Aug. 9, 1966 M. E. GERRY 3,265,931

MAGNETIC IGNITION DISTRIBUTOR

Filed Sept 21, 1964 3 Sheets-Sheet 1

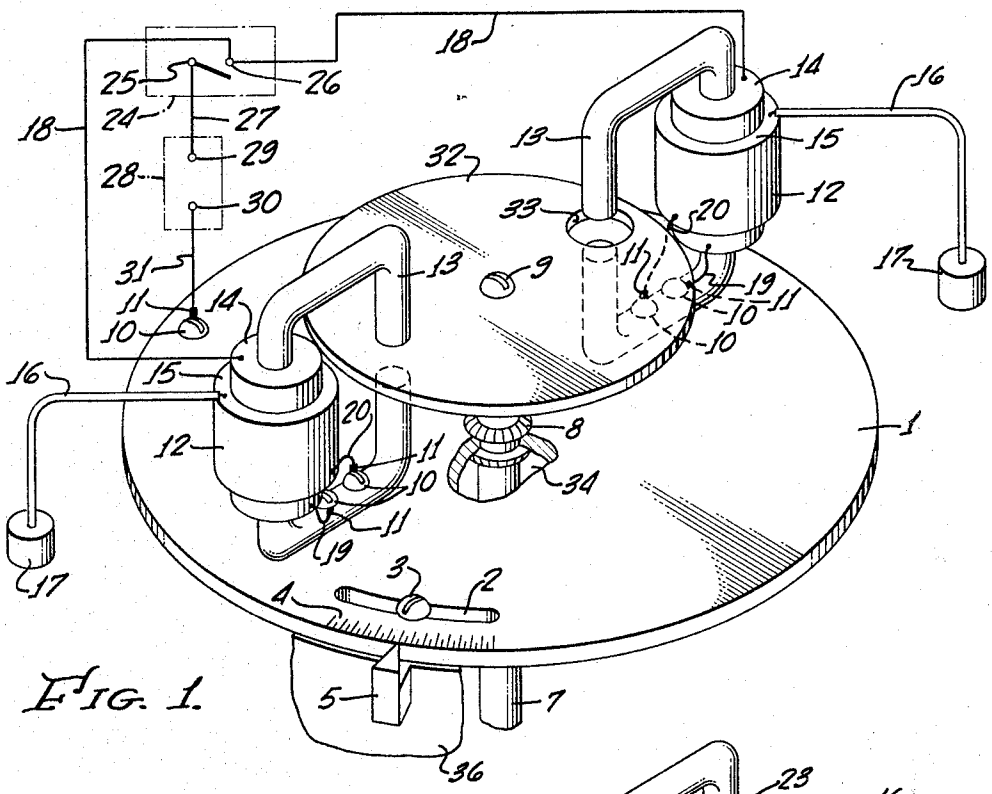
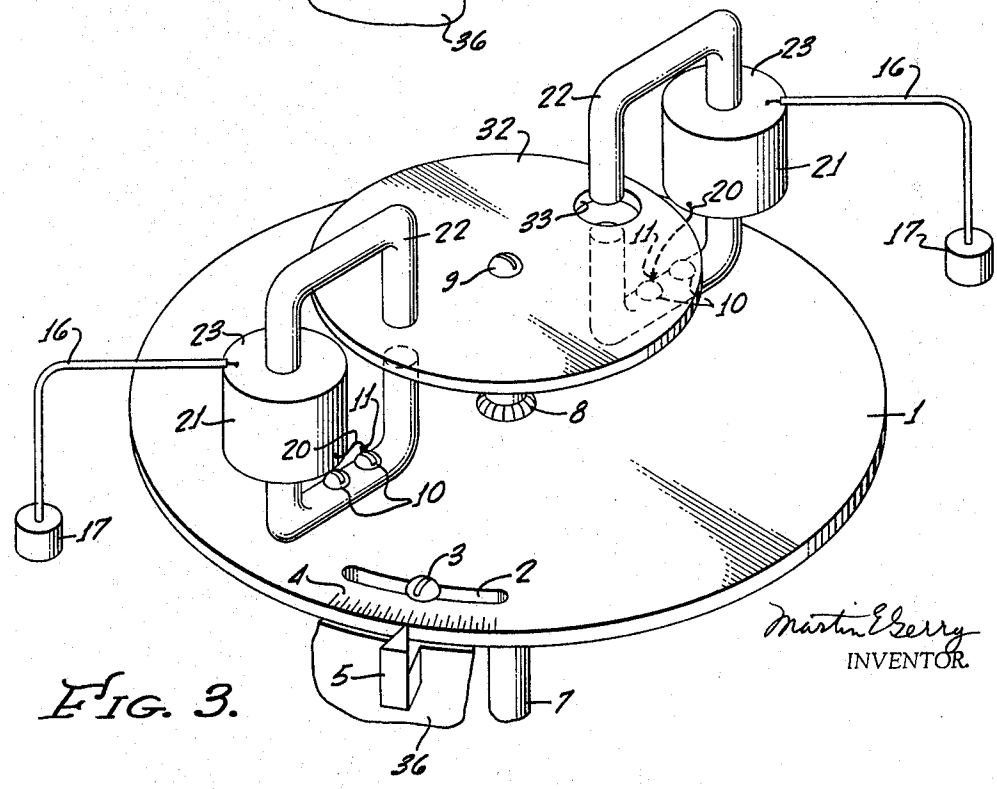


