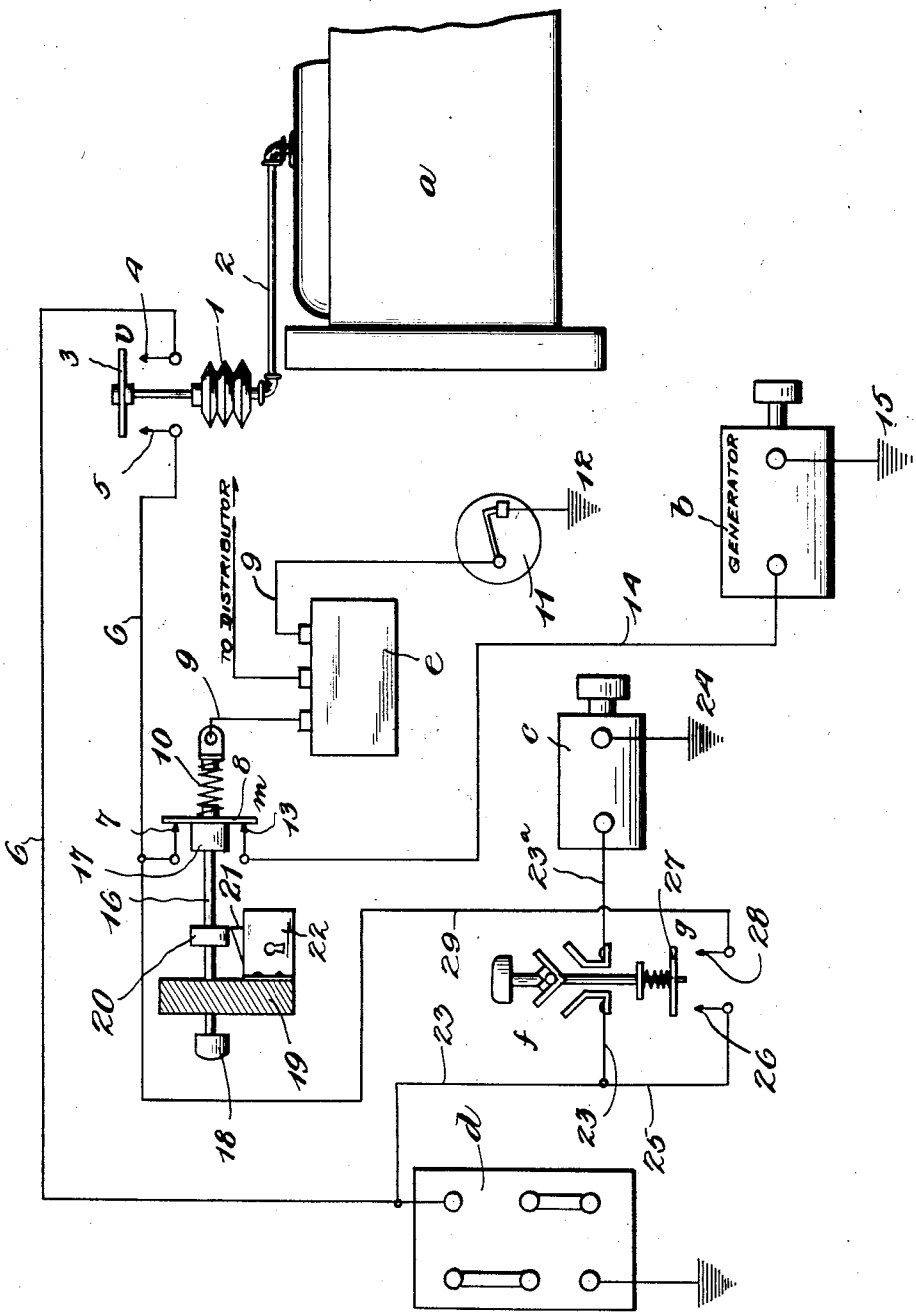
Sept. 2, 1924. 1,507,266

G. H. WHITTINGHAM

IGNITION SYSTEM FOR INTERNAL COMBUSTION ENGINES

Filed June 4, 1923



Inventor,

George H. Whittingham.

By Robert H. Watson

Attorney

Patented Sept. 2, 1924. 1,507,266

UNITED STATES PATENT OFFICE.

GEORGE H. WHITTINGHAM, OF BALTIMORE, MARYLAND.

IGNITION SYSTEM FOR INTERNAL-COMBUSTION ENGINES.

Application filed June 4, 1923. Serial No. 643,302.

To all whom it may concern:

Be it known that I, GEORGE H. WHITTINGHAM, a citizen of the United States, residing at Baltimore, in the State of Maryland, have invented certain new and useful Improvements in Ignition Systems for Internal-Combustion Engines, of which the following is a specification.

