IGNITION AND STARTING ELECTRICAL CIRCUIT

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FIG. 1

FIG. 2

TO DISTRIBUTOR

FIG. 3

INVENTOR.

GILTNER J. KNUDSON

BY

Bauer and Seymour

ATTORNEYS
IGNITION AND STARTING ELECTRICAL CIRCUIT

Giltner J. Knudson, Guilford, N.Y., assignor to Bendix Aviation Corporation, New York, N.Y., a corporation of Delaware

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This invention relates to electrical apparatus and more particularly to ignition systems for internal combustion engines and the like.

One of the objects of the present invention is to provide novel means for supplying starting energy to an engine ignition system of the magneto-generator type.

Another object is to provide novel electrical circuit means for supplementing the energy of a magneto-generator when the latter is operating at a low speed.

A further object is to provide simplified means for boosting the energy of an engine ignition system or the like for the purpose of starting the engine.

Still another object is to provide a novel booster circuit of the above type which is novelty combined with the magneto and starting motor circuits.

Another object is to provide electrical apparatus of the above character which may be easily and satisfactorily radio-shielded at low cost.

The above and further objects and novel features of the present invention will more fully appear from the following detailed description when the same is read in connection with the accompanying drawings. It is to be expressly understood, however, that the drawings are for the purpose of illustration only and are not intended as a definition of the limits of the invention.

In the drawings, wherein like reference characters refer to like parts throughout the several views, Figs. 1 to 3 are diagrammatic illustrations of three modifications of engine ignition circuits embodying the invention.

In the several embodiments of the invention illustrated in the drawings, by way of example, the same is shown in conjunction with a conventional type of engine ignition system wherein the required electrical energy is generated during normal engine operation by a magneto generator, the rotating parts of which are usually driven by the engine. In each of the modifications shown, a magneto M is shown as comprising the usual ignition coil which includes a primary winding 5 and a secondary winding 6.

One end of the primary winding 5 is connected to the ungrounded contact of a circuit breaker 7 which is normally maintained open by spring means 8, but is closed periodically by a rotating cam 9. A condenser 10 is connected across the contacts of the circuit breaker to reduce arcing.

Electrical energy is generated in coil 5, 6 in any conventional manner, such as by a rotating magnet system, not shown. The high potential end of secondary winding 6 is shown connected to the rotor of a conventional distributor D through which said winding is successively connected to the spark plugs 11 in the engine cylinders.

It is present common practice, particularly in automobiles, to start the engine by using a battery excited motor for initially driving or rotating the engine crank shaft. For this purpose, the winding of the starting motor SM is connected with a battery B through a switch 12, which may be either manually or relay operated.

In the form shown, switch 12 is normally held open by spring means 14 and urged to closed position by a relay coil 15 when the latter is energized. Coil 15 may be connected to battery B or through a manually operable switch 16. Thus, when starter switch 16 is closed, relay coil 15 is energized and switch 12 will be closed, permitting current to flow from the battery to the winding of the starting motor SM.

At the relatively low speed at which the engine and hence the magneto M are driven by the motor SM, the magneto is usually incapable of supplying sufficient electrical energy to effect starting of the engine. It is accordingly desirable and usually necessary to supplement the energy of the magneto for starting the engine. This additional energy may be taken from the battery B or other comparable source, and the present invention comprehends novel combinations for circuits wherein this result is accomplished with simplicity, and without appreciably affecting the normal operation of the circuits above described.

Normally, the low potential ends of magneto windings 5 and 6 are connected to ground, and the magneto is rendered inoperative by closing an ignition switch 17 interposed between the other end of primary winding and ground. The present invention contemplates supplying current directly from the battery to the normally grounded end of magneto primary winding 5.

In the embodiments of Figs. 1 and 3, this is accomplished by connecting battery B to primary winding 5 through relay switch 18, a resistance 19 and a second relay switch 19, the latter being actuated to starting position by a coil 20 which is connected in circuit with the battery whenever the switch 12 is closed. Switch 19 is spring actuated to the illustrated or normal operating position to connect winding 5 directly to ground for thus restoring conventional operating conditions after the engine has started and the starter system is de-energized by the opening of switch 16.

