April 2, 1940. V. A. CARPENTER 2,195,612

POLARITY COMPENSATING IGNITION SYSTEM FOR AUTOMOBILES

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FIG. 1

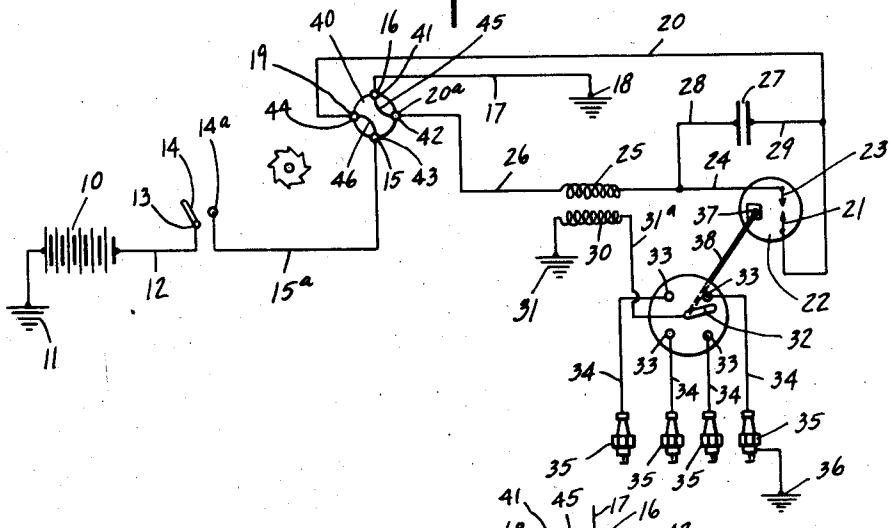


FIG. 2

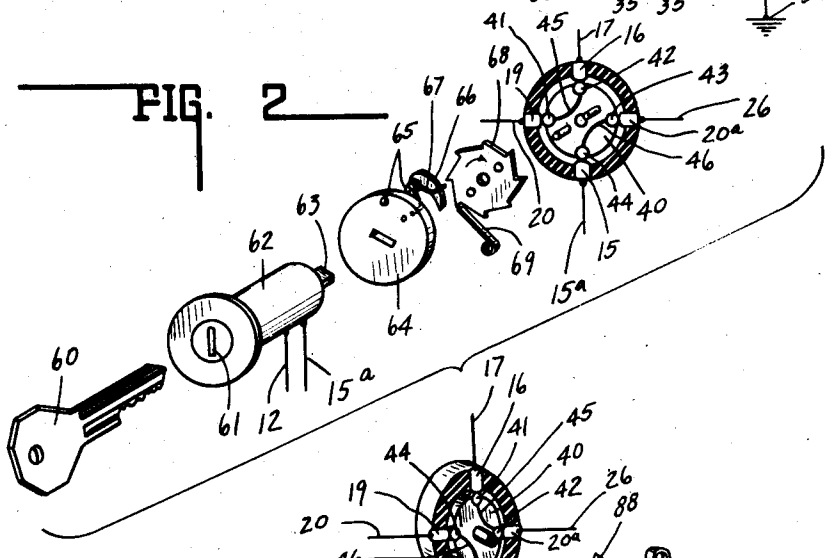
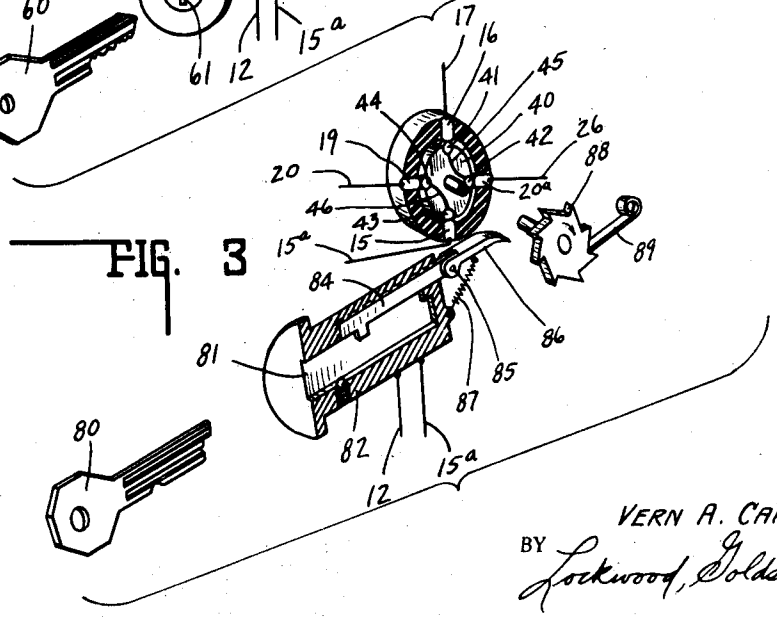


