June 24, 1969 F. W. MURPHY, JR., ET AL 3,452,308

MAGNETIC SWITCH

Filed Dec. 13, 1967

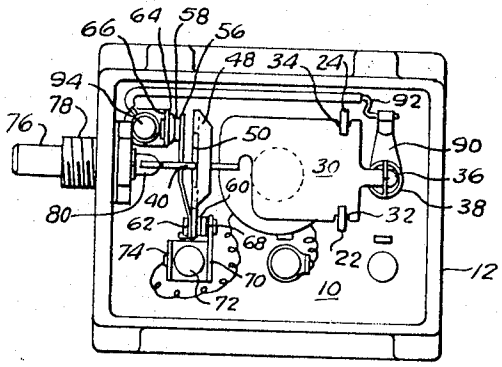


FIG. 1.

FIG. 2.

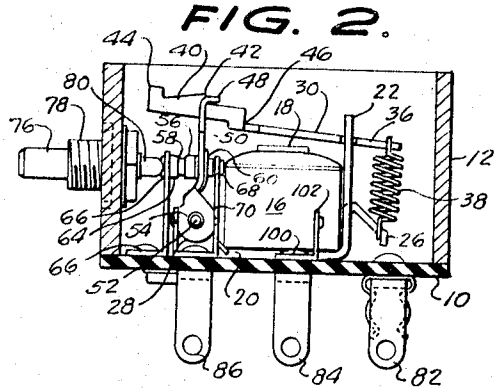


FIG. 3.

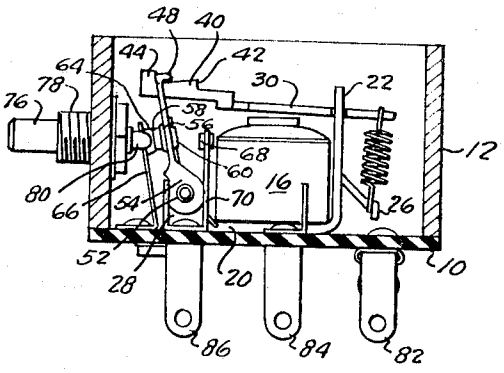


FIG. 4.

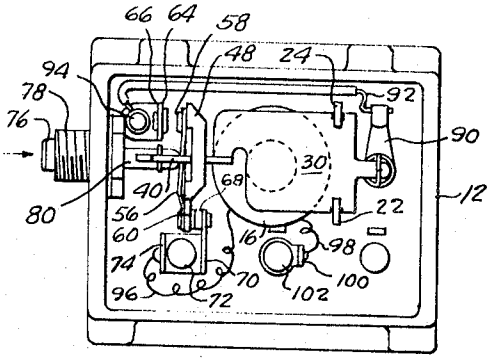


FIG. 5.

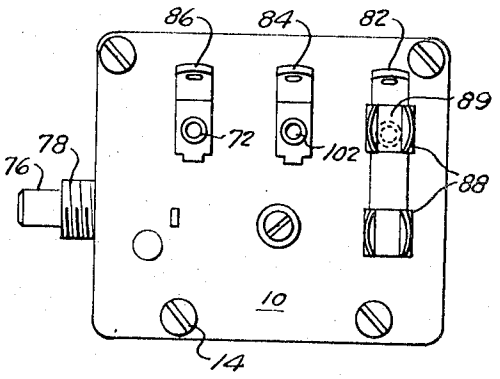
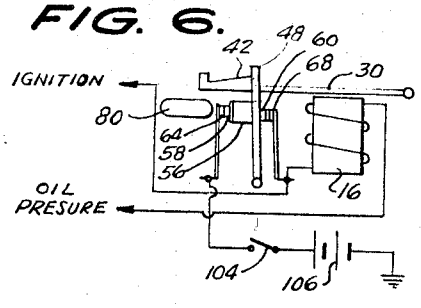


FIG. 6.



