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AUTOMATIC ENGINE STARTING SYSTEM

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ABSTRACT OF THE DISCLOSURE

An auxiliary automatic starting circuit for an automotive vehicle includes a circuit breaker having a heater element which is in parallel with the starting system and is energized through a resistor to control the cranking interval of the engine when cranked by the automatic circuit and to quickly disable the automatic circuit by shorting out the resistor when the gear selector is moved out of "Park" position preventing unauthorized movement of the vehicle while under the control of the automatic circuit.

Summary of the invention

The present invention relates generally to a starting circuit for an automotive vehicle engine and more particularly to an improved auxiliary automatic starting circuit therefor.

Prior automatic starting circuits for automotive vehicles have included complex electro-mechanical devices and/or sophisticated electronic components to protect the battery against undue discharge where the engine fails to start within a prescribed time interval, and to protect against theft of the vehicle when the engine is operating by means of the automatic circuit.

It is an object of the present invention to provide an automatic starting circuit incorporating improved simplified reliable electrical components which provides protection against unauthorized movement of the vehicle when the engine is under the control of the automatic circuit and which limits the time interval during which the engine can be cranked by the automatic circuit to a predetermined maximum.

Brief description of the drawing

The figure is a schematic drawing of an electrical control system for an internal combustion engine employing the present invention.

Description of the preferred embodiments

Referring now to the drawing, the broken line 10, for convenience of description, encloses certain conventional components of an automotive vehicle engine including an ignition system 11, a starter system 12, and portions of a carburetor apparatus 13 having a throttle linkage. The enclosure 14 indicates a conventional ignition and starting switch such as the usual key operated switch used in motor vehicles. The broken line 16 encloses certain additional circuit components, to be described more fully hereinafter, illustrating the present invention.

A battery 17 is connected to conventional starting and ignition switch 14 by means of leads 18 and 19. Switch 14 is connected to ignition system 11 by lead 21, and to starting system 12 by means of lead 22. Starting system 12 includes a solenoid 23, and a starter motor 25 connected to battery 17 by leads 24 and 26. Ignition system 11 includes a spark coil 27, a breaker 28 and a distributor 29. The circuit thus far described includes conventional com-

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ponents of automotive vehicles, switch 14 being effective to supply energy to ignition and starting systems 11 and 12 upon manual operation thereof as by an ignition key.

According to the present invention an improved arrangement of auxiliary starting circuit 39 is provided for automatically starting the engine and maintaining it in operation responsive to the occurrence of a preselected condition such as temperature drop. Auxiliary starting circuit 39 includes a circuit breaker 31, portions of a gear selector switch 41, a condition sensitive switch 42 and a vacuum switch 43 connected in series between battery 17 and starter system 12.

Circuit breaker 31 includes contacts 32, 33 arranged to be bridged by a manual pushbutton 34 upon actuation thereof, contact 32 being connected to battery 17 by leads 37, 26, and 18. A heater element 36 is incorporated in circuit breaker 31 so as to move contact 33 laterally away from pushbutton 34 after a predetermined current flow therethrough. When the contacts of circuit breaker 31 have been thus opened, pushbutton 34 cannot be used to manually override the device until sufficient cooling has occurred. If desired, an indicator lamp 38 may be connected between contact 33 and ground to provide a visual indication that auxiliary circuit 39 is operatively connected to battery 17 through circuit breaker 31.

Gear selector switch 41 includes a first stage having active contacts 44 and 46 in auxiliary starting circuit 39 and a second stage having active contacts 47, 48 in a timing circuit 51 for heater element 36. As shown schematically, switch 41 is remotely actuated by means of relay 72 which in turn is controlled by switch 73. Switch 73 is actuated by means of a cam 52 connected to gear selector 53. Relay 72 and switch 73 are arranged to close contacts 44 and 46 in auxiliary starting circuit 39, and to close contacts 47 and 48 in timing circuit 51 when gear selector 53 is in "Park" position. A spring 54 is provided to open switch 73 when gear selector 53 is moved to other than "Park" position. When switch 73 is open contacts 44 and 56 of switch 41 are closed in the first stage and contacts 47 and 49 are closed in the second stage. Switch 41 may also be a double pole double throw switch actuated directly by cam 52 of gear selector 53. The switch 73 and relay 72 may be used to enhance installation in certain types of vehicles. Contact 56 in the first stage is connected to contact 49 in the second stage by lead 69.

