

M. B. CRIST.
IGNITION SYSTEM FOR INTERNAL COMBUSTION ENGINES.
APPLICATION FILED FEB. 15, 1906.

922,673.

Patented May 25, 1909.

4 SHEETS—SHEET 1.

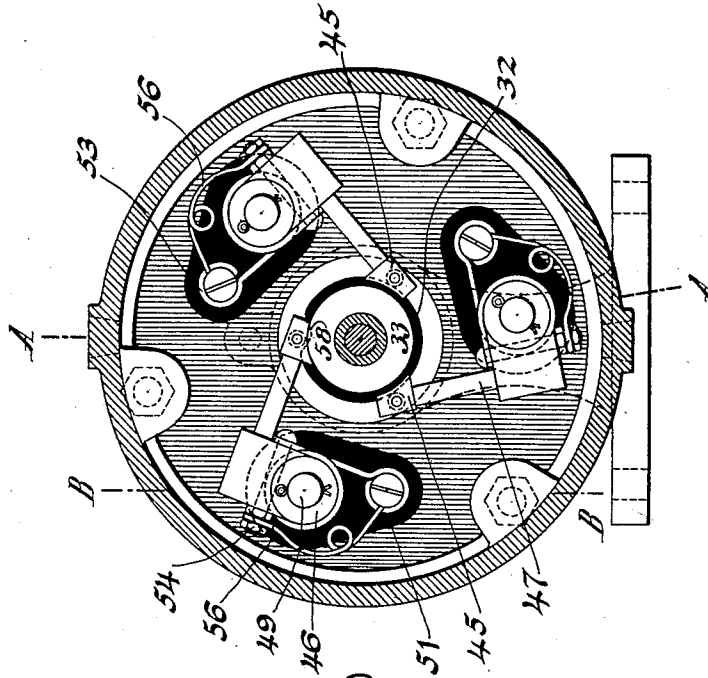


Fig. 2.

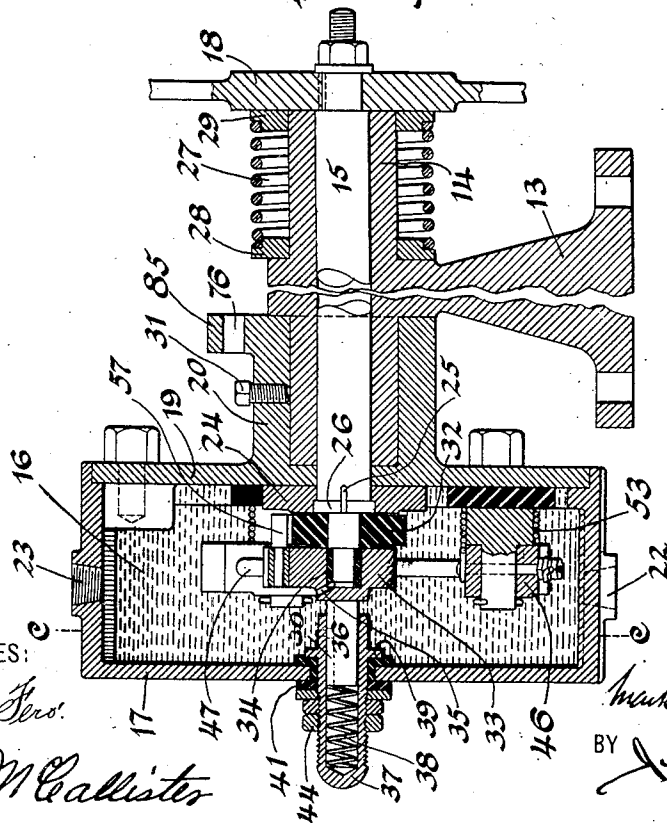


Fig. 1.