FIG. 1.



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FIG. 3.

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MAGNETIC IGNITION DISTRIBUTOR

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FIG. 2.

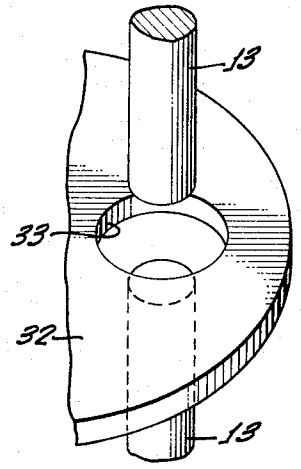


FIG. 6.

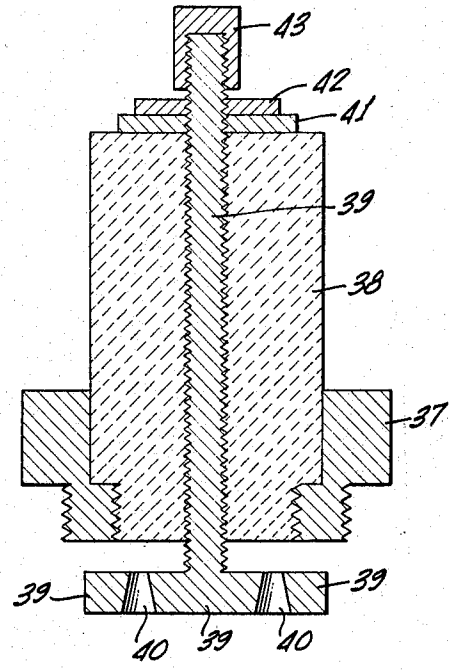
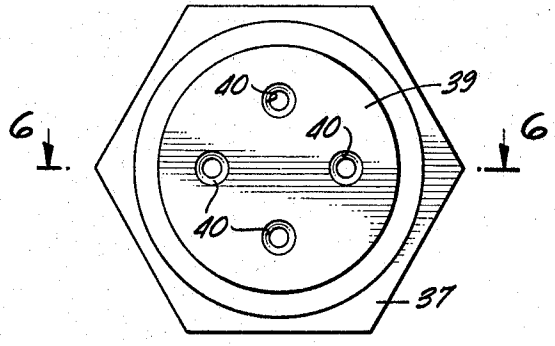


FIG. 7.



