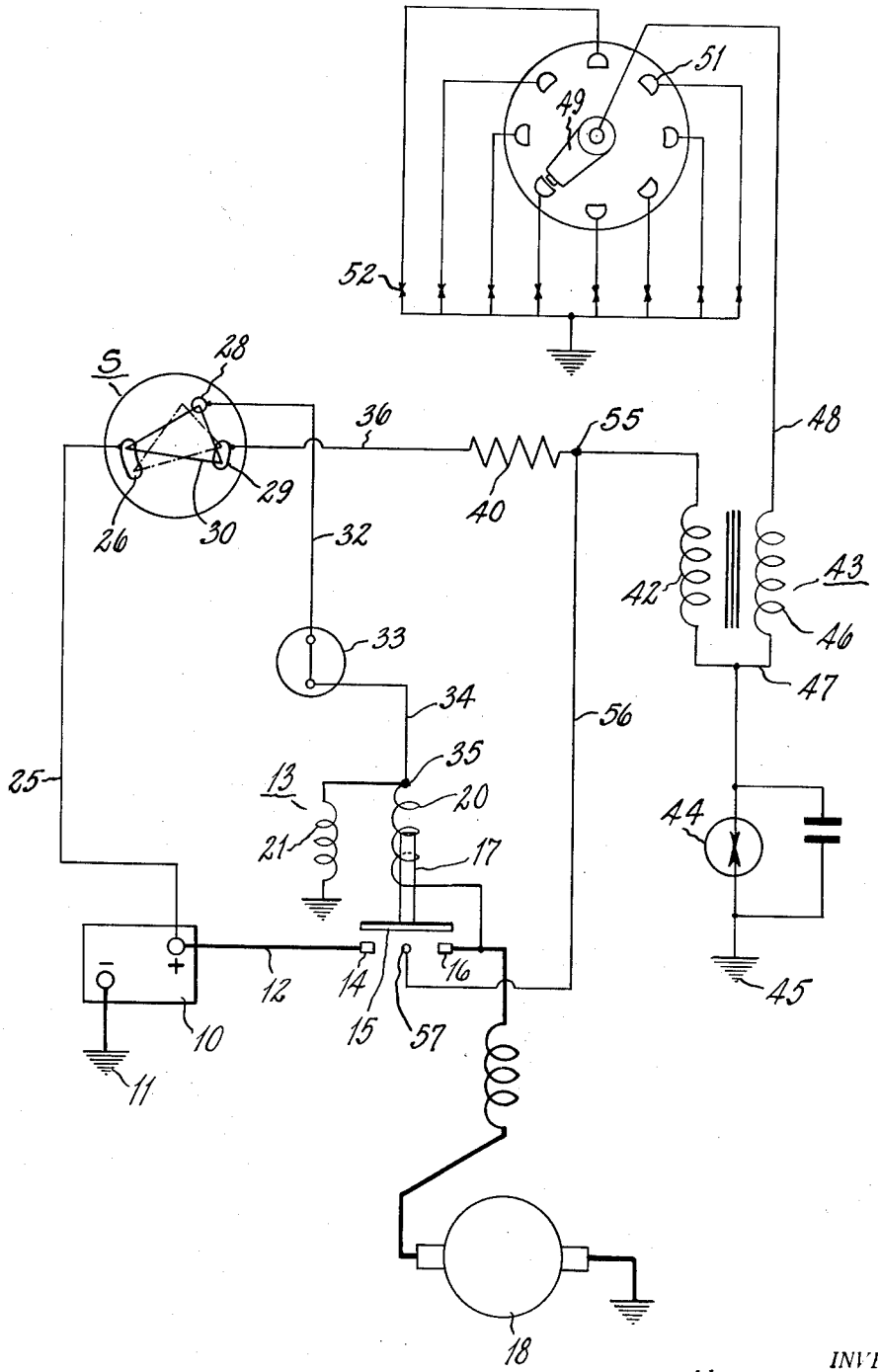
Nov. 15, 1955 H. L. HARTZELL 2,723,654

CONTROL CIRCUIT

Filed July 31, 1952



INVENTOR.
HERMAN L. HARTZELL
BY
Willits, Hardman & Fehr
his ATTORNEYS

United States Patent Office 2,723,654 Patented Nov. 15, 1955

2,723,654

CONTROL CIRCUIT

Herman L. Hartzell, Anderson, Ind., assignor to General Motors Corporation, Detroit, Mich., a corporation of Delaware

Application July 31, 1952, Serial No. 301,821

2 Claims. (Cl. 123—179)

This invention relates to improvements in ignition systems designed particularly for internal combustion engines to ignite combustible charges supplied to the cylinders thereof.

