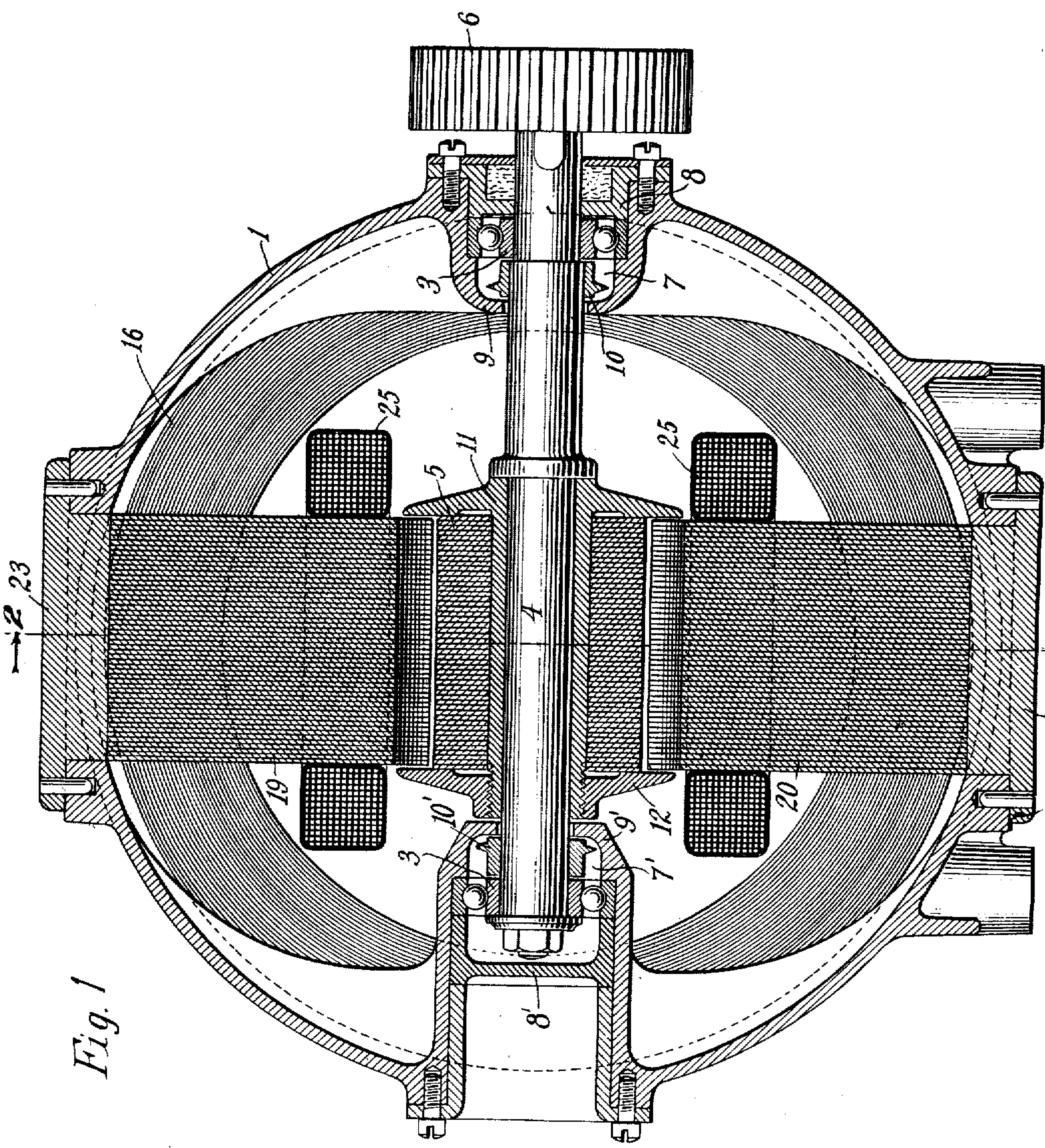
No. 843,541. PATENTED FEB. 5, 1907.

L. J. LE PONTOIS.

INDUCTOR MAGNETO ALTERNATOR.

APPLICATION FILED DEC. 11, 1905.

