Feb. 23, 1965 R. FORTIER 3,170,451

ENGINE STARTING SYSTEM

Filed Dec. 26, 1961 2 Sheets-Sheet 1

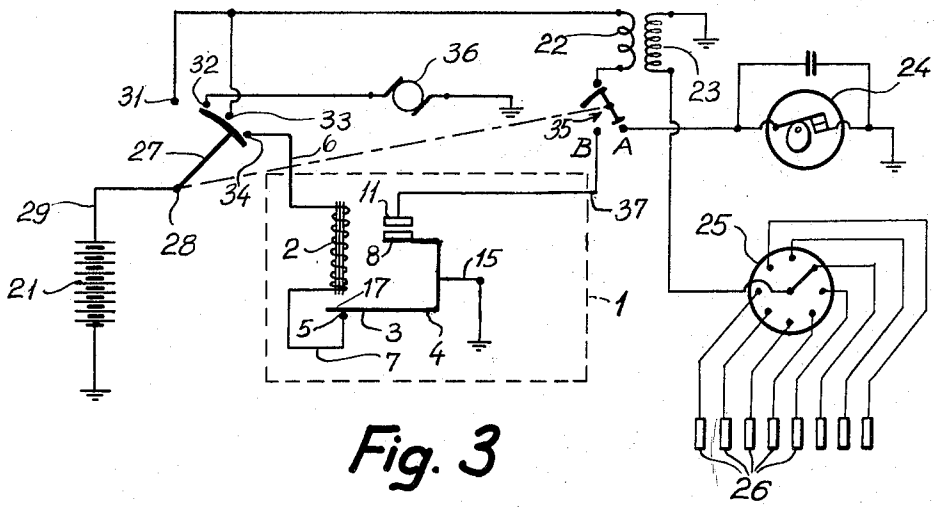


Fig. 3

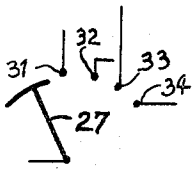


Fig. 4

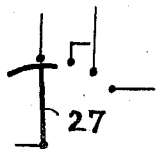


Fig. 5

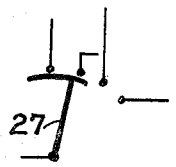


Fig. 6

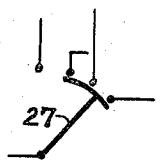


Fig. 7

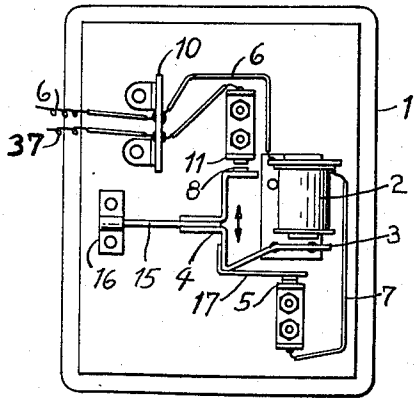


Fig. 2

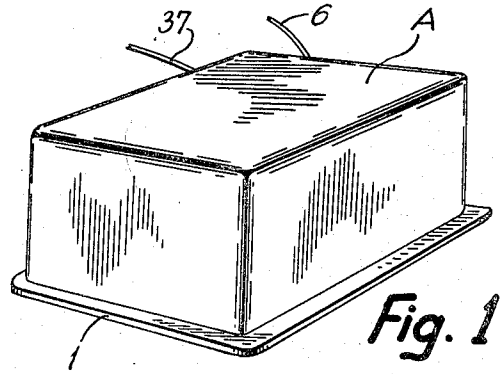


Fig. 1

INVENTOR

Roland FORTIER

BY Pierre Lespérance

PATENT AGENT

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ENGINE STARTING SYSTEM

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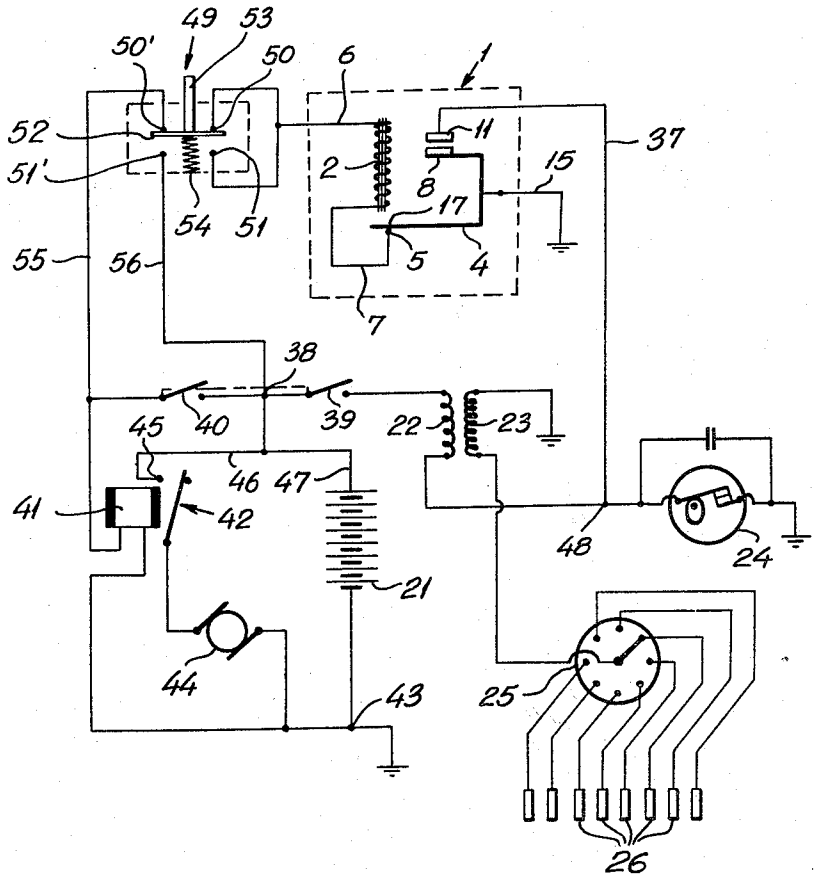


Fig. 8

INVENTOR
Roland FORTIER

BY Pierre Lesperance

PATENT AGENT

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ENGINE STARTING SYSTEM

Roland Fortier, Thetford Mines, Quebec, Canada, assignor to Les Industries Electriques de Thetford Ltee, Thetford Mines, Quebec, Canada

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The present invention relates to a starting system for internal combustion engines which facilitates starting in cold and/or humid weather.

More particularly, the present invention relates to an ignition system in which a rapid succession of sparks are produced in each cylinder of the engine at the time the compression is completed.

An object of the present invention resides in the provision of a system of the character described which is of simple, inexpensive and very efficient construction.

Another important object of the present invention resides in the provision of a vibrator unit for producing the rapid succession of sparks which is of solid and long life construction.

Another object of the present invention resides in the provision of a system of the character described in which an ignition switch is provided so arranged, that, with the use of only one ignition key, winter starting with a rapid succession of sparks as well as normal starting can be obtained, the vibrator circuit being automatically cut off when the engine is started.

