No. 808,551. PATENTED DEC. 26, 1905.

L. J. LE PONTOIS.

IGNITION DEVICE.

APPLICATION FILED NOV. 7, 1903.

2 SHEETS—SHEET 1.

Fig. 1

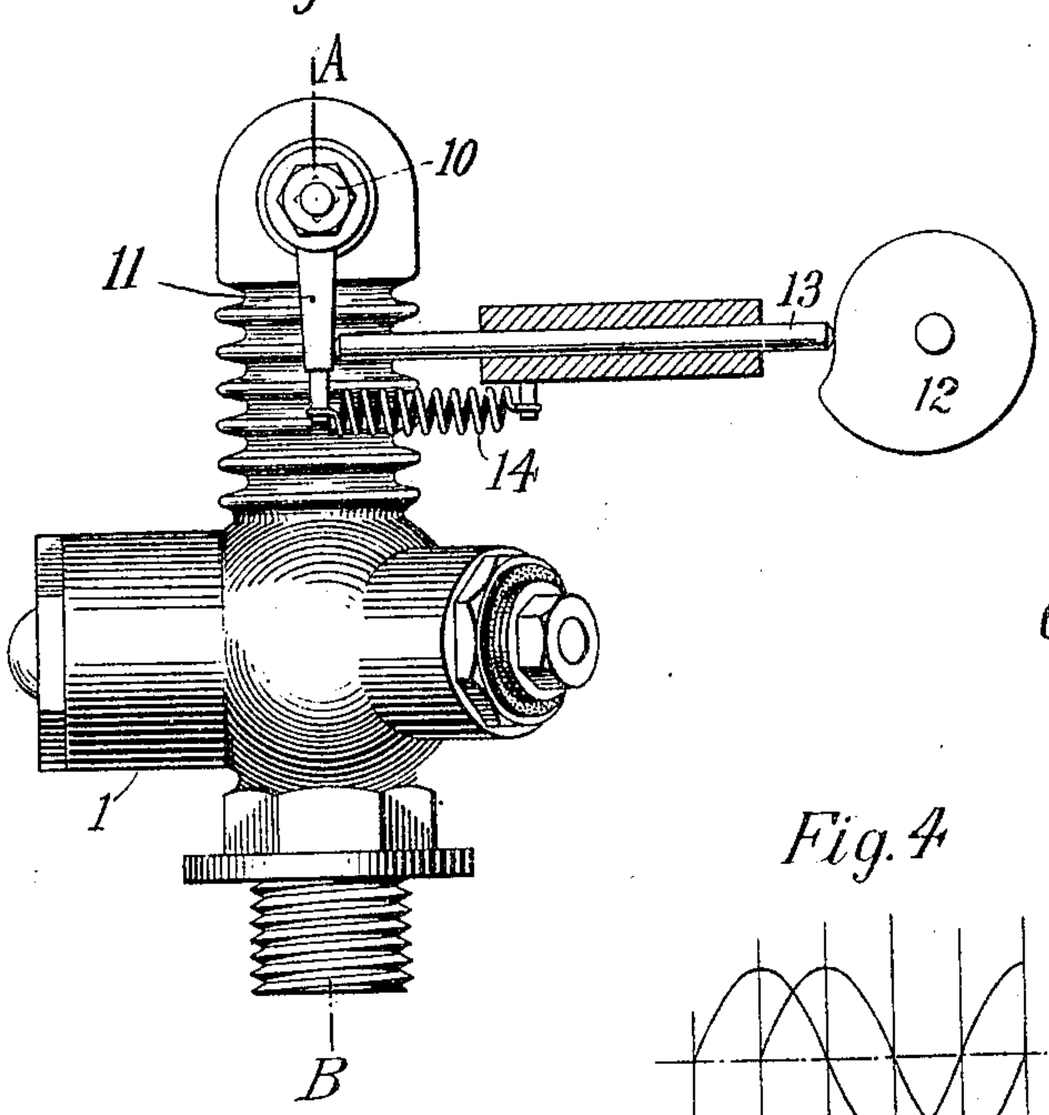


