No. 808,553. PATENTED DEC. 26, 1905.

L. J. LE PONTOIS.

METHOD OF IGNITING COMBUSTIBLE MIXTURES.

APPLICATION FILED SEPT. 24, 1904.

3 SHEETS—SHEET 1.

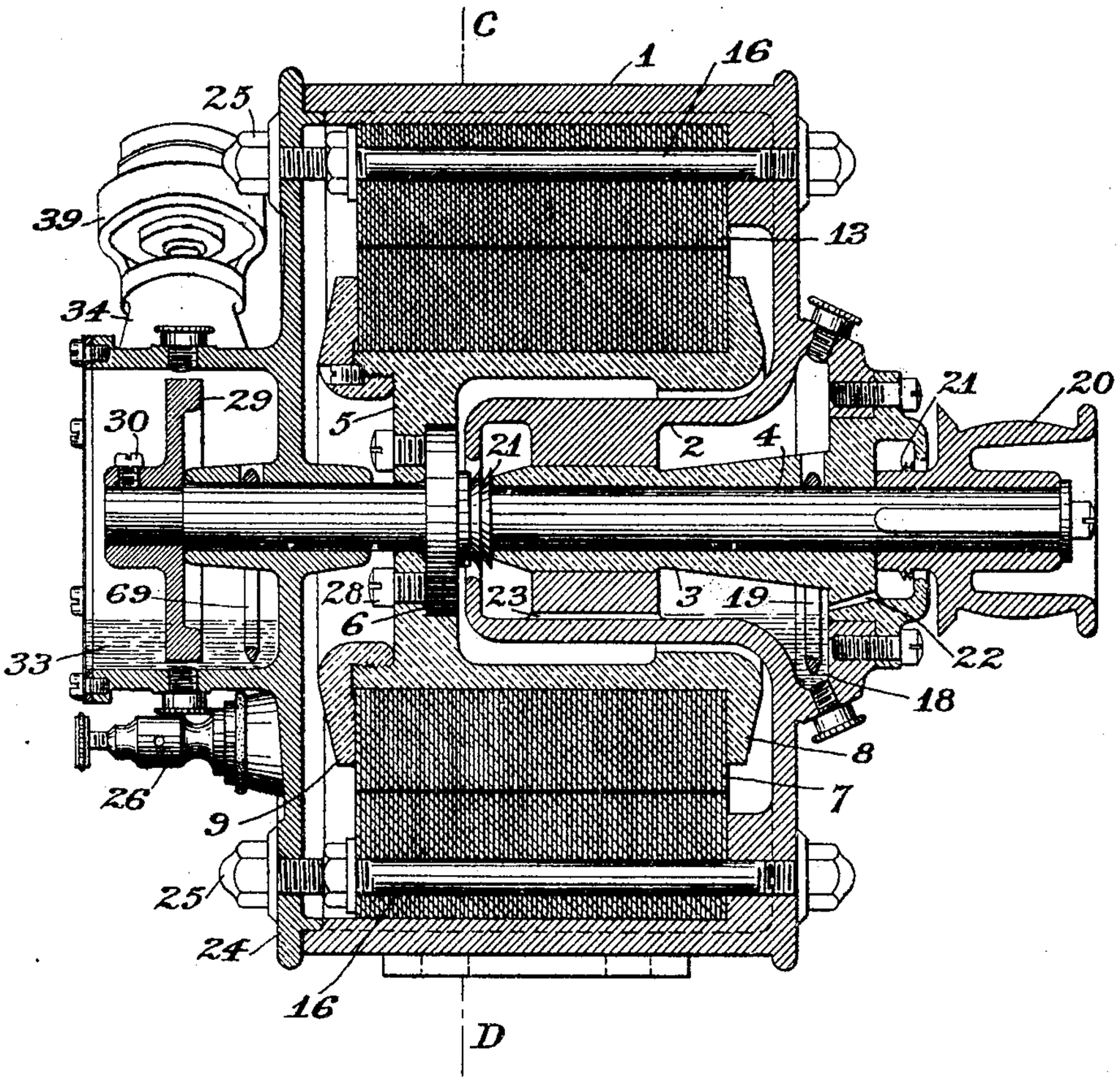

Fig. 1.