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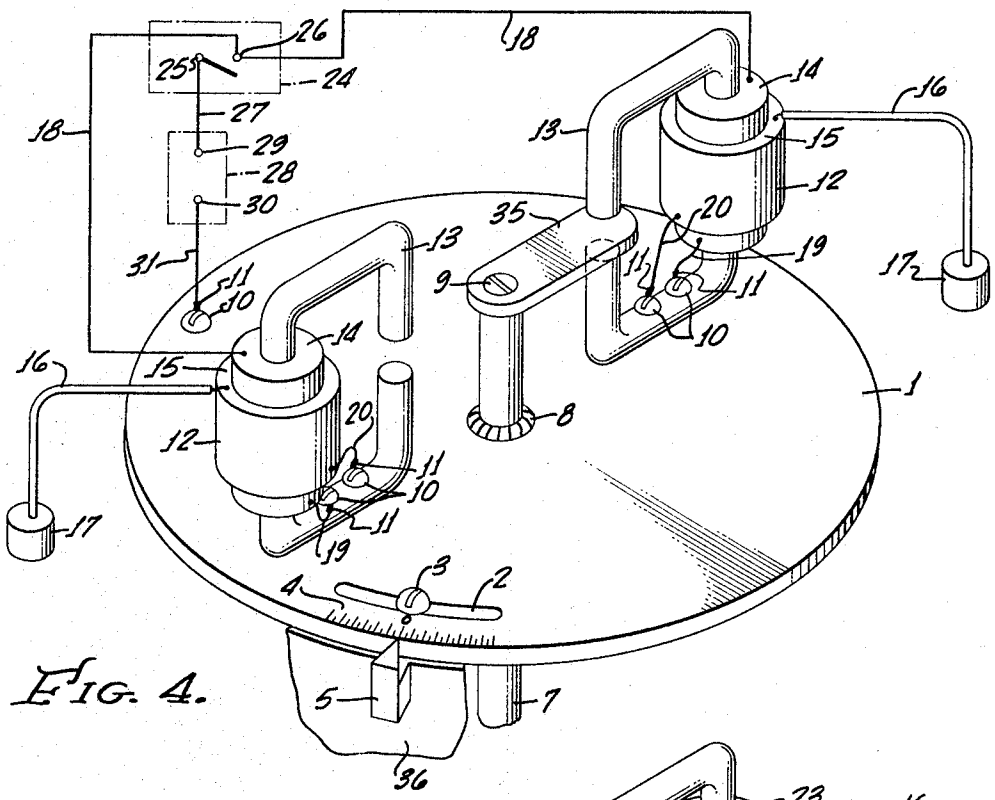


FIG. 4.

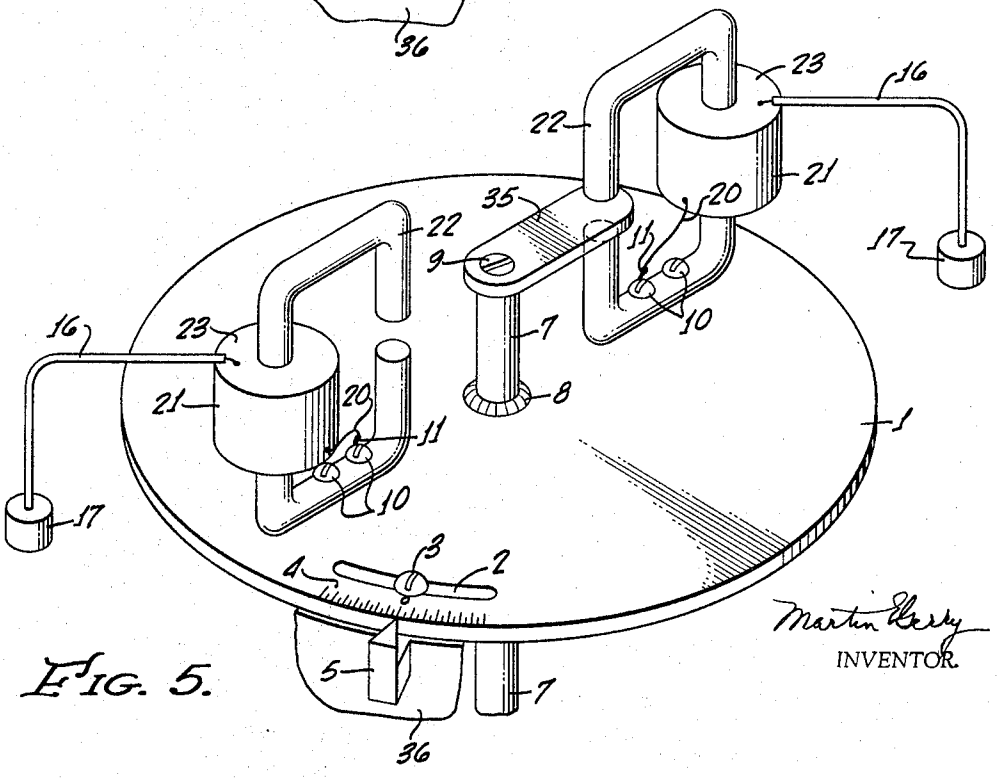


FIG. 5.