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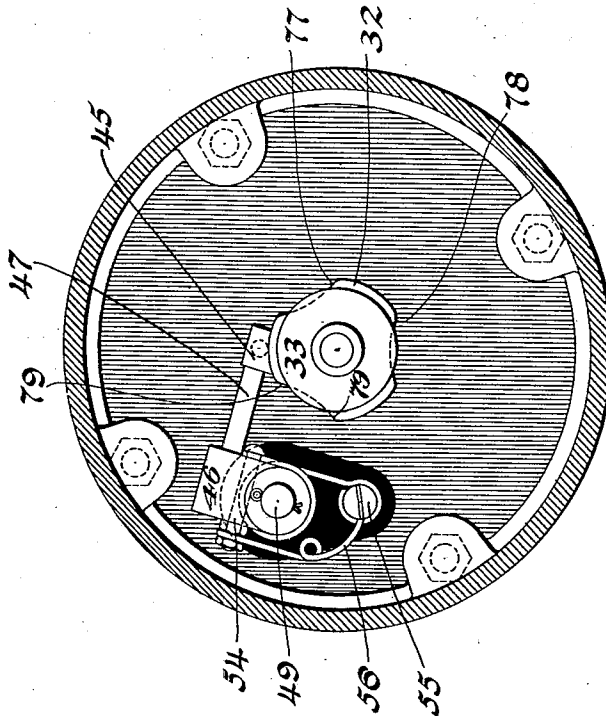


Fig. 7.

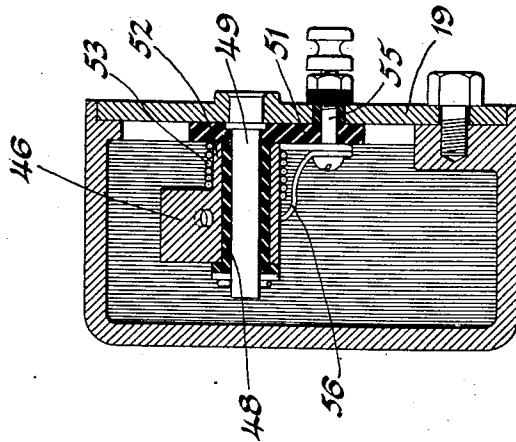


Fig. 3.

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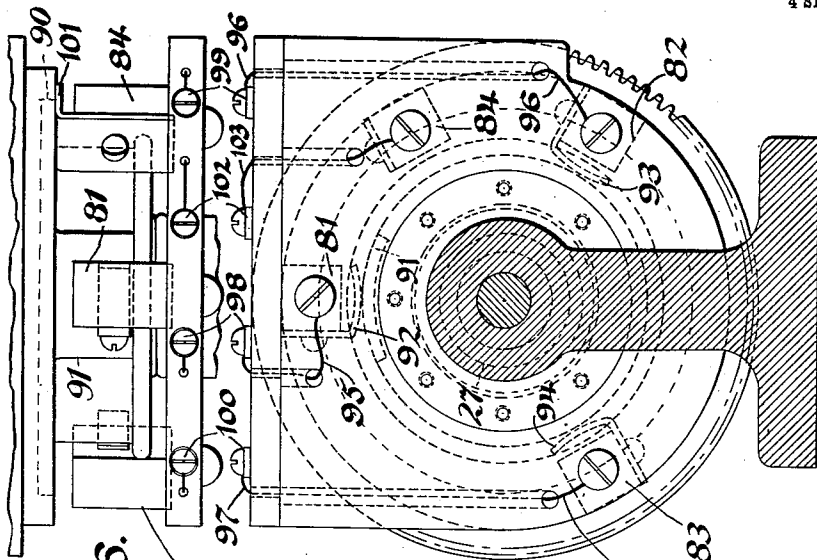


Fig. 5.

Fig. 6.