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MAGNETIC SWITCH

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5 Claims

ABSTRACT OF THE DISCLOSURE

An improved automatic magnetic safety switch for disabling engine ignition systems which includes an energizable solenoid, an armature having a detent pivotally mounted for movement by the solenoid and biased away from the solenoid, a pivotally mounted plate engageable by the detent such that when so engaged the plate is in a first position and when released upon energization of the solenoid, the plate moves to a second position, a pair of fixed contacts spaced on either side of the movable plate, a contact on the plate engageable with one fixed contact only when the movable plate is engaged by the detent and a contact carried by a resilient leaf spring carrier on the plate engageable with the other fixed contact both when the plate is engaged by the detent and when it is released from the detent, the plate being biased for movement to a second position upon disengagement of the detent and a return pushbutton which engages first the contact carrier and then moves the plate from the second position to the first position to prevent the manual disabling of the safety switch by holding the pushbutton depressed.

CROSS REFERENCE TO RELATED PATENTS

The present invention constitutes an improvement over United States Patent No. 2,467,333, Murphy et al., issued Apr. 12, 1949, and United States Patent No. 2,992,303, issued to F. W. Murphy on July 11, 1961.

BACKGROUND OF THE INVENTION

Field of the invention

The present invention relates to magnetic switches and more particularly to magnetic switches and switch systems for automatically disabling an internal combustion engine upon the occurrence of an abnormal temperature or oil pressure condition or the like.

Description of the prior art

As is described in the aforementioned patents, it is known in the prior art to provide switches which automatically disable the ignition circuit on internal combustion engines to turn the engine off when the engine overheats, when there is a low pressure condition in the oil system, or some other abnormality occurs. The particular application found most valuable for such switches is for turning off the engine when a low oil pressure condition occurs. In United States Patent No. 2,992,303, there is described an automatic safety ignition switch which in its general construction and operation is similar to that of the present invention and the disclosure of said patent is incorporated herein by the reference and reference will be made thereto for completion of the disclosure. The switch described in the last-named patent, however, has been found, after several years of commercial use, to have a number of difficulties attendant thereto. For example, it has been found that some difficulty has been encountered in adjusting the position and tensions of the leaf springs which support the contacts therein. Some difficulty has also been encountered in disconnecting the safety switch from the circuit. The most important difficulty which has occurred, however, is that it was possible to disable the protection switch and thereby destroy the effectiveness of the switch in the circuit. There have been many instances where incompetent operators in the field have refused to let the magnetic safety switch trip by jamming toothpicks into the button housing with the pushbutton partially depressed. This keeps the latching mechanism from tripping but, as the coil is an intermittent duty coil, it would also overheat the coil and destroy it. In the present invention, any time the pushbutton is depressed far enough to prevent the latch from tripping, the switch circuit is automatically disconnected. It is, therefore, an object of the present invention to provide an "idiot-proof" switch which is an improvement of the automatic safety ignition switch described in United States Patent No. 2,992,303.

SUMMARY

Without intending to limit the scope of the invention, the improved switch of this invention may be described as including an armature actuable by a solenoid, the armature having a detent thereon for engaging a plate when actuated. The plate is movable from a first position wherein it is engaged by the detent to a second position upon release by the detent and is provided with two contacts thereon. One contact is mounted directly to the plate, the other contact being mounted by means of a resilient leaf spring and is urged outwardly away from the plate. Spaced fixed contacts are positioned on either side of the plate such that one contact is in electrical contact with the carrier mounted contact when the plate is in both the first and second position and the contact fixed to the plate makes electrical connection with the fixed contact only when the plate is in the first position engaged by the detent. Upon energization, the armature releases the plate for movement and thus opens the circuit between two of the contacts. A pushbutton is provided which engages the leaf spring first and then the plate such that the plate may be returned from its second position to engagement with the detent in the first position. Whenever the pushbutton is depressed, however, it first engages the leaf spring and thereby opens the circuit through the contacts thus cutting off the electrical circuit to the coil and preventing damage or destruction thereof. Accordingly, it is a principal object of this invention to provide an improved automatic safety ignition switch.

A more specific object of the invention is to provide an automatic safety ignition switch wherein one of the contacts is resiliently carried by a movable plate, said contact being disengaged by return means before the plate is returned to its normal position.

