T. M. MUELLER.

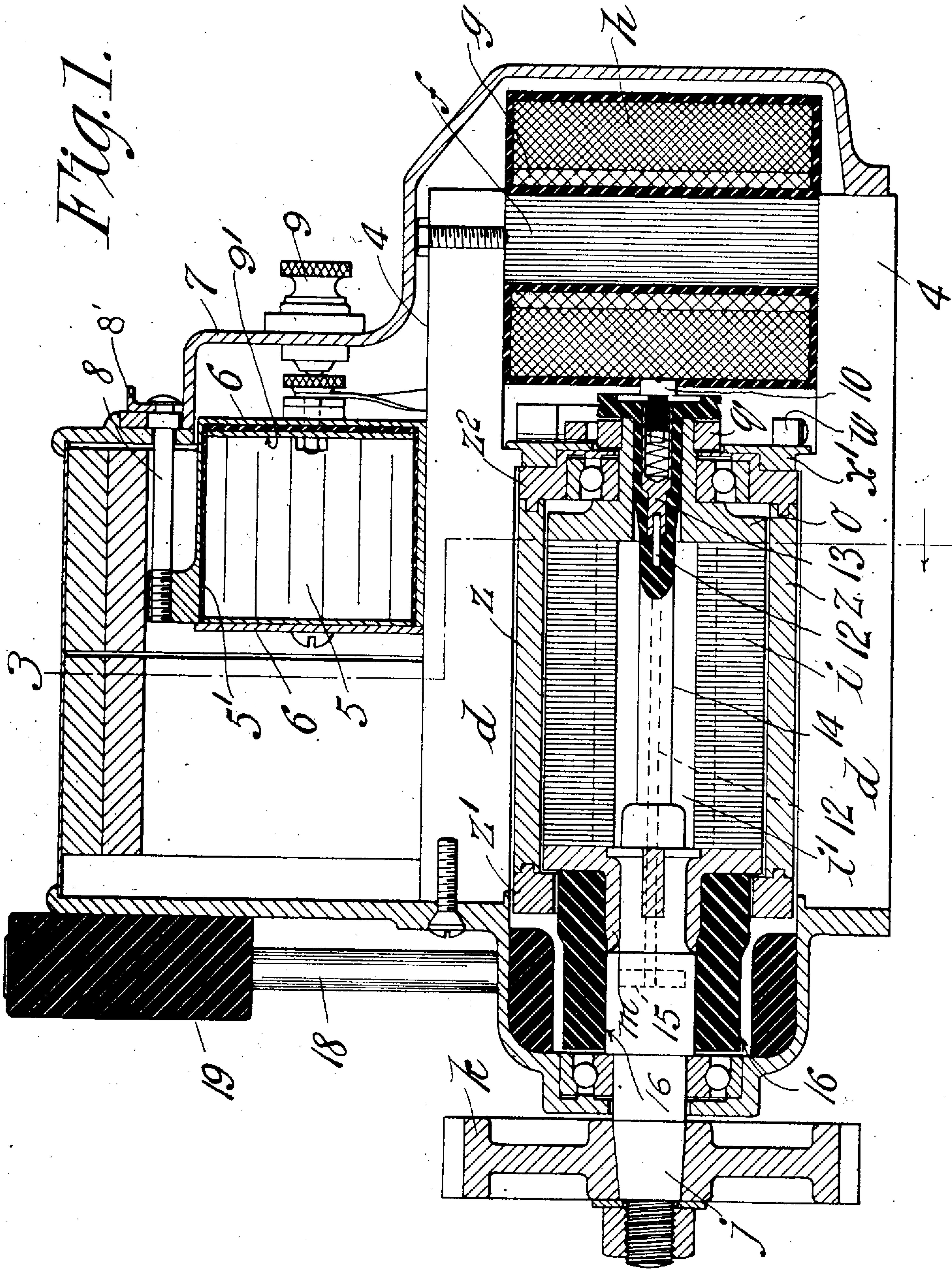
MAGNETO ELECTRIC MACHINE.

APPLICATION FILED FEB. 25, 1909.

943,697. Patented Dec. 21, 1909.

