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International application number:		**PCT/EP2017/079687**
International filing date:		**17 November 2017 (17.11.2017)**
Document type:		**Certified copy of priority document**
Document details:	Country/Office:	**US**
	Number:	**62/496,057**
	Filing date:	**04 October 2016 (04.10.2016)**
Date of receipt at the International Bureau:		**11 January 2018 (11.01.2018)**

Remark: Priority document submitted or transmitted to the International Bureau in compliance with Rule 17.1(a),(b) or (b-*bis*)

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APPLICATION NUMBER: *62/496,057*
FILING DATE: *October 04, 2016*

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62/496057
10/04/2016

PTO/SB/16 (03-13)
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PROVISIONAL APPLICATION FOR PATENT COVER SHEET – Page 1 of 2

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c).

Express Mail Label No. ______________________

INVENTOR(S)

Given Name (first and middle [if any])	Family Name or Surname	Residence (City and either State or Foreign Country)
Robert Ray	Holcomb	Sarasota,Florida

Additional inventors are being named on the ______________ separately numbered sheets attached hereto.

TITLE OF THE INVENTION (500 characters max):

Solid State Multi-Pole and Uni-Pole Electric Generator Rotor for AC/DC Electric Generators

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ENCLOSED APPLICATION PARTS (*check all that apply*)

☐ Application Data Sheet. See 37 CFR 1.76.
☐ CD(s), Number of CDs ______________
☑ Drawing(s) *Number of Sheets* 62
☐ Other (specify) ______________
☑ Specification (e.g., description of the invention) *Number of Pages* 36

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PROVISIONAL APPLICATION FOR PATENT COVER SHEET – Page 2 of 2

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

- [x] No.
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SIGNATURE Robert Ray Holcomb DATE 09/30/2016

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Title of the Invention

Solid State Multi-Pole and Uni-Pole Electric Generator Rotor for AC/DC Electric Generators

Inventor

Robert Ray Holcomb MD, Ph.D.

Cross-Reference to Related Applications

The following applications are related:

1. High Efficiency AC/DC Electric Motor, Electric Power Generating Systems with Variable Speed, Variable Power, Geometric Isolation and High Efficiency Conducting Elements (PCT/IB2013/054184)

Statement Regarding Federally Sponsored Research:

Not Applicable

Assigned To:

Redemptive Technologies LTD

Background of the Invention

1. Field of the Invention

The method and application of this invention relates to the use of a unique solid state rotor system for an electric generator for the conversion of energy from electrons in the environment into electrical energy in the form of either alternating current (AC) or direct current (DC) with reduced electromagnetic drag which is commonly referred to as reverse torque, thereby greatly improving the operating efficiency of the generator. This improved efficiency through removal of reverse torque is attained by a unique solid state static rotor in which the rotor body does not rotate, only the magnetic poles rotate at the desired frequency for the full 360 degrees of rotation. Reverse torque is not a factor because the rotor body does not rotate.

2. Background

Rapid depletion of the earth's fossil fuel sources along with environmental pollution of land, air and water with simultaneous climate change makes obvious the clear and urgent need for alternative energy supplies which are efficient, requiring no fossil fuels and are non-polluting.

The singular contribution for safely resolving the earth's demand for increasing energy consumption is to increase the efficiency of electrical power generation by removing reverse torque from the rotary electric power generator. Removal of reverse torque from rotary generators associated with converting mechanical energy into electrical power can provide an opportunity for an electrically powered, self-sustaining power generation plant. Removal of the reverse torque allows an alternating current (AC) or direct current (DC) generator, to operate with a 4-500% increase in efficiency, thereby driving the generator with a smaller electric motor, a self-sustaining electric power plant is operable.

The world's first electrical generator was Faraday's disk dynamo. Michael Faraday discovered the operating principle of electromagnetic generators in the years 1831 – 1882. These observations were later reduced into a principle called Faraday's Law written by James Clerk Maxwell. The law simply states that an electromagnetic force is generated in an electrical conductor that encircles a varying magnetic flux. Faraday built the first magnetic rotary induction generator called a Faraday Disc. This first machine was a type of homo polar generator, using a copper disc rotating between the poles of a horseshoe magnet. This generator produced a small DC voltage, but high amperage. The Faraday dynamo or unipolar generator does not lend itself well to practical commercial development because of the nature of its output, i.e. it produces very low DC voltage at extremely high current.

However, the Faraday one piece homo polar generator does lend itself well to study the mechanisms of reverse torque in electrical induction machines.

All standard generators in use today require by definition, 1 horsepower of kinetic energy input to generate 746 watts of electrical energy.

This relationship of mechanical horsepower to electrical watts involves derived units of power which have evolved from observations and measurements on physical and electrical machines (as well as horses!)

The term "watt" was named after James Watt, a Scottish scientist, for his work on improving the steam engine and quantifying the power of the steam engine. The unit "watt" was recognized by the Second Congress of the British Association for the Advancement of Science in 1882, concurrent with the start of commercial power production. The dynamo was the first electrical generator capable of delivering power to industry and is still the most important generator in use even to this day. The dynamo uses a particular machine design and electromagnetic principles to convert mechanical rotation into an alternating electric current. The first commercial power plants which were operated in Paris in the 1870's were designed by Zenobe Gramme. The use of electric generators made it desirable to establish a common unit for electrical power in order to standardize this newly evolving energy source. The watt is a derived unit of power (i.e. an algebraic combination of base units). The watt is now an approved unit of the international system (SI). In 1960 the 11th General Conference on Weights and Measures adopted it for the measurement of power into the International System of Units (SI).

The watt is defined:

1 watt is the rate at which work is done when an object's velocity is held constant at 1 meter per second against a constant opposing force of 1 newton.

$W = J / S = N.M / S = Kg.M^2 / S^3$

J = Joule M = Meter N = Newton Kg = Kilogram

Joule = Work done when a force of 1 Newton is displaced through a distance of 1 Meter

1 Joule = 1 watt-second, 10^7 ergs = 0.2390 calories or 0.738 ft-lb.

Therefore if 1 (one) mechanical horsepower is equal to 550 ft-lb per second (or 33,000 ft-lb per minute), then by definition of the watt being 0.738 ft-lb per second,
1 hp = 550 ft-lb per second / 0.738 ft-lb per second = 745.257 watts

and by definition the electrical watt is the rate at which work is done when 1 ampere (A) of current flows through an electric potential difference of 1 volt (V):

W = V A

745.257 watts = 27.299 V × 27.299A or any combination of amps and volts in which the product is equal to 745.257 watts.

Therefore by definition and derivation 1 hp = 746 watts

The original work on which these standards units hinge was performed by James Watt who introduced the term "horsepower" when he wanted to explain how powerful his steam engines were compared to horses. After some tests (not with engines, rather with horses), he established that, on average, the horses being used could pull coal up a mine shaft at the rate of 22,000 ft-lb per minute. For whatever reason, he decided to raise this number by 50% and arrived at a number which is commonly accepted as 33,000 ft-lb per minute. So, if an engine or any rotary machine can push 33,000 lbs of something 1 ft in 1 minute, we say it is a 1 hp engine.

A standard generator requires, by definition, 1 hp to generate 746 watts plus enough additional horsepower to turn the physical mechanisms of the rotor at proper speed to maintain the desired frequency. The hp required to spin the mechanism is usually about 0.2 hp in a standard generator to generate 746 watts for a total 1.2 horsepower to generate 746 watts, although only 0.2 hp of that energy is used to actually generate electrical power. The remaining 1 hp which is equal to 746 watts is required to overcome the reverse torque or so-called "back EMF".

The "back EMF" or "reverse torque" of all rotary generators in use today can best be described by reference to "Lenz's Law" which in summary states that when an EMF is generated by a change in magnetic flux according to Faraday's Law, the polarity of the induced EMF is such that it produces a current whose magnetic field opposes the magnetic flux which produces it. The induced magnetic field inside any loop of wire always acts to keep the magnetic flux in the loop constant. If the B field is increasing the induced magnetic field acts in equal and opposite direction to it, if it is decreasing the induced magnetic field acts in the direction of the applied field with equal force. In all standard generators, the rotor is stationed inside the coil loops of the stator, therefore the rotor generates a current which in turn generates a magnetic field which is equal in force and opposite in polarity, hence reverse torque is a product of the design.

In the case of the HEG the rotors are solid state and do not rotate, the magnetic poles rotate, therefore there is no reverse torque or pole to pole magnetic drag between the rotor and the stator. This induced pole in the stator iron is induced by current flow, it is in no way responsible for a current flow, as is evidenced by the fact that the generator reaches full voltage prior to current going to an electrical load.

Due to the reverse torque, about 85% more mechanical energy is required to turn the rotor than is required to generate power.

In the case of the HEG with respect to the current invention it only requires energy to excite the rotor to generate the rotating magnetic poles. Therefore the system takes the power required and cycles it back to drive the generator and the remaining power is usable electric power to be used for whatever purpose is required.

Please see accompanying figure – this depicts actual data off of the HEG alongside two standard "off the shelf" generators. Power output vs. power input demonstrating the reverse torque with increasing load for a standard generator and no reverse torque for the increasing load in the case of the HEG. This proves that reverse torque is not a requirement for power generation.

The "back EMF" or "reverse torque" of all rotary generators in use today can best be described by reference to Lenz Law which in summary states that when an EMF is generated in an electrical conductor that encircles a varying magnetic flux according to Faraday's Law, the polarity of the induced EMF is such that it produces a current whose magnetic field opposes the magnetic flux which produces it. The induced magnetic field inside any loop of wire always acts to keep the magnetic flux in the loop constant.

If the "B" field is increasing the induced magnetic field acts in equal and opposite direction to it, if it is decreasing the induced magnetic field acts in the direction of the applied field with equal force. In all standard generators, the rotor is stationed inside the coil loops of the stator, therefore the rotor generates a current which in turn generates a magnetic field which is equal in force and opposite in polarity, hence reverse torque is a product of the design. The Lenz losses are related to inductive coupling between the rotor standing poles and the stator induced poles. In addition to our current work and observations on reduction of reverse torque, Nikola Tesla published an article entitled "Notes on an Unipolar Dynamo", Nikola Tesla, The Electrical Engineer, N.Y. September 2, 1891. Tesla reported upon a modification of the Faraday Dynamo design. The design varied in two major ways:

1. First, he used a magnet that was bigger in diameter than the disc, so that the magnet completely covered the disc.
2. Second, he divided the disc into sections with spiral curves out from the center of the outside edge.

The Tesla modification caused the current to make a full trip around the outside edge of the disc. Because the current is flowing in a large circle at the rim of the disc, the magnetic field created does not work against the field magnet. This modification eliminated the biggest problem of electric power generation i.e. the reaction to every action or as is commonly called, reverse torque or back EMF.

This design change and its effect on reverse torque was accomplished by geometric isolation of the standing pole from the induced pole of the machine. In the case of the current invention, the rotor is static therefore reverse torque is not an issue. The induced pole is induced by current flow which is generated by the standing pole. The induced pole is in no way responsible for current flow or power generation in the induced coils. This design change fully removes Lenz losses produced by the induced stator poles attracting and repelling polar coupling between the stator poles and the rotor poles.

The solid state rotor of this invention is virtually free of reverse torque due to four design changes when compared to the standard electric rotary generator:

1. The rotor of the solid state system has no moving parts.
2. The rotor does not rotate in the stator cavity.
3. The magnetic poles rotate in proper frequency and sequence to generate the desired electric power output.
4. The solid state rotor can be used to retrofit any standard generator, single-phase, two-phase or three-phase.

Notes to Consider:

1. Please see graph of power to load (base load has been subtracted in all cases) from actual data of HEG and standard generators. This is power required to generate each unit of power. The graph reveals 1 unit of input power to the generator shaft for each unit of power generated in the case of the standard generators. In the case of the High Efficiency Generator, no additional power is required above baseline requirements regardless of the power generated to a load.
2. A commercial contract has been signed for a multi megawatt order such that this technology, featuring the eliminated reverse torque, will be operating in a commercial environment.

PROOF OF COMMERCIAL UTILITY IS AS FOLLOWS:

1. The design changes in the High Efficiency Generator are not anticipated by Lenz and therefore do not violate Lenz Law. No power is created – reverse torque has been removed and therefore it takes only the amount of input power required to excite the rotor poles without effecting the usual amount of power which the generator would produce had the reverse torque not been removed.
2. **Mathematical pr of** of the removal of reverse torque was demonstrated utilizing Maxwell's equations which are a set of partial differential equations that, together, with

Lorentz Force Law, form the foundation of classical electro dynamics. The equations were used to structure a transient magnetic field simulation modeling computer program – Maxwell 2D/3D field simulation software licensed from ANSYS. The simulation of magnetic fields was performed as well as, torque, voltage, current and power output – see attached LEAP Report.

3. Actual data from a HEG machine in which reverse torque has been removed (see attached graph).
4. Historic data – Faraday's disc as modified by Nikola Tesla in which reverse torque is reduced and the results were published.

Summary

Various exemplary embodiments are discussed and described herein involving aspects of a singular electric generator rotor which is solid state and can be used to convert any existing rotary generator into a self sustaining power plant which is clean and consumes no fuel. The changes which make this possible result in the elimination of reverse torque which has plagued the conventional generator since its inception. The mechanisms of removal of this reverse torque and the expansive relevance of the elimination of reverse torque to its uses and applications are presented and discussed.

In accordance with an aspect, a method is disclosed for removing reverse torque from a rotary electric generator that includes replacement of the standard dipole or multipole spinning rotor with a unipole, dipole or multipole, static solid state rotor insert which creates rotating magnetic poles and generates electric power. Since the rotor is stationary there is no energy consuming interaction between the magnetic poles formed in the stator iron when the generator is connected to an electric load. Nor does the generator require energy to spin a rotor at the proper frequency. This radical redesign of the rotor is accomplished by, for example, but not limited by, cutting laminates from electrical steel in the desired diameter (6 inches but not limited to 6 inches) with 16 salient pole pieces (but not limited to 16) of equal size and distribution. The pole pieces are wound with the desired and appropriate electrical magnet wire. The magnet wire coils is terminated in two leads which are wired to a PLC controlled excitation system which allows switching in an alternate fashion from first polarity to second polarity and from second polarity to first polarity by use of a Mosfet diode gating system in the excitation circuit. In the case of the four pole, the salient poles are wired into four groups of four poles per group, or two groups of eight poles per group, but not limited to two or four groups.

In the case of 60 hz power, the four pole rotor, pole #1, group #1 is a first polarity and pole #1 of group #2 is a second polarity. Pole #1 group #3 is a first polarity and pole #1 group #4 is a second polarity. Pole #1 for each group is excited by a solid state exciter board channel #1 (ch1). Pole #2 for each group is excited by a solid state exciter board channel #2 (ch2). Pole #3 for each group is excited by a solid state exciter board channel #3 (ch3). Pole #4 for each group is excited by a solid state exciter board channel #4 (ch4). Pole #1 of each group is excited and 2.084 milliseconds later pole #2 is excited, then again 2.084 milliseconds later pole #3 is excited, then again 2.084

milliseconds later pole #4 is excited and 2.084 milliseconds later pole #1 is excited again and the cycle repeats continuously. The pole circuits are excited with a first polarity DC current in the first cycle and the second polarity DC current in the second cycle. The first and second cycle makes up one AC cycle every 16.667 milliseconds in the case of 60 hz current. Appropriate adjustments are made for other frequencies such as 50 hz. Each pole is excited for 4.167 milliseconds with a 4.167 millisecond collapse time for each magnetic salient pole. The excitation wave progresses clockwise which distorts each pole as it is forming which pushes the magnetic flux in a progressive clockwise fashion by the repelling flux of the preceding poles. This in effect constantly pushes discrete separated magnetic poles in a clockwise circular fashion at the desired frequency and the poles are separated, alternate first polarity and second polarity. Every complete 16.667 millisecond cycle the excitation switches from first polarity to second polarity such that the four distinct magnetic poles continue to rotate without physical rotation of the rotor member itself.

In the case of the two pole magnetic rotor, salient poles are wired into two groups of eight pole pieces per group. Pole pieces in each group are connected to a circuit from the exciter system. Pole piece #1 and group #1 is a first polarity, pole piece #1 of group #2 is a second polarity. Pole #1 for each group is excited by solid state exciter channel #1. Pole piece #2 for each group is excited by solid state exciter board channel #2. Pole piece #3 for each group is excited by solid state exciter board channel #3. Pole piece #4 for each group is excited by solid state exciter board channel #4. Pole piece #5 for each group is excited by solid state exciter board channel #5. Pole piece #6 for each group is excited by solid state exciter board channel #6. Pole piece #7 for each group is excited by solid state exciter board channel #7. And pole piece #8 for each group is excited by solid state exciter board channel #8.

Pole piece #1 of each group is excited and 1.042 milliseconds later pole piece #2 of each group is excited. Pole piece #2 of each group is excited and 1.042 milliseconds later pole piece #3 of each group is excited. Pole piece #3 of each group is excited and 1.042 milliseconds later pole piece #4 of each group is excited. Pole piece #4 of reach group is excited and 1.042 milliseconds later pole piece #5 is excited. Pole piece #5 of each group is excited and 1.042 milliseconds later pole piece #6 is excited. Pole piece #6 of each group is excited and 1.042 milliseconds later pole piece #7 is excited. Pole piece #7 of each group is excited and 1.042 milliseconds later pole piece #8 is excited. Pole piece #8 of each group is excited and 1.042 milliseconds later pole piece #1 of each group is excited and the cycle repeats continuously.

The excitation polarity changes with each cycle. Therefore in the case of the four pole unit, the polarity switches four times per each 16.667 milliseconds and with the two pole unit, the polarity of the excitation switches two times per 16.667 milliseconds/ cycle for 60 hz current.

In the case of the unipole magnetic rotor, 16 salient poles are wired into four groups of four pole pieces per group. All 16 pole pieces may be excited north pole for 8.3335 milliseconds then all 16 excited south pole for 8.3335 milliseconds each complete cycle of 16.667 milliseconds. Pole pieces in each group are connected to a circuit from the PLC driven exciter system. Pole piece #1 of group #1 is a first polarity, pole piece #1 of group 2, 3, and 4 are a first polarity for one cycle, then switch to a second polarity for pole piece #1, 2, 3 and 4. The entire rotor alternates between first polarity for 360 degrees and second polarity for 360 degrees. Alternating polarity is controlled by a Mosfet gating system. The speed of the rotating field is not relevant to the generated current frequency. The frequency is controlled by the computer controlled gating system and may be 50 hz, 60 hz or any other desired frequency. The speed of rotation of the magnetic field is controlled by the rate of progression of excitation.

To obtain a rotation rate of the magnetic field at 7,500 rpm's the following sequence applies. Pole piece #1 of each group is excited and 0.5 milliseconds later pole piece #2 is excited, 0.5 milliseconds later pole piece #3 is excited and 0.5 milliseconds later pole piece #4 is excited and 0.5 milliseconds later pole piece #1 is again excited and the cycle is repeated continuously until the excitation polarity is switched. Each pole piece is excited for 0.1 millisecond. The pole circuits are excited with a first polarity DC current in the first cycle and a second polarity DC current in the second cycle. Number one cycle plus number two cycle make a complete AC cycle.

The structure of the rotor laminates and the rotor windings must be altered in order to operate as a functional rotating magnetic field. When a standard bipolar rotor is wired and excited such that both poles of the rotor are either north pole or south pole (i.e. north-north or south-south) the internal poles cancel a large portion of the external magnetic flux. In the example included in the figures (Figure 48) the external flux dropped from 4000 gauss to 100 gauss for a 40-fold deterioration in flux density when the polarity was changed from north-south to north-north or south-south. In order to correct this issue, the current multipolar solid state rotor is constructed such that the rotor which opposes another rotor by 180 degrees is actually wound and constructed as two complete dipole magnets, combined and separated by mu metal-steel flux return structure positioned between the two dipoles. When dipole magnet A side with outer coil (a) and inner coil (b) is excited, (a) is excited north pole facing out toward the observer and (b) is excited north pole facing out toward the observer with (a) being wound in the outer rotor slot and (b) being wound in the inner rotor slot. Simultaneously magnet B side of the unipole is excited with the outer coils (c) and inner coils (d), (c) is excited north pole facing outward toward the observer and (d) is excited north pole facing outward toward the observer.

Isolation of magnets A from B by a mu metal steel flux return apparatus along with the above winding pattern allows full north pole flux of 6,000 gauss on the pole surface of every activated rotor pole and alternating with south pole flux of 6,000 gauss for full 360 degrees of salient pole shoe surface attained by alternation of positive and negative excitation of the leads via a solid state Mosfet gating system.

The excitation polarity is controlled by the DC feed current to the above mentioned PLC which control salient pole excitation. The DC feed is controlled by a master PLC which alternates the DC polarity by use of Mosfet gating system which alternates the polarity every 8.3335 milliseconds in the case of 60 hz current and 10 milliseconds in the case of 50 hz current.

This solid state system in which the generator rotors are stationary and only the magnetic field rotates allows any existing generator to be retrofitted with this unique rotor of the invention with the result of zero electromagnetic drag or removal of reverse torque. In addition to manufacture of new generators, every electric power generation plant in the world can be retrofitted with the rotor of the current invention to allow them to operate as zero emissions, free standing power plants which require no fuel.

The unique embodiment of the solid state static rotor of the current invention allows the generator rotors to be operated in any embodiment or design of generator stator. It allows the rotor magnetic poles to be rotated at any speed without consideration of power output frequency. The frequency can be controlled by the excitation circuit rather than by the speed of the rotors. This design allows flexibility in power output by increasing and decreasing the speed of the rotor field without altering the frequency. For example, a generator operated at 3,000 rpm's can double the power output by increasing the operating speed of the rotor magnetic poles up to 6,000 rpm's or more. Also by decreasing the power one can bring the power as low as desired by progressively decreasing the speed of the rotor but maintaining the frequency by timed excitation of the rotor coils. If the conductor material with very low resistance to electron flow is employed (a room temperature super conductor) such as graphene coated magnet wire, is used to wind both the stator and the rotors, significant increase in power output can be realized with no change in input. Alternatively, a generator $1/5^{th}$ or $1/10^{th}$ the size could generate the same power output if using super conductor coils.

Various configurations are presented in the prior art, but none approach the issues of reducing magnetic drag or reverse torque, nor a solid state static rotor as is presented in the present disclosure.

Therefore, it is an object to present a method and apparatus for reducing the electromagnetic drag or reverse torque in an electric generator and thereby improve the efficiency by presenting a solid state static rotor in which only the magnetic poles rotate.

It is an additional object to present a method and apparatus by which the electromagnetic poles are constructed and activated in the proper sequence and frequency by a computer controlled solid state DC excitation system such that the desired magnetic poles rotate at the desired speed.

It is a further object of the present exemplary method for removing reverse torque from a rotary electric generator that includes replacement of the standard dipole or multi-pole spinning rotor with a solid state static rotor insert which creates rotating magnetic poles and generates electric power.

It is an additional object of the present invention to reveal a stationary rotor in which there is no energy consuming interaction between the magnetic poles of the rotor and the magnetic poles formed in the stator when the generator is connected to an electric load.

It is a further object of the present invention to reveal a generator rotor which is static and therefore requires no energy to spin it inside the stator in order to maintain the proper frequency.

It is an additional object of the present invention to reveal a mechanism whereby the solid state static rotor may be manufactured by cutting laminates from electrical steel in the desired diameter with 16 salient pole pieces (but not limited to 16) of equal size and distribution.

It is a further object of the current invention to reveal salient pole pieces wound with the desired and appropriate magnet wire which may be aluminum, copper, graphene coated or some other appropriate electrical conductor.

It is an additional object of the current invention to reveal the two leads from the wound salient poles wired to a PLC-controlled excitation system which allows switching poles in alternate fashion from first polarity to second polarity and from second polarity to first polarity.

It is a further object of the current invention to reveal the mode of switching the salient polarity by use of a Mosfet diode gating system placed in the excitation circuit.

It is an additional object of the current invention to present and describe a structure of rotor laminates and rotor windings that are altered from conventional structure in order to operate at peak capacity when salient pole pieces are excited in the same magnetic polarity when separated by 180 degrees on the rotor.

It is a further object of the current invention to reveal the structure of salient poles separated by 180 degrees and excited in the same polarity and still emit flux from the surface of the shoe of the rotor of 6,000 gauss but not limited to 6,000 gauss.

It is an additional object of the current invention to reveal the structure of the current multipolar solid state rotor constructed such that rotor salient poles that oppose one another by 180 degrees are wound such that they emit maximum magnetic flux from the face of the pole shoe.

It is a further object of the current invention to reveal the reduction in external field strength when a standard bipolar rotor is wired and excited such that both poles of the rotor are excited either north pole or south pole (i.e. north-north or south-south). The external poles cancel a large portion of the external magnetic flux.

It is a further object of the current invention to reveal experimental evidence of a 40-fold deterioration in flux density when rotor poles 180 degrees separated are excited either north-north or south-south.

It is a further object of the current invention to reveal a unipole rotor in which the salient poles separated by 180 degrees are actually two complete dipole electromagnets which are separated by mu metal steel flux return system.

It is an additional object of the current invention to reveal the excitation sequence of the salient poles such that the proper isolated poles are pushed either clockwise or counterclockwise such that the poles rotate the full 360 degree circumference of the stator at the desired intensity and speed.

It is a further object of the current invention to reveal the uses of the solid state static rotor in newly manufactured generators as well as existing generators and commercial generators in power plants etc.

