

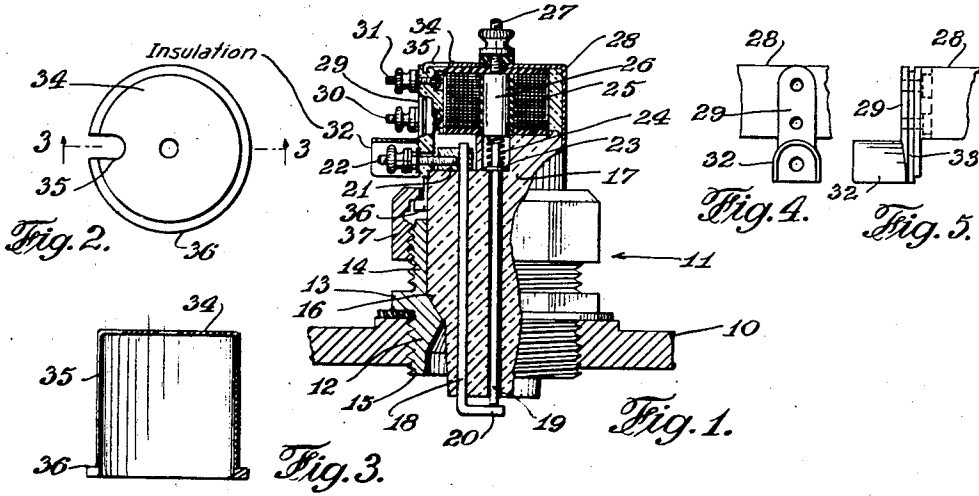
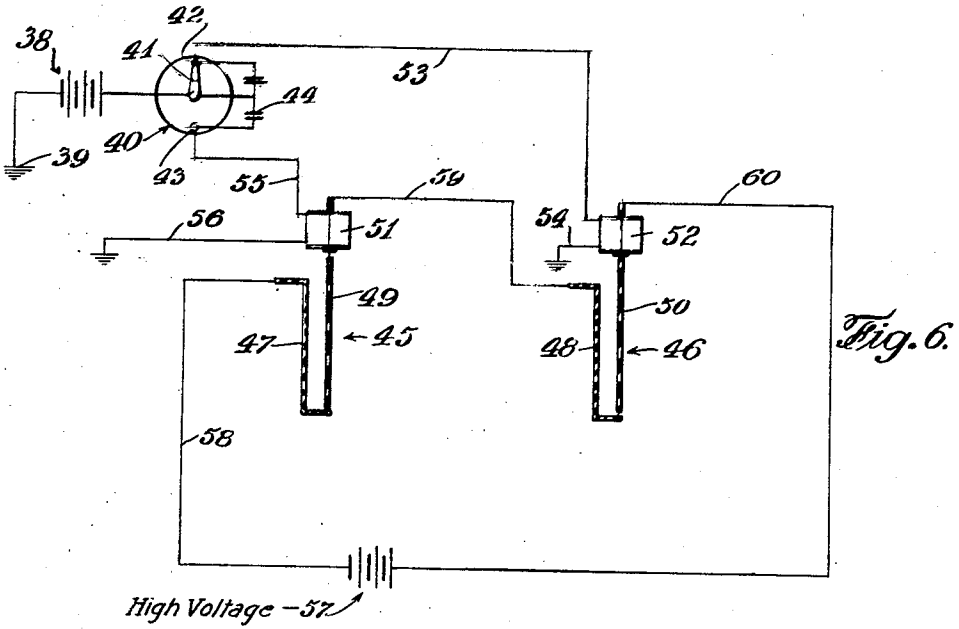
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IGNITION SYSTEM

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IGNITION SYSTEM

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This invention relates to an ignition system for internal combustion engines, and the means whereby that system is rendered operative.

One of the prime objects of this invention is to provide an ignition system for internal combustion engines which will effectively eliminate electric interference with the operation of sensitive instruments and radio devices, especially on board of aircraft.

Another object of this invention is to provide an ignition system wherein a high potential current is caused to flow continuously through the electrodes of an ignition device, such as a spark plug, and wherein such continuous high potential current flows through the electrodes of all spark plugs of an internal combustion engine, while these plug electrodes are either in contact or are spaced from one another.