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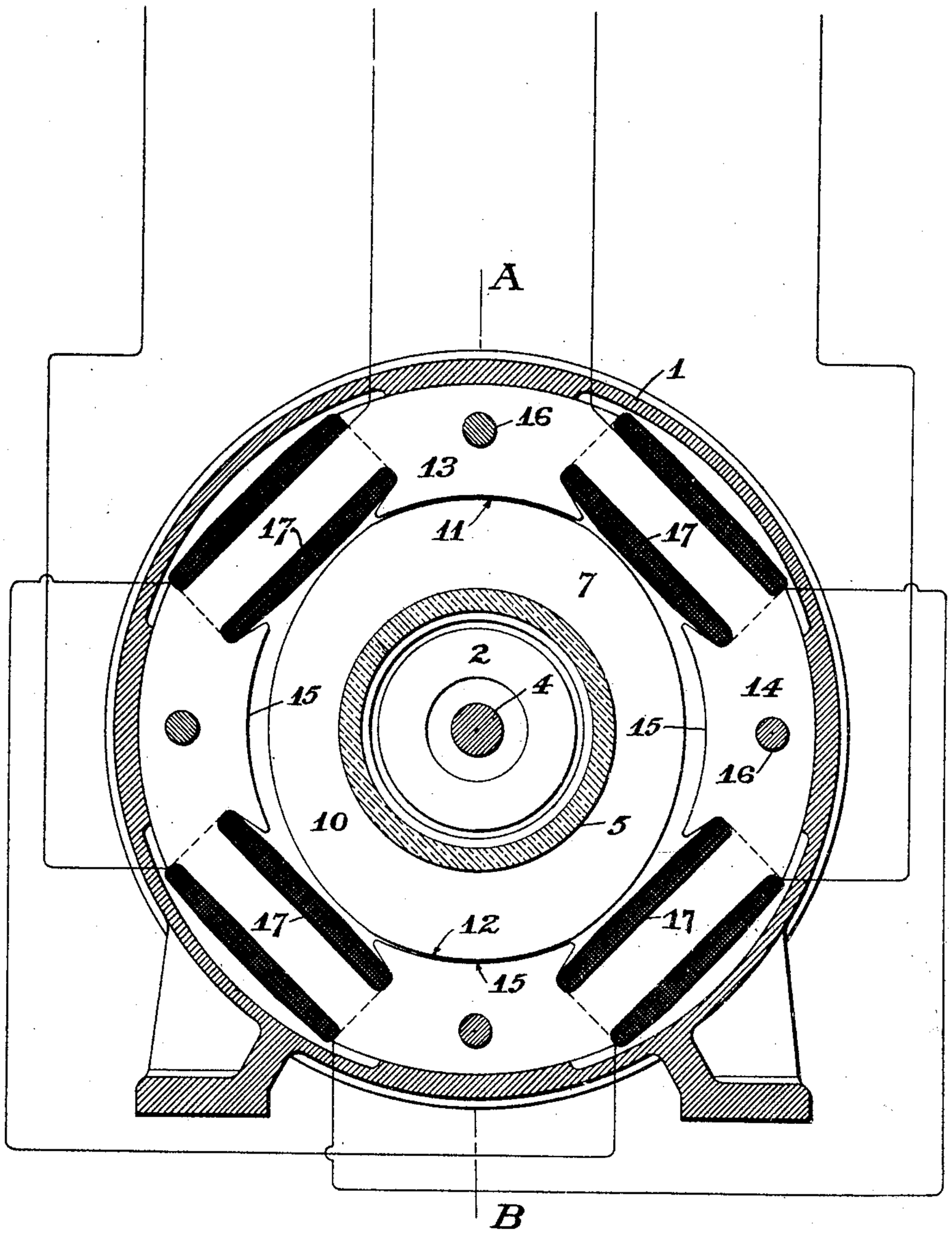

Fig. 2.

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3 SHEETS—SHEET 3.