3 SHEETS—SHEET 1.

Fig. 1.



WITNESSES:

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3 SHEETS—SHEET 2.

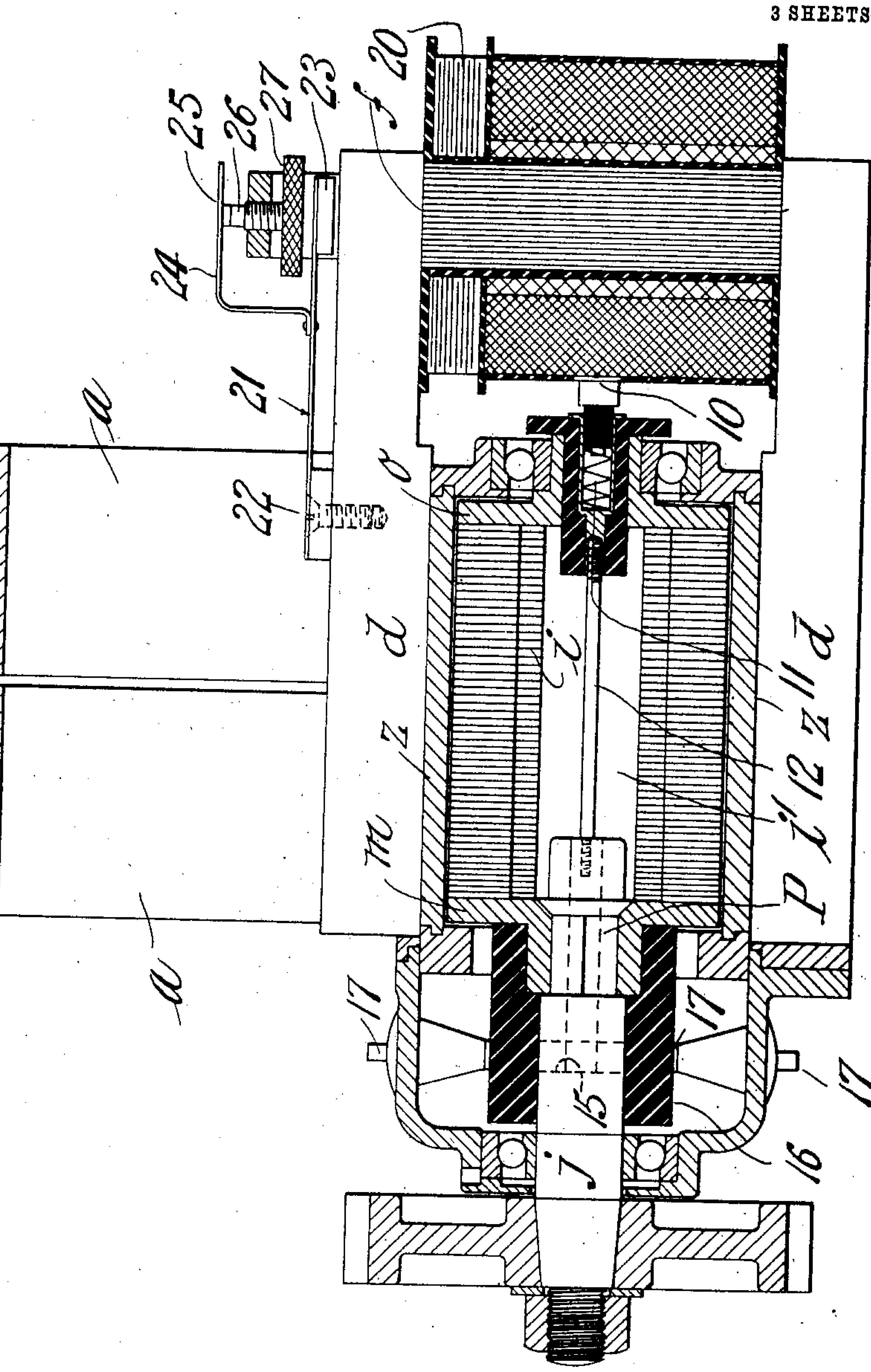

Fig. 2.

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3 SHEETS—SHEET 3.