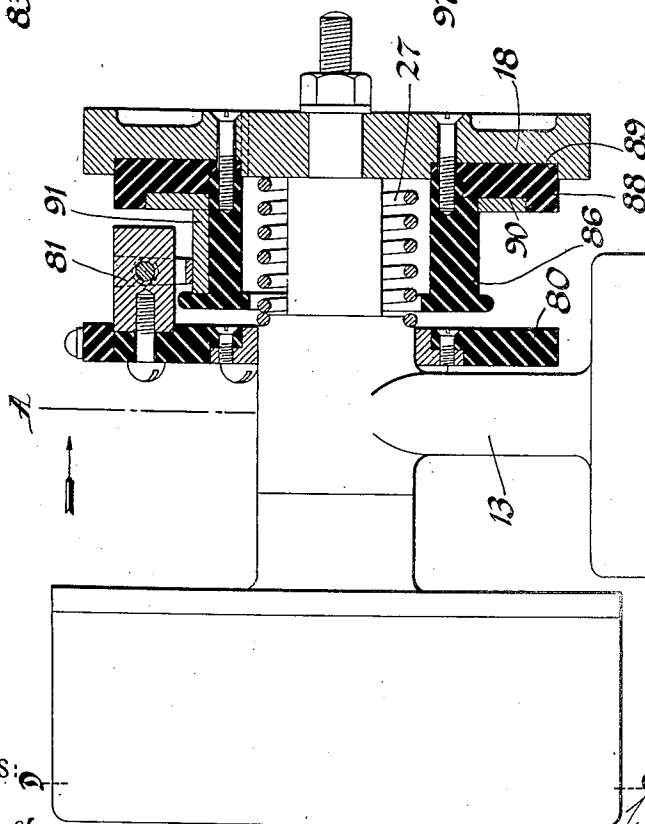


Fig. 4.

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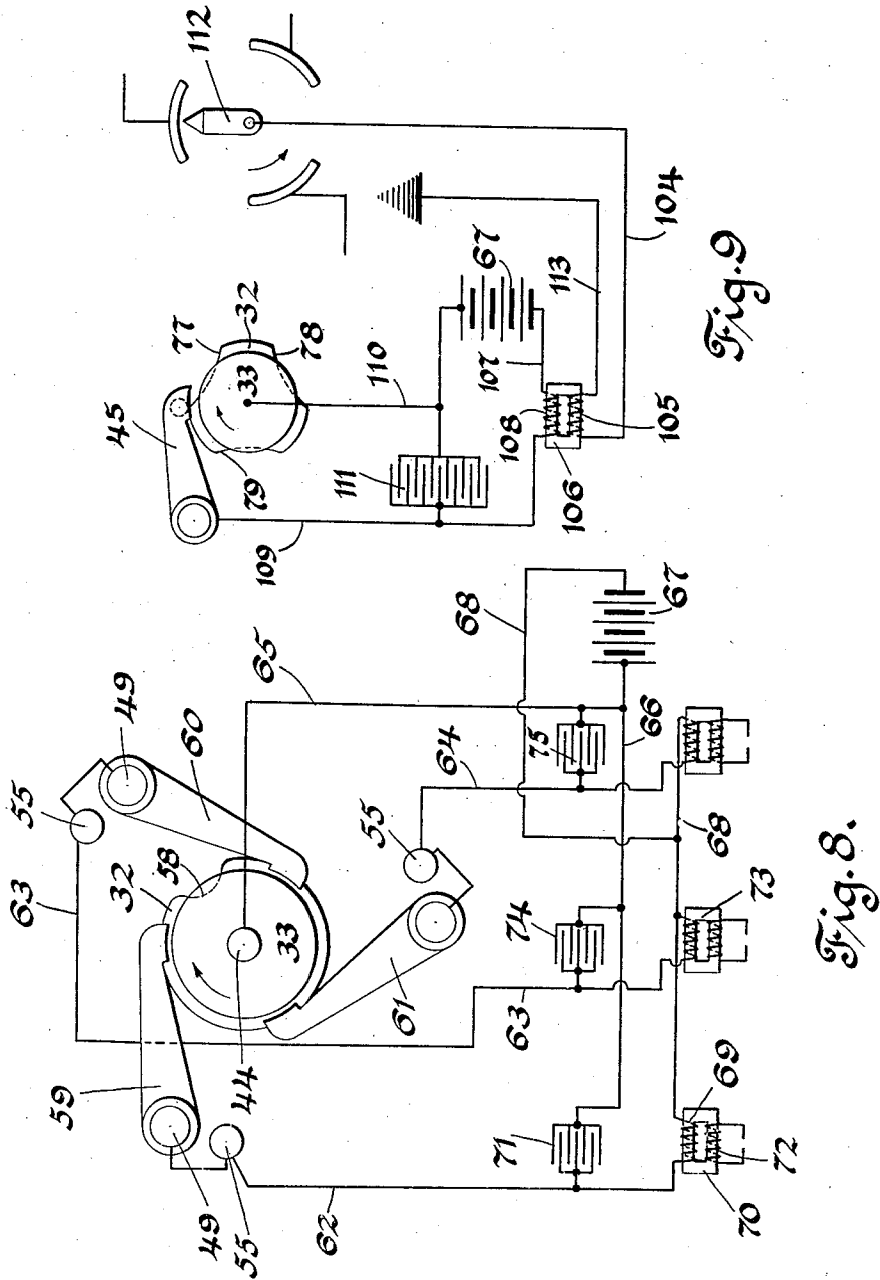