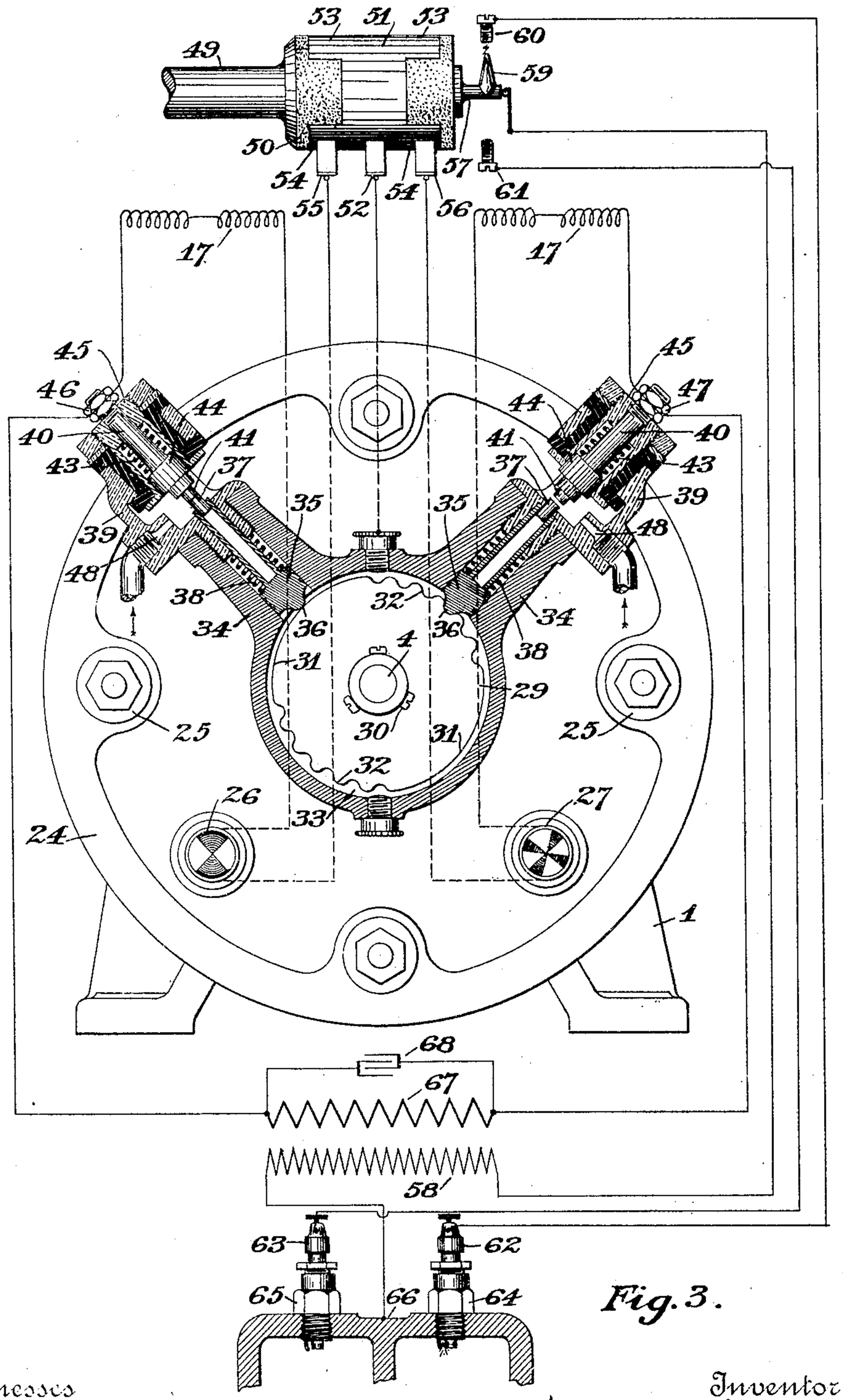

Fig. 3.

Witnesses
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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.

METHOD OF IGNITING COMBUSTIBLE MIXTURES.

No. 808,553. Specification of Letters Patent. Patented Dec. 26, 1905.

Application filed September 24, 1904. Serial No. 225,854.

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 New Rochelle, Westchester county, New York, have invented a certain new Method of Igniting Combustible Mixtures, of which the following is a specification.

The object of my invention relates to a new method for igniting combustible mixtures based on the use of polyphase currents.

In a previous patent, No. 752,690, dated February 23, 1904, I have described and claimed a method of producing sparks in the cylinders of internal-combustion engines, which invention was based on the idea of utilizing polyphase currents for igniting purposes and consisted substantially in simultaneously breaking two or more alternating currents differing in phase from each other in order that the intensity of the spark or sparks obtained might be practically constant, the energy of the combined circuits being utilized in order to obtain a spark or sparks having sufficient intensity at all times to ignite combustible mixtures. In the present invention I have retained the use of polyphase currents, as they give practically a constant flow of electrical energy, but utilize only one current at a time and at the time when its energy is suitable for the ignition of combustible mixtures, maintaining at the same time the other current in a short circuit on itself. It can readily be seen that if the generator supplying the polyphase currents has been so designed that its electromotive-force curve is slightly flattened at the top the current produced will vary very little during the ninety degrees of its alternation corresponding to its maximum intensity. If now at the moment when the electromotive force of one current begins to fall down in value the other current is allowed to throw its energy into the circuit, it will follow that a sufficiently-constant current for the purpose will be supplied to the sparking devices.

In the following I have described, with reference to the accompanying drawings, a structure embodying one form of my invention, the features thereof being more particularly pointed out hereinafter in the claims.