This invention relates to an ignition system, for internal combustion engines, of the type in which a battery furnishes current to a spark coil while the engine is being started, and a generator charges the battery and furnishes current to the coil while the engine is running and driving the generator at a speed sufficient to generate a voltage higher than that of the battery voltage. In such systems, reverse current relays or centrifugally operated switches are generally employed to disconnect the generator from the battery, when the generator voltage falls below the voltage of the battery, as when the engine is running very slowly or when it stops. In such systems also the connections from the battery and generator to the coil are controlled by a hand switch, which is opened to stop the motor and it must be closed before the motor can be started. If this switch is left closed while the motor is stopped, a discharge from the battery will take place through the coil providing the contacts of the timer happen to be closed.

In carrying out my invention, I provide means whereby the magnetic or centrifugally operated switches referred to are rendered unnecessary, and instead of closing a hand operated switch to connect the spark coil to the battery and generator circuits, the spark coil is normally connected to these circuits through a push button switch which is momentarily opened to stop the engine. The battery circuit leads to the coil and to the generator circuit through this normally closed switch, and in the battery circuit is arranged a normally open switch, which closes by the suction of the engine when the engine starts, and opens automatically when the engine stops. This suction-controlled switch automatically disconnects the spark coil and the generator from the battery whenever the engine comes to a stop, so that the battery cannot discharge through the coil or generator. It sometimes happens, with battery ignition systems, that the operator will leave the key switch, which connects the battery to the coil, closed, when the engine is stopped, as when the engine is stalled, and if the timer contacts happen to be closed, the battery will discharge through the coil. In the present invention, this cannot happen because the circuit from the battery to the coil is always open at the vacuum switch when the engine is stopped, and it is not necessary to keep the manually controlled switch open while the engine is stopped. This latter switch closes automatically as soon as the operator releases it, after the stoppage of the engine, although it may be locked in open position merely to prevent an unauthorized person from operating the engine.

I also provide means, associated with the starting switch of the engine, for short-circuiting the terminals of the vacuum controlled switch while the engine is starting, to insure a supply of current from the battery to the coil at the moment when the starter circuit is closed. Thus, in some engines, where the vacuum produced in the intake pipe is very low, the suction-controlled switch may not completely close during the first turn-over of the engine, and in that case the coil would not receive current immediately; but by providing a shunt around the terminals of the vacuum controlled switch and a switch for closing this shunt circuit when the starter pedal is depressed, current is supplied to the coil at the time when the starter-motor commences to turn the engine. This shunt circuit is broken by the release of the starter pedal, but before the pedal is released the engine is turning and the suction of the engine has closed the vacuum switch through which current will then flow from the battery to the coil or from the generator to the battery and coil as long as the engine is in operation, the direction of flow depending upon the relative voltages of the generator and battery.

The accompanying drawing is a diagram illustrating the ignition system of my invention.

Referring to the drawing, *a* represents an internal combustion engine, *b* represents a generator driven by the engine, *c* the motor for starting the engine, and *d* represents the storage battery which supplies current to the starter motor and also to the ignition coil *e*, in starting. The usual pedal-operated switch for closing the circuit through the starter motor is shown at *f*. A bellows 1 is connected by a pipe 2 to the

intake manifold of the engine. This bellows is normally expanded as shown, and carries an insulated metal bridge-piece 3 which forms the movable contact member of a switch *v*. When the engine is started, the suction of the engine causes the bellows 1 to collapse and the bridge-piece 3, which is normally out of engagement with the stationary contacts 4 and 5 of the switch *v*, is carried down against said contacts. When the engine stops and the suction ceases, the bellows expands and the bridge-piece 3 is carried away from the contacts 4 and 5 so that the switch *v* stands normally open. This switch is in what may be termed a battery circuit 6 leading from one pole of the battery through said switch to a manually operable switch *m*, which is normally closed and connects the circuit 6 through contact 7 and bridge-piece 8 to the primary circuit 9 of the spark coil *e*, through the spring 10 which bears against the bridge-piece 8 and normally holds the switch *m* closed. The primary circuit 9 of the spark coil extends through a circuit breaker 11, as usual, and thence to ground, as indicated at 12. The bridge-piece 8 of the switch *m*, connects the contact 7 with a contact 13, which is one terminal of what may be termed a generator circuit 14, leading from the generator *b*. The other terminal of the generator is grounded, as usual, as indicated at 15.

The switch *m* as above stated is normally closed by the spring 10, but it may be opened when desired by means of a push rod 16 having at one end a block of insulating material 17 to which the bridge piece 8 is secured, and having at its other end a knob 18 serving as a push button. In an automobile, this push rod will extend through the dashboard, indicated at 19, so that it may be conveniently actuated by the operator. The arrangement is such that when the operator presses the knob toward the dashboard, the switch *m* will be opened thereby, disconnecting the battery and generator circuits from the primary of the spark coil and from one another. When the operator releases the push button, the spring 10 will cause these connections to be restored. Normally this switch remains closed and it is only opened momentarily to cut off the current to the spark coil to stop the engine. It may, however, be locked in open position to prevent unauthorized persons from starting the engine. A means for locking the switch in open position is illustrated conventionally in the drawing by a collar 20 on the rod, and a catch 21 on the key-controlled lock 22. The collar may pass this catch freely when the latch is withdrawn, as shown in the drawing, but by turning the key the latch will be projected into the path of the collar or stop and will prevent the operation of the switch rod after it has moved the switch to open position.