The disclosure as shown in the drawings and described constitutes a further object of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 is a top view of the switch of this invention shown with the top of the housing removed.

FIGURE 2 is a side elevational view in partial cross section showing the switch of this invention in the housing, the plate being shown in the normal position.

FIGURE 3 is a side elevational view of the switch of this invention shown in partial cross section, the plate being shown in the abnormal or second position.

FIGURE 4 is a top plan view of the switch of this invention showing the pushbutton return member depressed for returning the plate from its abnormal or second position to its normal or first position.

FIGURE 5 is a bottom view of the switch of this invention showing the connections to the switch.

FIGURE 6 is a partial schematic view of the circuitry of the switch as applied to an ignition circuit.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The overall operation of switches of this type is described in United States Patent No. 2,992,303, the disclosure and drawings of which are incorporated at this point herein by reference.

The improvement which constitutes this invention includes a switch mechanism mounted on a base plate **10** and enclosed in a housing **12**, shown open at the top but normally being closed at the top to prevent dust and debris from entering the switch. An overall view of the housing is shown in FIGURES 1 and 2 of United States Patent No. 2,992,303.

The base plate is secured to the housing by means of screws, an example of which is shown at **14** in FIGURE 5.

The switch mechanism includes a solenoid **16** having a core **18** which is mounted on a curved metallic mounting plate which also serves as a carrier for the magnetic field of the solenoid and is shown at **20**. The plate **20**, as best shown in FIGURE 4, includes an upstanding portion having a pair of ears **22** and **24** extending upwardly and a rearwardly extending ear **26**. On the other side of the solenoid, there are a pair of upstanding mounting ears **28**, one of which is shown. Each of these mounting ears consists merely of an upstanding member with an aperture therethrough for receiving a pin as will be described hereinafter.

Mounted for movement above solenoid **16** is a movable armature **30**, the armature being mounted between the upstanding ears **22** and **24** by means of slots **32** and **34**. The armature includes a rearwardly extending finger **36** which, as best shown in FIGURES 1 and 2, is connected to the rearwardly extending ear **26** by means of a spring **38** for resiliently biasing the armature upwardly away from the solenoid. The armature also includes a forwardly extending portion **40** which includes a detent **42** and may desirably include a detent **44**. The detent **42** is designed and adapted for engaging a plate for holding the plate in a first position as will be described. The detent **44** is merely a stop and is provided for convenience but is not necessary to the operation of the invention. Preferably, the extending portion **40** is unitarily formed from the same piece as the armature by bending a portion upwardly from the armature, which is generally a plate, as indicated at **46** in FIGURE 2.

A plate **48** which includes an opening **50** through which the forwardly extending portion **40** is received, the top part of the plate being engageable by the detent, is pivotally mounted by a pin **52** which extends through the upstanding portions **28** on the plate **20** and through apertured ears **54**. Thus, the plate is pivotally mounted for movement toward and away from the solenoid and is generally perpendicular to the armature, although it will be apparent that the particular angular relationship is of no great consequence and will vary depending upon the position of the armature and of the plate.

For purposes of description, the plate and the armature will be described as having first and second positions or, alternatively, normal and abnormal positions. The first positions of both the plate and the armature, the normal positions, are as shown in FIGURE 2; that is, with the armature spaced above the solenoid and the plate engaged by the detent **42** on the armature. The second positions, the abnormal positions, of both the armature and the plate are shown in FIGURE 3 with the armature held toward the solenoid, in this case, by the engagement of the plate **48** in the detent **44**, with the plate being moved away from the armature.

A leaf spring **56** carries a first contact **58** thereon and is secured by means of a pin extending rearwardly from a second contact **60**, the pin being shown at **62** in FIGURE 1 and connecting both the leaf spring **56** and the contact **60**, respectively, to the first and second sides of the plate **48**. A fixed contact **64** is supported by a resilient upright

member **66** proximate the first side of the plate, and spaced therefrom, while a second fixed contact **68** is supported by an upright resilient member **70**, the member **70** being secured by a pin **72** through the base plate and including a terminal post **74**. The contacts **64** and **68** are referred to as fixed contacts for convenience although, according to good engineering practice, the supports are slightly resilient to permit some movement of the contacts for adjustment purposes and to make certain that electrical contact is made properly.

