United States Patent

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[33] **France**
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[54] **ENGINE STARTER CONTROL CIRCUITS**
2 Claims, 1 Drawing Fig.

[52] U.S. Cl. 290/38
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[50] Field of Search 290/22, 27, 28, 31, 32, 36, 38, 46, 47

[56] **References Cited**

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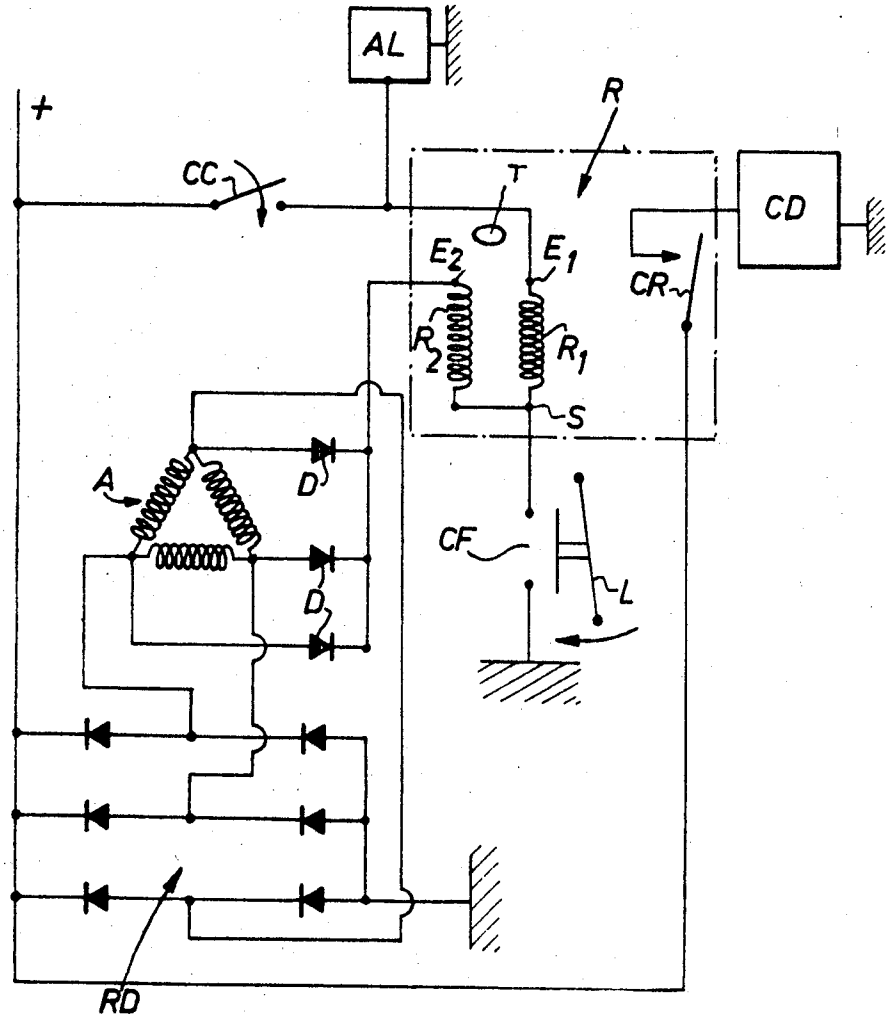
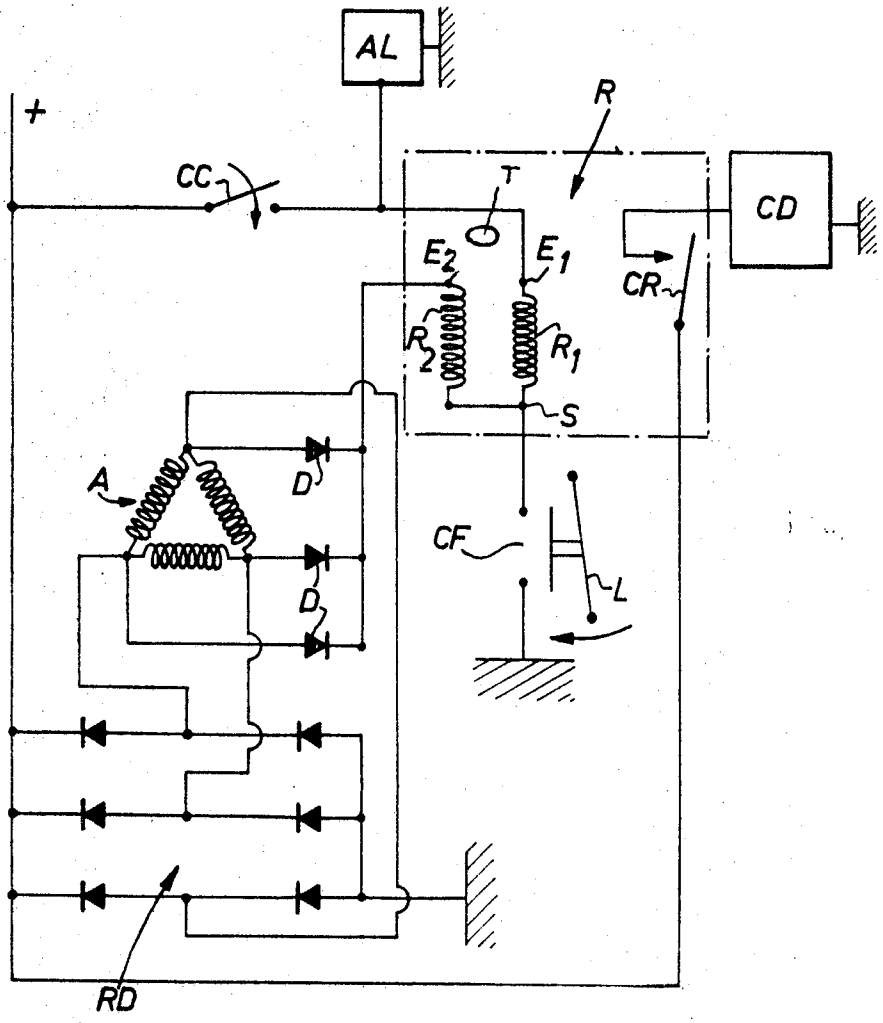
ABSTRACT: A starter motor control circuit contains a relay having two windings associated in opposed relationship, the first winding being energized through the medium of the ignition key switch and the second winding from the alternator through a special group of rectifying diodes of which the number is proportional to that of the phases of said alternator and the capacity consistent with the current drawn by the winding of the starter relay supplied therethrough.

