June 19, 1923. 1,459,397

R. R. HERRMANN

SELF INDUCTION COIL

Filed May 2, 1919 2 Sheets-Sheet 1

Fig. 1.

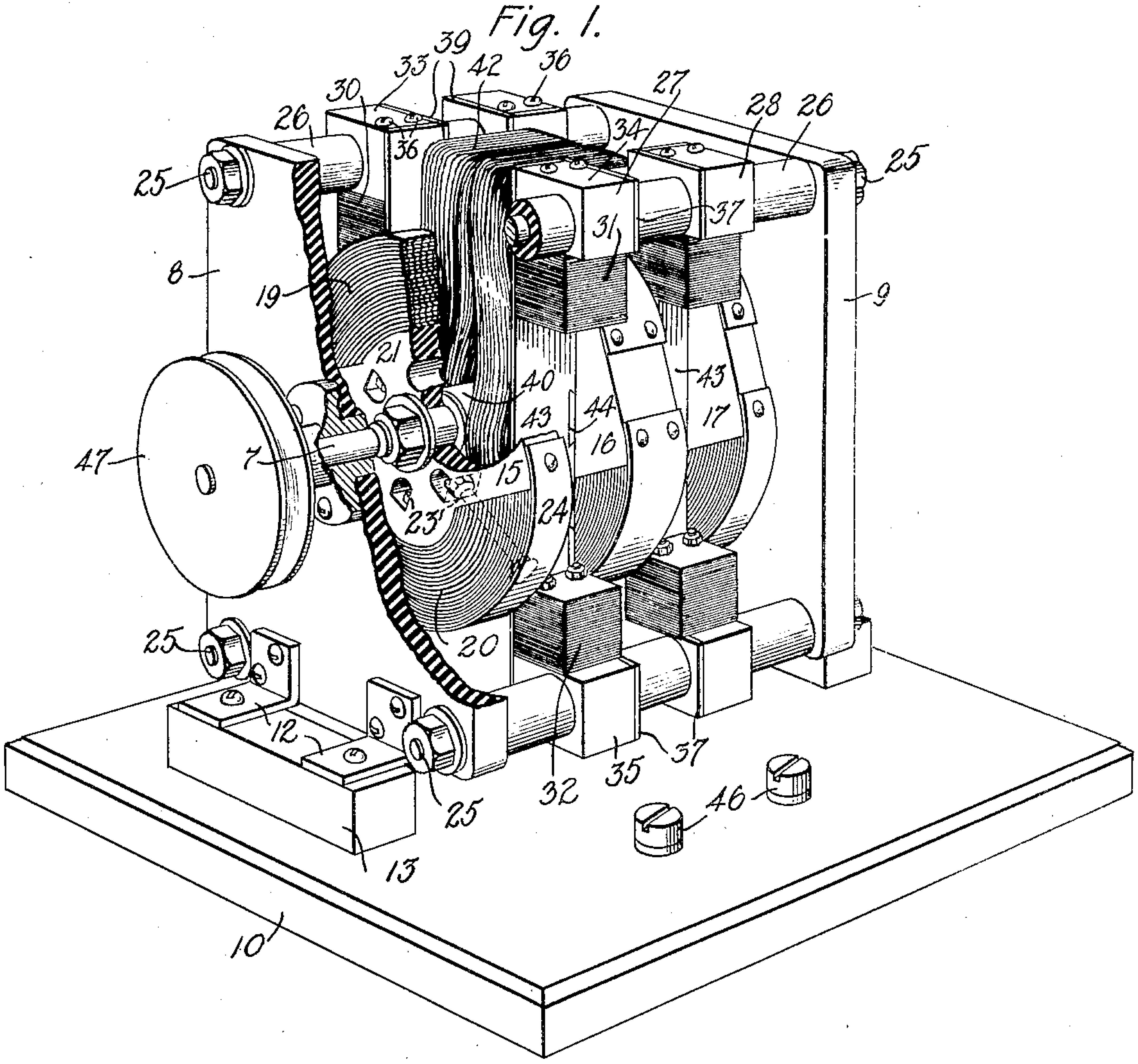
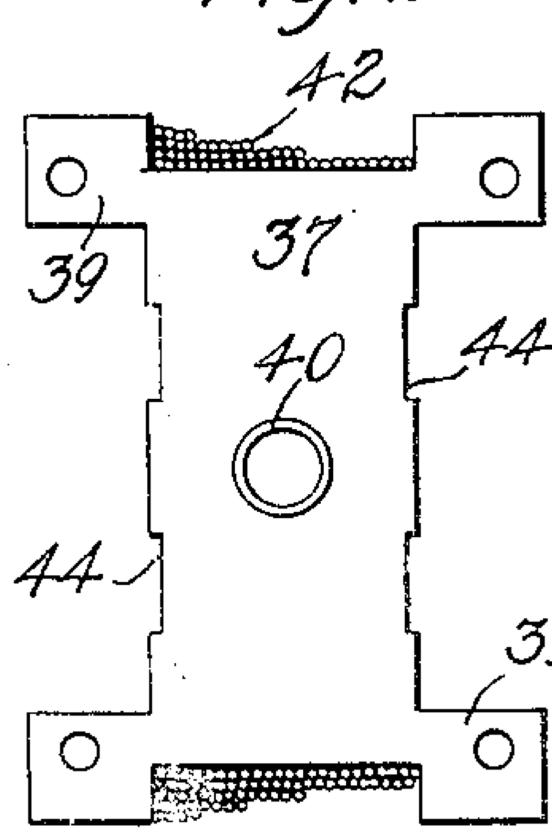


