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SAFETY SWITCH

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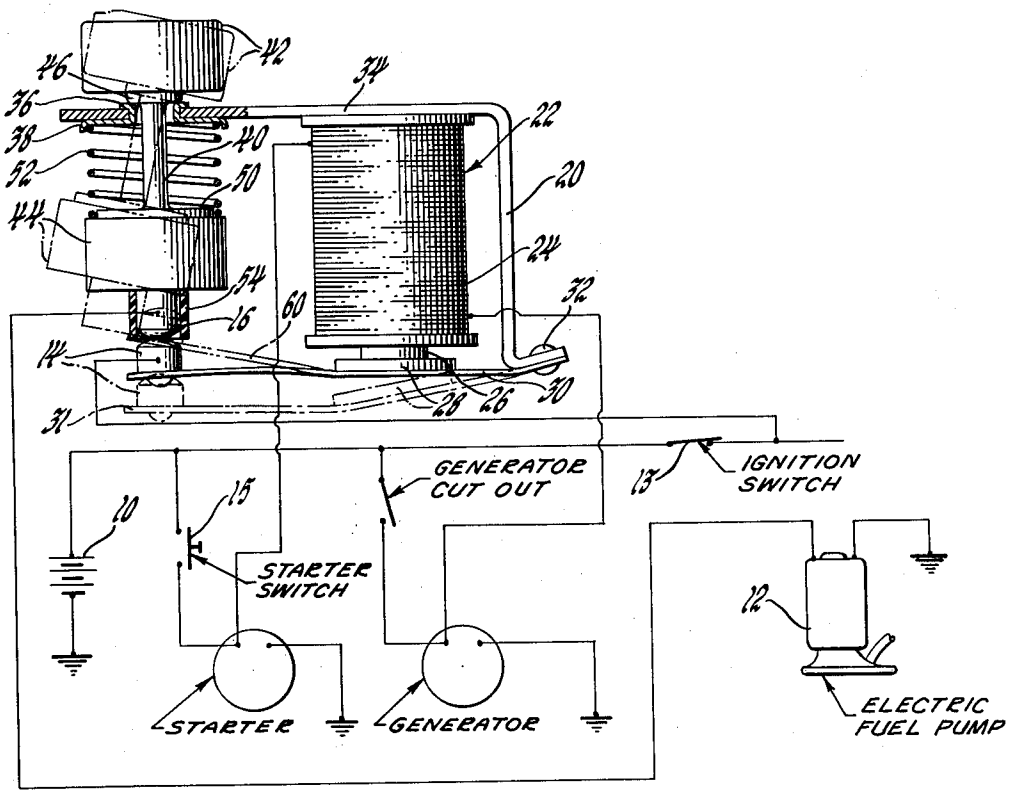


Fig. 1

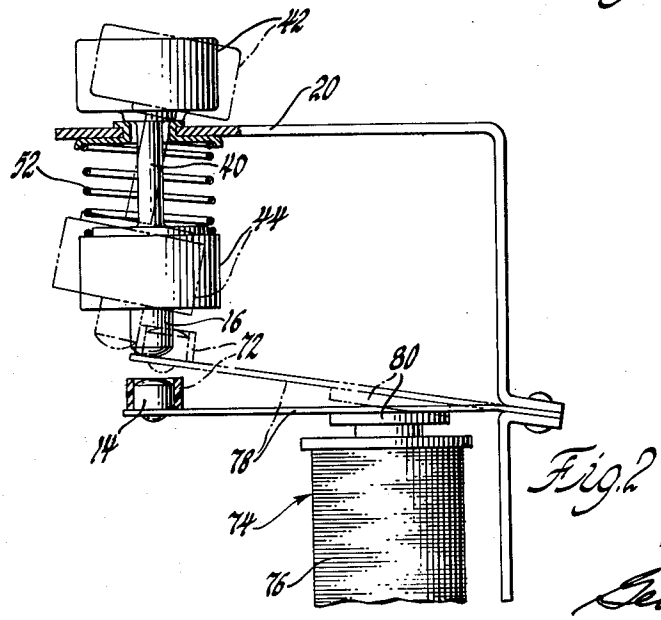


Fig. 2

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SAFETY SWITCH

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This invention relates to switches and more particularly to safety switches rendered inoperable by gravitational force, inertia or momentum.

