H. J. PODLEŠÁK & T. E. PODLESAK.

INDUCTOR GENERATOR FOR IGNITION PURPOSES.

APPLICATION FILED JAN. 28, 1908.

1,003,649.

Patented Sept. 19, 1911.

2 SHEETS—SHEET 1.

Fig. 1.

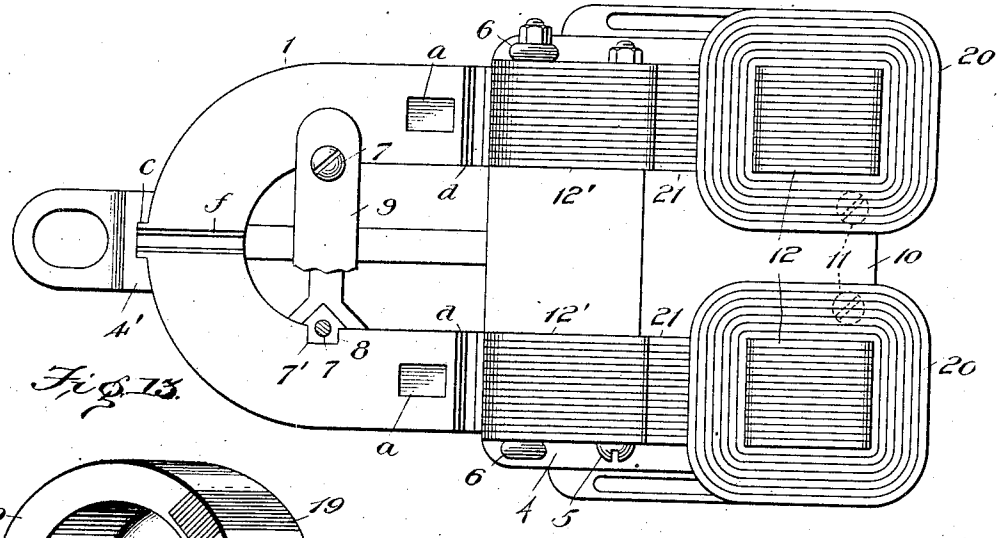


Fig. 1a.

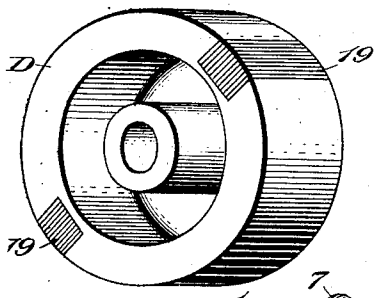
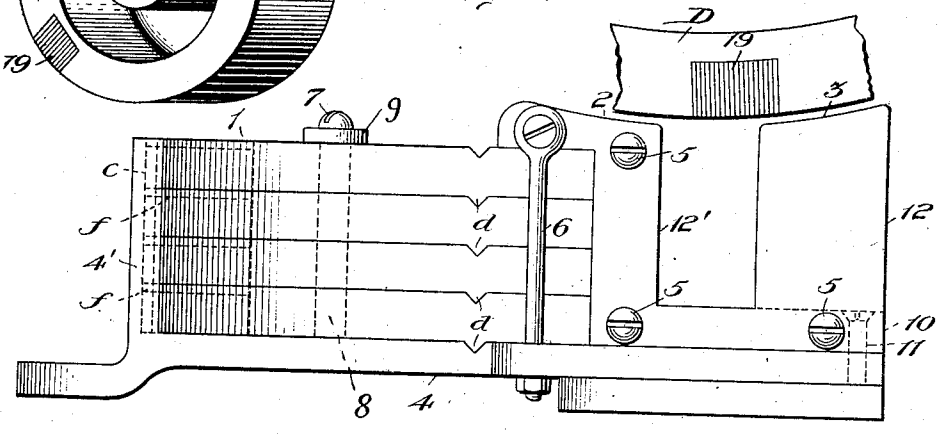


Fig. 2.



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2 SHEETS—SHEET 2.

Fig. 3.

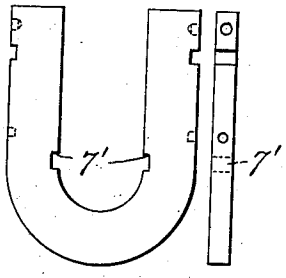


Fig. 4.

