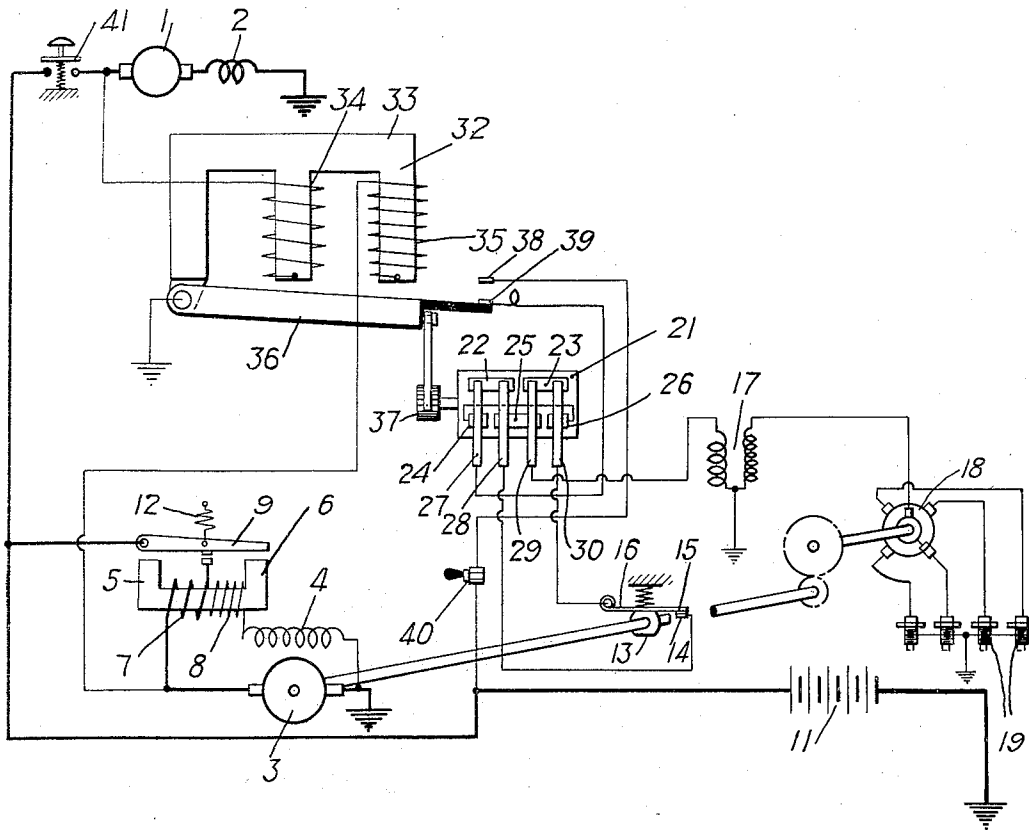


R. P. JACKSON.
ELECTRICAL SYSTEM.
APPLICATION FILED FEB. 3, 1916.

1,298,728.

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WITNESSES:

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ELECTRICAL SYSTEM.

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To all whom it may concern:

Be it known that I, RAY P. JACKSON, a citizen of the United States, and a resident of Edgewood Park, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Electrical Systems, of which the following is a specification.

My invention relates to electrical systems for automobiles and particularly to systems in which the direction of current through the primary circuits of ignition systems is periodically reversed.

My invention has for its object to provide a system of the above indicated character which embodies a simple and efficient means for reversing the direction of current traversing the contact members of an interrupter in the primary circuit of an ignition system.

In the operation of interrupter mechanisms for the ignition circuits of internal-combustion engines, it is desirable that the current be reversed periodically in order to maintain substantially plane surfaces upon the faces of the contact members. If each of the contact members is permanently connected to one pole of a battery or a magnet, as the case may be, current always flows from the same contact member to the other in the arc which follows their separation to break the primary circuit.

The result is to cause one contact piece to become pitted because of the surface metal being carried away and to cause projections on the surface of the other contact member because of the metal deposited during the existence of the arc. The efficiency of the interrupter is decreased by the resulting poor electrical contact between the irregular surfaces of its contact members and the life of the mechanism is correspondingly shortened.

It has been proposed, heretofore, to accomplish the reversal of direction of current traversing the contact members of interrupters by means of reversing switches located upon the dashboards of automobiles and operatively connected to the manually operable switches for controlling the ignition circuits. In such arrangements, it is necessary that each of the various conductors which connect the source of current and the interrupter mechanism to the reversing switch be brought to the dashboard. In view of the distances separating the various

mechanisms and the difficulty in providing means for supporting a large number of conductors, the above described arrangement possesses a number of disadvantages.

