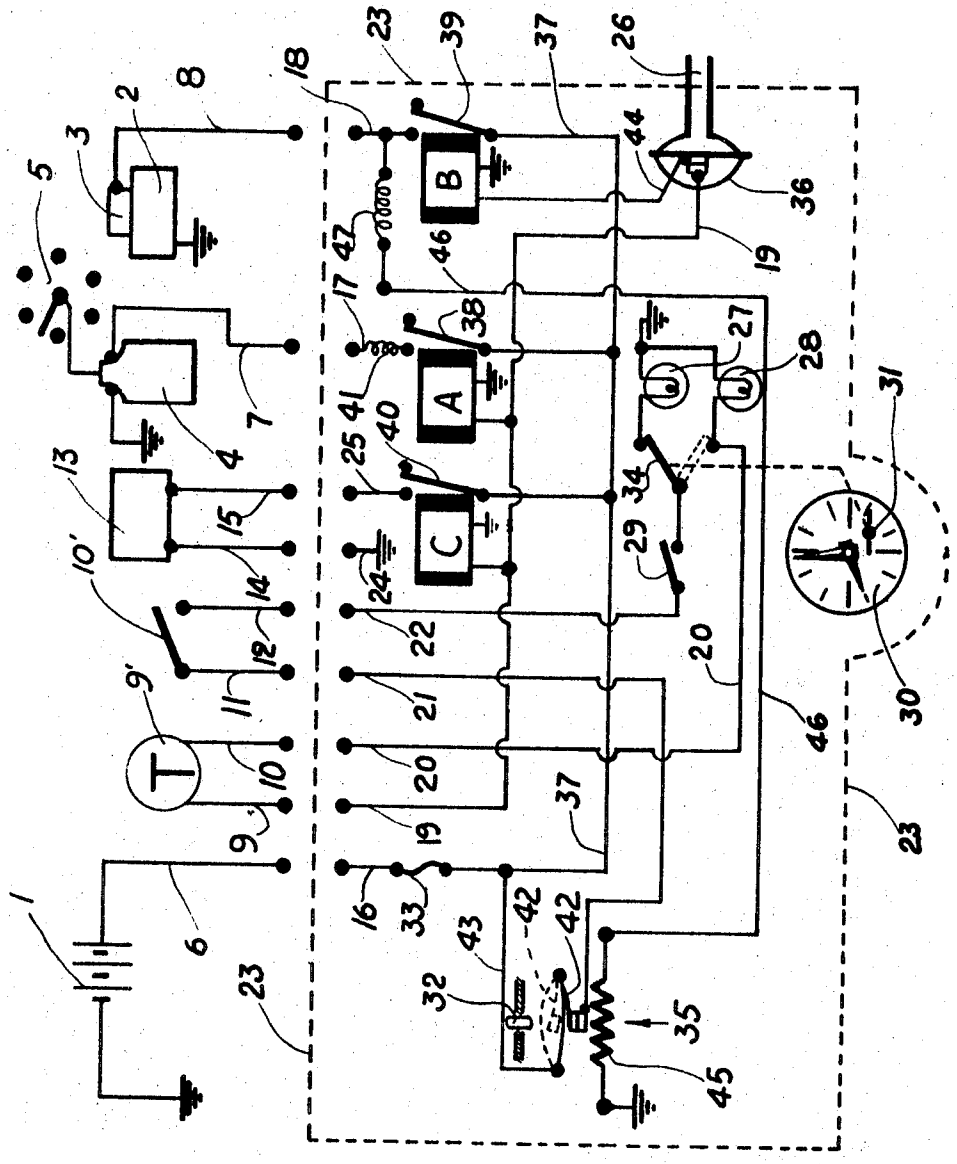
May 13, 1969 R. HÉBERT 3,443,557

AUTOMATIC STARTING DEVICE FOR INTERNAL COMBUSTION ENGINES

Filed March 8, 1967



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United States Patent Office 3,443,557
Patented May 13, 1969

3,443,557

AUTOMATIC STARTING DEVICE FOR INTERNAL COMBUSTION ENGINES

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Filed Mar. 8, 1967, Ser. No. 621,519
Int. Cl. F02n 11/08
U.S. Cl. 123—179 1 Claim

ABSTRACT OF THE DISCLOSURE

An automatic starting system for an internal combustion engine comprising a starter relay under the control for a vacuum switch opened by the rotating motor engine, and a time delay manual reset thermal switch including a heating element connected to the starter circuit, and operable to open the switching part of the thermal switch after a few seconds of operation of the starter, said thermal switch once opened, cutting off all the circuits of the starting system until it is manually reset, thereby avoiding any drain on the automobile battery and any damage to the starter which might result from repeated attempts at starting the engine.

