This invention relates to safety switch assemblies for electrical systems in which storage batteries are used and more particularly to a safety switch assembly for a vehicle electrical system.

It is among the objects of the invention to provide an improved safety switch assembly which can be mounted in any convenient location near the batteries, as on the back side of an instrument panel, and can be operated both by remote control push buttons and automatically to interconnect and disconnect the batteries, or other source of electrical energy, and the associated wiring system, to interconnect and disconnect the energy source and the wiring system under operator control and to disconnect the energy source and wiring system under emergency conditions, such as short circuit, current overload or upset or crash of a vehicle in which the safety switch assembly may be installed, which provides a signal which is automatically operated to warn the operator that the safety switch is closed so that the system will not unintentionally be left in this condition, and which provides an auxiliary circuit around the safety switch for use to operate a device, such as a vehicle parking light, requiring only a predetermined small amount of current and will interrupt this auxiliary circuit if more than the predetermined amount of current flows through the auxiliary circuit.

Other objects and advantages will become apparent from a consideration of the following description and the appended claims in conjunction with the accompanying drawings wherein:

Figure 1 is a wiring diagram showing the device of the invention with the necessary wiring system;

Figure 2 is a side elevational view of a safety switch assembly illustrative of the invention showing the terminal side of the assembly;

Figure 3 is a side elevational view of the opposite side of the switch assembly from that illustrated in Figure 2;

Figure 4 is a top plan view of the safety switch assembly;

Figure 5 is a front end elevational view of the safety switch assembly;

Figure 6 is a terminal side elevational view of a fragmentary part of the safety switch assembly with certain parts omitted and broken away to better illustrate the construction of the assembly and particularly the switch contacts;

Figure 7 is a side elevational view of the opposite side of the switch assembly from that illustrated in Figure 6 with certain parts omitted to better illustrate the mechanical construction of the switch assembly:

Figure 8 is a longitudinal cross sectional view of an overload switch constituting an operative component of the safety switch assembly;

Figure 9 is a cross sectional view on an enlarged scale of a fragmentary portion of the switch assembly taken substantially on the line 8--9 of Figure 5; and

Figure 10 is a cross sectional view on the line 10--10 of Figure 4.

With continued reference to the drawings and particularly to Figure 1, the arrangement thereinafter illustrated shows a vehicle electrical system equipped with a safety switch illustrative of the invention. The original wiring system of the vehicle includes a storage battery 10, a generator 11, a voltage regulator 12 connected to the generator, a starting motor 13 provided with a control switch 14 and the usual wiring system including a light circuit 15, an ignition circuit 16, a horn circuit 17, a circuit 18 for accessories, such as a radio, and a voltage regulator circuit 19.

The safety switch assembly of the present invention comprises a main switch as indicated at 21, having two fixed contacts 22 and 23 and a movable contact 24 which electrically interconnects the fixed contacts 22 and 23 when the main switch is closed. The movable contact 24 of the main switch is moved into engagement with the fixed contact by a solenoid 25 and is moved away from the fixed contacts by spring means 26.

One side of the battery 10 is grounded, as indicated at 26, and the other side of the battery is connected by a battery cable 27 to the fixed contact 22 of the main switch. The fixed contact 23 of the main switch is connected to one side of the starter motor switch 16 by a cable 28, the opposite side of the switch 14 being electrically connected to the starter motor 13 and the starter motor being grounded at 29.

With this arrangement, when the main switch 21 is closed and the starter switch 14 is also closed, the starter motor will operate.

A conductor 30 is connected at one end to the cable 28 and is connected to a heater 31 for an overload switch 65 and this heater is connected to the wiring system including the circuits 15 to 19 inclusive of the original wiring.

One side of the solenoid 25 is connected to the battery connected fixed contact 22 through the conductor 32, the fuse 33 and the conductor 34, and the other side of this solenoid is connected through a remote control push button switch 35, hereinafter referred to as the "on" button, to
ground at 36 so that the solenoid 25 will be energized when the "on" button 35 is momentarily closed.

Referring now to Figures 2, 9 and 10, the solenoid 25 is mounted on a hollow base 37 and the solenoid housing consists of the fixed contacts 42 and 23, the movable contact 24 of the main switch, and springs 25 for urging the main switch to open position. A lever 38 is pivotally connected at one end to the base 37 adjacent one end of the solenoid 25 by the hinge butt 39 and 40 secured to the lever 38 and the hinge pin 41 extending through these hinge butts and through registering apertures in the opposite side walls of the base 37. A connecting rod 42 projects from the solenoid and is connected at its outer end to the lever 38, and a bracket 43 secured to the base 37 at the side of the lever 38 remote from the solenoid 25 carries an adjustable stop screw 44 for limiting movement of the lever 38 in a direction away from the solenoid.