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ENGINE STARTER CONTROL CIRCUITS

The present invention relates to control systems of internal combustion engine starter motors.

In conventional control systems of engine starter motors if the starter switch is actuated while the engine is already firing the starter drive pinion teeth engage those of the flywheel already receiving the engine torque, thus producing clashes between these sets of teeth and a risk of damage thereto.

Various devices have already been proposed with a view to avoid this inconvenience by utilizing either the current supplied from the dynamo, or a pressure responsive switch, or a centrifugal contactor.

Devices operating on current produced by the dynamo are advantageous in that they are particularly simple in design for it is only necessary to connect the starter motor or preferably its control relay or solenoid in opposition to the voltage derived from the dynamo.

However, this simple mounting cannot be used when an alternator-rectifier unit is substituted for the dynamo, for the presence of the rectifier prevents the starter relay energizing circuit from being closed through the alternator windings.

It is an object of the present invention to provide a simple starter motor control system affording the same reliability of operation when an alternator is used as a source of energizing current.

This control system comprising, branched off the energizing circuit of an ignition distributor, a relay controlling the starter switch in series with a front contact actuated by a selector lever of the change-speed transmission mechanism, is characterized in that said relay comprises a pair of associated and oppositely connected windings of which one is adapted to be energized through the ignition key switch and the other from the alternator through a special group of rectifying diodes the number of which is proportional to the number of phases of the alternator, the capacity of said diodes corresponding on the other hand to the current absorbed by the starter relay winding energized therewith.

Now a typical example of a device constructed according to the teachings of this invention will be described with reference to the single FIGURE of the attached drawing illustrating diagrammatically the wiring diagram of the device.

This device comprises in an electrical ignition circuit connected to the inserted terminal of a storage battery an ignition key switch CC connected in turn to the ignition distributor AL, the circuit being completed to the ground. Branched off this circuit between the ignition key switch and the distributor is the input terminal E_1 of a first winding R_1 of a starter motor control relay R. Another winding R_2 of this relay, wound in opposition to said first winding R_1, has its input terminal E_2 connected to a group of three star-connected diodes D each connected in turn to a separate terminal of a three-phase alternator A supplying charging current to the storage battery through a diode bridge rectifier RD having its negative terminal grounded. The output terminal S common to both winding R_1 and R_2 of relay R is connected to a front contact CF responsive to the selector control lever L of the change-speed transmission mechanism. The circuits of relay R are closed through the ground.

The starter motor relay is adapted to actuate a contact CR INSERTED in the starter switch control circuit CD.

The system operates as follows:

When the ignition key switch CC is turned on for energizing the distributor AL the energization of relay R is prepared. The closing of contact CF associated with the gear-change selector lever L causes energizing current to be supplied to the winding R_1 of relay R, thereby closing its contact CR. The starter motor switch, which may comprise an electromagnet controlling the axial translation of the starter pinion, is then energized and the motor is started.

The alternator A driven by the engine torque supplies current to the second winding R_2 of the starter relay through the medium of the three diodes D. This winding R_2 reduces to zero the magnetic field produced by the first winding R_1, thus opening the contact CR and preventing the operation of the starter motor when the engine is revolving.

Of course, this invention is applicable regardless of the number of phases of the alternator A, the number of diodes D being varied accordingly. The capacity of these diodes is selected as a function of the current absorbed by the winding R_2 of relay R.

It may be desired to retard the deenergization of relay R immediately as the engine begins to rotate, so as to prevent the engine from stalling just after it is started. In this case, the relay R will be equipped with a known time-lag device consisting either of capacitors or, as shown in the FIGURE of a retarding ring T surrounding the core of said relay.

We claim:

1. An improvement in the control systems for starter motors of internal combustion engines in automobiles and the like, which motors have a starter switch and which engines have an ignition system, including an ignition key and an alternator, and a transmission having a gear change selector, comprising a relay having two oppositely wound windings and controlling said starter switch, switch means closed by said gear-change selector and connected to one end of each of said windings, one of said windings being connected to be energized by closure of said ignition key, a plurality of rectifying diodes proportional in number to the number of phases of the alternator and connected to energize the other winding from said alternator, the capacity of said diodes corresponding to the current absorbed by said other relay winding whereby when the engine is running both windings will be energized in opposite direction thus producing zero magnetic field and preventing energization of said relay.

2. An improvement as set forth in claim 1 wherein the starter motor control relay further comprises a time-lag device for retarding the deenergization of said relay.