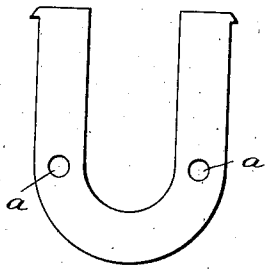


Fig. 5.

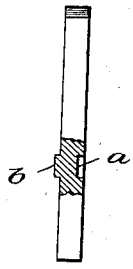


Fig. 6.

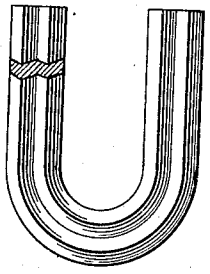


Fig. 7.

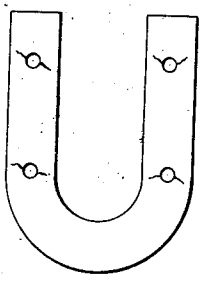


Fig. 8.

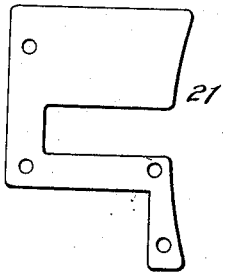


Fig. 9.

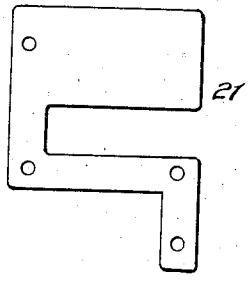


Fig. 10.

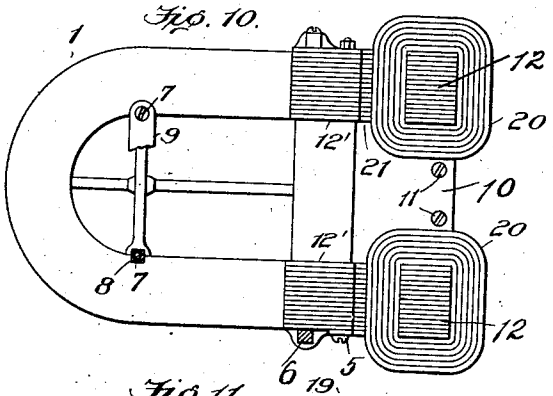


Fig. 12.

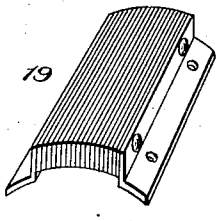
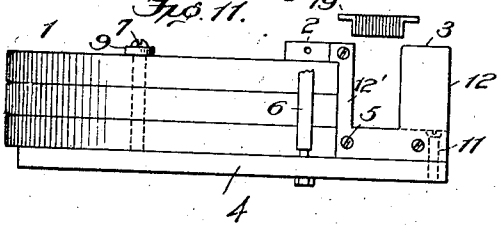


Fig. 11.



Witnesses

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UNITED STATES PATENT OFFICE.

HENRY JOSEPH PODLEŠÁK, OF CHICAGO, ILLINOIS, AND TESLA EMIL PODLESAK, OF MORRISTOWN, NEW JERSEY.

INDUCTOR-GENERATOR FOR IGNITION PURPOSES.

1,003,649. Specification of Letters Patent. Patented Sept. 19, 1911.

Original application filed September 25, 1901, Serial No. 76,559. Divided and this application filed January 28, 1908. Serial No. 413,068.

To all whom it may concern:

Be it known that we, HENRY JOSEPH PODLEŠÁK and TESLA EMIL PODLESAK, residing at Chicago, in the county of Cook, State of Illinois, and Morristown, county of Morris, State of New Jersey, respectively, have invented certain new and useful Improvements in Inductor-Generators for Ignition Purposes, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to inductor alternators for ignition purposes.

It essentially pertains to inductor alternators capable of producing electrical effects suitable for the ignition of combustible charges in internal combustion motors.

It is for a division of the subject matter shown and disclosed in our application for Letters Patent, Serial No. 76,559, filed September 25, 1901.

One of the objects of our invention is to suitably support and position the permanent magnets, employed to establish the magnetic field, without the necessity of drilling holes in them, or otherwise disarranging the molecules of the magnet metal so as to diminish the magneto-motive force of which the magnets are capable and to establish consequent poles within the magnets themselves.

Another object of our invention is to so arrange and correlate the permanent field magnets to the other elements of an inductor alternator, that in operation the permanent magnets will be kept magnetized and built up.