Fig. 4.

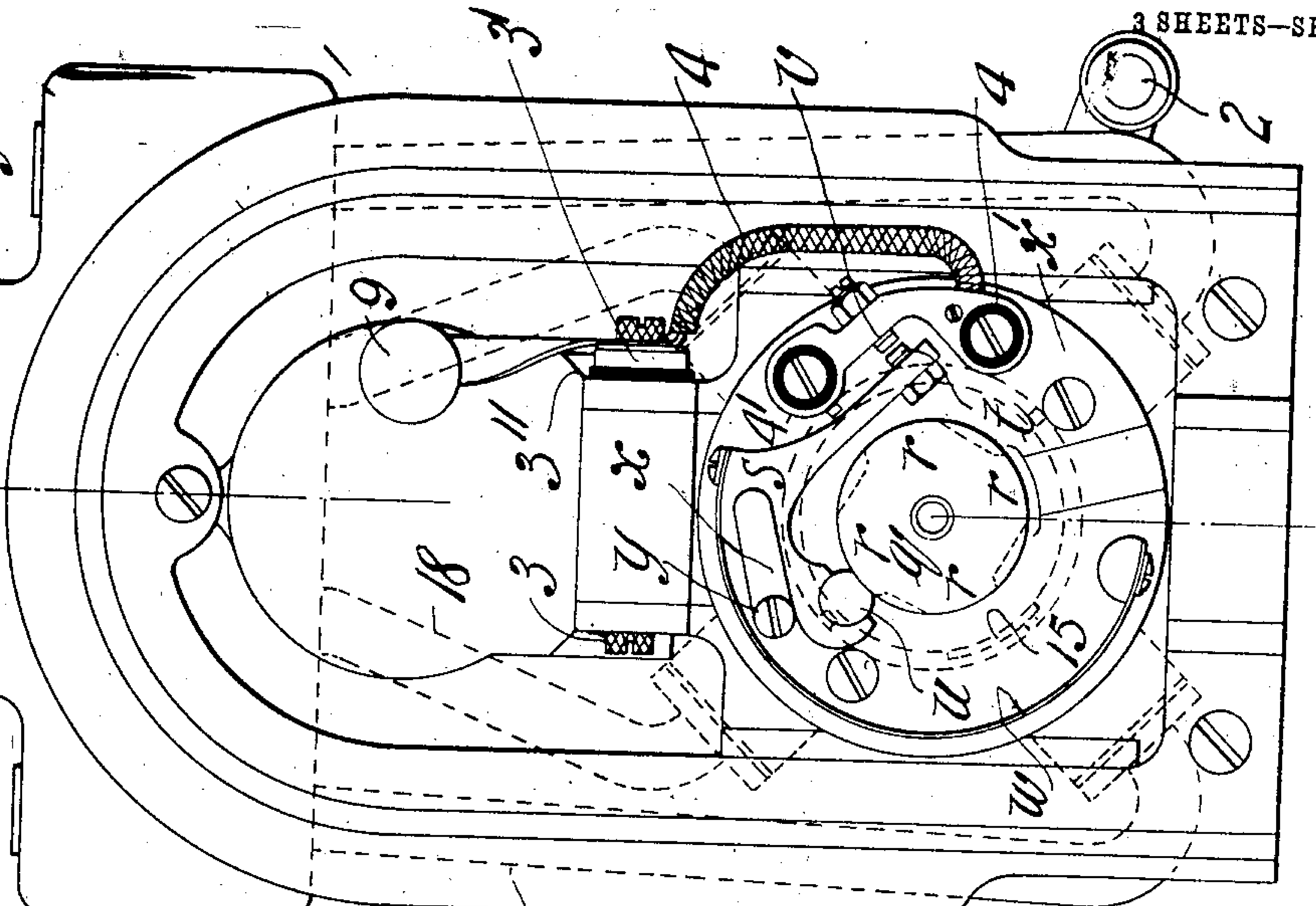