Brief Description of the Drawings

In order that embodiments may be fully and more clearly understood by way of non-limitative examples, the following description is taken in conjunction with the accompanying drawings in which like reference numbers designate similar or corresponding elements, regions and portions and in which:

1. FIG. 1 is a diagram illustrating a cross-sectional end view of an exemplary rotor laminate revealing the salient pole irons and mu metal flux return ring;
2. FIG. 2 is a diagram illustrating a cross-sectional end view of an exemplary rotor laminate revealing the salient pole irons, the mu metal flux iron and pole iron windings;
3. FIG. 3 is a diagram illustrating an end view of the solid state rotor revealing the 16 wound salient poles as well as the flux return insert;
4. FIG. 4 is a diagram illustrating an end view of the solid state rotor with pole windings and excitation polarity sequencing circuits demonstrated for all 16 salient poles through a four-pole, 60 hz cycle - pulse number 1;
5. FIG. 5 is a diagram illustrating an end view of the solid state rotor with pole windings and excitation polarity sequencing circuits demonstrated for all 16 salient poles through a four-pole, 60 hz cycle - pulse number 2;
6. FIG. 6 is a diagram illustrating an end view of the solid state rotor with pole windings and excitation polarity sequencing circuits demonstrated for all 16 salient poles through a four-pole, 60 hz cycle - pulse number 3;
7. FIG. 7 is a diagram illustrating an end view of the solid state rotor with pole windings and excitation polarity sequencing circuits demonstrated for all 16 salient poles through a four-pole, 60 hz cycle - pulse number 4;
8. FIG. 8 is a diagram illustrating an end view of the solid state rotor with pole windings and excitation polarity sequencing circuits demonstrated for all 16 salient poles through a four-pole, 60 hz cycle - pulse number 5;

9. FIG. 9 is a diagram illustrating an end view of the solid state rotor with pole windings and excitation polarity sequencing circuits demonstrated for all 16 salient poles through a four-pole, 60 hz cycle – pulse number 6;
10. FIG. 10 is a diagram illustrating an end view of the solid state rotor with pole windings and excitation polarity sequencing circuits demonstrated for all 16 salient poles through a four-pole, 60 hz cycle – pulse number 7;
11. FIG. 11 is a diagram illustrating an end view of the solid state rotor with pole windings and excitation polarity sequencing circuits demonstrated for all 16 salient poles through a four-pole, 60 hz cycle – pulse number 8;
12. FIG. 12 is a diagram illustrating an end view of the solid state rotor with pole windings and excitation polarity sequencing circuits demonstrated for all 16 salient poles through a four-pole, 60 hz cycle – pulse number 9;
13. FIG. 13 is a diagram illustrating an end view of the solid state rotor with pole windings and excitation polarity sequencing circuits demonstrated for all 16 salient poles through a four-pole, 60 hz cycle – pulse number 10;
14. FIG. 14 is a diagram illustrating an end view of the solid state rotor with pole windings and excitation polarity sequencing circuits demonstrated for all 16 salient poles through a four-pole, 60 hz cycle – pulse number 11;
15. FIG. 15 is a diagram illustrating an end view of the solid state rotor with pole windings and excitation polarity sequencing circuits demonstrated for all 16 salient poles through a four-pole, 60 hz cycle – pulse number 12;
16. FIG. 16 is a diagram illustrating an end view of the solid state rotor with pole windings and excitation polarity sequencing circuits demonstrated for all 16 salient poles through a four-pole, 60 hz cycle – pulse number 13;
17. FIG. 17 is a diagram illustrating an end view of the solid state rotor with pole windings and excitation polarity sequencing circuits demonstrated for all 16 salient poles through a four-pole, 60 hz cycle – pulse number 14;
18. FIG. 18 is a diagram illustrating an end view of the solid state rotor with pole windings and excitation polarity sequencing circuits demonstrated for all 16 salient poles through a four-pole, 60 hz cycle – pulse number 15;
19. FIG. 19 is a diagram illustrating an end view of the solid state rotor with pole windings and excitation polarity sequencing circuits demonstrated for all 16 salient poles through a four-pole, 60 hz cycle – pulse number 16;
20. FIG. 20 is a diagram illustrating an end view of the solid state rotor with pole windings and excitation polarity sequencing circuits demonstrated for all 16 salient poles through a four-pole, 60 hz cycle – pulse number 1;
21. FIG. 21 is a diagram which depicts a two-pole rotor of the invention along with necessary excitation circuit.
22. FIG. 22 is a diagram which depicts experimental data to support the observed decrease in external magnetic flux when a standard dipole electromagnet is excited as a "unipole";
23. FIG. 23 is a diagram which depicts a four-pole rotor of the invention along with necessary excitation circuit;
24. FIG. 24 is a diagram which depicts a north pole "unipole" or alternating single-pole rotor of the invention along with the necessary excitation circuit;

25. FIG. 25 is a diagram which depicts a south pole "unipole" or alternating single pole rotor of the invention along with the necessary excitation circuit;
26. FIG 26 is a diagram illustrating an end view of the solid state four-pole rotor of the invention with pole windings and excitation polarity sequencing circuits demonstrated for all 16 salient poles through a four-pole 60 hz cycle demonstrating pulse 1 with depiction of the magnetic flux field;
27. FIG 27 is a diagram illustrating the magnetic flux field from the end view of the solid state four-pole rotor of the invention with pole windings and excitation polarity sequencing in which the first two poles in each group fired in sequence with depiction of the magnetic flux field;
28. FIG 28 is a diagram illustrating the magnetic flux field from the end view of the solid state four-pole rotor of the invention with pole windings and excitation polarity sequencing in which the flux field is demonstrated in the first three poles which are being fired in sequence;
29. FIG 29 is a diagram illustrating the magnetic flux field from the end view of the solid state four-pole rotor of the invention with pole windings and excitation polarity sequencing;
30. FIG 30 is a diagram illustrating the magnetic flux field from the end view of the solid state four-pole rotor of the invention with pole windings and excitation polarity sequencing in which excitation sequencing progresses clockwise;
31. FIG 31 is a diagram illustrating the magnetic flux field from the end view of the solid state four-pole rotor of the invention with pole windings and excitation polarity sequencing along with the flux field rotating clockwise;
32. FIG 31a is a diagram illustrating a depiction of an experiment which demonstrates the movement of the magnetic field when approached with a same polarity magnetic field;
33. FIG 31b is a photograph of the experiment of 31a which demonstrates the movement of the magnetic flux around the rotor in parallel to the face of the rotor;
34. FIG 31c is a photograph of an experiment in 31a and 31b which demonstrates the movement of the magnetic flux around the rotor in parallel to the face of the rotor;
35. FIG 32 is a diagram which depicts a two-pole stator and rotor of the invention;
36. FIG 33 is a diagram which depicts a four-pole stator and rotor of the invention;
37. FIG 34 is a diagram which depicts a four-pole rotor of the invention situated in a 3-phase stator which depicts a 3-phase winding;
38. FIG 35 is a diagram which depicts a stator with 3-phase winding with a "high-wye" hookup;
39. FIG 36 is a diagram which depicts a graphic hookup of a 3-phase winding in a "high-wye" configuration;
40. FIG 37 is a diagram which depicts an oscilloscope tracing of the current flow in the three phase legs of the generator with a "high-wye" hookup and covers the entire 360 degrees of rotation;
41. FIG 38 is a diagram which depicts a cross-section of a unique stator of the invention containing "unipole" rotors of the invention but absent stator coils;
42. FIG 39 is a diagram which depicts a cross-section of a unique stator of the invention containing unipole rotors of the invention with $1/3^{rd}$ of the stator coils in place;

43. FIG 40 is a diagram which depicts a cross-section of a unique stator of the invention containing unique rotors of the invention with all of the stator coils in place;
44. FIG 41 is a diagram which depicts a cross-section of a unique stator of the invention containing unique rotors of the invention without stator coils being depicted;
45. FIG 42 is a diagram of a cross section of a unique stator of the invention containing unique rotors of the invention with a depiction of the routing of one of the three coils in the stator;
46. FIG 43 is a diagram which depicts an early stage commercial generator with a retrofit rotor of the invention;
47. FIG 44 is a diagram which depicts a standard generator in use today which may be retrofitted with a rotor of the invention;
48. FIG 45 is a diagram which depicts a retrofit rotor of the invention which may be installed in the stator of generator depicted in FIG 44;
49. FIG 46 is a diagram illustrating a lateral oblique view of an experimental rotor with double windings from each pole with shielding between the two poles revealing the skewed rotor slots, slip rings, bearing rest and windings;
50. FIG 47 is a diagram illustrating a cross sectional view of a rotor laminate and slot wedge of the experimental "unipolar" mechanical rotor supporting this current invention;
51. FIG 48 is a diagram illustrating the effect of excitation polarity of 180 degrees separated magnetic poles on the external magnetic flux field which is emanated;
52. FIG 49 is a diagram illustrating the internal polarity necessary to build a functioning "unipolar" rotor either mechanical or solid state, north pole "unipole" rotor;
53. FIG 50 is a diagram illustrating the internal polarity necessary to build a functioning "unipolar" rotor either mechanical or solid state, south pole "unipole" rotor ;
54. FIG 51 is a diagram illustrating the internal windings and electric polarity necessary to build a functioning "unipolar" rotor either a functioning mechanical or solid state "unipolar" north pole;
55. FIG 52 is a diagram illustrating the internal windings and electric polarity necessary to build a functioning "unipolar" rotor either a functioning mechanical or solid state "unipolar" south pole.
56. FIG 53 is a diagram illustrating the solid state rotor of the invention slip fit into a standard 3 phase stator with an end safety shield in place.
57. FIG 54 is a diagram illustrating the solid state rotor of the invention slip fit into a standard 3 phase stator without the end guard in place.
58. FIG 55 is a diagram illustrating a standard 3 phase stator with the solid state rotor of the invention poised to be slip fit inside.
59. FIG 56 is a depiction of a circuit diagram of the invention revealing the programmable logic center (PLC) circuits and the pole switching circuits.
60. FIG 57 is a depiction of a circuit diagram of the invention revealing the circuits of the rotor excitation system and the interaction with the PLC and pole switching circuits.
61. FIG 58 is a depiction of a solid state generator of the invention revealing the input connections from the rotor excitation circuits along with the power cable to the electrical load and the regenerative circuits to the battery rectifier interface.

62. FIG 59 is a diagram illustrating a cross-sectional end view of an exemplary rotor laminate revealing the salient pole irons with angulation in a clockwise fashion, the mu metal flux return iron and pole iron windings;

Detailed Description of the Drawings

In accordance with the various exemplary embodiments discussed and described herein by way of brief summary, an exemplary high efficiency generator with greatly reduced electromagnetic drag requires a solid-state multi-pole or "unipole" electromagnetic static rotor with rotating magnetic poles.

FIG 1 is a diagram illustrating a laminate used to construct the rotor in an exemplary embodiment of the invention. The rotor body is made of laser cut disc 20 of 0.34mm annealed electrical steel which is stacked on a jig in such a fashion that the salient poles 2 are formed. The jig contains shaft 15 which has been slip fit with a mu metal sleeve 4. The rotor body and salient poles are pressed and retained by through bolts in holes 1. The insulated salient pole windings are then wound around the pole pieces 3.

FIG 2 is a diagram illustrating the end view of a rotor 20 of the invention. For this depiction each salient pole has two leads which can be excited north pole 6, 7 or south pole 8, 9. Retention holes containing retention bolts 1a are shown along with support shaft 15 and mu metal sleeve 4.

FIG 3 is a diagram illustrating a superior oblique view of a rotor 11 of the invention with stacked and pressed laminates 20, long salient poles 2 and revealing mu metal sleeve 4 along with support shaft 15.

FIG 4 is a diagram illustrating an end view of a rotor 11 of the invention revealing the end laminate 20 and retention bolts 1a. This FIG 4 is a depiction of a 4 pole rotor in a static state view of the excitation cycle of the salient poles. The salient poles 2 are numbered 1 - 16. The 4 rotor magnetic poles are labeled - north pole #1 is labeled N - A, south pole #1 is labeled S - A, north pole #2 is labeled NB and south pole #2 is labeled SB. Each magnetic rotor pole consists of 4 electrically excited wound salient pole pieces. North pole excitation leads 6, 7 and south pole excitation leads 8, 9 are sequentially excited in the following manner. Pole #1 first group (poles 1 - 4) is excited in a first polarity and pole #1 of second group (5 - 8) is excited in a second polarity. Pole #1 of third group (9 - 12) is excited in a first polarity and pole #1 of group 4 (13 - 16) is excited in a second polarity. All salient pole pieces are not excited simultaneously but sequentially. Salient pole #1 for each group is excited by a solid state exciter board channel #1 (CH_1) and channel #2 (CH_2). Salient pole #2 for each group is excited in a first polarity by solid state exciter board channel #3(CH_3) and channel #4 (CH_4). Salient pole #3 for each group is excited in a first polarity by a solid state exciter board channel #5 (CH_5) and #6

(CH_6). Salient pole #4 for each group is excited in a first polarity by a solid state exciter board channel #7 (CH_7) and channel #8 (CH_8). Salient pole #1 of each group is excited in a first polarity and 2.084 milliseconds later salient pole #2 is excited in a first polarity, 2.084 milliseconds later salient pole #3 is excited in a first polarity, and 2.084 milliseconds later salient pole #4 is excited in a first polarity and 2.084 milliseconds later salient pole #1 is again excited in a second polarity, and the cycle repeats continuously. The pole circuits are excited by a first polarity DC current in the first cycle and a second polarity DC current in a second cycle. The first and second cycles make up one AC cycle every 16.667 milliseconds in the case of 60 hz current. Appropriate adjustments are made for frequencies other than 60 hz. In the case of 60 hz current each pole is excited for 4.167 milliseconds with a 4.167 millisecond relaxation time for each salient pole. The excitation wave progressive clockwise which distorts each pole as it is forming with the result being a pushing of the flux in a progressive clockwise fashion parallel to the surface of the rotor as a result of the repelling of the flux from the preceding pole. The effect in the case of FIG 4 is that four discreet alternating magnetic poles circulate in a clockwise circular fashion at the desired frequency. The poles are separated at an alternating first polarity and second polarity. Every complete 16.667 millisecond cycle involves first polarity and second polarity in each 180 degrees of rotation. Two cycles involve 360 degrees of rotation. The four distinct magnetic poles continue to rotate without physical rotation of the rotor member.

FIG 5 is a diagram illustrating an end view of a rotor 11 of the invention revealing the end laminate 20 and retention bolts 1a. This FIG 5 is a depiction of a four pole rotor in a static state view of the excitation cycle of the salient poles. The salient poles 2 are numbered 1 - 16. This is station Two (2) of a 16 step rotation of the discreet magnetic poles. The mu metal ring 4 and shaft 15 are revealed. The 4 magnetic poles are labeled: North pole #1 is labeled C-A, South pole #1 is labeled S-A, North pole #2 is labeled N-B, South pole #2 is labeled S-B. Each magnetic rotor pole consists of four electrically excited salient pole pieces wound with copper magnet wire. The north pole wound magnet wire leads 6-7 and south pole wound magnet wire leads are 8-9 with 6 (+), 7 (-) and 8 (-), 9 (+). These excitation leads are sequentially excited as in FIG 4.

FIG 6 is a diagram illustrating an end view of a rotor 11 of the invention revealing the end laminate 20 and retention bolts 1a. This FIG 6 is a depiction of a four pole rotor in a static state view of the excitation cycle of the salient poles. The salient poles 2 are numbered 1-16. This is station three (3) of a 16 step rotation of the four discrete magnetic poles. The mu metal ring 4 and shaft 15 are revealed. The magnetic poles are labeled: North #1 is labeled N-A, South Pole #1 is labeled S-A, North Pole #2 is labeled N-B, and South Pole #2 is labeled S-B. Each magnetic rotor pole consists of four electrically excited salient pole pieces wound with copper magnet wire. The north pole wound magnetic wire leads 6-7 and south pole wound magnetic wire leads are 8-9 with 6 (+) and 7 (-) and 8 (-) 9 (+). The excitation leads are sequentially excited as in FIG 4 and FIG 5.

FIG 7 is a diagram illustrating an end view of rotor 11 of the invention revealing the end laminate 20 and retention bolts 1a. This FIG 7 is a depiction of a four pole rotor in a static state view of the excitation cycle of the salient poles. The salient poles 2 are numbered 1-16. This depicts station four (4) of a 16 step rotation of the four discrete magnetic poles involving 360 degrees of rotation. The mu metal ring 4 and shaft 15 are revealed. The four magnetic poles are labeled: North pole #1 is labeled N-A, South Pole #1 is labeled S-A, North Pole #2 is labeled N-B, and South Pole #2 is labeled S-B. Each magnetic rotor pole consists of four electrically excited salient pole pieces wound with copper magnet wire. The north pole wound magnet wire leads are expressed as 6-7 and south pole wound magnet wire leads 8-9 with six (+), seven (-), 8 (-) and 9 (+). These excitation leads are sequentially excited as in FIG 4, FIG 5 and FIG 6.

FIG 8 is a diagram illustrating an end view of a rotor 11 of the invention revealing the end laminate 20 and retention bolts 1a. This FIG 8 is a depiction of a four pole rotor in a static state view of the excitation cycle of the salient poles. The salient poles 2 are 1-16. This depicts station five (5) of a 16 step rotation of the discrete magnetic pole involving 360 degrees of rotation. The mu metal ring 4 and shaft 15 are revealed. The 4 magnetic poles are labeled: North pole #1 is labeled N-A, South Pole #1 is labeled S-A, North Pole #2 is labeled N-B, and South Pole #2 is labeled S-B. Each magnetic rotor pole consists of four electrically excited salient pole pieces wound with copper magnet wire. The north pole wound magnet wire leads are expressed as 6-7 and south pole wound magnet wire leads 8-9 with six (+), seven (-), 8 (-) and 9 (+). These excitation leads are sequentially excited as in FIG 4, FIG 5, FIG 6 and FIG 7.

FIG 9 is a diagram illustrating an end view of a rotor 11 of the invention revealing the end laminate 20 and retention bolts 1a. This FIG 9 is a depiction of a four pole rotor in a static view of the excitation cycle of the salient pole which generate the rotating poles. The salient poles 2 are numbered 1-16. This depicts station six (6) of a 16 step generation and rotation of the four discrete magnetic poles involving 360 degrees of rotation and two cycles of 60 hz current. The mu metal ring 4 and shaft 15 are revealed. The 4 magnetic poles are labeled: North pole #1 is labeled N-A, South Pole #1 is labeled S-A, North Pole #2 is labeled N-B, and South Pole #2 is labeled S-B. Each magnetic rotor pole consists of four electrically excited salient pole pieces wound with copper magnet wire. The north pole wound magnet wire leads are expressed as 6-7 and south pole wound magnet wire leads 8-9 with six (+), seven (-), 8 (-) and 9 (+). These excitation leads are sequentially excited as in FIG 4, FIG 5, FIG 6, FIG 7 and FIG 8.

FIG 10 is a diagram illustrating an end view of a rotor 11 of the invention revealing the end laminate 20 and retention bolts 1a. This FIG 10 is a depiction of a four pole rotor in a static state view of the sequential excitation cycle of the salient poles which generate a rotating magnetic pole. The salient poles are numbered 1-16. This FIG 10 illustrates station seven (7) of a 16 step generation and rotation of the four discrete magnetic poles involving 360 degrees of rotation and two cycles of 60 hz current. The mu metal ring 4 and shaft 15 are revealed. The 4 magnetic poles are labeled: North pole #1 is labeled N-A, South Pole #1 is labeled S-A, North Pole #2 is labeled N-B, and South Pole #2 is labeled S-B. Each magnetic rotor pole consists of four electrically excited salient pole pieces wound with copper magnet wire. The north pole wound magnet wire leads are expressed as 6-7 and south pole wound magnet wire leads 8-9 with six (+), seven (-), 8 (-) and 9 (+). These excitation leads are sequentially excited as in FIG 4, FIG 5, FIG 6, FIG 7, FIG 8 and FIG 9.

FIG 11 is a diagram illustrating an end view of a rotor 11 of the invention revealing the end laminate 20 and retention bolts 1a. This FIG 11 is a depiction of a four pole rotor in a static state view of the sequential excitation cycle of the salient poles which generate a rotating magnetic pole. The salient poles are numbered 1-16. This FIG 11 illustrates station eight (8) of a 16 step generation and rotation of the four discrete magnetic poles involving 360 degrees of rotation and two cycles of 60 hz current. The mu metal ring 4 and shaft 15 are revealed. The 4 magnetic poles are labeled: North pole #1 is labeled N-A, South Pole #1 is labeled S-A, North Pole #2 is labeled N-B, and South Pole #2 is labeled S-B. Each magnetic rotor pole consists of four electrically excited salient pole pieces wound with copper magnet wire. The north pole wound magnet wire leads are expressed as 6-7 and south pole wound magnet wire leads 8-9 with six (+), seven (-), 8 (-) and 9 (+). These excitation leads are sequentially excited as in FIG 4, FIG 5, FIG 6, FIG 7, FIG 8, FIG 9 and FIG 10.

FIG 12 is a diagram illustrating an end view of a rotor 11 of the invention revealing the end laminate 20 and retention bolts 1a. This FIG 12 is a depiction of a four pole rotor in a static state view of the sequential excitation cycle of the salient poles which generate a rotating magnetic pole. The salient poles are numbered 1-16. This FIG 12 illustrates station nine (9) of a 16 step generation and rotation of the four discrete magnetic poles involving 360 degrees of rotation and two cycles of 60 hz current. The mu metal ring 4 and shaft 15 are revealed. The 4 magnetic poles are labeled: North pole #1 is labeled N-A, South Pole #1 is labeled S-A, North Pole #2 is labeled N-B, and South Pole #2 is labeled S-B. Each magnetic rotor pole consists of four electrically excited salient pole pieces wound with copper magnet wire. The north pole wound magnet wire leads are expressed as 6-7 and south pole wound magnet wire leads 8-9 with six (+), seven (-), 8 (-) and 9 (+). These excitation leads are sequentially excited as in FIG 4, FIG 5, FIG 6, FIG 7, FIG, 8, FIG 9, FIG 10 and FIG 11.

FIG 13 is a diagram illustrating an end view of a rotor 11 of the invention revealing the end laminate 20 and retention bolts 1a. This FIG 13 is a depiction of a four pole rotor in a static state view of the sequential excitation cycle of the salient poles which generate a rotating magnetic pole. The salient poles are numbered 1-16. This FIG 13 illustrates station ten (10) of a 16 step generation and rotation of the four discrete magnetic poles involving 360 degrees of rotation and two cycles of 60 hz current. The mu metal ring 4 and shaft 15 are revealed. The 4 magnetic poles are labeled: North pole #1 is labeled N-A, South Pole #1 is labeled S-A, North Pole #2 is labeled N-B, and South Pole #2 is labeled S-B. Each magnetic rotor pole consists of four electrically excited salient pole pieces wound with copper magnet wire. The north pole wound magnet wire leads are expressed as 6-7 and south pole wound magnet wire leads 8-9 with six (+), seven (-), 8 (-) and 9 (+). These excitation leads are sequentially excited as in FIG 4, FIG 5, FIG 6, FIG 7, FIG 8, FIG 9, FIG 10, FIG 11 and FIG 12.

FIG 14 is a diagram illustrating an end view of a rotor 11 of the invention revealing the end laminate 20 and retention bolts 1a. This FIG 14 is a depiction of a four pole rotor in a static state view of the sequential excitation cycle of the salient poles which generate a rotating magnetic pole. The salient poles are numbered 1-16. This FIG 14 illustrates station eleven (11) of a 16 step generation and rotation of the four discrete magnetic poles involving 360 degrees of rotation and two cycles of 60 hz current. The mu metal ring 4 and shaft 15 are revealed. The 4 magnetic poles are labeled: North pole #1 is labeled N-A, South Pole #1 is labeled S-A, North Pole #2 is labeled N-B, and South Pole #2 is labeled S-B. Each magnetic rotor pole consists of four electrically excited salient pole pieces wound with copper magnet wire. The north pole wound magnet wire leads are expressed as 6-7 and south pole wound magnet wire leads 8-9 with six (+), seven (-), 8 (-) and 9 (+). These excitation leads are sequentially excited as in FIG 4, FIG 5, FIG 6, FIG 7, FIG 8, FIG 9, FIG 10, FIG 11, FIG 12 and FIG 13.

FIG 15 is a diagram illustrating an end view of a rotor 11 of the invention revealing the end laminate 20 and retention bolts 1a. This FIG 15 is a depiction of a four pole rotor in a static state view of the sequential excitation cycle of the salient poles which generate a rotating magnetic pole. The salient poles are numbered 1-16. This FIG 15 illustrates station twelve (12) of a 16 step generation and rotation of the four discrete magnetic poles involving 360 degrees of rotation and two cycles of 60 hz current. The mu metal ring 4 and shaft 15 are revealed. The 4 magnetic poles are labeled: North pole #1 is labeled N-A, South Pole #1 is labeled S-A, North Pole #2 is labeled N-B, and South Pole #2 is labeled S-B. Each magnetic rotor pole consists of four electrically excited salient pole pieces wound with copper magnet wire. The north pole wound magnet wire leads are expressed as 6-7 and south pole wound magnet wire leads 8-9 with six (+), seven (-), 8 (-) and 9 (+). These excitation leads are sequentially excited as in FIG 4, FIG 5, FIG 6, FIG 7, FIG 8, FIG 9, FIG 10, FIG 11, FIG 12, FIG 13 and FIG 14.

FIG 16 is a diagram illustrating an end view of a rotor 11 of the invention revealing the end laminate 20 and retention bolts 1a. This FIG 16 is a depiction of a four pole rotor in a static state view of the sequential excitation cycle of the salient poles which generate a rotating magnetic pole. The salient poles are numbered 1-16. This FIG 16 illustrates station thirteen (13) of a 16 step generation and rotation of the four discrete magnetic poles involving 360 degrees of rotation and two cycles of 60 hz current. The mu metal ring 4 and shaft 15 are revealed. The 4 magnetic poles are labeled: North pole #1 is labeled N-A, South Pole #1 is labeled S-A, North Pole #2 is labeled N-B, and South Pole #2 is labeled S-B. Each magnetic rotor pole consists of four electrically excited salient pole pieces wound with copper magnet wire. The north pole wound magnet wire leads are expressed as 6-7 and south pole wound magnet wire leads 8-9 with six (+), seven (-), 8 (-) and 9 (+). These excitation leads are sequentially excited as in FIG 4, FIG 5, FIG 6, FIG 7, FIG 8, FIG 9, FIG 10, FIG 11, FIG 12, FIG 13, FIG 14 and FIG 15.

FIG 17 is a diagram illustrating an end view of a rotor 11 of the invention revealing the end laminate 20 and retention bolts 1a. This FIG 17 is a depiction of a four pole rotor in a static state view of the sequential excitation cycle of the salient poles which generate a rotating magnetic pole. The salient poles are numbered 1-16. This FIG 17 illustrates station fourteen (14) of a 16 step generation and rotation of the four discrete magnetic poles involving 360 degrees of rotation and two cycles of 60 hz current. The mu metal ring 4 and shaft 15 are revealed. The 4 magnetic poles are labeled: North pole #1 is labeled N-A, South Pole #1 is labeled S-A, North Pole #2 is labeled N-B, and South Pole #2 is labeled S-B. Each magnetic rotor pole consists of four electrically excited salient pole pieces wound with copper magnet wire. The north pole wound magnet wire leads are expressed as 6-7 and south pole wound magnet wire leads 8-9 with six (+), seven (-), 8 (-) and 9 (+). These excitation leads are sequentially excited as in FIG 4, FIG 5, FIG 6, FIG 7, FIG 8, FIG 9, FIG 10, FIG 11, FIG 12, FIG 13, FIG 14, FIG 15 and FIG 16.

FIG 18 is a diagram illustrating an end view of a rotor 11 of the invention revealing the end laminate 20 and retention bolts 1a. This FIG 18 is a depiction of a four pole rotor in a static state view of the sequential excitation cycle of the salient poles which generate a rotating magnetic pole. The salient poles are numbered 1-16. This FIG 18 illustrates station fifteen (15) of a 16 step generation and rotation of the four discrete magnetic poles involving 360 degrees of rotation and two cycles of 60 hz current. The mu metal ring 4 and shaft 15 are revealed. The 4 magnetic poles are labeled: North pole #1 is labeled N-A, South Pole #1 is labeled S-A, North Pole #2 is labeled N-B, and South Pole #2 is labeled S-B. Each magnetic rotor pole consists of four electrically excited salient pole pieces wound with copper magnet wire. The north pole wound magnet wire leads are expressed as 6-7 and south pole wound magnet wire leads 8-9 with six (+), seven (-), 8 (-) and 9 (+). These excitation leads are sequentially excited as in FIG 4, FIG 5, FIG 6, FIG 7, FIG 8, FIG 9, FIG 10, FIG 11, FIG 12, FIG 13, FIG 14, FIG 15, FIG 16 and FIG 17.