Fig. 9

Fig. 8.

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UNITED STATES PATENT OFFICE.

MARK B. CRIST, OF PITTSBURG, PENNSYLVANIA, ASSIGNOR TO THE WESTINGHOUSE MACHINE COMPANY, A CORPORATION OF PENNSYLVANIA.

IGNITION SYSTEM FOR INTERNAL-COMBUSTION ENGINES.

No. 922,873.

Specification of Letters Patent.

Patented May 25, 1909.

Application filed February 15, 1906. Serial No. 301,226.

To all whom it may concern:

Be it known that I, MARK B. CRIST, a citizen of the United States, and a resident of Pittsburg, in the county of Allegheny and State of Pennsylvania, have made a new and useful Invention in Ignition Systems for Internal-Combustion Engines, of which the following is a specification.

This invention relates to internal combustion engines and more particularly to ignition means for such engines.

In ignition systems utilizing high-voltage jump-spark coils an electric current is induced in the secondary coil of a transformer and is utilized in firing the compressed charges of fuel in the engine cylinders. The second or high-voltage spark occurs in the igniter plug at the time of breaking the primary circuit of the induction coil.

A difficulty encountered in jump-spark ignition is that the contact points of the make and break device utilized in the primary circuit are oxidized or eaten away by the heat of the arc and the arc is also lengthened or drawn out, thereby preventing the secondary spark from jumping with precision across the terminal of the secondary coil.

The object of this invention is, therefore, the production of a simple non-vibrator jump-spark coil contact device in which effective means are utilized for insuring an effective operation of the apparatus and for preventing the oxidation or eating away of the contact points. This and other objects I attain in a contact device embodying the features herein described and illustrated in the drawings accompanying this application, throughout the several views of which corresponding numerals indicate like parts.

Figure 1 is a sectional elevation along the line A A of Fig. 2 and illustrates an apparatus embodying this invention. Fig. 2 is a section along the line C C of Fig. 1. Fig. 3 is a section along the line B B of Fig. 2. Fig. 4 is a side elevation of the apparatus shown in Fig. 1 in connection with a vertical section of a high-voltage timing device. Fig. 5 is a section along the line A A of Fig. 4. Fig.

6 is a plan view of the apparatus shown in Figs. 4 and 5. Fig. 7 is a section along the line D D of Fig. 4. Fig. 8 is a wiring diagram illustrating the electrical connections utilized in connection with the apparatus illustrated in Figs. 1, 2 and 3. Fig. 9 is a wiring diagram utilized in connection with the apparatus illustrated in Figs. 4, 5 and 6.

