Nov. 27, 1923. 1,475,184

W. W. HAWKINS

IGNITION SYSTEM

Filed Feb. 20, 1922

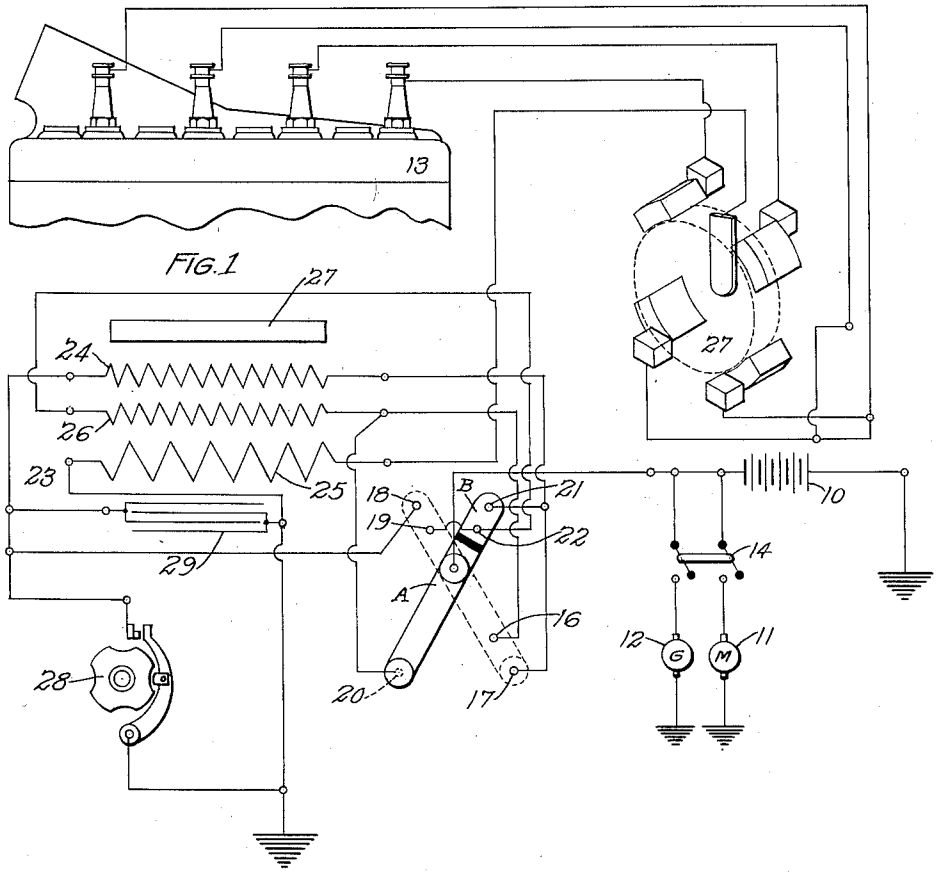


FIG. 1

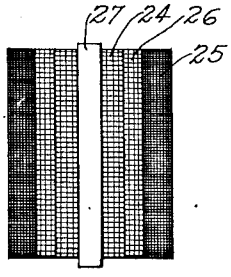


FIG. 2

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UNITED STATES PATENT OFFICE.

WILLIAM W. HAWKINS, OF BROOKLYN, NEW YORK, ASSIGNOR TO WEBSTER ELECTRIC COMPANY, OF RACINE, WISCONSIN, A CORPORATION OF WISCONSIN.

IGNITION SYSTEM.

Application filed February 20, 1922. Serial No. 537,988.

To all whom it may concern:

Be it known that I, WILLIAM W. HAWKINS, a citizen of the United States, and resident of Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Ignition Systems, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to an ignition system which comprises a storage battery which is also adapted to be operably connected with engine starting and battery charging equipment.

The principal object of the invention is the provision of an ignition system which will function to produce effective ignition sparks when, at starting, the storage battery is being heavily drained of energy by the starting motor, and which will also function to furnish effective sparks when, with the engine running, the battery is fully charged or is being charged.

Other objects and advantages of my invention will appear as the following detailed description progresses.