FIG 19 is a diagram illustrating an end view of a rotor 11 of the invention revealing the end laminate 20 and retention bolts 1a. This FIG 19 is a depiction of a four pole rotor in a static state view of the sequential excitation cycle of the salient poles which generate a rotating magnetic pole. The salient poles are numbered 1-16. This FIG 19 illustrates station sixteen (16) of a 16 step generation and rotation of the four discrete magnetic poles involving 360 degrees of rotation and two cycles of 60 hz current. The mu metal ring 4 and shaft 15 are revealed. The 4 magnetic poles are labeled: North pole #1 is labeled N-A, South Pole #1 is labeled S-A, North Pole #2 is labeled N-B, and South Pole #2 is labeled S-B. Each magnetic rotor pole consists of four electrically excited salient pole pieces wound with copper magnet wire. The north pole wound magnet wire leads are expressed as 6-7 and south pole wound magnet wire leads 8-9 with six (+), seven (-), 8 (-) and 9 (+). These excitation leads are sequentially excited as in FIG 4, FIG 5, FIG 6, FIG 7, FIG 8, FIG 9, FIG 10, FIG 11, FIG 12, FIG 13, FIG 14, FIG 15, FIG 16, FIG 17 and FIG 18.

FIG 20 is a diagram illustrating an end view of a rotor 11 of the invention revealing the end laminate 20 and retention bolts 1a. This FIG 20 is a depiction of a four pole rotor in a static state view of the sequential excitation cycle of the salient poles which generate a rotating magnetic pole. The salient poles are numbered 1-16. This FIG 20 illustrates station one (1) of a 16 step generation and rotation of the four discrete magnetic poles involving 360 degrees of rotation and two cycles of 60 hz current. The mu metal ring 4 and shaft 15 are revealed. The 4 magnetic poles are labeled: North pole #1 is labeled N-A, South Pole #1 is labeled S-A, North Pole #2 is labeled N-B, and South Pole #2 is labeled S-B. Each magnetic rotor pole consists of four electrically excited salient pole pieces wound with copper magnet wire. The north pole wound magnet wire leads are expressed as 6-7 and south pole wound magnet wire leads 8-9 with six (+), seven (-), 8 (-) and 9 (+). These excitation leads are sequentially excited as in FIG 4, FIG 5, FIG 6, FIG 7, FIG 8, FIG 9, FIG 10, FIG 11, FIG 12, FIG 13, FIG 14, FIG 15, FIG 16, FIG 17, FIG 18 and FIG 19.

FIG 21 is a diagram illustrating an end view of a rotor 11 of the invention, connected to the excitation system. FIG 21 represents a two (2) pole rotor. In the case of the two pole magnetic rotor, the salient poles are wired into two groups of 8 salient pole pieces per group. The wound coils of the pole pieces in each group are connected to a circuit from the exciter system. Pole piece #1 (salient pole #1) of group #1 is a first polarity, pole piece #1 (salient pole #9) of group #2 is a second polarity. The coils for pole piece #1 for each group is excited by a solid state exciter channel #1 contained in the excitation panel 18. The excitation panel 18 is powered through conductors 25 by battery 19. The battery charge is maintained by a full wave rectifier from the generator containing the rotors 11 through conductors 26. The excitation control signal is transmitted through conduits 24 from programmable logic center (PLC) 17. The signal for activating the proper PLC parameter is transmitted through conductor 23 from control module 16. Pole #1 for each of the two pole groups is excited through conduit 22 by a solid state exciter channel #1 in excitation panel box 18. Pole piece #2 for each group is excited through conduit 22 by a solid state exciter board channel #2 in excitation panel box 18. Pole piece #3 for each group is excited through conduit 22 by solid state exciter board channel #3 in excitation panel box 18. Pole piece #4 for each group is excited through conduit 22 by solid state exciter board channel #4 in excitation panel 18. Pole piece #5 for each group is excited through conduit 22 by solid state exciter board channel #5 in excitation panel 18. Pole piece #6 for each group is excited through conduit 22 by solid state exciter board channel #6 in excitation panel 18. Pole piece #7 for each group is excited through conduit 22 by solid state exciter board channel #7 in excitation panel 18. Pole piece #8 for each group is excited through conduit 22 by solid state exciter board channel #8 in excitation panel 18.

Pole piece #1 of each group is excited and 1.042 milliseconds later pole piece #2 of each group is excited, and 1.042 milliseconds later pole piece #3 of each group is excited, and 1.042 milliseconds later pole piece #4 of each group is excited, and 1.042 milliseconds later pole piece #5 of each group is excited, and 1.042 milliseconds later pole piece #6 of each group is excited, and 1.042 milliseconds later pole piece #7 of each group is excited, and 1.042 milliseconds later pole piece #8 of each group is excited and 1.042 milliseconds later pole piece #1 of each group is again excited but in the opposite polarity and the cycle repeats continuously cycling two discrete rotor poles of a first polarity in one pole and a second polarity in the second pole. Each pole is cycled for 8.336 milliseconds in a first polarity, and 8.336 milliseconds in a second polarity. Each salient pole is excited for 4.168 milliseconds with a collapse time of 4.168 milliseconds.

In testing the function of the rotor in FIG 21 it was discovered that salient poles of the invention which geometrically are separated by 180 degrees and excited in the same simultaneous first polarity or second polarity, the internal poles cancel a large portion of the external flux thereby weakening the poles.

FIG 22 is an experimental representation of this above described effect. When the rotor 28 winding 31 was excited in a first polarity with reference to the outer circumference and coil 30 excited in a second polarity with reference to the outer circumference, the gauss measurements of flux on the outer circumference was 4,000 gauss for the first polarity and 4,000 gauss for the second polarity. When coil 31 was excited in a first polarity and coil 30 in a first polarity, the external flux measurements were 100 gauss. When coil 31 was excited in a second polarity and coil 30 was excited in a second polarity, the external flux measurements were 100 gauss.

In order to correct this issue, the current winding pattern for two electromagnets which are attached to the same shaft 180 degrees apart, the structure is actually two complete dipole magnets combined and separated by a mu metal cylinder which functions as a flux return plate. This structure was employed in FIG 23. Dipole magnet constructed by winding salient pole piece #1 with outer coil leads 40 and 41 and inner coil leads 39, 42 is excited in leads 40 and 41 to produce a north pole emanating out toward the observer and leads 39 and 41 are excited north pole emanating out toward the observer with coil leads 40 and 41 being in the outer rotor slot and leads 39 and 42 being wound in the inner rotor slot. Simultaneously dipole magnet constructed by winding salient pole piece 9 with outer coil leads 40a and 41a along with inner coil leads 39a and 42a is excited such that in leads 40a and 41a to produce a north pole emanating out toward the observer and leads 39a and 41a are excited north pole emanating out toward the observer with coil leads 40a and 41a being in the outer rotor slot and leads 39a and 42a being wound in the inner rotor slot.

Isolation of the magnet on salient pole #1 from #9 by a mu metal cylinder 4 flux return plate allows full north pole flux of 6,000 gauss in both salient poles #1 and

#9. The polarity is alternated north pole/south pole flux by alternating the feed current to the leads via the solid state Mosfet gating system through leads 37.

FIG 23 is a diagram illustrating an end view of rotor 11 of the invention connected to the excitation system. In this case of the four pole rotor wound salient pole #1 in each group is connected to a Mosfet circuit from the excitation system in control cabinet 34. The wound salient poles in FIG 23 are grouped. Group #1 (poles 1-4) Group #2 (poles 5-8) Group #3 (poles 5012) and Group #4 (poles 13-16). The poles are excited as follows: Pole #1 of Group #1 is a first polarity and Pole #1 of Group #2 is a second polarity. Pole #1 of Group #3 is a first polarity and Pole #1 of Group #4 is a second polarity. Pole #1 for each group is excited by solid state excitation system housed in cabinet 34. Pole #1 in each group is excited by a common channel #1 (CH 1) housed in cabinet 34. Pole #2 for each group is excited by a common solid state exciter board channel #2 (CH 2). Pole #3 for each group is excited by a common solid state exciter board channel #3 (CH 3) and pole #4 for each group is excited by a common solid state exciter board channel #4 (CH 4). The power to excite the salient poles is taken from battery 36 through conductors 35 into solid state exciter system 34. The control signals for the exciter system is sent from PLC 32 through conductors 33. Commands to PLC 32 are generated in control panel 31. The battery 36 is recharged from generator power output through a full wave rectifier and conductors 36a to the battery 36. The poles are excited through conductors 37 and 38. The pole leads 39, 40, 41 and 42 are connected to conductors 38 in the appropriate location. This numbering scheme is representative for all poles 1-16. Pole #1 of each group is excited and 2.084 milliseconds later pole #2 of each group is excited, 2.804 milliseconds later pole #3 is excited, 2.084 milliseconds later pole #4 is excited and 2.084 milliseconds later pole #1 is excited again but in a second polarity and the cycle repeats continuously. The pole circuits are excited with a first polarity DC current in the first cycle and a second polarity DC current in the second cycle. The first and second cycle makes up one AC cycle every 16.667 milliseconds in the case of 60 hz electric power. Appropriate adjustments are made in the control system for other frequencies such as 50 hz electric power. For 60 hz power each pole is excited for 4.167 milliseconds with a 4.167 millisecond collapse time for the magnetic salient pole iron. The excitation wave progresses clockwise with the magnetic flux of each pole being distorted in a clockwise fashion by the previous like magnetic pole. Therefore the discrete rotor pole made up of four salient pole pieces at any one point in time progresses clockwise due to the repelling flux of the preceding salient pole. This in effect constantly pushes discrete separated magnetic poles in a clockwise circular fashion at the desired frequency. The poles are separated and alternate first polarity and second polarity. The four discrete magnetic poles continue to rotate without physical rotation of the rotor member itself.

FIG 24 is a diagram illustrating an end view of rotor 11 of the invention connected to an excitation system. This figure in this case represents a functional unipole magnetic rotor. All 16 salient poles are wired into four groups of four salient pole pieces in each group. All 16 pole pieces may be excited in a first polarity (north pole)

8.333 milliseconds and then all 16 may be excited in a second polarity (south pole) 8.333 milliseconds each to complete a cycle of 16.667 milliseconds. Pole pieces in each group are connected to a circuit from PLC 49 which sends signals through conduit 53 to exciter panel 51. This excitation system excites the salient pole coils with DC current from CH_1, CH_2, CH_3 and CH_4 through conduits 47 and 48. Pole piece coil of group #1 (1-4 coils) is excited in a first polarity. Salient pole piece #1 of group 2, 3 and 4 are also excited in a first polarity (north pole) for one cycle then switched to a second polarity (south pole) for each pole piece 1, 2, 3 and 4. The entire rotor alternates between first polarity for 360 degrees then second polarity for 360 degrees. Alternating polarity is controlled by a Mosfet gating system 51 – CH_1, CH_2, CH_3 and CH_4. The frequency is controlled by the computer-controlled gating system and may be 50 hz, 60 hz or any other desired frequency. The speed of the rotation of the magnetic field is controlled by the rate of progression of salient pole excitation. The frequency of the power output is controlled by the central system alternating the polarity of the DC feed current polarity every 8.3335 milliseconds in the case of 60 hz electric power.

To obtain a rotation rate of the magnetic poles at 7,500 rpm's the following sequence applies. Pole piece coil #1 in each group is excited and 0.50 milliseconds later pole piece coil #2 is excited, and 0.50 milliseconds later pole piece coil #3 is excited, and 0.50 milliseconds later pole piece coil #4 is excited and 0.50 milliseconds later pole piece #1 is again excited and the cycle repeats continuously until the excitation polarity is switched. Each pole piece is excited for 1.0 millisecond. The pole coil circuits are excited with a first polarity DC current for 8.3335 milliseconds and then a second polarity DC current for 8.3335 milliseconds.

The excitation polarity is controlled by the DC feed current from the PLC and Mosfet circuits. The DC feed is controlled by a master PLC 49 which alternates the DC polarity by use of a Mosfet gating system which alternates the DC current feed polarity every 8.3335 milliseconds in the case of 60 hz current output from the generator and 10 milliseconds in the case of 50 hz current output from the generator.

In the case of FIG 24 unipole rotor, a classic generator stator cannot be used but a stator structured as in FIG 33, 34, 35, 36 and37 must be used.

FIG 24 is a depiction of the unipolar rotor in the first polarity and FIG 25 is a depiction of the unipolar rotor in the second polarity.

FIG 26 is a diagram illustrating an end view of the solid-state four pole rotor of the invention with pole windings and excitation polarity sequencing circuits demonstrated for all 16 salient poles through a four pole 60 hz cycle demonstrating pulse #1 with depiction of the magnetic flux field. The first salient pole (1, 5, 9 and 13) to be excited in the four pole sequence is depicted by magnetic flux field 171 north and 172 south.

FIG 27 is a diagram illustrating the magnetic flux field from the end view of the solid state four pole rotor of the invention with pole windings and excitation polarity sequencing in which the first two poles in each group are fired in sequence. Salient poles #2, #6, #10 and #14 are excited 2.084 milliseconds after poles #1, #5, #9 and #13. Flux fields 171, 172 and shown. Therefore the flux from salient poles #2, #6, #10 and #14 are pushed by the repelling poles in #1, #5, #9 and #13 and are made to travel in a clockwise direction. When all poles are excited in sequence this phenomenon results in rotation of four discrete alternating magnetic poles.

FIG 28 is a diagram illustrating the magnetic flux field from the end view of the solid state four pole rotor of the invention with pole windings and excitation polarity sequencing in which the first three poles in each group are being fired in sequence. Salient poles #2, #6, #10 and #14 are excited 2.084 milliseconds after the excitation of poles #1, #5, #9 and #13. Therefore flux fields 171 and 172 deflect the growing fields 173 and 174. Therefore the flux from salient poles #2, #6, #10 and #14 are repelled and deflected and pushed by the repelling poles #1, #5, #9 and#13 to rotate in a clockwise direction. The salient poles #3, #7, #11 and #15 are excited 2.084 milliseconds after poles #2, #6, #10 and #14. The salient pole flux 75 and 76 from salient poles #3, #7, #11 and #15 is repelled in a clockwise direction as it is generated.

FIG 29 is a diagram illustrating the magnetic flux field from the end view of the solid state four pole rotor of the invention with pole windings and excitation polarity sequencing in which the first of these poles in each group are being fired in sequence. Salient poles #2, #6, #10 and #14 are excited 2.084 milliseconds after poles #1, #5, #9 and #13. Therefore flux fields 171 and 172 repel the evolving fields 173 and 174. The flux from salient poles #2, #6, #10 and #14 are repelled and deflected by the repelling poles in #1, #5, #9 and #13. The field rotates in a clockwise direction. The salient poles #3, #7, #11 and #15 are excited 2.084 milliseconds after excitation of poles #2, #6, #10 and #14 therefore the salient pole flux 175 and 176 from #3, #7, #11 and #15 is repelled in a clockwise direction as it is generated. The salient poles #4, #8, #12 and #16 are excited 2.084 milliseconds after poles #3, #7, #11 and #15 therefore the salient pole flux 177 and 178 from poles #4, #8, #12 and #16 are repelled in a clockwise direction. This progressive sequencing continues thereby creating four alternating magnetic poles which spin at 1800 rpm's and therefore generate 60 hz electric power.

FIG 30 is a diagram illustrating the magnetic flux field from the end view of the solid state four pole rotor of the invention with pole windings and excitation polarity sequencing in which the excitation sequencing progresses clockwise. Salient poles #1, #5 and #9 and #13 have changed polarity in the progression of salient pole excitation. Flux field 171 is now south pole or second polarity and flux field 172 is north pole or first polarity. This process continues as four alternating poles rotate at 1800 rpm and generate 60 hz electric power.

FIG 31 is a diagram illustrating the magnetic flux field from the end view of the solid state four pole rotor of the invention with pole windings and excitation polarity sequencing and flux field rotation clockwise. Flux field 171 is first polarity and is collapsing. Flux field 172 is second polarity and is collapsing. Both 171 and 172 have been excited for 4.167 milliseconds. Flux field 173 is a first polarity and is at peak excitation after 4.167 milliseconds of excitation. Flux field 174 is a second polarity and is at peak excitation after 4.167 milliseconds of excitation. Flux field 175 is a first polarity and is 2.084 milliseconds into the excitation cycle. Flux field 176 is a second polarity and is 2.084 milliseconds into the excitation cycle. Flux field 177 and 178 are a first polarity and are only microseconds into the excitation phase. This FIG 31 clearly depicts the sweeping clockwise rotation of the magnetic poles. This rotational effect is generated by the adjacent like pole deflecting the flux in a clockwise direction as the salient poles are sequenced in a clockwise fashion.

FIG 31a is a depiction of an experiment which demonstrates the movement of the magnetic flux field. Flux field 184 is visualized by sprinkling iron filings onto a white board in which a magnetic body has been placed underneath the board. Gauss meter 183 measures the flux density in gauss at point 180 and 179 by placing the window of the probe 181 at a 90 degree angle with the surface. The probe is attached to a gauss meter 183 via conductor 182. The gauss reading at point 179 which is directly over the center of the magnetic body underneath the board reads 66 gauss. When the magnet of the same flux strength 186 is slid along underneath the board and approaches points 179 and 180, the flux density is visually driven to the right and the measurable flux density increases. Location 179 increases from 66 gauss to 120 gauss and point 180 increases from 16 gauss to 29 gauss.

FIG 31b is a picture of the iron filing pattern which reflects the magnetic flux generated by the magnet of FIG 31a underneath a white board.

FIG 31c is a picture of the iron filing pattern of magnetic flux generated by a magnet underneath a white board demonstrating the lateral movement of the flux lines of the flux field 185 by an approaching magnetic pole of the same polarity.

FIG 32 is a depiction of a two pole electric generator 60 with stator windings 61 and 62. Solid state two pole rotor 20 is in place and the stator field coils are connected to an electrical load through conductors 58 and 59.

FIG 33 is a depiction of a four pole electric generator of the invention with solid state four pole rotor 20 and stator field coils 65, 66, 67 and 62 along with lead wires 63 and 64 carrying power to an electrical load.

FIG 34 is a depiction of a three phase generator 69 containing solid state rotor 20 and field coils 68 sitting on base 70.

FIG 35 demonstrates as would be readily appreciated by one skilled in the art, a hookup which is referred to as a "high wye" three phase connection. Each phase can be configured to include two winding circuits which may be connected in series to produce 480 volts ("high wye) or alternatively the two winding circuits may be connected in parallel and referred to as "low wye" and produces 240 volts. The voltage is different but the power output is the same because the amperage also changes between the two hookups. Following the phase circuits from the power output leads through the circuits to the neutral "wye" connection, phase A leg 83 includes coil group 71 wound in a counterclockwise or north pole (N) direction. Input is at circle 1 ((1)) and output is at circle 4 ((4)). The output lead 92 connects with coil group 74, wound in a clockwise or south pole (S) direction with an input at circle 1 ((1)) and output at circle 4 ((4)). The output lead 86 connects with coil group 77 wound in a counterclockwise direction (N) with an input at circle 7 ((7)) and output at circle 10 ((10)). The output lead 95 connects with coil group 80 wound in a clockwise direction (S) with input at circle 7 ((7)) and output at circle 10 ((10)). The output lead 90 connects at the central "wye" connection 62 with the other two phases.

Phase B leg 85 includes coil 73 wound in a counterclockwise direction (N) with an input at circle 2 ((2)) and output at circle 5 ((5)). The output lead 93 connects with coil group 76 which is wound in a clockwise direction (S) with an input on circle 2 ((2)) and out on circle 5 ((5)). The output lead 88 connects to coil group 79 wound in a counterclockwise direction (N) with an input at circle 8 ((8)) and output at circle 11 ((11)). The output lead 96 connects to coil group 82 which is wound in a clockwise direction (S) with an input at circle 8 ((8)) and output at circle 11 ((11)). The output lead 91 connects with the "wye" connection at 62.

Phase C leg 87 connects to coil group 75 wound in a counterclockwise direction (N) with an input at circle 3 ((3)) and an output at circle 6 ((6)). The output lead 97 connects to coil group 78 wound in a clockwise direction (S) with an input at circle 3 ((3)) and an output at circle 6 ((6)). The output lead 89 connects to coil group 81 wound in a counterclockwise direction (N) with an input at circle 9 ((9)) and output at circle 12 ((12)). The output lead 97 connects to coil group 72 wound in a clockwise direction (S) with an input at circle 9 ((9)) and output at circle 12 ((12)). The output lead 84 forms the third leg of the "wye" connection 62.

With reference to FIG 36, phase A leg 83 is connected to coil group 71a wound in a counterclockwise direction (N) with an input at circle 1 ((1) and an output at circle 4 ((4)). The output lead 92 connects to coil group 74a which is wound in a clockwise direction (S) with an input at circle 1 ((1)) and an output at circle 4 ((4)). The output lead of these two coil groups 86 connects to coil group 77a wound in a counterclockwise direction (N) with an input at circle 7 ((7)) and output at circle 10 ((10)). The output lead 104 connects to coil group 47a wound in a clockwise direction (S) with an input at circle 7 ((7)) and output at circle 10 ((10)). The output lead 109 makes up the "wye" connection 62 with the other two phases.

Phase B leg 85 connects with coil group 73b wound in a counterclockwise direction N with an input at circle 2 ((2)) and an output at circle 5 ((5)). The output lead 93 connects to coil group 76b wound in a clockwise direction S (S) with an input at circle 2 ((2)) and an output at circle 5 ((5)). The output lead 88 connects to coil group 79 wound in a counterclockwise direction N (N) with an input at circle 8 ((8)) and output at circle 11 ((11)). The output lead 96 connects to coil group 82 wound in a clockwise direction (S) with an input at circle 8 ((8)) and output at circle 11 ((11)). The output lead 91 connects to a portion of the "wye" connection 62.

Phase C leg 87 connects to coil group 75 wound in a counterclockwise direction (N) with an input at circle 3 ((3)) and output at circle 6 ((6)). The output lead 94 connects to coil group 78 wound in a clockwise direction (S) with an input at circle 3 ((3)) and output at circle 6 ((6)). The output lead 89 connects to coil group 81 wound in a counterclockwise direction (N) with an input at circle 9 ((9)) and output at circle 12 ((12)). The output lead 97 connects to coil group 72 wound in a clockwise direction (S) with an input at circle 9 ((9)) and output at circle 12 ((12)). The output lead 84 connects to "wye" connection 62.

FIG 37 depicts an oscilloscope tracing of the three phase legs of three phase current from the three phase generator of FIG 36. Phase leg A (142) feeds into B (143) and C (144). Beginning at 0° as the rotor rotates through 360° of rotation the relationship changes as is depicted but with the phase legs feeding into each other and not to ground neutral.

FIG 38 depicts cross section of stator 148 in which the magnetic field of solid state rotor 20 is outside of the stator coil wound as follows: Coil #1 between rotor cavity 146a and 146b, coil #2 between rotor cavity 146b and 146c, coil #3 between rotor cavity 146c and 146d, coil #4 between rotor cavity 146d and 146a, coil #5 between rotor cavity 146e and 146f, coil 36 between rotor cavity 146f and 146g, coil #7 between rotor cavity 146g and 146h, coil #8 between rotor cavity 146h and 146e. With the rotors outside of the stator coil loops there is no magnetic interaction between the rotor magnetic poles and the stator magnetic poles therefore eliminates reverse torque or electromagnetic drag. The primary design change is the use of the solid state rotor 20 in which the magnetic poles rotate but the physical rotor body is stationary. By use of geometric isolation of the rotor magnetic poles from the stator magnetic poles and the solid state rotor 100% of reverse torque is removed from this embodiment of the high efficiency generator. Therefore the only energy required to power the generator is the DC power required to excite the rotors. This allows approximately 10 units of power output for each unit of power input.

This stator 148 is supported by support posts attached to an end plate which are slip fit into the port holes 147. The center portion of the stator 148 is held in place by retention bolts 151. The stator is cooled through vent holes 149.

FIG 39 is a depiction of a cross section of an embodiment of the invention identical to FIG 38 except that FIG 39 reveals multiple wire slots rather than a single slot which accepts a flat conductor. FIG 39 reveals winding 52 and 1/3rd of the slots with solid state rotor 20 in all of the cavities.

FIG 40 is identical to FIG 39 except that all of the wire slots containing windings. In this embodiment again the rotor is stationed outside of the stator coil loops and utilizes the solid state rotor 20. Without reverse torque this generator will generate 10 units of electric power for each unit of power input.

FIG 41 is a depiction of four classic generator stators 155 clustered in a housing to be wound in the same fashion as FIG 38, 39 and 40. Solid state rotors 20 are inside the stator rotor cavities. The stators 155 are supported by a support means 153. FIG 42 is a depiction of four classic generator stators 155 clustered in a housing 153 and each stator is connected with winding conduit 156. The conduit is installed on each end of the stator housing so that windings 159, 159a, 159b and 159c can be installed.

FIG 43 is a depiction of a commercial power generator 166 with exciter generator 165 which sits on base 166. Rotor 163 is driven by shaft 164. The exciter generator 165, shaft 164 and rotor 163 can be replaced with a solid state rotor of the invention along with the rotor excitation system.

FIG 44 is a depiction of a commercial dynamo 167 with exciter 168. The rotor and exciter may be removed and retrofit with the solid state rotor and exciter system of the invention.

FIG 45 is a depiction of a rotor 170 from a commercial power dynamo with shaft 164, wire slots 169 and rotor coils 161. The rotor windings 161 can be replaced with windings and excitation system of the current invention.

In order to operate an electromagnetic unipolar rotor of the invention, or to operate a first polarity electromagnet 180 degrees separated from a second first polarity electromagnet and/or operate a second polarity electromagnet 180 degrees separated from a second polarity electromagnet, structural winding and excitation changes must be altered from that of the standard electromagnetic rotor.

In order to build this altered rotor to function as a unipolar magnetic rotor, drastic changes were made. The structure of the rotor laminates and rotor windings must be altered in order to operate as a functional "unipolar" electromagnetic rotor. When a standard bipolar rotor FIG 48 is wired and excited such that both poles of the rotor are either north pole or south pole (i.e. north-north or south-south) the internal poles interact to cancel a large portion of the external flux.

In the example of FIG 48 the external flux dropped from 4000 gauss to 100 gauss or a 40 fold deterioration of external flux density. In order to correct this issue an experimental unit was constructed which led to the current mechanical and solid state rotors. The current "unipole" is actually two complete dipole electromagnets, combined and separated by a mu metal steel flux return plate and contained in a single rotor. When (FIG 49) dipole magnet A side with outer coils (a) and inner coil (b) is excited, (a) is excited north pole facing out toward the observer and (b) north pole facing out toward the observer, with (a) being in the outer rotor slot and (b) being wound in the inner rotor slot. Simultaneously magnet B side of the "unipole" is excited with outer coils (c) and inner coils (d), (c) is excited north pole facing outward toward the observer and (d) is excited north pole facing outward toward the observer. Isolation of magnets A side from B side by a mu metal steel laminate flux return plate and/or ring allows full north pole flux or 6000 gauss for the full 360 degrees of rotor surface and allows alternation with south pole flux for 360 degrees of rotor surface by alternation of (+) and (-) excitation of the leads via a solid state Mosfet gating system.