Referring to Figs. 1, 2 and 3: A pedestal 13 is provided with a suitable bearing 14 in which an operating shaft 15 of the contact device is mounted. The shaft 15 extends into a chamber 16 inclosed within a casing 17 and is provided with a rigidly mounted operating gear 18. A plate 19, forming a part of the casing 17, is provided with a laterally-extending sleeve portion 20 which is mounted on the walls of the bearing 14. The chamber 16 is provided with an inlet port 22 and an outlet port 23 and is adapted to be filled with oil. A disk 24, rigidly mounted on the shaft 15 by a key 25, is adapted to pack the joint between the shaft and the casing and is held in place on the shaft by an integrally-formed collar 26. A helical spring 27, surrounding the shaft, operates between a ring 28, loosely mounted on the pedestal 13, and a loosely mounted ring 29 in contact with the gear 18 and is adapted to hold the sleeve 20 in place on the pedestal 13. The sleeve 20 is provided with a set screw 31 adapted to prevent the casing 17 from rotating with the shaft.

A fiber cam 32 is rigidly mounted on the shaft 15 between the disk 24 and a copper disk 33, which is mounted on a fiber bushing or thimble 34 inclosing the end of the shaft 15. An oil hole 35 extends through the disk 33 and the bushing 34 and lubricates the end of the shaft. A copper brush 36 is mounted on the casing 17 and holds the copper disk 33 and the fiber bushing 34 in place. The brush 36 is mounted within a sleeve portion 37, which is provided with a helical spring 38 adapted to hold the brush against the disk 33. A feather-way connection 39 is provided between the sleeve portion 37 and the brush 36 to keep the brush from turning with the disk 33, and is so constructed that an

opening of sufficient size is maintained between the interior of the sleeve portion 37 and the chamber 16 to permit of an adequate flow of oil between the chamber and the sleeve portion so that the brush 36 will answer to the slightest longitudinal vibration of the shaft 15 and be continually held in contact with the disk 33.

The sleeve-portion 37 is provided with a retaining collar 39 and is insulated from the casing 17 by a fiber washer 41 and is provided with lock nuts 44 adapted to be utilized as a terminal in a primary electric circuit of the ignition system of a combustion engine.

Contact shoes 45, adapted to contact with the copper disk 33 at certain intervals during a revolution of the shaft 15, are connected to holder blocks 46 by rods 47. The holder block is pivotally mounted on an insulating bushing 48 which surrounds a pin 49, riveted on the plate 19. The holder block 46 is insulated from the casing 17 by a fiber washer 51 and is provided with an extending sleeve 52 around which a helical spring 53 is mounted. One end of the helical spring 53 is connected to the holder block 46 by a bolt 54 and the other end is secured to a terminal screw 55 which extends through the plate 19 and is insulated therefrom and may be utilized as an electrical connection between the contact block 45 and the terminal screw 55. A wire 56 also connects the bolt 54 with the terminal screw 55 and is used auxiliary to the spring 53 as an electrical connection between the block 45 and the terminal screw. The contact shoe 45 is held against the disk 33 by the tension of the spring 53 and the pin 49 is so placed with reference to the shaft 15 that the holder block may be turned around it to adjust the tension of the spring when the shoe 45 and the rod 47 are removed from the block 46 and the disk 33 and the cam 32 are removed from the shaft 15. The holder block and cam, however, are so proportioned that the block cannot turn an entire revolution around the pin 49 when the cam is in place on the shaft or when the rod or the shoe are in place on the holder block. The shoe 45 is provided with a laterally-extending lug 57 which contacts with the outer surface of the cam 32 and thereby reciprocates the shoe. The fiber cam 32 is provided with a cut-away portion 58 adapted to allow the shoe 45 to contact with the disk 33 and thereby complete an electric circuit. The contact device illustrated in Figs. 2 and 3 is adapted to be utilized on a three-cylinder internal combustion engine and is provided with three contact shoes 45; since the cam 32 is rigidly mounted on the shaft, the shoes 45 will successively come in contact with the copper disk 33 during a revolution of the shaft.