Still another object of this invention is to provide an electrically non-interfering ignition system for internal combustion engines, wherein one of the electrodes of the ignition-producing device employed in the system is fixed or stationary, while the other electrode thereof is movable, and wherein the electrodes are normally urged into contact with one another and conduct a steady flow of high potential current, irrespective of whether they are in contacting or separated positions, and wherein means are provided for actuating the movable electrode so that it will momentarily separate from the fixed electrode to form a gap between the electrodes for producing an electric arc to effect ignition of a charge.

Another important object of this invention is to provide a spark plug having insulated fixed and movable electrodes which are normally in contact with one another, and wherein the movable electrode is normally urged against the fixed electrode by electro-conductive means, and wherein other electro-conductive means are provided for actuating the movable electrode, both of said electro-conductive means being adapted to form electro-conductive extensions of the movable electrode, for conducting high potential current from the movable electrode to the fixed electrode.

The foregoing and still further objects and important advantages of the present invention will become more fully disclosed in the accompanying drawing and the appended specification and explanatory matter, and in which drawing:

Fig. 1 is an elevation partially in cross section of a spark plug in accordance with my invention;

Fig. 2 is a top view of the cover or closure of the spark plug;

Fig. 3 is a vertical cross section therethrough taken on line 3—3 of Fig. 2;

Fig. 4 is a partial front view, and

Fig. 5 is a fragmental side elevation of an in-

ulating member employed within the spark plug; and

Fig. 6 is a diagram indicating a typical ignition system in accordance with my invention.

Referring first to Figs. 1 to 5, inclusive, numeral 10 denotes a portion of a cylinder of an internal combustion engine, wherein a spark plug 11 is secured. The spark plug consists of a metallic base 12 in the general form of a bushing, and is provided with a central flange 13 adapted to facilitate the engagement thereof by a wrench, and having two threaded portions extending above and below the flange, and indicated respectively at 14 and 15. The base has a tapered seat 16, upon which rests a correspondingly tapered face of an insulating member 17, which latter is provided with at least two passages for the reception of a fixed or stationary electrode 18 and a movable electrode 19. The fixed electrode is preferably cemented in its passage and is shown in the drawing to be provided with a horizontal leg 20, which forms a rest for movable electrode 19. The upper end of fixed electrode 18 is held within a locking block 21, through which passes a terminal post 22, the latter serving as fastening means within block 21 for the upper end of electrode 18.

It will be observed that insulating member 17 has a recess for accommodating locking block 21. It will be further noted that the upper end of movable electrode 19 is housed within a cylindrical recess provided in insulating member 17. The upper end of electrode 19 is provided with an annular flange 23 against which bears an expansion spring 24. This spring is intended to normally urge electrode 19 into contact with leg 20 of fixed electrode 18.

Immediately above insulating member 17 there is arranged an electromagnet 25 which is completely insulated electrically both from within and from without. At the center of the electromagnet is disposed a soft iron core 26, terminating at its upper end in a binding post 27. Spring 24 bears with its upper end against the bottom end of core 26, which latter is electrically insulated from the magnet coil. Core 26 and spring 24 form electro-conductive extensions of movable electrode 19.

The exterior insulation surrounding electromagnet 25 consists of a ring-shaped member 28, from which extends downwardly a binding post support 29 for the reception of binding post 22, connected to the fixed electrode 18, and binding posts 30 and 31 forming the termini of electromagnet 25. The lower binding post 30 is electrically shielded from binding post 22 by a semi-cylindrical insulating shield 32, extending from binding post support 29. This support is provided with a vertical guide channel 33 (see Fig. 5).

The entire electromagnetic arrangement, including the ring-shaped insulating member 28, is housed within a metal cover 34. The latter is provided with a vertical guide slot 35 for accommodating binding post support 29 by way of channel 33. Cover 34 has an annular flange 36 at its bottom, which flange is adapted to be engaged by the inwardly turned upper end of a hollow nut 37. The interior thread of nut 37 engages upper threaded extension 14 of the base, whereby insulating member 17 and the electromagnetic arrangement above the insulating member are tightened in position and are held in proper relation to one another within the base. Thus the entire structure of the spark plug is caused to form a compact unit.

When electromagnet 25 becomes energized, soft iron core 26 becomes magnetized and attracts movable electrode 19, causing it to move upwards, against the tension of spring 24. By this movement the normally contacting electrodes become momentarily separated, whereby a gap is formed between them. It is intended that the electrodes serve as conductors for a continuous flow of a high potential current. The gap formed between the separated electrodes will thus produce an electric arc sufficient to effect ignition of a charge within the cylinder.