FIG. 3



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POLARITY COMPENSATING IGNITION SYSTEM FOR AUTOMOBILES

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11 Claims. (Cl. 123—146.5)

This invention relates to ignition systems for internal combustion engines.

Ignition systems of this character include a source of energy such as a storage battery, carried by the vehicle and charged by the engine in its operation, a key operable master switch, a coil arrangement, a condenser, a make-and-break switch, engine operable, and a distributor for selective energization of the firing spark plugs.

Such systems, after about four thousand miles and in specially designed systems at about six thousand miles of vehicle travel, produce a "tit" on one contact member of the make-and-break switch and a pit corresponding thereto on the other contact member of said switch.

Such formation is universal and materially affects engine performance and efficiency. Such formation is the result of ionization and arcing incident in uni-directional flow of current in the low tension portion of the ignition system of conventional character.

Such formation can be delayed, as suggested, by utilizing arc-resisting contact points, et cetera, but the problem cannot be solved permanently by such expedient since all known, satisfactory contact material is subject to metal transfer incident to ionization and arcing.

It has been proposed to reverse the current flow after each current impulse but such reversal results in the disadvantage that the switch is of constant reversing character, that is, it must be operative at all times for engine operation and has a limited life due to its repetitions, or constant operation, to wit: millions of reversals per day of usual driving.

The present invention solves both problems and one installation upon a vehicle which normally requires contact replacement or repair, as by dresing, etc.), at five thousand miles of vehicle travel, has successfully operated more than twelve thousand miles with but little or no evidence of "titting" or "pitting."

The chief object of this invention is to provide a practical and successful solution to the basic problem and not incorporate in such solution any of the disadvantages of the proposed corrective, as set forth hereinbefore.

The chief feature of the invention consists in providing a practical solution, automatic in character which solves said problem, such solution including a current reversing arrangement in the low tension side of the ignition circuit operable as by the key operable "ignition switch."

Such arrangement may take various forms, such as directly operable by switch movement, key insertion into the ignition switch lock, or remote operation by initial ignition circuit energization conditioning the reversing switch for subsequent reversal upon deenergization of the ignition circuit.

What is believed to be one of the simplest form of said invention has been selected for illustration herein, but this is by way of example only.

Other objects and features of the invention will be set forth more fully hereinafter.

The full nature of the invention will be understood from the accompanying drawing and the following description and claims:

In the drawing Fig. 1 is a diagrammatic plan of a conventional ignition system with the invention included therein. Fig. 2 is a perspective, exploded view of a key operable ignition switch with the automatically operable reversing switch operatively associated therewith. Fig. 3 is a sectional exploded view of a modified form of key operable reversing switch, the key operable lock portion being shown in elevation.

In Fig. 1, 10 indicates a source of energy such as a magneto or battery, the latter being illustrated, and same is grounded at 11. A line 12 leads to one terminal 13 of the "ignition switch" having movable switch member 14. The other terminal 14a is connected by line 15a to one terminal 15 of a four terminal reversing switch.