Fig. 2

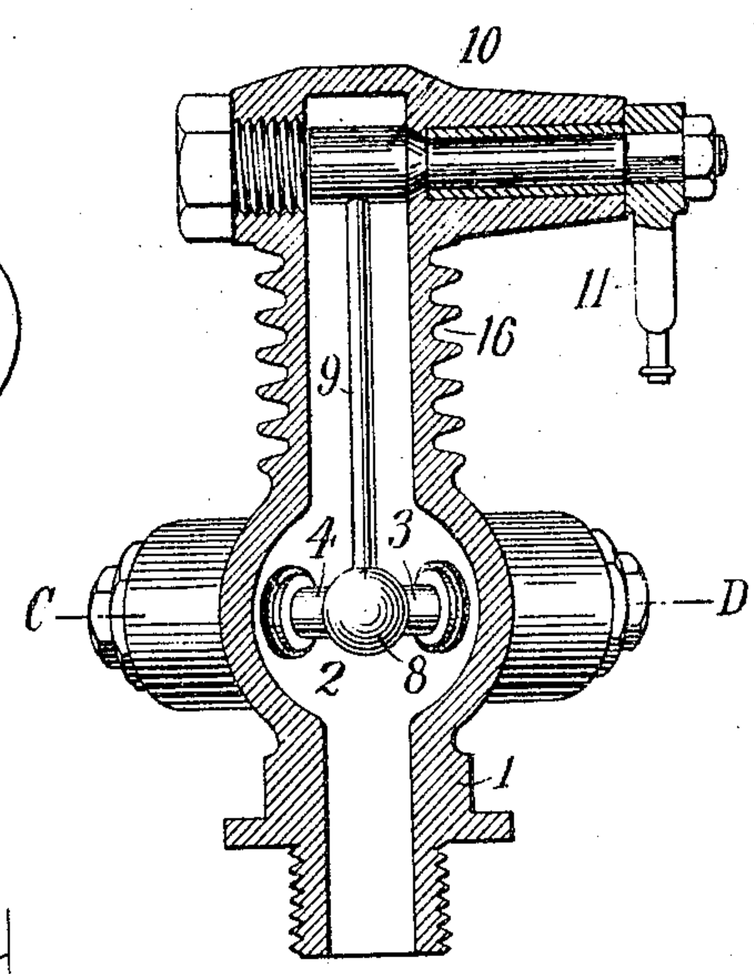
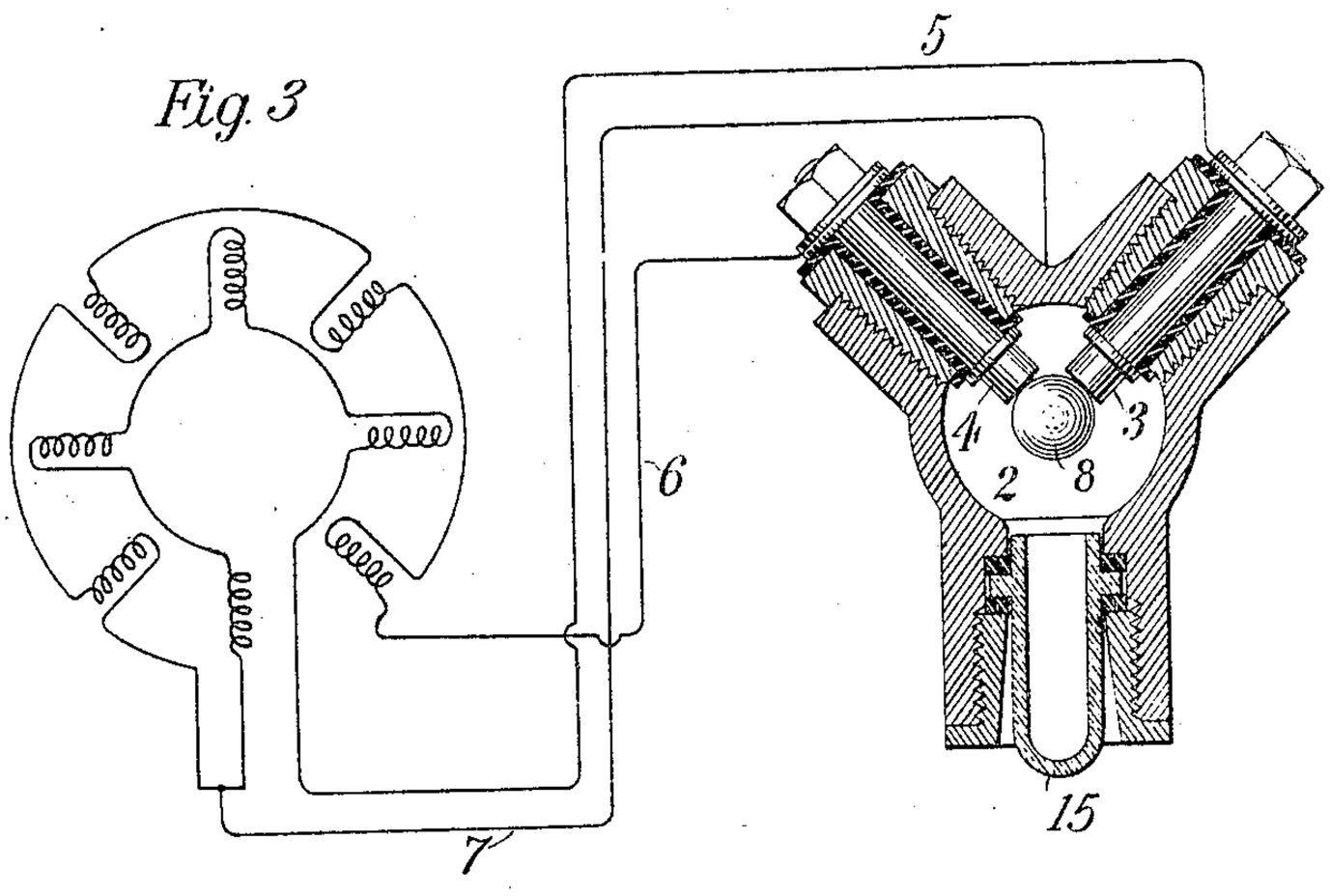