Fig. 2.



Inventor:
Raymond R. Herrmann.
by J. G. Roberts
Att'y.

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Fig. 3.

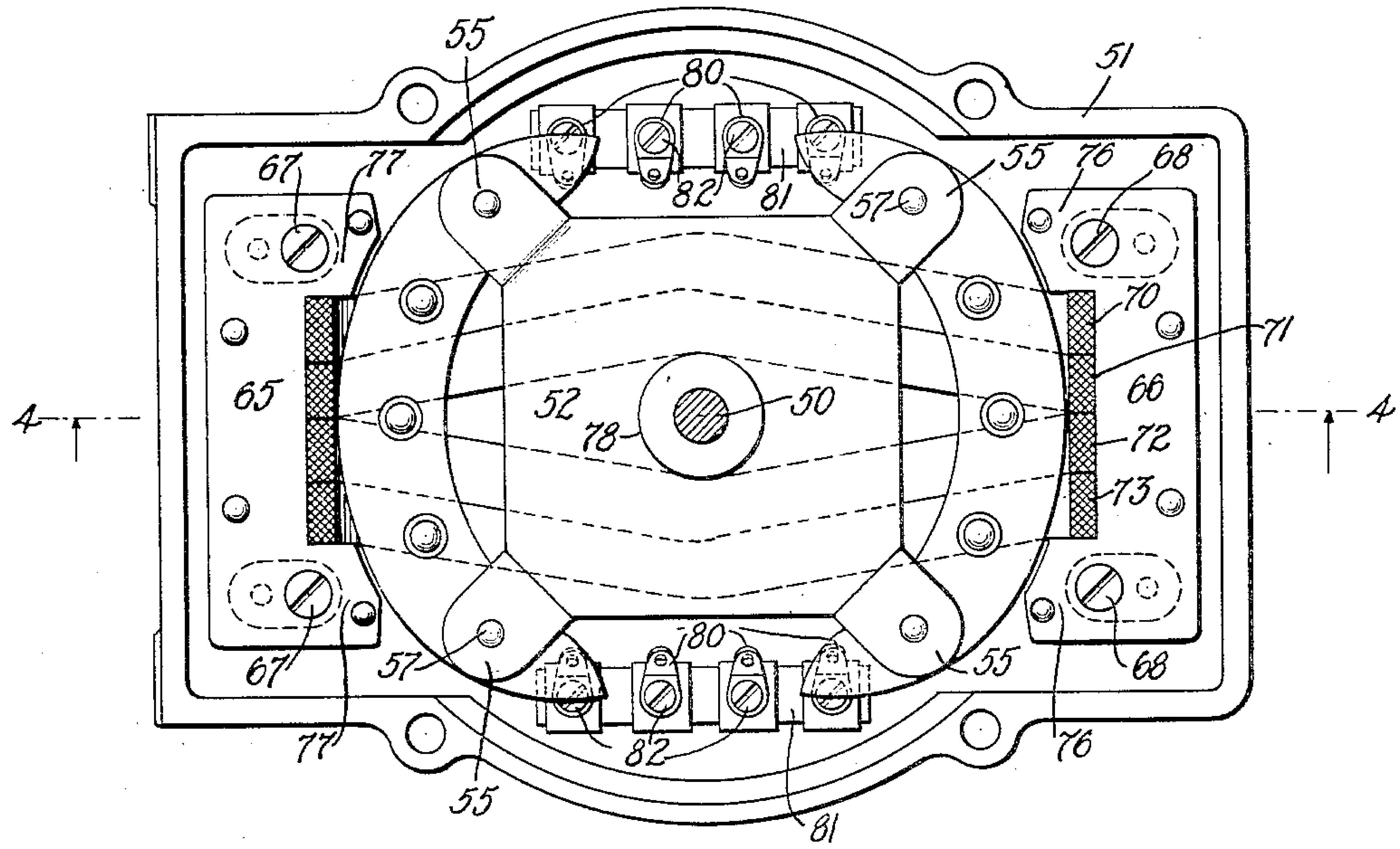


Fig. 4.