Referring to Fig. 8, the shoes 45 and their

mountings are diagrammatically represented by contact arms 59, 60 and 61, to which are connected wires 62, 63 and 64 respectively. The contact arms are arranged to make and break the circuit at intervals of 120° during a revolution of the shaft. The terminal nuts 44, which are in electrical connection with the brush 36, are connected by wires 65 and 66 to a battery 67. The contact arms 59, 60 and 61 are respectively connected to a lead wire 68 of the battery 67 by the wires 62, 63 and 64 thereby providing three independent battery circuits, each of which is provided with an induction coil in series in the circuit and a condenser in parallel with the circuit breaker. The terminals of the secondary or high-voltage coil of each transformer are connected to the igniter plugs arranged in the individual cylinders of the engine.

When the arm 59 contacts with the disk 33, a current from the battery passes through the wire 68, a primary coil 69 of a transformer 70, the wire 62, the arm 59, the disk 33, and through the wires 65 and 66 to the battery.

A condenser 71, connected between the wire 62 and the wire 66, is shunted around the make and break device and at the instant of breaking the primary circuit, a current is induced in a secondary coil 72 of the transformer 70 thereby causing a high-voltage spark to jump across the spark gap of an igniter plug in one of the engine cylinders. When the arm 60 contacts with the disk 33 a current from the battery 67 passes through the wire 68, a primary coil of a transformer 73, the wire 63, the arm 60, the disk 33 and through the wires 65 and 66 and back to the battery. A condenser 74 is connected between the wire 63 and the wire 66 in parallel with the circuit breaker. A condenser 75 is connected between the wire 64, which is connected to the contact arm 61 and the lead wire 66 of the battery.

The operations of the contact arms 60 and 61 are similar to the operation of the contact arm 59 and the jump-spark current introduced in each circuit fires the compressed charges in the respective cylinders of the engine.

Since the chamber 16 of the contact device is filled with oil the make and break in the primary circuits caused by the reciprocations of the shoes 45 occurs under oil and the oxidizing effect of the arc is overcome and the arc is destroyed causing a quick cessation of the current and consequently less eating away of the contact surfaces.

Since the copper disk 33 is loosely mounted on the shaft 15 a new surface will be presented to the contact shoes at each contact, as the tendency of the disk will be to move with the shaft except during the time of contact with one of the shoes.

A lug 85 of the sleeve 20 is provided with a

hole 76 and is adapted to be utilized in connection with a governor in automatically revolving the casing 17 about its axis and thereby varying the time of the ignition by varying the relative positions of the shoes 45 with reference to the shaft 15. When the governor connection is utilized the set screw 31 is omitted.

A modification of the contact device is shown in Figs. 4, 5, 6, 7 and 9 in which but one contact shoe is utilized. A contact shoe 45 and its holding block 46 are mounted on the plate 19 as in the previous case. The cam 32 is provided with three cut-away portions 77, 78 and 79, arranged 120 degrees apart, thus permitting the contact shoe 45 to contact with the disk 33 three times during the revolution of the shaft 15. With such an arrangement a timing device, as illustrated in Figs. 4, 5 and 6, must be utilized when the induced current of the transformer is used in connection with an engine provided with more than one cylinder. The apparatus illustrated is adapted for a three-cylinder engine.