Another object of the present invention resides in the provision of a system of the character described further including a push button switch which can extend the duration of the production of the succession of sparks even after the engine is started and the starter motor is stopped.

The foregoing and other important objects of the present invention will become more apparent during the following disclosure and by referring to the drawings, in which:

FIGURE 1 is a perspective view of the sealed box containing the vibrator in accordance with the invention;

FIGURE 2 is a top plan view of the vibrator;

FIGURE 3 is a schematic electric circuit of the starting system in accordance with a first embodiment of the invention and incorporating the vibrator;

FIGURES 4 to 7 inclusive show in a schematic manner the different positions of the ignition switch movable member; and

FIGURE 8 is a schematic electric circuit of a second embodiment of the starting system in accordance with the invention.

In the drawings, like reference characters indicate like elements throughout.

In accordance with the present invention, for cold or damp weather starting, the usual cam operated timing switch is supplanted by a vibrator which produces a rapid succession of sparks at the spark plug of the cylinder being under compression.

The vibrator in accordance with the invention is located in a completely sealed box A which has a base 1 on which is mounted an electro-magnet 2 which is adapted to attract a branch 3 of a vibrating lever 4 in the form of a fork the main leg of which consists of a spring blade 15 secured to a bracelet 16 itself secured to and electrically connected to base 1. Lever 4 has a movable contact 17 adapted to abut stationary contact 5 secured to but electrically insulated from base 1. Electric current is fed to the solenoid of electro-magnet 2 by wire 6 mile the output of said solenoid is connected by wire 7 to stationary contact 5 and current returns to ground by contact 17, lever 4, bracket 16 and base 1 which is grounded.

