ROTARY MULTIPLE CONTACT PERIODIC SWITCH FOR INTERNAL COMBUSTION ENGINE WITH IMPROVED DISTRIBUTOR SHAFT CONTACT COLLAR

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ABSTRACT
An ignition system for an internal combustion engine has circularly arranged stationary brushes and one or more insulated contacts rotating with the distributor shaft which replace the make-and-break contacts of an ordinary engine ignition system. The brushes and rotating contacts are adaptable to be mounted in the ordinary distributor housing. A single contact on the distributor shaft provides one ignition spark in each power stroke of a piston and more than one contact provides a corresponding number of sparks in each power stroke.

12 Claims, 11 Drawing Figures
ROTARY MULTIPLE CONTACT PERIODIC SWITCH FOR INTERNAL COMBUSTION ENGINE WITH IMPROVED DISTRIBUTOR SHAFT CONTACT COLLAR

This application is a continuation of application Ser. No. 16,273, filed Mar. 4, 1970, now abandoned.

BACKGROUND OF THE INVENTION

The invention relates to internal combustion engine ignition systems and apparatus of the brush and contact type, and more particularly to such systems and apparatus wherein the brushes are stationary and the contact or contacts rotate, and it is the object of the invention to provide an improved system and apparatus of this character.

It has been found that the provision of two ignition sparks for each power stroke of a piston in an automobile engine substantially improves the operation of the engine, particularly at higher speeds. The improved operation includes increased gasoline mileage, increased high speeds, and generally improved performance. It is believed that the improved performance is attributable to substantially improved combustion of the mixture in the engine cylinder.

The internal combustion engine, and particularly the automobile engine, has come in for much criticism because of its exhaust emission and the concomitant pollution of the atmosphere. Improving the fuel combustion in the cylinders of automobile engines and the like, especially where this results in substantially decreased carbon monoxide emission, is a very worthwhile objective. Accordingly, it is a further object of the invention to provide an ignition system for an automobile engine which contributes greatly to decreased atmospheric pollution.

The ignition system of an ordinary automobile engine and similar engines have breaker points which are actuated by a follower engaging the surface of a breaker cam. The follower, the cam, and the breaker points are subject to wear and corrosion and require periodic adjustment, which is expensive. It is also quite inconvenient and annoying because it takes the vehicle out of service. It is an object of the invention to minimize this problem.

Prior art devices for providing more than one spark to each piston power stroke are known, as in U.S. Pat. No. 3,221,116, D. M. McAllister, and prior devices utilizing brush and rotating contact combinations are known, as in U.S. Pat. Nos. 1,494,597, W. A. Evans; 2,278,679, K. Straub; 2,593,205, B. H. Short et al.; 2,839,622, A. H. Billings; 3,004,115, J. de Regeris; 3,022,389, V. F. Wolrab; 3,052,764, J. de Regeris; 3,087,000, R. R. Krone; 3,270,150, R. A. Stevens; 3,342,955, W. C. Smith et al.; 3,435,161, M. A. Webster; and 3,732,249, D. D. Wittem. The devices of these patents have not effectively eliminated the problems existing in the ignition system. Particularly, the problem of eliminating the effects of wear between the moving parts has not been solved. Prior devices create an unbalanced force between the rotating contact and commutator members, thereby resulting in uneven wear, giving rise to eccentricities of the rotating contact member. In turn, this causes wear of the brush or brushes riding on the contact surface with consequent poor ignition. It is a further object of the invention to provide a combination of stationary brushes and rotating contacts which reduce wear of these parts to a minimum, if not eliminating it altogether, and wherein such wear as occurs is uniform.

Other objectives and advantages of the invention will become apparent as the description proceeds.