Still another object of our invention is to provide an inductor alternator which is readily adaptable to all classes of internal combustion motors, such as automobile, marine, and stationary motors, and to the special requirements of each class, and is readily adjustable for varying the period of generation of maximum electro-motive force relative to the position of a piston within an engine cylinder.

Figure 1 is a plan view of the relatively stationary part of an inductor alternator embodying our invention. Fig. 2 is a side elevation of the inductor alternator shown in Fig. 1. Fig. 3 is an edge elevation and side elevation showing one manner of constructing the permanent magnets. Fig. 4 is a side elevation of still another construction of permanent magnets. Fig. 5 is a view partly in edge elevation and partly in section of the magnet shown in Fig. 5. Fig. 6 is a plan view of a permanent magnet having a corrugated surface. Fig. 7 is a plan view diagrammatically illustrating results which occur when holes are drilled in the magnets. Fig. 8 is a side elevation of one form of sheet metal punching or lamina of which the pole pieces of one of the inductor alternators hereinafter described, are made. Fig. 9 is a side elevation of another shape of pole piece punching or lamina. Fig. 10 is a plan view of the normally stationary part of a modified form of an inductor alternator embodying our invention. Fig. 11 is a side elevation of the inductor alternator shown in Fig. 10. Fig. 12 is a perspective view of one style of inductor employed by us in carrying out our invention. Fig. 13 is a perspective view of an inductor-carrying disk with inductors embedded in it.

In the drawings—1 indicates a permanent magnet preferably horseshoe or U-shaped in form. It is composed of as many magnet sections, arranged in a series, as may be required to establish the desired density of magnetic field.

4 is a frame, preferably of non-magnetic material, and employed to position and support in proper relation to each other the normally stationary parts of our inductor alternator.

9 is a clamp piece or cleat arranged to bear against the outermost magnet section in the series, and 7 are bolts or screws extending through said cleat and into the frame 4, and adapted to bind or clamp the said frame and permanent magnet 1 together. In order to prevent displacement of the magnet sections in the series, relative to each other and to the said frame 4, we have devised several ways of suitably shaping or forming and securing them. In Figs. 1, 2 and 3 are shown U-shaped magnet sections having their edges suitably notched or recessed at 7′ to receive the bolts 7 which clamp the series of magnet sections to the frame 4. Some easily fusible metal, as indicated at 8, may be cast around the bolts 7

and between them and the walls of the recesses in which they are inserted, and the entire structure thus made a rigid one. To further facilitate in the rigidity of the construction as an entirety, and to prevent the relative lateral movement of the magnet sections, these sections may be punched, as shown in Figs. 4 and 5, so as to form depressions *a* on one side of the magnet, and corresponding projections *b* on the other. When the magnet sections are thus formed, the projections *b* on one magnet section register with and enter the corresponding depressions *a* in the next adjacent magnet section of the series. The depressions on one face of the magnet and the corresponding projections on the other may be of any desired shape and form. In Figs. 1 and 2, we have shown V-shaped depressions and corresponding projections *d*, and trough-shaped projections *f*. Both surfaces of the magnet sections may, if desired, be corrugated, as indicated in Fig. 6, to accomplish the same results of preventing the relative displacement of any of the magnet sections of the frame 4.

In Figs. 1 and 2 we have shown a frame 4 having an upward extension 4′ suitably recessed to receive projections or lugs *e* on the yokes or toes of the magnet sections. In this case, as before described, the parts of the frame need not be accurately machined, as a readily fusible metal may be employed to fill up any cavity which may exist between the walls of the registering parts, and thus prevent relative movement of the said parts.

It will be clearly seen that many combinations of the several methods above referred to of securing the magnets immovably to the frame are possible, the exact arrangement being determined by the particular case in hand.