Fig. 4

Fig. 3



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2 SHEETS—SHEET 2.

Fig. 5

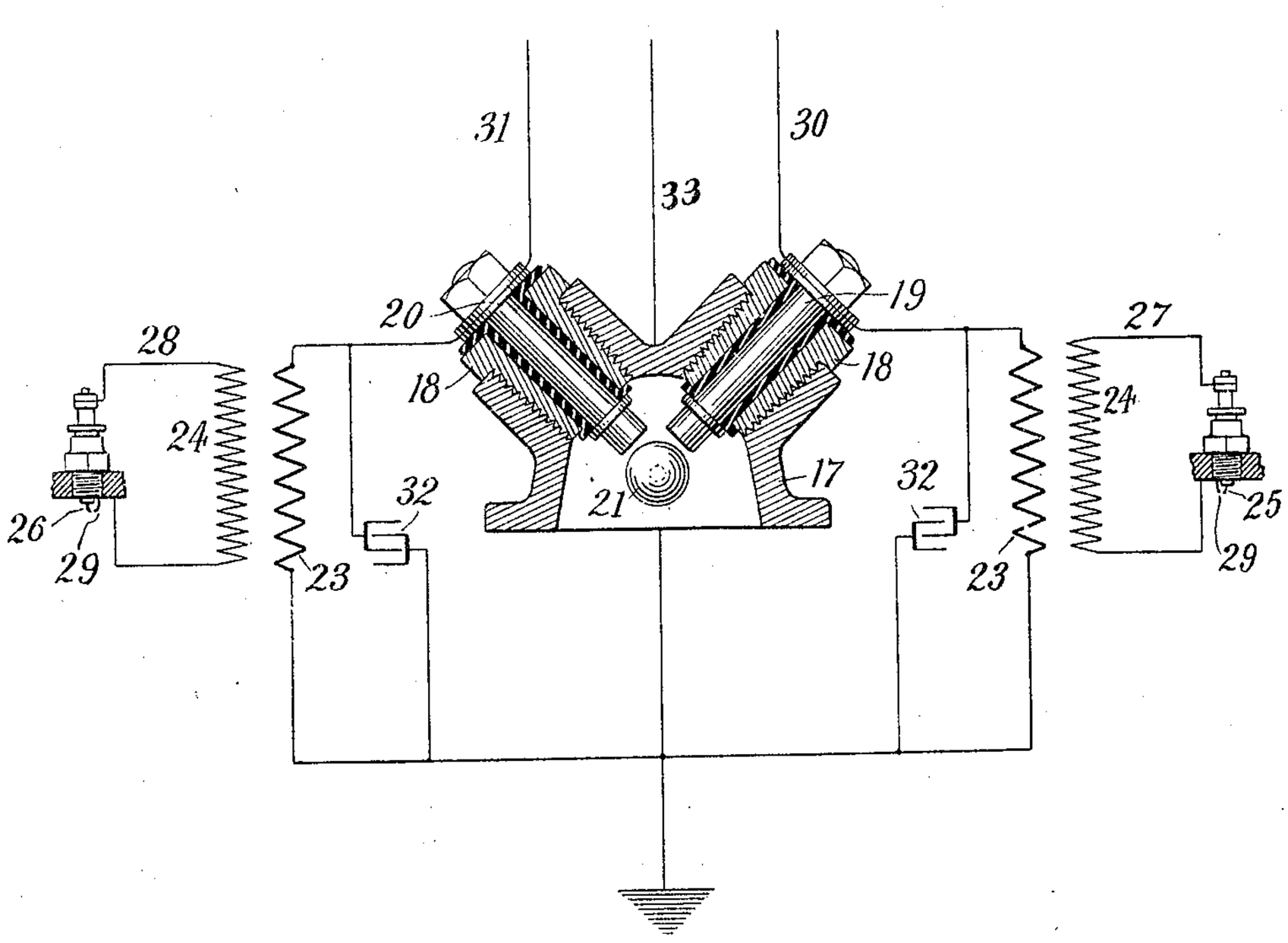
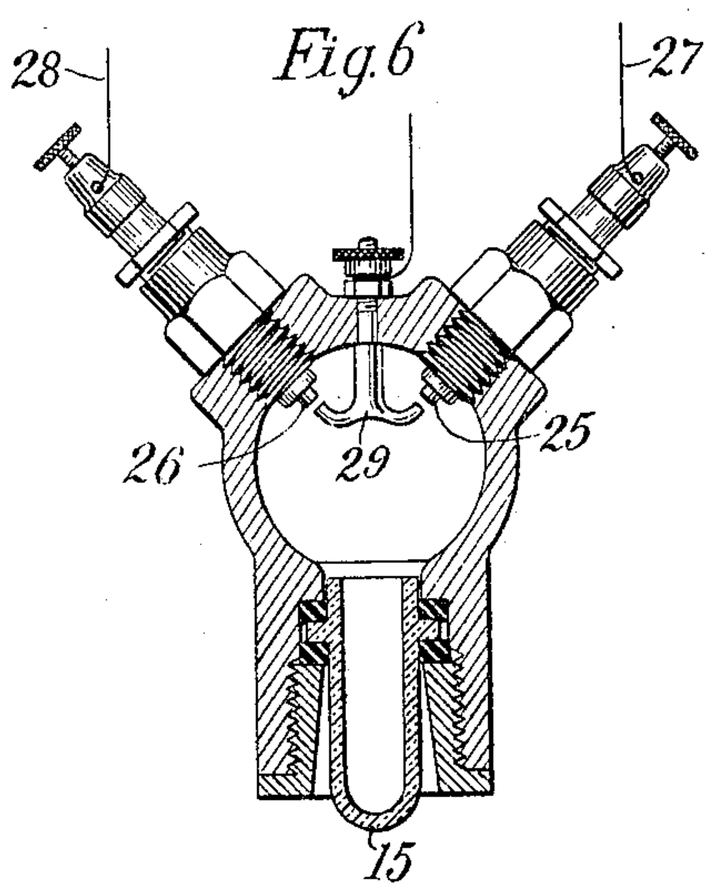


Fig. 6



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UNITED STATES PATENT OFFICE.