SUMMARY OF THE INVENTION

In carrying out the invention in one form, there is provided an ignition system for an internal combustion engine of the type including a series of cylinders, a spark plug for each cylinder, a spark coil, and distributor means including a rotor driven by a metallic distributor shaft for directing ignition sparks from such spark coil to conducting leads extending to such spark plugs and a contact supporting plate comprising an insulating collar having an exterior cylindrical surface surrounding said metallic distributor shaft; contact means which engage said metallic distributor shaft, extend through said insulating collar and terminate on said cylindrical surface; a series of brushes insulatingly mounted on said supporting plate; said brushes being circumferentially spaced around said distributor shaft at the same angle relative to each other and each having one end bearing against said exterior cylindrical surface in a plane so as to engage said terminated of said contact means during its rotation; the angular spacing between successive ones of said brushes being equal to 360° divided by the number of engine cylinders; means urging each one of said brushes into engagement with said cylindrical surface; said conductor means for connecting each one of said brushes to a source of electrical current; the angular extent, at the cylindrical surface of said collar, of said contact means being less than the angular extent between the rearward and forward edges of successive ones of said brushes.

In carrying out the invention in another form, there is provided apparatus for making and breaking the primary circuit of an automobile ignition system two times in the power stroke of each piston for providing a primary ignition spark and a secondary ignition spark to each spark plug including a distributor having a metallic distributor shaft and a plug-and-dwell circuit breaker cam thereon adapted to open and close breaker points, comprising a series of stationary equiangularly spaced brushes adapted to be mounted circumferentially in the distributor of said ignition system; a rotating insulating cylindrical collar having interior peaks and dwells to be disposed over said circuit breaker cam; a primary contact member and a secondary contact member extending through said collar and being spaced apart from each other, each of said primary and secondary contact members having an interior termination and an exterior termination; conductor means connecting one end of each of said brushes to a source of electrical current; the other ends of each of said brushes being adapted to ride on the cylindrical surface of said collar and to engage said exterior termini of said primary and secondary contact members; said interior termini of said primary and secondary contact members being adapted to engage the surface of said circuit breaker cam; the angular spacing, at the cylindrical surface of said collar, between the radius of the trailing edge of said exterior termination of said primary contact member and the radius of the next rearward interior peak of said collar being essentially equal to the angular spacing between the the radius of the point on said circuit breaker cam where such breaker points would open and the radius of the next rearward peak of such breaker cam; the angular spacing, at the cylindrical surface of said collar, between the trailing edge of said exterior termination of said primary contact member and the radius of the exterior termination of the leading edge of said secondary contact member being greater than the angular width, at said cylindrical surface of any of said brushes; the angular spacing at the cylindrical surface of said collar, between the radius of the trailing edge of said primary contact member and the radius of the trailing edge of said secondary contact member corresponding to the predetermined time interval between such first and second sparks; the angular spacing at the cylindrical surface of said collar, between the radius of the leading edge of said primary contact member and the radius of the trailing edge of said secondary contact member being less than the angular spacing, at the cylindrical surface of said collar, between the radii of the rearward edge of any of said brushes and the forward edge of the next rearward brush.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top view, somewhat diagrammatic, of an internal combustion engine ignition system and apparatus according to the invention;

FIG. 2 is a sectional view, including additional structure, taken substantially in the direction of the arrows 2—2 of FIG. 1.
FIG. 3 is a top view of one operating component of the apparatus; FIG. 4 is an elevational view of another operating component of the apparatus illustrated in Fig. 1; FIG. 5 is a wiring diagram of an ignition system embodying the invention according to Fig. 1; FIG. 6 is a fragmentary sectional view on a larger scale of certain components illustrating one manner of operation; FIG. 7 is a schematic view of a portion of an automobile engine ignition system; FIG. 8 is a top view similar to FIG. 1 of another form of the invention; FIG. 9 is an elevational view of one operating component of the apparatus illustrated in FIG. 8; FIG. 10 is a fragmentary sectional view on a larger scale of certain components illustrating another manner of operation; and FIG. 11 is a wiring diagram of an ignition system embodying the invention according to FIG. 8.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the drawings, the ignition system and apparatus 10 are shown comprising a series of brushes 11, 12, 13, 14, 15, and 16, and a rotor 17. The brushes are disposed on an insulating plate 18 which is adapted to be mounted in an ordinary distributor, the distributor cap of which is illustrated by the reference character 19 in FIG. 2. The rotor 17 is of insulating material, such, for example, as nylon, includes a metallic contact 21, and is adapted to be received over the peak-and-dwell cam 22 of the ignition system of an ordinary automobile engine. For this purpose, the interior surface of contact member 17 is hexagonal in form, having wells and peaks corresponding to the wells and peaks of the cam 22.