21 are pole pieces composed of a suitable number of punchings or laminae shown in Figs. 8 and 9. A pair of these pole pieces is preferably used, assembled, one at either side of a suitable center piece or spacing piece 10 of non-magnetic material, and suitably bolted together by means of bolts 5. This non-magnetic spacing piece 10 is suitably secured to the frame 4 by means of screws 11 and bolts 6, so as to hold the laminated pole pieces 21 in close magnetic contact with the ends or poles of the permanent magnets. Each one of the pole pieces has a pair of polar projections 12, 12′, the former of which serves as a coil core upon which a winding or coil 20 of insulated wire is slipped, and to which the said coil is suitably secured. The coil core 12, on each pole piece, is spaced by a suitable air gap from the adjacent polar projection 12′ on said pole piece. The outer faces or polar faces of the said polar projections 12, 12′, are suitably shaped to conform to the path of travel of a suitable inductor, hereinafter described. The polar faces on the polar projections 12′ are designated by 2, and hereinafter referred to as exciting polar faces, and the polar faces on the polar projections 12 are designated by 3, and hereinafter referred to as generating polar faces.

19 is an inductor, preferably formed of punchings or laminæ of suitable metal. This inductor is adapted to be rotated so as to have one of its faces pass over and closely adjacent to the exciting polar faces 2 and the generating polar faces 3, or in other words, as close to said polar faces as mechanical conditions will permit. The inductor 19 may be caused to cross over or pass over the exciting polar faces and then the generating polar faces in any desired manner. In Fig. 2 we have shown the exciting and generating polar faces on the pole pieces, and the face of the inductor 19 which travels closely adjacent to them, shaped to conform to the arc of a circle about the axis of which the inductor is rotatable. Normally the lines of magnetic force emanate in a scattered way, from all sides of the magnet for about one-half of its length from its free ends, and some of these lines of force emanate from the pole pieces. The inductor 19, in operation, first spans the exciting polar faces 2 and causes the concentration of a dense flow of magnetic lines of force; *i. e.*, a substantial magnetic short circuit between the polar projections 12′ of the laminated pole pieces. The inductor then moves across the air gap between the exciting polar faces and the generating polar faces and causes a rapid and substantially complete diversion of the magnetic flux density, first concentrated across the exciting polar faces, into and through the coil cores 12 and across the generating polar faces, so as to establish a substantial magnetic short circuit across the generating polar faces. The inductor then leaves the generating polar faces and the magnetic flux density through the induction windings is rapidly diminished, due to the fact that the lines of magnetic force instantly seek the path of least reluctance between the magnet poles.

With an inductor alternator constructed in accordance with our invention, the inductor does not at any time move sufficiently close to the limbs of the magnets themselves to draw or concentrate a dense magnetic flux across the limbs of the magnets above the poles thereof, but on the contrary, we have so constructed and arranged the elements of an inductor alternator for ignition purposes, that the inductor in its operation tends only to draw or concentrate the magnetic flux emanating from the magnet poles at

the free ends of said magnet, thereby tending to prevent the shifting of the said poles and to overcome the tendency of the said poles to shift, with the consequent loss of magneto-motive force by the magnets.

The electro-motive force is generated in the inductive windings 20, as in all dynamo-electric generators, by varying the magnetic flux density through the said windings. The inductor 19 operates to cause a very rapid varying of the magnetic flux density by first establishing a substantial magnetic short circuit, *i. e.*, by concentrating the magnetic flux at a point adjacent to but outside of the induction windings so that the magnetic flux density in the cores of said windings is practically zero, then quickly diverting the magnetic flux through the coil cores, and then, practically instantly, permitting the magnetic flux density in said coil cores to again drop to substantially zero.

D is a disk for carrying an inductor or inductors 19, as many inductors being employed as are requisite to cause the generation of electro-motive force at the different intervals required. With multi-cylinder motors, two or more inductors are used, there being one inductor for each cylinder, as will readily be understood, unless the periods of ignition of two or more of said cylinders occur at the same period of the stroke at alternate revolutions. In any case, an inductor must be provided and so arranged that it will pass over and span the generating polar faces when the ignition of a combustible charge is required. When desired, for the sake of appearance or greater safety, the inductor or inductors 19 may be embedded or inserted in a carrying disk or element of non-magnetic material.

The advantages of securing the sections of the permanent magnet together and to the frame in accordance with our invention, are many. It is well known that where the magnets or magnet sections are drilled, for the purpose of connecting them to a frame by means of bolts or screws passed through holes, the metal is liable to crack around the holes, as illustrated in Fig. 7, when it is tempered or hardened. This cracking materially diminishes the efficiency of the magnet, and sometimes destroys it entirely.