2 SHEETS—SHEET 1.



Witnesses
Raphaël Netter
Geo. W. Luing

Leon J. Le Pontois Inventor
By his Attorneys
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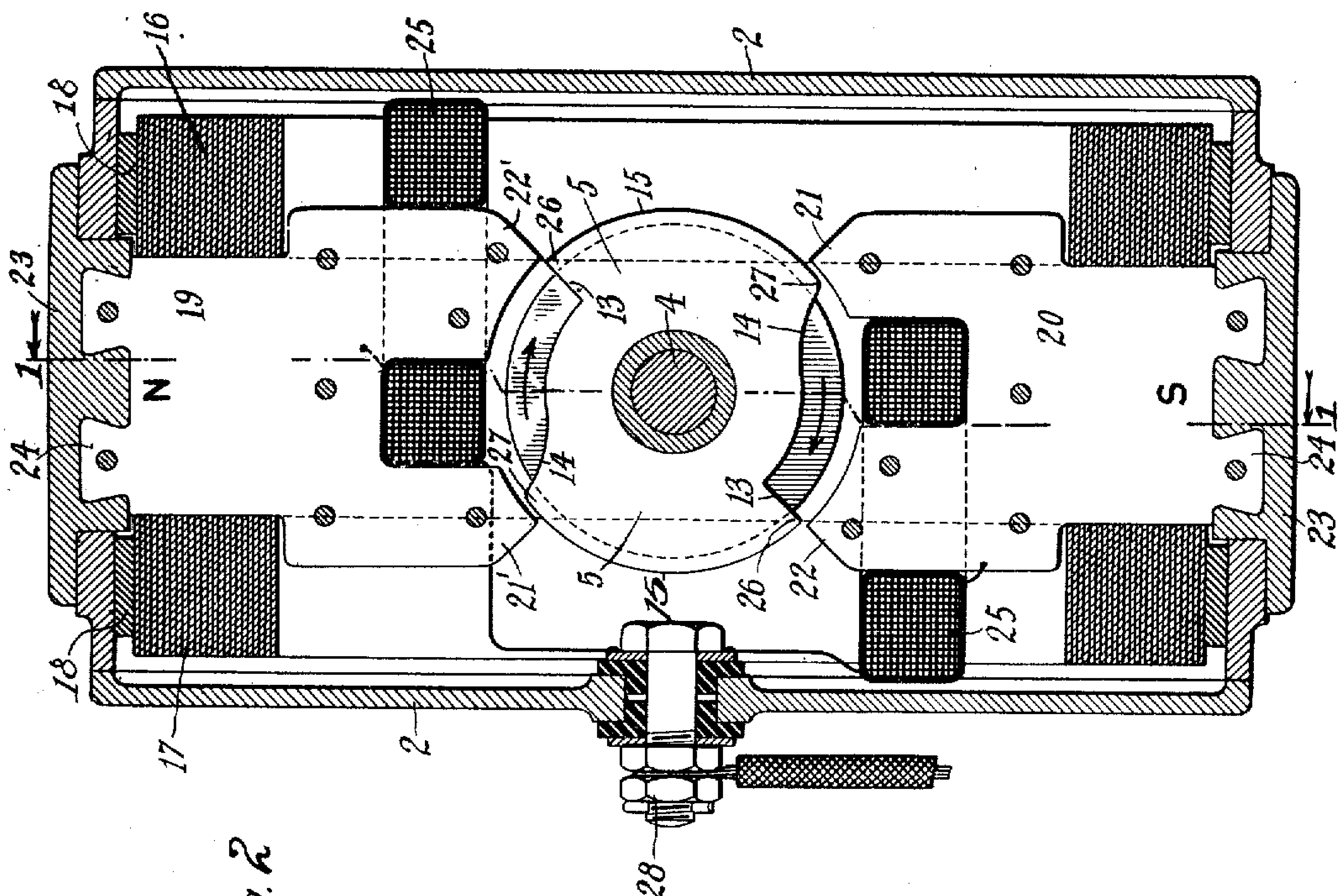

Fig. 2

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UNITED STATES PATENT OFFICE.

LEON J. LE PONTOIS, OF NEW ROCHELLE, NEW YORK, ASSIGNOR TO POLYPHASE IGNITION SYSTEM COMPANY, A CORPORATION OF NEW YORK.

INDUCTOR MAGNETO-ALTERNATOR.

No. 843,541. Specification of Letters Patent. Patented Feb. 5, 1907.

Application filed December 11, 1905. Serial No. 291,261.

