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F. Y. TAYLOR ET AL 2,481,176

SAFETY SWITCH ARRANGEMENT FOR VEHICLES

Filed April 29, 1947

2 Sheets-Sheet 1

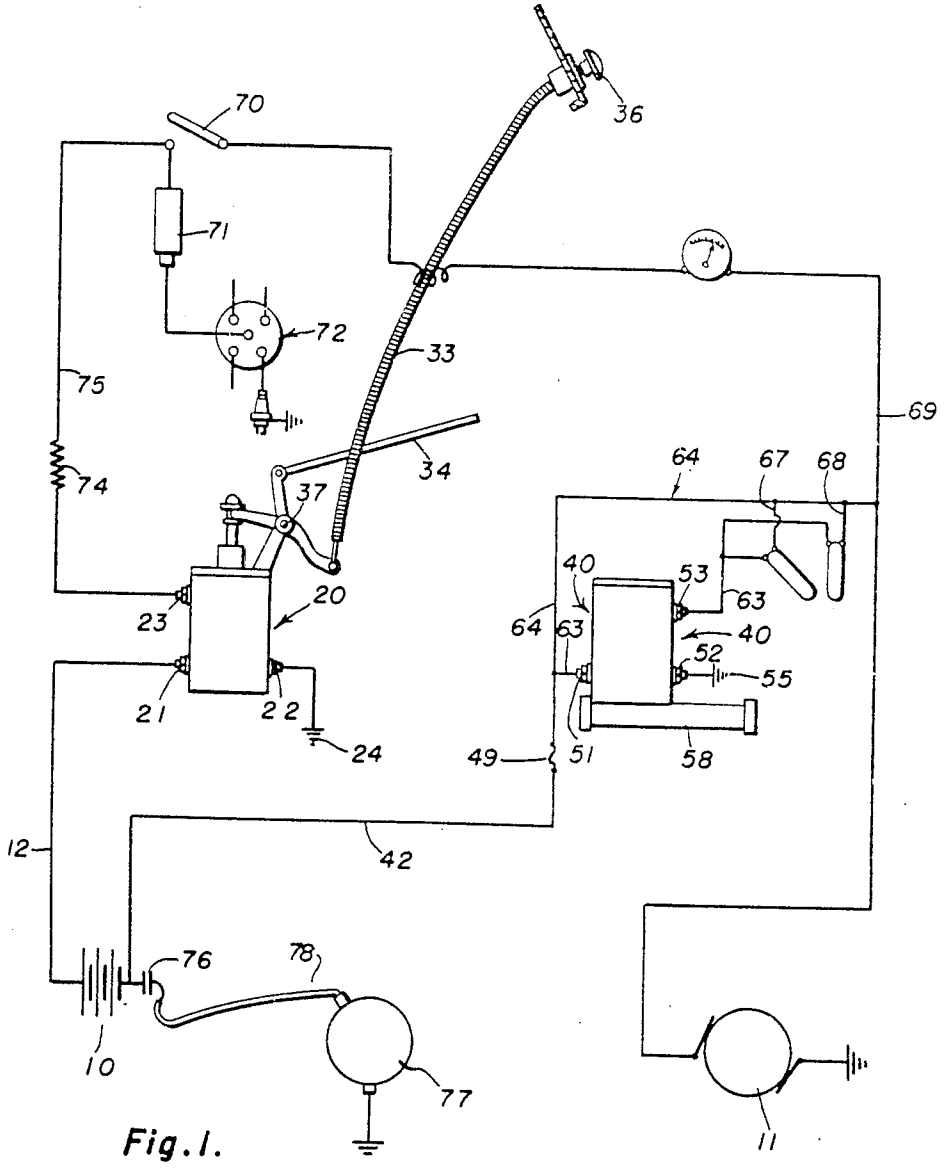

Fig. 1.

Inventors

Frank Y. Taylor

Charles C. Taylor

By Clarence A. O'Brien and Harvey B. Jacobson

Attorneys

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2 Sheets-Sheet 2

Fig. 2.