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United States Patent Office 3,265,931 Patented August 9, 1966

3,265,931

MAGNETIC IGNITION DISTRIBUTOR

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Filed Sept. 21, 1964, Ser. No. 397,849
2 Claims. (Cl. 315—218)

The invention relates to an automotive engine or any engine comprised of cylinders or other compartments burning gaseous, liquid or other fuels in said cylinders or compartments, said fuel being ignited through the use of high voltage igniters, spark plugs, or similar ignition devices, and wherein igniters, spark plugs, or other ignition devices are triggered by an ignition distributor device in a sequential manner. The invention also relates to substantially failure-proof systems of generating and distributing a high voltage to said igniters, spark plugs, or similar ignition devices without the useage of a conventional high voltage distributor switch, nor vacuum advance, without the use of distributor points, and without the use of a condenser. The invention embodies individual transformers or permanent magnet inductors with as many transformers or permanent magnet inductors as there are spark plugs, igniters, or other ignition devices, and a rotating flux switching disk made of magnetic iron, with a hole at or near its outer periphery, or a rotating flux switching arm made of magnetic iron, either disk or arm rotating through slots in magnetic cores of said transformers or through slots in permanent magnet cores of said inductors. The invention also embodies a novel spark plug which has an adjustable disk shaped firing plate with tapered holes in said firing plate so that if fuel is ignited between said firing plate and the threaded spark plug insert, a pressure differential developed between the inner and outer surfaces of said firing plate tapered holes to provide a jet stream flame into the engine cylinder or compartment so that more effective ignition of fuels retained therein occur, thus resulting in a higher performance engine.

Several forms of the invention are illustrated in the accompanying drawings in which:

FIGURE 1 is an isometric view of a rotating distributor shaft, usually coupled to and moved by the cam shaft action of the engine, to which is attached a magnetic iron flux switching disk with a hole at its outer periphery, and mounted on a spark advance-retard adjustable baseplate are transformers with slots cut into the cores of the transformers so that magnetic disk can rotate through, the primaries of the transformers electrically connected in parallel through an ignition switch to a battery, and high voltage leads with spark plug connecting caps electrically connected to high voltage secondary output terminals of said transformers. Also shown is a cutaway section in base mounting plate to illustrate how distributor shaft is fitted to baseplate by means of a bearing sleeve.

FIGURE 2 is an isometric segment of FIGURE 1 clearly showing the relationship between the hole in flux switching disk and the magnetic iron core to clearly show that the disk and core physically or mechanically never cooperate or touch each other.

FIGURE 3 is an isometric view similar to FIGURE 1 except that instead of a transformer there is a single coil winding and the magnetic iron core is of the permanently magnetized type; this figure does not show nor have the need for a battery and an ignition switch.

FIGURE 4 is identical to FIGURE 1 excepting that instead of a flux switching magnetic disk with a hole at its outer periphery, there is a flux switching magnetic arm.

FIGURE 5 is identical to FIGURE 3 excepting that instead of a flux switching magnetic disk with a hole at its outer periphery, there is a flux switching magnetic arm.

FIGURE 6 is a cross section view of section 6—6 of FIGURE 7, of a spark plug, showing the threaded cylinder insulator as related to the threaded steel spark plug insert together with the coaxial feed through rod and disk firing plate combination with tapered holes in said firing plate.

FIGURE 7 is the bottom view of the spark plug showing the steel spark plug threaded insert and the disk firing plate wtih its four tapered holes bored therein.