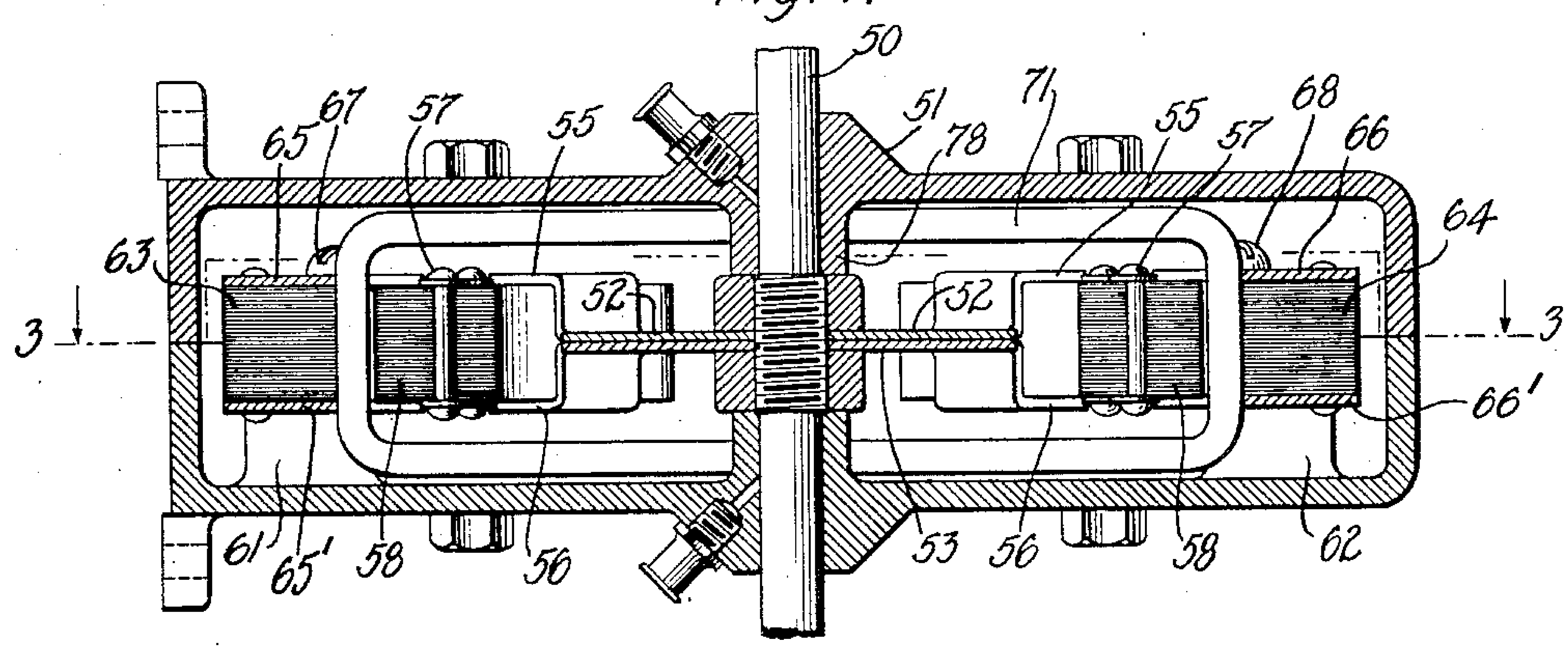


Fig. 5.