It is a well known fact that in ignition systems for internal combustion engines at the time of starting an internal combustion engine a very heavy current is required to operate the starting motor to crank the engine, and this causes a considerable drop in voltage across the battery terminals. This condition will exist as long as the starting motor is energized. It is very important that good ignition be obtained at starting, because during the starting period the voltage applied to the ignition system is reduced.

In many present day high compression engines, the adjustments of gaps, points, etc., to produce the desired ignition characteristics is of a critical nature. Thus upon a reduction of secondary voltage for any reason, the conditions required for good ignition are not always present. With the present system as disclosed the increased battery voltage makes possible the use of an improved hookup which produces higher secondary output and thus reduces the critical nature of the heretofore required adjustments. This permits improved operation over a wide spread of plug and point adjustments and in general eliminates many of the past difficulties.

It is therefore among the objects of the present invention to provide a 12 volt ignition system having means for reducing the resistance of the primary ignition circuit while the engine is being cranked by a starting motor, thus permitting more current to pass through the primary winding of the ignition coil while the starting motor is engaged to crank the engine, and after the engine is self-operative the resistance is automatically inserted in the primary ignition circuit by opening the circuit to the starting motor. In the disclosed embodiment, this object is accomplished by use of shunt circuit for shunting out the resistance which is connected in parallel with a circuit which controls the starting motor, said motor circuit is connected with the battery only when an ignition switch is closed. The ignition switch by which the motor circuit is closed includes at least three positions, namely Off, Start, and Run positions. When the ignition switch is moved to Start position it simultaneously energizes the ignition and the motor circuit whereby the starting motor is energized and the resistance is cut out by establishment of the shunt circuit. When the engine becomes self operative and the ignition switch is moved to the Run position the ignition circuit is maintained and the motor circuit is deenergized and the shunt circuit is destroyed.

Further objects and advantages of the present invention will be apparent from the following description reference being had to the accompanying drawings wherein a preferred embodiment of the present invention is clearly shown.

In the drawing:

The accompanying diagram illustrates the circuit connections embodying the present invention.

Referring to the drawing, 10 designates a current source

of storage battery grounded at 11. The battery is connected by a lead 12 with an electromagnetic switch 13 which includes stationary contacts 14 and 16 and a movable contact 15 attached to a solenoid armature 17. Contact 16 is electrically connected to a starting motor 18 which is grounded. The electromagnetic switch 13 includes windings 20 and 21 which cooperate to attract the armature to move contact 15 into circuit closing position in which the motor is connected with the battery but the winding 20 is short circuited. The armature 17 is held in circuit closing position by the coil 21 only.

The battery 10 is also connected by a lead 25 to stationary contact 26 of a manually operated key switch S of the type disclosed in the copending application of Brown et al., Ser. No. 177,618, filed August 4, 1950. This switch provides at least three positions, namely Off, Run, and Start positions.

In the present instance the switch is shown diagrammatically and includes a movable contact 30 of triangular form having three contact bosses, not shown. The movable contact bosses cooperate with stationary contacts 26, 28 and 29 which are connected as follows: Contact 26 is connected to the battery by the lead 25; contact 28 is connected by lead 32 to a neutral safety switch 33 which is connected by a lead 34 to a terminal 35 which joins the coils 20 and 21. The contact 29 is connected by a lead 36 to one end of a resistor or fixed resistance 40. The other end of the resistance is connected to one end of a primary winding 42 of an ignition coil 43. The other end of the primary winding is connected with a timer mechanism 44 of conventional form including a fixed contact and a movable contact with the fixed contact being grounded at 45. A secondary winding 46, inductively associated with the primary winding, has electrical connection with the secondary winding by a conductor 47 and thence by way of a conductor 48 forms a path of electrical connection with a rotor 49 of a distributor. The distributor includes a plurality of spaced terminals 51 from which leads extend through spark plugs 52 to ground.