In FIGURE 1, base mounting plate **1** is mounted on motor block whose cross section **36** is shown; contiguous to said motor block section is situated calibration index pointer **5**, which indicates the number of degrees of ignition advance or retard calibration, is set at edge **4** of base mounting plate **1**. Calibration is held adjusted after base mounting plate has been positioned to the desired ignition degrees advance or retard by advance-retard set screw **3** protruding through slot **2** and threaded into and held firm by motor block **36**. Cutaway **34** in base mounting plate **1** shows distributor shaft **7**, the cutaway end of shaft **7** usually coupled to and driven by motor cam shaft not shown herein; beryllium copper bearing sleeve **8** with split curled ends fitting on undercut portion of said shaft **7**, bearing sleeve **8** cooperating with, inserted in, and holding base mounting plate **1** so that there is essentially little vertical motion of said distributor shaft **7** and any of the parts attached thereto with respect to said base mounting plate **1**. Magnetic flux switching disk **32** having a keyed mounting hole at its center is mounted on keyed upper surface of distributor shaft **7** by means of set screw **9** protruding through said mounting hole of magnetic switching disk into tapped hole concentric with shaft and in shaft **7** thereby holding said disk **32** firmly in place. Ignition transformers **12**, comprised of magnetic iron cores **13**, primary windings **14**, and secondary windings **15**, are held mechanically attached to base mounting plate **1** by means of screws **10** which retain terminal lugs **11**; screw **10** retaining lug **11** is also threaded into base mounting plate **1** to electrically connect negative ground return wire **31** to negative battery terminal **30** of battery **28**; primary ground return wires **19** and secondary or high tension winding ground return wires **20** are connected to terminal lugs **11** thereby establishing the base mounting plate **1** at negative or ground electrical potential. Hole **33** in flux switching disk **32** is situated at extreme edge or periphery of said disk **32** and said disk **32** when mounted and held in place by screw **9** has its edges situated in gap of iron core **13** without cooperating or making any mechanical contact with said iron core **13** thereby rotating freely when distributor shaft **7** rotates being driven by the engine to which said shaft **7** is mechanically coupled. Connecting wire **27** electrically connects positive terminal **29** of battery **28** to movable contact **25** of ignition switch **24**. Low tension wires **18** from primaries **14** of ignition transformers **12** are electrically connected to stationary contact **26** of ignition switch **24**. High tension wires **16** from secondaries or high tension output windings **15** of transformers **12** are each electrically connected to spark plug connecting caps **17** which caps **17** are normally electrically connected to or fitted over caps of spark plugs, igniters, or other ignition devices mounted in motor block. Hole **33**, FIGURES 1, 2, in flux switching disk **32** is substantially larger than magnetic iron core **13** so that when disk **32** is relatively rapidly rotated due to distributor shaft **7** rotation by motor to a point where the magnetic core **13** is concentric with hole **33**, that is the slotted segment of the magnetic core **13** is concentric with hole **33**, a high reluctance path to magnetic flux lines is created. Magnetic flux of substantially constant character is residual normally in iron core **13**, and is established in said iron core **13** when ignition switch **24** is closed so that contacts **25** and **26** of said switch cooperate causing direct current to flow from positive terminal **29** of battery **28**, through wire **27**,

through contacts 25 and 26, through wires 18, through primary windings 14, and returning through primary return wires 19, base mounting plate 1 and wire 31 to negative terminal 30 of battery 28, so that when magnetic flux switching disk rotates normally through gaps in magnetic iron cores 13 under which conditions a constant magnetic field is present, no transfer of energy from the primary winding to the secondary winding is possible, however when the flux lines or magnetic field in the iron core 13 which also penetrate through and are present in the iron magnetic disk 32 are suddenly interrupted due to rotation of the disk where the hole 33 is aligned with gap of the iron core 13 and the sudden disappearance of magnetic material of disk 32 in the gap of said core 13, and because of the rapid rate of change of magnetic material through the iron core gap, the reluctance of the gap is suddenly increased, suddenly collapsing the magnetic field, and changing the flux quantity through the gap. This collapse of the field and sudden rate of change of flux induces a voltage into the secondary winding 15 proportional to the number of turns of the secondary winding and the time rate of change of the gap flux which applies a high voltage to high tension wire 16, spark plug connecting cap 17, and to the spark plug or other ignition device causing a spark to jump the spark plug or other ignition device gap, and ignite any fuel that may be present in the cylinder or compartment of engine in which said spark plug or ignition device is inserted.