The present invention relates to internal combustion engines and, more particularly, to an automatic starting device for such engines, more specifically of motor vehicles.

In cold weather it is often very difficult to start the engine of an automobile and it is most uncomfortable to enter a very cold automobile and to have to wait several minutes before the engine is sufficiently hot to be able to start the vehicle without damage to the engine and to supply hot water to the passenger compartment heater to heat said compartment to a comfortable temperature. In practice, the automobile driver is in a hurry and, generally, does not wait until the engine has attained its operating temperature to move the vehicle, which is highly damageable to the engine.

The general object of the present invention resides in the provision of a system which is either clock-controlled to automatically start the engine of the motor vehicle a sufficient number of minutes before the predetermined time of use of the vehicle to enable the engine to attain its operating temperatures and the passenger compartment to attain a comfortable temperature.

Another object of the invention resides in the provision of a system of the character described, of simple and inexpensive construction, which prevents unauthorized persons to drive off with the vehicle and which automatically stops the engine if difficulties are experienced in the starting procedure, in order to prevent excessive drain on the battery.

With these objects and other objects of the invention, the present invention is characterized by the fact that the automatic system of the invention is so designed that its electrical components become completely de-energized in the event that the starter fails to start the engine after an attempt of a few seconds and the components remain so de-energized until manual resetting of the circuit to thereby completely eliminate any avoidable drain on the battery.

The invention is also characterized by the fact that the electrical components are arranged in a box of small dimensions and able to be disposed under or in the dashboard of any existing motor vehicle, and that these electrical components are connected to the various accessories of the engine without modifying in any way the existing electrical circuit of the engine.

The invention is also charaterized by the fact that the starter ceases to operate as soon as the engine is started, the starter being controlled by the vacuum created by the engine.

The foreging will become more apparent during the following disclosure and by referring to the drawings, in which:

The single figure is an electric diagram of the system in accordance with the invention.

The conventional car battery is indicated at **1**; the conventional engine starter is indicated at **2**, having its conventional starting relay **3**. The engine is also provided with a conventional ignition system including induction coil **4** and distributor **5**. One terminal of battery **1** is grounded while the other terminal is connected to wire **6**. One pole of the secondary of induction coil **4** is grounded while the other pole of said secondary is connected to a wire **7**. Similarly, a wire **8** runs to the solenoid **3** of starter **2**.

In accordance with the invention, a thermostatic switch **9'** is applied to the motor vehicle engine and will open its contacts on the engine attaining a maximum operating temperature and will close its contact some degrees below this maximum. The thermostat is connected to wires **9, 10.**

A safety switch **10'** is operated by the transmission lever of the motor vehicle so as to be closed only in the "park" position of said lever. The safety switch **10** is connected to wires **11** and **12.**

An accessories such as an electric seat pad, the fan of the conventional passenger compartment heater of the motor vehicle and the like, as indicated at **13**, are connected in parallel to two wires **14, 15.**

Wires **6, 7, 8, 9, 10, 11, 12** are united in a cable provided with a male multi-connector terminal plug, detachably connectable to a female multi-connector plug so that the above-noted wires will be detachably connected to wires **16, 17, 18, 19, 20, 21** and **22** respectively of the system in accordance with the invention which is contained in a box, indicated in dotted lines at **23**, said box having a small size and adapted to be mounted, for instance, under the dashboard of a motor vehicle.

Box **23** is further provided with a female terminal outlet, indicated by wires **24** and **25**, adapted to be connected to the wires **14, 15** of the accessories **13.**

Protruding outside the box is a tube **26** adapted to be connected by a flexible hosing to the intake manifold of the engine or other engine chamber in which the engine produces vacuum when rotating.