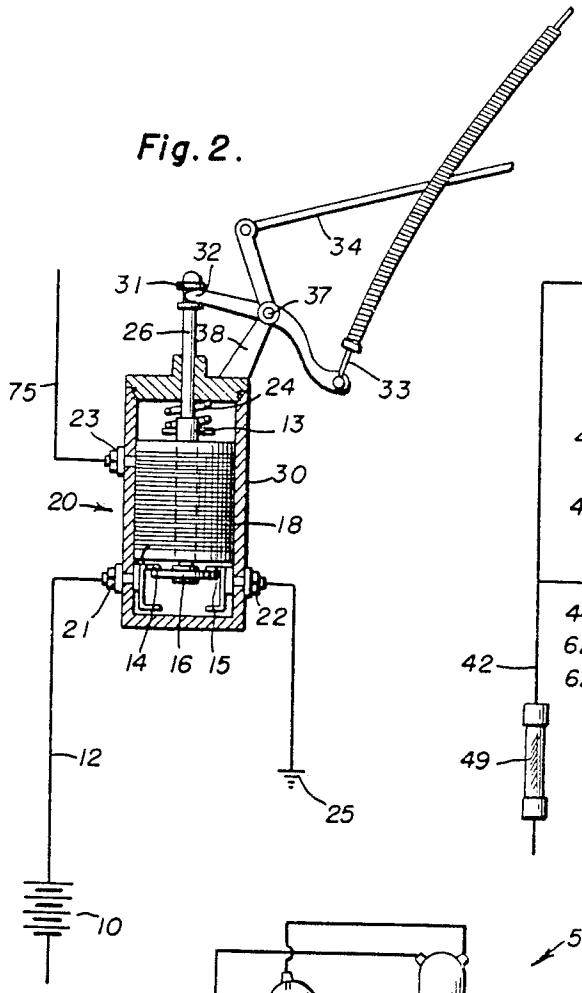
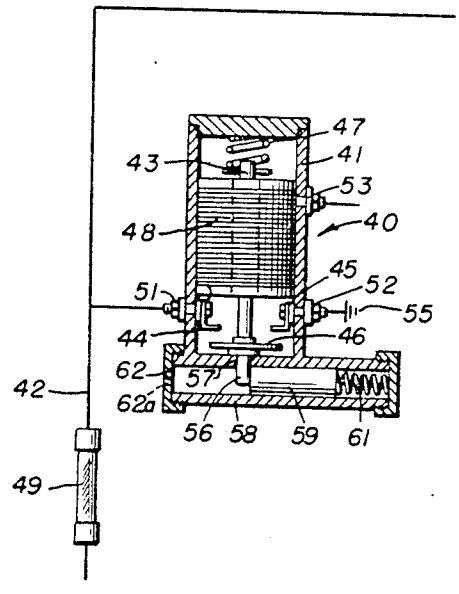


Fig. 3.



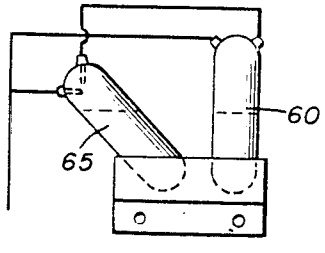


Fig. 4.

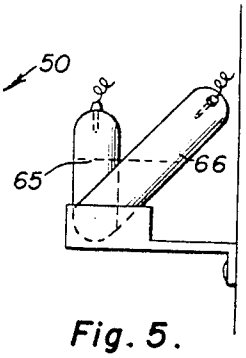


Fig. 5.

Inventors

Frank Y. Taylor

Charles C. Taylor

By Clarence A. O'Brien and Harvey B. Jacobson

Attorneys.

Patented Sept. 6, 1949

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SAFETY SWITCH ARRANGEMENT FOR VEHICLES

Frank Y. Taylor, Deadwood, and Charles C. Taylor, Huron, S. Dak.

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7 Claims. (Cl. 171—97)

1

This invention relates to safety arrangements for automobiles and it has for its main object to provide devices and arrangements by means of which the current is completely cut off as soon as the car is subjected to certain abnormal conditions, usually occurring in connection with an accident, in which an arc or spark generated in some part of the electric circuit may start a fire. Collisions, overturning of the car or dangerous inclinations in any direction cause, as a rule, flooding of some areas within the car with gas and the main source of danger in such a case is an arc or spark produced in the electric circuit either through a rupture due to the accident itself or to the stress to which the structure and the cables and connections attached to it are submitted by the abnormal position of the car. It is therefore desirable that in abnormal positions of the car or in the event of concussions or the like due to a collision the current be cut out completely and can only be restored by hand manipulation.

It is therefore an object of the invention to make the flow of current through the circuit dependent on devices which will permit the flow of current as long as no abnormal position or concussion will occur but which will be operated positively and cut out any flow of current in the event of such abnormal position or concussion.