The users of motorized vehicles constantly indicate a desire for an increase in electrical equipment in acquiring new vehicles. As an example, electric fuel pumps have come into wider use. This particular use poses a problem—i.e., in the event of vehicle collision or upset an electric fuel pump must not continue pumping gasoline. Whether it be a fuel pump or some other electrical accessory being operated, it is clear that the circuit supplying that accessory should be opened automatically in the event of a sudden stop as occasioned by a collision or the overturning of a vehicle and that circuit should not be closed again until the operator desires operation of that accessory or takes a deliberate step to that end. Mere righting of an upset vehicle should not close the circuit.

An object of the present invention is to provide an improved safety relay switch which is simple and low in cost and which will automatically serve to open an electric circuit when sudden force is applied because of vehicle upset or collision necessitating resetting of the switch before the circuit can be closed again.

A feature of the present invention is a single pole switch having two contacts normally in a path of alignment and adapted to complete a circuit and subject to abnormal misalignment by force until deliberately reset. Another feature is a switch having two contacts adapted to close a circuit with one of the contacts being pendulum mounted and subject to movement to break contact and alignment with respect to the other, means being provided to restrain the contacts from closing the circuit until alignment of the contacts is deliberately effected.

These and other important features of the invention will now be described in detail in the specification and then pointed out more particularly in the appended claim.

In the drawings:

FIGURE 1 depicts a switch as one embodiment of the present invention utilized with an electrical circuit for a fuel pump on an automobile, the circuit being shown diagrammatically and the switch being of the normally open type; and

FIGURE 2 is another embodiment of a safety switch similar to that shown in FIGURE 1 but which is of the normally closed type.

The fuel pump circuit as depicted in FIGURE 1 is more fully described in the United States patent application Serial No. 4,440, filed January 25, 1960, now Patent No. 2,989,644, in the name of Werner F. Schultz, and entitled "Safety Systems for Electric Fuel Pumps." Details regarding the circuit are not given here as the circuit forms no part of the present invention but a casual inspection of the circuit will show that operation of the fuel pump **12** is by current derived from a battery **10** when the ignition switch **13** is closed. The circuit to the pump to cause the latter's operation is also through two contacts **14** and **16**. When these contacts are normally open, the fuel pump must stop. The circuit is such that during running of the engine, the power supply for the pump **12** is taken from the generator or the battery depending on speed and during starting, from the battery, the shift from one to the other being automatic.

The safety switch of FIGURE 1 comprises an L-shaped bracket **20** which serves as a support for the contacts **14** and **16** as well as a solenoid generally indicated at **22** and having a coil **24**. Whenever the coil **24** of the solenoid is energized, a condition necessary for operation of the pump **12**, the core **26** of the solenoid attracts an armature **28**, closing contacts **14** and **16**. This armature is a flat piece fixed to a spring arm **30**. One end of the latter is riveted, as at **32**, to the support bracket **20**. The spring arm **30** is such that a free end thereof will be in the normally open position depicted at **31** in dot-and-dash lines in FIGURE 1 when the coil **24** is not energized. This free end carries the cylindrical contact **14**. A horizontal leg **34** of the support bracket **20** is apertured to receive a hub **36** which is integral with a dielectric circular spring end retaining plate **38**. Loosely suspended within the hub **36** to aid in forming a pendulum mounting for the contact **16** is a shaft **40**. This shaft carries weights **42** and **44** at opposite ends. The weight **42** has a shoulder portion **46** on its underside which rests on the hub **36**. The upper surface of the weight **44** bears a reduced diameter shoulder portion **50**. A coil spring **52** surrounds the rod **40** and one end rests on the underside of the plate **38** and the other end snugly fits around the portion **50**. The spring **52** is under compression tending to hold the rod **40** in a vertical position so that the contacts **14** and **16** are normally in a path of alignment. The spring action of the arm **30** is adapted to guide and urge the contact **14** along the alignment path as will further appear. The pendulum mounting of the contact **16** on the other hand permits movement of the contact **16** in the second or lateral path substantially transverse to the alignment path.