The contact 21 extends through the wall of member 17 so that its interior terminus 21A engages the surface of cam 22 for completing the electrical circuit. The exterior terminus 21B of the contact 21 conforms to the cylindrical outer surface 23 of the member 17 and lies in a plane determined by the brushes 11-16.

While six brushes and a hexagonal cam 22 are shown and apply to a six-cylinder engine, it will be understood that this is by way of example only, and that the invention has application to engines of any desired number of cylinders. In any case, the breaker points are circumferentially spaced at equal angular distances from each other, such angles being equal to 360° divided by the number of engine cylinders. As shown, the brushes are spaced apart 60°. The ignition system is shown as applying specifically to an automobile engine, but it has equal application to other similar internal combustion engines.

Each of the brushes 11-16 is slideably mounted on the insulating member or plate 18 by a pair of U-shaped stirrups 24. The ends of the stirrups are firmly embedded in the plate 18, but other means for slideably holding the brushes to the plate may, of course, be used. The inner end 25 of each of the brushes is curved so as to conform to the circumference of the rotating member 17, and the opposite end, or base, 26 of each brush is adapted to have one end of a spring 27 bear thereagainst. The other end of each spring 27 bears against a suitable abutment 28 forming part of the supporting plate 18 so that the springs 27 urge their respective brushes 11-16 against the cylindrical surface of contact collar 17. The base 26 of each of the brushes is connected by a conductor or pigtail 29 to the conductor 30 of an insulated wire 32, whereby electrical current may be supplied to the brushes when necessary. For example, 21A of contact 21 in engaging the surface of metallic cam 22 which is driven by the distributor shaft 33 of the ordinary engine becomes part of the electrical circuit because the metal parts of the engine, including the distributor shaft, form a ground. The brushes 11-16, which are spaced from the supporting member 34 by suitable spacers 36, are mounted to the supporting member 34 by suitable spacers 36. The breaker point supporting member 34 is shown as being connected to the usual spark advance-and-retard lever 37 which is pivoted to supporting plate 34 by a suitable pin 38. Provided in brush-supporting plate 18 are arcuate slots 39 through which the shanks of screws 35 are passed permitting positional adjustment of the brush-supporting plate.

Referring to FIG. 2, there is shown the usual distributor rotor 41 which is suitably keyed to the upper end 42 of the distributor shaft 33. The rotor includes a spring contact finger 43, contacting a terminal 44 which cooperates with the usual terminals 45 in the distributor cap 49. The terminal 44 includes an arcuate tail, or extension, 46 for a purpose to be described.

Referring to FIG. 5, the ignition circuit may be visualized. Thus, the ignition coil 47 has a primary winding 48 which has one end connected through conductor 49 to the conductor 31, and thus through the brushes 11-16, the rotating contact 21 and the distributor shaft 33, to ground. The other end of primary coil 48 is connected through the ignition switch 51, battery 52 and conductor 53, to ground. The capacitor 54 is connected to ground and to conductor 49, as shown, to prevent arcing at the brushes, as is well understood. The coil 47 includes a secondary winding 55 connected to ground at one end through conductor 56, and at the other end through high-voltage conductor 57 to the metallic members 43 and 44 of rotor 41. Contact 46 of rotor 41 completes the circuit to the engine spark plugs 58 through terminals 45 and spark plug leads 59. In the form of the invention shown in FIG. 1, the terminal 44 need not have the extension 46 so long as the end of terminal 44 ends closely adjacent the terminals 45.

