

[54] **CONDUCTING FLUID TYPE GRAVITY SAFETY SWITCH WITH SPIRAL CONTACTS**

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[51] Int. Cl. **H01h 35/02**

[58] Field of Search **200/61.47, 220, 233, 235**

[56] **References Cited**

UNITED STATES PATENTS

3,599,745 8/1971 Hughes 200/61.47 X

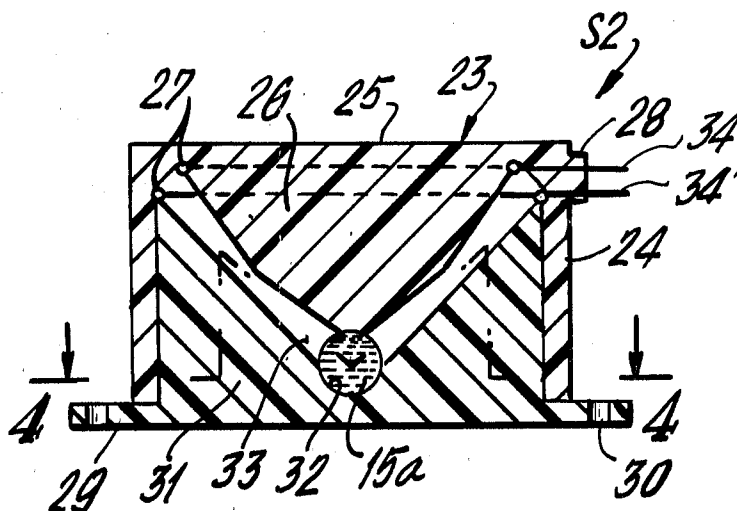
1,858,191 5/1932 Hadley et al. 200/61.47
1,688,217 10/1928 Whalen 200/233
3,227,866 1/1966 Peters et al. 200/61.47 X

Primary Examiner—James R. Scott

[57] **ABSTRACT**

An improved gravity operated switch includes a movable electrically conductive member in a housing normally on a central seat when in a normal horizontal position out of the circuit. When the housing is tilted, the movable conductive member moves out of the seat to bridge a pair of fixed spaced electrical contacts in an associated electrical circuit to control the flow of fuel to the engine of the vehicles, ignition, or other engine control components. The switch has particular utility in engine powered vehicles, such as tractors.