In the accompanying drawings,

Figure 1 is a diagrammatic representation of an ignition system embodying my invention, and

Figure 2 is a sectional view illustrating how the primary, secondary and tertiary windings of the ignition coil are mounted upon their associated core.

Referring to the drawings, reference numeral 10 indicates a storage battery of the type commonly employed in connection with the starting and ignition equipment of automotive vehicles. At 11 and 12, respectively, I have illustrated a starting motor and generator, the armatures of these dynamo-electric machines being adapted to be connected with the crank shaft of engine 13 in the usual or any satisfactory manner, it being understood that the motor 12 is placed in driving relation to the engine when the latter is to be started, and that the generator is placed in driven relation to the engine when the same is running under its own power. At 14 I have diagrammatically illustrated a switch for controlling the motor and generator circuits.

The ungrounded terminal of battery 10 is connected with the portion A of a switch 15, which also comprises a portion B which is insulated from portion A. The switch is intended to lie in the dotted line position of Figure 1 at starting, in the full line position when the engine is running, and in an intermediate position when the ignition system is to be put out of commission. When the switch 15 lies in the position illustrated by dotted lines in Figure 1, the portion A thereof connects each of two stationary buttons 16 and 17, and the portion B electrically connects a pair of stationary contact buttons 18 and 19. When the switch lies in the full line or "running" position, the portion A thereof connects a button 20 with battery, portion B of the switch at this time serving electrically to connect a pair of contact buttons 21 and 22.

Indicated as a whole by reference numeral 23 is an ignition coil which comprises a primary winding 24, a secondary winding 25, and a tertiary winding 26, the several windings being in inductive relation to, and preferably mounted upon, a suitable core 27, as illustrated in Figure 2. The secondary 25, as is customary, consists of a greater number of turns than the primary and is formed of finer wire than the primary. The tertiary winding is preferably, but not necessarily, identical with the primary, both with regard to its number of turns and the size of wire employed.

One end of secondary 25 is grounded, the other side of the secondary being connected by a suitable conductor with the flier of an engine driven distributor which is diagrammatically illustrated at 27. The distributor of course, comprises a plurality of segments which are connected with the spark plugs of engine 13, the flier being adapted, by co-operation with the segments, successively and in proper sequence to connect the spark plugs with the secondary winding.

One end of primary 24 is connected by suitable conductors with the contact buttons 21 and 17, the other end of the primary being connected by a suitable conductor with the stationary or insulated contact of an engine driven interrupter mechanism indicated at 28. The movable contact of the interrupter is grounded in the usual manner, a condenser 29 being connected across the interrupter contacts, as illustrated.

One end of the tertiary winding 26 is

connected by suitable conductors with the contact buttons 16 and 20, the other end of the tertiary winding being connected by suitable conductors with each of the contact buttons 22 and 19. Contact button 18 is electrically connected with the stationary interrupter contact.

It should be understood that the interrupter cam and the distributor flier are driven by and in timed relation to the engine, the flier being in contact with a proper one of its associated segments each time the interrupter contacts open.

Now let us assume that the switch 15 has been placed in the dotted line or "starting" position, and that the circuit of motor 11 has been closed to start the engine. When the motor circuit is closed, the battery is practically short circuited and is being rapidly drained of electrical energy, the result being that the terminal voltage of the battery is low. In ordinary ignition systems, the sparks produced when the battery is discharging heavily through the starting motor are very poor because the terminal voltage of the battery is so low that very little electrical energy traverses the primary circuit of the ignition system. In the system of my invention, this difficulty is minimized because when the switch 15 is in its "starting" position, the resistance of the primary circuit is very much less than is desirable and necessary when the voltage of the battery is normal.

At this time, I wish to point out that the resistance of each of the windings 24 and 26 is much less than (say, approximately one-half) what the resistance of the primary winding would necessarily be if the ignition coil were of the ordinary type comprising merely primary and secondary windings.