A further object of the invention consists in providing an arrangement in which the above named devices are held in their safety position in which the current has been cut, after having once being operated and can only be restored to their normal position by hand.

A further object of the invention consists in producing an irreversible cut out operation, such for instance as the melting of a fuse, to be performed, so as to render the cutting out of the current independent of accidental shifting or of movements of parts which may be due to the accident itself.

A further object of the invention consists in providing means of cutting off the battery from its so-called ground or main connection so as to render it ineffective.

A further object of the invention consists in providing a special current operated means for the cutting off of this ground connection which may therefore also be made responsive to the closing of the ignition switch, so that the battery will be cut off completely when the ignition switch is opened.

A further object of the invention consists in providing a special mechanically operated means

2

for closing the so-called ground connection of the battery for starting purposes.

Further objects will be apparent from the following detailed specification.

The invention will be more readily understood when described with reference to the accompanying drawings illustrating one embodiment thereof by way of example. It is to be understood, however, that this example is not the sole embodiment and that the specification does not contain an enumeration or indication as to possible modifications, but explains the principles on which the invention is based. Modifications are therefore not necessarily departures from the essence of the invention.

In the accompanying drawings:

Figure 1 is a diagrammatic view of the arrangement and of the connections.

Figure 2 is a sectional elevational view of one of the solenoids forming part of the arrangement.

Figure 3 is a sectional elevational view of a second solenoid forming part of the arrangement.

Figures 4 and 5 are diagrammatic elevational views at right angle to each other of mercury switches forming part of the arrangement.

In the example which has been illustrated 10 is the battery and 11 is the current generator of the type in common use. The battery 10 is connected with ground lead 12, leading to "ground" or to the chassis forming the return conductor, which contains two fixed solenoid switch contacts 14, 15 adapted to cooperate with a movable bridging contact 16 carried by the core 13 of a solenoid coil 18 (Figure 2) of a solenoid switch 20. The switch 20 is preferably housed within a closed casing 30. It is provided with three terminals or binding posts 21, 22, 23, two of which (21, 22) are connected with the fixed switch contacts 14, 15 while the third contact is connected with one end of the coil 18. The other end of said coil is connected with one of the switch contacts 14.

When the movable core 13 is drawn into the coil it bridges the contacts 14 and 15. When the current is interrupted the core falls back under the influence of a spring 24 which may or may not be assisted by gravity.

It will be seen that when core 13 falls back upon deenergization of the coil, the connection of the battery with "ground" 25, or with the structure forming the return conductor, is interrupted. Moreover the coil 18 itself is cut out and no further closure of the connection between conductor 12 and ground 25 can occur, even if the breaking

of the energizing circuit of the coil should not be of a permanent character.

In order to connect the contacts 14 and 15 again by means of a bridge piece 16 mechanical means have to be used as shown in Figure 2. The stem 26 of the core projects outwardly and carries a collar 31 cooperating with a pawl 32. Said pawl may be operated by a Bowden wire 33 or by a foot operated wire or rod 34. The Bowden wire may be connected with the start button or may be provided with a separate button 36 located so closely to the start button that it may be operated conjointly with the start button. The depression of the Bowden wire 33 lifts the pawl 33 which is for instance fulcrumed at 37 on a bracket 38 projecting from housing 30.

The second battery lead 42 includes a fuse 49 which is capable of carrying the load current for all the apparatus with which the battery is connected, but which melts under the influence of a short circuit current.

The battery lead 42 is moreover connected with a second solenoid switch 40 of a construction similar to that of solenoid switch 20. It comprises a casing 41 surrounding a coil 48 which acts on a movable core 43 carrying a bridge contact 46. This core cooperates with the two fixed contacts 44, 45 and is normally urged away from these contacts by a spring 47. The contacts 44, 45 are connected with binding posts 51, 52 mounted on casing 41. One of said contacts 45 is connected with a grounded line 55 (or the structure forming the return conductor).

The core 43 is provided with a stem 56 which projects into and enters a casing 58 through an opening 57. When in its normal position (shown in Figure 3) this stem 56 holds a plunger 59 within the casing which is under the influence of a spring 61 urging it towards the other end of the casing. When the core 43 is moved by the coil 48 the stem 56 is retracted and spring 61 pushes the plunger 59 towards the end of the casing.