Where the inductors 19 are embedded in the wheel or disk D of non-magnetic material, carrying them, as shown in Fig. 13, when one of the inductors passes over or spans the polar faces of the polar extensions on the pole pieces opposite each other, it establishes a path of low magnetic reluctance for the magnetic flux emanating from the magnet. The section of non-magnetic material which next passes over the said polar faces is of such relatively high reluctance, that it will divert the magnetic flux from the polar projections in which it has been concentrated by the inductor section preceding the said section of non-magnetic material.

What we claim is:—

1. In an inductor-generator for ignition purposes, the combination of a permanent magnet composed of sections, each section being provided with projections and depressions arranged to register with corresponding depressions and projections, respectively, on the sections adjacent to it, a pair of laminated pole-pieces, each in magnetic contact with the poles of said magnet and each pole-piece provided with two polar projections, each of which terminates in curved polar faces, two coils of wire, each wound in inductive relation to one projection of each of said pole-pieces, a frame of non-magnetic material, means for holding and fastening said pole-pieces to said frame and in suitable relation to each other, devices for holding said magnet in magnetic contact with said pole-pieces and to said frame, an unwound movable inductor arranged to concentrate by its movements the magnetic flux first through the unwound polar projections and then through the wound polar projections of said pole-pieces.

2. In an inductor generator for ignition purposes, the combination of a suitable frame of non-magnetic material, a permanent magnet built up in sections, each section having recesses to receive parts of the connecting means between the magnet and the said frame, and having depressions and projections arranged to register with corresponding projections and depressions, respectively, on the sections adjacent to it, means for clamping the permanent magnet to the frame, including bolts arranged to enter the recesses in said magnet sections, laminated pole pieces secured to said frame and each in magnetic contact with one of the poles of said magnet, induction windings in inductive relation to said pole pieces, and an unwound inductor movable relative to said pole pieces to vary the magnetic flux density in said induction windings.

3. In an inductor-generator for ignition purposes, the combination of a permanent field-magnet, a pair of laminated pole-pieces in magnetic contact with the poles of said magnet and having each a pair of polar projections, a non-magnetic support directly in contact with said pole-pieces, a winding surrounding one of the polar projections on each of said pole-pieces, the other polar projection on each pole-piece being unwound, connections between said pole-pieces and said support for rigidly clamping the pole-pieces to said magnet and to said support, an inductor movable to periodically vary the magnetic flux through said windings, and a rotatable member of non-magnetic material in which said inductor is embedded.

4. In an inductor-generator for ignition purposes, the combination of a permanent magnet composed of sections, each section having depressions and projections arranged to register with corresponding projections and depressions, respectively, on the sections adjacent to it, whereby relative displacement of the sections is prevented, a suitable frame of non-magnetic material, means for clamping the permanent magnet to the frame, laminated pole-pieces in magnetic contact with the poles of said magnet, connections between said pole-pieces and said frame for rigidly clamping the pole-pieces to the frame, said connections passing outside of the permanent magnet to avoid perforating the same, a winding on said pole-pieces, and an inductor movable in proximity to said pole-pieces to vary the magnetic flux through said winding.

5. In an inductor generator for ignition purposes, the combination of a permanent magnet, a pair of laminated pole pieces, each held in magnetic contact with one of the poles of said magnet, extending laterally therefrom and having a plurality of polar projections with curved polar faces disposed at one side of the plane of the magnet and relatively remote from the poles of said magnet, two coils of wire, each in inductive relation to one polar projection on each pole piece, means formed of non-magnetic material connecting the said pole pieces together and holding them suitably spaced apart and in contact with the poles of said magnet, and an unwound inductor movable relative to the polar faces of said polar projections, and adapted to concentrate the magnetic flux emanating from the poles of said magnet only between said pole pieces, and alternately across the polar faces of the unwound and then the wound polar projections on said pole pieces.

6. In an inductor-generator for ignition purposes, the combination of a suitable frame of non-magnetic material, a permanent magnet composed of sections provided with recesses, each section having depressions and projections arranged to register with corresponding projections and depressions on the sections adjacent to it, means arranged to enter the recesses in said sections for clamping the permanent magnet to the frame, laminated pole-pieces secured to said frame and each in magnetic contact with one of the poles of said magnet, a winding on said pole-pieces, and an inductor movable in proximity to said pole-pieces to vary the magnetic flux through said winding.