In FIGURE 3, base mounting plate 1 is mounted on motor block whose cross section 36 is shown; contiguous to said motor block section is situated calibration index pointer 5 which indicates the number of degrees of ignition advance or retard calibration is set at edge 4 of base mounting plate 1. Calibration is held adjusted after base mounting plate has been positioned to the desired ignition advance or retard angle by advance-retard set screw 3 protruding through slot 2 and threaded into and held firm by motor block 36. The cutaway end of shaft 7 is usually coupled to and driven by motor cam shaft not shown herein; beryllium copper bearing sleeve 8 with split curled ends fitting on undercut portion of said shaft 7, bearing sleeve 8 cooperating with, inserted in, and holding base mounting plate 1 between its split curled ends so that there is essentially little vertical motion of said distributor shaft 7 and any of the parts attached thereto with respect to said base mounting plate 1. Magnetic flux switching disk 32 having a keyed mounting hole at its center, is mounted on keyed upper surface of distributor shaft 7 by means of set screw 9 protruding through said mounting hole of magnetic switching disk into tapped hole concentric with and in shaft 7 thereby holding said disk 32 firmly in place. Ignition inductors 21, comprised of permanent magnet iron cores 22 with slots cut therein for magnetic flux switching disk injection, and coil windings 23, are held mechanically attached to base mounting plate 1 by means of screws 10 which retain terminal lugs 11; ground return wires 20 are connected to terminal lugs 11 thereby establishing the base mounting plate 1 at ground electrical potential. Hole 33 in flux switching disk 32 situated at extreme edge or periphery of said disk 32, and said disk 32 when mounted and held in place by screw 9 has its edges situated in gaps of iron cores 22 thereby rotating freely when distributor shaft 7 rotates being driven by the engine to which said shaft 7 is mechanically coupled. High tension wires 16 from coil windings 23 of ignition inductors 21 are each electrically connected to spark plug connecting caps 17 which caps 17 are normally electrically connected to or fitted over caps of spark plugs, igniters, or other ignition devices mounted in motor block. Hole 33, FIGURES 1, 2, in flux switching disk 32 is substantially larger than iron core 22 so that when disk 32 is relatively rapidly rotated due to distributor shaft 7 rotation by motor, to a point where the slotted segment

of permanent magnet core 22 is concentric with hole 33, a high reluctance path to magnetic flux lines is created. Magnetic flux of substantially constant character is residual normally in iron core 22 due to the fact that said iron core 22 is a permanent magnet, so that when magnetic flux switching disk rotates normally through gaps in said cores 22 maintaining a constant magnetic field in gap of said core as well as in disk 32, however when the flux lines or magnetic field in iron core 22 is suddenly interrupted due to rotation of the disk 32 to the point where hole 33 is aligned with gap of iron core 22 and the sudden disappearance of magnetic material of disk 32 in the gap of said core 22 and because of the rapid rate of change of magnetic material through the iron core gap, the reluctance of the gap is suddenly increased, suddenly collapsing the magnetic field and changing the flux quantity through the gap. The collapse of the field and the sudden rate of change of flux induces a voltage into the coil of ignition inductor 23 proportional to the number of turns of said coil and the product of the time rate of change of the gap flux, which applies a high voltage to high tension wire 16, spark plug connecting cap 17, and to the spark plug or other ignition device, causing a spark to jump the spark plug or other ignition device gap, and ignite any fuel that may be present in the cylinder or compartment of engine in which said spark plug or ignition device is inserted.

In FIGURE 4, base mounting plate 1 is mounted on motor block whose cross section 36 is shown; contiguous to said motor block section is situated calibration index pointer 5 which indicates the number of degrees of ignition advance or retard calibration is set at edge 4 of base mounting plate 1. Calibration is held adjusted after base mounting plate has been positioned to the desired ignition angle by advance-retard set screw 3 protruding through slot 2 and threaded into and held firm by motor block 36. The cutaway end of shaft 7 usually coupled to and driven by motor cam shaft not shown herein; beryllium copper bearing sleeve 8 with split curled ends fitting on undercut portion of said shaft 7, bearing sleeve 8 cooperating with, inserted in, and holding base mounting plate 1 so that there is essentially little vertical motion of said distributor shaft 7 and any of the parts attached thereto with respect to said base mounting plate 1. Magnetic flux switching arm 35 having a keyed mounting hole at its center is mounted on keyed upper surface of distributor shaft 7 by means of set screw 9 protruding through said mounting hole of magnetic switching arm into tapped hole concentric with shaft and in shaft 7 thereby holding said arm 35 firmly in place. Ignition transformers 12, comprised of magnetic iron cores 13, primary windings 14, and secondary windings 15, are held mechanically attached to base mounting plate 1 by means of screws 10 which retain terminal lugs 11; screw 10 retaining lug 11 is also threaded into base mounting plate 1 to electrically connect negative ground return wire 31 to negative battery terminal 30 of battery 28; primary ground return wires 19 and secondary or high tension winding ground return wires 20 are connected to terminal lugs 11 thereby establishing the base mounting plate 1 at negative or ground electrical potential. Magnetic flux switching arm 35 has one of its edges rotate freely through iron core gaps 13 without cooperating or making any mechanical contact with said iron core when distributor shaft 7 rotates, being driven by the engine to which said shaft 7 is mechanically coupled. Connecting wire 27 electrically connects positive terminal 29 of battery 28 to movable contact 25 of ignition switch 24. Low tension wires 18 from primaries 14 of ignition transformers 12 are electrically connected to stationary contact 26 of ignition switch 24. High tension wires 16 from secondaries or high tension output windings 15 of transformers 12 are each electrically connected to spark plug connecting caps 17 which caps 17 are normally electrically connected to or fitted over caps of spark plugs, igniters, or other ignition de-

