two side legs 46 and 48, together with the back leg 53 are supported cantilever fashion from the strip 38 and float above the card.

A contact 56 is provided at the end of legs 46 and 48 respectively, opposite back leg 52. Each contact 56 is adapted to engage a respective contact 58 only after the respective leg 46 or 48 has been heated to a desired degree. The contacts 58 are suspended on the end of respective flexible arms 60. The arms 60 are fixed to terminals 34 and 36 respectively. Adjustment of the contact spacing is effected by energizing the coils to a desired degree and threading a screw member 62 through the card 36 against contact 58 to ensure that the contacts close at the proper time, and cementing the screws, when the adjustment is complete.

Thus coil 42 is adapted to be energized to a degree dependent on the position of arm 32 of rheostat 28 which in turn is controlled by the fuel tank float. Coil 26 is thus enabled to operate from its conventional 5 volts constant voltage supply without altering its parameters, while a failure developing in the circuit to either coil 42 or 26 does not incapacitate the other coil. If desired, coil 42 may be operated from the 12 volt supply while connected to rheostat 28 as shown without altering the parameters of coil 26; however, this would require a larger number of turns on coil 42.

The leg 46 will respond to the current passing through coil 42 by flexing about its juncture with leg 53. Stability of leg 53 with regard to flexure about an axis perpendicular thereto is ensured by the transverse rib section 54. Thus leg 46 flexes downward to a degree dependent on the voltage drop across coil 42. When the fuel level is sufficiently low, preferably about 3 gallons, coil 42 is energized sufficiently to cause the associated contacts 56 to engage contact 58.

A circuit from the 12 volt supply extended through terminal 16 and coil 44 is therefore completed through terminal 34 and bimetal legs 46 and 52 to ground through terminal 38. The coil 44 therefore energizes to initiate flexing of the bimetal leg 48 about its juncture with leg 53. After a desired period of time contact 56 on leg 48 engages adjacent contact 58 to extend a circuit from battery through the alarm lamp 14 and terminal 36 to ground over the bimetal legs 48 and 52 and terminal 38. The alarm lamp 14 now lights to signal that the fuel level has fallen below a desired level.

It will be noted that the lamp 14 is operated under control of coil 44 to introduce a desired time delay and not under direct control of coil 42. The reason for this is that there are occasions when the fuel level in the tank is temporarily disturbed as may occur when the vehicle is rounding curves or corners. Under these circumstances the float may cause coil 42 to energize sufficiently to operate its contacts. However, since the lamp 14 does not light until coil 44 has closed its associated contacts 56 and 58, temporary dislocations in the fuel level do not cause unnecessary alarms. The choice of operating the lamp and coil 44 from the 12 volt supply instead of the 5 volt supply is in good part dictated by the need to avoid overloading the 5 volt circuit and the availability of the 12 volt supply.

In brief, therefore, the bimetal switch 20 supplies a constant voltage to a series of coils such as 26 at various bimetal gauges. The coil 26 operates the associated pointer to indicate the fuel level in correspondence with the position of arm 32 at rheostat 28. If the fuel level is above a predetermined value, for example, 3 gallons, coil 42 does not close the associated contacts 56 and 58 although it is energized. If the fuel level falls below the predetermined value, coil 42 is energized sufficiently to close its associated contacts 56 and 58 to energize coil 44.

After a period of time, sufficient to ensure that coil 44 has been energized as a result of a true low level fuel condition, coil 44 closes its associated contacts to energize lamp 14 and alert the operator of the low fuel condition, whereafter appropriate steps may be taken. Thus coil 42 must be energized to a predetermined degree before it energizes coil 44, and coil 44 in turn must be energized for a predetermined time period before the lamp 14 is lighted.

The foregoing constitutes a description of an improved fuel alarm system employing an improved single bimetal structure although it will be appreciated that two separate conventional bimetal structures may be utilized in place of structure 50; however, the inventive concepts of this invention are believed to be more fully set forth in the appended claims.

What is claimed is:

1. An alarm system for use in operating a 12 volt lamp from a 12 volt battery to alert a motor vehicle operator of a depleted fuel condition with said 12 volt battery being adapted to control a bimetal switch to normally supply 5 volts to one or more bimetal gauges including a fuel gauge, the improvement comprising a rheostat having one end connected to said fuel gauge and an arm connected to ground potential with said arm adapted to be moved in response to changes in the fuel level of an associated tank for controlling said gauge to indicate said level, a bimetal switch, a first coil for controlling said bimetal switch and connected between the other end of said rheostat and said 5 volt supply and energized to a degree dependent on the position of said arm and the fuel level in said tank, for closing said bimetal switch only if said first coil is energized to a predetermined value, and a second coil controlled by said bimetal switch for causing said lamp to be lighted to alert said operator only in the event said second coil is energized for a predetermined time period.

2. An alarm system for use in operating a 12 volt lamp from a 12 volt battery to alert a motor vehicle operator of a depleted fuel condition with said 12 volt battery being adapted to control a bimetal switch to normally supply 5 volts to one or more bimetal gauges including a fuel gauge, the improvement comprising a rheostat having one end connected in circuit with said fuel gauge and an arm connected to ground with said arm adapted to be moved in response to changes in the fuel level of an associated tank for controlling the resistance in circuit with said gauge and thereby indicate the level of said fuel, a first bimetal switch, a coil connected between the other end of said rheostat and said 12 volt battery and energized thereby to a degree dependent on the fuel level in said tank for operating said bimetal switch only if said level falls below a predetermined value, a second bimetal switch, and a second coil energized in response to the operation of said first bimetal switch by said first coil, and adapted to operate said second switch only if said second coil remains energized for a predetermined time period to thereby light said lamp and alert said operator.

3. The alarm system claimed in claim 2 in which both said bimetal switches comprise a single bimetal lamination.

4. The alarm system claimed in claim 2 in which both said bimetal switches comprise a single E-shaped bimetal lamination with said coils being mounted on a respective end leg and said bimetal lamination being supported only from the end of the center leg opposite the back leg.

5. An alarm system for use in operating a 12 volt lamp from a 12 volt battery to alert a motor vehicle operator of a depleted fuel condition, the improvement comprising a rheostat having one end connected to a 5 volt source through a fuel gauge and an arm connected to ground with said arm adapted to be moved in response to changes in the fuel level of an associated tank for controlling said gauge to indicate said condition, a coil connected between the other end of said rheostat and a desired supply voltage and energized to a degree on the position of said arm and therefore the fuel level in said tank for closing a set of contacts if said level falls below a predetermined value, and a second coil controlled by said set of contacts for causing said lamp to be lighted to alert said operator only if said set of contacts remain closed for a predetermined time period.

6. An alarm system for use in operating a 12 volt lamp from a 12 volt battery to alert a motor vehicle operator of a depleted fuel condition, the improvement comprising a rheostat having one end connected to a 5 volt source through a fuel gauge and an arm connected to ground with said arm adapted to be moved in response to changes in the fuel level of an associated tank for controlling said gauge to indicate said condition, a coil connected between the other end of said rheostat and said 12 volt battery and

energized to a degree dependent on the position of said arm and therefore on the fuel level in said tank for enabling said lamp to light only if said level falls below a predetermined value.

No references cited.

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