On the outside of the box **23**, appear a green light **27**, a red light **28**, and a lever-operated main control switch **29.**

The front of the box **23** is provided with a circular opening for removably receiving an ordinary spring-actuated alarm clock **30**, of the type having at the back a winding crank which operates both the alarm and the clock mechanism and which rotates when the clock is unwinding upon sounding an alarm. This crank is indicated at **31.**

On the outside of box **23**, finally appear a reset button **32** and also a normally closed opening for removable insertion of the fuse, which fuse is indicated at **33.**

The circuit contained in box **23** includes an ignition relay A, a starter relay B and an accessory relay C; also, a double pole double throw switch **34**, adapted to be actuated by the winding crank **31** of alarm **30**, a time delay manual reset switch **35** adapted to be manually reset to closed position by pushing on reset button **32**, and a vacuum switch **36** actuated by the vacuum created in tube **26** by the engine upon starting of the same.

Wire **16**, connected to the battery **1**, is connected to fuse **33**, in turn connected to wire **37** which is connected in parallel to the movable contacts **38, 39,** and **40** of the three relays A, B, C.

Closing of movable contact **39** under action of the op-

erating coil of the relay B completes the circuit to the starter through wires **18**, **8**, and conventional starting relay **3**. Closing of the contact **38** of relay A under the action of its coil, closes the circuit to the induction coil **4** through movable arm **38**, resistance **41**, wires **17** and **7**.

Resistance **41** is inserted to prevent burn-out of the contact points of the distributor system of the engine.

Closing of movable contact arm **40** of accessory relay C under action of the energized coil of said relay C, closes the circuit to the accessories through wires **25**, **15**, accessories **13**, wire **14** and grounded return wire **24**.

The coils of the three relays A, B, C are connected in parallel in a main control circuit including series-connected time delay switch **35**, safety switch **10'**, main control switch **29**, clock-operated switch **34**, thermostatic switch **9'**. In addition, starter relay B is under the control of vacuum switch **36**.

More specifically, the heat-responsive switching part **42** of time delay switch **35** is connected by wire **43** to fuse **33** and by wires **21** and **11** to the safety switch **10'**. The return of the safety switch is connected by wires **12** and **22** to the main control switch **29**. This switch **29** is series-connected to the movable arm of double throw-clock-operated switch **34**.

This switch **34** is normally in the position shown in the drawings connecting the green light **27** to ground. Thus, upon closing of the main control switch **29**, provided that the safety switch **10'** is closed, that is that the transmission lever of the engine is in the "park" position, green light **27** will become illuminated, indicating to the user that the control switch **29** and safety switch **10'** are closed and the system is therefore ready for operation.

Switch **34** will take the alternative position under the action of winding crank **31** of alarm clock **30**. In this alternative position, the red light **28** will be connected and the circuit completed to ground, whereby this light will become illuminated and also the circuit coming from control switch **29** will be connected to wires **20** and **10**, thermostatic switch **9'**, wires **9**, **19** and, in parallel to the input terminal of the operating coils of the relays A, B, C, the other terminals of the coils of said relays being grounded. However, relay B is also controlled by vacuum switch **36**, which is connected to wires **19** and **44**, the latter in turn connected to the input terminal of the coil of relay B.

The delay switch **35** is provided with a heating resistance **45** grounded at one end and the other terminal of which is connected by wire **46** to wire **18** going to the starter with the interposition of a resistance **47**.

The circuit in accordance with the invention operates as follows:

When the motor vehicle is left outside, for instance for overnight parking, and that the driver wishes to use the same at, say, 7:00 o'clock in the morning, he will remove the alarm clock **30** from within the recess in box **23** and wind the alarm clock by crank **31** and set the alarm to ring, for instance at ten to seven the next morning. He replaces the alarm clock in the box **23** so that the crank arm **31** will be in operative arrangement with the movable contact switch **34**. The driver closes main control switch **29**, places the transmission lever of the car in the "park" position, thereby closing switch **10'**, puts, for instance, the electric seat pad and the electric fan of the car heater on the "on" position. When the system is ready for operation, green light **27** will become illuminated. If the winding crank **31** of the clock has been improperly positioned, red light **28** will become illuminated, indicating that the switch **34** is in the position closing the circuit to wire **20**. With green light "on," the driver leaves the car after having locked the main car switch and removed the ignition key and locked the doors. The engine will remain idle till ten to seven next morning, at which time alarm clock **30** will ring an alarm and the crank **31** will rotate until near the end of its course, it actuates switch **34** to the position closing the circuit to wire **20**. The thermostat **9'** being closed, the following circuit is closed: battery **1**, fuse **33**, heat-responsive switching element **42**, safety switch **10'**, closed control switch **29**, clock-operated switch **34**, wire **20**, thermostat switch **9'** and the coils of the three relays A, B, C, the coil of relay B being energized through the closed vacuum switch **36**. The movable contacts **38**, **39**, and **40** of relays A, B, C close the circuits to the starter **2**, to the induction coil **4** and to accessories **13**. The starter rotates the engine, which is fed with sparks through induction coil **4** and distributor **5**. Upon the engine starting, it creates a vacuum which opens vacuum switch **36**, thereby opening the circuit to the coil of relay B; therefore, the movable contact **39** opens the circuit to the starter **2** but the engine continues to run, because relay A remains closed.

When the engine has attained its maximum operating temperature, thermostatic switch **9'** opens, thereby cutting the electrical supply to relays A and C, whereby the ignition is cut off, stopping the engine, and also the accessories are de-energized. Upon the engine reaching a certain minimum predetermined temperature, the thermostatic switch **9'** again closes to restart the engine. The cycle is repeated until the driver opens main switch **29**.

Heating wire **45** which was energized during all the time the starter was energized through wire **18**, will cause opening of the heat-responsive switching element **42** of the delay switch **35**, after about ten seconds of opening of switch **42**, all the circuits become completely dead, no electricity whatever being fed to the various components of the system, because switch **42** controls the supply of electricity to all the coils of the relays A, B, C.

It should also be noted that the starter becomes de-energized as soon as the engine is started, because the vacuum switch **36** is very sensitive to any sufficient vacuum created in the engine.

If the user so desires, for instance when he intends to park his automobile for a limited period of time, he closes switch **29** and either simply removes the alarm clock **30** or selects the position of crank **31**, so that the switch **34** takes its position closing the circuit of wire **20**. This can be ascertained by the red light **28** becoming illuminated. Under these conditions, the system will operate under the control of the thermostat **9'** monitoring the engine temperature.

If desired, the motor vericle equipped with the system in accordance with the invention can be provided with conventional means for facilitating starting of the engine and including an actuator device for actuating the accelerator pedal and in turn actuated by vacuum or by electricity. Therefore, when the engine is turned by the starter **2**, the above-mentioned mechanism will actuate the accelerator pedal to open the butterfly valve of the carburator.

It is noted that the car, with the engine running, cannot be driven away by an unauthorized person, because, upon placing the transmission lever to any one of the drive or reverse positions, switch **10'** is automatically open, thereby opening the circuit of the system in accordance with the invention.

While a preferred embodiment in accordance with the invention has been illustrated and described, it is understood that various modifications may be resorted to without departing from the scope of the appended claim.

What I claim is:

1. In an automatic starting system for an internal combustion engine wherein said engine is provided with a battery, an electric starter motor having a starter coil, an electric ignition system having an ignition coil, said engine having a chamber in which vacuum is produced when the engine rotates, said system comprising an ignition relay and a starter relay, each having an operating coil and a pair of normally open relay contacts, wires connecting in parallel one terminal of said relay contacts di-

rectly to said battery, wires connecting the other terminals of said relay contacts to said ignition coil and starter coil respectively, a time delay manual reset thermal switch including a heater element and a heat responsive switching part, a wire connecting said heater element to the wire connecting the other terminal of the relay contacts of the starter relay to the starter coil, a main switch, a normally closed thermostatic switch responsive to the temperature of the engine and opening at a maximum predetermined temperature of the engine, an adjustable clock switch, wires connecting said battery in series with said heat responsive switching part, said thermostatic switch, said main switch and said clock switch and connecting in parallel the operating coils of said ignition and starter relays, and a normally closed vacuum switch opening when vacuum is produced in said engine chamber, series connected with the operating coil of said starter relay.

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U.S. Cl. X.R.

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