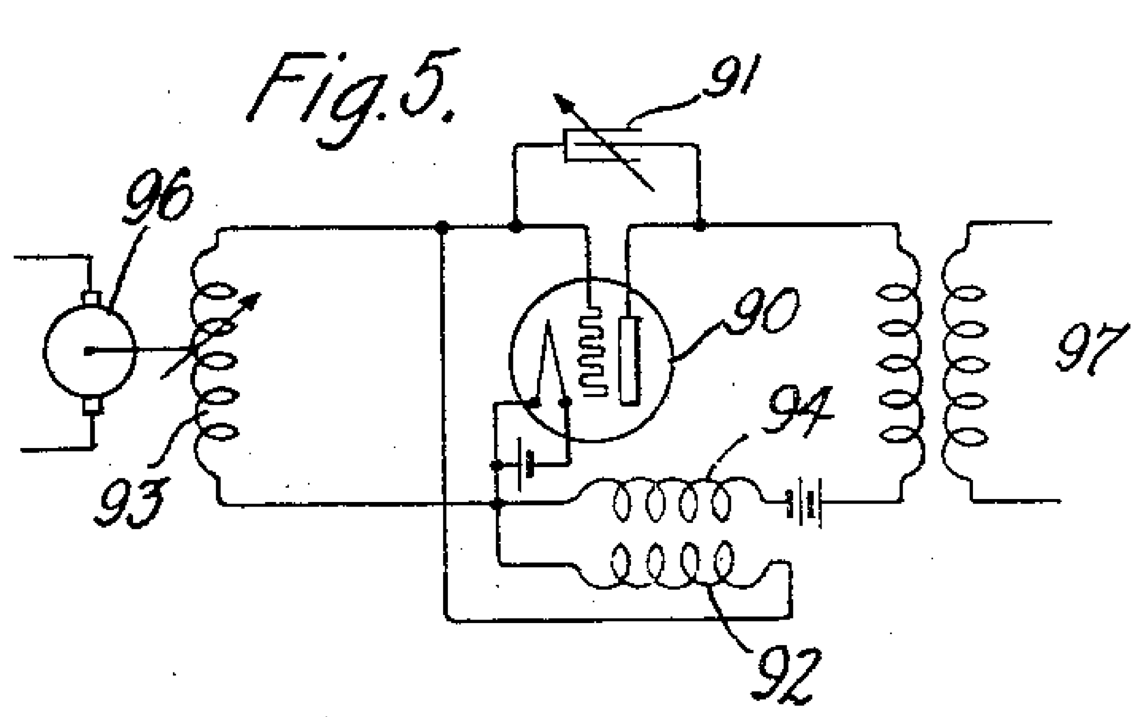
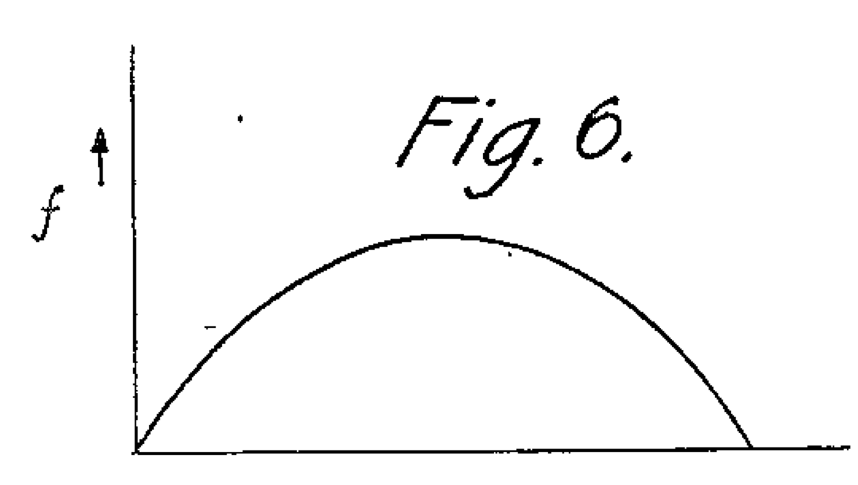


