Aug. 19, 1941. A. J. BARNUM ET AL 2,253,221

IGNITION MECHANISM

Filed May 22, 1939 2 Sheets-Sheet 1

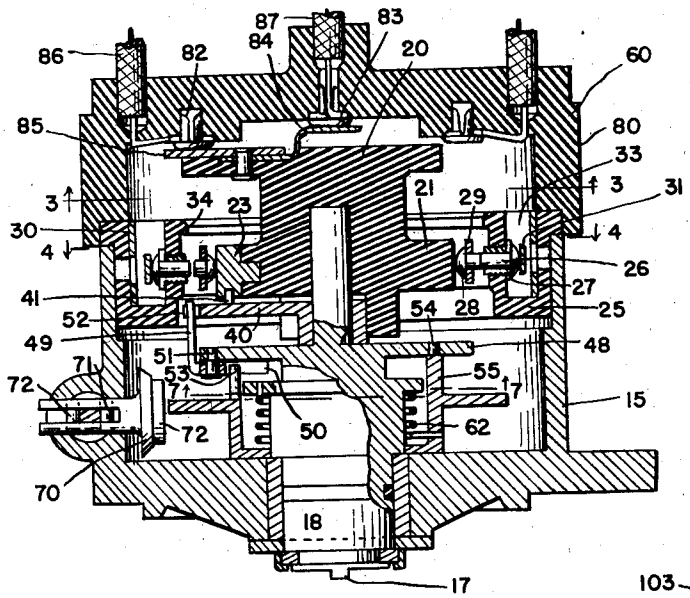


FIG.2.

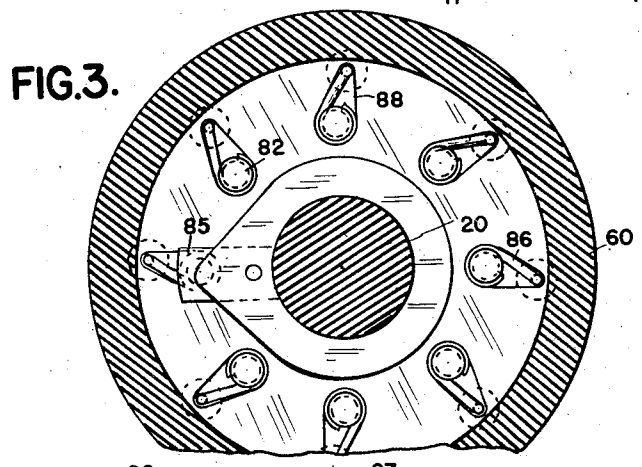


FIG.3.

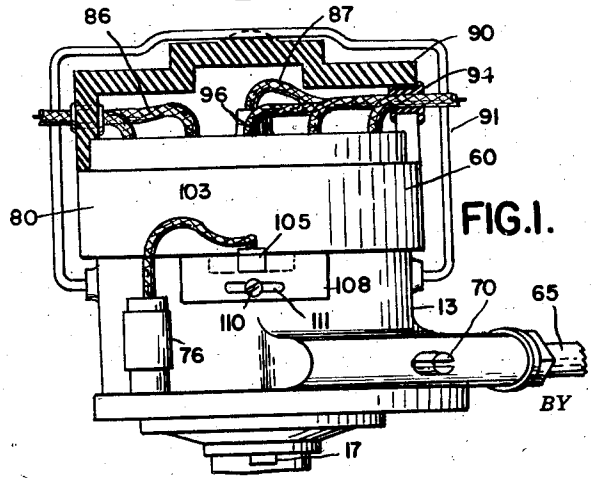


FIG.1.

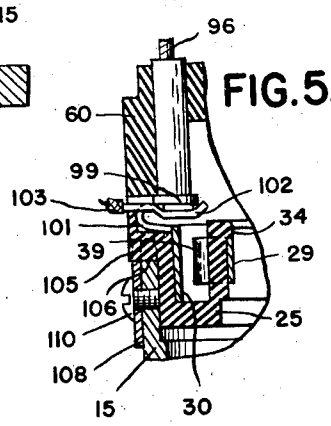
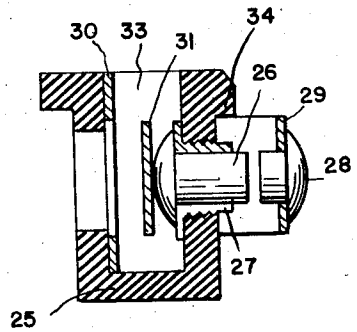


FIG.5.