To all whom it may concern:

Be it known that I, LEON J. LE PONTOIS, a citizen of the Republic of France, and a resident of New Rochelle, Westchester county, New York, have invented a certain new and useful Improvement in Inductor Magneto-Alternators, of which the following is a specification.

The present invention relates to an inductor magneto-alternator designed to generate alternating currents suitable for the ignition of combustible mixtures in internal-combustion engines either by the make-and-break system or by the jump-spark system.

In my Patent No. 808,555, dated December 26, 1905, I have described a magneto presenting a very important feature in that without the use of rectifying means the alternating current generated was partially utilized to maintain the so-called "permanent magnet" constituting the field of the magneto to an actual permanent degree of magnetization.

The object of the present invention is to construct a magneto embodying the same principle and presenting the additional advantage that in whatever position the inductor-rotor may be stopped the reluctance of the magnetic circuit comprising the field-magnets, the polar projections, the inductor-rotor, and the air-gaps between the latter and the faces of the polar projections will be sufficiently low to allow the larger part of the magnetic field to close itself through such circuit instead of closing itself by leakage along the lines of least magnetic reluctance, which leakage tends to cause the ultimate depolarization of the permanent magnet.

In carrying out my invention I provide two distinct paths for the magnetic flux issuing from the poles of the permanent magnet, said paths being so disposed with relation to the inductor-rotor that whenever said rotor by its position causes the reluctance of one of the paths to be increased a corresponding decrease will take place in the reluctance of the other path, thereby maintaining the total reluctance of the magnetic circuit, including the rotor, to a fairly constant value for the purpose desired.

The invention will be understood by reference to the accompanying drawings, in which—

Figure 1 is a vertical longitudinal section on the plane of the line 1 1 of Fig. 2, and Fig. 2 a transverse vertical section on the plane of the line 2 2 of Fig. 1.

Similar reference-numerals indicate similar parts in the several views.

In embodying my invention in practical form I have obtained the best results by employing the annular permanent magnet described in my Patent No. 807,949, dated December 19, 1905, overcoming, however, any objections to the bulk inherent to that form of magnet by disposing the axis of rotation of the rotor in a plane parallel to the plane of the annular magnet. I am thus enabled to construct a magneto having a comparatively powerful field and occupying notwithstanding a somewhat narrower space than the ordinary magneto having horseshoe-magnets. In order, however, to properly balance the magnetic pull on the inductor, I employ two such annular magnets so placed that poles of the same polarity face each other and that the magnetic flux issuing from the opposite poles of each magnet will follow the same magnetic path through the rotor.

In order to secure a very compact structure, I inclose the parts above referred to in a substantially circular diamagnetic casing 1, preferably aluminium, closed on its sides by suitable covers 2 to provide a dust and water proof structure. In suitable ball-bearings 3 is supported a shaft 4, to which latter are secured the rotor 5 and the driving member 6. The ball-bearings 3 may be of any usual type adapted to the purpose, the present construction showing the casing 1 formed with inwardly-projecting chambers 7 and 7′, within which the bearings are supported. One of these chambers is closed by a suitable cover 8, forming an oil-chamber between said cover and the inner end 9 of this chamber. A similarly-disposed cover 8′ closes the chamber 7′. The oil in the chambers 7 and 7′ is prevented from escaping into the casing 1 by rings 10 and 10′, having sharp projecting shoulders, as shown. Rigidly secured to the shaft 4 is a bushing 11, supporting an armature 5, formed of soft-iron laminæ insulated from each other and pressed together between a flange at one end of the bushing and a screw-cap 12 at the opposite end of the bushing 11 to constitute an inductor-rotor. The inductor-poles are of the peculiar construction shown in Fig. 2, the object being to provide a magnetic conductor capable of modifying by its rotation the reluctance of a magnetic field passing through its mass. The plates when properly assembled present the appearance substantially of a cylinder having two sections of its periphery cut away, the depth of the depression being in one of my commercial forms about one centimeter. The depressed circular walls drop abruptly and substantially radial in direction at 13 and rise at 14 to the surfaces 15 of the cylinder by a very gradual slope.