The stem 56 cannot re-enter the casing any more as it now rests on the plunger 59 and therefore, once the core has been attracted, the contact 46 cannot move away from contacts 44 and 45.

In order to reset the apparatus either the closure device 62 has to be unscrewed from casing 58 and the plunger has to be pushed back or a wire (not shown) which may be provided on or near said closure device may be inserted through the hole 62a (shown in dotted lines) in order to push the plunger 59 back and to return it into its normal position.

The coil 48 of the solenoid switch 40 is connected at one end with one of the fixed contacts (44) and on the other end with a special terminal or binding post 53.

The lead 42 has two branches 63 and 64 arranged in parallel. The branch 63 which includes the coil 48 also includes a group 50 of mercury switches. This group contains a number of switches 65, 66, two of which are shown, the inclination of which towards the horizontal is preferably adjustable. In the example shown one switch is inclined in a longitudinal direction and the other in a transverse direction. Both are inclined at a desired angle which corresponds to an angle larger than the angle which the car may be permitted to assume against the horizontal and which is considered as safe. The mercury switches are of the customary construction and are provided with two contacts at one end and with any desirable quantity of mercury. The two switches

are connected in parallel and are arranged on the two branches 67, 68.

These two branches join the two parallel conductors 63 and 64 and are in their turn connected with the line 69 leading from the generator 11 which contains the ignition switch 70 from which the ignition coil 71, the ignition device 72 and all other lines leading to apparatus operated by current branch off. The switch 70 is moreover connected with lead 75 which may contain a suitable resistance 74 to limit the amount of current flowing through this branch and leads to terminal 23 connected with one end of coil 18.

It will be clear from the preceding description that when the car is tilted either in a longitudinal or in a transverse direction beyond the angle which may be tolerated or is overturned or when a severe concussion, due to a collision or the like occurs, the mercury in one of the switches 65, 66 will bridge the switch contacts and a current will flow over the branch 63 which is normally idle and through coil 48. As soon as a current flows over the coil 48 of switch 40, the core 43 is moved against the action of spring 47 and contact 46 bridges the contacts 44, 45 and is permanently held in this position by plunger 59. Even if the current flow ceases after a short while (as will be the case when the car has righted itself again to a certain extent or when a collision occurred) the contacts 44, 45, will remain bridged by contact 46.

As will be clear from Figures 1 and 3 the bridging of the contacts 44, 45 short-circuits the battery 10 and a current of excessive amperage will flow through conductor 42 thereby melting the fuse 49. This cuts off current completely. The solenoid switch 20 which is normally energized when the ignition switch 70 has been closed over lead 12, coil 18, lead 75, lead 69 and conductors 64 and 42 is thereby deenergized and the core 13 of this switch moves downwardly (in Figure 2) and interrupts the connection of the battery 10 with ground 25 on the structure providing the return. The battery is thereby completely disconnected.

This state will also be the state of the connections of switch 20 when the ignition switch has been turned off. Under normal conditions, however, when none of the mercury switches has been operated the position of the solenoid switch 40 will be the position shown in Figure 2, and the fuse 49 in lead 42 will be conducting. To start the car the starter button is pressed after closing the ignition switch 70 as usual. Thereby the starter contacts indicated at 76 are closed. Simultaneously also button 36 (which may be connected or not connected with the starter button) is pressed. The core 13 is thereby lifted, the battery lead 12 is grounded at 25, the starter 77 receives current over cable 78 and starts the engine. Simultaneously current flows over 42, 49, 64, 69, 70, 75, 74 and 23 over coil 18 this circuit being closed by conductor 12. When button 36 is a separate button the core may be moved by the wire 34 leading to a foot pedal.

It will be clear that the specific construction of the various devices is not of material influence provided the function as explained is not affected thereby and therefore a changed construction of the device need not necessarily affect the invention as defined in the annexed claims.