According to the present invention, I provide a reversing switch which controls the direction of current traversing the primary circuit of the ignition system in accordance with the operation of the usual electric starting motor. A reversing switch mechanism is actuated to reverse the electrical connections of the primary circuit of the ignition system. An electromagnet, which is operatively connected to the reversing switch by means of a pawl-and-ratchet mechanism, has a magnetizing winding in circuit with the starting motor. The electromagnet is provided, also, with a holding coil that is in circuit with the electrogenerator of the double-unit system in connection with which my invention is employed.

The details of my invention will be described in connection with the accompanying drawing in which the single figure is a diagrammatic view of circuits and apparatus embodying my invention.

An electric motor 1, which may be operatively connected to the internal combustion engine of an automobile, has a series field-magnet winding 2. An electric generator 3, which is also operatively connected to the internal-combustion engine in any suitable manner, has a shunt field-magnet winding 4.

The main or charging circuit of the generator is controlled by a cutout 5 which comprises a core member 6 of magnetic material, a coil 7 that is in series with the armature of the generator and a coil 8 that is in series with the shunt field-magnet winding 4. A pivotally mounted armature member 9 controls the connection of a storage battery 11 to a common point of the coils 7 and 8. A spring 12 normally holds the armature member 9 in its uppermost position to break the main circuit of the generator.

An ignition system, which is supplied with energy from the generator 3 or the battery 11, as the case may be, comprises an interrupter having a rotatable cam 13 that is operatively connected to the generator 3, a stationary contact member 14 and a co-acting movable contact member 15 that is carried by a pivotally mounted lever 16. The ignition system comprises also an induction coil 17, a distributor 18 that is oper-

actively connected to the generator 3, and the usual spark plugs 19.

The electrical connections of the interrupter contact members are controlled by a reversing switch mechanism 21 comprising contact segments 22, 23, 24, 25 and 26 and contact fingers 27, 28, 29 and 30. The reversing switch 21 is controlled by an electromagnet 32 which comprises a core member 33 of magnetic material, a coil 34 that is in parallel-circuit relation to the starting motor 1, a coil 35 that is connected across the terminals of the generator 3, and a movable armature member 36. The movable armature member 36 is operatively connected to the reversing switch 21 by means of a pawl-and-ratchet mechanism 37. The ignition circuit is controlled by a pair of relatively movable contact members 38 and 39 which are in engagement only when the movable armature member 36 occupies its uppermost position. The ignition circuit is controlled also by a manually operable switch 40 which may be the usual plug switch of the type that is mounted upon the dashboard of an automobile.

In the operation of the system described above, a switch 41 is closed to complete the circuit of the starting motor 1. The motor circuit extends from one terminal of the storage battery 11 through switch 41, armature of motor 1, and field-magnet winding 2 to ground and thence to the grounded terminal of the battery 11. A parallel circuit, which is also completed by the switch 41, extends through coil 34 and core member 33 to ground. The coil 34 is energized to cause the armature member 36 to be drawn upwardly to effect the engagement of contact members 38 and 39 and thereby render the ignition mechanism operative. The starting motor 1 operates to crank the internal-combustion engine to which it is operatively connected.

During the actuation of the engine by the starting motor, the generator 3 and the ignition mechanism will be operated to cause ignition sparks at the spark plugs 19. The primary circuit of the ignition system extends from one terminal of the battery 11 through plug switch 40, contact members 38 and 39, contact finger 27, contact segment 22, contact finger 28, interrupter contact members 14 and 15, interrupter lever 16, contact finger 30, contact segment 23, contact finger 29 and the primary winding of the induction coil to ground and thence to the grounded terminal of the battery 11.

When the engine starts under its own power, the switch 41 is released to open the circuits of the starting motor and the coil 34. The armature member 36 is maintained in its operative position by the coil 35 which is energized by the generator 3 and operates as a holding coil to maintain the closure of the

electromagnet during such time as the generator 3 is in operation. Current also traverses the circuit comprising the generator 3, shunt field-magnet winding 4 and coils 8 and 7 of the cutout 5. When the voltage of the generator reaches a predetermined value, the armature member 9 is drawn downwardly to connect the generator 3 to the battery 11, the coil 7 acting as a holding coil to maintain the charging circuit of the generator during such time as the voltage of the latter is greater than that of the battery.