FIG 46 is a diagram of this "unipole" rotor illustrating rotor and slip rings through which the coils are excited. The slip ring assembly allows alternating excitation of positive and negative leads to the four separate electromagnets along with one eddy current ground ring (rings 9a - 17a). The rotor body is made by stacking multiple laser cut discs of electrical steel which is 0.34mm thick annealed electrical steel which is stacked on a jig in such a fashion that the wire slots on either side are skewed from the slip ring end of the rotor. The rotor laminates are then dipped in electric motor insulating varnish and baked at 300 degrees F until cured. The rotor body 2a is depicted containing four magnetic coils 3a which are made up internally and are electrically excited by slip rings through the appropriate leads. Shaft 8a, bearing rest 1a and 7a are shown. Eddy current discharge lead is also shown. FIG 47 depicts a laminate of the rotor shown in FIG 46. The laminate depicted in FIG 47 is cut from 0.34 mm thick electrical steel. Magnet A, winding slots 19a and 20a are wound with appropriate magnet wire and connected such that (FIG 49, 50, 51 and 52) the outer coil (a) is activated in a counterclockwise fashion in a first polarity viewed from the outer surface of the rotor and perpendicular to the coil. The inner coil (b) of magnet A FIG 49 is wound and connected such that the inner coil is activated in a counterclockwise fashion in a same first polarity as outer coil (a) when viewed from the outer surface of the rotor perpendicular to the coil which makes up magnet A. Magnet B winding slots 19a and 20a are wound with appropriate magnet wire in a counterclockwise fashion and connected such that the outer coil (c) is activated in a first polarity when viewed from the outer surface of the rotor and perpendicular to the coil. The inner coil (d) of magnet B FIG 47 is wound in a counterclockwise fashion and connected such that the inner coil (d) is activated in a same first polarity as outer coil (a), inner coil (b) and outer coil (c) when viewed from the outer surface of the rotor and perpendicular to the coil of the rotor portion which makes up magnet B.

The rotor in FIG 46 is pulsed (first polarity) north pole 360 degrees of rotor surface through two leads (+) and (-). The above description described north pole excitation which alternates 50 or 60 times per second with south pole (second polarity) for 360 degrees of rotor surface. Alternating polarity excitation is accomplished through the same two leads by utilization of a solid state Mosfet excitation gating system. The excitation for the second polarity (south pole) is as follows: Magnet A (FIGS 50 and 52) winding slots 19a and 20a are wound with appropriate magnet wire and connected such that the outer coil (a) is activated in a clockwise fashion in a second polarity (south pole) when viewed from the outer surface of the rotor perpendicular to the coil. The inner coil (b) of magnet A is wound and connected such that the inner coil is activated in a clockwise fashion in a same second polarity (south pole) as outer coil (a) when viewed from the outer surface perpendicular to the coil of the rotor portion which makes up magnet A. Magnet B winding slots 19a and 20a are wound with appropriate wire in a clockwise fashion and connected such that the outer coil (c) is activated in a second polarity (south pole) viewed from the outer surface of the rotor perpendicular to the coil. The inner coil (d) of magnet B FIG 47 is wound in a clockwise fashion and connected such that the inner coil (d) is activated in the same second polarity (south pole) as the outer coil (a), inner coil (b) and outer coil (c) when viewed from the outer surface of the rotor and perpendicular to the coil of the rotor portion which makes up magnet B.

FIG 48 is a depiction of a standard dipole rotor when operated as a dipole and as a monopole rotor. The external flux from the monopole operation is only 2% that of operation as a dipole.

FIG 53 is a depiction of a solid state rotor electric generator of the invention 176. The support rotor end piece 171 is a support for the frame of the safety cage struts 172. The rotor winding 173 is revealed as is the stator winding 179. Junction box 175 is in fact the makeup box for the generator stator leads as they are connected to the power leads.

FIG 54 is a view of the three phase solid state rotor of the invention as in FIG 53 minus the protective cage on the end.

FIG 55 is a depiction of the solid state rotor 181 pulled out of the stator. The support rotor end piece 171 is revealed and attaches to shaft 164. Magnetic fields are revealed sequentially evolving from the salient poles. Flux field 186, 201 and 189 are shown to be moving clockwise. Pole excitation leads 183 are revealed.

The Mosfet programmable logic controller (PLC) system allows sequencing of the alternating salient magnetic poles of the invention. The sequencing for each pole is described herein. The excitation cycle for each salient pole through a complete north/south cycle is controlled by two channels of the PLC because one signal from CH 1 is for 135 degrees of rotation of the sensor wheel and the other signal for CH 2 is for 180 degrees of rotation. The sensor wheel 240 FIG 56 rotates at 1800 rpm's in the case of a three phase four pole 60 hz generator (the sensor wheel may be replaced by a frequency generator set at 1800 signals per minute). The sensor wheel opening passes through the sensor 241 and a signal is generated when the system is turned on by the on/off switch 236 in the face of the HMI (Human Machine Interface). The DC pulsed signal is sent to the first and second channels of PLC 239 through conduit 242. PLC Ch 1 controls the signal to the excitation board through conduits 244 and 243. PLC CH 2 controls the signal to the pole switching board through conduits 231 and 245. The excitation is transmitted to the excitation board and enters the circuit through contact block 277 FIG 57. The signals control Mosfet gates 272 and 269. The Mosfet gates 272 and 269 have 12+ volts of DC current on them constantly to maintain the gates closed. The default position for these gates is open. The PLC CH 1 and CH 2 turn the DC current off of the Mosfets for 135 degrees and 180 degrees of rotation respectively at 1800 rpm's of signal speed and allows the gate to open for 135 degrees of rotation in the case of CH 1 and 180 degrees of rotation in CH 2 which allows current to be routed in the case of CH 1 through conduits 279 and 273 to contact block 278. Contact block 278 has four contact points #1, #2, #3 and #4. Jumper connections connect contact #1 block 278 to contact #1 213 on the pole switching board. Jumper connections connect contact #2 block 278 to contact #2 214 on pole switching board. Jumper connections connect contact #3 block 278 to contact #3 215 on pole switching board. Jumper connections connect contact #4 block 278 to contact #4 216 on pole switching board. These circuits provide a timed alternating pulse of DC current (20 volts and 6 amps) to the pole switching board side #1 and side #2. PLC channel #2 sends signal to Mosfet gates 209 and 225 on pole switching board to open for 180 degrees through conduit 245 to side #1 and 231 to side #2. The DC power to operate the excitation circuit is provided by two 24 volt 525 amp DC lead acid batteries (but not limited to lead acid batteries). Battery 248 (battery A) is connected to contact block 250 through conductor 259 to side A anode and through 260 to side A cathode. Battery 249 (B) is connected to the contact block 250 through conductor 257 to side B anode and through conduit 258 to side B cathode. The pulsed current to the rotors consists of 20 volts and 6.25 amps DC. The current flow is controlled by a 3.2 ohm resister in conduit 261 and 262.

First polarity current (north pole) is generated as follows: Mosfet gates 209, 225, 272 and 269 are closed by 12 volt current (default position is open) when sensor wheel 240 sends a signal to PLC channel 1 (CH 1), channel 1 in turn sends a signal to discontinue the 12 volt current to Mosfet 269 on the excitation board for 135 degrees of rotation. Channel 2 (CH 2) simultaneously receives the signal and opens Mosfet 225 for 180 degrees of rotation. When these two gates are open, 20 volts and 6.2 amps of DC current flows from battery A into cathode A (IN) through resistor 262 (3.2 ohms). When the power is on to cathode A and anode A FIG 57 Mosfet 270 opens and allows current to flow through the Mosfet 270, conduit 268, Mosfet 269, conduit 279 into cathode #1 post on contact block 278. A jumper carries current from cathode post #1 on contact block 278 FIG 57 to contact block post 213 FIG 56. The current then flows into "cathode #1 (in)" through conduit 204 with "anode #1 (in)" connected through conduit 206 on pole switching board FIG 56. The current flows through open Mosfet 207 on through conduit 207a to rotor contact block 219 through lead 221 to north pole wound coil and out through lead 220 and through conduit 224 then through open Mosfet 225 through conduit 226 to earth ground. This circuit for 135 degrees of rotation delivers a first polarity current to the rotor pole (north pole).

At the end of the first 180 degrees Mosfet 269 and Mosfet 225 closes.

The second circuits of PLC channel 1 (CH 1) and channel 2 (CH 2) are operative at the end of the first 180 degrees of rotation. Channel 1 turns off the 12 volt current to 272 on the excitation board for 135 degrees of rotation. Channel 2 of the PLC opens Mosfet 209 for 180 degrees of rotation. DC current (20 volts, 6.2 amps) flows from battery B into "cathode B (in)" through resistor 261 (3.2 ohms). When power is on to cathode B and anode B FIG 57 Mosfet 256 opens and allows current to flow through Mosfet 256, conduit 271 into Mosfet 272 on through conduit 273 into cathode #2 post on contact block 278. A jumper carries current from cathode post #2 on contact block 278 FIG 57 to contact block post 216 FIG 56. The current then flows into "(cathode #2 in)" through conduit 276 with "(anode #2 in)" connected through 227 on pole switching board FIG 56. Current flows through open Mosfet 223 on through conduit 223a to rotor contact block 219 through lead 220 to south pole wound coil out through lead 221 and through conduit 207a and 208 then on through open Mosfet 209 through conduit 210 to earth ground. After 135 degrees of rotation, the second 180 degree rotation Mosfet 272 closes and after 180 degrees of rotation Mosfet 209 closes and the cycle begins all over again.

This same sequence of events is repeated for four times in sequence over a complete cycle of 16.66 milliseconds. Salient pole #1 in each group is excited as just described above. Salient pole #1 is excited in a first polarity and 2.084 milliseconds later salient pole #2 is excited in a first polarity, 2.084 milliseconds later salient pole #3 is excited in a first polarity and 2.084 milliseconds later salient pole #4 is excited in a first polarity and 2.084 milliseconds later salient pole #1 is again excited however this alternate excitation is in a second polarity. 2.084 milliseconds later salient pole #2 is excited in a second polarity, 2.084 milliseconds later salient pole #3 is excited in a second polarity and 2.084 milliseconds later salient pole #4 is excited in a second polarity and 2.084 milliseconds later salient pole #1 is again excited in a first polarity.

Adjoining pole groups to the segment just discussed will have the excitation sequence carried out in an opposite polarity.

FIG 58 is a depiction of a solid state three phase generator 285 of the invention revealing input connections from the rotor circuits #1 - 280, #2 - 281, #3 - 282, #4 - 283. The input circuits enter the unit through conduit 286. The solid state rotor 273 is visible and is protected by a safety cage 172 which is attached to end plate 171 and back to the body of the stator. The cable 288 is made up in junction box 175. Cable 288 carries 3 phase power to an electrical load. The regenerative power to the batteries exits the junction box 175 through conduit 287. The 480 volts, 25 amps power is put through a 3 phase step-down transformer to drop the voltage to 24 volts and 500 amps. The 3 phase power goes through a conduit 289 traversing a single direction diode 291 and through a 3 phase bridge rectifier to convert to DC current to charge batteries A - 248 and B - 249.

FIG 59 is a diagram illustrating a cross-sectional view of a rotor laminate with salient pole irons which exhibit angulation in a clockwise rotational fashion. This angle allows the evolving magnetic field from each pole to emanate at a 45 degree angle in a clockwise direction and as the field is repelled by the existing like adjoining pole, the flux rotates parallel to the surface of the rotor in a clockwise direction.

What is Claimed

1. A method of sustained self-generation of electric power utilizing a solid state electromagnetic rotor which generates a 360 degree revolving magnetic field which is emitted sequentially from salient poles and moves parallel to the surface of the stator in a 360 degree circular motion as either a unipole, dipole, four-pole but not limited to a unipole, dipole or four-pole rotor; solid state rotor is placed inside an appropriate stator and power leads are

connected to an electric power load with at least a portion of that power being sent to a storage device where a portion of the stored power is utilized to re-excite the rotor;

2. The method of claim 1, further comprising a computer controlled, programmable logic center and solid state excitation system utilizing Mosfet gates for switching polarities of the excitation circuits;
3. The method of claim 1, further comprising placement of the solid state stationary rotor into the stator of a conventional electric power generator;
4. The method of claim 1, further comprising placement of the solid state stationary rotor into a stator of multiple rotor cavities of the invention;
5. The method of claim 1, further comprising storing at least a portion of the power output from the generator in a power storage device such as a battery and recovering and returning at least a portion of the stored energy to power the rotor excitation system;
6. A method of claim 1 wherein at least one of the power storage devices is a battery;
7. The method of clam 1, wherein at least one of the power storage devices is the electric power grid;
8. The method of claim 1, wherein power from the generator to power the storage device in the case of a battery as a storage device flows through a power rectifier;
9. The method of claim 1, wherein the power storage may be in any type energy storage technology;
10. An assembly for providing sustained power self generation comprising a solid state power generator rotor which is placed into an electric power generator stator and attached to the stator housing such that it remains stationary and generates a rotating magnetic field which constitutes a single magnetic pole or a double magnetic pole or a four pole rotor or any other desirable and workable number of magnetic poles; with sequential excitation by the solid state Mosfet gated excitation, that generates power to an electric load with a portion going to the storage device to be retrieved for powering the excitation system;
11. The assembly of claim 11, wherein the solid state rotor constructed by a series of adjacent salient poles attached to a central support shaft;
12. The assembly of claim 10 and claim 11, wherein the solid state rotor may be constructed by cutting laminates and assembling them into the form of a rotor of the appropriate size;
13. The assembly of claim 10 and claim 11 wherein the solid state rotor may be constructed of any ferromagnetic material;
14. The assembly of claim 10 and claim 11 wherein the salient poles of the solid state rotor are wound with appropriate magnet wire;
15. The assembly of claims 10, 11 and 14 wherein the salient pole windings are connected to appropriate excitation leads from the solid state excitation system;

16. The assembly of claim 10, wherein the salient poles are divided into groups of 2 or 4 or other appropriate numbers and the windings are connected by leads to the solid state excitation system;
17. The assembly of claims 10 – 16 wherein channel #1 of the excitation system is connected to pole #1 from each group of salient poles;
18. The assembly of claims 10 and 16, wherein channel #2 of each of the excitation system is connected to pole #2 of each group of salient poles;
19. The assembly of claims 10 and 16, wherein channel #3 of the excitation system is connected to pole #3 of each group of salient poles;
20. The assembly of claims 10 and 16, wherein channel #4 of the excitation system is connected to pole #4 of each group of salient poles;
21. The assembly of claims 10, 17, 18, 19 and 20 wherein an appropriate similar connection will apply for any number of rotor magnetic poles;
22. The assembly of claims 10, 17, 18, 19, 20 and 21 wherein the excitation system excites the salient poles sequentially such that discrete alternating magnetic poles rotate parallel to the surface of the rotor at the desired speed and frequency;