FIG.11.



INVENTORS

WARREN J. BARNUM

ARTHUR J. BARNUM

BY

ATTORNEYS

Aug. 19, 1941. A. J. BARNUM ET AL 2,253,221

IGNITION MECHANISM

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FIG.4.

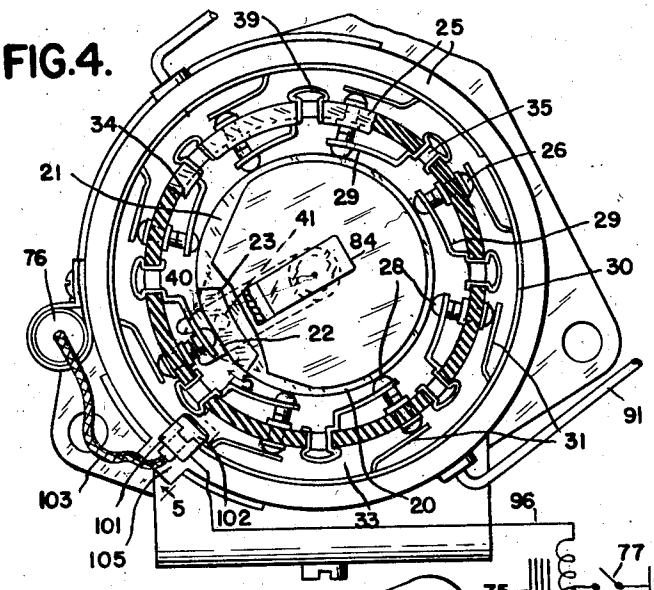


FIG.7.

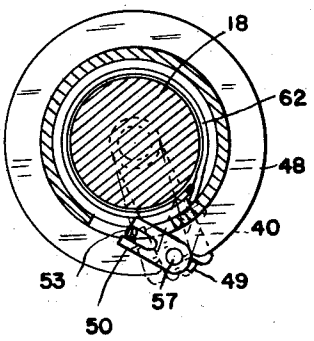


FIG.9.

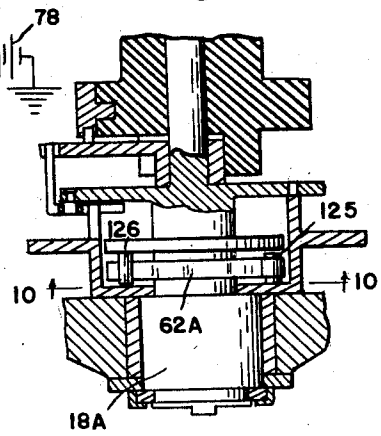
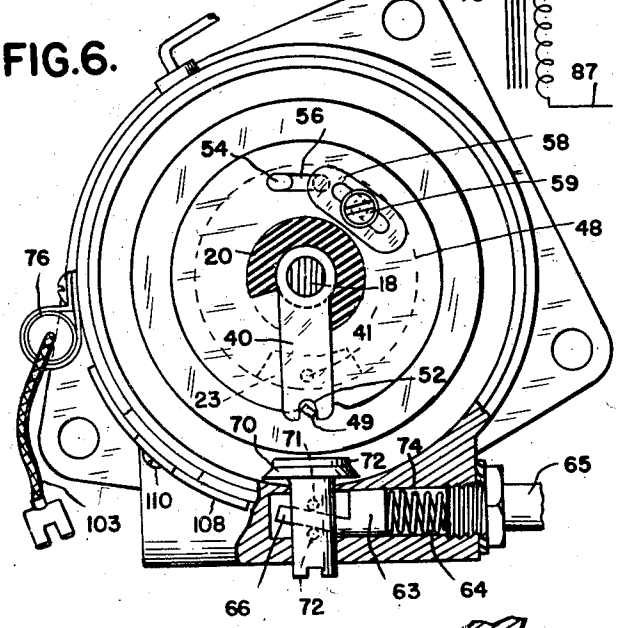


FIG.6.