Condition sensitive switch 42 is a thermal switch arranged to sense the temperature in the water jacket of a water cooled engine or the air temperature in an enclosure associated with the vehicle which becomes warm after operation of the engine. Such enclosures may be the passenger compartment of the vehicle in which a heater is operative when the engine is running or may be the engine enclosure itself. Switch 42 is arranged to close contacts 57, 58 in auxiliary starting circuit 39 responsive to the occurrence of a preselected low temperature and to open the circuit responsive to a preselected higher temperature.

Vacuum switch 43 includes contacts 59, 61, closed when the engine is inoperative or cranking, and open when the engine is operating at idle speed or greater. A vacuum motor 62, communicating with the engine manifold, is arranged to move in one direction under the urgency of spring 63 and in the other direction when the engine has developed sufficient vacuum to overcome the spring force. Vacuum motor 62 is preferably connected to

the throttle control by means of a flexible member such as a bead chain or a one-way clutching device and to switch 43 so that the switch is closed and the throttle is open when the engine is inoperative or cranking, and so that switch 43 is opened and the throttle is returned to idle speed setting when the engine is in operation. The opening and subsequent closing of the throttle is effective to condition the automatic choke for operation before cranking begins and generally duplicates the manual actuation of the vehicle accelerator pedal before cranking the engine when starting by means of the conventional key operated starting switch. The use of a one-way clutching member or flexible link for connecting vacuum motor 62 with the throttle control permits normal operation of the vehicle by means of the accelerator pedal.

Timing circuit 51 is connected in electrical parallel with starting system 12 and is in series circuit with both auxiliary starting circuit 39 and the conventional starting circuit including starting switch 14 and leads 18, 19, and 22. Timing circuit 51 includes a dropping resistor 64, contacts 47 and 48 of gear selector switch 41 and the heater element 36 of circuit breaker 31. The resistance value of resistor 64 is selected in accordance with the operating characteristics of heater element 36 and the time interval during which the engine is to be cranked. For example, resistance values of from 2 to 3 ohms have been found to provide a cranking cycle of 8 to 10 seconds which is satisfactory for various well-known passenger automobiles having 12 volt electrical systems.

A diode 66 is connected between auxiliary circuit 39 and ignition system 11 by leads 67, 68 biased to pass current from auxiliary circuit 39 to ignition system 11 and to block passage of current in the reverse direction. In normal operation of the vehicle, the operator may, on occasion, open the throttle to accelerate the vehicle, which causes a momentary loss of vacuum allowing vacuum switch 43 to close momentarily. Diode 66 prevents flow of current from ignition system 11 to the starter system 12 through the momentarily closed vacuum switch 43.

Auxiliary starting circuit 39 is conditioned for automatic operation by manually placing the gear selector of the vehicle in "Park" position and by manually depressing pushbutton 34 which is preferably latched in the "On" or "Set" position. Indicator lamp 38 is energized to give a visual indication that the circuit is in condition for automatic operation. Thereafter, when the temperature drops to the preselected low value, thermal switch 42 is closed. Vacuum switch 43 is normally closed when the engine is inoperative such that a circuit is completed from battery 17 to starter solenoid 23 for cranking the engine. As soon as the engine begins to run, vacuum switch 43 is opened breaking the circuit to starter solenoid 23 and to timing circuit 51. In the case of a spark ignition engine, current is supplied to ignition system 11 by the auxiliary circuit 39 through diode 66 even though the starter system 12 has been disengaged by vacuum switch 43. The engine will then continue to run until a preselected higher temperature is reached at which thermal switch 42 opens contacts 57, 58 thereby opening the circuit to ignition system 11 to stop the engine.