As shown in FIGURE 2, when the plate is in the normal or first position, the first contacts **58** and **64** are in electrical communication and the second contacts **60** and **68** are also in electrical communication. However, as best shown in FIGURE 3, when the plate is in the second or abnormal position the contacts **60** and **68** are open but the contacts **58** and **64** are still in contact.

The plate may be returned from the abnormal position shown in FIGURE 3 to the normal position shown in FIGURE 2 by means of a reciprocable member, a pushbutton, shown at **76** which is slidably received in a mounting means **78** of a conventional design as shown in the previously referred to patent. The pushbutton **76** has a smaller end **80** interior of the housing which, upon being depressed, first engages the leaf spring contact carrier **56** and upon being further depressed, the leaf spring and indirectly the plunger or pushbutton engage the plate and return it to the first position, as shown in FIGURE 4.

It is important to note that because of the arrangement of the leaf spring on the plate and the disposition of the pushbutton **76**, the leaf spring is first engaged and the contacts **58** and **64** are first separated before the plate is moved. Thus, it is impossible to return the plate to its normal or first position without first disconnecting the circuit between contacts **58** and **64**. It is this operating sequence and the construction which permits the operating sequence which constitutes the improvement of the present invention over the prior Patent No. 2,992,303.

The switch also includes first, second and third terminals **82**, **84** and **86**, the terminal **82** being connected through a fuse clip **88** for holding a fuse to protect the circuit. One terminal of the fuse clip is connected upwardly through the plate by means of a pin **89** to an interior terminal **90**, inside the housing. The terminal **90** is connected by means of a conductor **92** to a pin **94** which secures the support **66** to the base plate. Thus, a circuit is completed, when the plate is in the first or normal position, from the terminal **82** through the fuse in the fuse clip, the rivet or pin **89**, the terminal **90**, the conductor **92**, the support **66**, the contacts **64** and **58** and the carriers **56**, the contacts **60** and **68** to the support **70** and through the pin **72** to the third terminal **86**. A circuit is also completed, by the path described, from the terminal **82** through a conductor **96**, best shown in FIGURE 4, to one side of the solenoid. The other side of the solenoid is connected by a conductor **98** to a terminal post **100** and through a pin or rivet **102** to the second terminal **84**.

The switch is normally connected as described in the prior Patent No. 2,992,303, a simplified schematic diagram of such connection being shown in FIGURE 6, to which reference is made now.

The overall system in which the safety switch is utilized includes the ignition system, i.e., the coils, the distributor, the spark plugs, etc., and an oil pressure system which includes a low pressure sensing device. The system also includes an ignition switch **104** for connecting the system to a battery **106**.

In operation, when the plate is in the normal position, as shown in FIGURE 6, a circuit is completed from one side of the battery **106** through the igntion switch **104**, through contacts **64** and **58** and carrier **56** to contact **60** and thence to contact **68** where there is a connection to the ignition system and to one side of the solenoid. Thus, voltage is applied to the ignition system when the plate is in the normal position. Voltage is also applied to the

solenoid when the plate is in the normal position. The other side of the solenoid is connected to the low pressure sensor of the oil pressure system. When the low pressure sensor is actuated, that is when a low pressure condition exists, the connection is grounded thus completing a circuit to the other pole of the battery **106** through the solenoid. This energizes the solenoid and draws the armature **30** downwardly such that detent **42** no longer engages the plate **48** and the plate **48** moves away from the solenoid thus opening the contacts **60** and **68**. When the contacts **60** and **68** are open the circuit to the ignition is opened and the circuit to the solenoid is also opened. Thus, the ignition circuit is disabled and the engine is shut down and the solenoid is disabled so that it does not burn up. The solenoid **16** is what is normally referred to as an intermittent duty type solenoid and is not designed for continuous carrying of the high currents necessary to actuate the armature **30**.