LEON JULES LE PONTOIS, OF NEW ROCHELLE, NEW YORK, ASSIGNOR TO POLY-PHASE IGNITION SYSTEM COMPANY, A CORPORATION OF NEW YORK.

IGNITION DEVICE.

No. 808,551. Specification of Letters Patent. Patented Dec. 26, 1905.

Application filed November 7, 1903. Serial No. 180,176.

To all whom it may concern:

Be it known that I, LEON JULES LE PONTOIS, a citizen of the Republic of France, and a resident of the city of New Rochelle, Westchester county, New York, have invented a certain new and useful Improvement in Ignition Devices, of which the following is a specification.

My invention relates to an igniting device for use with internal-combustion engines, and is designed more particularly for use in connection with an electric generator delivering two or more alternating currents differing in phase from each other.

The object of the invention is to provide a multiple circuit-breaker so constructed and arranged that the different currents delivered by the generator shall be interrupted simultaneously either within the ignition-chamber, thereby producing breaking sparks, or outside of the ignition-chamber, thereby producing in the secondary of suitable transformers two or more high-tension currents capable of causing sparks to jump across a gap or jump-sparks. It results from such simultaneous interruption of alternating currents differing in phase from each other that the total heat energy of the spark or sparks produced thereby at any given time is substantially constant whatever may be the current value of any one of the component currents at the time of interruption.

The mechanism and system described and claimed in the present application may be used to carry out the method of igniting combustible mixtures in gas-engines described and claimed in my application, Serial No. 170,399, filed August 22, 1903.

In the accompanying drawings, which form a part of my specification, Figure 1 is a view in elevation of one form of ignition-chamber of the breaking type. Fig. 2 is a vertical section along the plane of the line A B of Fig. 1. Fig. 3 is a section on the plane of the line C D of Fig. 2, showing also diagrammatically the windings of a polyphase-current generator. Fig. 4 is the usual diagrammatic representation of a biphase alternating current. Fig. 5 shows in section a form of interrupter in connection with a suitable transformer to change a primary current of low voltage into a high-tension current capable of producing jump-sparks, and Fig. 6 is a view of a jump-spark ignition-chamber which may be used in the system shown in Fig. 5.

Similar numerals of reference indicate similar parts throughout the several views.

Referring first to Figs. 1, 2, 3, and 4, the ignition-chamber is made in the form of a casting of any suitable form adapted to be secured in the wall of the combustion-chamber. Said ignition-chamber comprises a cavity 2, receiving the insulated terminals or so-called "spark-plugs" 3 and 4, arranged at a suitable angle to each other to permit simultaneous interruption of the circuits. To said terminals are connected, respectively, the leaders 5 and 6 of a biphase circuit, the common return-wire 7 being connected to the wall of the ignition-chamber. Any suitable form of polyphase-current generator may be employed. A suitable winding is shown diagrammatically in Fig. 3. The multiple circuit-interrupter comprises a metallic ball 8, preferably made of nickel, at the end of a resilient rod 9, connected to a rock-shaft 10, having a seat in an arm forming a part of the casting. The shaft 10 is adapted to be rocked by an arm 11, actuated by a rod 13, supported in any suitable manner and acted upon by a cam 12. The cam 12 is secured upon a shaft driven by the engine at a proper speed ratio and when rotating with said shaft at suitable intervals contacts with the rod 13, causing the latter to impinge against the arm 11, and thereby rocking the shaft 10. The effect of such movements is to intermittently move the ball 8 out of contact with the terminals 3 and 4 simultaneously. A spring 14, attached at one end to the arm 11 and at the other end to a fixed part of the engine-frame, acts to retract the arm 11 and rod 13 after each forward movement—that is, the rocking of the shaft 10 removes the ball 8 from contact with the terminals and the spring 14 acts to reëstablish such contact. An essential feature of my invention is the relation between the terminals 3 and 4 and the interrupter 8. This relation should be such that a simultaneous make and break will be effected. A convenient and simple form of arrangement is that shown in Figs. 2 and 3 by placing the terminals 3 and 4 at an angle to each other. By so placing the terminals a positive means is provided whereby the ball will be simultaneously removed from contact with said terminals and simi-

larly brought back into contact with them. Corrugations 16 on the walls are provided to radiate the heat of the ignition-chamber, and hence to keep the valve-seat and the rock-shaft comparatively cool. A sight-glass 15 in the side of the wall of the ignition-chamber affords means for the inspection of the sparks taking place in the chamber 2.