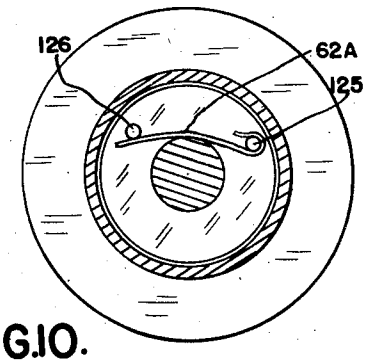


FIG.10.

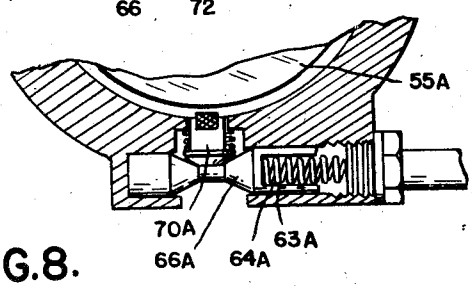


FIG.8.

INVENTORS

WARREN J. BARNUM

BY ARTHUR J. BARNUM

ATTORNEYS

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IGNITION MECHANISM

Arthur J. Barnum and Warren J. Barnum,
Detroit, Mich.

Application May 22, 1939, Serial No. 275,036

12 Claims. (Cl. 200—21)

This invention relates to ignition devices for internal combustion engines, and particularly to the provision of an improved distributor head, for controlling the firing of the spark plugs of an internal combustion engine having a high tension ignition system, and for interrupting the current supplied to the primary of the ignition transformer to induce the desired high tension current in the secondary circuit which supplies the spark to fire the several cylinders of the engine in the proper sequence, as established by the distributor mechanism.

An important object of the invention is to provide an improved interrupter mechanism having a plurality of breaker points, so designed that while the points may be quickly and easily replaced, and are of very inexpensive nature, the work done by any one set of such points is greatly reduced, so that the life of the breaker point assembly is greatly extended, and even the necessity for adjustment of these parts is virtually eliminated during the ordinary life of the engine.

A further important object of the invention is to provide such an interrupter construction which is permanently synchronized with the distributor, and remains so synchronized regardless of any advance or retarding of the spark.

Still another object is to provide such an improved interrupter assembly which maintains the primary of the auto-transformer constantly energized, except when firing, the current for the firing being created by momentarily breaking the primary circuit.

A further object is to provide an improved automatic spark control mechanism, adapted to be operated by a vacuum brake controlled by the vacuum created in the intake manifold of the engine, such mechanism being arranged to advance the spark from a normal, retarded setting, when the speed of the engine rises to a point which requires such advancement, although the extent of advance of the spark is also properly correlated to the load upon the engine, to provide the proper automatic spark control.

Still another object is to provide an improved automatic distributor system, arranged above and operated concurrently with the interrupter mechanism, and which is so arranged that the possibility of interference with the action of the distributor by moisture is virtually eliminated.

Another object is to provide improved means for connecting the wires to the distributor contact points.

Still another object is to incorporate in such an ignition device improved means for breaking the ignition circuit and stopping the engine in event a back fire or other cause should turn the engine backwards.

Other objects and advantages will be apparent from the following description, wherein reference is made to the accompanying drawings illustrating preferred embodiments of our invention and wherein similar reference numerals designate similar parts throughout the several views.

In the drawings:

Figure 1 is a side elevational view of an improved distributor head incorporating the principles of this invention, with the protective cap broken away to show the same in section.

Figure 2 is a vertical diametric cross section of the device.

Figure 3 is a horizontal section taken substantially on the line **3—3** of Figure 2, and looking in the direction of the arrows.

Figure 4 is a horizontal section taken substantially on the line **4—4** of Figure 2, and looking in the direction of the arrows.

Figure 5 is a sectional detail taken substantially on the line **5—5** of Figure 4, and looking in the direction of the arrows, but with the distributor cap in place.

Figure 6 is a plan view of the device with the distributor head, breaker point assembly and cam member removed, and with the vacuum brake cylinder partly broken away to show the interior thereof.

Figure 7 is a horizontal section taken substantially on the line **7—7** of Figure 2, and looking in the direction of the arrows.

Figure 8 is a horizontal sectional view of a vacuum brake spark control mechanism of somewhat modified construction.

Figure 9 is a fragmentary vertical section taken substantially centrally through another modified construction.

Figure 10 is a horizontal section taken substantially on the line **10—10** of Figure 9, and looking in the direction of the arrows.