It was possible with the invention described in the aforementioned Patent No. 2,992,303, for the operator to hold the button depressed thus completing a circuit to the ignition system and, simulaneously, completing a circuit to the coil and if the button were held in the depressed position for a long period of time, the solenoid would be destroyed. In the present invention, when the pushbutton **80** is moved inwardly it first contacts the carrier **56** thus opening the circuit to the solenoid and preventing continuous flow of current therethrough. In this sense, the present switch is described as an "idiot-proof" improvement of the automatic safety switch of United States Patent No. 2,992,303.

It will be apparent that while a specific embodiment has been described and a specific constructional relationship has been described and is shown in the drawings that departures may be made from the actual disclosure without departing from the spirit and scope of the claims which follow. It will also be understood that while claim **1** uses reference numerals to identify the components claimed in the combination the actual construction of the individual components and the relation of the components may be varied to some degree without departing from the scope of the claim.

We claim:

1. An improved automatic safety switch for ignition circuits of internal combustion engines for turning the engine off upon the occurrence of an abnormal operating condition which comprises:

a solenoid (**16**) for being energized upon the occurrence of an abnormal engine condition;

an armature (**30**) mounted for movement by energization of the solenoid, said armature having a normal position and an energized position and including a plate engaging member (**42**);

a plate (**48**) mounted for movement from a normal position wherein said plate is normally engaged by the plate engaging member on the armature to an abnormal position, said plate being constructed to move from the normal to the abnormal positions upon energization of the armature and consequent change in engagement of the armature plate engaging member and the plate;

a first fixed contact (**64**) secured proximate one side of the plate;

a second fixed contact (**68**) secured proximate the other side of the plate;

a first contact (**58**) mounted by a movable resilient contact carrier (**56**) on the plate for normally contacting the first fixed contact when the plate is in the normal and the abnormal positions; a second contact (**60**) on the plate for contacting the second fixed contact only when the plate is in the normal position; and

a reciprocable member (**80**) mounted such that when moved toward the plate said member contacts the contact carrier and upon further movement urges the plate toward the normal position from the abnormal position;

said first and second contacts being constructed for completing a series circuit therethrough from a battery to the engine ignition system and to one side of the solenoid, the other side of the solenoid including means for connection to an engine condition sensing means for completing a path to the opposite pole of the battery; whereby upon occurrence of an abnormal condition a circuit is completed through the first and second contacts from the battery to the solenoid and through the condition sensing means for energizing the solenoid to release the plate for movement to the abnormal position, said plate being returnable to the normal position by movement of the reciprocable member, said reciprocable member simultaneously opening the first contacts for preventing manual disabling of the safety switch.

2. The switch of claim **1** wherein:

the contact carrier is a resilient conductive leaf spring carrying the first contact proximate one end and being connected to the plate at the other end.

3. An improved automatic safety switch which comprises:

a solenoid;

an armature pivoted on one side of the armature for being moved from a first position to a second position upon energization of the solenoid;

means urging the armature to the first position;

an engaging detent on the armature;

a plate pivotally mounted generally perpendicularly to the armature, said plate including a portion engageable by the detent on the armature to hold the plate in a first position;

means urging the plate to a second position for moving the plate to the second position upon energization of the solenoid and release of the plate by the detent on the armature;

first and second fixed contacts mounted, respectively, spaced from first and second sides of the plate;

a resilient contact carrier on the first side of the plate;

a first contact on the carrier, said carrier urging the contact outwardly away from the plate normally into contact with the first fixed contact when the plate is in the first and second positions; and

a second contact on the other side of the plate, said second contact being in contact with the second fixed contact only when the plate is in the first position.

4. The switch of claim **3** further comprising:

first, second and third terminals;

first circuit means connecting the first treminal through the first and second contacts and the first and second fixed contacts to one side of the solenoid and to the third terminal; and

second circuit means connecting the second terminal to the other side of the solenoid.

5. The switch of claim **4** wherein the contact carrier comprises:

a leaf spring secured at one end to the plate and carrying the first contact on the other end thereof.

References Cited

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