ABSTRACT OF THE Disclosure

A time delay relay is used in a seat operated safety circuit for interrupting the ignition system of a vehicle engine. A transistor is used in conjunction with the time delay relay and means are employed to positively disconnect the transistor from the power source when the relay is opened, even though the ignition switch at the operator's station is left on. The means employed include a bridging circuit with a diode between the starter and ignition circuits which are operable to initially energize the time delay relay.

This invention relates to a seat operated safety system with time delay to prevent disabling the vehicle when the seat is vacated for a short period of time.

Heretofore others have suggested seat operated safety devices of various types, including mechanical and electrical devices. At least one such electrical prior art device suggests the use of a mechanical time delay mechanism to prevent operation of the seat operated switch (for disabling the ignition circuit) long enough to permit cranking of the vehicle engine by hand or delivery of goods by a deliveryman. Electric time delays for various applications have been suggested heretofore to prevent operation of cutoff switches when a member, whose movement is sensed to operate the safety device, is momentarily shifted.

In the present invention, an electrical time delay is incorporated in a seat operated ignition cutoff safety system, which employs a transistor in the cutoff relay. In order to prevent current flow through the transistor after opening of the cutoff switch, the relay circuit is not connected to the ignition circuit on the battery side of the cutoff relay, instead the relay circuit, with its transistor, is connected to the starter circuit through a diode to effect initial energization (closing) of the cutoff relay when the operator is seated upon the starter switch being closed. The seat switch is placed in the base circuit of the transistor and thus may be of small capacity and inexpensive in view of the low power carried by that circuit.

It is an object of this invention to provide an improved seat operated ignition circuit cutoff with time delay.

It is a further object of this invention to provide a seat operated ignition cutoff wherein the ignition circuit is interrupted after a time delay, by a relay whose operating circuit is interrupted by movement of the operator's seat upon the latter being vacated.

It is a further object of this invention to employ a transistor in the relay operating circuit of the hereinbefore outlined system and means to disconnect the transistor from the power source when the relay switch is opened.

It is a further object of this invention to provide a system as outlined in the previous objects wherein the engine starting circuit is interconnected with the time delay device to effect initial closing of the relay switch when the starting switch is closed and the operator is seated.

These and other objects and advantages of this invention will be apparent to those familiar with the art when the following description is read in conjunction with the schematic drawing illustrating one use of my invention.

Referring to the drawing, the present invention is illustrated schematically in the electrical system for a spark ignition engine powered vehicle. A source of electric power, in the form of a storage battery 11, supplies current for the starting motor circuit 12 and the ignition circuit 13. The starting motor 14 is controlled through a relay 15 operated by starter relay circuit 17 which includes a manually operated push button starter switch 18 and the operating coil 19 of relay 15. A triggering diode 20 prevents the inductive voltage spike generated by the collapse of the magnetic field of coil 19 from damaging diode 32 in bridging circuit 43. The ignition circuit includes a manually operated ignition switch 21, having the usual on and closed positions, an ignition coil 22, distributor 23 and spark plugs 24, only one of which is shown. An electric time delay device 26 includes a relay 27 whose contacts 28 are in the ignition circuit 13. A relay operating circuit 31 is connected to the starting motor relay operating circuit 17 through diode 32 and to the ignition circuit 13 on the ignition system side of relay 27 through diode 33. The diode 32 prevents current flow from the relay operating circuit to the starter circuit 17. The relay operating circuit 31 of the time delay device in addition to diode 33 includes coil 34 of relay 27 and an NPN transistor 36, the base circuit 37 of which includes switch 38 operated by a hinged operator's seat 39.

OPERATION

When the operator's station, in the form of seat 39, is occupied, the seat will pivot down about its pivot connection with the chassis 41 of the vehicle against the biasing action of spring 42 thereby closing switch 38. The operator next closes the ignition and starter switches, which are located at the operator's station, to energize coil 19 of the starter relay 15, thus closing the starting motor contacts 16 to activate the starting motor 14. Upon closing of the push button switch 18 in the starter relay operating circuit 17, current flows through diode 32 in bridging circuit 43, through closed seat switch 38 in circuit 37, through resistor 44 into the base-emitter junction of transistor 36 thus turning it on to permit current flow in circuit 31 energizing relay 27 to close contacts 28 and energize the ignition circuit 13. The time delay device 26 is energized by the charging of capacitor 46. Diode 32 prevents current flow from the bridging circuit 43 to the ignition circuit. Thus ignition cannot occur unless the operator is seated to close the time delay 27 and the ignition switch 21 is closed.