Fig. 6.



Inventor:
Raymond R. Herrmann.
by J. G. Roberts Att'y.

Patented June 19, 1923. **1,459,397**

UNITED STATES PATENT OFFICE.

RAYMOND R. HERRMANN, OF NEW YORK, N. Y., ASSIGNOR TO WESTERN ELECTRIC COMPANY, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

SELF-INDUCTION COIL.

Application filed May 2, 1919. Serial No. 294,217.

To all whom it may concern:

Be it known that I, Raymond R. Herrmann, a citizen of the United States, residing at New York, in the county of Bronx and State of New York, have invented certain new and useful Improvements in Self-Induction Coils, of which the following is a full, clear, concise, and exact description.

This invention relates to a self-induction coil, and more particularly it relates to a self-induction coil the inductance of which may be continuously varied within given limits.

It is well known in the art that the inductance of a coil depends upon the value of the magnet flux flowing therethrough, increasing in value with increase in the flux and decreasing with decrease in the magnetic flux. An object of this invention is to provide means for varying the magnetic flux through a coil so that the value of its inductance may be variable and may, if desired, be made to vary cyclically between upper and lower limiting values.

In the preferred form of this invention, this variation in the magnetic flux flowing through a coil is accomplished by placing the coil between stationary pole-pieces and rotatable magnetizable material, and rotating the magnetic material so that the amount of the material in the magnetic field of the coil is varied. In the preferred form of this invention neither the stationary or rotatable members are permanent magnets, although they may be permanently magnetized if desired.

This invention will be better understood from the following detailed description taken in connection with the accompanying drawings in which Fig. 1 shows a perspective view, with certain parts broken away, of one form the variable inductance may have. Fig. 2 is a plan view of a coil supporting plate forming a part of the variable inductance shown in Fig. 1. Figs. 3 and 4 illustrate another form the invention may assume. Fig. 5 shows diagrammatically, a circuit arrangement in which the variable inductance of this invention is employed to vary the frequency of the waves generated by an oscillation generator, and Fig. 6 shows in the form of a curve, how the frequency of such a generator will vary with time.

Referring to Fig. 1 of the drawings, 7 is a shaft rotatably mounted between the end plates 8 and 9 of insulating material. Plate 8 is fastened to the base 10 by means of angle braces 12, and a block 13, the latter being suitably fastened to the base 10. Similar supporting means for the plate 9 are provided. The shaft 7 carries three spaced disc armatures 15, 16 and 17, each of which is provided with opposed pole-pieces such as 19 and 20, of laminated strips of silicon steel, for instance, and which are circumferentially incomplete. The laminations for armature 15 are suitably fastened to the insulating core 21 by a plurality of bolts and nuts 23, and a retaining band 24. Similar fastening means are provided for the other armatures 16 and 17.