The foregoing description of the spark plug is intended for explanatory purposes only so that the following matter will become more easily understood. It is quite obvious however that the construction of the spark plug illustrated is by no means intended to limit my invention to the details disclosed and that variation may be resorted to in meeting different requirements.

Referring now to the diagram shown in Fig. 6, numeral 38 indicates a low potential source of electric energy, grounded at 39 and connected to a diagrammatically illustrated distributor 40. The latter, for explanatory purposes, consists of a movable contact member or brush 41, adapted to rotate and to pass alternately over contacts 42 and 43. These contacts and brush 41 are preferably bridged by by-pass condensers 44.

The spark plugs, forming part of the system illustrated in Fig. 6, are indicated diagrammatically at 45 and 46. The detail structure of these spark plugs, as shown in Fig. 1, is omitted and only the major portions are retained, such as stationary electrodes 47 and 48, movable electrodes 49 and 50 and solenoids 51 and 52.

It will be seen that brush contact 42 is connected through conductor 53 to solenoid 52, while the bottom lead of the solenoid 54 is grounded. Fixed contact point 43 of the distributor is connected by means of conductor 55 to solenoid 51, while the other lead 56 from the solenoid is grounded.

At the bottom of the figure a high potential electric source 57 is indicated, from which leads conductor 58 to fixed electrode 47 of spark plug 45. The current passes through fixed electrode 47, to movable electrode 49, through the core of electromagnet 51, to conductor 59, which connects with fixed electrode 48 of spark plug 46. The current flows from fixed electrode 48 through movable electrode 50, and continues through the core of electromagnet 52, from which it passes by means of conductor 60 back to electric source 57. The flow of high potential current supplied from source 57 is intended to be continuous and not interrupted at any time. All conductors leading from the source to the spark plugs and from one spark plug to another spark plug are

intended to be sufficiently insulated to prevent leakage of current.

Timing device 40 is shown to contain only two fixed brush contacts, and similarly only two spark plugs are indicated. Obviously the system can be enlarged to include any number of timing contacts and spark plugs.

The operation of the system is very simple and effective. When brush 41 passes over fixed brush contacts 42 or 43 the electromagnets controlled by the contacts become energized, and when thus energized will cause movable electrodes 50 and 49, normally in contact with fixed electrodes 48 and 47, to momentarily separate from the latter electrodes, respectively. Through this momentary separation of the electrodes gaps are formed between them to produce electric arcs, which will ignite the charge within the cylinders controlled by the respective spark plugs. The fact that the high tension current continuously flows through the electrodes of the spark plugs is indicated by broken lines passing through the centers of the electrodes. There is never an interruption of the high potential current flowing through the system including the spark plugs. In consequence of this uninterrupted flow of current, and the fact that arcs produced in the gaps of two distanced electrodes are shielded within the metal of the engine cylinders, and, furthermore, since all leads serving the high potential electric source supplied to the spark plugs are intended to be thoroughly shielded, the shielding being grounded, not shown, electric interference with sensitive instruments and especially radios is positively eliminated.

The low potential current flowing through the electromagnets for actuating the movable electrodes of the spark plugs ordinarily will not interfere with radio reception, especially when points intended for making and breaking contacts are properly shielded and are provided with condensers, as indicated at 44.

From the above description it will become quite evident that the present invention is intended to provide an effective ignition system for internal combustion engines, wherein a high potential current commonly used in such systems is employed to assure positive ignition when and where desired, and wherein man-made static interference ordinarily accompanying the use of high potential current in an ignition system is effectively prevented. It will be also evident that the high potential current employed in the spark plugs is rendered non-interfering in that it is caused to flow continuously and without interruption through the entire ignition system, irrespective of the fact whether the electrodes of the spark plugs are in their normal, contacting position, or are separated momentarily for producing arcs for the purpose of effecting ignition.

It may be mentioned also that the present system possesses other inherent advantages over present day spark systems using either spark plugs with fixed gaps, or ignition devices with mechanical interrupters. In both of these systems either spark coils or magnetos are employed, which produce "peaks" in current during ignition periods, and the sparks produced may be termed "jumping sparks" which comprise exchanges of electric charges between the electrodes of the sparking device. In both types of these ignition devices there is present an initial resistance caused by the surrounding atmosphere, which latter has to be overcome by ioniza-

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tion before a fairly unrestricted exchange of discharges may follow.