The other branch of lever 4 supports a movable contact 8 which is adapted to abut against a stationary contact 11 which is secured to but is electrically insulated from base 1.

Spring blade 15 resiliently maintains lever 4 in a position in which contacts 8 and 11 are spaced apart and contacts 5 and 17 close the circuit. When branch 3 of lever 4 is attracted by electro-magnet 2, closing of contacts 8 and 11 and opening of contacts 5 and 17 takes place. A wire 37 is connected to stationary contact 11. Wires 6 and 37 extend outside the box A through the intermediary of an insulating plate 10 which closes an opening made in the box A.

The vibrator in accordance with the invention is electrically connected to the ignition and starting circuits of the engine as shown in FIGURE 3.

In this figure, the conventional battery of the vehicle is shown at 21, the primary and secondary of the induction coil are shown at 22 and 23 respectively, the cam operated timer switch and its condenser are shown at 24 while reference numeral 25 indicates the distributor connected to the spark plugs 26 of the respective cylinders of the engine.

In accordance with the first embodiment of the invention, the main ignition and starting switch is of the rotary type and is actuated by an ignition key; it is schematically shown by lever 27 pivoted on a shaft 28 on which is also mounted another rotary switch 35.

Lever 27 of the ignition switch is connected to battery 21 by wire 29 and can take four different positions shown in FIGURES 4, 5, 6 and 7.

In the position of FIGURE 4, the ignition switch is completely opened.

In the position of FIGURE 5, lever 27 makes contact only with contact 31 which closes the circuit to the input of the primary 22 of the induction coil, the output of primary 22 being connected to timing switch 24 through the rotary switch 35 which is in position A. In the position of FIGURE 5, the ignition is normal for the engine in running condition.

The position shown in FIGURE 6 is a normal starting position to effect one spark for each cylinder and to operate the starting motor 36. In this position, lever 27 is in contact with contacts 31 and 32 and rotary switch 35 is still in position A. The normal ignition circuit is closed by contact 31 which contact 32 which is connected to the starting motor 36 completes the circuit for said motor and actuates the same.

FIGURE 7 shows the position of the ignition switch for winter or damp weather starting. In this position, lever 27 makes contact with contacts 32, 33 and 34 while rotary switch 35 is now in the position B. Contact 33 is connected to the primary 22 of the ignition coil, the output of said primary is connected by wire 37 through switch 35 to the points 8, 11 of the vibrator unit and to the ground. Contact 34 feeds electricity to the solenoid 2 of the vibrator. Thus, the vibrator is actuated and causes the rapid closing and opening of contacts 8, 11, which causes a rapid variation of the current in the primary 22, thus a rapid succession of sparks at the spark plug 26 put in circuit by distributor 25.

It will be noted that rotary switch 35 which is mounted on the shaft 28 of the ignition switch and which is actuated by the ignition key remains in position A for the positions of lever 27 shown in FIGURES 4, 5 and 6 and takes the position B only when lever 27 assumes the position shown in FIGURE 7. Thus, the operator operates the ignition switch in normal manner for normal starting and only has to turn the ignition key further clockwise to cause winter or damp weather starting by means of a rapid succession of sparks in accordance with the invention.