8 Claims, 9 Drawing Figures



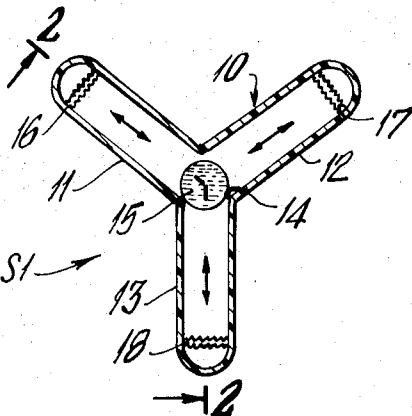


FIG. 1

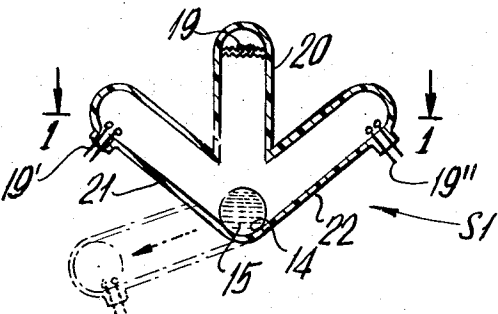


FIG. 2

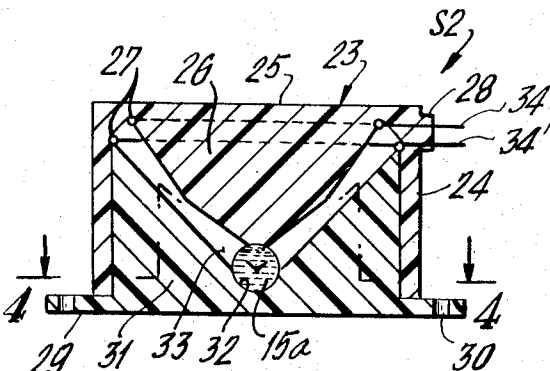


FIG. 3

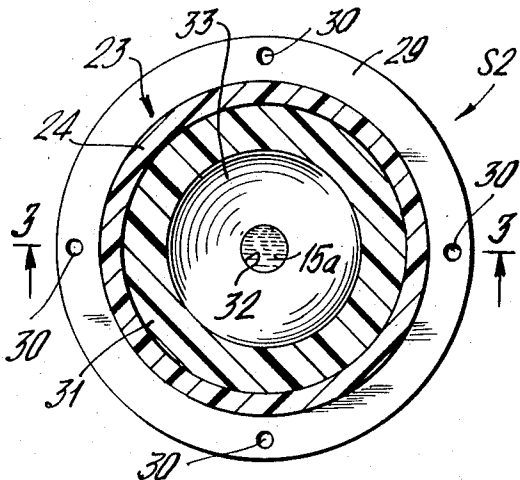


FIG. 4

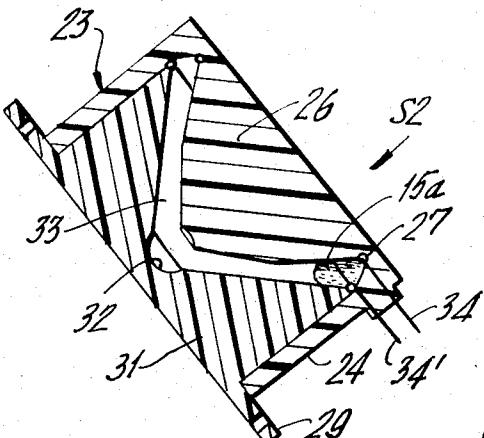


FIG. 5

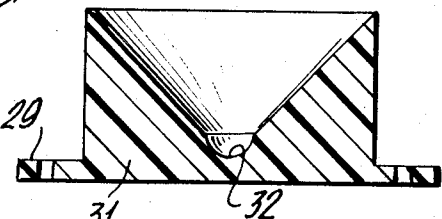
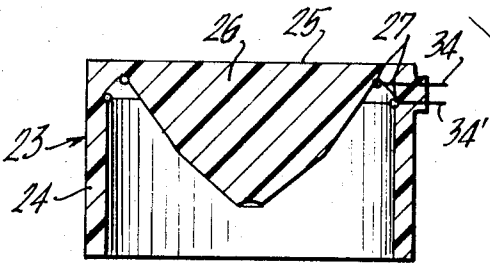