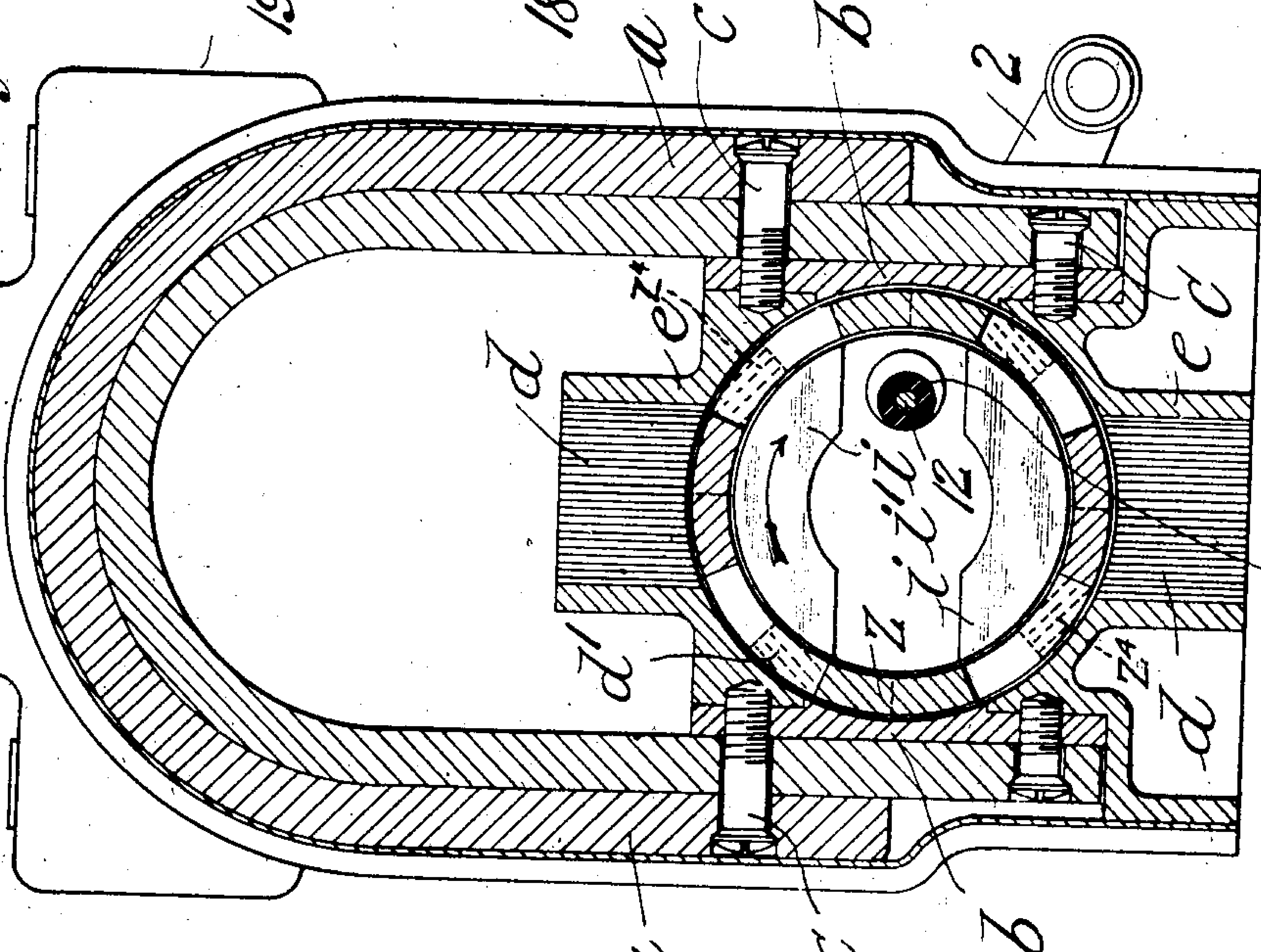