The operation of the ignition system and additional structure may now be described. With the ignition switch 51 closed, electric current is supplied to the primary winding 48 when the leading edge 21C of contact 21 engages the downward edge 12A of brush 12, for example. See particularly, FIG. 6. In this figure, the cam 22 is in a position, shown dotted, when the leading edge 21C of contact 21, also in a doted position, engages the rearward edge 12A of brush 12. As cam 22 rotates clockwise, it reaches the position shown by the solid lines, at which time the leading edge 21C of contact 21 has reached the point shown by the solid lines in FIG. 6. Correspondingly, the trailing edge 21D of contact 21 has moved from its initial position, shown dotted, to its final position, shown solid, where the trailing edge 21D is just about to leave the forward edge 12B of brush 12. Just as trailing edge 21D leaves the forward edge 12B, the circuit to the primary winding 48 is broken and a high-voltage spark is received by the secondary winding 55, causing the spark plug 58 to fire. Thus, the separation of trailing edge 21D and forward edge 12B corresponds to the opening of the circuit breaker contacts of an ordinary engine ignition system.

Correspondingly, the length of travel from the point where the leading edge 21C of contact 21 engages the rearward edge 12A of brush 12 until the trailing edge 21D of contact 21 leaves the forward edge 12B of brush 12 corresponds to the cam-dwell period of an ordinary engine ignition system. In FIG. 6, the angular extent of contact 21 at the radius of engagement with brush 12 is shown as about equal to twice the angular extent of brush 12, and brush 12 is shown as being about 12° in angular extent. This combination of angular dimensions results in a dwell or primary circuit closed of about 36° (brush width plus contact width). As shown in FIG. 6, the leading edge 21C of contact 21 on continued rotation will engage the rearward edge 13A of brush 13 preparatory to firing the next cylinder. This travel of contact 21 corresponds to 24° of distributor shaft rotation, indicating that the open circuit portion of the cam interval is 24°. Thus, as shown, the dwell of the circuit is 36° and the open portion is 24°, as is typical of a six-cylinder automobile engine.

It will be apparent that other combinations of angular extents of the brushes and contacts may be selected to achieve particular conditions of operation.
Substantial flexibility of operation accrues from the rotating contact apparatus as described in that the angular extent of the contact 21 can be of any dimension so long as it is slightly less than the angular distance between the forward edge 12B of brush 12 and rearward edge 13A of brush 13. In this way, the dwell, or energization portion of the primary coil may be increased, resulting in a better spark and consequently better combustion of the mixture in the engine cylinder.

The rotating member 17 may be termed a collar inasmuch as it fits relatively tightly over the make-and-break cam 22.

For use in an already existing automobile engine, for example, the interior hexagonal surface 17A of the collar must fit appropriately relative to the cam 22 of the existing engine. Referring to FIG. 7, there is shown, schematically, a hexagonal cam 22, a breaker arm 60 and points 61, a follower 62 being disposed to bear on the cam surface for actuating the points 61. In the position shown, the follower 62 is in the middle of the dwell period of cam surface 22A. About 18° of rotation later of cam 22, when point 63 reaches follower 62, the points 61 open. Thus point 63 corresponds to the separation of trailing edge 21D and forward edge 12B, as described. For the particular conditions indicated, then, the peak 64 of cam 22 must be about 12° of rotation behind the opening point of the contacts. Twelve degrees of rotation after this, when point 65 reaches the center, the make-and-break cam 22 (a total travel of 24°), the contacts 61 again close, and this closing point corresponds to the time when the leading edge 21A reaches the rearward edge 13A, as shown in FIG. 6, to begin a new dwell period.

To permit adjustments in relative location of the brush assembly 11–16, 18 and rotating contact 21, the arcuate slots 29 have been provided as described. After the appropriate adjustment has been made, the automatic spark mechanism of the engine by means of lever 37 operates the mechanism in the customary manner.