The circuit for the starter motor *c* extends from the battery through conductor 23 to the starting switch *f*, which is normally open, then through conductor 23[a] to the battery and thence to ground, as indicated at 24.

I provide means for forming a shunt from the battery to the switch *m* around the switch *v*, and a switch *g* for closing this shunt circuit when the starting switch is closed and for opening the circuit when the starting switch is opened. This shunt circuit extends from the battery through conductor 23 to the conductor 25, thence to stationary contact 26 of the switch *g*, thence through bridge-piece 27 of said switch to contact 28, thence through conductor 29 to contact 7 of the switch *m*, through which connection is made to the primary circuit 9 of the spark coil.

The operation is as follows: To start the engine, the starting switch *f* is closed and the starting motor *c* then turns the engine over and simultaneously with the closure of the starting switch the shunt circuit is closed by the switch *g* and the primary of the spark coil receives current through the shunt circuit. As the engine turns over the suction of the engine causes the vacuum switch *v* to close and when this switch is closed, current feeds through the battery circuit 6 and said switch to the spark coil circuit through the manually controlled switch *m*. The shunt circuit is opened at the switch *g* as soon as the operator releases the starting switch. As soon as the engine is well started the generator, which is driven by it, generates a current at a higher voltage than that of the battery and the current from the generator flows to the primary of the spark coil through the switch *m* and also to the battery through the circuit 6, which includes the vacuum switch *v*. Thus, as long as the engine and generator are in operation and the speed of the generator is sufficient to cause it to generate electromotive force higher than that of the battery, the battery will be charged by the generator and the spark coil will also receive current from the generator. At a very low speed, the generator voltage may fall below that of the battery in which case the battery will supply current to the coil. In average running, the generator voltage will exceed that of the battery and the current will flow from the generator to the battery and the coil. The vacuum switch will remain closed as long as the engine runs.

In order to stop the motor, it is merely necessary to press the knob 18 so as to open the switch *m*. This will disconnect both the generator and the battery from the spark

coil circuit and also disconnect the generator circuit from the battery circuit. The disconnection of the spark coil from the current sources will, of course, cause the engine to stop and when the engine stops, the bellows 1 will expand and open the switch *v*, thereby making a break in the battery circuit. The operator releases the push button switch *m* as soon as the engine has stopped, and as the battery circuit is then open at the switch *v*, no current can discharge from the battery through the coil or through the generator even though the switch *m* is closed.

The system will operate satisfactorily without the shunt circuit where the engine starts quickly and with strong suction in the intake pipe which will cause the vacuum switch to close quickly; but it is better to employ the shunt circuit in all cases as the suction in the intake pipes of some engines is insufficient to cause the switch to close until the engine has made one or more complete revolutions.

What I claim is:

1. In an ignition system for internal combustion engines, a battery, a generator, a spark coil, circuits leading from the battery and generator, a normally closed stopping switch connecting said circuits together and to the coil, and a normally open switch in the battery circuit adapted to be closed by the operation of the engine.

2. In an ignition system for internal combustion engines, a battery, a generator, a spark coil, circuits leading from the battery and generator, a normally closed stopping switch connecting said circuits together and to the coil, and a normally open switch in the battery circuit adapted to be closed by the suction of the engine.

3. In an ignition system for internal combustion engines, a battery, a generator, a spark coil, circuits leading from the battery and generator, a normally closed stopping switch connecting said circuits together and to the coil, a normally open switch in the battery circuit adapted to be closed by the operation of the engine, a circuit in shunt to the latter switch, and a normally open switch for closing said shunt circuit.

4. In an ignition system for internal combustion engines, a battery, a generator, a spark coil, circuits leading from the battery and generator, a normally closed stopping switch connecting said circuits together and to the coil, a normally open switch in the battery circuit adapted to be closed by the operation of the engine, a circuit in shunt to the latter switch, and a normally-open pedal-operated switch for closing said shunt circuit.

5. In an ignition system for internal combustion engines, the combination with a starting switch, of a battery, a generator, a spark coil, circuits leading from the battery and generator, a normally closed stopping switch connecting said circuits together and to the coil, a normally open switch in the battery circuit adapted to be closed by the operation of the engine, a circuit for shunting the latter switch, and a normally open switch movable with the starting switch to close said shunt circuit.

In testimony whereof I hereunto affix my signature.

GEORGE H. WHITTINGHAM.