FIG. 6

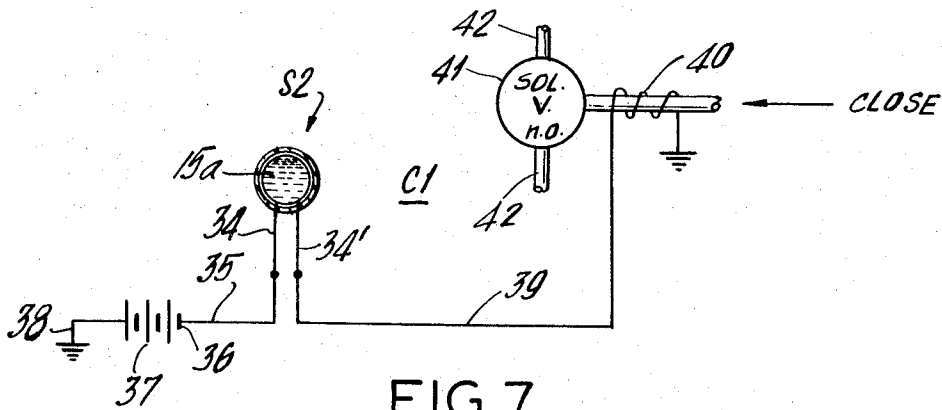


FIG. 7

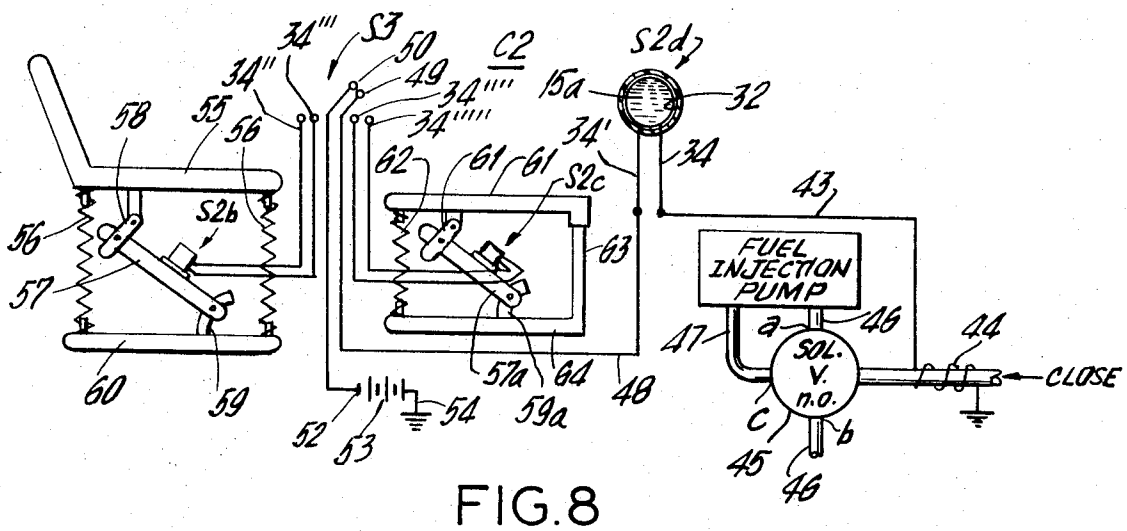


FIG. 8

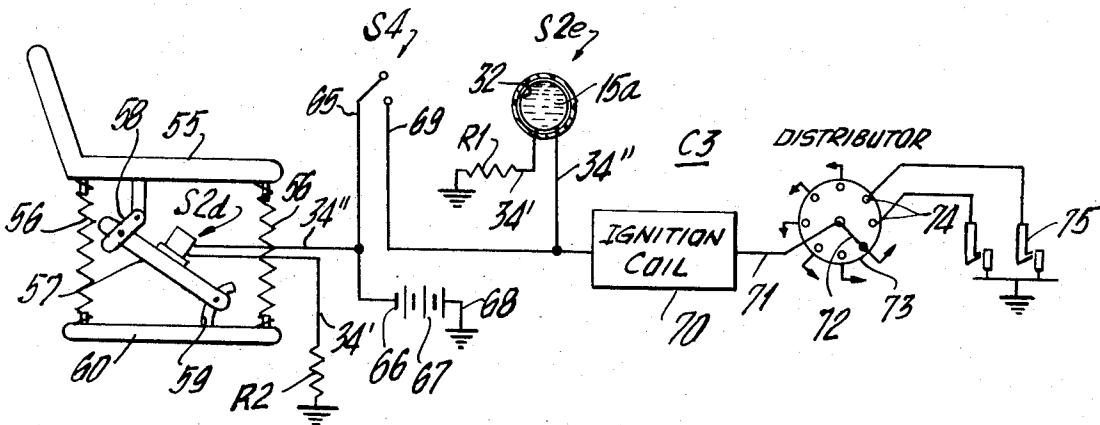


FIG. 9

CONDUCTING FLUID TYPE GRAVITY SAFETY SWITCH WITH SPIRAL CONTACTS

IMPROVED GRAVITY SAFETY SWITCH

The improvements relate to the construction and the function of my U.S. Pat. No. 3,599,745, also to the teaching of prior art, such as taught by Hadley et al, U.S. Pat. No. 1,858,191, and others who taught having a switch with a movable electrical member in a housing bridging a pair of fixed spaced contacts, connected to an outside external control circuit closed being bridged by the globule while the switch is in a normal horizontal position. When tilted beyond a predetermined angle, the globule would move off the contacts opening the circuits. It was also taught when the above circuit was open by the movement of the globule, the globule would move to bridge a pair of spaced fixed contacts in the same switch connected to an associated control circuit to close this last named circuit in an effort to control the fuel supply, and or ignition, when employed on an engine on a machine. When employed in the above manner the engine will misfire due to vibration of the engine, and when the machine is traveling on rough surfaces which causes the globule of mercury to bounce and move off the contacts momentarily causing the misfire.