vices mounted in motor block. When distributor shaft 7 rotates magnetic flux switching arm 35 through gaps of magnetic cores 13, a low reluctance path to magnetic flux lines is created in the gaps. Magnetic flux of substantially constant character is residual normally in iron core 13, and is established in said iron core 13 when ignition switch 24 is closed so that contacts 25 and 26 of said switch cooperate causing direct current to flow from positive terminal 29 of battery 28, through wire 27, through contacts 25 and 26, through wires 18, through primary windings 14, and returning through primary return wires 19, base mounting plate 1 and wire 31 to negative terminal 30 of battery 28, under which conditions no energy is transferred from primary 14 to secondary 15 windings. However when magnetic flux switching arm 35 passes through the gap of core 13 additional magnetic material being momentarily added to the gap instantly decreases the gap reluctance, interrupts the flux lines through the gap and in fact momentarily increases said flux lines in the gap causing a voltage to be induced into the secondary winding; such a voltage is a high voltage inasmuch as it is proportional to the product of the number of secondary winding turns and the time rate of change of flux in the gap and hence in magnetic core 13; a high magnetic field is also created at the particular time when the gap reluctance is suddenly decreased. A high voltage is therefore applied to high tension wire 16, spark plug connecting cap 17, and to the spark plug or other ignition device, causing a spark to jump the spark plug or other ignition device gap, and ignite any fuel that may be present in the cylinder or compartment of engine in which said spark plug or ignition device is inserted.

In FIGURE 5, base mounting plate 1 is mounted on motor block whose cross section 36 is shown; contiguous to said motor block section is situated calibration index pointer 5 which indicates the number of degrees of ignition advance or retard calibration is set at edge 4 of base mounting plate 1. Calibration is held adjusted after base mounting plate has been positioned to the desired ignition advance or retard angle by advance-retard set screw 3 protruding through slot 2 and threaded into and held firm by motor block 36. The cutaway end of shaft 7 is usually coupled to and driven by motor cam shaft not shown herein; beryllium copper bearing sleeve 8 with split curled ends fitting on undercut portion of said shaft 7, bearing sleeve 8 cooperating with, inserted in, and holding base mounting plate 1 between its split curled ends so that there is essentially little vertical motion of said distributor shaft 7 and any of the parts attached thereto with respect to said base mounting plate 1. Magnetic flux switching arm 35 having a keyed mounting hole at its center, is mounted on keyed upper surface of distributor shaft 7 by means of set screw 9 protruding through said mounting hole of magnetic switching arm into tapped hole concentric with and in shaft 7 thereby holding said arm 35 firmly in place. Ignition inductors 21, comprised of permanent magnet iron cores 22 with slots cut therein for magnetic flux switching arm injection, and coil windings 23, are held mechanically attached to base mounting plate 1 by means of screws 10 which retain terminal lugs 11; ground return wires 20 are connected to terminal lugs 11 thereby establishing the base mounting plate 1 at ground potential electrically. Magnetic flux switching arm 35 when mounted and held in place by screw 9 has one edge situated in gap of iron core when momentarily rotated through the gap by distributor shaft 7 driven by the engine to which said shaft 7 is mechanically coupled. High tension wires 16 from coil windings 23 of ignition inductors 21 are each electrically connected to spark plug connecting caps 17 which caps 17 are normally electrically connected to or fitted over caps of spark plugs, igniters, or other ignition devices mounted in motor block. When distributor shaft 7 rotates magnetic flux switching arm 35 through gaps of magnetic cores 22, a low reluctance path to magnetic flux lines is created in the gaps. Magnetic flux of substantially constant character is residual normally in iron core 22 inasmuch as this iron core 22 is a permanent magnet. Therefore when magnetic flux switching arm passes suddenly through the gap of magnetic core 22, the gap reluctance suddenly decreased, and the flux lines in the gap suddenly cut by the rotating arm 35, the magnetic field of high intensity is suddenly created, and a voltage proportional to the product of the number of turns or windings of coil 23 and the time rate of flux change in the gap of magnetic core 22 is induced or created in said coil 23. The high voltage produced is applied to high tension wire 16, spark plug connecting cap 17, and to the spark plug or other ignition device, causing a spark to jump the spark plug or other ignition device gap, and ignite any fuel that may be present in the cylinder or compartment of engine in which said spark plug or ignition device is inserted.