Within the casing and symmetrically disposed on each side of the central vertical plane of Fig. 2 are secured two annular magnets 16 and 17, having consequent poles N and S. These magnets are similar in construction, each consisting of a steel ribbon continuously wound in the form of a helix after it has been hardened. Instead of winding in a circular or ring form the ribbon may be wound in the form of an oval, square, or rectangle, suitable insulation being interposed between adjacent convolutions to prevent the formation of a magnetic short circuit between convolutions, which might be at a different magnetic potential. After the steel ring has been wound and the ends securely fastened it is accurately ground on both faces and placed in a powerful magnetic circuit, closing itself by each side of the magnet to thereby develop in two opposite zones two opposite magnetic poles. In order to hold the convolutions of the magnets during the process of grinding and magnetization, a brass ring 18 is shrunk thereon. When the two magnets are assembled in the casing, they are so placed that poles of similar polarity face each other. Located between the polarized zones of the two magnets and rigidly fastened to the casing are polar projections 19 and 20, extending into close proximity to the rotating inductor.

The polarized zones of the magnets are placed in close magnetic contact with the polar projections 19 and 20. These latter are built up of soft-iron laminæ substantially rectangular in shape and having two teeth 21 22 and 21′ 22′ of unequal width and terminating in faces struck on the arc of a circle from a central point on the axis of the inductor. These laminæ are held together by suitable insulated rivets and secured to the casing by means of two brass disks 23, substantially circular in shape, cast around the upper ends of the laminæ after they have been assembled. To insure a perfect union between the laminæ and the brass disks, the former when stamped are shaped with dovetail projections 24. It will be noted that the faces of the teeth of the polar projections having the same width are diametrically placed. Coils 25 are wound upon the teeth 22 and 22′, care being taken that the outer surfaces thereof are carefully protected from any possible grounding. These coils are wound right and left, their beginnings being electrically connected to the metallic structure of the machine, the ends connected together, so that both coils are grouped in parallel and connected to the binding-post 28, located on one of the side covers 2.

The elements above described constitute an alternating-current generator of the inductor type partially excited by the permanent magnetic field and partially exciting itself, owing to the shape of the rotating inductor and the location in the path of the magnetic field of the windings 25, in which the alternating currents are generated.

It is obvious that upon the rotation of the inductor in the direction of the arrow in Fig. 2 the rotor will at one time reach a position when the outer circular surfaces 15 will bridge the total width of the teeth 21 22 and 21′ 22′. In this position the magnetic flux issuing from the permanent magnets will find a practically-closed path from pole to pole, dividing itself between the two teeth 21 22 and 21′ 22′ in proportion to their respective magnetic cross-sections. Upon a further angular motion of the inductor in the same direction the depressions of the inductor are brought across the teeth 21 21′ of the polar projections. The considerable increase in the reluctance of the air-gaps existing between these teeth and the depressed walls of the inductor causes the magnetic flux to seek the better path offered by the teeth 22 22′. The density of the magnetic flux threading through the coils 25 is then a maximum. A further angular motion of the inductor in the same direction brings it to the position shown in Fig. 2. While reaching that position the reluctance of the path between the teeth 22 22′ is on the verge of increasing abruptly, as the air-gap existing between said teeth and the edges 26 of the inductor is increasing rapidly for a very slight angular motion of the inductor. In the meantime the edges 27 have penetrated within the faces of the teeth 21 21′, thereby causing part of the magnetic flux to be diverted from the path 22 22′ to seek the better path being established between the teeth 21 21′. It is at this moment that the rate of change in the intensity of the magnetic flux threading through the coils 25 reaches suddenly a maximum, and therefore the current generated in said coils reaches a high peak wave pending a very short angular motion of the inductor. It must be borne in mind, however, that the edges 27 should not penetrate too deeply within the polar surfaces of the teeth 21 21′ before the reluctance of the magnetic path 22 22′ has increased suddenly, for otherwise the magnetic field threading through the coils 25 would pass too gradually from the path 22 22′ to the path 21 21′, thereby defeating the object of the invention, which is to obtain a very sharp peak wave, which will give the best result with the ordinary induction-coil. For this reason experiments have been made to determine the best possible relation of the angular distances between the outside edges of the teeth 21 22 and 21′ 22′ and the inductor edges 26 27 in order to obtain the greatest possible rate of change in the intensity of the flux threading through the coils 25, allowing, however, the inductor edges 27 to penetrate deeply enough within the teeth 21 21′ to offer a fairly good magnetic path for the flux issuing from the permanent magnets, so that should the generator at this critical moment be brought to a standstill and remain stationary for any length of time the by-path offered by the teeth 21 21′ and that part of the inductor covered by these teeth to the magnetic flux will be of sufficiently low reluctance to prevent an abnormal leakage outside of this path and will therefore tend to prevent the depolarization of the magnet. The current thus generated can be led directly to the terminals of a suitable make-and-break sparking plug and utilized in this form. It may also be utilized to energize the primary of an induction-coil when connected to said primary by a suitable interrupter shunted by a proper condenser, as described in an application filed by me of even date herewith.