The plates 8 and 9 are provided with four bolts 25, each of which carries a plurality of spacers 26 for suitably spacing the frames 27 and 28 which carry the stationary pole-pieces. The frame 27 supports four cubical polar projections 30, 31, 32 and another one, not shown, but positioned below 30 in the same relative position thereto as 32 to 31. The laminations of each of the stationary pole-pieces may be of silicon steel, and are fastened to corresponding insulating blocks 33, 34 and 35 by means of bolts 36. The four pole projections and their supporting insulating blocks 33, 34 and 35 are held in position against the outer face of a plate 37 of insulating material shown in Fig. 2. This plate 37 has four apertured corners 39, which are adapted to receive the supporting bolts 25. The plate 37 is provided with a cylindrical sleeve 40, shown in Figs. 1 and 2, through which the shaft 7 is adapted to pass. The sleeve 40 forms a support for the winding 42, and prevents this winding from coming in contact with the shaft. The windings are prevented from spreading laterally by means of the insulating strips 43, which are fastened at right angles to either side of the insulating plate 37 by means of the dove-tail 44. The framework 27 thus comprises the insulating blocks 33, 34 and 35 and the plate 37. The insulating supporting frame 28 comprises a plate similar to the plate 37, and a side piece 43 is provided on the opposite side of the armature 16.

The coil 42 is a single coil of a suitable number of turns, and electrical connections may be made to it by means of the binding posts 46.

From the description, it is, therefore, apparent that the inductance of the winding 42 depends upon the relative positions of the stationary and movable pole pieces so that if the shaft 7 is rotated by a motor coupled to pulley 47, the value of the inductance of coil 42 will be cyclically and continuously varied between maximum and minimum values. The rotatable armatures at times serve to substantially complete a magnetic circuit for the coil.

Fig 3 is a view in plan, and Fig. 4 a cross-sectional view of another form that this invention may assume. In Fig. 3, the upper half of the casing 51 has been removed. Referring to these figures, 50 is a shaft rotatably mounted in the casing 51. This shaft carries two plates 52 and 53 each of which has four apertured corners 55 and 56 which are bent away from each other so as to include therebetween a plurality of laminated strips 58, fastened to the plates by the bolts 57.

Supported by the two bosses 61, 62 are two stationary pole-pieces 63 and 64, which consist of laminated strips of silicon steel, for instance, that are held between the brass plates 65, 65′, 66 and 66′ by bolts 67 and 68. Located between the movable and the stationary pole-pieces are four coils 70, 71, 72 and 73 which are sprung against the stationary pole-pieces and are held laterally in place by the corners 76 and 77 of these pole-pieces. The two pairs of coils are separated by the shaft 50 and are prevented from touching it by the sleeves 78.

In Fig. 3 are shown eight terminals 80 to which the ends of the four coils may be connected. These terminals 80 are mounted on insulating blocks 81 by bolts 82 which pass through the casing 51 to provide external connections, not shown, thus allowing the coils to be used singly, serially or in any combination to obtain the amount of inductance desired in any given case.

Fig. 5 shows how the variable inductance of this invention may be employed in the circuit of a generator in order to vary continuously and cyclically the frequency of the oscillations generated thereby. 90 is an oscillation generator of the vacuum tube type. In its input circuit is included a capacity 91 and two inductances 92 and 93 connected in parallel. The inductance 94 in the output circuit of the tube is inductively related to the inductance 92 in the input circuit. As is well known in the art, the tube 90 with such a circuit arrangement will generate oscillations of a frequency depending upon the values of the inductance and capacity associated therewith. If now, the variable inductance 93 is of the form similar to the one shown in Figs. 1 or 3, and a motor 96 is provided for rotating the inductance to vary its value, it follows that the generator 90 will deliver to the outgoing line 97, oscillations that will vary cyclically and continuously in frequency. However, the idea of varying the frequency by changing the inductance of the oscillation circuit of a generator to give a uniformly, continuously and cyclically varying frequency, is not a part of this invention, but is the invention of another and is described and claimed in a copending application to F. W. Isles, Serial No. 328,626, filed October 6, 1919.

Fig. 6 illustrates how the frequency of the generated oscillations rises and falls in value, as the value of the inductance 93 is varied from minimum to maximum and then to minimum again. The ordinates correspond to values of the frequency and the abscissae represent time. The character of the curve will depend on the design of the rotatable pole-pieces of the variable inductance, so that with properly designed pole-pieces the curve may have any slope desired.

It is to be understood that the forms of this invention described above, may be considerably modified without departing in any way from the spirit of this invention, as defined in the appended claims.

What is claimed is:

1. A variable inductance comprising a stationary magnetic member, a rotatable disc on either side of said stationary magnetic member, said disc containing sections of magnetic material separated from each other by insulating material, and a coil located between said discs and having its axis at right angles to the axis of rotation of said discs.