Figure 11 is an enlarged sectional view through the center of the contact members.

Referring now to the drawings:

Reference character **15** represents the substantially cylindrical casing of our improved ignition device, which is adapted to be supported by any suitable means (not shown) upon the engine (also not shown) whose ignition system is to be controlled. The interrupter and distributor mechanism is adapted to be driven by the engine, in timed relation thereto, as through

the coupling 17, carried by and at the lower end of a shaft 18, journaled in and projecting upwardly inside the casing 15.

A single cam rotor 20 actuates both the interrupter mechanism for the primary of the ignition transformer and the distributor means which directs the high tension current in proper sequence to the several spark plugs. The rotor is formed of insulating material, mounted on and driven from the shaft 18. The angular relation of the rotor with respect to the shaft is variable within predetermined limits, to advance and retard the spark, by mechanism presently to be described.

The interrupter means consists of a plurality of radially disposed contact points carried by an annular insulating support 25 fitted into the top of the casing 15 and adapted to be clamped in position by the distributor cap 60. The entire assembly is readily removable when the cap is removed. The insulating support is of channel section, to provide spaced inner and outer walls. One set of contacts is provided for each cylinder of the engine, each set consisting of a contact member 26, radially slidable in a suitable bushing as 27 in the inner wall of the insulating support 25, and an inner contact member 28, adapted to move to and from engagement with its cooperating contact member 26. Each inner contact member 28 is carried by a spring support 29. The enlarged lower portion 21 of the rotor 20 is large enough to maintain engagement between all of the contact points 26, 28, except that which, at the time of firing, is engaged by a flattened section 22 of an interrupter cam 23 embedded in and forming a continuation of the portion 21. At such time the circuit is broken to cause an impulse current to be induced in the secondary of the ignition transformer, such current being delivered to the spark plug through the distributor system presently to be described.

Spring arms 29 constantly urge the inner contact members 28 away from the contact members 26, but the separation of such contacts is only allowed when the flattened portion 22 comes into alignment with the inner contact 28. The inserted metallic breaker cam 23 is of sufficient length to bridge the distance between successive contacts 28, for a purpose which will presently appear, but is not long enough to bridge three of the contacts when the flat section is centered upon the central one of the three. Contact members 26 are urged inwardly by spring contact fingers 31, formed integrally with a spring metal ring 30, housed in the channel-like space 33 between the inner and outer walls of the insulating support 25. The spring ring 30 is connected to the primary of the ignition transformer 15, as schematically shown in Figure 6, and may also be connected to a condenser 76. Such connection is effected by means of a wire 96 projecting downwardly through the distributor cap and connected to a contact stud 99 which when the cap is in place bears against and holds in place the contact clips 101, 102, the former formed integrally with the spring band 30 and the latter carried by the lead 103 when extends from the side of the housing to the condenser 76. The contact clips 101, 102, may be made to interlock to assure their proper relative positioning when the cap is in place, as shown in Figure 4.

During normal operation, the interrupter cam 23 is grounded, through shaft 18 to the engine or chassis of the vehicle (unshown), the primary circuit being adapted to be completed through an ignition switch 77 and battery 78. These elements are of course connected in series with the same ground and with the primary portion of the auto-transformer, in the conventional or any other suitable manner, such as that shown in Figure 5.

Each of the spring supports 29 is provided at its end farthest from the contacts with a U-shaped clip portion 39, adapted to be snapped into one of a plurality of properly spaced slots 35, cut in the top of the inner wall of the insulating support 25. It will be seen from the drawing that the portion 39 is shaped to prevent dislodgement of the spring support, the resilience of which maintains the spring contact arm firmly in properly aligned position. The upper edge of the inner wall of the insulating support 25 may be provided with an overhanging portion 34 which normally overengages a part of the spring supports 29, to lock the same in place and prevent their removal unless their clip portions 39 are sufficiently compressed.