Said switch includes a terminal 16 connected by line 17 to a ground 18 or same may be directly connected to the battery 10 or source of energy. Two intermediate terminals 19 and 20a are provided. Terminal 19 is connected by line 20 to one terminal 21 of the make-and-break switch 22. The other terminal 23 is connected by line 24 to one terminal of the primary coil 25, the other terminal thereof being connected by line 26 to the remaining terminal 20a of the four terminal reversing switch. A condenser 27 is connected by lines 28 and 29 across the switch 22 or more especially across points 21 and 23 thereof.

Before describing the additional elements and operation of the primary system, the secondary system or high tension side will be described.

The secondary coil 30 is grounded at 31. The other end is connected by line 31a to the movable switch member 32 of the distributor switch which successively contacts the contacts 33, each of which is connected by a line 34 to spark plug 35 grounded at 36 in the conventional manner.

The movable contact 32 moves with member

37 controlling the operation of the "make-and-break" switch 22, the operative connection being diagrammatically indicated at 38. Thus, when the circuit is closed at 21—23 current flows in the low tension circuit and high tension current is supplied by the secondary coil through switch member 32 to the proper spark plug.

The automatic reversing switch includes an insulated base 40 having four contacts 41, 42, 43 and 44 thereon. Contacts 41 and 42 are electrically connected as at 45 and contacts 43 and 44 are similarly connected as at 46.

When the reversing switch is positioned as illustrated in Fig. 1, battery current is supplied to contact 15, contact 43, connection 46, contact 44, line 20, primary coil 25, line 26, contact 20a, contact 42, connection 45, contact 41 and line 17.

When the reversing switch is positioned at 90° to said Fig. 1 illustrated position, see Fig. 2, substantially the same circuit is completed except the direction of current flow is reversed in line 20, the make-and-break switch 22, line 24, primary coil 25 and line 26. Such reversal also changes current phase relation in the high tension circuit as well.

Thus, arcing, pitting, et cetera, of the make-and-break switch contacts is reduced to a minimum, as hereinafter pointed out.

In Fig. 2, 60 indicates a key, 61 a keyhole reciving same, 62 a switch structure and lock connected to lines 12 and 15a as shown in Fig. 1, 63 an extension pin or shaft carrying a disk 64 to which is pivoted at 65 a pawl 66, normally constrained by spring 67 into ratchet tooth 68 engagement. A spring 69 may prevent reverse rotation of the ratchet. Rigid with ratchet 68 is the reversing switch member 40 previously described.

When the key 60 is inserted in keyhole 61 and turned clockwise 90°, the ignition switch 13, 14, and 14a is closed. In this movement pawl 66 seated or having ratchet tooth engagement rotates ratchet 68 and reversing switch 40 an amount of 90°. Upon key 60 being turned 90° to open the ignition circuit, the pawl ratchets over ratchet teeth 68 and reengages the ratchet at 90° to the previous engagement. Spring 69 prevents reverse ratchet movement. Spring 67 insures ratchet and pawl cooperation.

Thus, each time the ignition switch is turned on and off, or vice versa, if desired, the reversing switch is rotated 90° for current direction reversal, as previously described, and for the purpose described, and such reversing switch operation is automatic, that is, does not require any other manual performance than now required in a conventional system.

Fig. 3 illustrates another form of key operable switch-reversing switch arrangement. This, however, is not as satisfactory as that previously described because it merely requires insertion and removal of the key for reversing switch operation.

Slidably mounted in lock 82 is a plunger 84 adapted for movement when key 80 is inserted in keyhole 81. Pivoted to plunger 84 at 85 is a pawl 86 normally constrained by spring 87 into engagement with ratchet 88 pivoted upon an axis transverse to that of ratchet 68 illustrated in Fig. 2. Spring 89 prevents reverse rotation of the ratchet 88. Rigid with ratchet 88 is the reversing switch member 40. Note that spring 87 also returns plunger 84 to initial position when the key 80 is removed from the lock. Each reciprocation of bar 84 rotates ratchet 88 90°.

In most forms of locks, key rotational movement is required to close the ignition circuit, in others only key movement longitudinally thereof is required, or both may be required.

