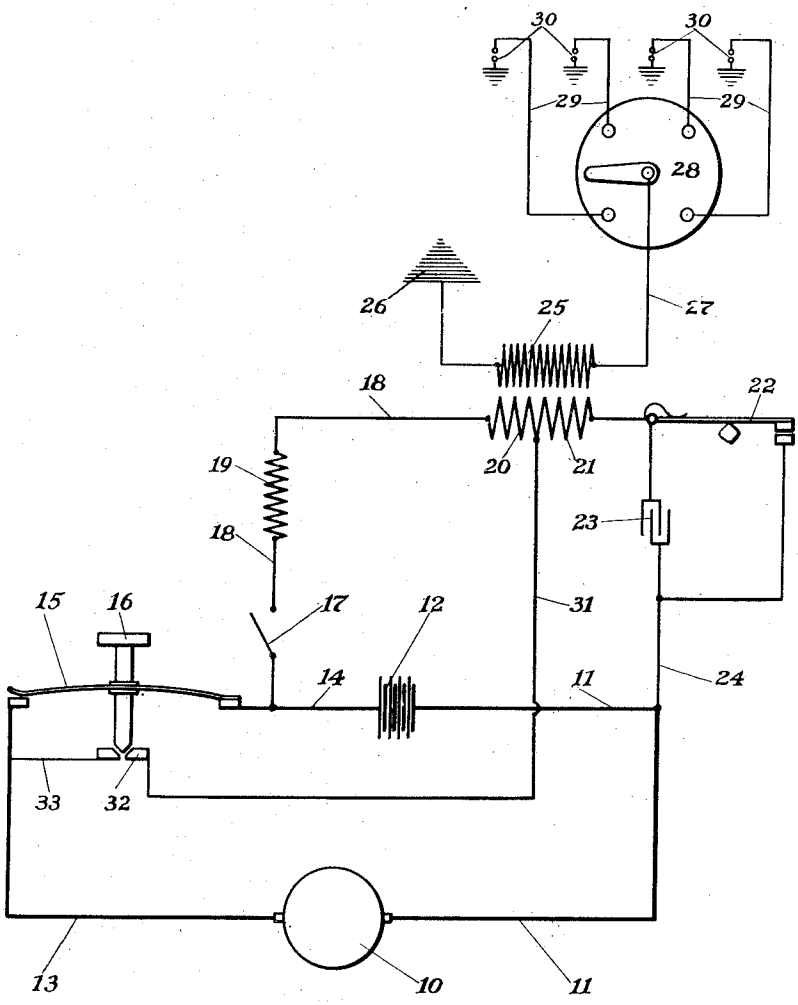
March 18, 1924. 1,487,210

H. R. DAVIES

STARTING AND IGNITION SYSTEM

Original Filed April 28, 1919



Inventor
Henry R. Davies

By Chester W. Braselton
Attorney

Patented Mar. 18, 1924. 1,487,210

UNITED STATES PATENT OFFICE.

HENRY R. DAVIES, OF NEW YORK, N. Y., ASSIGNOR TO INDUSTRIAL RESEARCH CORPORATION, OF TOLEDO, OHIO, A CORPORATION OF DELAWARE.

STARTING AND IGNITION SYSTEM.

Application filed April 28, 1919, Serial No. 293,176. Renewed June 25, 1923.

To all whom it may concern:

Be it known that I, HENRY R. DAVIES, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Starting and Ignition Systems, of which I declare the following to be a full, clear, and exact description.

This invention relates to improvements in starting and ignition systems for internal combustion engines, particularly those in which the starting power comes from an electric motor, the latter drawing current from a storage battery which supplies ignition to the engine. At the time of starting, a very heavy current is required by the motor, and this so reduces the voltage across the battery terminals that the ignition current suffers a considerable reduction. Obviously it is important that good ignition be obtained at starting. The principal object of the invention is, accordingly, the provision of means for reducing the total resistance of the primary ignition circuit while the starting motor is in operation, thus permitting a heavier current to pass through the primary winding of the ignition coil, thereby increasing the total number of ampere turns, and hence, producing a hotter spark. Another object contemplated in the invention is the accomplishment of the reduction in the primary coil resistance at starting without at the same time reducing proportionately the primary self induction and thereby securing an increase in ampere turns without disturbing materially the time constant of the primary coil.

Other objects, and objects relating to details of construction and economies of manufacture, will appear as I proceed with the description of that embodiment of the invention, which, for the purposes of the present application, I have illustrated in the accompanying drawing, which is a diagrammatic showing of apparatus and electrical connections embodying my invention.

In the drawing, 10 indicates an electric motor for starting a gas engine (not shown). The motor is joined by a wire 11 with the negative terminal of a storage battery 12, and by wires 13 and 14, together with a switch arm 15, with the positive terminal of the battery. The switch arm 15 has a normal tendency to maintain the circuit open and is arranged to be depressed by a starting button 16 to close the circuit. The battery 12 furnishes current for the ignition system of the engine when a switch 17 is closed, current then flowing from the battery 12 through wire 14, switch 17, wire 18, which may include a resistance 19 if desired, primary windings 20 and 21, and thence through interrupter 22 or condenser 23, as the case may be, and wires 24 and 11 back to the battery. A secondary coil 25, in which high tension alternating current is induced, is connected to ground at 26, and through wire 27 with a distributor 28, from which leads 29 extend through spark plugs 30 to ground.