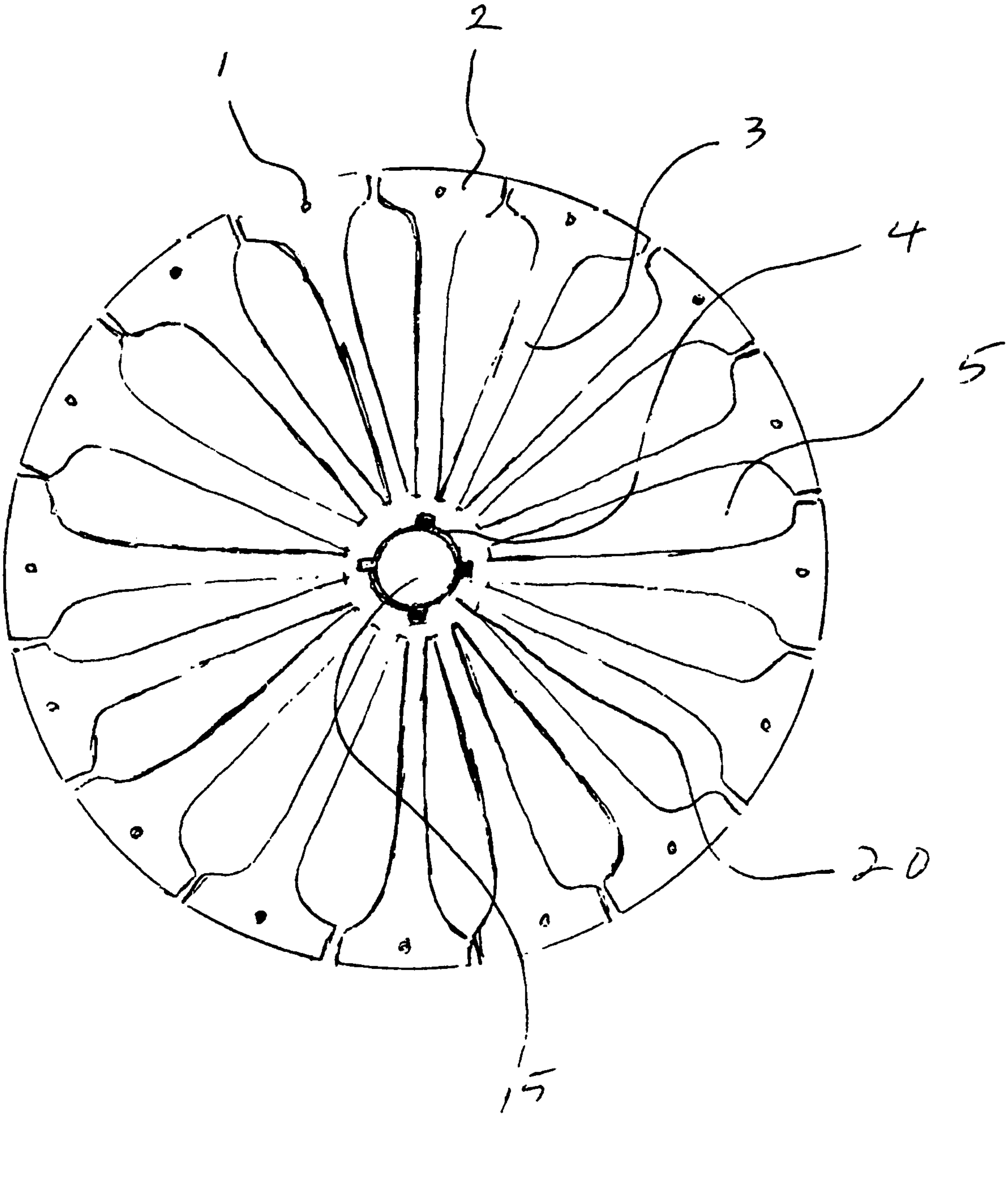


FIG 1

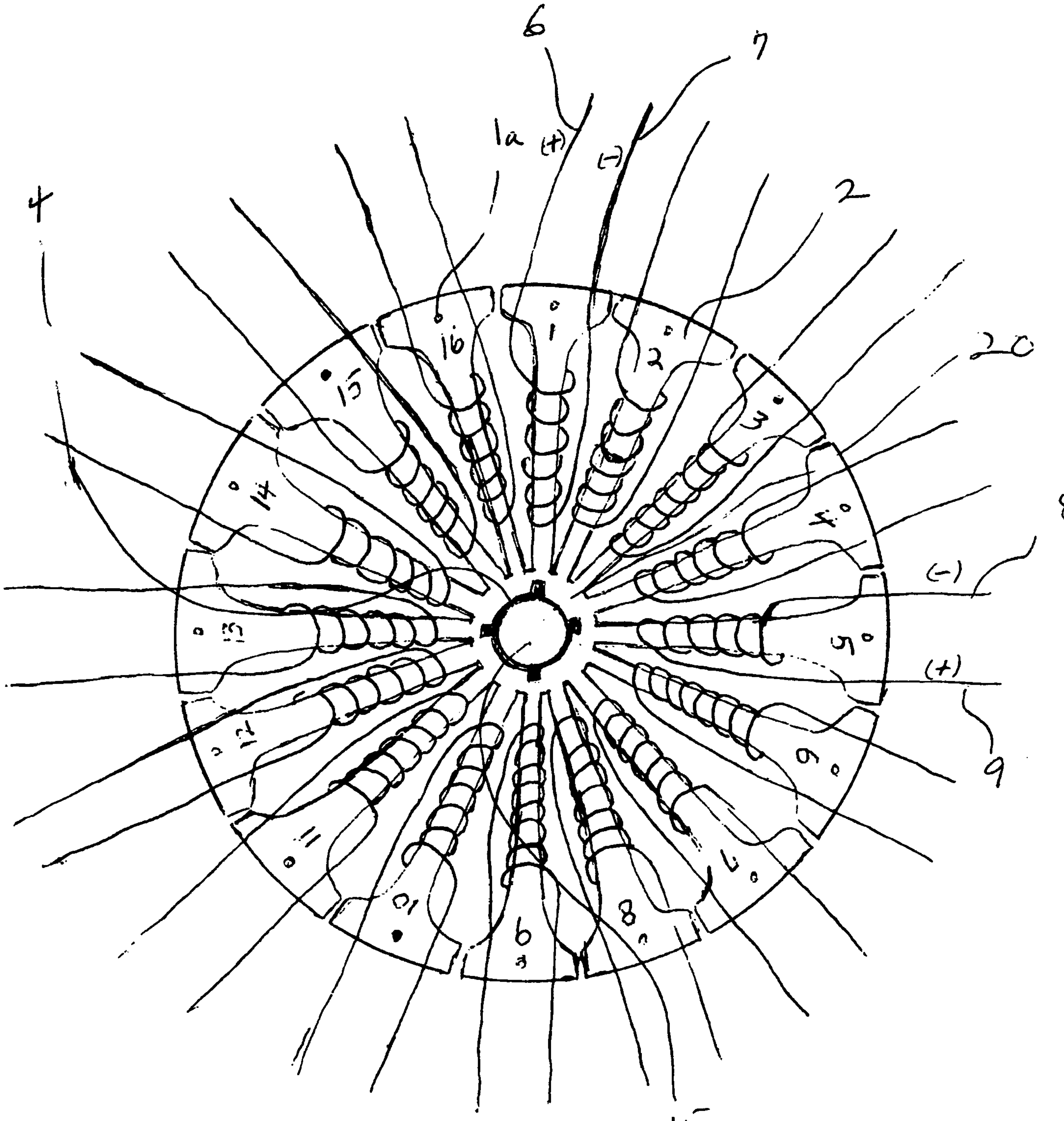


FIG 2

1

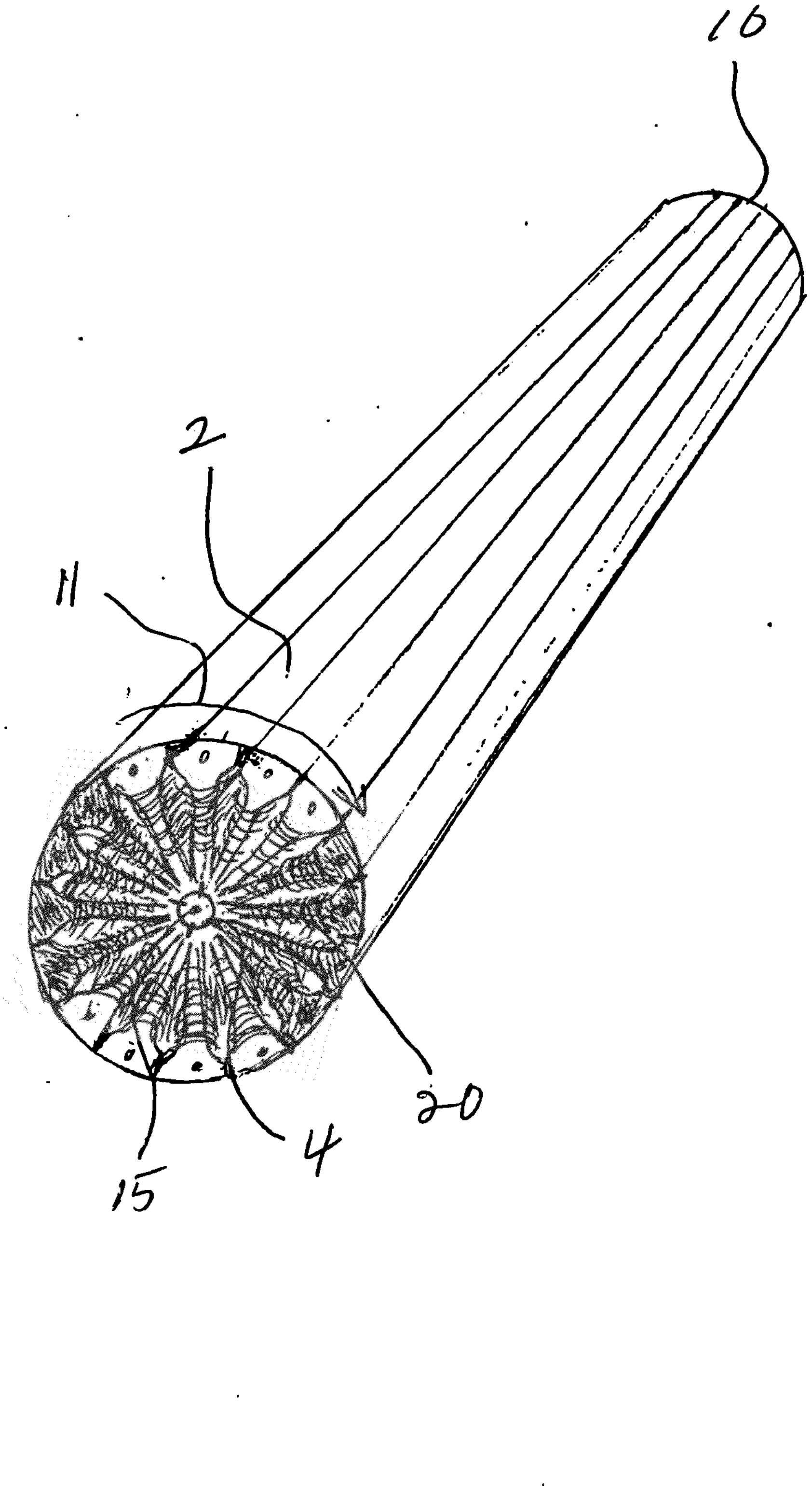


FIG 3

39

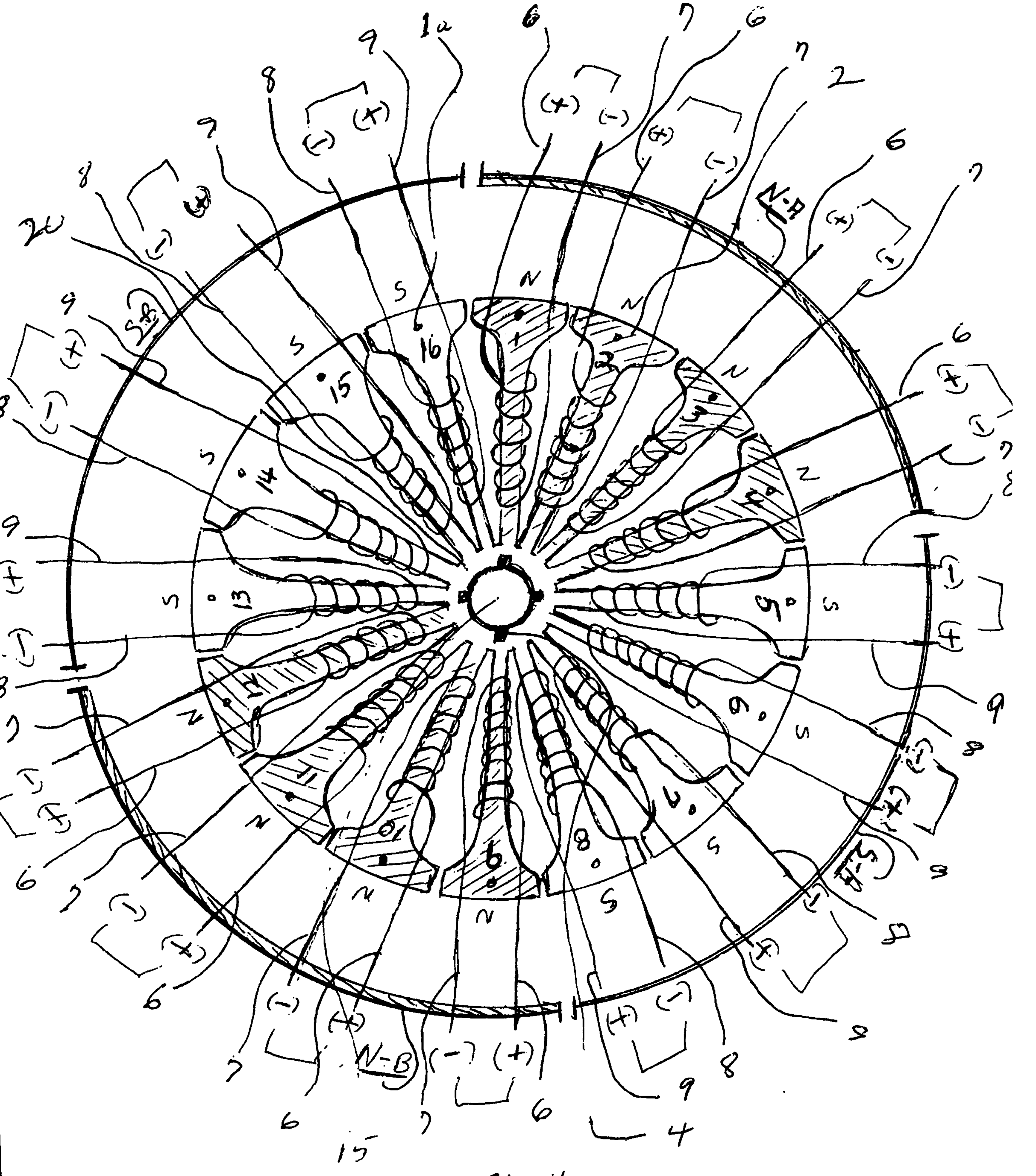


FIG 4

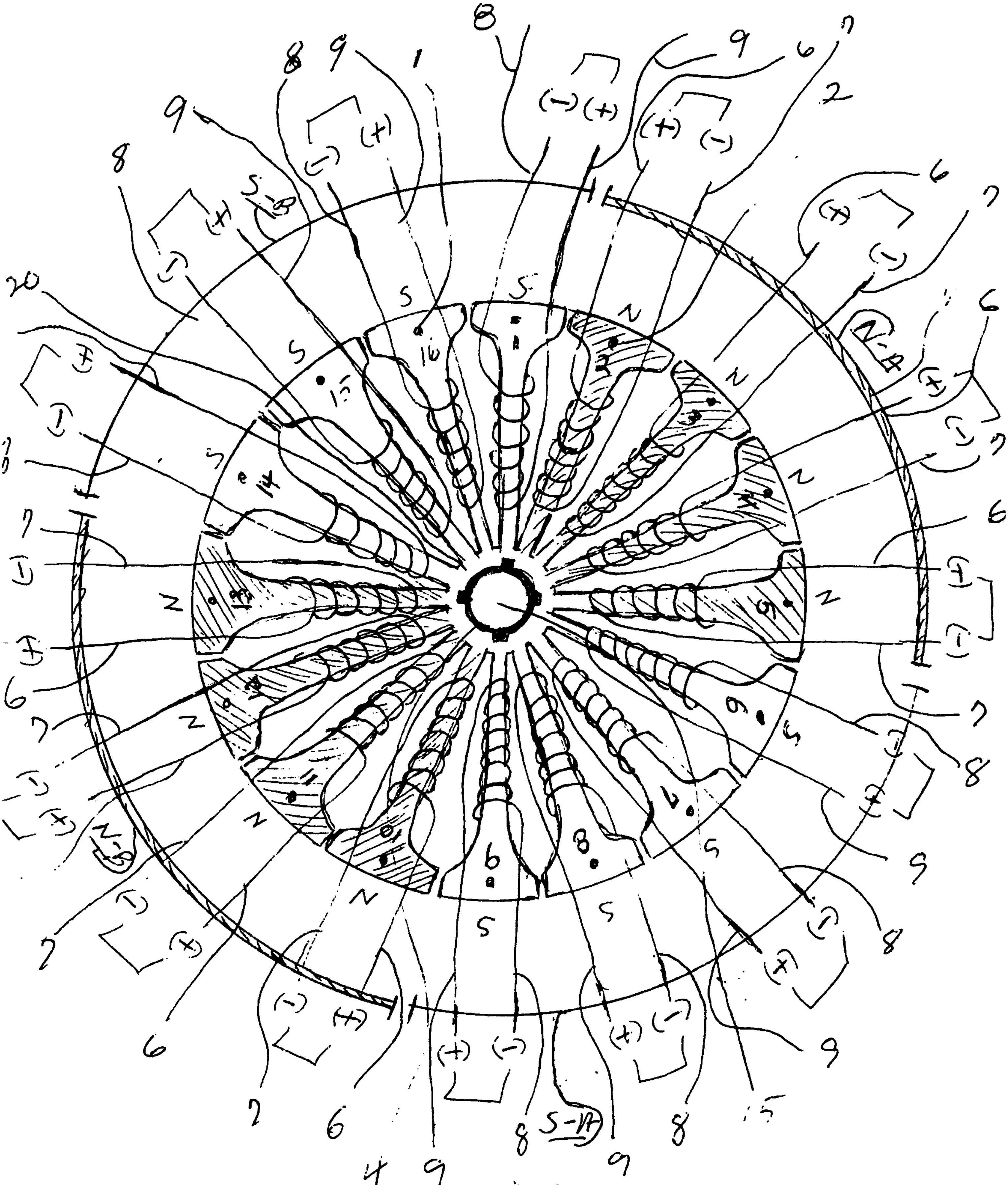


FIG 5

+ - | -

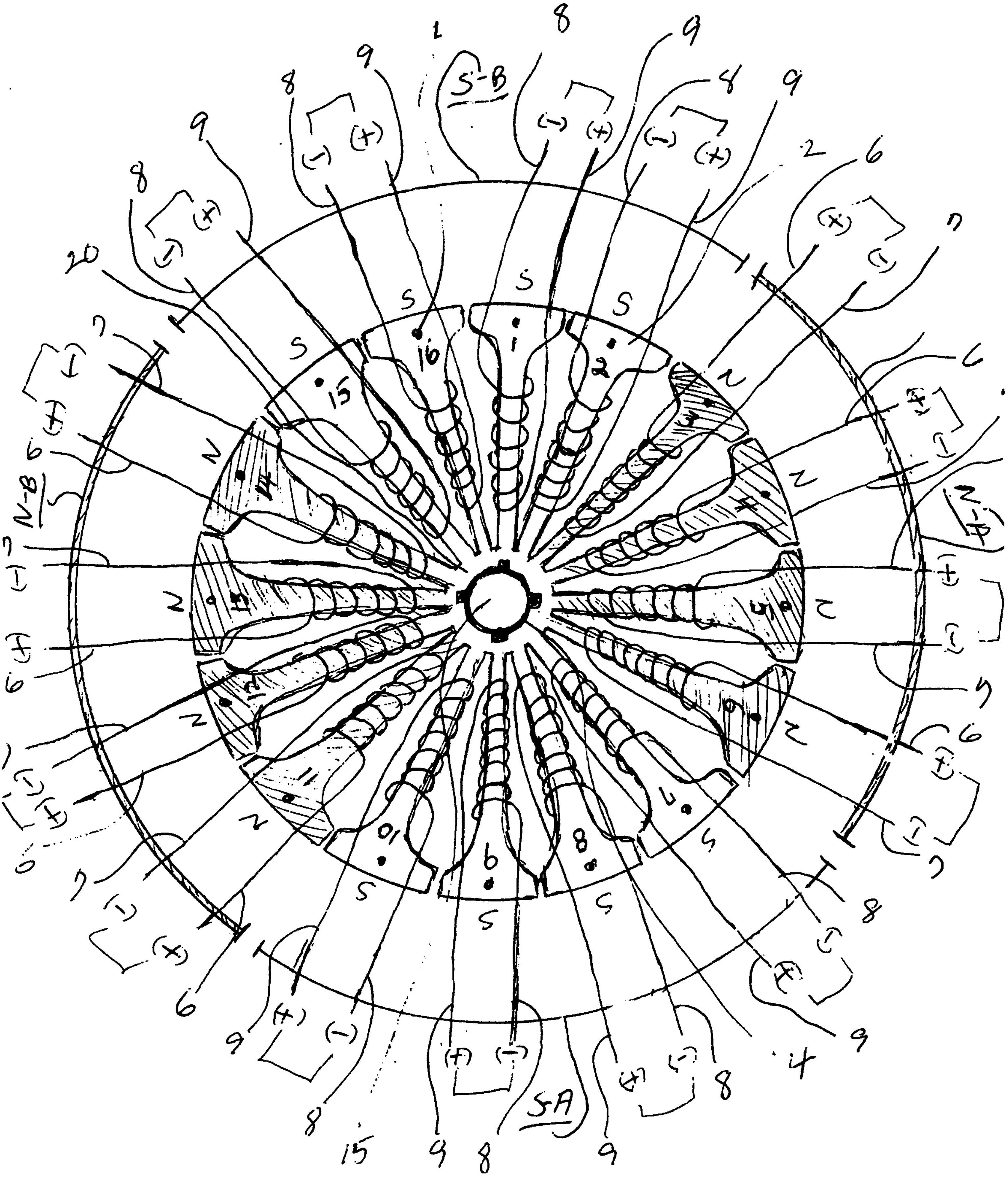


FIG 6

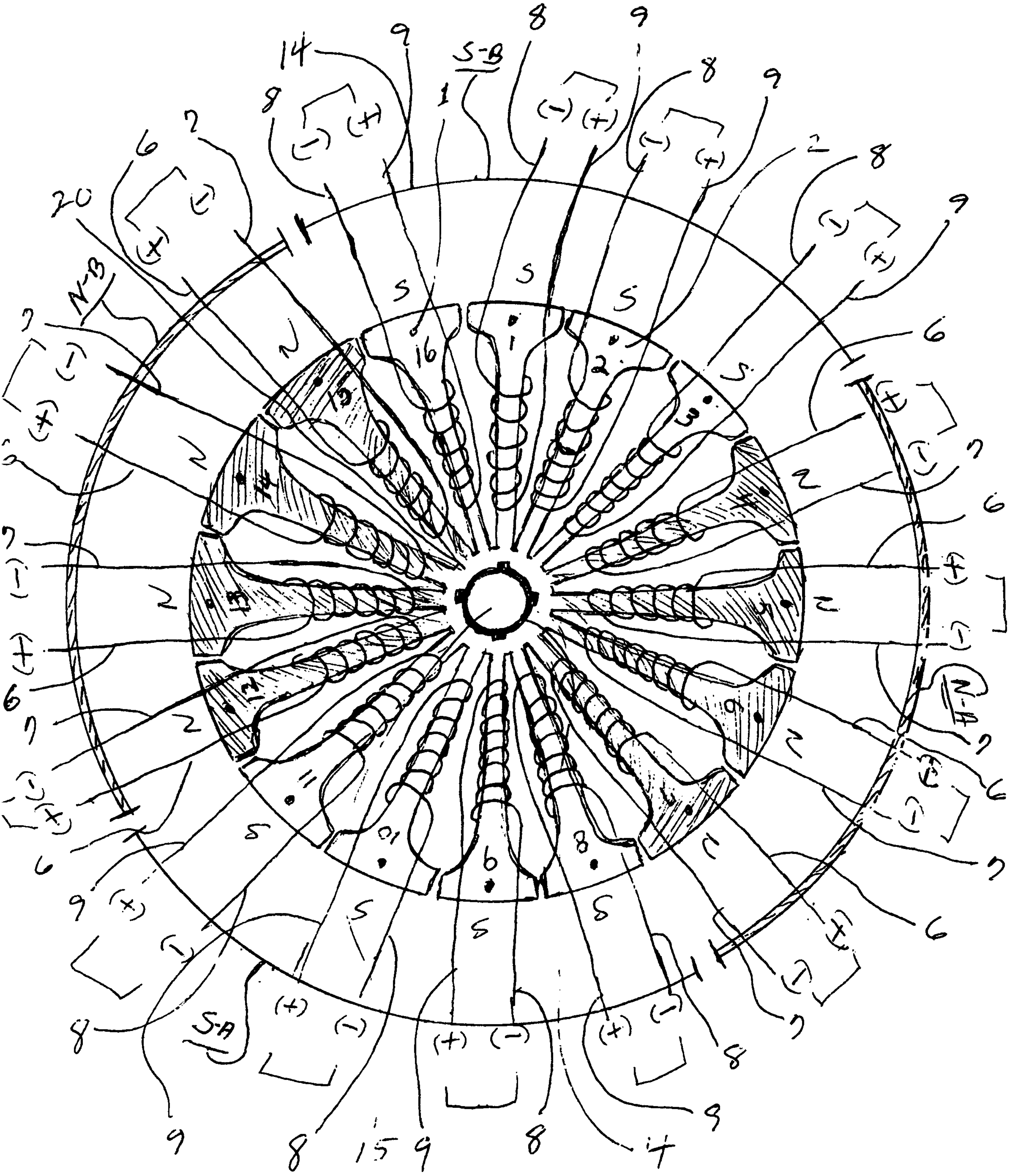


FIG 7

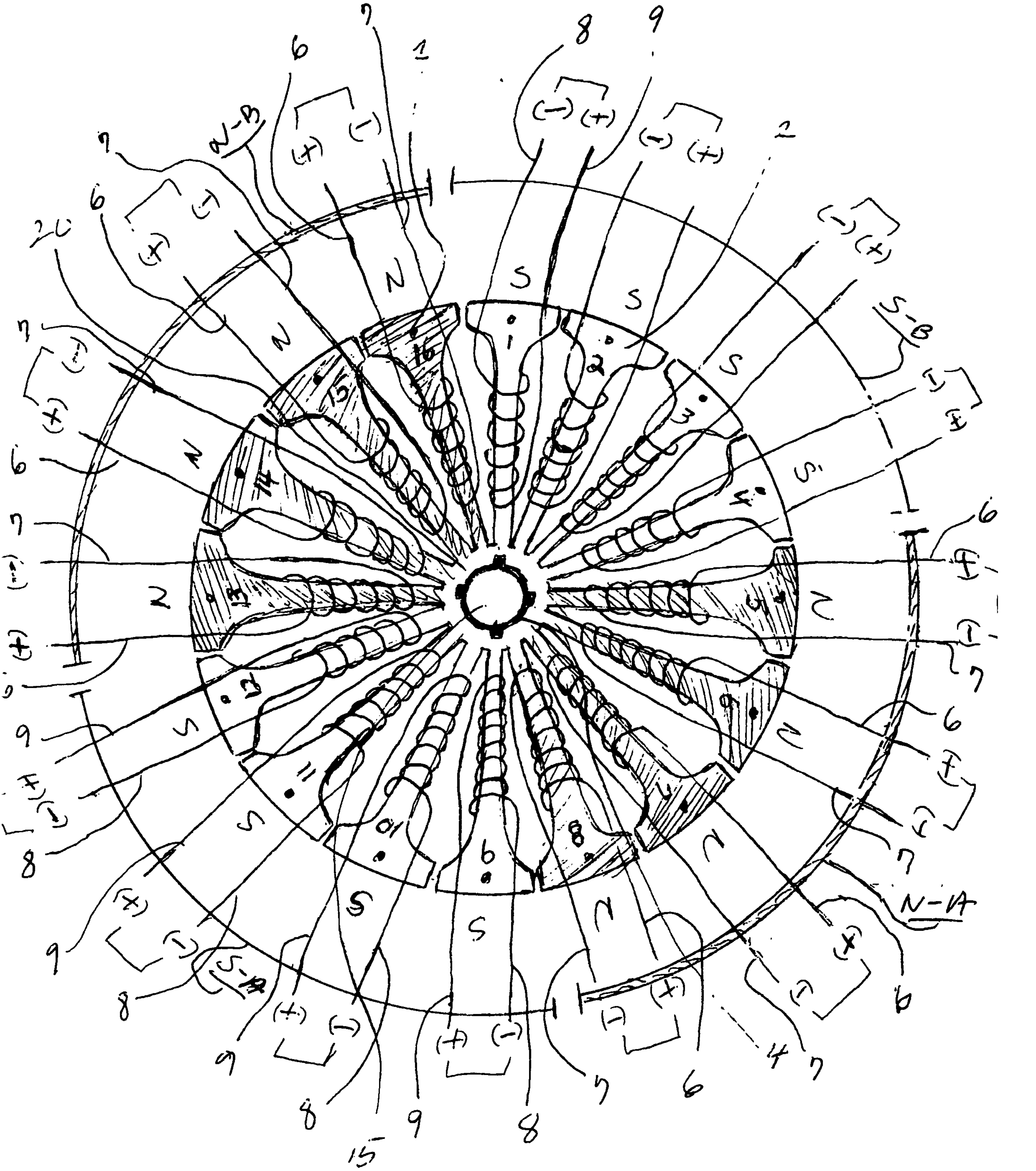


FIG 8

44

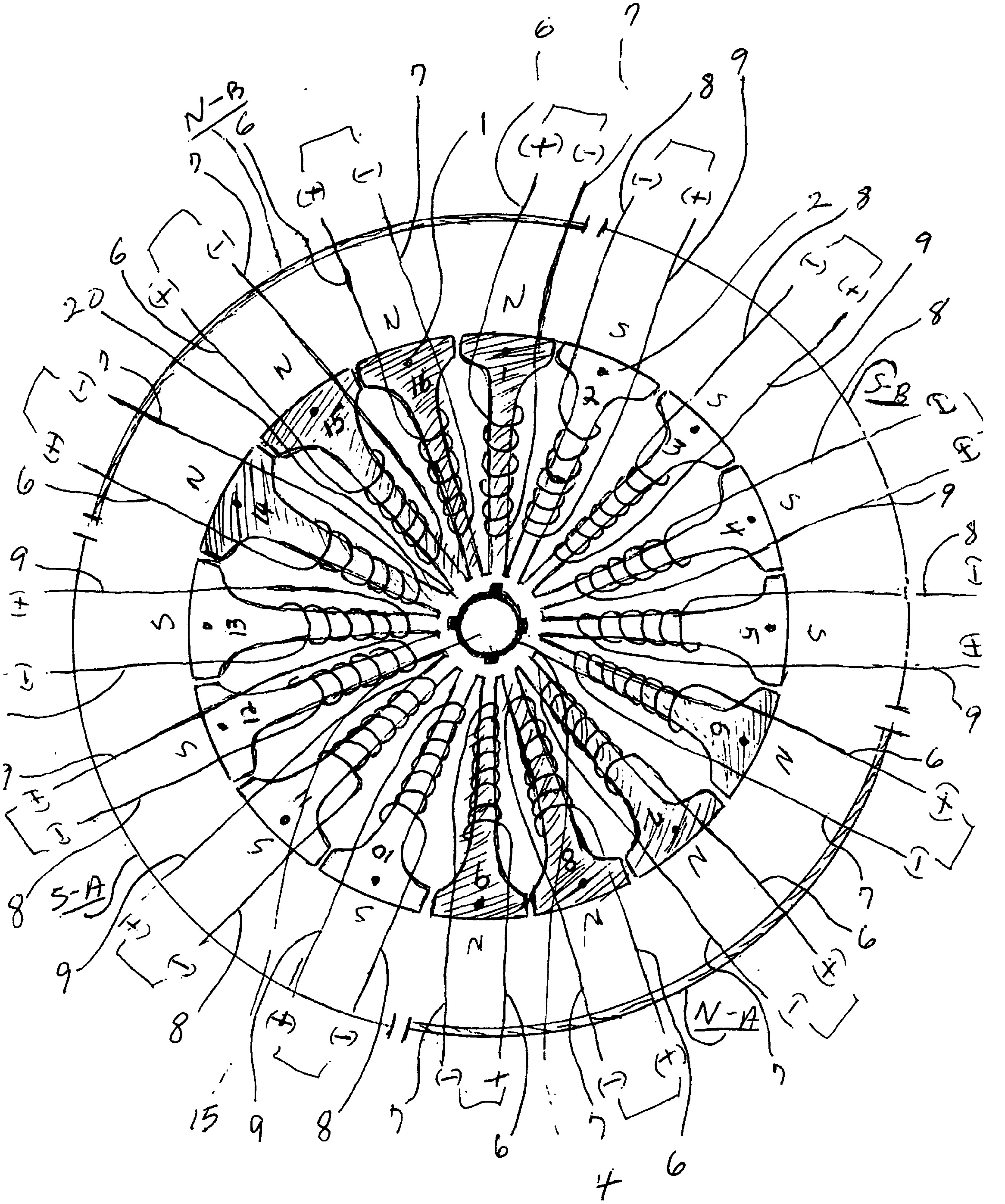


FIG 9

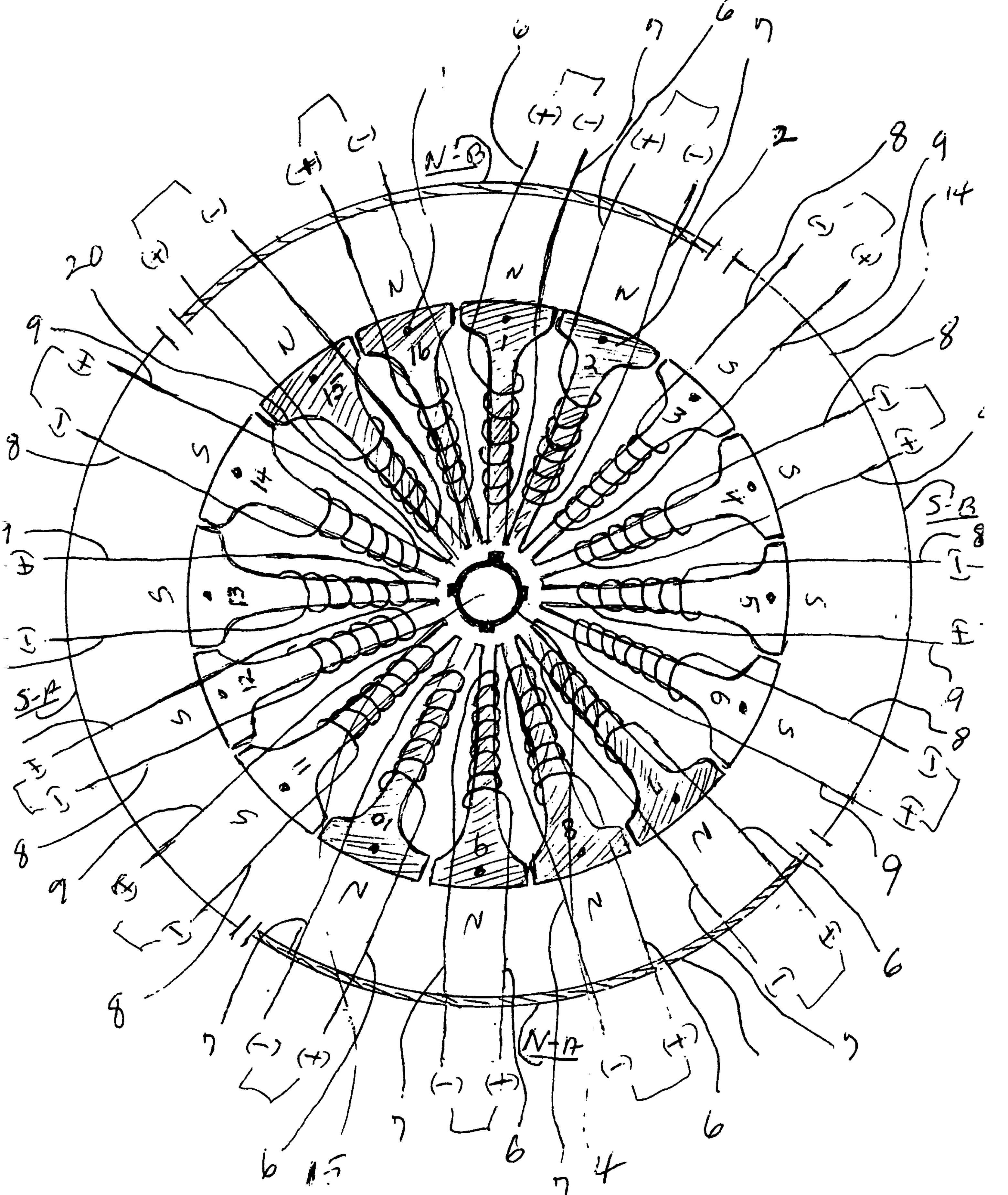


FIG 10

46

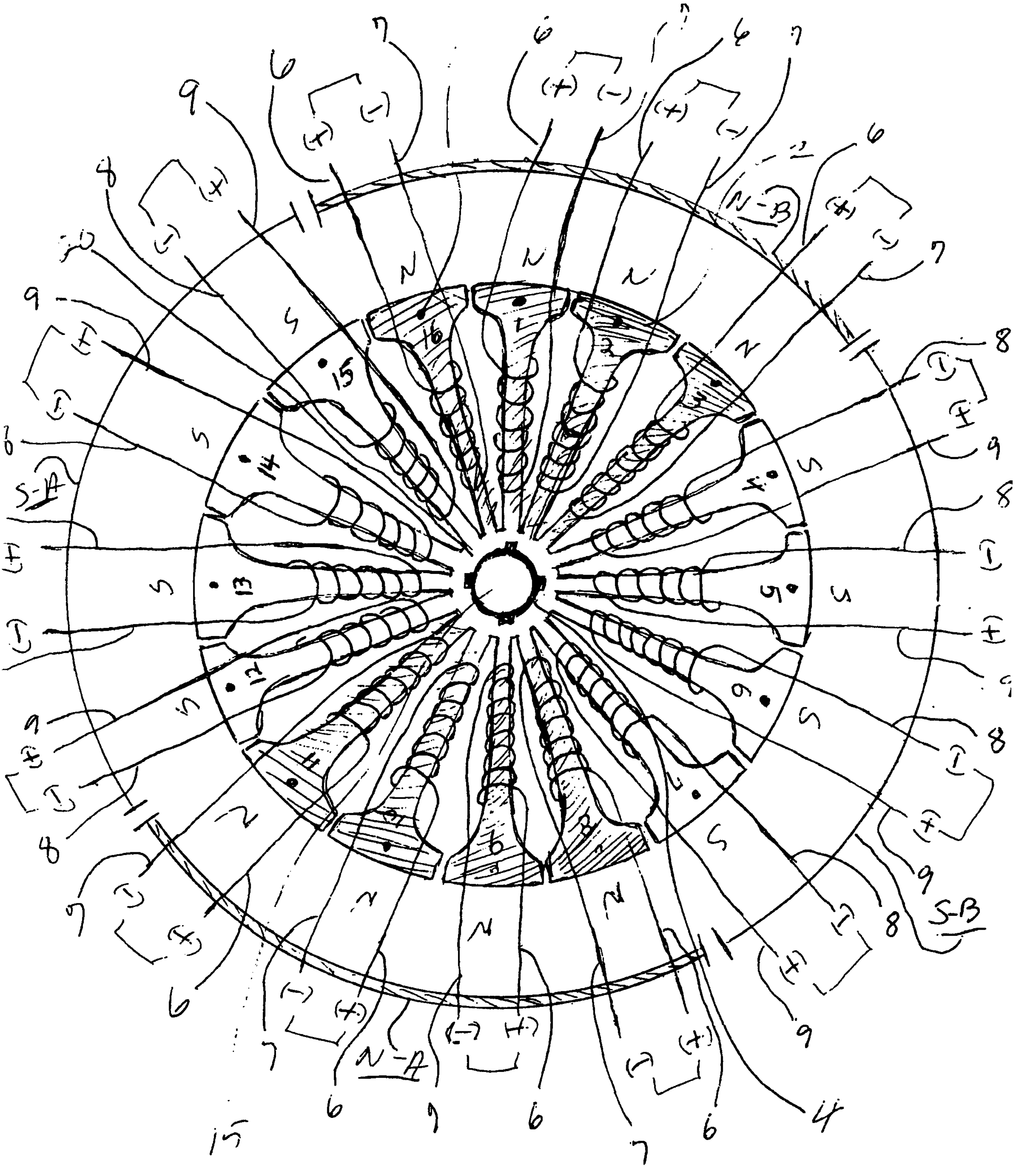