The circumferential or angular extent of contact 21 may be chosen along with the circumferential or angular dimensions of the brushes to achieve the desired dwell and open periods, and the axial dimension of the contact 21 may be selected to be larger than the axial brush dimension as shown in order to achieve decreased resistance.

The symmetrical arrangement of the brushes brings equal wear forces to bear on the collar 17 whereby this member will wear uniformly without creating any eccentricities. Accordingly, necessary spark adjustments are reduced to a minimum. Moreover, material such as nylons, of which the collar 17 may be made, does not wear significantly and, consequently, the collar and contact will last a long time. The contact 21 may be made of any suitable conducting material, such as copper or compressed carbon, for example.

The brush combination supported by plate 18 can be attached to an existing ignition system, for which purpose the supporting plate 18 has a circular opening 66 large enough to easily slip over the collar 17. The collar 17, instead of being a separate unit adaptable to be attached to the cam 22 of an existing engine, may be formed as part of the distributor shaft in the first instance by the engine manufacturer.

It will be understood that the rotor 41 is located in the usual manner so that contact 44 is opposite the appropriate terminal 45 when the spark is to occur. The brush-supporting plate 18 may be located to cause the trailing edge 21D and forward edge 12B to separate, that is, to create a spark at the desired point in the engine cycle, usually somewhat ahead of the top dead center position of the particular piston. While the operation has been described with respect to a particular brush 12, it will be evident that the same type of operation occurs at every other brush.

It has been found that more efficient operation, higher speeds, better combustion and improved operation generally can be obtained in an ordinary engine by firing the spark plug of each cylinder more than once during the same piston power stroke. For example, the first or primary spark, at some speed, may occur approximately 8° ahead of the top dead center position of a particular piston, and the second or secondary spark, at the same spark plug, may occur about 45° later in rotation of the engine crankshaft, which is to say about 224° later in rotation of the distributor shaft. The reason for the improved engine performance, the reason that the second spark, is not fully understood because, after the first spark, the fuel mixture in the cylinder is burning, but it has been found that a second spark causes improved performance, as stated. At the present time, with the constant and heavy emphasis on minimizing, if not eliminating, atmospheric pollution from any source, including automobile engines, it is a worthwhile effort to improve the fuel combustion in such an engine.

Referring to FIGS. 8–11, there is shown a form of ignition system wherein two sparks are provided during each power stroke of a piston. Thus, there is shown a rotating insulating collar 67 having an exterior cylindrical surface 68 for cooperation with the inner ends of the brushes 69, 71, 72, 73, 74 and 75, as described for brushes 11–16, and having an interior hexagonal surface 76 to be tightly received over the ordinary make-and-break cam 22. Insulating collar 67 includes a conducting contact 77 of the same dimensions, terminus and location as contact 21 of collar 17. Accordingly, the primary ignition spark will occur, in this form of the invention, at the same time as the spark occurs in the form shown in FIG. 6, that is, when the trailing edge 77D of contact 77 leaves the forward edge 69B of brush 69. The operation of the coil 47 in providing the circuit for creating the spark are the same as shown and described in connection with FIG. 5.

Collar 67 includes a second contact 78 which has an interior terminus 79 for engaging the surface of cam 22 and an exterior terminus 81 for engaging the inner ends of the brushes. The leading edge 78A of contact 78 is angularly, or circumferentially, disposed behind the trailing edge 77D by an angular extent slightly greater (for example, 28°) than the angular extent of brush 69. In this manner, the first or primary spark occurs before the dwell period begins for the next or secondary spark, and no short circuit of the coil during the first spark takes place. The trailing edge 78B of contact 78 extends angularly 80°, for example, behind leading edge 78A, so that this trailing edge 78B moves away from the forward edge 69B of brush 69 before the leading edge 77C of contact 77 reaches the rearward edge 71A of brush 71. In this manner, again, no short circuit of the ignition coil during the secondary spark takes place, and the separation between trailing edge 78B and the forward edge 69B (224°) takes place to create the secondary spark at the spark plug at the desired time interval. In the form shown in FIG. 10, a 1½° interval has been allowed for trailing edge 78B to leave forward edge 69B before leading edge 77C reaches the rearward edge 71A. That is to say, the overall angular or circumferential extent of the two contacts 77 and 78 is slightly less than the angular extent between the forward edge 69B of brush 69 (or any brush) and the rearward edge 71A of the next forward brush 71 (or any next forward brush).