To stop the engine, it is only necessary to open the switch 40 to render the ignition mechanism inoperative. When the speed of the generator 3 falls to a rate at which its voltage is less than that of the battery 11, current tends to flow in a reverse direction through the charging circuit comprising the holding coil 7. The latter, which normally assists the shunt coil 8, now opposes it, and the armature member 9 is released to open the charging circuit. When the generator voltage has decreased to substantially zero value, the coil 35 is deenergized and the armature member 36 is drawn downwardly by force of gravity to separate the contact members 38 and 39 and to actuate the reversing switch through the pawl-and-ratchet mechanism 37.

To again start the engine, the cycle of operations above described is repeated. It will be noted, however, that the electrical connections of the interrupter contact members 14 and 15 have been reversed by the switch 21. When the armature member 36 is drawn upwardly to effect the engagement of the contact members 38 and 39, the primary circuit of the ignition system extends from one terminal of the battery through the switch 40, contact members 38 and 39, contact finger 27, contact segments 24 and 26, contact finger 30, interrupter contact members 15 and 14, contact finger 28, contact segment 25, contact finger 29 and the primary winding of the induction coil 17 to ground and thence to the grounded terminal of the battery.

It will be readily understood that the electrical connections of the interrupter contact members are reversed periodically, the frequency of such reversals corresponding to the use of the starting motor. It has been found in practice that the starting of the engine occurs with sufficient frequency to maintain the interrupter contact members in satisfactory condition. It may be noted, also, that I provide an automatic arrangement for controlling the ignition system in accordance with the electrical conditions of the starting motor and that the operation of the ignition system is maintained in accordance with the electrical conditions of the generator.

Various modifications of my invention 13

may occur to those skilled in the art to which my invention appertains and it is understood that such changes may be made as fall within the scope of the appended claims without departing from the spirit of my invention.

I claim as my invention:

1. In an electrical system, the combination with an electric motor, and an ignition circuit comprising an interrupter, of electro-responsive means actuated in accordance with circuit conditions of said motor for controlling the electrical connections of said interrupter.

2. In an electrical system, the combination with a starting motor and an ignition circuit comprising an interrupter, of means controlled in accordance with conditions in the starting motor circuit for reversing the electrical connections of said interrupter.

3. In an electrical system, the combination with an electric motor, and an ignition circuit comprising an interrupter, of a reversing switch for controlling the electrical connections of said interrupter, and electro-responsive means in circuit with said motor for actuating said reversing switch.

4. In an electrical system, the combination with an electric motor, and an ignition circuit comprising an interrupter, of an electric generator, and electro-responsive means controlled in accordance with circuit conditions of said motor and said generator for controlling the electrical connections of said interrupter.

5. In an electrical system, the combination with an electric motor, and an ignition circuit comprising an interrupter, of an electric generator, and an electro-magnet for controlling the electrical connections of said interrupter, said electromagnet comprising a coil in parallel-circuit relation to said motor and a coil in shunt relation to said generator.

6. In an electrical system, the combination with an electric motor, and an ignition circuit comprising an interrupter, of an electric generator, and an electromagnet for controlling the electrical connections of said interrupter, said electromagnet comprising an actuating coil in circuit with said motor

and a holding coil in circuit with said generator.

7. In an electrical system, the combination with an electric motor and an ignition circuit comprising an interrupter, of electro-responsive means actuated in accordance with motor circuit conditions for simultaneously controlling said ignition circuit and reversing the electrical connections of said interrupter.

8. In an electrical system, the combination with an electric motor, and an ignition circuit comprising an interrupter, of a reversing switch for controlling the electrical connections of said interrupter, an electro-responsive device in circuit with said motor, and a ratchet mechanism for operatively connecting said device to said switch.

9. In an electrical system, the combination with an electric motor, and an ignition circuit comprising an interrupter, of a reversing switch for controlling the electrical connections of said interrupter, an electro-responsive device in circuit with said motor having a movable member for controlling the ignition circuit and for actuating said switch.

10. In an electrical system, the combination with an electric generator, an electric motor, and ignition mechanism, of means controlled by circuit conditions of said generator and said motor for controlling the operation of said ignition mechanism.

11. In an electrical system, the combination with an electric motor, and an ignition circuit comprising an interrupter, of electro-responsive means automatically actuated in accordance with the circuit conditions of said motor for reversing the electrical connections of said interrupter.

12. In an electrical system, the combination with an electric generator, an electric motor, and ignition mechanism, of means automatically controlled by circuit connections of said generator and said motor for reversing the circuit connections of said ignition mechanism.

In testimony whereof, I have hereunto subscribed my name this 27th day of Jan. 1916.

RAY P. JACKSON.