FIG 11

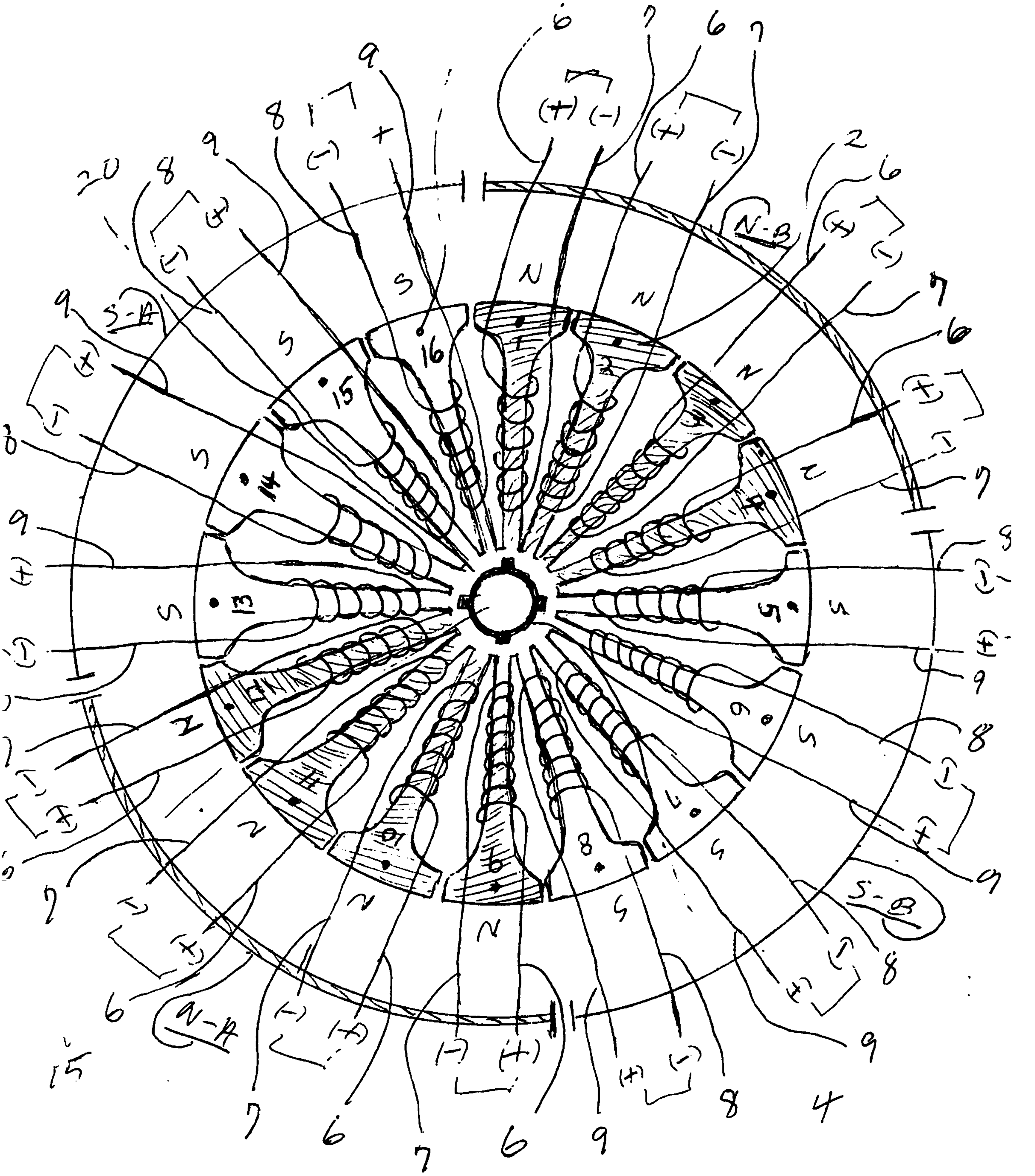


FIG 12

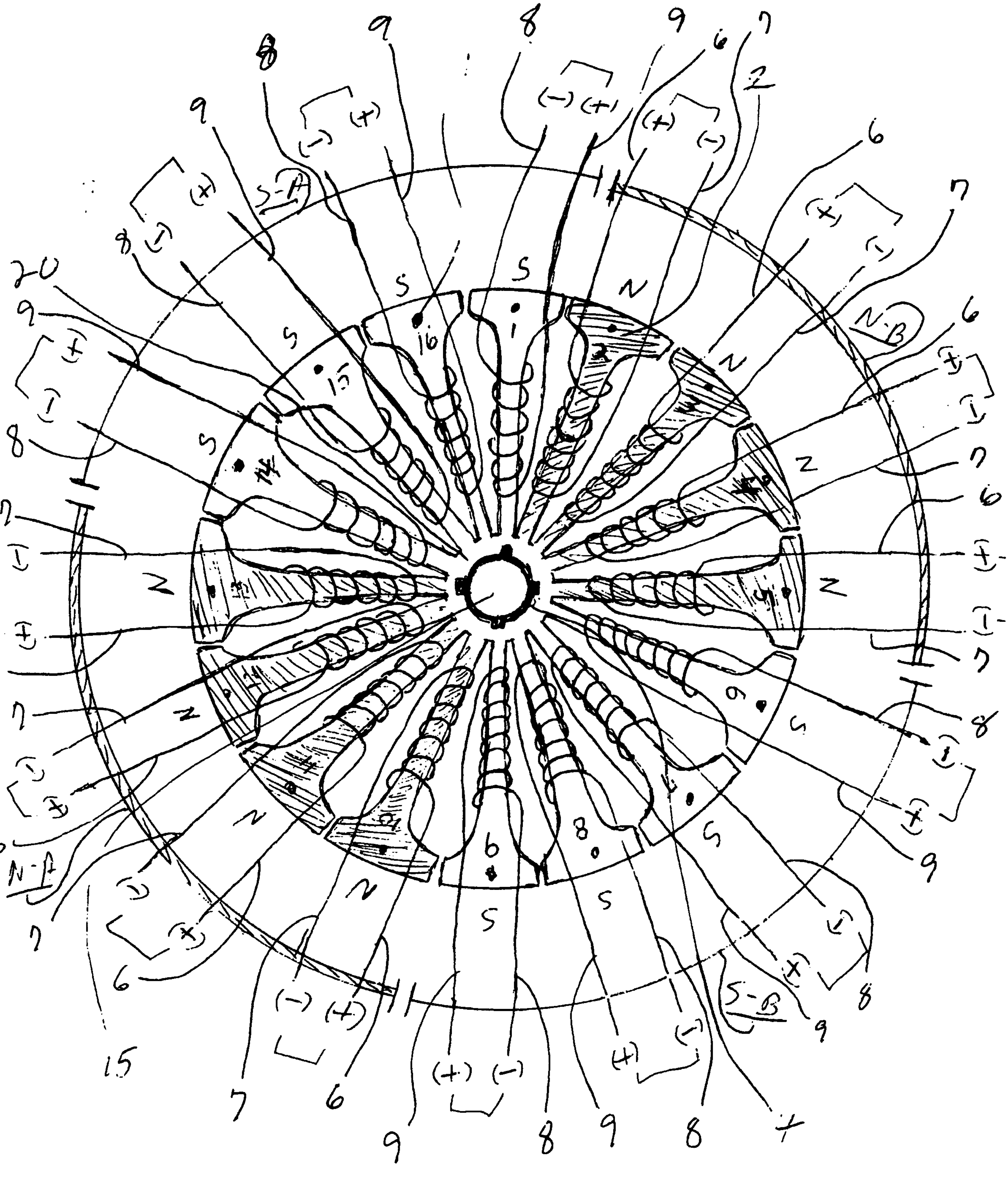


FIG 13

49

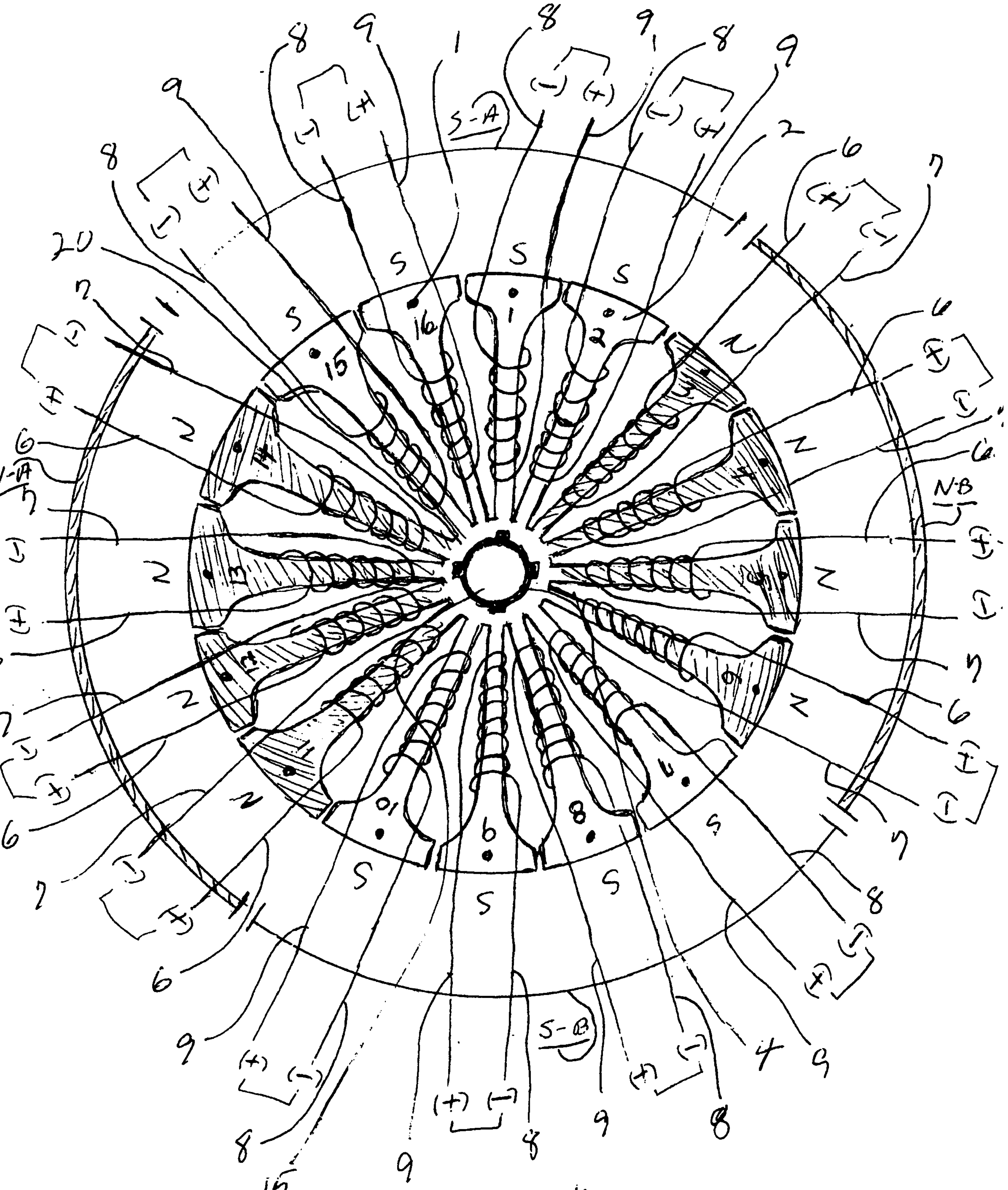


FIG 14

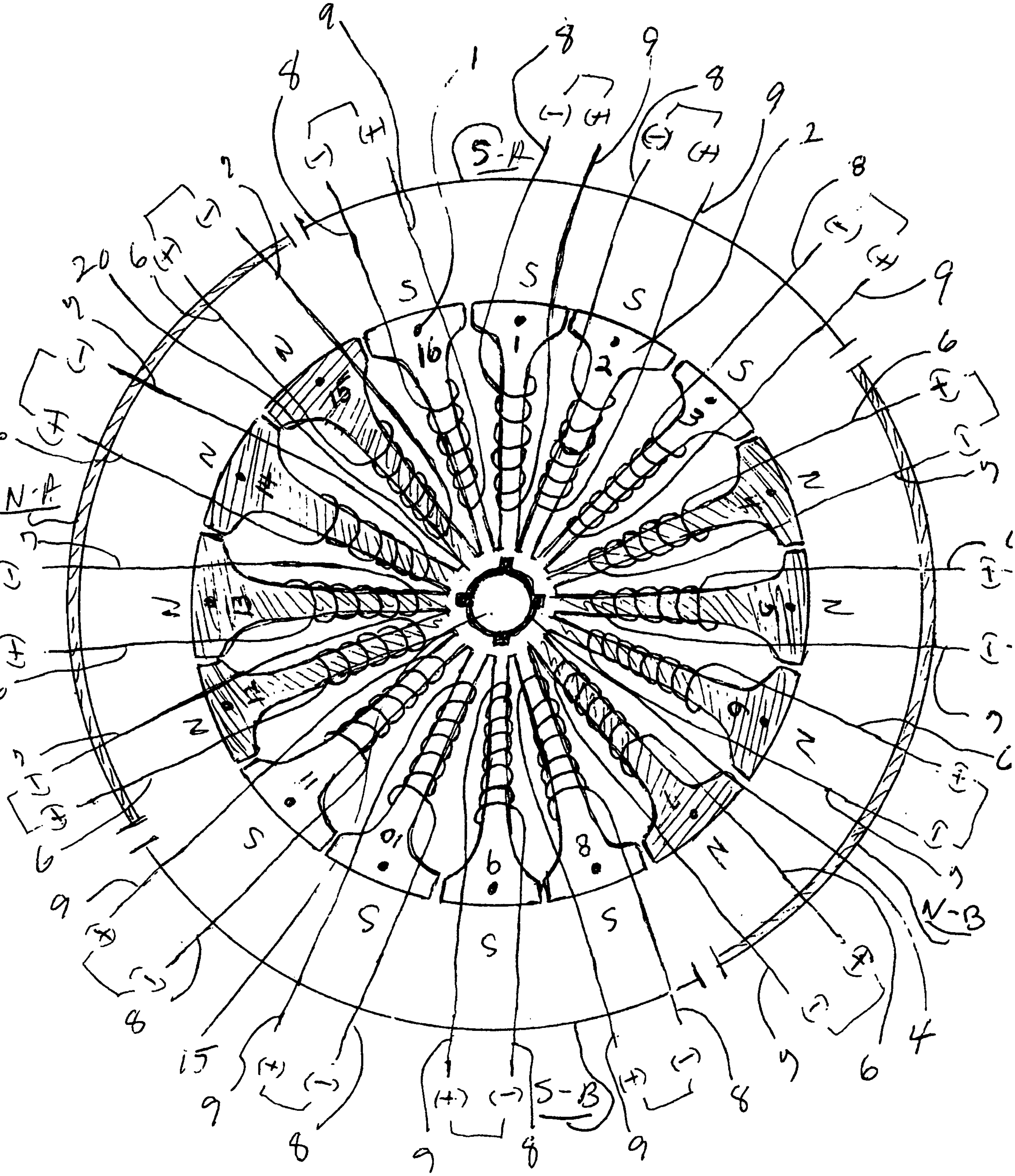


FIG 15

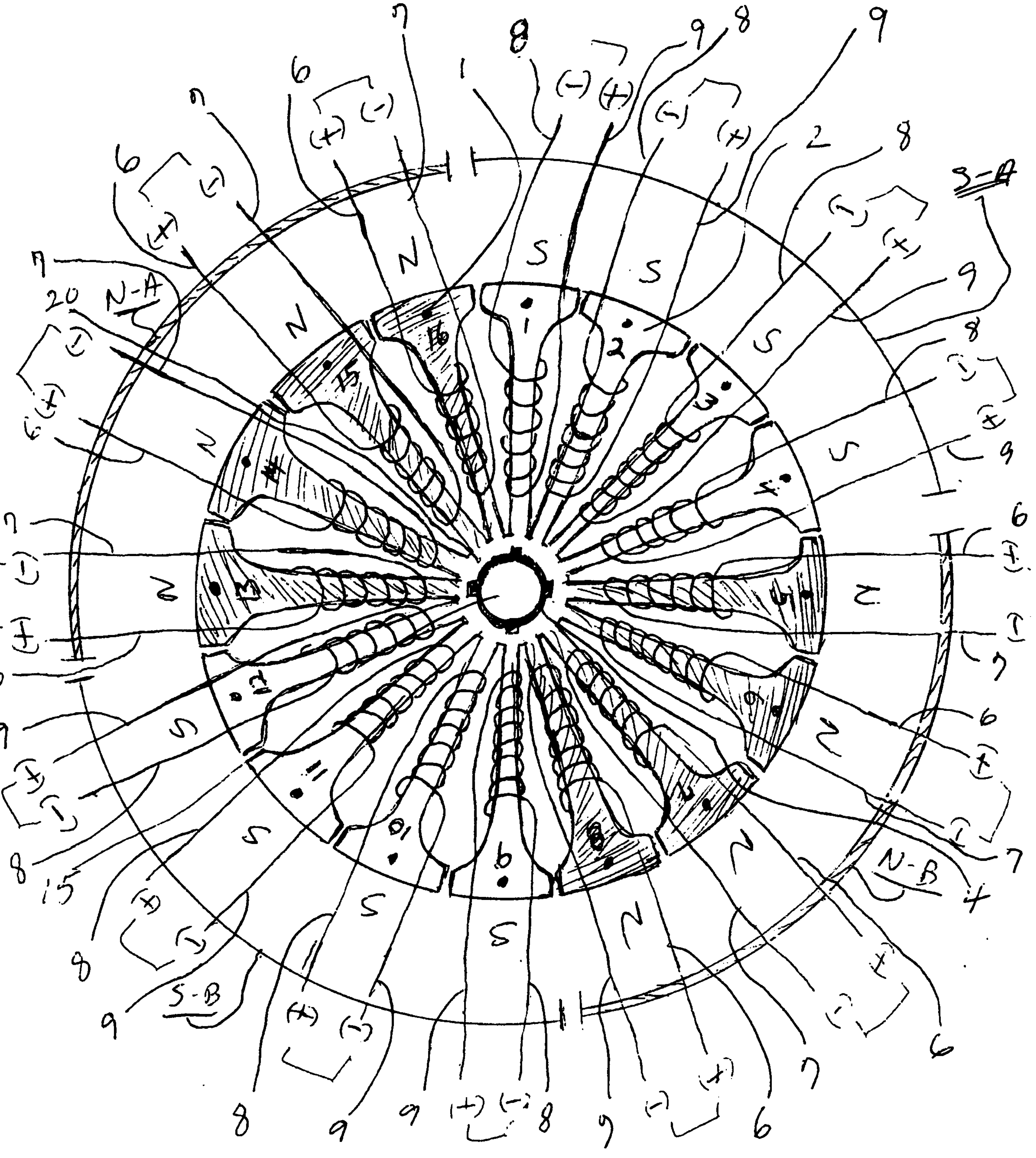


FIG 16

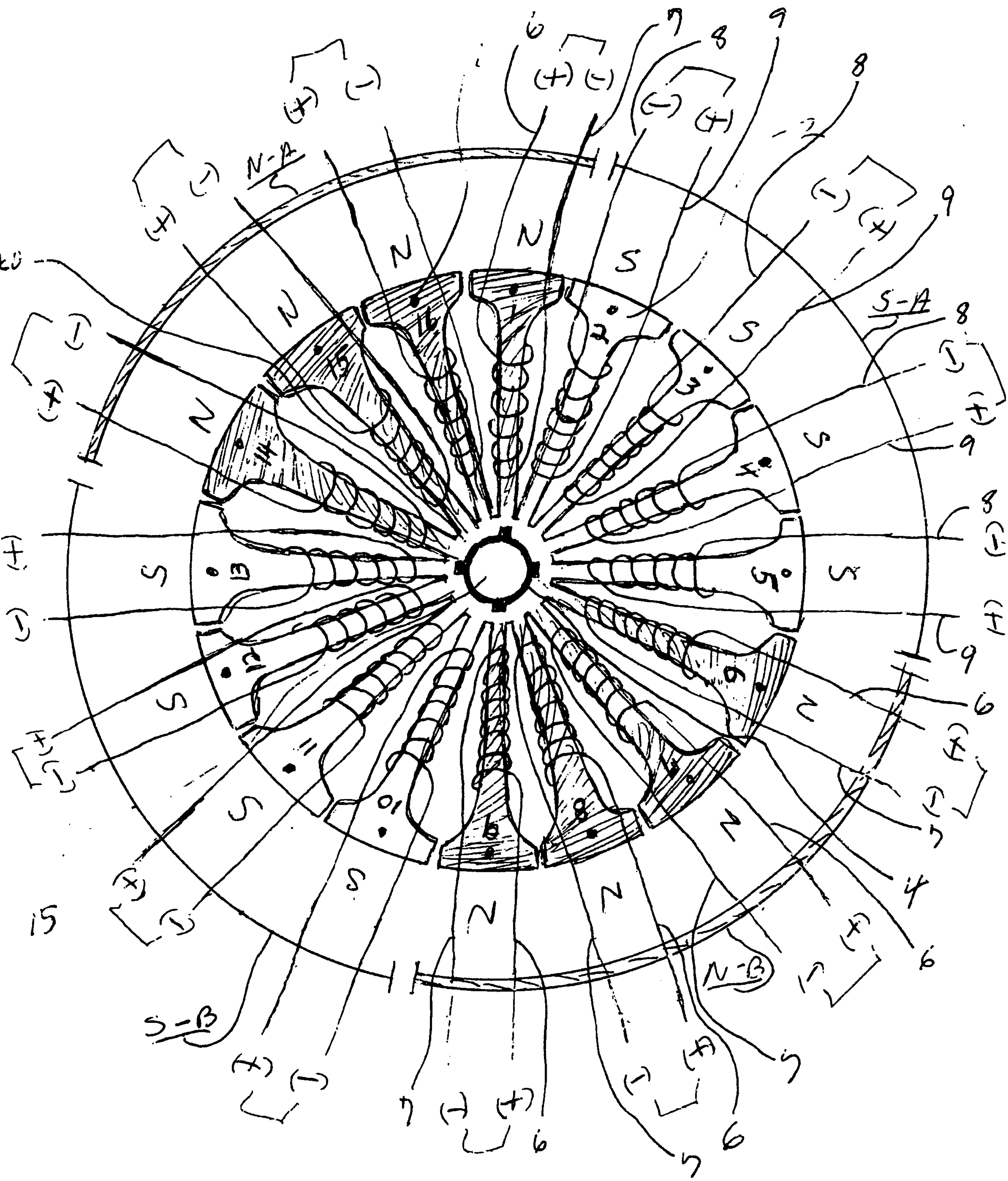


FIG 17

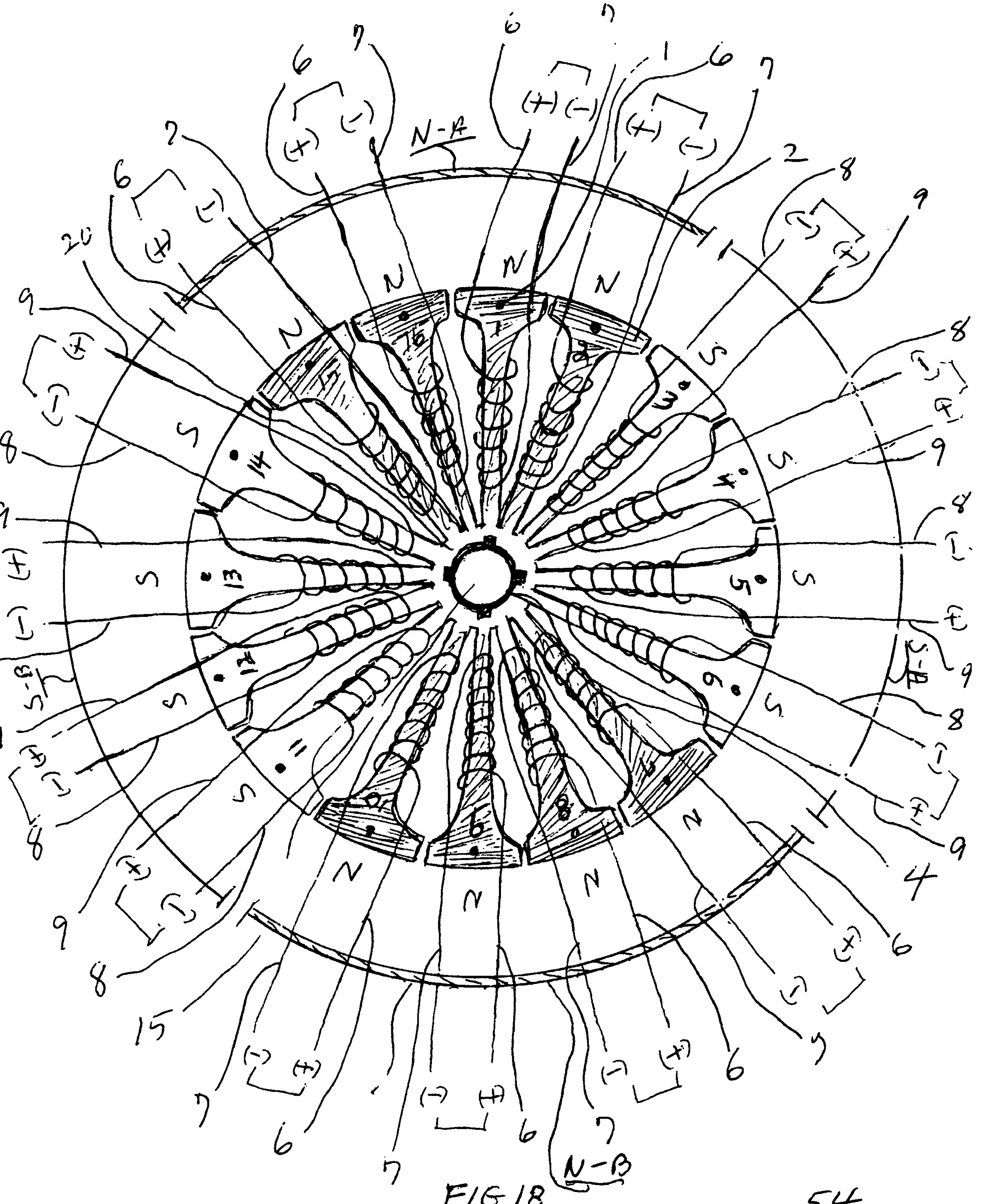


FIG 18

54

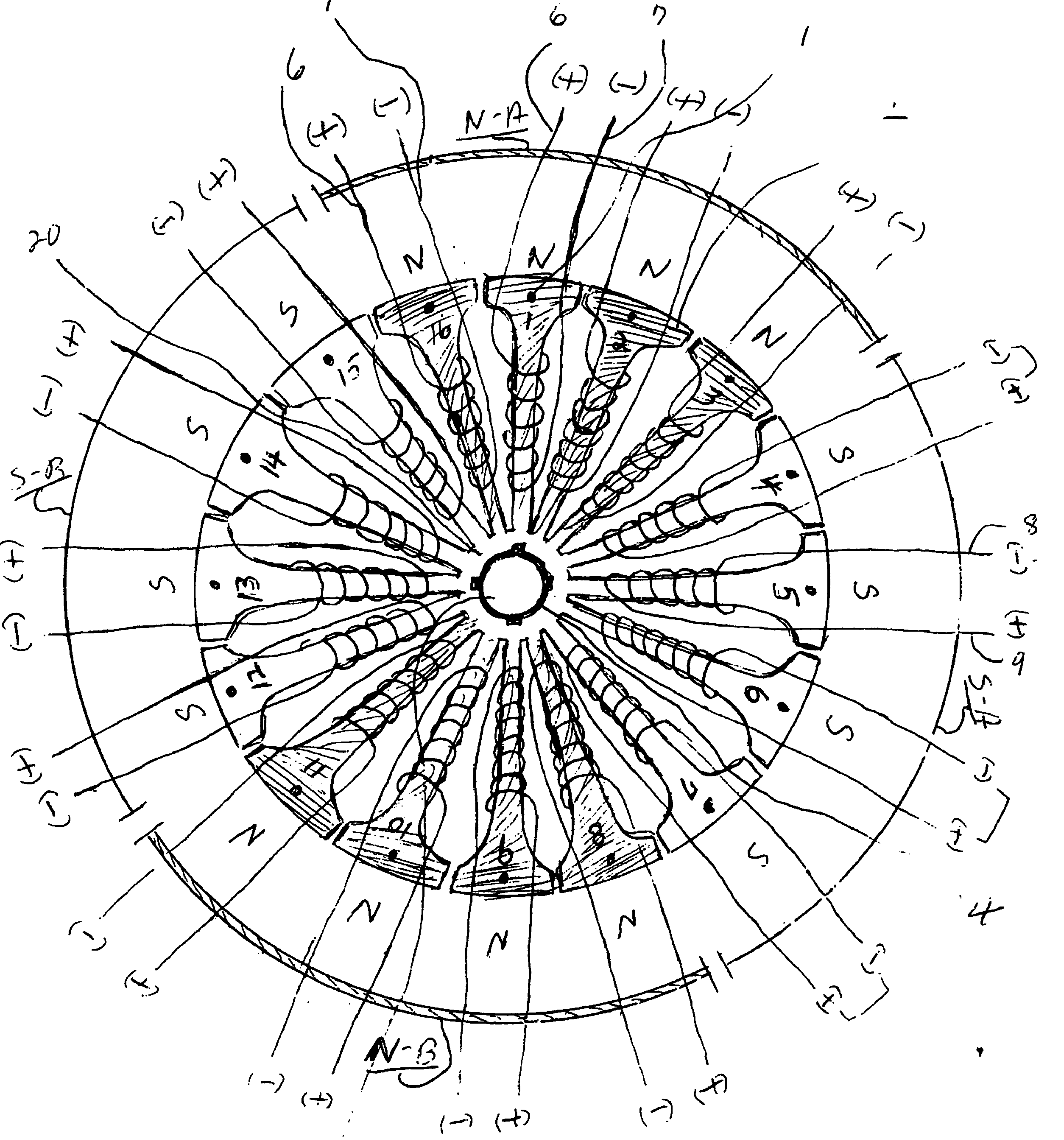


FIG 19

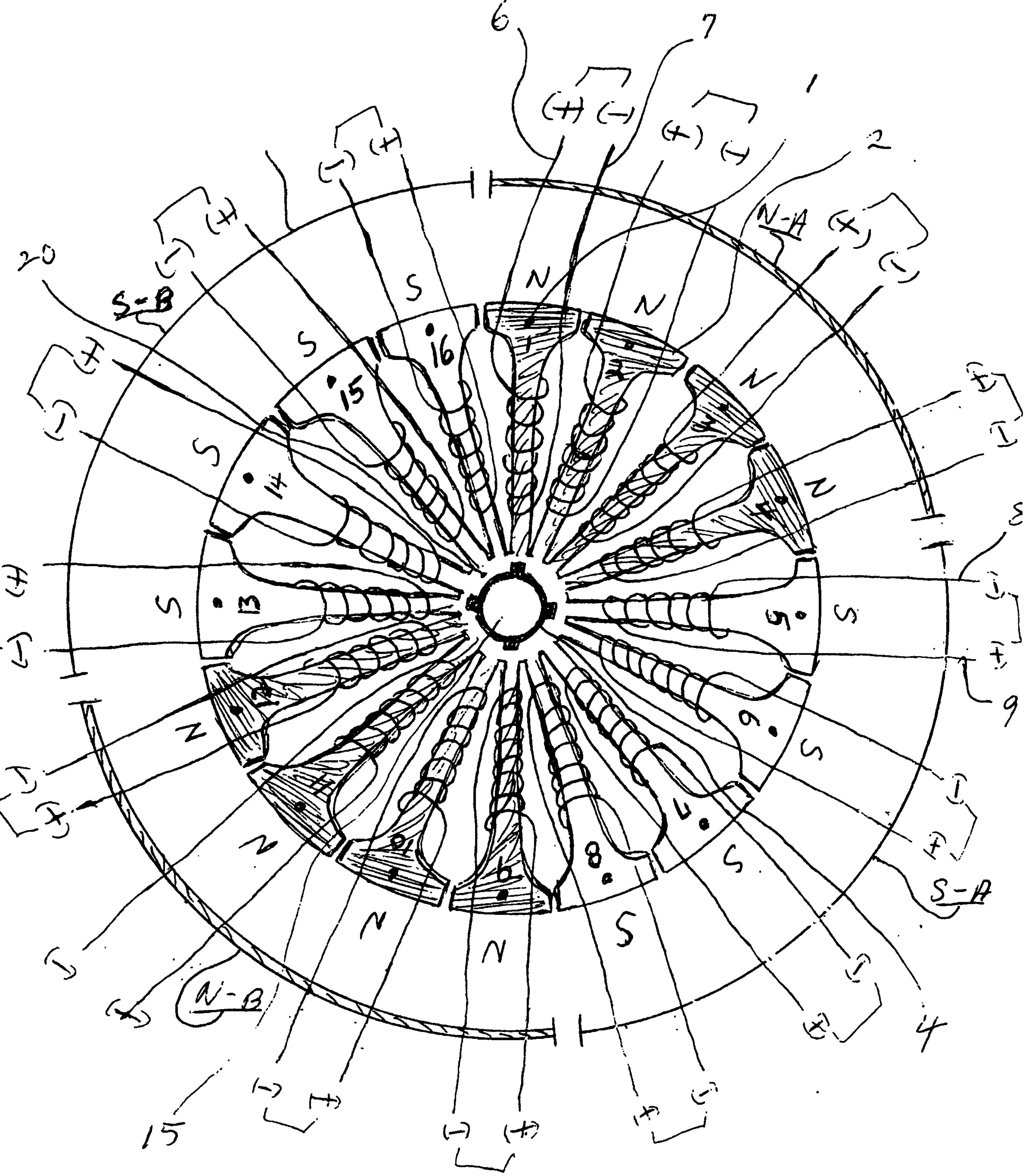
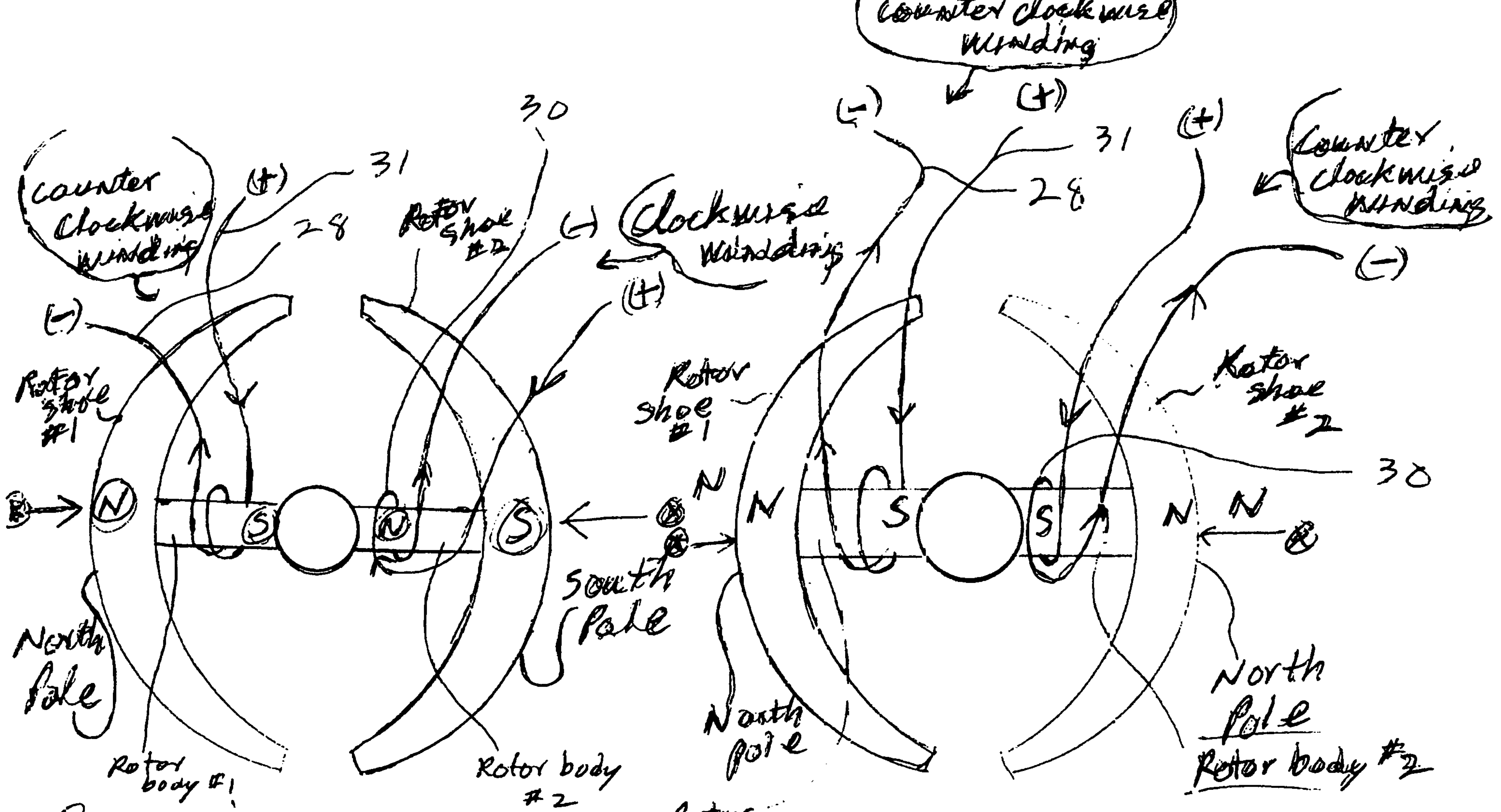


FIG 20

56



(x) - Viewing reference