The resistance 18 is inserted between the battery and the primary winding 5 for the purpose of reducing the current flow through said winding and hence, to minimize the demagnetization effect thereof on the magnet system of the magneto and prevent overheating of the magneto coil. With various magnetos designed and adapted for automotive use, it has been found that a suitable resistance 18 may vary from about 3 to about three ohms depending upon the battery voltage and the design of the magneto coil. The ohmic value of resistor 18 should be such that adequate current for boosting the magneto will flow through coil 5 at minimum expected battery voltage. At the same time, said resistance should prevent the flow of current at maximum expected battery voltage which would overheat the magneto coil and cause rotor demagnetization. In calculating resistance 18 for any particular system, one must then determine how much current can safely be permitted to flow in winding 5 and how little current will satisfactorily boost the magneto energy for the desired purpose. The range of battery voltage must also be known. In most automotive and similar equipment, batteries rated at from 6 to 24 volts are presently used.

If desired, relay switch 19 may be omitted and the winding 5 permanently connected to ground through resistance 18 and the winding of starting motor SM. In such a circuit, some energy from the magneto will be dissipated in the resistance during normal operation, but in many instances this loss is of insufficient magnitude to appreciably affect normal engine operation. When the relay switch 19 is omitted, it may in some cases be desirable to permanently connect winding 5 directly to ground through a second resistance 21, as shown in Fig. 2. With respect to the magneto during normal operation, resistances 18 and 21 are connected in parallel and hence the effective resistance and the resultant loss of magneto generated energy are less than when only one resistance 18 is
used. The resistances 18 and 31 are in series with respect to battery B when the latter is furnishing the energy and, hence, the effect thereof in preventing demagnetization and overheating is not appreciably changed by the addition of the second resistance.

Another advantage of the invention resides in the fact that the same permits of placing the ignition switch, by means of which the magneto is rendered operative or inoperative, in the normal ground connection for the primary winding 5. Such a circuit is shown in Fig. 3 wherein a switch 22 is connected between the magneto coil 5 and relay switch 19. Whenever switch 22 is open, disconnecting the ground 5 from ground, the magneto will be inoperative since said winding will then be in an open circuit. Switch 22 accordingly performs the functions of switch 17 of the embodiment of Fig. 1. In other respects, the circuits of Figs. 1 and 3 are the same. If desired, a switch like switch 22 may be incorporated in Fig. 2 in lieu of switch 17 thereof. It will be understood that switch 22 may be manually operated, but the same may also be relay operated as illustrated. An actuating coil 23 is provided for switch 22, and said coil is connected in circuit with battery B through a manually operated switch 24.

There is thus provided a novel and effective means for boosting or supplementing the output of a magneto generator, particularly at low speeds, to start engines and for similar purposes. The novel circuit and apparatus thus comprehended is also simple, both in construction and mode of operation. Additionally, the same requires fewer and less complicated parts than prior known apparatus for the same purpose and may accordingly be fabricated more rapidly at less cost.

Although only a limited number of embodiments of the invention are illustrated in the accompanying drawings and described in the foregoing specification, it will be understood that the invention is not limited thereto. For example, a different battery from the one used for energizing the starter motor may be employed for boosting the magneto. Also, the various circuits shown as being completed through a pair of common ground connections could be completed through wire connections, if desired. In the specification and claims, the term “ground” is used in a broad sense to include any type of return connection. Various changes may also be made in the specific design and arrangement of the parts illustrated without departing from the spirit and scope of the invention as the same will now be understood by those skilled in the art.

What is claimed is:

1. In electrical apparatus of the class described, a magneto generator comprising a coil having primary and secondary windings and circuit breaker means having an ungrounded contact connected to one end of said primary winding for periodically opening and closing a circuit through said primary winding, a source of direct current electrical energy, such as a battery, means including a current limiting resistance for connecting the other end of said primary winding to said source, and means including said resistance for connecting said other end of the primary winding to ground.

2. In electrical apparatus of the class described, a magneto generator comprising a coil having primary and secondary windings and circuit breaker means having an ungrounded contact connected to one end of said primary winding for periodically opening and closing a circuit through said primary winding, a source of direct current electrical energy, such as a battery, means including a current limiting resistance for connecting the other end of said primary winding to said source, and means including said resistance for connecting said other end of the primary winding to ground.

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