It is to be noted that the intensities of the sparks and their length in heretofore used ignition devices will vary with altitude. At sea level an ignition spark requires greater intensity, and the spark is short. When the device is used at higher altitudes the resistance of the surrounding atmosphere is lessened and the length of the spark increases. This fact is the cause of ignition failures, in that the current intended to pass through the sparking device is diverted by "shorts" or sparks jumping from conduits to the engine body or other engine parts.

In the present system the above possibilities of defects in ignition are entirely eliminated for the following reasons:

In the first place the current supplying the ignition system is a uniform, continuous current without "peaks," which flows evenly over conductors which are entirely insulated from all parts of the engine.

Secondly, this system does not produce any "sparks" in the sense explained above, but the so-called "sparks" produced by the separation of the electrodes in the present invention constitute portions of a one-directional, continuous current, although these portions are exposed to induce ignition.

Thirdly, since "sparks" of the type produced in heretofore employed ignition systems are non-existent in the present system, a change in altitude will have no influence upon and will not affect the proper functioning of the present device. Consequently "shorts" by-passing spark plugs will also be eliminated.

While in the illustrations the movable electrodes are shown to be actuated by employing a non-interfering, low tension current for energizing electromagnets, it is quite obvious that mechanical devices for operating the movable electrodes may be substituted with equally satisfactory results.

Thus while specific structures and diagrams have been illustrated and described, it is self-evident that my invention shall not be restricted to the actual disclosures, and I therefore reserve for myself the right to make changes and improvements in my invention, without departing from its broad scope, as defined in the annexed claims.

I claim:

1. In an ignition system for internal combustion engines, a closed electric circuit, a source of electric energy continuously supplying said circuit, an interrupter-type spark plug in said circuit, the electrodes of said spark plug being normally in contact with each other, and means for momentarily separating the spark plug electrodes when ignition is desired.

2. In an ignition system for internal combustion engines, a continuously energized, closed electric circuit, including a source of electric energy and an interrupter-type spark plug, having normally contacting electrodes, adapted to be separated for producing a gap at the moment ignition is to take place, and timed means for causing a momentary separation of said electrodes.

3. In an ignition system for internal combustion engines, as set forth in claim 2, said spark plug having one fixed and one movable electrode, said timed means for momentarily separating

said electrodes comprising a mechanism for actuating said movable electrode.

4. In an ignition system for internal combustion engines, as set forth in claim 2, said spark plug having one fixed and one movable electrode, said timed means for momentarily separating said electrodes comprising a mechanism for actuating said movable electrode, said mechanism comprising an electromagnet, another source of energy supplying electric current to the latter, and a timing device controlling the supply of electric energy from said other source to said electromagnet.

5. In an ignition system for internal combustion engines, as set forth in claim 2, said spark plug having one fixed and one movable electrode, said timed means for momentarily separating said electrodes comprising a mechanism for actuating said movable electrode, said mechanism comprising an electromagnet, another source of energy supplying electric current to the latter, and a timing device controlling the supply of electric energy from said other source to said electromagnet, said first mentioned source of electric energy being adapted to supply said closed electric circuit with a high tension current, said other source of energy for energizing said electromagnet adapted to supply a low tension current.

6. In an electric ignition system employing spark-producing means, a closed, uninterrupted electric circuit including said spark-producing means, and carrying a continuous, high potential current, said spark-producing means being adapted to form a gap for inducing a continuous electric arc when ignition is desired.

7. In a spark plug for producing a non-fluctuating electric ignition arc, normally contacting fixed and movable electrodes, adapted to serve as conductors for a constant, continuously flowing high potential current, and means for actuating the movable electrode to momentarily separate it from the fixed electrode, so that a gap is formed between the electrodes when an ignition arc is to be produced.

8. In a spark plug, as set forth in claim 7, said actuating means comprising an electromagnetic instrumentality, controlled by a low potential electric current, and adapted to attract the movable electrode to bodily move the latter away from the fixed electrode.

9. In a spark plug structure, a mountable casing consisting of a base and a detachable cover, an electromagnet and an insulating core fixedly held within the casing, passages in the core, fixed and movable electrodes in the passages, said electromagnet being adapted to attract said movable electrode when energized, conductive means between the iron core of said electromagnet and said movable electrode for normally urging the latter into contact with said fixed electrode, both electrodes being adapted to conduct an uninterrupted current of a high potential, said electromagnet being energized by a low potential current, said iron core being electrically insulated and serving as a continuation of the movable electrode.

10. In a spark plug structure, as set forth in claim 9, an insulating member engaging and held by said cover, and binding posts for said electromagnet and for the fixed electrode supported by said member.

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