A metallic pin 41 projects from the bottom of interrupter cam portion 23, and normally rides upon an arm 40, through which it provides a ground connection to the shaft. Arm 40 drives the rotor 20. The flat section 22 is relatively short, so that it allows only one set of the contact points to open at a time, such opening occurring when the metallic cam portion 23 is in engagement only with the set of contacts to be opened, as will be apparent from Figure 5. The circuit to ground which maintains the primary circuit of the auto-transformer closed can occur only through such metallic cam insert 23, since the remainder of the rotor is formed of insulating material, the result being that the primary circuit is maintained through whichever of the contact members 28 the non-flattened portion of the cam member 23 engages, but that when such cam is in engagement with only one set of contacts, the circuit is momentarily broken while such contact rides over the flattened area, which is cut away sufficiently to allow the contacts to open under the influence of the spring portion 29. The portion of the rotor which overhangs the arm 40 is cut away throughout a substantial arc, so that while the rotor is being turned in the proper direction by the arm, the latter bears against the side of such cut out area to drive the rotor while the contact pin 41 rests on top of the arm. Should the shaft 18 be turned in the opposite direction, however, as by a back-fire, the lost motion allowed between the driving arm and rotor is sufficient to allow the arm to move backwardly, and out of contact with pin 41. The ignition circuit is thus automatically broken, and the engine is prevented from running backwards.

Directly beneath the cam assembly 20, shaft 18 will be seen to be provided with an integral, disc-like projecting portion 48, which supports the driving arm 40, the latter being freely rotatable with relation to the shaft assembly, but maintained in desired angular relation thereto by a lever 49, pivoted to the under side of the disc portion 48 upon a pin 51. Arm 49 projects upwardly from the disc into a slot 52 in the end of arm 40. An inwardly projecting arm 50, formed integrally with lever arm 49, is slotted and projects beneath the disc 48 to receive an upwardly projecting pin portion 53 carried by a cylindrical spark control member 55, rotatably

encircling the shaft assembly. The extent of relative rotation between the shaft assembly and member 55 is limited by a pin 54, carried by member 55 and projecting upwardly into a concentric slot 56 formed in the disc portion 48. The length of the slot is adjustable by means of a sliding plate 58, which may be moved to cover more or less of the slot as desired, and so to restrict movement of the pin, the plate being releasably held in place by means of a clamping screw 59. A torsion spring 62 normally maintains the spark control member in such angular relation to the shaft assembly as to swing the arm 40 to a position which represents the most retarded position at which it is desired to operate the ignition system of the engine, although it will be understood that this may be adjusted by means of the plate 58. The arm 40 is thus resiliently held in a position which drives the interrupter cam 23 in a retarded relation.

A vacuum brake mechanism connected to the intake manifold of the engine is arranged to cause the spark to advance when the vacuum in the intake manifold increases sufficiently, as when the engine speed rises to a predetermined value, and the load upon the engine is not so great as to cause such vacuum to fall away unduly. The automatic spark advancing brake means consists of a plunger 70, having a leather or other suitable friction facing 72 adapted to engage the periphery of the vacuum brake member 55, the brake plunger being operable by means of a piston 63 housed in a cylinder 64 cast integrally upon the side of the distributor housing and connected as by means of the tube 65 to the intake manifold (unshown) of the engine. A cam member 66 carried by the piston actuates the brake plunger 70 through the agency of a pair of pins 71, 72 through which the cam slidably projects. A spring 74 may be provided to preload the brake toward released position sufficiently to maintain the same released until the engine creates a sufficient vacuum in the intake manifold, as previously stated. When the vacuum rises sufficiently, application of the brake, by retarding the spark control member 55, swings the lever 49 in the direction required to advance the arm 40, and so advance the spark, by causing the interrupter contacts to break sooner.

The adjustment provided by means of the plate 58 need not be changed, ordinarily, during the life of the engine, and is furnished for initial factory adjustment. Another and more conveniently accessible adjusting means is provided whereby the entire ring 25 carrying the breaker point assembly may be rotated with relation to the housing, and fastened in any desired position within its range of adjustment, to advance or retard the spark. The interrupter support will be seen to be provided with an integral projection 105, which may serve to house the contacts 101, 102, and which is engaged in an opening 106 in a circumferentially adjustable clamping plate 108, normally held tightly against the side of the housing by means of a screw 110, but shiftable when the screw is loosened, the travel being limited by a slot 111 in the plate, through which the screw engages. This will be seen to provide convenient means for changing the spark timing to compensate for changes of fuel or other operating conditions or when tuning or adjusting the engine.

