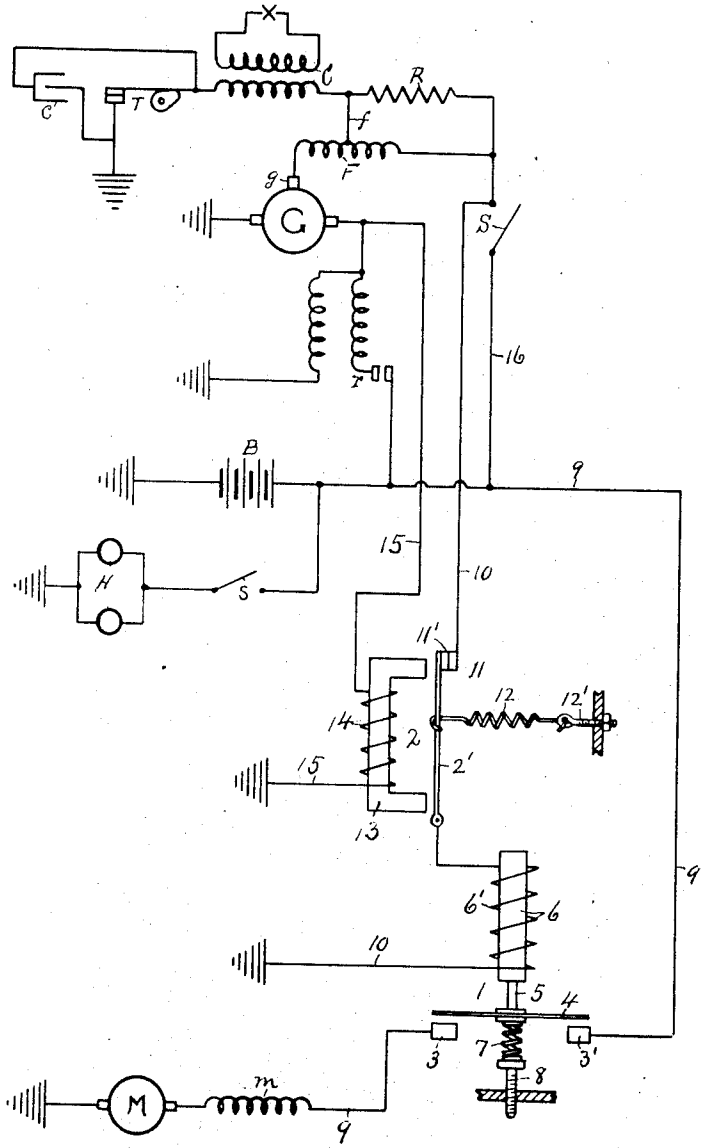
Dec. 26, 1933. A. E. DOMAN 1,941,433

ELECTRICAL SYSTEM FOR AUTOMOBILES

Filed Jan. 18, 1932



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Patented Dec. 26, 1933 1,941,433

UNITED STATES PATENT OFFICE

1,941,433

ELECTRICAL SYSTEM FOR AUTOMOBILES

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Application January 18, 1932. Serial No. 587,359

1 Claim. (Cl. 290—37)

This invention relates to an improved electrical ignition and starting system for motor vehicles in which an internal combustion engine is used as the motive power and is similar in some respects to that shown in my pending application Serial No. 573,029, filed November 30th, 1931, in that the closing of a single master switch energizes the ignition system and causes the operation of the starting motor and simultaneously produces separate excitation of the generator field. The engine operates under its own power immediately following the initial operation of the starting motor.

Another similarity is that immediately following the operation of the engine under its own power the current voltage of the engine driven generator is utilized for the operation of a circuit breaker to break the circuit through the starter switch and thereby to allow the latter to open for stopping the starting motor and that in case the engine should become stalled from any cause while the master switch remains closed, the starter switch will be automatically closed to again operate the starting motor without any further attention upon the part of the operator, it being understood that the starting motor will be automatically thrown out of action immediately following the operation of the engine under its own power.

The broad objects of both applications are, therefore, quite similar, but it will be noted that the pending application referred to includes "a self-opening circuit closer adapted to be closed only when the starter switch is closed and arranged to open when the current required by the starting motor is reduced to a suitable value and that this circuit closer is connected in parallel with an electromagnetic circuit breaker having its armature and core both electrically connected in series with the winding of the starter switch".

These structural features are entirely practicable and efficient in operation, but I have found that the circuit closer may be dispensed with and the armature of the circuit breaker connected directly in series with the winding of the starter switch, and the main object of the present invention is to make these changes for the purpose of simplifying the construction and operation and at the same time greatly increasing the efficiency and reliability of systems of this character.

Other objects and uses will be brought out in the following description.