Fig. 4 represents diagrammatically the sinusoidal waves of a biphase current. A mere inspection of such diagrammatic view shows that wherever the simultaneous interruption of the two currents occur the total heat energies liberated by the spark or sparks resulting from the simultaneous interruptions is substantially constant.

Figs. 1, 2, and 3 illustrate a form of igniting device which may be employed in what is popularly known as a "primary-ignition" system. Figs. 5 and 6, however, show an igniting device which may be used in what is popularly known as a "jump-spark" system. As is well known, the latter system comprises, generally stated, means for interrupting the primary circuit of a transformer energized by a current of low voltage to thereby produce a high difference of potential between the terminals of a finely-wound secondary. A condenser is generally inserted across the primary spark-gap. Such a system I have illustrated in Figs. 5 and 6, by which are produced two high-tension sparks differing in phase from each other and having therefore at any time a total heat value substantially constant regardless of the time at which the primary polyphase-current circuits are interrupted. I may employ any suitable form of primary interrupter, the essential feature being a device which will interrupt both primary-current circuits simultaneously. For such purpose I prefer the construction shown in Fig. 5, in which the numeral 17 designates a suitable form of socket to receive plugs 18, which serve to support the terminals 19 and 20, connected, respectively, to conductors 30 and 31, leading to a suitable polyphase generator, the common return-wire 33 being grounded on the interrupter. Said terminals are insulated from their plugs, as shown. The terminals 19 and 20 are set at an angle to each other for the purpose stated above in connection with Figs. 2 and 3, the ball 21 being moved into and out of contact with the terminals 19 and 20 simultaneously by any suitable means and preferably that described above in connection with Figs. 1, 2, and 3. It will be noticed that at the moment when simultaneous contacts take place both polyphase-current circuits are grounded in short circuit, causing the current to reach a high intensity, owing to the considerable reduction in the ohmic and inductive resistance of their respective circuits. In practice I have found that it is preferable to short-circuit the circuits of the primaries of the transformer previous to throwing them into the polyphase circuits instead of allowing these primaries to be all the time in series with the terminals of the generator. The induced current in the secondary circuits 24 of the transformer passes to the terminals 25 and 26, located in the ignition-chamber, through the conductors 27 and 28, said terminals being suitably insulated from the walls of said chamber. It is obvious from the above description that when the primary circuits are simultaneously interrupted the electrical energy of each polyphase circuit is caused to energize suddenly the primary 23 and the condenser 32, resulting in a sudden rise of current in the secondary 24, a spark or sparks jumping across the gap or gaps existing between the insulated terminals 25 and 26 and the common ground-terminal 29. A ground connection 34 leads from the socket 17. Any usual form of condenser, as indicated at 32, may be inserted across the primary spark-gap. The function of said condenser is to nullify by its condensance the reactance of the primary 23, so as to permit the current delivered to the primary at the time of the break to reach its full value. A sight-glass 15 may be provided to ascertain that the sparks are regularly taking place and is similar to that shown in Fig. 3.

I do not limit myself to the precise details of construction herein described, as it is obvious that various changes may be made without departing from the spirit of my invention.

It is evident that instead of using the mains coming from a polyphase-current generator I may resort to the well-known method of changing a single-phase current into a polyphase current.

What I claim, and desire to secure by Letters Patent, is—

A sparking system comprising two or more insulated electrodes located in the ignition-chamber of an internal-combustion engine, ground connections for said electrodes, and means to simultaneously disconnect said electrodes from their ground connections so that the respective circuits of a polyphase-current generator leading to said electrodes may be simultaneously interrupted.

In testimony whereof I have hereunto signed my name in the presence of two subscribing witnesses.

LEON JULES LE PONTOIS.

Witnesses:

OTTO P. OSMERS,

GRACE L. HEASLEY.