The distributor mechanism is carried by the cap 80, and consists of a plurality of circumferentially spaced contact members 82, carried in such position, upon the interior of the cap, as to be successively engaged by a distributor contact arm 85, secured to the top of the rotor 20. Each of the distributor points 82 is of course connected to one of the spark plugs (unshown) as by means of a cable 86, while the secondary of the ignition transformer is connected by means of a cable 87 to a central contact 83, with which the distributor contact arm maintains constant electrical contact, as by means of a spring finger 84. Each of the contact points 82, 83, 99 consists of a stud having a resilient stem portion, the stem tending by friction to maintain itself in an opening in the cap, and the wire for connection thereto being led through a suitably positioned opening, as 89, and wrapped around the stud beneath the head thereof. Recesses as 88 may be provided in the under side of the head to accommodate the wires, as shown.

An additional cap 90 is preferably provided over the cap 80, to protect the openings in the latter cap against the entrance of moisture, the double cap assembly being clamped in place by means of a bail 91 swingably attached to the body 15 and adapted to snap over the upper cap 90 to maintain it and the cap 80 firmly in place. The wires 86—87, and the wire 96 from the primary of the transformer to the interrupter mechanism, preferably extend out through rubber grommets or the like, as 94, which are clamped in suitable complementarily formed notches in the two cap portions 80, 90, all openings to the interior of the distributor mechanism being thus virtually sealed.

In the somewhat modified construction shown in Figures 8, 9 and 10, the vacuum brake mechanism consists of an integrally formed piston and cam assembly 63A having a double tapered central cam portion 66A engageable with a brake plunger 70A in such manner as to clamp the spark control disc 55A when the piston portion is actuated by a sufficient rise of intake manifold vacuum, in the manner previously described. In this construction it will be seen that an opening is left in the side of the vacuum cylinder 64A through which the brake plunger may be removed for inspection or replacement, after removal of the piston and cam assembly 63A—66A.

As shown in Figures 9 and 10, the spring means for yieldably maintaining the spark in the retarded position may comprise a spring as 62A of different shape from the coiled spring 62 shown in Figure 2 and previously described. Spring 62A comprises a simple leaf spring, looped at one end about a pin 125 carried by the spark control member 55A, and at its other end bearing against a pin 126 rigidly carried by the shaft 18A and projecting downwardly in suitable position from an integral collar 118 carried by the shaft. The central portion of the spring may react against the shaft, and other portions of the mechanism equivalent to parts previously described will be seen to have been given like reference characters, distinguished by the addition of the letter "A." The effect of the spring 62A will be seen to be in like fashion to exert torque upon the spark control member 55A tending constantly to maintain it in the retarded position.

We are aware that the invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof, and we therefore desire the present embodiments to be considered in all respects as illustra-

tive and not restrictive; reference being had to the appended claims rather than to the foregoing description to indicate the scope of the invention.

We claim:

1. Mechanism for controlling the ignition system of an internal combustion engine of the spark ignition type comprising a casing, a plurality of interrupter contacts circumferentially carried thereby and movable to induce a sparking current, and means normally maintaining said contacts closed but allowing successive opening thereof including a rotor element having a portion operatively engageable with and disengageable from said contacts progressively, a part of said portion of the rotor allowing said contacts to separate momentarily in desired sequence when the rotor is rotated.

2. Means as set forth in claim 1 in which said interrupter contacts are circumferentially spaced around said rotor, and distributor means also operable by said rotor, including a high tension contact carried by the casing in substantially aligned relation to each of said interrupter contacts.

3. Means as set forth in claim 2 in which said interrupter contacts are circumferentially spaced around said rotor, and distributor means also operable by said rotor, including a high tension contact carried by the casing in substantially aligned relation to each of said interrupter contacts, means for driving the rotor, and spark timing means for advancing and retarding said rotor with respect to said driving means without disturbing the relationship of said high tension contacts and interrupter contacts.

4. Mechanism for controlling the ignition system of a multi-cylinder engine, comprising in combination, a casing, an insulated support removably mounted in said casing, a plurality of interrupter contacts carried by said insulating support, including a plurality of interrupter contact assemblies, one for each cylinder of an engine to which the device is adapted to be connected, and means adapted to be driven by such an engine, in timed relation thereto, for operating said contacts in properly timed sequence to create momentary sparking currents for the several cylinders of such engine.