7. In an inductor-generator for ignition purposes, the combination of a permanent magnet composed of a plurality of sections provided with recesses, a frame of non-magnetic material, means for clamping said frame and magnet together, said clamping means including members fitted to enter said recesses, a filling of readily fusible metal between said members and the walls of the recesses for holding the members firmly in place, a pair of pole-pieces secured to said frame and each held in magnetic contact with one of the poles of said magnet, a pair of polar projections provided on each pole-piece, a winding on one of said polar projections, and an inductor movable in proximity to said polar projections to vary the magnetic flux through said winding.

8. In an inductor-generator for ignition purposes, the combination of a frame of non-magnetic material, a pair of pole-pieces secured to said frame and each provided with two polar projections, a winding arranged on one of said pole-pieces, a permanent field magnet composed of sections and having its poles in magnetic contact with said pole-pieces, connecting devices for holding said magnet to said frame, the sections of said magnet being suitably recessed to receive parts of said connecting devices, and a movable inductor arranged to concentrate the magnetic flux alternately through one pair and then through the other pair of polar projections to vary the magnetic flux through said winding.

9. In a magnetic field structure, the combination of a permanent magnet, a pair of pole-pieces therefor, a non-magnetic support having a flat engaging surface directly in contact with said pole-pieces and said magnet, and connections between said pole-pieces and said support for rigidly clamping the pole-pieces to said magnet and to said support.

10. In a magnetic field structure, the combination of a permanent magnet of horse-shoe shape, a pair of pole-pieces provided with extensions adapted to rest upon the face of said magnet, a non-magnetic support directly in contact with said pole-pieces, and connecting members secured to said extensions and to said support for rigidly clamping the pole-pieces to said magnet and to said support.

11. In a magnetic field structure, the combination of a permanent magnet provided with recesses, a non-magnetic support for said magnet, a fastening device including bolts arranged to enter said recesses for clamping the magnet to the frame, and a filling metal cast around the bolts in said recesses whereby the magnet and the fastening device are rigidly connected together.

12. In an inductor-generator for ignition purposes, the combination of a suitable support of non-magnetic material, a permanent magnet composed of sections provided with recesses, laminated pole-pieces secured to said support and in magnetic contact with the poles of said magnet, means arranged to enter said recesses for clamping and hold-

ing the magnet to the support independently of the pole-pieces, said pole-pieces being provided with a winding, and an inductor movable in proximity to said pole-pieces to vary the magnetic flux through the winding.

13. In an inductor-generator for ignition purposes, the combination of a suitable frame of non-magnetic material, a permanent magnet composed of sections, each section having depressions and projections arranged to register with corresponding projections and depressions on the sections adjacent to it, means for clamping said magnet to the frame, laminated pole-pieces in magnetic contact with the poles of said magnet, a winding on one of said pole-pieces, and an inductor movable in proximity to said pole-pieces to vary the magnetic flux through said winding.

14. In an inductor generator for ignition purposes, the combination of a frame of non-magnetic material, a pair of pole-pieces secured to said frame and each provided with two polar projections, two coils of wire, one in inductive relation to one of said projections on each pole-piece, a permanent field magnet composed of sections and having its poles in magnetic contact with each said pole-piece, connecting devices for holding said magnet in magnetic contact with said pole-pieces, the sections of said magnet being suitably recessed to receive parts of said connecting devices, and a movable inductor arranged to concentrate the magnetic flux alternately through one pair and then through the other pair of polar projections to vary the magnetic flux through said coils of wire.

15. In an inductor generator for ignition purposes, the combination of a frame of non-magnetic material, a pole-piece secured to said frame and provided with two polar projections, a coil of wire in inductive relation to one of said projections, a permanent field magnet composed of sections and having its poles in magnetic contact with said pole-piece, connecting devices for holding said magnet in magnetic contact with said pole-piece, the sections of said magnet being suitably recessed to receive parts of said connecting devices, and a movable inductor arranged to concentrate the magnetic flux alternately through one and then through the other of the polar projections to vary the magnetic flux through said coil of wire.

In witness whereof we affix our signatures, in the presence of two witnesses.

HENRY JOSEPH PODLEŠÁK.
TESLA EMIL PODLESAK.

Witnesses to the signature of Henry Joseph Podlešák:
Y. TOMÁŠEK,
F. PTÁČEK.

Witnesses to the signature of Tesla Emil Podlesak:
LILLIAN B. SHERMAN,
JOHN H. BONSALL.