FIGURE 8 shows another embodiment of the starting system in accordance with the present invention in which the vibrating unit is so connected that it automatically operates every time the starter motor is in operation and which includes manually operated means for continuing operation of the vibrator even after stoppage of the starter motor, for instance during the first few minutes of running of the engine. In FIGURE 8, the vibrator unit is enclosed in the dotted line rectangle indicated by 1, and comprises the same elements as shown in relation with FIGURES 3 and 2. The vibrating unit is connected to the conventional electrical circuit of the engine of the motor vehicle in a manner which will be described after reference is made to said normal electrical circuit of the vehicle. Said circuit comprises as in the first embodiment, a battery 21 connected to ground on one side, and connected to junction 38 on its high side which is in turn connected to the primary 22 of the ignition coil through ignition switch 39, the secondary 23 of the ignition coil being connected to the distributor 25 which in turn is connected to spark plugs 26 in usual manner. The primary 22 is connected to the timer switch 24 in usual manner. Starter switch 40 is connected to junction 38 and to the solenoid 41 of the starter motor relay 42. The other end of solenoid 41 is connected to ground at 43. The starter motor 44 is connected to ground 43 and to the movable contact of starter motor relay 42, the latter contact making contact with stationary contact 45 of the relay 42 upon actuation of solenoid 41. Contact 45 is connected to the high side of battery 21 through wires 46 and 47. Switches 39 and 40 are normally combined in conventional manner although they have been shown as being independent of each other in the drawing. Namely, these two switches are mechanically connected so that the ignition switch 39 operates first and then the starter switch 40 in response to rotation of a key in a key controlled combined ignition and starter switches. Wire 37 of the vibrator 1 is directly connected at 48 to the wire connecting the output of primary 22 to the timer 24. The wire 6 of vibrator unit 1 is connected to a push button switch generally shown at 49; said switch comprises a pair of upper stationary contacts 50 and 50′ and a pair of stationary lower contacts 51 and 51′. A movable contact plate 52 provided with a push button 53 protruding from the box of the switch is urged by spring 54 into contact with the upper pair of contacts 50, 50′ to make connection between said contacts; upon pressure exerted on push button 53, contacts 51 and 51′ become electrically connected through plate 52. Wire 6 is connected to contacts 50 and 51. Contact 50′ is connected by wire 55 to the input of solenoid 41 of starter motor relay 42. Lower contact 51′ is connected by wire 56 to junction 38.

As previously mentioned, in the rest position of push button switch 49, contacts 50 and 50′ are interconnected by movable plate 52. Upon closing of combined ignition switch 39 and starter switch 40, the ignition circuit is closed in conventional manner and also the starter circuit by means of relay 42. Simultaneously, and as long as starter switch 40 is closed, the vibrator circuit is also closed in the following manner: Starter switch 40, wire 55, contact 50′, plate 52, contact 50, wire 6, solenoid 2 of the vibrator, contacts 5, 17, lever 4, 15 and ground. The vibrator vibrates and contacts 8, 11 rapidly open and close to thereby supply variable current to the primary 22 of the induction coil through wire 37 and junction 48. Thus, a plurality of sparks are produced by the spark plugs 26 connected through distributor 25. As soon as starter switch 40 opens, the vibrator unit is cut off.

However, after opening of starter switch 40 and stoppage of starter motor 44, the operator can still cause production of a rapid succession of sparks through the vibrator unit by depressing push button 53 in which case the starter switch 40 is by-passed through wire 56, contact 51′, plate 52 and contact 51.

The push button switch 49 will be normally located on the dash board of the motor vehicle with button 53 readily accessible to the driver. The provision of switch 49 for effecting rapid succession of sparks even after the starter motor is stopped, is very useful especially during the first few minutes of engine running, when the spark plug electrodes are still damp with humidity or wet with excessive gas condensed thereon. The sparks in rapid succession will rapidly dry out the spark plug electrodes.

In the second embodiment, it will be noted that the timer switch 24 is not cut off during operation of the vibrator, as it has been found that the continuing operation of the timer does not impede operation of the vibrator.

While preferred embodiments in accordance with the present invention have been illustrated and described it is understood that various modifications may be resorted to without departing from the spirit and scope of the appended claim.

What I claim is:

A starting system for internal combustion engines comprising spark plugs, a battery, a starter motor, an induction coil having a primary and a secondary, a cam operated timer switch and a vibrator unit electrically connected to said primary, a distributor for the spark plugs of the engine electrically connected to said secondary, an ignition switch for electrically connecting the induction coil to the battery, a starter switch for electrically connecting the starter motor to the battery, and a manually operated push button switch having a normal position in which said switch electrically connects said vibrator unit to the wire electrically connecting said starter switch to the starter motor, such that said vibrator unit will vibrate as long as said starter motor operates, said manually operated push button switch having an alternate depressed position in which it by-passes said starter switch and electrically connects said vibrator unit directly to said battery, so that continuation of operation of said vibrator unit can be achieved even after stoppage of said starter motor, said vibrator unit having a solenoid, a fork-shaped vibrating lever with contacts at the outer ends of its two branches and electrically connected to ground by a spring blade, and stationary contacts adapted to successively and alternatively abut the contacts at the outer ends of said branches, one of said stationary contacts being electrically connected to said solenoid and the other stationary contact being electrically connected to the primary of the induction coil.

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