Surrounding the contact **16** and fixed thereto is a collar **54** of insulating material. This collar extends downwardly but to such an extent as not to interfere substantially with the lateral movement of the contact **16** with respect to the contact **14** as will further appear.

In starting the engine, the ignition switch **13** must first be closed. Subsequent closure of the starter switch **15** not only cranks the engine but energizes the relay coil **24** to close the contacts **14** and **16**. The pump then operates at battery voltage. When the engine runs, there is a reversal in the current in the coil **24** as the generator becomes effective. Grounding of the coil **24** is either through the generator or the starter.

In the operation of the arrangement of FIGURE 1, the energizing of the coil **24** of the solenoid **22** is accompanied by the operation of the fuel pump **12** as heretofore stated. At this time, the contacts **14** and **16** are operationally closed as positioned in full lines in the figure. Assuming, however, that the vehicle being served by the fuel pump is either upset or involved in a collision, the mass involved in the two weights **42** and **44** will cause the contact **16** to move laterally or transverse to the path of contact alignment and into a position such as depicted in dot-and-dash lines. This will separate the contacts **14** and **16** and stop the fuel pump **12** and the circuit for the pump cannot be closed again until done so deliberately whether the coil **24** be energized or not. This is because the free end of the spring arm **30** will first move upwardly to its top position. At this stage of the operation, the position of the free end of the arm **30** will be as depicted by the dot-and-dash lines at **60**. The contact **16** cannot swing back into the path of alignment with the contact **14** as the insulation collar **54** will separate the two contacts. Ordinarily, however, if the contact **16** has swung out of alignment with the contact **14** and the contacts are separated, the coil **24** becomes deenergized with the stoppage of the engine and the spring arm **30** will be released to its

position at 31. Closure of the fuel pump circuit through the contacts 14 and 16 cannot be reestablished except by the deliberate use of the starter switch or by push start. The force of impact tending to displace the contact 16 is partially counteracted by the spring 52 and the weight 42. This eliminates disconnections or breaking of the pump circuit because of any minor shocks or forces. For upset, the weight 42 cooperates with the weight 44 in separating the contacts.

In the switch arrangement of FIGURE 2, a supporting bracket 20 is employed to support the contact 16 with a pendulum mounting as in FIGURE 1. An insulating collar 72, which is similar to the collar 54, is employed in this particular embodiment but it is mounted surrounding the lower contact 14. The collar extends upwardly an adequate distance to insure no meeting of the two contacts when they are out of the path of alignment but does not extend sufficiently to interfere with lateral movement of the contact 16 necessary for breaking the circuit. A solenoid 74 utilizing a coil 76 is supported by means not shown but in this instance is located below a spring arm 78 to affect the position of an armature 80 attached midway the length of the spring arm. The switch is shown with the contacts 14 and 16 in solid lines in their aligned and operatively open positions during which the coil 76 is energized. The normally closed position of the contact 14 is effected by virtue of spring action by the spring arm 78 when the contact 16 is in the alignment path and the coil 76 is deenergized. When impact or upset of the vehicle occurs, the contact 16 swings out, the spring arm 78 moves upwardly into the dot-and-dash line position of FIGURE 2 and the insulator collar 72 prevents reestablishment of a circuit. Before the normally closed and aligned positions of the contacts may be assumed again, coil 76 must be momentarily energized to pull the spring arm 78 downwardly and permit the realignment of the contacts by action of the spring 52 and the weights 42 and 44. With the deliberate energizing and subsequent deenergizing of the coil 76, the normally closed positions of the contacts will be had.

In each figure of the drawing the collar 54 or 72 is preferably annular so that it becomes immaterial in which horizontal direction the contact 16 may be caused to swing.

We claim:

A switch having two contacts normally in a path of alignment, a first of said contacts being movable substantially along said alignment path, the other of said contacts being movable in a second path substantially transverse to said alignment path, insulating means on one of said contacts to prevent their contact subsequent to their movements in said paths toward the intersection thereof, and solenoid actuated means associated with said first contact for moving the latter along said alignment path toward and away from said intersection whereby normal alignment of said contacts may be established.

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