Fig. 3.



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MAGNETO-ELECTRIC MACHINE.

943,697. Specification of Letters Patent. Patented Dec. 21, 1909.

Application filed February 25, 1909. Serial No. 480,038.

To all whom it may concern:

Be it known that I, THEODOR M. MUELLER, a subject of the Emperor of Germany, residing at Dalton, in the county of Berkshire and State of Massachusetts, have invented new and useful Improvements in Magneto-Electric Machines, of which the following is a specification.

This invention relates to improvements in magneto electric machines of the inductor alternator type, and is designed for, and has as its object the generation of electric currents to be used in the ignition of the vaporous or gaseous charge in internal combustion engines, although I do not limit myself to this particular use.

The especial feature of the invention lies in the production of an electric generator which employs a simple armature or inductor element, and an adjustable element for varying the density of the magnetic flux through the inductor element.

The particular objects of the invention are,—(1) To provide means for rendering the different elements of the machine easy of access in case of needed repairs. (2) To provide means for the adjustment of certain parts of the machine so that the timing or the production of the spark may be regulated so as to correspond with the position of the piston movements, that is to say causing either an advanced or retarded ignition of the charge, as desired. (3) To provide for the location and arrangement of the primary and secondary windings so that there is absolutely no danger of injury to the same or failure to operate; (4) To provide a machine that is readily adapted for use either with a two-cycle or four-cycle engine of an internal combustion engine; (5) To provide means for advancing and retarding the spark and at the same time maintaining the maximum induction in the primary and secondary windings whereby the spark current is always maintained at the maximum amount.

Other objects of the invention will appear in the body of the specification and be particularly pointed out in the claims.

In the drawings forming part of this application,—Figure 1 is a detail, longitudinal, sectional view through the driving-shaft of the machine on the line 1—1 of Fig. 4, with certain parts omitted, clearly illustrating the laminated construction of the armature or inductor element, the arrangement and location of the primary and secondary windings, and also clearly illustrating the position of the condenser. Fig. 2 is a view similar to Fig. 1 but showing a slightly modified construction as regards the location of the condenser, and also in the make and break mechanism. Fig. 3 is a transverse sectional view on the line 3—3 of Fig. 1, clearly showing the construction of the armature or inductor element and the adjustable cylindrical element located between the pole-pieces and the armature. Fig. 4 is an end elevation of Fig. 1 with the end casing and coil removed illustrating the make and break mechanism and the cam carried on the armature shaft for operating the make and break mechanism; also showing in dotted lines the lead wires for conveying the spark current to the various cylinders of the engine.

Referring to the drawings in detail, *a* designates a compound permanent magnet provided with the soft iron pole-pieces *b* that are secured to the magnets *a* by means of the machine screws *c*. Located in a plane transverse to the plane of the magnet *a* are the soft iron laminated pieces *d* to which are secured the pieces *e* and into which the screws *c* extend for securing the same in place. Extending between the opposite ends of the laminated pieces *d* is the soft iron core *f* of an induction coil, the primary winding of which is shown at *g*, and the secondary at *h*.

i designates the soft iron arc-shaped laminations of the armature, the shaft of which is shown at *j*, which is driven by means of the spur-gear *k*, or any equivalent driving means. Said laminations are located between, and are secured to, the disk-shaped end pieces *m* and *o*, located on opposite sides of the shaft *j* as shown, being separated by an air space. The shaft *j* is provided with a squared end portion, as shown at P, that fits a correspondingly shaped socket in the end piece *m*, and is riveted over or welded to make a solid joint between the shaft *j* and the end piece *m*.

It will be noticed that the laminations *i* are spaced from each other, as shown at i^1, (Figs. 1, 2, and 3) thereby providing room for transmitting the spark current from the secondary winding of the induction coil to the distributer cables. The arc-shaped surface of the laminations *i* extends substantially through 135°, the purpose of which will be fully explained, although I do not confine myself to the exact number of degrees.

Located between the laminations i of the armature and the pole-pieces b and d is an adjustable slotted cylindrical member that is composed of a series of soft iron longitudinally arranged bars, as shown at z, and the location of these bars with relation to the pole-pieces and the laminations i, determines in a measure the output of the machine, or the wave form of the spark current.

Each pole-piece b, and the laminated bar d, and spaces d^1 extend through an arc of 45° and the extent of curvature of the bars z also extends through 45°. The laminations i of the armature therefore cover, as shown in Fig. 3, a distance equal to one bar and two spaces, or 135°, or two bars and one space.