FIGURES 6 and 7 illustrates a spark plug comprised of threaded cylinder insulator 38 which is made of Teflon or ceramic material and is seated or threaded into steel insert 37 used to mount spark plug in engine, and said cylinder insulator 38 has a hole with threads through its cylindrical axis through which is threaded firing plate with threaded coaxial feed through rod 39, and the gap between said firing plate and steel insert 37 is set by adjusting rod feed through extension of 39 and tightened by means of nut 42 retaining retainer washer 41 between said nut 42 and said cylinder insulator 38. Threaded on end of rod extension 39 is threaded a cylindrical top for fitting over said top 43 spark plug connecting cap 17 FIGURES 1, 3, 4, 5. FIGURE 6 being a section view taken on line 6—6 of FIGURE 7, shows the circular firing plate 39 with tapered four holes 40. The tapers being smaller closer to the steel insert 37 or on the inside of the gap surface between insert 37 and firing plate 39, and the larger opening at the outer surface of said firing plate, causes a pressure differential to exist with the higher pressure in the gap side of the tapered holes 40, thereby when fuel is ignited in the gap due to a spark, the burning fuel in the form of a pencil flame is shot through said holes 40 into the cylinder or compartment of motor, thus cleaning the spark plug metal elements, and enabling more thorough ignition of fuel in said cylinder or compartment resulting in greater efficiency of combustion, higher performance of motor, more complete burning of fuel, and better fuel utilization economy.

The features and principles underlying the invention described above in connection with specific exemplifications will suggest to those skilled in the art many modifications thereof, such as utilizing slots or scalloped edges at the periphery of magnetic flux switching disk in lieu of the hole in said magnetic disk specified, or any other such modifications. It is accordingly desired that the appended claims shall not be limited to any specific feature or details thereof.

I claim:

1. In an internal combustion engine having an ignition system comprising an energy generation and distribution means, and fuel igniter devices,

an electromagnetic apparatus comprising:

an ignition inductor with a coil tightly wound on a magnetized core which has a slotted segment wherein a magnetic flux is established; and

a rotatable disk of magnetic material with its peripheral edge rotatable in and passing through the said slotted segment of the said ignition inductor core; and

a single hole in said disk located at the said peripheral edge of the said disk, for interrupting the said magnetic flux in the said slotted segment, causing a voltage to be induced in the said ignition inductor proportional to the product of the number of turns of the said ignition inductor and the flux rate of change with time, to cause a spark to jump a gap of an igniter device connected to said ignition inductor and igniting the

fuel in a cylinder chamber into which the said igniter device is inserted and mechanically held thereby.

2. In an internal combustion engine having an ignition system comprising an energy generation and distribution means, and fuel igniter devices,

a spark plug, comprising:

a disk-shaped firing plate at which center of one of its surfaces is mechanically attached a rod, which rod is inserted through the axis of an insulating member of said spark plug, and a high voltage is applied to the unattached end of said rod; and

said disk-shaped firing plate has tapered cylindrical holes with the smaller apertures of the said tapered cylindrical holes on the surface of the said disk-shaped firing plate to which the said rod is attached, and a pressure differential between the surfaces of the said disk-shaped firing plate exists, the higher pressure at the smaller said apertures of the said tapered cylindrical holes, and the fuel residual between the inner surface of the said disk-shaped firing plate and the spark plug insert is ignited, and pencil-shaped flames are

directed from the said smaller apertures to the larger apertures of the said tapered cylindrical holes of the said disk-shaped firing plate into the cylinder chamber of the said internal combustion engine.

References Cited by the Examiner

UNITED STATES PATENTS

1,225,534	5/1917	Varley	315—219
1,352,434	9/1920	Conrad	315—219
1,377,854	5/1921	Roberts	313—122 X
1,660,635	11/1926	Thompson	313—123 X
2,221,509	11/1940	Darke	315—219
2,966,615	12/1960	Meyer	315—219
3,152,281	6/1964	Robbins	315—201
3,161,803	12/1964	Knittweis	315—209

FOREIGN PATENTS

946,638	1/1964	Great Britain.

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