We claim:

1. A safety arrangement for cutting off the current in all operational circuits of a vehicle in the case of an accident, comprising a source of current, a connection with ground on one side of

the source of current, maintained closed during normal operation of the operational circuits of the vehicle, a first solenoid switch controlling the said ground connection and maintaining it closed and operative when energized, a conductor leading from the source of current to the operational circuits of the vehicle, a second ground connection leading from the aforesaid conductor and maintained open during normal operation of the operational circuits of the vehicle, a fuse in said conductor between said ground connection and the source of current, a second solenoid switch controlling the last named ground connection, closing the same and making it operative upon energization of the said second solenoid switch, an energizing circuit for the first named solenoid switch connected with the operational circuits of the vehicle and maintaining the said first solenoid switch closed while a flow of current is maintained to said operational circuits, an energizing circuit for the second solenoid switch, branching off from the aforesaid ground connection and conductor, and gravity operated switches in the energizing circuit of the second solenoid switch closing the energizing circuit of the said second solenoid switch when an inclined position of the vehicle exceeds a predetermined limit, the energizing of the second solenoid switch producing a short circuiting, a melting of the fuse, an interruption of the current flow to the operational circuits and thereby to the energizing circuit of the first solenoid switch, which in its turn cuts the ground connection of the source of current which is thus disconnected on both sides.

2. A safety arrangement for cutting off the current in all operational circuits of a vehicle in the case of an accident, comprising a source of current, a connection with ground on one side of the source of current, maintained closed during normal operation of the operational circuits of the vehicle, a first solenoid switch cntrolling the said grund connection and maintaining it closed and operative when energized, a conductor leading from the source of current to the operational circuits of the vehicle, a second ground connection leading from the aforesaid conductor and maintained open during normal operation of the operational circuits of the vehicle, a fuse in said conductor between said ground connection and the source of current, a second solenoid switch controlling the last named ground connection closing the same and making it operative upon energization of the second solenoid switch, an energizing circuit for the first named solenoid switch connected with the operational circuits of the vehicle and maintaining the said first solenoid switch energized while a flow of current is maintained through said operational circuits, a manually operated mechanism for bringing said first solenoid switch into a position in which the first named ground connection of the source of current is closed, said mechanism being operated at the starting of the operation of the operational circuits, an energizing circuit for the second solenoid switch, branching off from the aforesaid ground connection and conductor, and gravity operated switches, in the energizing circuit of the second solenoid switch, closing the energizing circuit of the said second solenoid switch when an inclined position of the vehicle is adopted, exceeding a predetermined limit, the energizing circuit of the second solenoid switch producing a short circuiting of the source of current to ground, a melting of the fuse, and interruption of the current flow through the operational circuits and to the energizing circuit of the first solenoid switch which in its turn cuts off the ground connection of the source of current which is thus disconnected on both sides.

3. A safety arrangement for cutting off the current in all operational circuits of a vehicle in the case of an accident, comprising a source of current, a connection with ground on one side of the source of current, maintained closed during normal operation of the operational circuits of the vehicle, a first solenoid switch controlling the said ground connection, and maintaining it closed and operative when energized, a conductor, leading from the source of current to the operational circuits of the vehicle, a second ground connection leading from the aforesaid conductor and maintained open during normal operation of the operational circuits of the vehicle, a fuse in said conductor between said ground connection and the source of current, a second solenoid switch controlling the last named ground connection, closing the same and making it operative upon energization of the second solenoid switch, an energizing circuit for the first named solenoid switch, connected with the operational circuits of the vehicle and maintaining the said first solenoid switch closed, while the flow of current is maintained through said operational circuits, a manually operated mechanism for bringing said first solenoid switch into a position in which the first named ground connection with the source of current is closed, said mechanism being operated at the start of the operation of the operational circuits, an energizing circuit for the second solenoid switch, branching off from the aforesaid second ground connection and conductor and gravity operated switches in the energizing circuit of the second solenoid switch closing the said energizing circuit of the said second solenoid switch when an inclined position of the vehicle exceeds a predetermined limit, a mechanical locking device for said second solenoid switch holding the same mechanically and permanently in the position in which the second ground connection is closed, after interruption of the current flow to the energizing circuit of the second solenoid switch, the energizing of the second solenoid switch producing a short circuit of the source of current to ground, melting of the fuse, and interruption of the current flow to the operational circuits and thereby an interruption of the current flow to the energizing circuit of the first solenoid switch which, in its turn, cuts the ground connection of the source of current which is thus disconnected on both sides.