Flux produced when pole is excited as a dipole

North pole = 4000 gauss

south pole = 4000 gauss

(+) = positive lead

(-) = negative lead

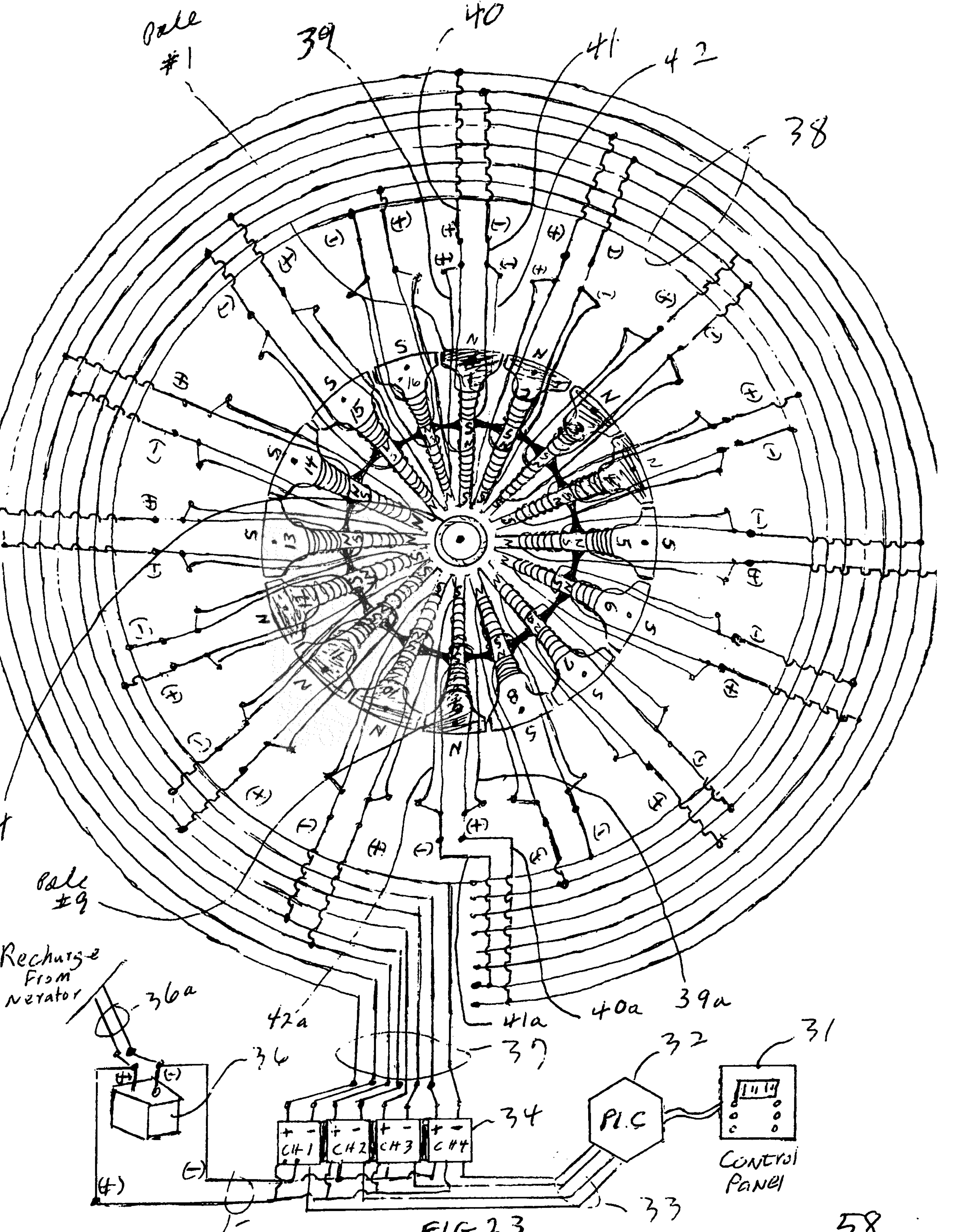
Flux produced when pole is excited as a "unipole"

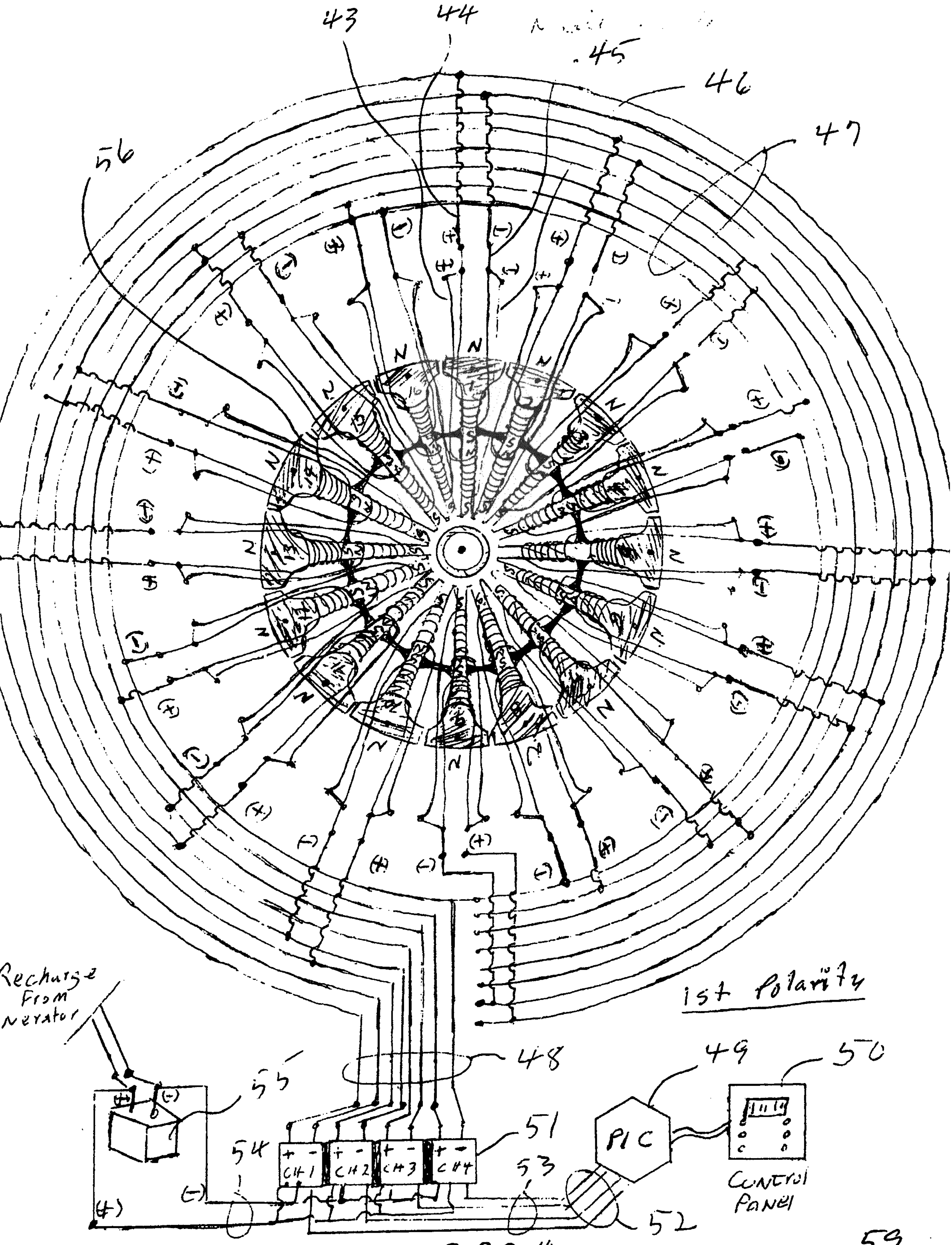
North pole = 100 gauss

North pole = 100 gauss

FIG 22

57


Pole #1
39
40
41
42
38
Pole #9
Recharge From Nerator
36a
36
42a
41a
40a
39a
37
32
31
PLC
Control Panel
CH1
CH2
CH3
CH4
34
33
35
FIG 23



43
44
45
46
47
56
Recharge From Nerator
55
48
49
50
PIC
Control Panel
51
CH1
CH2
CH3
CH4
54
53
52
1st Polarity