Referring now to the make and break mechanism which is clearly illustrated in Figs. 1 and 4, and which is carried by the slotted cylindrical member: q designates a circuit breaker cam secured to the disk-shaped head-piece o of the armature and driven therefrom,—this cam being provided with the elevations r, four of which are shown. Operatively associated with the circuit breaker cam q is the make and break lever s that has a platinum contact point t, carried by its free end. The make and break lever s is provided with a hardened bearing piece, as shown at u, and is normally held against the fixed stop v by means of the leaf-spring w which is constantly in a state of stress. The contact lever s, and stop v are mounted on a circuit breaker plate x^1 which, in turn, is secured to the ring-shaped end member z^2 of the slotted cylinder member previously referred to. x designates a plate that is secured to the circuit breaker plate x^1 by means of the screw y for holding the contact lever s in place. 2 designates a handle that is suitably connected to the slotted cylindrical member by means of which the bars z and disk-shaped head z^1 and the circuit breaker plate x^1 are secured and may be moved from one position to another for the purpose of varying the amount of magnetic flux that flows from the permanent magnets a through the bars d and the core f of the induction coil, whereby the wave form of the current and voltage that flows from the secondary winding may be changed. It will be noticed that the bars z are adjustable, as shown in dotted lines in Fig. 3 at z^4, and that the laminations i are rotatable, as shown by the arrow in this figure.

Referring now to the electrical connections and the path of the currents of the machine: One end of the winding of the primary coil g is connected to the field or ground of the machine by means of the screw 3, the other end of the primary winding being connected to the contact or plate 3^1 which is screwed to the frame of the machine but insulated therefrom by means of the insulation 3. From said plate 3^1 a wire 4 makes connection with the platinum contact-piece v of the circuit breaker which is suitably insulated from the circuit breaker-plate x^1, as shown at 4^1. The current generated in the primary winding, when the armature is rotated, is therefore short circuited, as long as the points t and v are in contact, but is broken of course by means of the cam q moving the lever s which is in connection with the frame of the machine, or grounded. 5 designates the usual condenser which is connected in parallel or across the terminals of the make and break for the purpose of reducing or absorbing the spark, as usual; and is insulated from the frame of the machine, as shown at 5^1. This condenser is protected by means of an aluminum housing 6 and is held to the frame 7 by means of the bolt 8 and a latch 8^1. 9 designates a terminal by means of which the primary winding may be grounded when it is desired to cut out the operation of the machine. The terminal 9 is in electrical connection with the plate 9^1 of the condenser, which terminal provides means for connecting one side of the condenser, and also for grounding the other side.

Referring now to the secondary of spark current: One terminal of the secondary coil or winding h is connected to the primary winding, as at 3, the other terminal of the secondary winding being connected to the brass button 10, and the current is conveyed by means of the spring 11 and conductor 12, which is connected to the insulated tubular casing 13. The conductor 12 passes through the insulator of hard rubber 14 to the distributer segment 15. 16 designates a hard rubber insulator or housing for the high tension terminals 17 with which the distributer segment 15 contacts during the rotation of the armature or inductor. 18 designates cables connected to the terminals 17, and which lead to the cable sockets in the distributer plate 19, and from the sockets the high tension current is distributed by means of cables to the spark-plugs of the various cylinders in the usual manner.

In Fig. 2 (which shows a slightly modified construction) the condenser 20, instead of being placed some distance away from the primary winding, is located in close proximity thereto. The conductor in this case is provided with a perforation whereby the same may be placed over one terminal of the core f of the induction coil.

The make and break device shown in Fig. 2 is also somewhat different from that shown in Figs. 1 and 4: In this construction, 21 designates a leaf-spring which is secured to the part d by means of the screw 22, and carries at its outer end a soft iron armature

23. 24 designates a bent arm or finger-piece that is attached to the leaf-spring 21 and carries a contact point 25 which engages and disengages a contact-piece 26 that is made adjustable by means of the milled nut 27. The cylindrical slotted member, composed of the bars *z*, is adapted to be adjusted by means of the handle, whereby the time of sparking may be either advanced or retarded. It will also be observed that the primary and secondary windings *g* and *h*, and the condenser, can, if necessary, be readily removed from the machine and a new one substituted. Further, that the inductor element contains no moving wire.