4. A safety arrangement for cutting off the current in all operational circuits of a vehicle in the case of an accident, comprising a source of current, a connection with ground on one side of the source of current maintained closed during normal operation of the operational circuits of the vehicle, a first solenoid switch, provided with a movable core member and with switch contacts, closable upon movement of the movable core, said first solenoid switch controlling the said ground connection and maintaining it closed and operative when energized, and moved to an operative position, a conductor, leading from the source of current to the operational circuits of the vehicle, a second ground connection leading from the aforesaid conductor and maintained open during normal operation of the operational circuits of the vehicle, a fuse in said

conductor between said second ground connection and the source of current, a second solenoid switch controlling the last named ground connection closing the same and making it operative upon energization of the said second solenoid switch, an energizing circuit for the first named solenoid switch, connected with the operational circuits of the vehicle and maintaing the said first solenoid switch closed, while the flow of current is maintained through the said operational circuits, a manually operated mechanism for moving said movable core member into its operative position, said mechanism including a lever, fulcrumed near said core, and operatively connected with said core, a member controlled by hand arranged within reach of the driver of the vehicle, and a flexible member leading from said hand controlled member to said lever for moving the same, thereby moving said core into its operative position.

5. A safety arrangement for cutting off the current in all operational circuits of a vehicle in the case of an accident, said vehicle being provided with a starter, controlled by a starter button, as claimed in claim 4, wherein the hand controlled member is arranged close to and is operable conjointly with said starter button.

6. A safety arrangement for cutting off the current in all operational circuits of a vehicle in the case of an accident, comprising a source of current, a connection with ground on one side of the source of current, maintained closed during normal operation of the operational circuits of the vehicle, a first solenoid switch, controlling the said ground connection and maintaining it closed and operative, when energized, said solenoid switch including a casing, a solenoid coil, a solenoid core moving within the coil, return means for moving the core in one direction opposed to the direction of movement imparted by the coil, two contact members arranged at opposite sides of the casing and of the core, a contact disk on said solenoid core, bridging said contacts, one of said contacts being connected with the source of current and with one end of the solenoid coil, the other contact being connected with ground, a conductor leading from the source of current to the operational circuits of the vehicle, a second ground connection leading from the aforesaid conductor, and maintained open during normal operation of the operational circuits of the vehicle, a fuse in said conductor between said ground connection and the source of current, a second solenoid switch controlling the last named ground connection, closing the same and making it operative upon energization of the said second solenoid switch, said second solenoid switch including a casing, a solenoid coil, a solenoid core within said coil, return means for moving said core in a direction opposed to the direction of movement imparted to it by the coil, two contacts arranged on opposite sides of the casing and of the core, a contact disk, bridging said contacts, one of said contacts being connected with the ground and the other with the connection, leading to the conductor connecting the source of current with the operational circuits, the latter contact being also connected with the coil, an energizing circuit for the first named solenoid switch, connected with the operational circuits of the vehicle and

with the end of the coil, not connected with the contact members of the first said solenoid switch, and maintaining the first solenoid switch closed while a flow of current is maintained through said operational circuits, a manually operated mechanism for moving said solenoid core into its operative position, said mechanism including a lever, fulcrumed near said solenoid core on the casing and operatively connected with the said solenoid core, a member controlled by hand, arranged within reach of the driver of the vehicle, and a flexible member leading from said hand controlled member to said lever, for moving the same and for moving said solenoid core into its operative position, an energizing circuit for the second solenoid switch branching off from the aforesaid second ground connection and conductor and connected with the second end of the solenoid coil of the second solenoid switch, and gravity operated switches in the energizing circuit of the second solenoid switch, closing the energizing circuit of the said second solenoid switch when an inclined position of the vehicle exceeds a predetermined limit, a mechanical locking device for said second solenoid switch, holding the same mechanically and permanently in the position adopted upon energization in which the second ground connection is maintained closed after interruption of the current flow to the energizing circuit of the second solenoid switch, said second solenoid switch producing a short circuiting of the source of current to ground, a melting of the fuse, an interruption of the current flow of the operational circuits, and thereby an interruption of the current flow of the energizing circuit of the first solenoid switch, which in its turn cuts the ground connection and the source of current, which is thus disconnected on both sides.

7. A safety arrangement for cutting off the current in all operational circuits of a vehicle in the case of an accident as claimed in claim 6, wherein the second solenoid switch is provided with a chamber containing a spring pressed plunger adjacent to the casing of the solenoid switch, said casing being provided with an aperture, a projection of the solenoid core passing through said aperture into the chamber and holding the spring pressed plunger when the aforesaid second solenoid switch is de-energized, said plunger moving across the aperture, preventing return of the solenoid core and holding the same in its position upon withdrawal of the core projection from the chamber through energization of the said second solenoid switch.

FRANK Y. TAYLOR.
CHARLES C. TAYLOR.

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