In the example shown in FIG. 10, the dwell period for the first spark is 36°, as is typical with six-cylinder engines, and the dwell period of the second spark is about 204°, that is, equal to the angular width of the brush 69 (12°) plus the angular width of contact 78 (8°).

The location of the cam peak 64 for the structure shown in FIG. 10 is the same as that shown for the structure in FIG. 6 inasmuch as the first, or primary, spark should occur at the same relative point in the engine cycle.

Referring to FIG. 11, it will be evident that the circuit diagram is essentially the same as that of FIG. 5. However, in order to produce two sparks at each spark plug, it is necessary that the distributor rotor 41 include the arcuate extension 46 so that when the second contact 78 breaks its circuit to create the second spark, the tail of extension 46 is still adjacent the distributor terminal 45, thereby to cause the voltage impulse to travel along the spark plug wire to the spark plug 58. The length of the extension 46 is selected to correspond to the angular travel of the distributor shaft, that is, the travel of collar 67, between the first and second sparks. In the particular ex-
ample, the extension 46 must be about 22\% long or somewhat longer.

In the form of the invention shown in FIGS. 6-11, the angular extent of the brushes and the angular extent of the contacts may be selected to give the desired amounts of dwell and open in the primary circuit of the coil. Ignition adjustments as described for the first form of the invention also apply with respect to the second form. Likewise, the advantages of the invention also apply.

It will be clear that more than two contacts may be disposed in the collar 67. As many as six may be advantageous.

In the form of the invention, while the collar 68 may be constructed to be utilised in an existing engine along with an appropriate assembly of brushes, it will be clear that the structural components of collar 68 may be part of the distributor in the first instance.

It is to be understood that the present disclosures have been made only by way of example and that many additional modifications, changes, and various details may be resorted to without departing from the spirit and scope of the invention as hereinafter claimed.

What is claimed is:

1. An ignition system for an internal combustion engine of the type including a series of cylinders, a spark plug for each cylinder, a spark coil, and distributor means including a rotor driven by a metallic distributor shaft for directing ignition sparks from such spark coil to conducting leads extending to such spark plugs and a contact supporting plate, comprising: an insulating collar having an exterior cylindrical surface surrounding said metallic distributor shaft; contact means in electrical contact with said metallic distributor shaft, extend through said insulating collar and terminate on said cylindrical surface; a series of brush tips insulatingly mounted on said supporting plate; said brushes being circumferentially spaced around said distributor shaft at the same angle relative to each other and each having one end bearing against said exterior cylindrical surface in a plane so as to engage said termination of said contact means during its rotation; the angular spacing between successive ones of said brushes being equal to 360° divided by the number of engine cylinders; means urging each one of said brushes into engagement with said cylindrical surface; and conductor means for connecting each one of said brushes to a source of electrical current; the angular extent, at the cylindrical surface of said collar, of said contact means being less than the angular extent between the rearward and forward edges of successive ones of said brushes.

2. The invention according to claim 1 wherein said contact means comprises two contact members.

3. The invention according to claim 1 wherein the series of brushes and the urging means are mounted on an insulating plate which is attached to the contact supporting plate.

4. The invention according to claim 1 wherein the insulating collar has an interior surface conforming to the primary circuit breaker cam of a regular automobile distributor.

5. The invention according to claim 4 wherein the series of brushes and the urging means are mounted on said insulating plate which includes a central opening to be received over said insulating collar when said insulating plate is attached to the contact supporting plate.

6. The invention according to claim 5 wherein the insulating plate includes arcuate slots for enabling adjustment of said insulating plate.