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

1. An inductor magneto-alternator comprising a permanent field-magnet, bifurcated polar projections adjacent to the poles of said magnet, stationary windings surrounding two of the diametrically opposite bifurcations, and an inductor-rotor adapted to modify by its rotation the distribution of the magnetic flux through the oppositely-disposed bifurcations, whereby the reluctance of the magnetic circuit comprising the permanent magnet, the bifurcated polar projections, the inductor-rotor, and the air-gaps existing between the rotor and the said polar projections is kept down to a fairly constant value for the purpose stated.

2. An inductor magneto-alternator comprising a permanent field-magnet, bifurcated polar projections adjacent to the poles of said magnet, stationary windings surrounding two of the diametrically opposite bifurcations, and a dissymmetric inductor-rotor adapted to modify by its rotation the distribution of the magnetic flux through the oppositely-disposed bifurcations, for the purpose described.

3. An inductor magneto-alternator comprising a permanent magnet formed of a permanently-magnetized ring wound from a continuous hardened-steel ribbon, laminated polar projections adjacent to the consequent poles of said magnet said poles being bifurcated, stationary windings surrounding two of the diametrically opposite bifurcations and an inductor-rotor adapted to modify by its rotation the distribution of the magnetic flux through the oppositely-disposed bifurcations, whereby the reluctance of the magnetic circuit comprising the permanent magnet, the bifurcated polar projections, the inductor-rotor, and the air-gaps existing between the rotor and the said polar projections is kept down to a fairly constant value for the purpose stated.

4. An inductor magneto-alternator comprising two annular permanent magnets so mounted that poles of the same polarity face each other, polar projections mounted between and adjacent to the magnetic poles of said magnets said projections being bifurcated, stationary windings surrounding two of the diametrically opposite bifurcations, a shaft located between and having its axis in a plane parallel to the plane of said magnets, and an inductor-rotor mounted on said shaft and adapted to rotate between the faces of said polar projections.

5. An inductor magneto-alternator comprising two annular permanent magnets so mounted that poles of the same polarity face each other, polar projections mounted between and adjacent to the magnetic poles of said magnets said projections being bifurcated, stationary windings surrounding two of the diametrically opposite bifurcations, a shaft located between and having its axis in a plane parallel to the plane of said magnets, and a dissymmetric inductor-rotor mounted on said shaft and adapted to rotate between the faces of said polar projections.

6. An inductor magneto-alternator comprising two similar annular permanent magnets each formed of a permanently-magnetized ring wound from a continuous hardened-steel ribbon said magnets being so mounted that poles of the same polarity face each other, polar projections mounted between and adjacent to the magnetic poles of said magnets said projections being bifurcated, stationary windings surrounding two of the diametrically opposite bifurcations, a shaft located between and having its axis in a plane parallel to the plane of said magnets, and an inductor-rotor mounted on said shaft and adapted to rotate between the faces of said polar projections.

7. An inductor magneto-alternator comprising two annular permanent magnets so mounted that poles of the same polarity face each other, polar projections mounted between and adjacent to the magnetic poles of said magnets, stationary windings adjacent to said polar projections, a shaft located between and having its axis of rotation in a plane parallel to the plane of said magnets, and an inductor-rotor mounted on said shaft

and adapted to rotate between the faces of said polar projections.

8. An inductor magneto-alternator comprising an annular permanent magnet, polar projections adjacent to the consequent poles of said magnet, stationary windings adjacent to said polar projections, a shaft having its axis of rotation in a plane parallel to the plane of said magnet, and an inductor-rotor mounted on said shaft and adapted to rotate between the faces of said polar projections.

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

LEON J. LE PONTOIS.

Witnesses:

OLIN A. FOSTER,

GEO. W. LANNG.