In the drawings, Figure 1 is a cross-sectional view along the plane of the line A B of Fig. 2. Fig. 2 is a cross-sectional view along the plane of the line C D of Fig. 1, and Fig. 3 is a front new view, partly in section and partly diagrammatic.

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

The magneto-alternator illustrated in the drawings being the subject of another application filed by me concurrently with the present one, I shall but tersely describe its operating parts.

1 indicates the outer casing of the magneto-alternator, preferably of brass and provided with an inturned projection 2, adapted to form a seat for the elongated bearing 3, preferably of bronze, of the shaft 4. A drum 5 is secured by tap-screws 28 or other means to the flange 6 of the shaft 4. The permanent magnet 7 is mounted on the drum 5 and clamped between the rim 8 and screw-ring 9 thereof. The magnet 7 is formed of separately-magnetized steel laminæ 10, the shape of the laminæ being substantially annular in order to increase as much as possible the polarized length of the magnetic circuit for a given diameter. By suitable magnetization two consequent poles 11 and 12 are developed at the opposite ends of the same diameter. As illustrated, the laminæ have been made slightly elliptical in shape in order to better concentrate the magnetic flux at the opposite ends of the major axis.

A ring 13 of soft-iron laminæ 14, each having four oppositely-disposed polar projections 15, is clamped to the casing 1 by means of insulated bolts 16. Coils 17 are wound around ring 13 between the polar projections 15, the oppositely-disposed coils being connected together either in series or in parallel, thus forming two distinct circuits in which currents differing in phase from each other by ninety degrees are generated.

An oil-well 18 is provided in the casing 1, a loose ring 19 resting on the shaft and depending into the oil-well acting as a medium for carrying the oil to the shaft. The shaft is adapted to be rotated by any convenient means through pulley 20, keyed to the shaft. The sleeve of the pulley and the shaft itself are each provided with oil-grooves 21 for preventing a surplus of oil from working out into the casing and which causes the same to drip off and return to the oil-well through oil-ducts

22 and 23, respectively. A cover 24 is adapted to be fastened to the front of the casing by means of suitable screws 25 and serves as a support for the binding-posts 26 27, adapted to receive one terminal of each of the pairs of coils. At the other end of the shaft 4 from the pulley 20, the shaft finding a bearing in the cover 24, is keyed a disk 29 by means of set-screws 30. This disk is divided into quadrants, the oppositely-disposed quadrants having smooth peripheries 31 31 and corrugated peripheries 32 32, respectively. As shown in the drawings, the corrugations in the corrugated quadrants have been shown on an enlarged scale, so as to illustrate more clearly; but in practice the depth of the corrugations preferably does not exceed one thirty-second of an inch. An oil-well 33, preferably cast as a part of the cover 24 of the casing 1, surrounds the disk, a loose ring 69 resting on the shaft and depending into the oil-well acting as a medium for carrying the oil to the shaft. The disk 29 in its path of movement passes through the oil, thus lubricating the parts with which it comes in contact. Mounted on the walls of the oil-well 33 are two projections 34 34, forming guides for pistons 35 35, each provided with a case-hardened tip 36 at one end and a platinum contact 37 at the other. The tips 36 of the pistons rest on the periphery of the disk 29, being pressed against the same by a spiral spring 38, resting one end against the piston 35 and the other against a bracket 39. In line with the pistons 35 and supporting the bracket 39 is an insulated sliding contact 40, having a platinum tip 41, the contact being spring-controlled by means of spiral spring 43, resting one end against the shoulder 44 of the contact and the other against the head of the screw-plug 45. By means of the springs 43 the contacts 40 are permitted a slight motion, resulting in good contact between its platinum point 41 and the platinum contact 37 of the piston 35. Binding-posts 46 and 47, respectively, are provided for the contacts. In line with the point of break of the circuit are located nozzles 48, connected with the exhaust-chamber of the engine, the purpose being to permit the burned gases still under considerable pressure to positively blow out any spark or arc tending to hang between the contact-points 37 and 41. It will thus be noticed that the action of the burned gases or carbon dioxid prevents any combustion of the platinum points.