A fiber disk 80 is rigidly mounted to the frame portion of the pedestal 13 and is provided with contact blocks 81, 82, 83 and 84 which are mounted by suitable screws or bolts. A fiber sleeve 86, mounted on the gear 18, incloses the spring 27 and is arranged to hold a fiber ring 88 rigidly within a recess 89 with which the gear is provided. A copper contact ring 90 is mounted on the fiber ring 88 and is provided with a laterally-extending sector 91, the surface of which is flush with the surface of the fiber sleeve 86. The contact blocks 81, 82 and 83 are provided with brushes 92, 93 and 94 respectively and are connected by wires 95, 96 and 97 to the respective terminals 98, 99, and 100. The contact block 84 is provided with a brush 101 which continually contacts with the ring 90 and is connected to a terminal 102 by a wire 103.

The terminal 102 is connected by a wire 104 (shown in diagram 9) to the terminal of a secondary coil 105 of a transformer 106. The contact shoe 45 in contacting with the disk 33 completes the primary circuit and a current flows from a battery 67 through a wire 107 into the primary coil 108 of the transformer 106, and from the primary coil through a wire 109, the contact shoe 45, the copper disk 33 and a wire 110, back to the battery.

Between the wires 109 and 110 a condenser 111 is connected in parallel with the circuit breaker. The secondary coil 105 of the transformer 106 is connected by the wire 104 to the terminal 102 or to the contact ring 90, diagrammatically illustrated by the arm 112.

A wire 113, leading from the secondary coil 105, connects with the metal frame of

the engine or the ground of the high voltage circuit. The arm 112 rotates synchronously with the cam 32 and the current induced in the coil 105 by breaking the contact between the shoe 45 and the disk 33 is conveyed successively to the brushes attached to the contact blocks 81, 82 and 83. Each wire leading from the terminals 98, 99 and 100 is connected to a spark plug in one of the cylinders of a three-cylinder engine and the high voltage current is conveyed by the timing device successively to the three cylinders.

What I claim is:

1. In combination in an electric circuit, a circuit breaker comprising a pivotally mounted contact shoe electrically connected within said circuit, a rotatable shaft, a contact disk loosely mounted on said shaft and included in said circuit, and a fiber cam rigidly mounted on said shaft and adapted to move said shoe and cause it to contact with and recede from said contact disk and thereby make and break said circuit.

2. A circuit breaker comprising a chamber filled with oil, a contact shoe pivotally mounted within said chamber, a rotatable shaft extending into said chamber, a contact disk loosely mounted on said shaft, and an operating cam rigidly mounted on said shaft and operating to move said contact shoe and cause it to contact with and recede from said contact disk.

3. A circuit breaker comprising a stationary casing filled with oil, a contact shoe mounted within said casing, a rotatable shaft extending into said casing, a contact disk loosely mounted on and insulated from said shaft, and an operating cam mounted on said shaft and adapted to move said contact shoe to contact with and to recede from said contact disk.

4. A circuit breaker comprising a chamber adapted to be filled with oil, a spring operated contact shoe pivotally mounted within said chamber, a rotatable shaft extending into said chamber, a contact disk loosely mounted on said shaft, and an operating cam rigidly mounted on said shaft and adapted to move said contact shoe and cause it to contact with and recede from said disk.

5. In an ignition system for internal combustion engines, a circuit breaker comprising a stationary casing filled with oil, a contact shoe mounted within said casing, a rotatable shaft extending into said casing, a contact disk loosely mounted on and insulated from said shaft, an operating cam rigidly mounted on said shaft and adapted to move said shoe, and means for varying the position of said casing to retard or advance the ignition in accordance with the speed of the engine.

6. In an ignition system for internal combustion engines, a circuit breaker comprising a stationary casing, a contact shoe mounted

within said casing, a rotatable shaft extending into said casing, a contact disk loosely mounted on and insulated from said shaft, an operating cam rigidly mounted on said
5 shaft and adapted to move said shoe to make and break contact with said disk, and means for rotating said casing to retard and advance the ignition of said engine.

In testimony whereof, I have hereunto subscribed my name this 13th day of February, 1906.

MARK B. CRIST.

Witnesses:

CHARLES W. MCGHEE,
E. W. MCCALLISTER.