A frame 45 is supported on the side of the housing of the solenoid 25 opposite the base 37 and a bracket 46 extends from the end of this frame adjacent the lever 38 in a direction away from the solenoid 25. A movable armature 47 is pivotally mounted intermediate its length on the outer end of the bracket 46 and carries a hook or dog 48 disposed at the side of the bracket 46 adjacent the lever 38. A bar 49 of electrically insulative material is secured to the lever 38 at the distal end of the lever and extends beyond the distal end of the lever toward the dog 48. A seat plate 50 is carried by the bar 49 electrically insulated from the lever 38 and this plate extends outwardly of the end of the bar 49 remote from the lever 38 and has on its outer end a seat formation 51 engageable by the dog 48 to releasably latch the lever 38 in position to hold the main switch closed. A tension spring 52 is connected between the plate 48 and the bracket 46 to resiliently urge the dog into latching engagement with the seat plate 50 and a weight 53 is mounted on the seat plate at the outer end of the bar 49 to increase the inertia of the assembly including the lever 38, the bar 49, the seat plate 50 and the weight 53.

The bar 49 is adjustably secured to the lever 38 for adjusting the engagement between the dog 48 and the seat formation 51 of the seat plate 50. With this arrangement, the "on" button 35 can be momentarily closed to close the main switch and then the button may be released. The main switch will then be maintained in closed position by the latching of the lever carried seat plate 50 by the dog 48 so that it is not necessary to maintain the solenoid 25 energized in order to maintain the main switch closed. This not only eliminates a drain on the battery but also prevents overheating of the solenoid 25 and other disadvantageous results.

An electromagnet 54 is mounted on the frame 45 at the side of the bracket 46 opposite the lever 38 and is positioned adjacent the armature plate 47 so that when the electromagnet 54 is energized it will move the armature 47 against the force of spring 55 and release the dog 48 from the seat plate 50 allowing the main switch to open under the influence of the spring 25' provided for this purpose. One side of the electromagnet 54 is connected to the battery through conductors 56, 57, switch 56 and conductor 69 extending in the manner mentioned in the frame 45. The switch 56 is automatically closed by the lever 39 when the main switch is closed, as is clearly illustrated in Figure 2, so that the one side of the electromagnet 54 will be connected to the battery only when the main switch is closed. The other side of the electromagnet 54 is connected through conductors 61, 62 and 63 to one side of a remote control push button switch 64, the opposite side of which is grounded at 66.

After the "on" button 35 has been closed to close the main switch and latch the main switch in closed position, the "off" button 64 may be closed to release the latch and permit the main switch to open. A thermostatic overload switch 65 is interposed between the conductor 61 and the ground at 66 to cause the main switch to open in the event of the above described circuit being subjected to overload current. This switch 65 is operated by the heater 61. A crash switch 67 is connected between the conductor 62 and the ground at 66 so that the electromagnet 54 will be energized to release the main switch to open in the event of an accident to the vehicle equipped with the switch assembly of the present invention.

A relay and contact 70 is mounted on the armature 47 and electrically insulated therefrom. This switch is connected at one side to the conductor 65 through a conductor 71 and is connected at its opposite side to a conductor 72 and is closed when the main switch 21 is open and opened when the main switch 21 is closed. The conductor 72 leads to one side of an overload switch 73, the other side of which is connected to one side of an overload coil 74. A conductor 75 leads from the opposite side of the coil 74 to one side of a remote control switch 76 the other side of which is connected to the relay switch 70. The relay and contact 70, the overload switch 73, the overload coil 74, the conductor 76, the remote control switch 76, the conductor 75, and the fuse 77 constitute an auxiliary circuit for supplying current to a parking light or equivalent device when the main switch 21 is open. The parking light circuit is not specifically illustrated but constitutes a part of the original wiring system of the vehicle.

The overload coil 74 is wound for a predetermined small current and will operate to open the overload switch 73 and interrupt the auxiliary circuit if this current is exceeded by adding further circuits than the parking light circuit to the auxiliary circuit or by a short circuit in the auxiliary or parking light circuits. Overload switch 73, when opened, will remain opened until reset by the closing of the main switch 21 in the manner described above.