The main object of this invention is to correct the above faults by having a mercury globule out of the circuit when in a normal operating position, when tilted this globule will move to bridge the contacts in the switch to close the circuit, thereby controlling the flow of fuel to the engine, ignition or other engine control components.

Another object is to stabilize the globule by having a superficial amalgam, a mixture of silver or gold dust making the globule more stable, and by having a spiral contact points that flex with the globule when bridged to give better contact during vibration.

Another object is to have a safety switch to protect all vehicles, tractors, cars, trucks, snowmobiles, beach buggies and the like, and such as power mowers, both the riding and the push type to ground the ignition when tilted, to prevent the engine starting while changing the blade, etc., to prevent an accident.

Another object is to have switches constructed so that engine vibrations, and traveling on rough surfaces will seldom, if ever, cause the globule to bounce to bridge the contacts momentarily, by having strictures, and having the wings and the travel space from the central region to the outer contact points the proper length.

The invention will be explained in further detail in conjunction with the drawings.

FIG. 1 is a sectional view taken substantially on line 1—1 of FIG. 2 of a first switch embodiment of the invention with the wings slanting upward about 40° from horizontal.

FIG. 2 is a side view taken substantially on line 2—2 of FIG. 1, dotted lines shows the wing in a tilted position with an amalgamated globule of mercury bridging the pair of contacts.

FIG. 3 is a vertical section view taken substantially on line 3—3 of FIG. 4 illustrating a second switch embodiment of the invention.

FIG. 4 is a horizontal cross sectional view taken on line 4—4 of FIG. 3.

FIG. 5 is a similar view of FIG. 3 showing the second switch in a tilted position with space globule travel having a stricture formed by the protruding dome.

FIG. 6 is a vertical sectional view similar to that of FIG. 3 showing the two parts of the second switch separated, to be fitted together and sealed.

FIG. 7 shows a first circuit employing a gravity switch protecting a vehicle by cutting off fuel supply of its engine.

FIG. 8 shows a second circuit employing a gravity switch for protecting a vehicle employing a diesel engine for power by cutting off its fuel supply.

FIG. 9 is a diagram of a third circuit employing a gravity switch to control the ignition of the engine of a vehicle.

Referring first to FIGS. 1 and 2 there is shown a switch S1 having a housing 10 made of hermetically sealed insulative material and formed with three tubular wings 11, 12, 13. The wings axially slant upward from a common intersection forming a pocket seal 14 in a central region in which is normally seated a fluid globule 15 consisting of mercury and silver dust or granules making a superficial amalgam. A pair of spiral fixed spaced electrical contacts 16, 17, 18 are in the tips of wings 11, 12, 13. These contacts are provided with electrical leads 19', 19'' which extend outward of the projections 20, 21, 22 formed in the bottom of the wing tips. The switch is in a normally horizontal position when all of the wing tips are horizontal. If the switch is tilted beyond a predetermined angle as illustrated by dotted lines in FIG. 2, the amalgamated mercury globule rolls out of pocket seat 14 and into one of the wings to bridge the contacts therein. If an electrical circuit is connected externally to leads 19', 19'', the pairs of contacts 16, 17, 18 of this circuit will be closed when globule 15 bridges any one of the contacts 16, 17, 18. If the switch is connected as illustrated in FIGS. 7, 8, 9 to any of the circuits C1, C2, C3, this will control the flow of fuel to the engine of the vehicle, ignition, or other engine control components. Other wings could be added if desired and strictures in the tubular wings could also be added.

Switch S2 is shown in FIGS. 3—6. It has a hermetically sealed somewhat cylindrical housing 23, formed with a cylindrical outer housing 24 having a dome or a top part 25 with an inside portion protruding downward resembling inverted cone 26. Concentrically and horizontally surrounding this cone inside of housing 24 is a pair of spaced fixed concentric electrical conductive ring contacts 27 to which leads 34, 34' are connected and extend out of projection 28. A circular flat base 29 with mounting holes 30 completes the enclosure. On the base inside is an elevated table 31 formed with a concaved conical seat 32 on which globule 15a is normally seated. A conical travel space 33 is formed, having a stricture between the dome 25 and seat 32 for globule 15a to travel to bridge contacts 27 when tilted beyond a predetermined angle. If leads 34, 34' are connected to an external circuit the circuit will be closed, closing off the flow of fuel to the engine, ignition or activating other engine control components.