Either of the above forms of key-switch-reversing switch constructions may be utilized, as required. In most instances, the direction of current flow will be reversed for each make-and-break of the ignition circuit by the key operable main switch. In other instances, the direction of current flow will be reversed only when the ignition lock key is inserted into or removed from the switch.

Since many drivers do not remove the key from the lock, as suggested by the insurance companies and police departments, the form of the invention shown in Fig. 2 is preferred because this insures a sufficient number of current reversals to accomplish the desired result which is whatever metal, et cetera, flows from contact 23 to contact 21 resulting in an attempt to pit contact 23 and tit contact 21, will upon current reversal return such transferred metal with the net result that the progressive pitting and titting action common to present ignition systems is eliminated, thus maintaining contacts 23 and 21 in substantially perfect condition at all times.

It has been ascertained that the duration of current flow in either direction is substantially equal for all kinds of driving, whether of cross-country, urban or suburban character or of mixed character.

While the invention has been illustrated and described in great detail in the foregoing description, the same is to be considered as illustrative and not restrictive in character.

The several modifications described herein, as well as others which will readily suggest themselves to persons skilled in this art, all are considered to be within the broad scope of the invention, reference being had to the appended claims.

In this connection, note that claim 5 is intended to include any reversing mechanism such as herein described which is operable automatically in brake operation, gear shift operation, or like or comparable operations having a frequency of operation other than that of the spark plugs and/or the distributor "make-and-break" switch.

The invention claimed is:

1. In combination with an ignition system of an internal combustion engine including a key controlled switch, a reversing switch included in said system for current reversal, and means operable by key movement in key switch control for actuating said reversing switch.

2. A system, as defined by claim 1, characterized by the key switch movement being of to and fro character and the reversing switch being of intermittent continuous rotation character.

3. A system, as defined by claim 1, characterized by the key switch movement being of to and fro character and the reversing switch being of intermittent continuous rotation character, the key movement being of reciprocatory type.

4. A system, as defined by claim 1, characterized by the key switch movement being of to and fro character and the reversing switch being of intermittent continuous rotation character, the key movement being of oscillatory type.

5. In an ignition system for an internal combustion engine, a high tension circuit and a low tension circuit, the former including a plurality of sparking members successively energized, and

the latter including a "make-and-break" switch operable in timed relation with each sparking member energization, and a reversing circuit arrangement including a current reversing switch operable at varying intervals independent of "make-and-break" switch operation or the energization of any sparking member.

6. In an ignition system for an internal combustion engine, a secondary circuit and a primary circuit, the former including a plurality of sparking members successively energized, and the latter including a "make-and-break" switch operable in timed relation with each sparking member energization, and a reversing circuit arrangement including a current reversing switch operable at varying intervals independent of "make-and-break" switch operation or the energization of any sparking member.

7. A device, as defined by claim 5, characterized by the reversing switch reversing current flow direction in the primary circuit.

8. In an ignition circuit a polarity or current flow direction changer including four stationary contacts arranged at 90° apart, a rotatable member having similarly spaced and cooperating contacts, same being connected together electrically in adjacent pairs, a ratchet movable with the rotatable member, a to and fro movable pawl means normally constrained to ratchet engagement for quadrant movement of the rotatable member, and means normally preventing reverse rotation of the rotatable member.

9. In combination with a source of energy, an ignition system including a distributor for an internal combustion engine and a main switch for said system, of means automatically operable in the main switch actuation for reversing the direction of current flow in the ignition system to reduce and substantially prevent distributor point pitting.

10. In combination with an ignition system of an internal combustion engine including a key controlled switch, a primary circuit and a secondary circuit, the latter including a plurality of sparking members successively energized, the former including a make and break switch operable in timed relation with each sparking member energization, a current reversing circuit arrangement for the primary circuit including a current reversing switch operable at varying intervals independent of make and break switch operation or the energization of any sparking member, and means operable by key movement in key switch control for actuating said reversing switch.

11. A system, as defined by claim 10, characterized by the key switch movement being of to and fro character and the reversing switch movement being of intermittent continuous rotation character.

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