The drawing represents diagrammatically the various elements of my improved ignition and starting system for a motor vehicle in which a conventional internal combustion engine is used as the motive power.

Current is supplied to the various translating devices of the system by means of a storage battery B and a dynamo electric generator G, which latter is preferably of the third brush type and is adapted to be driven by the engine in any well known manner not necessary to herein illustrate or describe.

The ignition system is similar to that set forth in my pending application referred to in that it includes a spark-coil C, a circuit breaker or timer T and a condenser C and is adapted to be energized by current from the battery B and generator G in a manner presently described through the closing of a normally open master switch S which is operable at will and also serves to control the operation of the starting motor.

The storage battery B is connected across the main circuit of the generator G through one side of a conventional reverse current relay switch *r* having its other side connected across the main brush circuit so that when the voltage of the generator exceeds a predetermined value, depending upon the speed of the engine, it will automatically close the generator circuit to the battery 3 and cause the recharging of the said battery.

The generator G is provided with a third brush field winding F in direct connection with and separately excited by current from the battery when the switch S is closed in order to expedite the voltage output of the generator at the beginning of its operation by the engine or as soon as possible after the engine is started through the energizing of the coil C by the battery current and thereby to conserve the battery energy, said field winding also serving, in connection with the armature reaction, as a part of the means for automatically regulating the voltage output of the generator under widely varying speeds.

A non-inductive resistance R is connected in the battery circuit leading to the ignition coil C to form a part of the initial battery ignition system and also to assist in the automatic regulation of the voltage output of the generator when the reverse current relay switch *r* is closed.

A wire *f* is connected to the ignition circuit between the resistances R and coil C and is tapped into the field winding F at an intermediate point (depending upon the resistance R), best adapted to produce the desired battery voltage in the ignition system when starting the engine and also

to increase the generator voltage in said circuit under increased speed of the engine and thereby to assure a more efficient ignition under all speeds without liability of burning of the breaker points under low or starting speed.

Electric starter control

An electric motor M of any conventional type is mounted upon the motor vehicle and is adapted to be automatically connected to the engine for starting and operating the same until the engine is operating under its own power and to be automatically disconnected from the engine and stopped from further operation when and as long as the engine is operating under its own power.

The operation of the starting motor is dependent upon the closing of the master switch S and is automatically controlled by a normally open self - opening electro - magnetic circuit - closer switch 1 deriving current from the battery B through a normally closed self-closing electromagnetic circuit breaker switch 2 deriving current from the generator G.

That is, the starting motor M, including its series winding *m*, is connected in or across the battery circuit through the closing of the switch 1 which, in turn, is controlled by the circuit breaker switch 2 in a manner presently described.

As illustrated, the circuit closer switch 1 comprises a pair of contact terminals 3 and 3' and a movable contact member 4 which is mounted upon the movable plunger 5 of a solenoid 6, the switch member 4 being yieldingly held in its open position by means of a spring 7 having one end resting against an adjusting screw 8 by which the tension of the spring may be adjusted.

The switch terminals 3 and 3' are connected in the starting motor circuit 9 deriving current from the battery B so that when the switch member 4 is closed current will flow from the battery through the circuit 9 to the starting motor M for operating the latter to start the engine.

The winding, as 6', of the solenoid 6 is normally connected in or across a second battery circuit 10 through the medium of normally closed contact members 11 and 11', one of which as 11' is mounted upon a movable armature switch member 2' forming a part of the electromagnetic switch 2, said switch member 2' being yieldingly held in its closed position by means of a spring 12 having one end connected to an adjusting screw 12' by which the tension of the spring may be adjusted.

It is now clear that when the master switch S is closed, current from the battery will flow through the circuit 10, including the closed contacts 11 and 11' and movable switch member 2' and thence through the winding 6' of the solenoid thereby operating the switch member 4 to contact with the terminals 3 and 3', thus closing the battery circuit 9 through the starting motor for operating the engine.

The movable switch member 2' is preferably made of magnetizable material and forms the armature of the electromagnetic switch 2.

The core, as 13, of the electromagnetic switch 2 is provided with a winding 14 which is connected across the main circuit of the generator G so that when the engine is operated by the starting motor M and continues its operation under its own power, current from the engine driven generator G will flow through the circuit 15 including its winding 14, thereby energizing the core 13 resulting in the operation of the switch member 2' to open the contacts 11 and 11' against the action of the spring 12 for breaking the battery circuit 10 through the electromagnet 6 and allowing the spring 7 to open the switch member 4.

This opening of the switch member 4 breaks the battery circuit 9 through the motor M thus causing the stopping of the motor while the engine continues to operate to disconnect it from the motor in the manner well known in connection with starting motors.