FIG. 7 shows schematically how an improved gravity switch S2 can be connected in a control circuit C1 for protecting a vehicle.

In switch S2 globule 15a is normally on seat 32. One lead 34 is connected to line wire 35 which terminates at terminal 36 of battery 37. The other terminal 38 of

the battery is grounded at its terminal 38 of coil 40. The other lead 34' of switch S2 is connected to lead wire 39 connected to coil 40 of a normally open solenoid valve 41 terminating at the ground. If the vehicle tilts to an unsafe angle globule 15a will move to bridge contacts 27 closing the circuit. This will energize coil 40 to close valve 41 to close off the fuel supply through fuel line 42 to the engine of the vehicle which will stop the engine. The engine can be re-started when the switch resumes a normal horizontal position. Switch S1 can be substituted for switch S2 to obtain the same results. There are no on-off switches in this circuit C1 which can be used on most vehicles.

FIG. 8 shows how switch S2a can be used for protecting a vehicle employing a diesel engine.

In circuit C2 employing gravity switch S2a, globule 15a is normally disposed on seat 32. One lead 34 is connected to line wire 43 which in turn is connected to coil 44 of a solenoid operated valve 45. The valve is located in the fuel supply line 46 to the engine if the vehicle ports a and b are normally open. When energized port b is closed to close off fuel to the engine, port c is opened to by pass drain line 47 leading back to main line through port a that remains open, releasing the fuel pressure and thereby stopping the engine. The other lead 34' of S2a is connected to line wire 48 and to terminal 49 of switch S3, a double pole double throw selector switch. This switch gives the operator a choice to sit or to stand. The other terminal 50 of selector S3 is connected to line wire 51 which terminates at terminal 52 of battery 53. The other terminal 54 is grounded at its terminal of coil 44. Underseat 55 is supported by springs 56. On bar 57 is gravity switch S2b in a tilted position. Bar 57 is pivotally mounted on brackets 58 to seat 55 and also to bracket 59 on base 60. Switch S2c leads 34', 34'' are terminally connected to selector switch S3. Foot switch S2c is pivotally mounted on bar 57a on bracket 58a under treadle 61 supported by spring 62 and pivot end 63 on base 64 and bracket 59a in a tilted closed position. Leads 34'', 34''' terminate at selector switch S3, thereby connecting switches S2a and S2b in parallel to wires 48 and 51 and to switch S2a in series with coil 44. The driver closes selector switch S3 to energize the circuit and sits on seat 55 thereby de-energizing the circuit which is now in a normal operating position. If the vehicle tilts excessively at an unsafe angle globule 15a will bridge contacts 27 to close the circuit energizing coil 44 to close off the fuel supply to the engine which will then stop. The engine can be re-started when the vehicle resumes a normal position. The same results occurs if the driver leaves seat 55 or if the driver selects the foot switch S2c and removes his foot from treadle 61. Selector switch S3 should be opened when the driver leaves the vehicle to prevent battery rundown. Switch S1 could be substituted for S2a, S2b or S2c to obtain the same result. Solenoid valve 41 in circuit C1 could be substituted for solenoid valve 45 in circuit C2, with the same result.

FIG. 9 shows another circuit C3 which is arranged to cut off power from the ignition when the vehicle tilts at a dangerous angle. Seat switch S2d is identical to switch S2a in circuit C2, the parts being numbered identically. Seat 55 is mounted on springs 56 and switch S2e is secured pivotally on bars 57 by bracket 58 to seat and bracket 59 to base 60. The foot switch could also be used in this circuit C3 as shown in circuit C2. Seat switch S2e is disposed in an axially tilted position. Lead

34'' is connected to resistor R2 and is grounded while lead 34 is connected to line wire 65 which is connected to on-off switch S4. Line wire 65 terminates at terminal 66 on battery 67 while the other terminal 68 of the battery is grounded at its terminal and spark plug 75. Line wire 69 is connected to on-off switch S4 and to the ignition coil 70 of the vehicle engine. The high voltage output line 71 of coil 70 is connected to rotary contact 72 of distributor 73 and contacts 74 are connected to spark plugs 75 of the engine. Lead 34' of switch SP is connected to resistor R1 and is grounded and lead 34 is connected to line wire 69. The resistors R1, R2 should have an ohmic value as to the resistance of the circuit to protect the circuit wire when grounded from over heating.