2. A variable inductance comprising a plurality of rotatable discs containing magnetic material, a plurality of stationary magnetic pole-pieces arranged in a plane parallel to said discs and between said discs, and an inductance coil wound between said discs and said stationary pole-pieces, said coil having its axis at right angles to the axis of rotation of said discs.

3. A variable inductance comprising a base, end plates supported by said base, a rotatable shaft in said plates, a plurality of discs on said shaft containing magnetic material, a stationary framework located between said discs and supported by said end plates, magnetic pole-pieces supported by said framework, and an inductance coil wound around said framework, said coil having its axis at right angles to said shaft.

4. A variable inductance comprising a base, end plates supported by said base, a rotatable shaft in said plates, a pulley on said shaft, a plurality of rotatable discs on said shaft each comprising a plurality of sections of magnetizable material separated from each other by insulating material, a stationary framework located between said discs and supported by said end plates, magnetic pole-pieces supported at the corners of said

framework, means for preventing said coil from coming into contact with said shaft, and an induction coil wound around said framework and having its axis at right angles to said shaft.

5. A variable inductance comprising a rotatable shaft, a plurality of pole-pieces fastened to said shaft, a plurality of stationary pole-pieces arranged with respect to each other in a plane substantially at right angles to said shaft, and an induction coil located in the field of said pole-pieces and having its axis parallel to the plane of said stationary pole-pieces, and means comprising a sleeve around said shaft for preventing said winding from coming in contact with said shaft.

6. A magneto-electric device comprising a rotor, a stator framework, a shaft for said rotor, and a coil surrounding said framework and positioned at one side of said shaft, said rotor comprising a plurality of separated discs on said shaft located on opposite sides of a portion of said stator.

7. A magneto-electric device comprising a rotor, a stator framework, a shaft for said rotor, and a coil surrounding said framework, portions of the turns of said winding extending in opposite directions from said shaft, said rotor comprising magnetic material external to said coil and magnetic material within said coil, said first mentioned magnetic material being located entirely outside of said coil during a complete rotation of said rotor.

8. A variable inductance comprising a stationary magnetic member, a coil associated with said member, a rotatable magnetic member surrounded by said coil, and a second rotatable magnetic member external to said coil for completing around said coil a path for magnetic flux in said stationary and said first rotatable members, said members being insufficiently magnetized to generate an appreciable current in said coil.

9. A variable inductance comprising a stationary magnetic member, a coil associated with said member, a rotatable magnetic member surrounded by said coil, and a second rotatable magnetic member external to said coil for completing a path around said coil for magnetic flux in said stationary and said first rotatable members, said rotatable members having parallel axes, said members being insufficiently magnetized to generate an appreciable current in said coil.

10. A variable inductance comprising a stationary magnetic member, a coil associated therewith, and a rotatable magetic member surrounded by said coil, said rotatable member comprising a circumferentially complete disc, said disc being divided into a small number of sectors, alternate sectors consisting entirely of magnetic material, the remaining sectors consisting entirely of insulating material, said members being insufficiently magnetized to generate an appreciable current in said coil.

11. A variable inductance comprising a stationary magnetic member, a coil associated with said member and a plurality of rotatable magnetic members associated therewith for completing at times a substantially closed magnetic circuit through said stationary member and around a part of said coil, said members being insufficiently magnetized to generate an appreciable current in said coil.

12. A variable inductance comprising a stationary magnetic member, a coil associated with said member, a rotatable magnetic member on one side of said coil and a second rotatable member on another side of said coil for completing at times a substantially closed circuit through said stationary member and around a part of said coil, said members being insufficiently magnetized to generate an appreciable current in said coil.

13. A variable inductance comprising a coil, a magnetic core for said coil substantially closed at times and comprising a rotatable magnetic member within said coil and a rotatable magnetic member external to said coil, said members being insufficiently magnetized to generate an appreciable current in said coil.

In witness whereof, I hereunto subscribe my name this 29th day of April A. D., 1919.

RAYMOND R. HERRMANN.