As illustrated in Figures 2 and 8, the overload switch 73 comprises a flat spring 78 of hairpin shape mounted at one end on a supporting plate 79 of electrically insulative material and carrying a contact 80 on its opposite end. A contact 81 complementary to the contact 80 is mounted on a bracket 82 secured to a standard 83 which projects upwardly from the frame 45 and carries one of the contacts of the relay and switch 70. Two spaced apart apertured ears 84 and 85 are disposed between the two sides of the spring 78 and are carried at one end of a bar 86 secured to that side of the spring 78 which is in turn secured to the support 79. The bearing ears 84 and 85 are provided with aligned apertures from the fuse 77 is journaled in these apertures. A cam 88 is mounted on the shaft 87 between the two sides of the spring 78 and is normally positioned to
force the contact carrying side of this spring away from the fixed side of the spring and hold the contact 90 in engagement with the contact 91. A crank 93 is secured to one end of the shaft 87 and projects radially therefrom into the path of a plunger 93 which projects from the armature 91 of the overload coil 74 toward the crank 89. When the overload coil 74 is energized this armature is moved in a direction to bring the plunger 90 into contact with the crank 89 and turn the shaft 87 so that the cam 98 is moved in a direction to permit the contact 90 and 91 to separate.

A second crank 92 projects from the end of the shaft 87 in a direction substantially opposite to that of the crank 93 and a second shaft 93 is journaled in apertured bearing ears 94 and 95 which extend upwardly from the frame 45 at spaced apart locations thereacross. The shaft 93 carries at one end an arm 96 the outer end of which is engageable with the outwardly turned end portion 91 of the crank 92. A radially extending arm 96 is mounted on the other end of the shaft 93 (see Figure 7) and a link 98 connects the outer end of this arm 96 to the bar 45 at the outer end of the latter.

With this arrangement, if the overload coil 74 is energized and moves the crank 93, to open the overload switch 73, when the solenoid 25 is energized to reclose the main switch 21, the consequent movement of the lever 38 swings the outer end of the bar 45 toward the shaft 93 and the link 99 causes this shaft to turn through a partial rotation. When this occurs, the arm 96 moves at its outer end against the outer end of crank 92 rotating the shaft 87 a sufficient amount and in the process the cam 98 to its position closing the overload switch 73. As the switch 70, which is in series with the overload switch 73, is opened when the main switch 21 is closed, the short circuit or other condition causing overload in the auxiliary circuit will not cause any trouble when the main switch is closed since the auxiliary switch is opened by the switch 76 when the main switch is closed.

The main terminal 109 of the generator 11 is connected through a conductor 101 to the voltage regulator 12 and the voltage regulator is connected through a conductor 120 with one side of the switch 104, the other side of which is connected by a conductor 105 to the field terminal 102 of the generator. When the switch 104 is closed the generator will operate and when the main switch 21 is opened, the switch 104 will also open and the generator cannot operate.

As particularly illustrated in Figure 3, the switch 104 comprises a flat spring structure 108 of hairpin shape having one side secured to the frame 45 and its other side bearing at its free end a contact 107. A complementary contact 108 is mounted on the free end of a hairpin shaped spring 109, the other end of which is secured to the frame 45. A pair of spaced apart bearing ears 110 is disposed between the two sides of the spring 108 and provided with aligned apertures. A shaft 111 is journaled in these apertures and carries a cam 112 which, in one position, maintains the conductive engagement of the points 107 and 108 and in another cam position, permits no conductive engagement with each other. The shaft 111 is provided at one end with a crank which is engaged by the end of link 99 remote from the lever carried bar 48. The arrangement is such that when the main switch 25 is closed the generator controlling switch 104 is also closed, and when the main switch is opened the generator controlling switch is also open. The operation of the switch 104 is such that when the main switch 21 is open and the generator is electrically disconnected from the battery 16, the output of the generator will be disconnected so that the engine will not operate when the main switch 21 is open and the voltage regulator points will not be damaged.

Returning now to Figure 1, a conductor 112 leads from the switch 53 to one side of a condenser 113 the opposite side of which is grounded at 114. A conductor 115 leads from the conductor 112 to one side of a push button switch 135 the opposite side of which is connected through conductor 117 to a signal device 116, such as a buzzer. This buzzer is connected through conductors 118 and 119 to two switches 123 and 121 operated by the front doors of the vehicle in a manner such that each of these switches 129 and 121 is open when its corresponding front door is closed, and closed when the corresponding front door is open. These door operated switches are connected in parallel between the buzzer 116 and the ground at 122 and 122.

With this arrangement, each of the door operated switches 120 or 121 is closed by opening the corresponding door while the main switch 21 and the switch 53 are closed, the buzzer 116 will sound indicating to the operator of the vehicle that the main switch is closed.