If the vehicle tilts excessively at an unsafe angle, globule 15a will move to bridge contacts 27 to close the circuit. This will ground the circuit and de-energized it to stop the engine. This engine can be restarted when the vehicle resumes a normal horizontal position. Other circuits are obvious to those skilled in the art such as connecting line wire 69 from the ignition coil of circuit C3 of FIG. 9 to line wire 39 in circuit C1 of FIG. 7 on a vehicle employing power from an ignition engine to control the fuel and ignition. When tilted beyond a safe operating angle, globule 15a will bridge contacts 27 to close the circuit energizing coil 40 of valve 41 to shut off the fuel supply to stop the engine. This will ground the ignition through coil 40. It would also stop the engine; hence, a double safety feature.

Another circuit using S2 is to connect one lead 34 at any point of an ignition circuit with grounded lead 34' to stop the engine when tilted. Fuses, triper fuses, circuit breakers, relay, time-delay relays, could be used, arranged to open the ignition circuit when the switch is tilted or inverted in an upset to cut-off the fuel supply and open the ignition circuit to stop the engine and prevent a possible fire. While but certain preferred embodiments of the invention are shown it will be apparent that the invention is capable of further variations and modification without departing from the scope of the invention as defined by the claims appended hereto.

What is claimed is:

1. An improved gravity switch combination for protecting a vehicle subject to tilting at an unsafe operating angle, comprising in combination: a housing mountable in a fixed position on said vehicle; an external circuit; said housing including a lower insulative base member with a slanted multi-U shaped groove configuration having a central recess or seat portion and an upper complementary cover member containing a fixed contact array disposed on the base member in operative relationship such that a flowable globule may bridge the fixed contact array at a desired position; an electrically conductive fluid globule flowable down an incline by gravity, normally seated on said seat portion; each of said groove configuration having a distal end receivable of said globule; a pair of electrically conductive spaced fixed contact elements in each of said distal ends connectable in said external circuit, whereby said external circuit is closed when bridged by said globule, thereby responsive to predetermined degrees of tilt the engine ignition and other electrical components being controllable as a safety feature.

2. A switch combination of claim 1, in which said distal ends are connected to said external circuit opera-

tively, and in which said contact elements are each flexible and of spiral shape providing sufficient flexibility for engagement with said globule when the globule is in a bridged position.

3. A switch combination of claim 2, in which said fluid globule includes mercury and other electrically-conductive metal granules in a predetermined stabilizing amount.

4. A switch combination of claim 3, in which said housing base member includes said multi-U shaped groove configuration shaped in a ray-configuration of radially outwardly-extending grooves from the central recess or seat, such that the globule moves by pull of gravity to bridge the contacts of at least one of the grooves when the housing is tilted in any direction the predetermined number of degrees of tilt.

5. A switch combination of claim 4, in which said external circuit includes a solenoid coil structure operatively closable of a fuel supply-line valve of an automobile engine, the coil structure being operatively connected to said contact elements such that the coil becomes energized when said globule bridges said contact

elements.

6. A switch combination of claim 5, in which the external circuit includes an ignition circuit operatively connected to break circuit when the globule bridges the contacts and to re-establish circuit when thereafter the globule moves-off the contacts.

7. A switch combination of claim 6, further including a second external circuit comprising the foot and seat circuit having a solenoid coil arranged to close a fuel line supply to an engine of a vehicle, and being operatively connected to said contact elements such that the second external circuit's solenoid coil is energized when said globule bridges said contact elements and is de-energized when the globule moves-off the contact elements.

8. A switch combination of claim 7, in which said second external circuit is operatively arranged such that when said globule bridges said contacts the circuit thereof is grounded and is thereafter de-energized when said globule is no longer ground-bridging the contacts.

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