On the engine cam-shaft 49, if the gas-engine is of the four-cycle type, or on the main shaft if it belongs to the two-cycle type, is located a drum 50, carrying an insulated ring 51, in constant contact with which is a brush 52, in electrical connection with the mass of the generator, as ground. Forming part of the ring 51 and on each side thereof and oppositely disposed to each other are two short contacts 53 53 and 54 54, which come alternately in contact with brushes 55 56, respectively, which said brushes are respectively connected with binding-posts 26 27 on the cover 24, each forming a terminal for one end of the pairs of coils 17 of the generator, respectively. On the end of the drum 51 and insulated therefrom is a projection 57, acting as a terminal for one end of the secondary 58 of an induction-coil and carrying a sharp platinum point 59, which rotates with the drum, coming in close proximity alternately to the insulated terminals 60 61, connected, respectively, to the binding-posts 62 63 of the sparking-plugs 64 65, secured in each of the two cylinders of the engine, if the engine is of the two-cylinder type, as illustrated, the other terminal of the secondary 58 being in electrical connection with the mass of the sparking-plugs, as at 66.

67 represents the primary of the induction-coil, the terminals of the primary being in electrical connection with the binding-posts 46 and 47, respectively. A condenser 68 of proper capacity is shunted around the primary in order to nullify the reactance of the primary. Binding-posts 46 and 47 are also in electrical connection with one end of the pair of coils 17, which are connected in series, as hereinbefore described, the other end of the coils being led to the binding-posts 26 27, respectively, which latter, as has been pointed out, are in electrical connection with brushes 55 and 56, which are in contact with ring 51, upon which bears brush 52, grounded to the mass of the generator, and consequently in electrical connection with disk 29.

It will be noted that in the position shown in Fig. 3 the pair of coils 17, in connection with the terminals 26 and 46, are short-circuited on themselves by reason of the contact-point 41 being in contact with piston 35, resting on the smooth periphery 31 of the disk 29, the circuit being completed, as has been pointed out, through the mass of the generator and brushes 52 and 55. At the same time coils 17, in electrical connection with binding-posts 27 and 47, are being rapidly short-circuited and open-circuited by reason of the corrugations 32 on disk 29 causing the piston 35 to be rapidly reciprocated. It will be seen that the current generated in coils 17, in electrical contact with binding-posts 27 and 47, is in open circuit through terminal 47, primary 67, terminal 46, contact 40, piston 35, mass of the generator, (including disk 29,) brush 52, ring 51, brush 56, and binding-post 27. The reciprocation of the piston 35 in contact with the corrugations 32 on disk 29, as described, will cause a rapidly-interrupted current to be sent through the primary 67 of the induction-coil, inducing in the secondary 58 high-tension currents, which are sent to the sparking-plug of the proper cylinder by means of the

platinum point 59, rotating with the engine-shaft, coming into proximity with the terminals 60 61 of the plugs.

It is obvious that a generator constructed and connected as described may be run at a speed which can differ widely from the engine speed and that during the rotation of shaft 4 the action of disk 29 on each piston and the contact produced by such action results in the fact that one current is alternately placed in short circuit on itself in the period during which its electromotive force would not be sufficient to produce the current required for ignition, while at the same time the other current is rapidly electrically interrupted at the moment when its energy is sufficient for the purpose stated.

It is obvious that the details of construction and the arrangement of parts may be varied without departing from the spirit of my invention, and I do not restrict myself to the same as herein shown and described.

What I claim, and desire to secure by Letters Patent of the United States, is—

1. The method of producing sparks suitable for igniting combustible mixtures consisting in alternately short-circuiting one of two alternating currents differing in phase from each other near the period of minimum intensity of its alternation and while it is short-circuited interrupting the other at or near the period of the maximum intensity of its alternation.

2. The method of producing sparks suitable for igniting combustible mixtures consisting in delivering to the primary of an induction-coil two alternating currents differing in phase from each other by ninety degrees, short-circuiting one of said currents at or near the period of minimum intensity of its alternation and while it is short-circuited interrupting the other current at or near the period of maximum intensity of its alternation.

3. The method of producing sparks suitable for igniting combustible mixtures consisting in delivering to the primary of an induction-coil having its secondary in electrical connection with a spark-plug, two alternating currents differing in phase from each other, alternately short-circuiting one of the two alternating currents at or near the period of minimum intensity of its alternation and while it is short-circuited interrupting the other of said currents at or near the period of its maximum intensity, in such manner that said circuits are caused to deliver alternately electrical energy to the primary of the induction-coil whereby high-tension sparks are caused to jump between the terminals of a spark-plug inserted in the secondary of the induction-coil.

4. The method of producing sparks suitable for igniting combustible mixtures consisting in continuously converting two alternating currents differing in phase from each other by ninety degrees into interrupted alternating currents having at all times a sufficient intensity to ignite a combustible mixture by short-circuiting one of said currents near the period of its minimum intensity and simultaneously rapidly interrupting the other of said currents at or near the period of its maximum intensity.

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

LEON JULES LE PONTOIS.

Witnesses:

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CHARLES S. JONES.