The wiring connections employed in my machine are well known and have not, therefore, been elaborated in full.

It will also be understood that by reason of the make and break mechanism being carried by the slotted cylindrical member when the bars *z* are adjusted, the greatest induction will always occur when the make and break occurs, and therefore the adjustment of the spark, whether advanced or retarded, will always be of the same voltage, practically.

What I claim, is:—

1. A magneto-electric machine having in combination with the permanent field magnets thereof, a rotatable inductor element, an adjustable, but normally stationary element, located between the field magnets and the inductor element for varying the magnetic flux through the inductor element, an induction coil, the core of the same being included in the magnetic circuit, and means carried by the inductor element for making and breaking the primary circuit.

2. In a magneto-electric machine, permanent magnets, a magnetizable core element, an induction coil located thereon, an inductor element for periodically varying the flow of magnetic flux from the permanent magnet to the core element, and means for changing the density of magnetic flux passing from the permanent magnets to the core element, whereby the wave form of the current and voltage generated in the induction coil may be changed.

3. In a magneto-electric machine of the inductor alternator type, in combination, permanent magnets, magnetizable elements spaced therefrom and provided with an induction coil, an inductor element for periodically changing the magnetic condition of the magnetizable element, and adjustable means for varying the flow of the magnetic flux through said elements, said means comprising a series of soft iron bars spaced from each other, whereby an alternating current of electricity is produced.

4. In a magneto electric machine of the inductor alternator type, in combination, permanent magnets, magnetizable elements spaced therefrom and provided with an induction coil, an inductor element for periodically changing the magnetic condition of the magnetizable element, and adjustable means for varying the magnetic flux through said elements, said means comprising a series of bars spaced from each other, the inductor element having an arc-shaped outer surface.

5. In a magneto-electric machine, in combination, permanent magnets, and magnetizable elements having poles arranged substantially 90° apart, a coil having a primary and secondary, arranged on the magnetizable element, a rotatable inductor member comprising magnetizable members spaced from each other, and located within said poles, whereby alternating currents having two complete cycles per revolution for the inductor may be generated in the coil, means for changing the density of the flux in the magnetizable element, and a make and break carried by said means, as described.

6. In a magneto-electric machine, in combination, permanent magnets, and magnetizable elements having poles spaced substantially 90° apart from the poles of the permanent magnets, an induction coil having its primary arranged on the magnetizable elements, a rotatable inductor element, a slotted cylindrical element for changing the flux density in the magnetizable elements, a make and break device included in the primary winding and carried by the cylindrical element, whereby the make and break occurs in the primary at the maximum point of induction in the magnetizable elements.

7. A magneto electric machine having in combination with the poles of permanent magnets, a rotatable inductor element located therebetween, and a slotted adjustable element between the inductor and poles, said slotted element having magnetizable bars extending through an arc of substantially 45°, and spaces between the bars of 45° in extent, and the inductor element having an arc extending through substantially 135°, and each pole of the magnet being equal in extent to a bar of the adjustable element, a magnetizable element having its poles arranged in magnetic relation to said inductor element, an induction coil, the core of said coil being arranged in the path of the flux through said magnetizable element, substantially as described.

8. A magneto-electric machine having in combination with the permanent field magnets thereof, a rotatable inductor member composed of arc-shaped elements spaced from each other and located on opposite sides of the axis of said member, an adjustable, but normally stationary cylindrical element interposed between the field magnets and the inductor member for varying the magnetic flux through the inductor member, an induction coil, the core of the

same being included in the magnetic circuit, and means carried by the inductor member for making and breaking the primary circuit of said coil.

9. A magneto electric machine having in combination with the permanent field magnets thereof, a rotatable inductor member consisting of sets of laminations, said sets being spaced from each other, an adjustable but normally stationary element located between the field magnets and the inductor elements for varying the flux in said element, a magnetizable member adapted to be energized from said inductor, and an induction coil included in the flux of said magnetizable member, substantially as described.

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Witnesses:
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