7. The invention according to claim 5 wherein the urging means comprises an individual spring bearing against the base of each of said brushes.

Apparatus for making and breaking the primary circuit of an automobile engine ignition system including a distributor having a distributor shaft and a peak-and-dwell circuit breaker cam thereon adapted to open and close breaker points comprising a series of stationary equiangularly spaced brushes adapted to be mounted circumferentially in the distributor of said ignition system; a rotating insulating cylindrical collar having interior peaks and dwells to be disposed over said circuit breaker cam; and a contact member extending through said collar and having an interior terminus and an exterior terminus; conductor means connecting one end of each one of said brushes to a source of electrical current; the other ends of each of said brushes being adapted to ride on the cylindrical surface of said collar and to engage said exterior terminus of said contact member; said interior terminus of said contact member being in electrical contact with the surface of said circuit breaker cam; the angular spacing, at the cylindrical surface of said collar, between the radius of the trailing edge of said exterior terminus of said contact member and the radius of the next rearward interior peak of said collar being essentially equal to the angular spacing between the radius of the point on said circuit breaker cam where the breaker points of an automobile ignition system open and the radius of the next rearward peak of such breaker cam; and the angular spacing, at the cylindrical surface of said collar, between the radii of leading and trailing edges of said contact member being less than the angular spacing, at the same cylindrical surface, between the radii of the rearward edge of any of said brushes and the forward edge of the next rearward brush.

9. The invention according to claim 1 wherein said contact means comprises more than one contact member, adjacent ones of which are spaced apart by an angular extent greater than the cooperating angular extent of any of said brushes, and the angular spacing between the trailing edges of adjacent contact members correspond to the predeterminated interval between two successive firing marks on to a spark plug.

10. The invention according to claim 9 wherein said contact means comprises two contact members.

11. Apparatus for making and breaking the primary circuit of an automobile ignition system two times in the power stroke of each piston for providing a primary ignition spark and a secondary ignition spark to each spark plug, including a distributor having a distributor shaft and a peak-and-dwell circuit breaker cam thereon adapted to open and close breaker points comprising a series of stationary equiangularly spaced brushes adapted to be mounted circumferentially in the distributor of said ignition system; a rotating insulating cylindrical collar having interior peaks and dwells to be disposed over said circuit breaker cam, a primary contact member and a secondary contact member extending through said peak-and-dwell circuit breaker cam; and an interior terminus of said primary and secondary contact members having an interior terminus and an exterior terminus; conductor means connecting one end of each of said brushes to a source of electrical current; the other ends of each of said brushes being adapted to ride on the cylindrical surface of said collar and to engage said exterior termini of said primary and secondary contact members; said interior termini of said primary and secondary contact members being in electrical contact with the surface of said circuit breaker cam; the angular spacing, at the cylindrical surface of said collar, between the radius of the trailing edge of said exterior terminus of said primary contact member and the radius of the next rearward interior peak of said collar being essentially equal to the angular spacing between the radius of the point on said circuit breaker cam where such breaker points would open and the radius of the next rearward peak of such breaker cam; the angular spacing, at the cylindrical surface of said collar, between the trailing edge of said exterior terminus of said primary contact member and the radius of the exterior terminus of the leading edge of said secondary contact member being greater than the angular width, at said cylindrical surface of any of said brushes; the angular spacing at the cylindrical surface of said collar, between the radius of the trailing edge of said primary contact member and the radius of the trailing edge of said secondary contact member corresponding to the predeterminated time interval between such first and second sparks; the angular spacing at the cylindrical surface of said collar, between the radius of the leading edge of said primary contact member and the radius of the trailing edge of said secondary contact member being less than the angular spacing, at the cylindrical surface of said collar, between the
radii of the rearward edge of any of said brushes and the forward edge of the next rearward brush.

12. The invention according to claim 11 wherein a distributor rotor is provided and includes a terminal of an arcuate extent corresponding to the time interval between the successive sparks.

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