5. Means as set forth in claim 4 in which said insulating support is of annular form and said contacts are formed in pairs, each pair including a contact element slidable radially in said support, an inner contact resiliently supported for movement to and from each slidable contact, said last mentioned contacts being mounted interiorly of the slidable contacts, means yieldably urging said last mentioned contacts away from the slidable contacts, said means for operating the contacts comprising a rotor rotatable in the space bounded by the inner contacts and engageable with all of said inner contacts, said rotor normally maintaining all of said contacts closed except at the time of firing, and having a cam portion to cause opening of said contacts in sequence.

6. Means as set forth in claim 10 in which said support comprises a plurality of concentric walls, said sheet metal elements for supporting said movable contacts being mounted in slots in the inner of said walls, additional contact members carried by said support and cooperating with the first mentioned contacts, mounting means for said additional contact members, said mounting means being radially adjustable to vary the relative positioning of said contacts, the outer wall of said support having openings therein to afford access to said mounting means to permit adjustment thereof.

7. Means as set forth in claim 12 including means for driving the rotor, and additional timing means for changing the angular relation of the rotor with respect to said driving means.

8. Mechanism for controlling the ignition system of a multi-cylinder engine, comprising a casing, interrupter contact means carried thereby and movable to induce a sparking current, a rotor for operating said interrupter contact means, means for driving the rotor, said rotor being angularly movable with respect to said driving means but normally maintained at one extreme of such angular movement, means for completing the circuit through said driving means and rotor to said contact means, said means being disengageable to break such circuit when the rotor is turned away from said normal angular relation with respect to the driving means by an attempt to drive said rotor in reverse direction.

9. Mechanism for controlling the ignition system of a spark ignition engine, comprising in combination with a casing, a plurality of interrupter contacts arranged therein and circumferentially spaced, one interrupter contact assembly being provided for each cylinder of an engine to which the device is adapted to be connected, an insulating support removably mounted in said casing and carrying all of said contacts, an actuating element for said contacts rotatable in the casing, means for driving said actuating element, and means for fixing said insulating support in any of a plurality of angular positions with respect to the casing.

10. Interrupter mechanism for the electrical ignition system of an internal combustion engine or the like, comprising in combination with a rotor adapted to be driven by an engine, an annular insulating support surrounding said rotor, a plurality of substantially radially disposed circumferentially spaced contacts carried by said support, and movable by the rotor to interrupt the ignition circuit, and means for supporting said contacts comprising resilient sheet metal elements frictionally secured to and removable from said support.

11. Interrupter mechanism for the electrical ignition system of an internal combustion engine or the like comprising in combination with a rotor formed of insulating material and adapted to be driven by an engine, an annular insulating support surrounding said rotor, a plurality of contacts circumferentially spaced substantially uniformly and carried by said support, said contacts being operable by the rotor to interrupt the ignition circuit, a conducting cam portion carried by the rotor and progressively carried thereby into contact with said contacts, said cam being of sufficient circumferential length to bridge two adjacent contacts, separate conductor means leading to said contacts and to said cam portion, whereby a circuit may be completed through said cam portion and contacts when engaged with each other, said cam being of insufficient length to bridge three of said contacts, and having a circuit breaking portion causing each contact to break in succession as the cam reaches a substantially centered position with respect thereto, whereby a circuit through said cam and contacts is maintained substantially constantly, and through successive ones of said contacts, but said circuit is successively broken for predetermined

intervals as said cam member reaches centered position with respect to said successive contacts.

12. A distributor-interrupter assembly for an internal combustion engine or the like, comprising in conjunction with a casing and a rotor therein, means for driving the rotor, an interrupter contact assembly mounted in said casing and including a plurality of contact means circumferentially spaced in said casing and operable by said rotor to induce a sparking current at predetermined intervals, said interrupter assembly, including said contact means, being adapted to be turned with respect to the casing and fixed in any of a plurality of angular positions to adjust the timing of said sparking current impulses, a cap affixable to said casing and keyed to and rotatable with said interrupter assembly during such adjustment thereof, and distributor means carried by said cap and operable by said rotor, including a plurality of high-tension contacts with which said rotor is adapted to make and break a high-tension connection, said high-tension contacts conforming in numbers to and being aligned with said first-mentioned contact means, whereby the interrupter contacts and the high-tension contacts are operable in predetermined time relationship and are also simultaneously movable in aligned relation to each other to change their timing with respect to the rotor.

ARTHUR J. BARNUM.
WARREN J. BARNUM.