From the juncture 55 to which one side of resistance 40 is connected a conductor 56 leads to a terminal 57 which is arranged to be engaged by the movable contact 15 whenever the latter bridges the contacts 14, 16. The lead 56 provides a shunt circuit adapted to cut out the resistance 40 when the switch S is in the Start position.

The operation of the present invention is as follows: When it is desired to start the engine the neutral safety 33 must be in its closed position. When the switch S is moved manually to the position shown in full lines the movable contact will bridge contacts 26, 28 and 29. This is accomplished by a key, not shown. In this position it will be clear that the battery will be connected to ignition terminal contact 29 and the neutral switch terminal 28 through movable contact 30, thus current will flow from the battery to the magnet windings 20 and 21, to attract the armature causing the movable contact 15 to engage contacts 14, 57 and 16. When this occurs the resistance 40 will be short circuited so that when the engine is being cranked current will pass through the shunt circuit 56. Consequently more current will flow through the primary winding than there would be if the current had to pass through the resistance 40. When the engine becomes self operative the operator releases the key permitting the movable contact to move automatically to the position shown in dot-and-dash lines due to the fact a spring part exerts a turning force upon the movable contact 30. The operation of this switch is fully disclosed in the copending application heretofore mentioned. When the switch is in the position shown in dot-and-dash lines the resistance 40 will be included in the ignition circuit, thus cutting down the flow of current to a lesser amount sufficient how-

ever, to secure ignition of the combustible mixture while the engine is in operation.

While the embodiment of the present invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted.

What is claimed is as follows:

1. An ignition and starting motor circuit for an internal combustion engine having an electric storage battery as a source of electric current, comprising in combination; a manually operated three position electric switch to control the connection of said circuits to said battery, an ignition circuit including; a resistance connected in series with the primary winding of an ignition coil, said ignition circuit being connected to the storage battery through said control switch when the switch is in one of its positions, a solenoid having a terminal connected with a starter motor and another terminal connected with the storage battery and a pair of solenoid windings adapted to actuate a solenoid armature for moving a contact to close a circuit between said terminals for making a circuit between the storage battery and starting motor, said windings both being connected through another terminal of said manual switch to the storage battery when said manual switch is in a second position, one of said solenoid windings being adapted for being shorted out when the starter motor circuit is closed by the solenoid contact, and a shunt lead having one end connected between the resistance and primary winding of the coil and the other end connected to a third solenoid terminal for being connected with the storage battery terminal for forming a circuit directly between the storage battery and the primary winding of the ignition coil and shunting out the resistance when the solenoid plunger actuates said contact for shorting out said one winding of the solenoid.

2. An ignition and starting motor circuit for an internal combustion engine having an electric storage battery as a source of electric current, comprising in combination; an ignition circuit including; an ignition coil having a primary winding and a resistance in series with said winding, a starting circuit including a starting motor, a shunt lead having one end connected between the resistance and primary winding of the ignition coil, and switch means having manual and electrically sequentially operated contacts for selectively connecting said ignition circuit and said starting circuit and said shunt lead to said storage battery, said switch means including; a three position switch having one terminal operatively connected to the storage battery, another terminal connected through the resistance to the primary winding of the coil in the ignition circuit and a solenoid having an actuating winding and a holding winding for moving a solenoid contact, said windings being operatively connected to the storage battery through a third terminal on the three position switch, said solenoid contact being constructed and arranged for closing a circuit between the storage battery and the starting motor and shunt lead for bypassing the ignition resistance while simultaneously shorting out the actuating winding of the solenoid.

References Cited in the file of this patent

UNITED STATES PATENTS

Re. 14,842	Delano	Apr. 20, 1920
1,214,555	Leese	Feb. 6, 1917
2,218,847	Korte et al.	Oct. 22, 1940