If the engine should fail to start after a predetermined interval of cranking, the current flow through resistor 64 and heater element 36 is effective to open circuit breaker 31 to disable auxiliary starting circuit 39. If an operator should neglect to disable auxiliary starting circuit 39 before starting the vehicle by means of the conventional key switch 14, or if unauthorized movement of the vehicle is attempted while the engine is running under control of auxiliary starting circuit 39, the switch 41 functions as an anti-theft and safety device. When gear selector 53 is moved from "Park" position, cam 52 rotates

so that contacts 44 and 56 are connected to each other and so that contacts 47 and 49 are connected to each other. In this position, switch 41 opens auxiliary circuit 39 ahead of lead 67 and diode 66 so that no current is supplied to ignition system 11. In addition, dropping resistor 64 is shorted out so that heater 36 is connected directly to battery 17 through auxiliary circuit 39. The application of current from battery 17 directly to heater element 36 results in the rapid tripping of circuit breaker 31 to open auxiliary circuit 39. Once tripped, the circuit breaker must go through an interval of cooling before it can be manually reset further frustrating unauthorized tampering with the vehicle. In the case of a vehicle which can be cranked by means of the key switch only when the gear selector is in "Park" position, the lead 69 can be connected directly to auxiliary circuit 39 eliminating the first stage of switch 41 including contacts 44, 46, 56. Heater 36 would then open circuit breaker 31 to prevent current flow to ignition system 11. However, since many vehicles can be cranked by means of the key switch when the gear selector is in either "Neutral" or "Park" positions, it is preferred to provide the additional contacts 44, 46, 56. Thus if the operator should start the vehicle when the gear selector is in "Neutral," the closed contacts 44 and 56 serve to open the circuit breaker 31, while the open contacts 44, 46 prevent the continued application of battery voltage across heater element 36 from starting system 12, through lead 69.

While preferred and alternate embodiments of the invention have been shown and described, it is to be understood that variations thereof are included within the spirit of the invention and the scope of the following claims.

I claim:

1. In an electrical control system for an internal combustion engine adapted for an automotive vehicle having a battery, an electric starter system, and a gear selector including a "Park" position for controlling motion thereof, said control system including a manually operable starting circuit connected between said battery and starter system the improvement comprising; an auxiliary starting circuit connected between said battery and starter system bypassing said manually operable starting circuit for automatically starting said engine responsive to a preselected condition, said auxiliary circuit including a condition sensitive switch, in series with a circuit breaker effective to open said auxiliary circuit responsive to a preselected current flow; and a heating circuit in parallel with said starter system including a resistor having a predetermined value connected in series with a heater element for said circuit breaker, regulating current flow to said heater element for opening said auxiliary circuit after a predetermined interval of engine cranking without starting when said engine is being caused to be cranked by means of said auxiliary starting circuit.

2. The combination according to claim 1 in which said electrical control system includes an engine ignition system selectively connectable to said battery by means of said manually operable starting circuit, and in which a diode is connected between said ignition system and said auxiliary starting circuit biased for passing current from said auxiliary starting circuit to said ignition system, said diode blocking passage of current from said ignition system to said starter system through portions of said auxiliary circuit.

3. The combination according to claim 1 in which said electrical control system includes an engine ignition system, said heating circuit including a selector switch actuated by said gear selector having a first contact connected to said resistor, and a second contact connected to said heater element, said first and second contacts being closed when said gear selector is in "Park"

position, and a third contact connected to said auxiliary circuit bridging said resistor when said gear selector is in other than "Park" position, said second and third contacts, when closed by movement of said gear selector to other than "Park" position, being effective to supply current directly from said auxiliary circuit to said heater element for quickly opening said auxiliary circuit and

preventing current flow to said ignition system, said selector switch preventing unauthorized movement of said vehicle while under control of said auxiliary starting circuit.

No references cited.

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