Upon starting the engine, the operator releases the spring biased starter switch 18 deenergizing circuit 17. A negative voltage spike is created by collapse of the field of coil 19 causing a current which flows into ground through clamping diode 20 and back to coil 19. This causes the voltage in operating circuits 17 and 43 to be clamped at approximately ground potential, thus preventing damage to diode 32. Current flow to the time delay relay circuit 31 through lead 43 is interrupted by the opening of starter switch 18; however, since the time delay contacts 28 are closed, current flows from the established ignition circuit 13 through diode 33 in circuit 37, thus maintaining the time delay relay 27 in its closed condition.

When the operator leaves his station, the seat 39 will move up causing seat switch 38 to open. This interrupts current flow in the base-emitter circuit 37 through resistor 44; however, the transistor 36 will remain turned on for a predetermined period of time by the flow of discharge current from capacitor 46 into the base-emitter junction of the transistor. There will, of course, also be some discharge current flow through resistor 47. When the capacitor 46 has discharged to such an extent that the transistor base voltage is below that required for conduction, the transistor 36 will stop conducting and the relay coil
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34 will deenergize causing relay 27 to open. Diode 48 functions as a clamping diode, preventing damage to transistor 36. When the relay contacts 28 open, the time delay device is totally disconnected from the battery 11 even though the ignition switch 21 may have remained closed when the operator left the seat 39.

The time delay device 26 is primarily needed to prevent interruption of the ignition circuit upon momentary opening of the seat switch 38, which may occur when the lift truck bounces over rough flooring or uneven ground causing the operator's weight to be removed from the seat.

From the foregoing description it is evident that a novel seat operated ignition cutoff system with time delay is provided by this invention. If the driver leaves the vehicle operator's station, either intentionally or accidentally, with the ignition switch on, the seat switch will open causing the time delay device to start the time delay sequence. At the end of the time delay interval, the relay is deenergized and the ignition circuit interrupted, which action cuts off all supply to the ignition circuit and time delay device. At this point, there are no live circuits remaining. The length of the time delay is a function of the capacitance of capacitor 46, the resistance of resistor 47 and the equivalent resistance of the base-emitter junction of the transistor 36. The components can be selected to provide a short time delay or a sufficiently long time delay to permit the operator to leave the lift truck to perform a minor chore in relation to his work.

The energization of the time delay relay 27 is achieved through control circuit means including circuits 17, 43, 31 and 37, independently of ignition switch 21. This permits the opening of relay contacts 28 to electrically isolate the operating circuit 31 of the time delay device 26.

The embodiments of the invention for which an exclusive property or privilege is claimed are defined as follows:

1. Mechanism for interrupting the ignition circuit connecting the ignition system for a vehicle engine to an electric power source when the operator's station on the vehicle is vacated including:
   - an ignition switch in said ignition circuit,
   - an electric time delay device including a time delay relay having contacts in said ignition circuit intermediate said ignition switch and said ignition system, and
   - a control circuit means independent of said ignition switch providing initial energization of said relay including

4. a seat operated switch, a starter circuit and a bridging circuit interconnecting said starter circuit and said relay operating circuit including a first diode permitting current flow from said starter circuit to said relay operating circuit and preventing reverse flow.

2. The invention of claim 1 wherein said control circuit means includes a relay operating circuit, a transistor in said operating circuit and a base circuit connected to said operating circuit and transistor and wherein said seat operated switch is in said base circuit.

3. The invention of claim 2 wherein said time delay relay includes a coil and wherein said relay operating circuit includes a clamping diode across said coil.

4. The invention of claim 1 wherein said relay operating circuit is connected to the ignition system side of said ignition circuit and further comprising a second diode in said relay operating circuit between the latter's connections with said ignition circuit and bridging circuit.

5. The invention of claim 4 wherein said starter circuit includes a relay coil and a clamping diode connected to the starter switch side of said coil to prevent negative voltage spikes from said relay coil from damaging said first diode.

6. The invention of claim 1 wherein said control circuit means includes a relay operating circuit connected to said ignition circuit on the ignition system side of said relay and wherein said seat operated switch controls the operation of said relay operating circuit.

7. The invention of claim 6 and further comprising a diode in said relay operating circuit between the latter's connections with said ignition and bridging circuits, said diode permitting current flow to said relay.

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