I shall now describe how the primary or ignition coil exciting circuit of the system of my invention functions when the switch 15 is in its "starting" position. Current flows from the ungrounded terminal of the battery to portion A of switch 15, which at this time contacts with each of the buttons 16 and 17. The current now flows in parallel through the primary and tertiary coils. One branch of the divided circuit may be traced from button 17 through primary 24, and thence through the interrupter contacts to ground and back to battery. The other branch of the divided circuit may be traced from button 16, through tertiary coil 26, thence through button 22, button 19, switch portion B, button 18, and interrupter contacts to ground and back to battery. The primary and tertiary coils are so wound that they co-operate in polarizing the ignition coil core.

We will now assume that the interrupter contacts are separated to cause the occurrence of the sparks at the spark plug with which the distributor flier is at the moment connected. Separation of the contacts opens the primary circuit which includes the primary and tertiary windings. The result of depolarization of the ignition coil core and the high frequency oscillations which occur in the primary and tertiary coils, due to the condenser discharge, causes a high tension ignition current to be induced in secondary 25. The operation just described continues so long as the switch 15 remains in its "starting" position, the distributor flier connecting the secondary winding in proper sequence with the spark plugs to be fired, the interrupter contacts separating each time a spark is to be created.

We will now assume that the engine is running, and that the motor 11 has been disconnected from battery, and that the battery is being charged by the generator. The battery voltage is now normal, or almost normal, and it is, of course, desirable that the primary circuit of the system have more resistance than it had when the battery was practically short circuited through the starting motor. The switch 15 is, therefore, shifted to its "running" position, indicated in full lines in Figure 1. The primary or energizing circuit of the ignition coil is now traced from battery to portion A of switch 15, thence to button 20, thence through tertiary coil 26, contact button 22, switch portion B, contact 21, primary 24, and the interrupter contacts to ground and back to battery.

It will be noted that the current at this time flows through each of the primary and tertiary coils in such direction that such coils still co-operate to polarize their associated core. However, the battery current now flows through the primary and tertiary windings in series. The resistance of the ignition coil exciting circuit is now substantially four times what it was when the switch 15 was in its "starting" position. With the switch 15 in its "running" position, the separation of the interrupter contacts opens a circuit including the primary and tertiary windings in series, and a high tension current is created in the secondary due to the de-energization of the primary and tertiary windings and the discharge of the condenser through such windings.

For convenience in description, I have spoken of the ignition coil as comprising primary, secondary and tertiary coils. Each of the coils 24 and 26 may, however, be considered a primary winding or a section of a primary winding, if one chooses to consider the windings 24 and 26 as constituting the primary winding of the coil. The important fact, however, is that the battery current is directed through the windings 24 and 26 in parallel for starting and in series when the engine is running.

Having thus illustrated and described a preferred embodiment of my invention,

what I claim is new and desire to secure by Letters Patent of the United States is:

1. In an ignition system, a secondary circuit, an ignition coil secondary forming part of said circuit, a primary circuit, primary and tertiary ignition coils, both in inductive relation to said secondary coil, and means adapted to connect said primary and tertiary coils either in parallel or in series with each other.

2. In an ignition system comprising a storage battery and an engine driven generator for charging said battery, an ignition coil comprising secondary, primary and tertiary windings, both of the latter being in inductive relation to said secondary winding, a primary circuit including said battery and said primary and tertiary windings, and a starting switch adapted when in one position to establish the primary circuit through the said primary and tertiary windings in parallel and when in another position to establish the primary circuit through the primary and tertiary windings in series.

3. In an ignition system, an induction device including a primary coil consisting of a plurality of parts, a source of electrical energy, a circuit including said source, and a circuit changing device and connections for connecting said parts to said circuit in series relation or in parallel relation.

4. In an ignition system, an induction device including a primary coil consisting of two parts, a source of electrical energy, a circuit connected thereto, connections and a circuit changing device cooperating therewith for in one position including said two parts of said coil in series in said circuit, and in another position including said two parts of said coil in parallel in said circuit.

5. In an ignition system, an induction device including a primary coil consisting of two substantially equal parts, a source of electrical energy, a circuit including said source, and a circuit changing device and connections for connecting said parts in said circuit in series relation, or in said circuit in parallel relation.

In witness whereof, I hereunto subscribe my name this 27th day of January, 1922.

WILLIAM W. HAWKINS.

Witnesses:
EDNA V. GUSTAFSON,
EMILE BOURGEOIS.