It is now evident that if the engine should cease to operate under its own power, thereby stopping the operation of the generator G, the magnet 2 will be de-energized thereby allowing the switch member 2' to close whereupon the solenoid 6 would immediately be again energized to close the switch member 4 upon the contacts 3 and 3' for operating the starting motor M to restart the engine until the latter begins to operate under its own power without any further attention upon the part of the operator, these operations being repeated as often as the engine ceases to operate under its own power.

Aside from the ignition circuits and automatic starter control circuits to which current is supplied from the battery B and also from the generator G, it is evident that one or more translating devices such as a pair of headlights H may be connected in both the battery circuit and generator circuit and controlled by a separate switch *s* as indicated diagrammatically in the drawing.

Operation

Assuming that the engine and generator are at rest and that it is desired to start the same, then it is simply necessary to close the master switch S thus permitting the current to flow from the positive pole to the battery through wire 16, closed master switch S, thence through the circuit wires 10, including the closed contacts 11 and 11', switch member 2', and winding 6' of the starter switch 1 and return to the battery, thus energizing the electromagnet 6 to close the switch member 4 upon the contacts 3 and 3' and thence through the starting motor M and return to the battery, it being understood that the starter switch 1 and starter will then be connected in the battery circuit 9 and that the operation of the motor M will start the engine.

Simultaneously with the closing of the master switch S, a part of the battery current will be diverted through the field winding F to the generator G for separately exciting said field and thereby to expedite the building up of the voltage of said generator immediately following the starting of the engine while at the same time the battery current will flow through the primary winding of the coil C and thence through the breaker T and condenser *c* to return to the battery, the short circuit connection *f* being tapped into the field winding F to control the voltage in the ignition circuit.

That is, the starter switch 1 will remain closed for operating the starting motor until the engine actually begins to operate under its own power during which time the current will flow from the positive pole of the generator G through the circuit 15 including the winding 14 of the electromagnetic switch 2 thereby energizing the core 13 of said magnet sufficiently to attract the armature switch member 2' to open the contacts 11 and 11' against the action of the spring 12, thereby breaking the circuit through the winding 6' of electromagnetic switch 1 and allowing the latter to be opened by the spring 7 for breaking the circuit

through the starting motor and allowing the latter to stop and to be automatically disconnected from the engine in a manner well known, it being understood that as long as the engine is operating under its own power the resultant operation of the generator G will maintain sufficient energy in the electromagnet 2 to hold the switch member 2' in its open position against the action of the spring 12.

On the other hand, should the operation of the engine and generator cease, the electromagnet 2 would be immediately de-energized, thereby releasing the switch member 2' and allowing the switch members 11 and 11' to close for re-establishing the battery circuit through the winding of the electromagnetic switch 1 for closing said switch and again operating the starting motor M for restarting the engine, these operations being automatically repeated without any further attention on the part of the operator as long as the master switch S remains closed.

It, therefore, follows that in order to stop or start the engine, it is simply necessary to open or close the master switch and that when the switch is closed the operation of the engine will be controlled automatically through the cooperation of the electromagnetic switches 1 and 2 and starting motor M.

It will be noted that the armature of electromagnetic switch 2 is directly connected in the battery circuit in series with the winding of the electromagnetic switch 1, thus allowing the battery current to flow directly through said armature and winding when the master switch S is closed, and causing instantaneous closing of the starter switch and resultant operation of the starting motor for starting the engine and that as soon as the engine begins to operate under its own power the core of the electromagnet 2 will be instantly energized by current from the generator to open the switch member 2' and thereby to de-energize the electromagnet 1 and allow its corresponding switch member 4 to open for stopping the motor and causing the latter to be automatically disengaged from the engine.

The various parts of this ignition and starting system are particularly simple, practical and efficient in automatically controlling the operation of the starter and engine through the medium of a single master switch in combination with the two controlling switches 1 and 2, but obviously various changes may be made in the wiring and in the particular construction of the electromagnetic switches as well as various parts of the ignition system and reverse current relay switch without departing from the spirit of the invention.

What I claim is:

In an electric starting and ignition system for motor vehicle engines of the internal combustion type, the combination with an electric battery, an engine-driven electric generator of the third brush type having a third brush field connected in the battery circuit for separate excitation, an electrical resistance and an ignition coil both connected in the battery circuit and generator circuit, and an electric conductor tapped into the intermediate portion of said field and connected to the ignition circuit between the resistance and coil, of a starting motor for the engine deriving current from the battery, a normally open self-opening switch in the starter circuit, an electromagnet connected in a branch of the battery circuit for closing said switch, a normally closed self-closing switch electrically connected in said branch circuit, a second electromagnet connected across the main generator circuit for opening the normally closed switch, and a master switch operable at will and arranged to control the battery circuit to the field, ignition coil and to the normally closed switch.

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