Push button switch 135 is normally closed and can be momentarily opened by the operator to discontinue operation of signal 116 if one of the front doors is opened while the main switch is closed.

A manually operated switch 123 is connected at one side to the conductor 118 through a conductor 124 and is connected at its opposite side to the conductor 61 through the conductor 62. The conductor 91 is connected to the same side of the electromagnet 58 to which the "off" push button 54 is connected. If either one of the door switches 120 or 121 is closed with switch 123 also closed, the above indicated side of the electromagnet 54 will be connected to ground through the closed door switch to complete the energization circuit of the electromagnet and release the main switch.

Thus, when the switch 123 closed the main switch will be automatically opened upon opening either of the doors associated with the door switches 120 and 121.

The safety switch assembly is provided with a terminal panel 125 receiving the wires by which the various devices, described above, are connected to the safety switch assembly. The body 126 indicates a supporting structure for the safety switch assembly, such a structure being a bracket or equivalent support mounted on the vehicle instrument panel or some other structural part of the vehicle. The base 31 is provided with outwardly projecting apertured ears 127 through which bolts 128 extend to secure the safety switch assembly to the bracket or other supporting structure.

The clock 20 is connected at one side to the conductor 66 through a conductor 129 and fuse 130 mounted on the terminal panel, and is connected at its opposite side to ground at 181 by a conductor 132.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiment is, therefore, to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the
appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are, therefore, intended to be embraced therein.

What is claimed is:

1. A safety switch assembly comprising a main switch for connection between a source of electrical energy and an associated wiring system, a solenoid connected to said main switch for closing the latter, said main switch being spring urged to open position, a push switch connected to said solenoid for energizing the latter to close said main switch, means releasably latching said main switch in closed position, an electromagnet disposed adjacent said latching means to release said main switch to open, a second push button switch connected to said electromagnet for energizing the latter, a generator control switch, means operated by said latching means opening said generator control switch to render the associated generator inoperative when said main switch is open, an auxiliary circuit connected across said main switch, a coil operated overload switch in said auxiliary circuit effective to open said auxiliary circuit when subjected to current above a predetermined amount of current, a signal device connected with said main switch and a signal switch connected to said signal device to energize the latter if said signal switch is closed while said main switch is closed.

2. A safety switch assembly comprising a main solenoid switch for connection between a source of electrical energy and an associated wiring system, a first push button switch connected to said solenoid switch to close the latter when said first push button switch is momentarily closed, means releasably latching said solenoid switch closed, an electromagnet connected to said means for releasing said solenoid switch to open when said electromagnet is energized, and a second push button switch connected to said electromagnet for energizing the latter when said second push button switch is momentarily closed.

3. A vehicle safety switch assembly comprising a main solenoid switch for connection between the battery and the associated wiring system of an automotive vehicle, a first push button switch connected to said solenoid switch to close the latter when said first push button switch is momentarily closed, means releasably latching said solenoid switch closed, an electromagnet connected to said means for releasing said solenoid switch to open when said electromagnet is energized, and a second push button switch connected to said electromagnet to energize the latter when said door operated switch is closed.

4. A safety switch assembly for connection between the battery and the associated wiring system of a vehicle comprising a main solenoid switch connected between the battery and the wiring system, a first push button switch connected to said solenoid switch to close the latter when said first push button switch is momentarily closed, means releasably latching said solenoid switch closed, an electromagnet connected to said means for releasing said solenoid switch to open when said electromagnet is energized, a second push button switch connected to said electromagnet for energizing the latter when said second push button switch is momentarily closed, and an auxiliary circuit extending around said main switch for energizing parking lights when said main switch is open.

5. A vehicle safety switch assembly comprising a main solenoid switch for connection between the battery and the associated wiring system of an automotive vehicle, means connected to said solenoid switch to close the latter, means releasably latching said solenoid switch in closed position, an electromagnet connected to said means for releasing said solenoid switch to open when said electromagnet is energized, means connected to said electromagnet for energizing the latter, and an auxiliary circuit extending around said main switch for energization when said main switch is open, said auxiliary circuit including in series a relay switch closed when said main switch is open and open when said main switch is closed, an overload switch and a remote control switch.

6. A safety switch assembly comprising a main solenoid switch for connection between a source of electrical energy and an associated wiring system, a first push button switch connected to said solenoid switch to close the latter when said first push button switch is momentarily closed, means releasably latching said main switch closed, an electromagnet connected to said means for releasing said main switch to open when said electromagnet is energized, means electrically connected to said main switch and a signal switch connected to said signal device to energize the latter if said signal switch is closed while said main switch is closed.

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