From the juncture of the coils 20 and 21, a conductor 31 leads to a switch 32, which is arranged to be closed by the starting button 16 whenever the latter is depressed to complete the motor circuit. The other side of the switch 32 is connected through a wire 33 with conductor 13. When the switch 32 is closed, current may pass from battery 12 through wire 14, switch arm 15, wires 13 and 33, switch 32, wire 31, coil 21, interrupter 22 and condenser 23, and wires 24 and 11 back to the battery.

In order to carry out my invention, that part of the normally operative ignition circuit which is shunted by closing of the switch 32 (in this case, wire 18, resistance 19 and coil 20) must contain greater resistance in proportion to the number of turns in its coil 20, than is contained in the balance of the circuit in proportion to the number of turns in its coil 21. In accomplishing this purpose it is convenient to make coil 20 of smaller or higher resistance wire than that of the coil 21. However, these two coils may be made of the same wire if preferred, and other resistance introduced into that part of the circuit containing the coil 20, such for instance as a coil of resistance wire 19, shown in the drawing, or if desired, the coil 19 may be employed in addition to the use of higher resistance wire in coil 20 than in coil 21. It should be borne in mind, however, that where the resistance 19 is not employed, the mere winding of coils 20 and 21 of different lengths thereby producing different resistances, but resistances that vary directly with the number of turns in the coils, will not have the desired effect provided that the time constant of the induction

circuit is low as compared to the rate of interruption.

In the operation of my invention, when it is desired to start the engine, the starting button 16 is depressed, causing the motor 10 to draw a heavy current from the battery in order to turn the engine shaft. This reduces the voltage of the battery to something less than half its normal voltage, which, in the usual wiring system, would result in a weak spark that under some conditions might cause great difficulty in getting the engine started. In my invention however, the act of closing the starting switch accomplishes the closing of a shunt circuit 31, 32, 33, around that part of the ignition circuit which contains the greater resistance in comparison to the number of turns in its winding. Consequently a proportionately greater current is enabled to flow through the other primary winding 21, and its ampere turns become greater than the ampere turns of the two coils would be without the shunt circuit. In addition, there is a small current flowing through coil 20, but the resistance of this path is so much greater than that of the shunt path that the ampere turns of coil 20 add very little to the total effect.

Attention is directed to the fact that since both the resistance and the induction of the primary coil are decreased during the starting operation, the time constant of the coil is not materially altered thereby maintaining the effectiveness of the induction in the secondary coil 25.

I am aware that the particular embodiment of my invention above described, and illustrated in the accompanying drawing, is susceptible of considerable variation without departing from the spirit thereof, and therefore I desire to claim my invention broadly as well as specifically, as indicated by the appended claims.

I claim as my invention:

1. In a starting and ignition system for gas engines, a motor for revolving the engine shaft at starting, a battery electrically connected to said motor, an ignition coil comprising two series primary windings of different resistance wire, said windings being connected to take current from said battery, a starting switch for the motor circuit, and a shunt also controlled by said switch extending from the juncture of said windings around the winding of greater resistance wire.

2. In a starting and ignition system for gas engines, a motor for revolving the engine shaft at starting, a battery electrically connected to said motor, an ignition coil comprising two primary windings in series, said windings being connected to take current from said battery, a starting switch for the motor circuit, and a shunt also controlled by said switch extending from the juncture of said windings around one of them, that part of the principal ignition circuit which is included between the ends of said shunt, being of greater resistance in comparison to the number of turns in its primary winding than the remainder of the circuit.

3. In a starting and ignition system for gas engines, a motor for revolving the engine shaft at starting, a battery electrically connected to said motor, an ignition coil comprising two primary windings, one of greater resistance in proportion to the number of turns than the other, said windings being connected together in series to take current from said battery, a starting switch for the motor circuit and a shunt also controlled by said switch extending from the juncture of said windings around the winding of larger proportional resistance.

4. In a starting and ignition system for gas engines, the combination of a storage battery, an electric motor electrically connected to the battery, an ignition system including a primary coil connected to the battery, said primary coil having a section with resistance relatively higher than the remaining portion of the coil, an electrical short circuit connection from the battery to the primary coil at the point of connection of the higher resistance and lower resistance sections, single switching means in the motor and short circuit effective to permit simultaneous electrical energization of the motor and that portion of the ignition coil having the lower resistance, and automatic means for maintaining said switch in a normally inoperative position.

5. In a starting and ignition system for gas engines, a motor for revolving the engine shaft at starting, a battery electrically connected to said motor, an ignition coil comprising two series primary windings of different resistance wire, said windings being connected to take current from said battery, a short circuit extending from the juncture of said windings to the battery, and a switch in the motor and short circuits, said switch being effective to simultaneously close the motor circuit and short circuit the winding of higher resistance.

In testimony whereof, I affix my signature.

HENRY R. DAVIES.