FIG 24

59

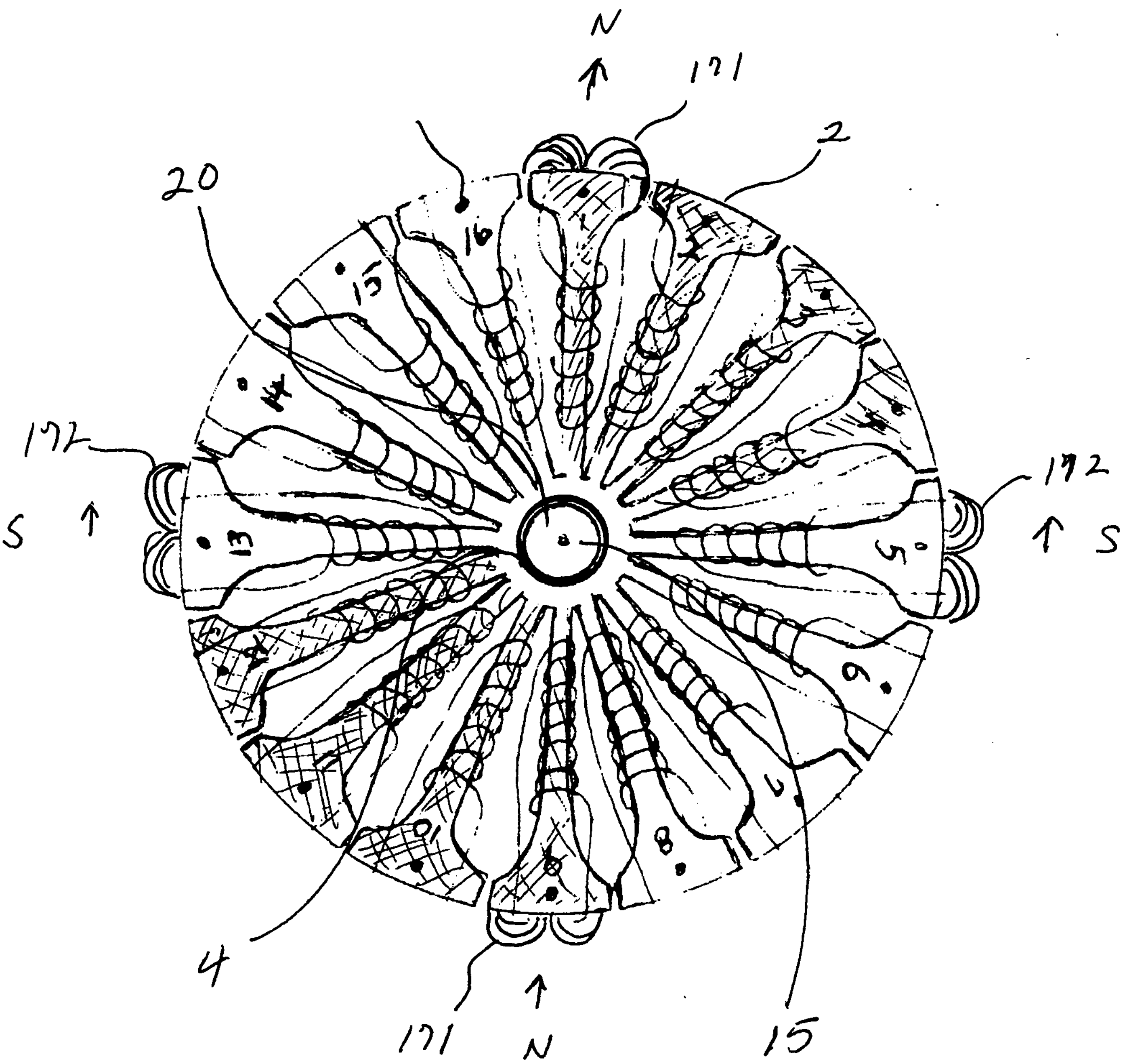


FIG. 26

60

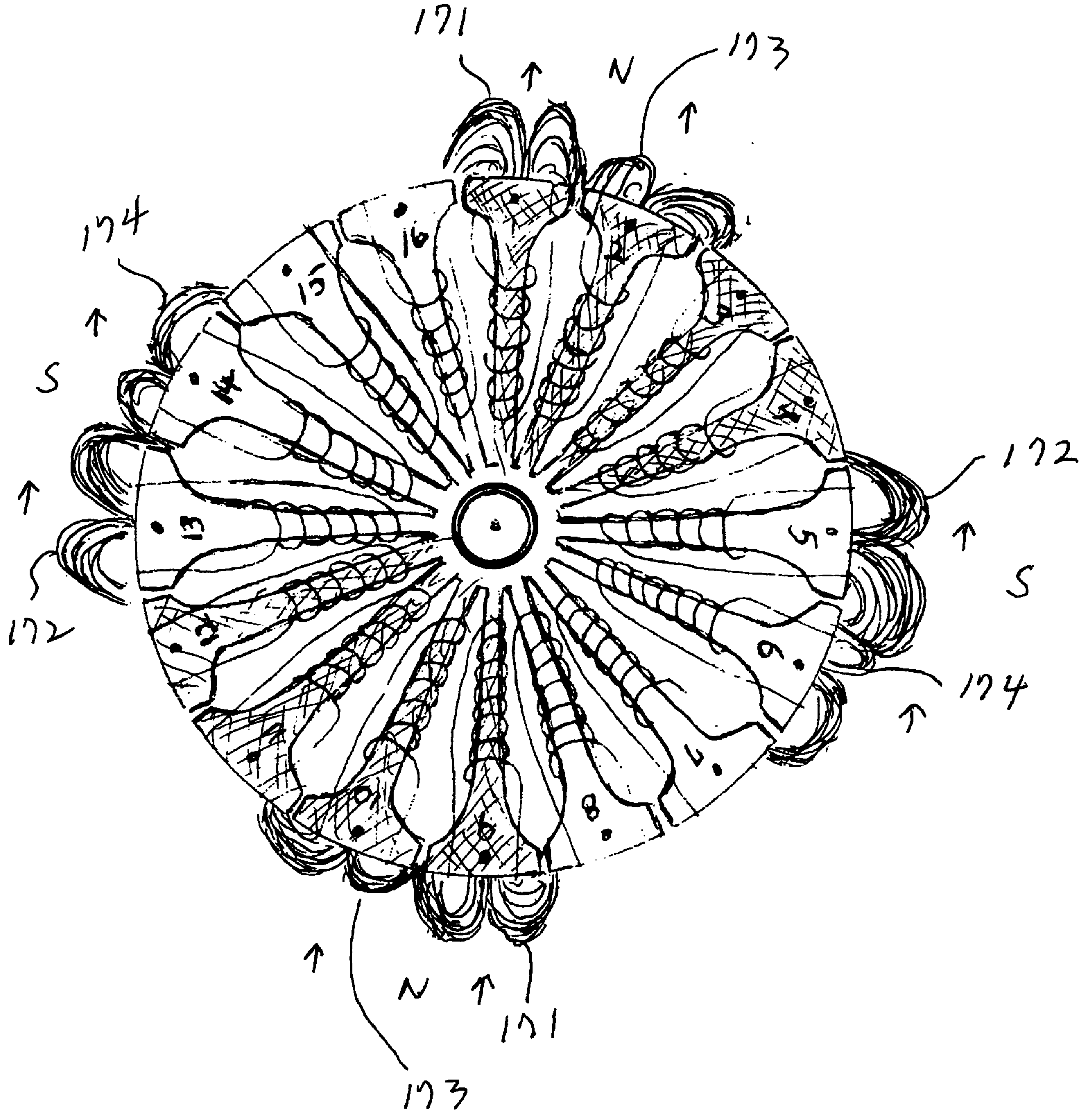


FIG 27

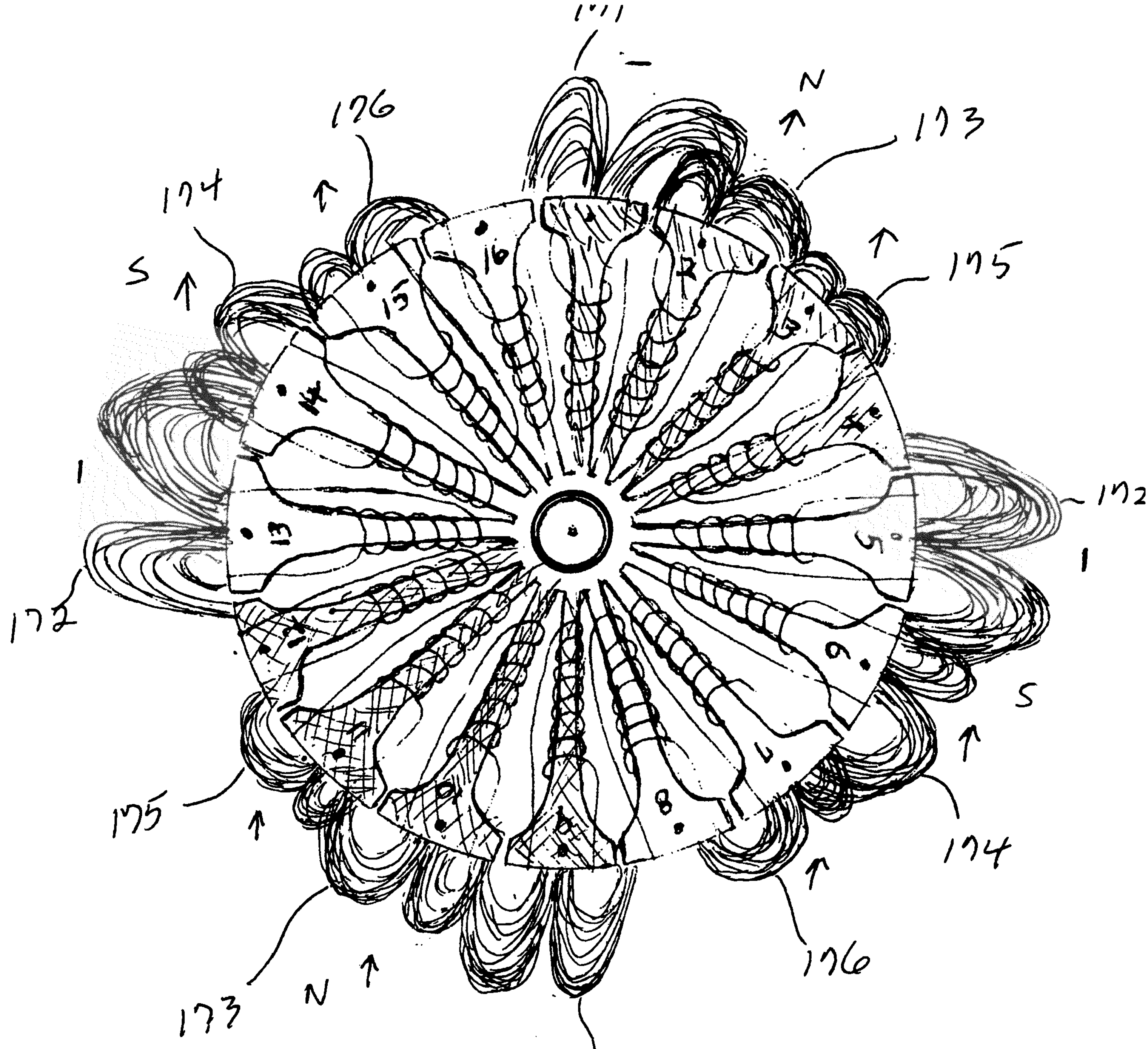

171
N
173
176
174
S
175
1
172
172
1
S
174
176
175
173
N
171
16
15
14
13
2
3
4
5
6
7
8

FIG 28

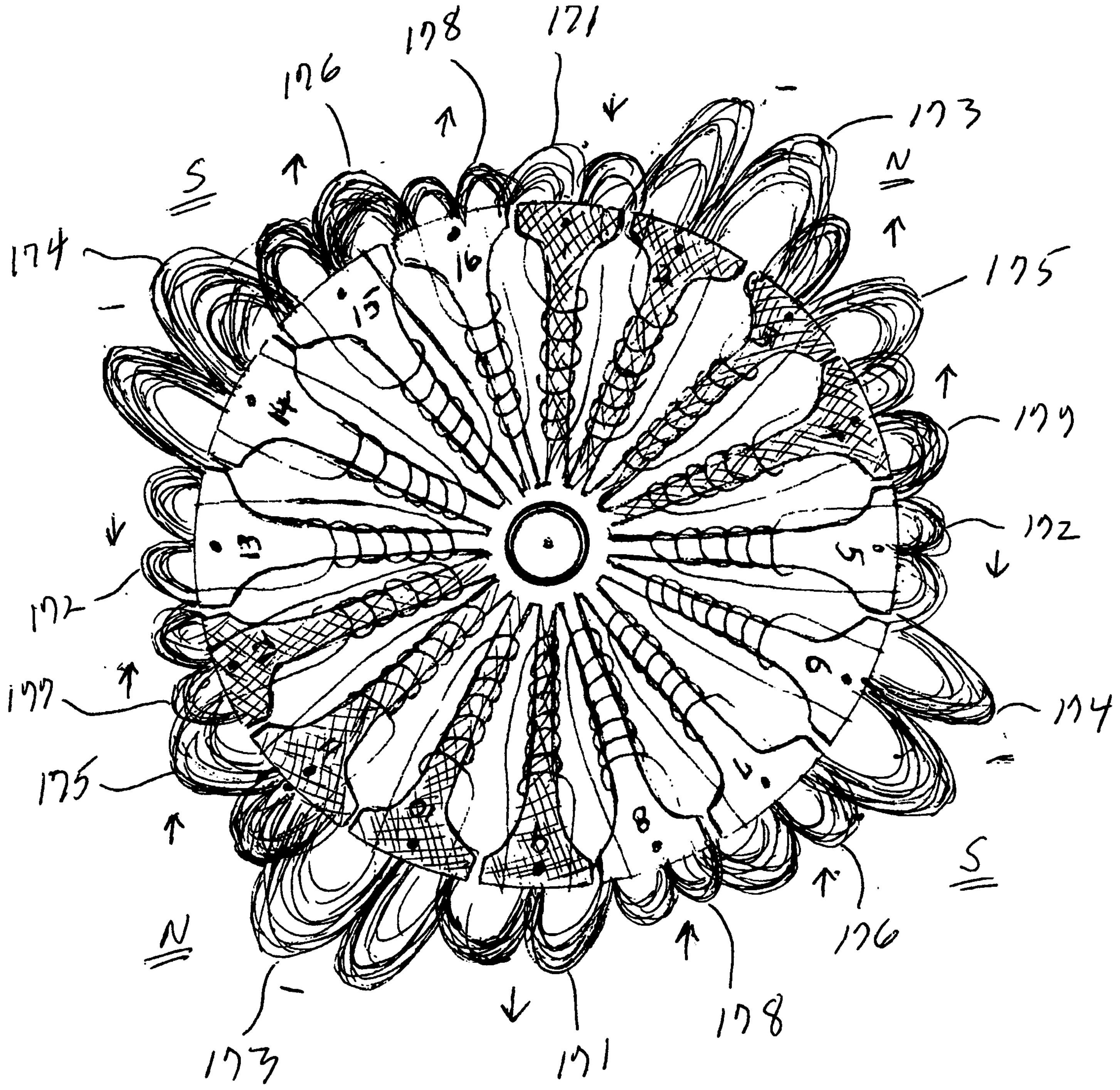

178
171
176
173
S
N
174
175
177
172
172
177
174
175
S
N
176
173
171
178
16
15
14
13
5
6
8

FIG 29

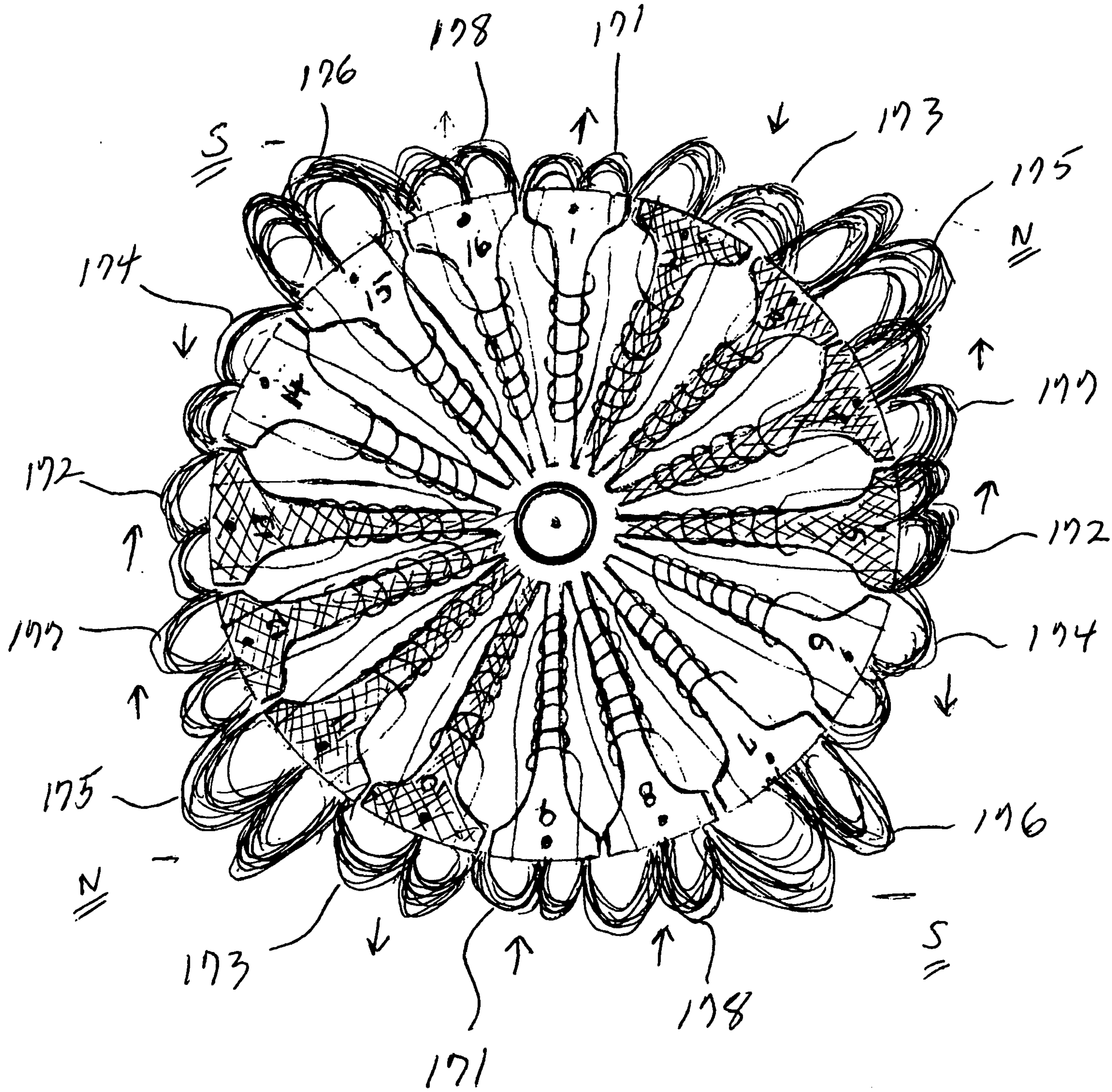

178
171
176
173
S
175
N
174
16
1
15
14
177
172
172
177
174
9
175
N
7
6
8
176
173
171
178
S

FIG 30

64

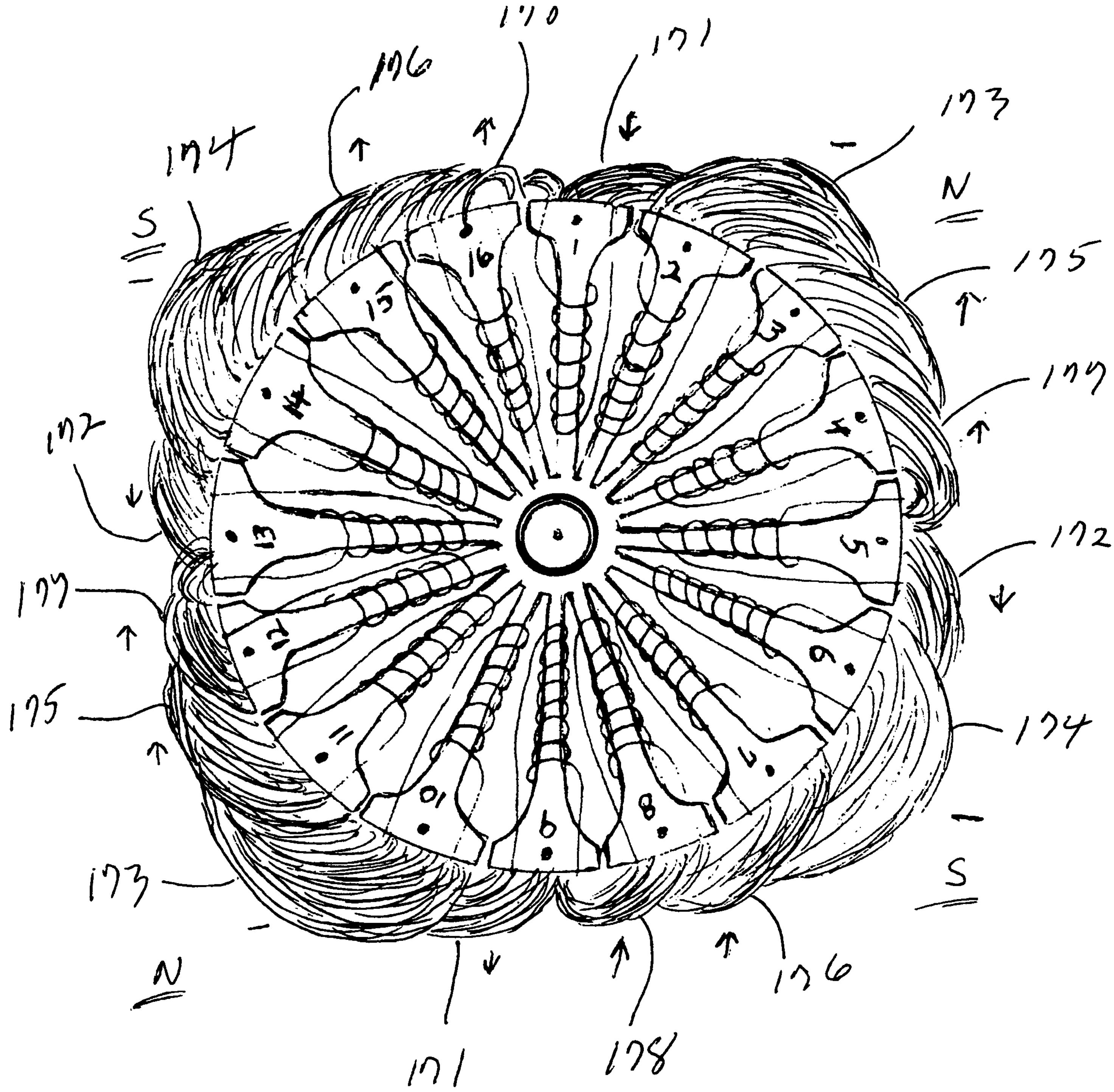
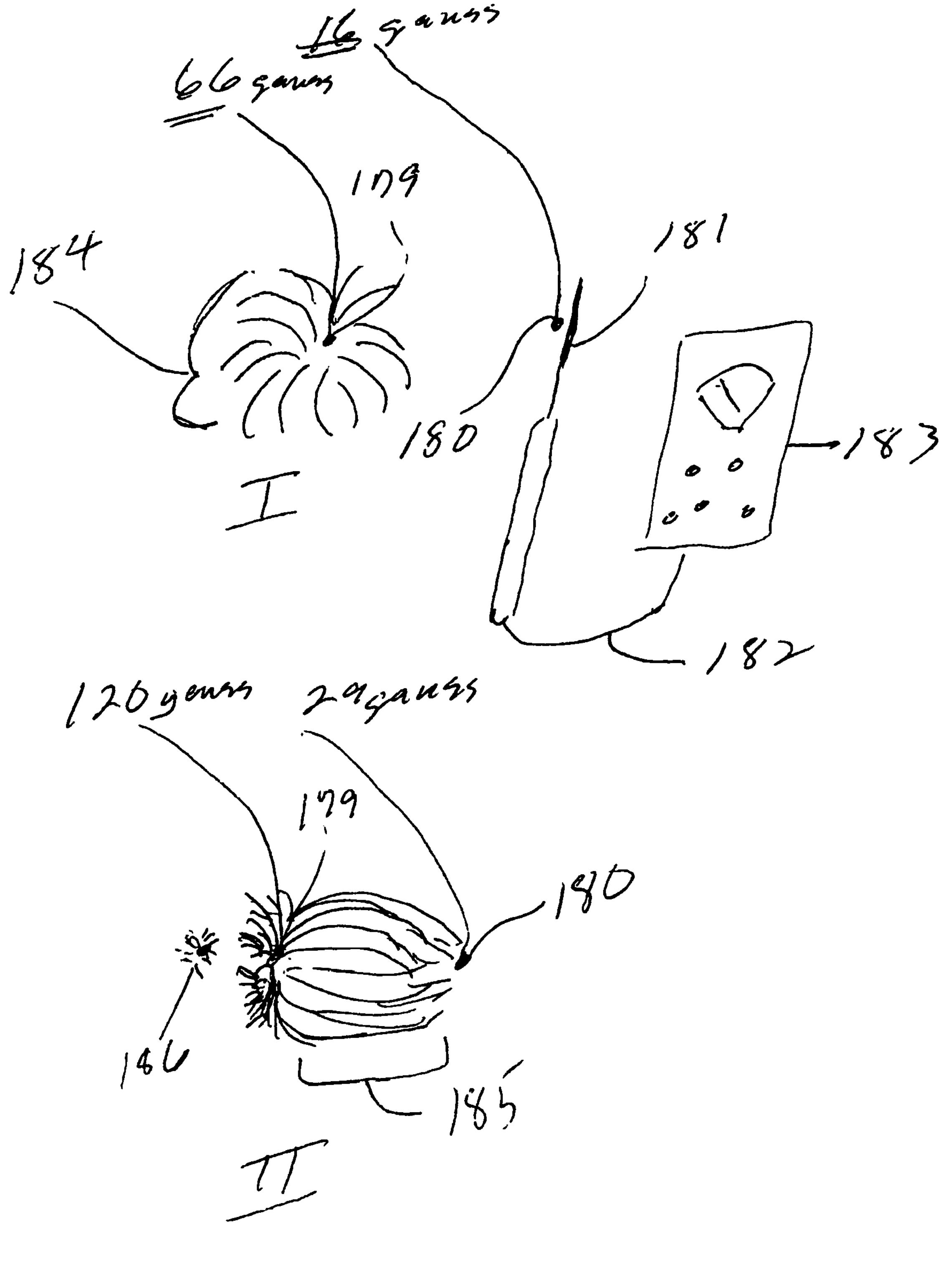

170
171
196
173
174
S
N
175
177
172
13
5
172
177
175
174
173
S
N
171
178
176
1
2
3
4
6
7
8
9
10
11
12
14
15
16

FIG 31

65



16 gauss
66 gauss
179
184
181
180
183
I
182
120 gauss
29 gauss
179
180
186
185
II

FIG 31a

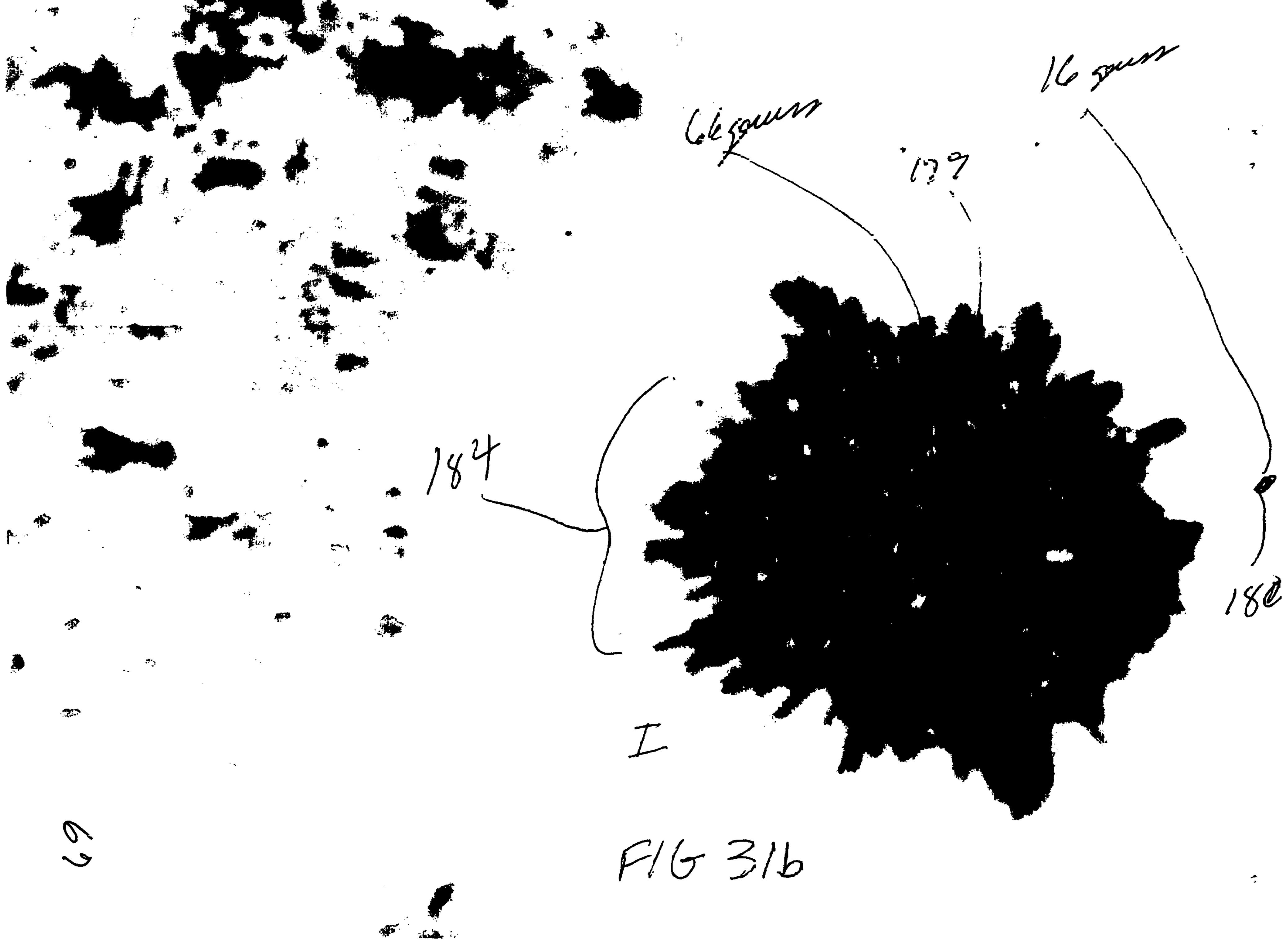


FIG 31b

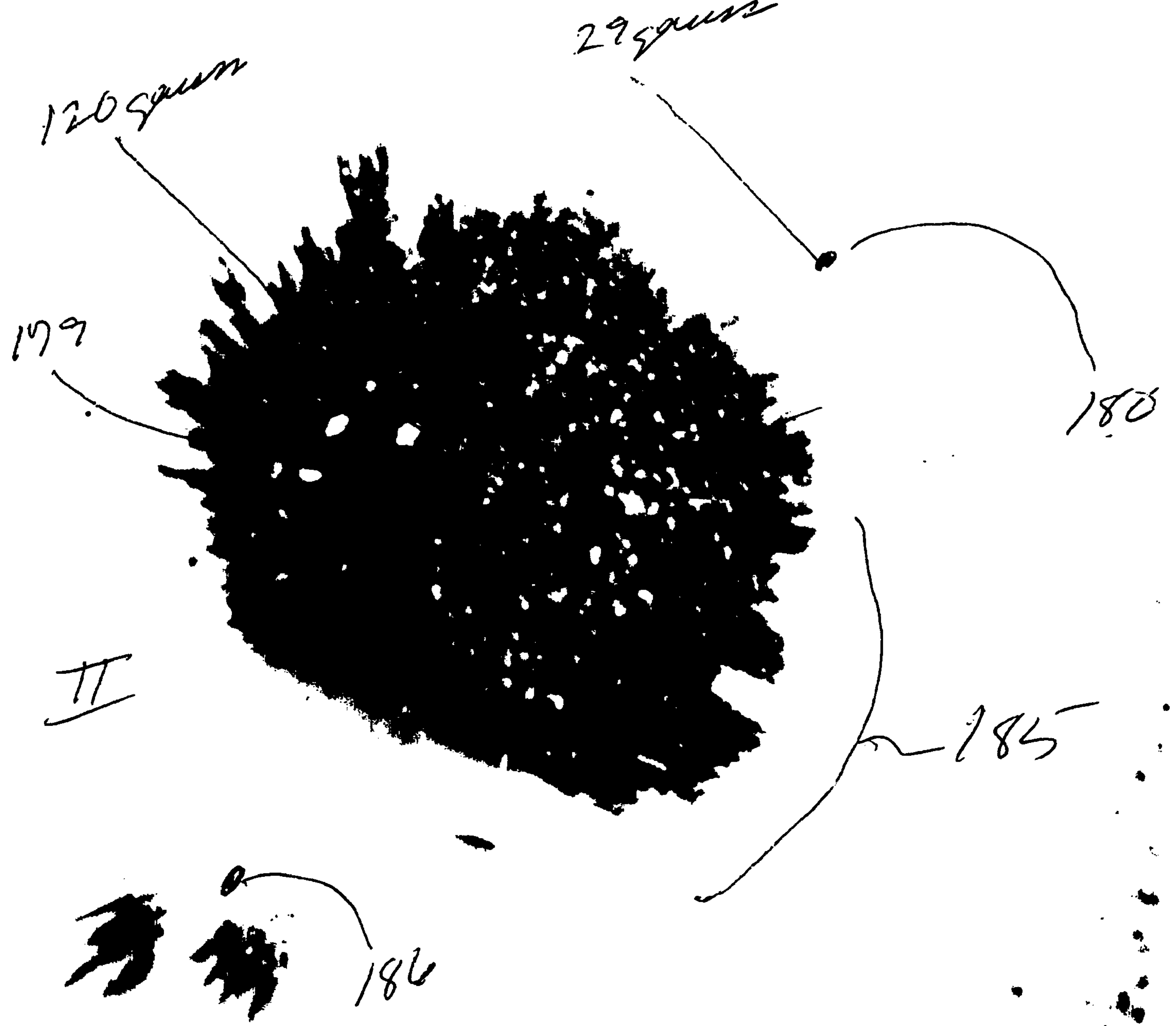


FIG 31c

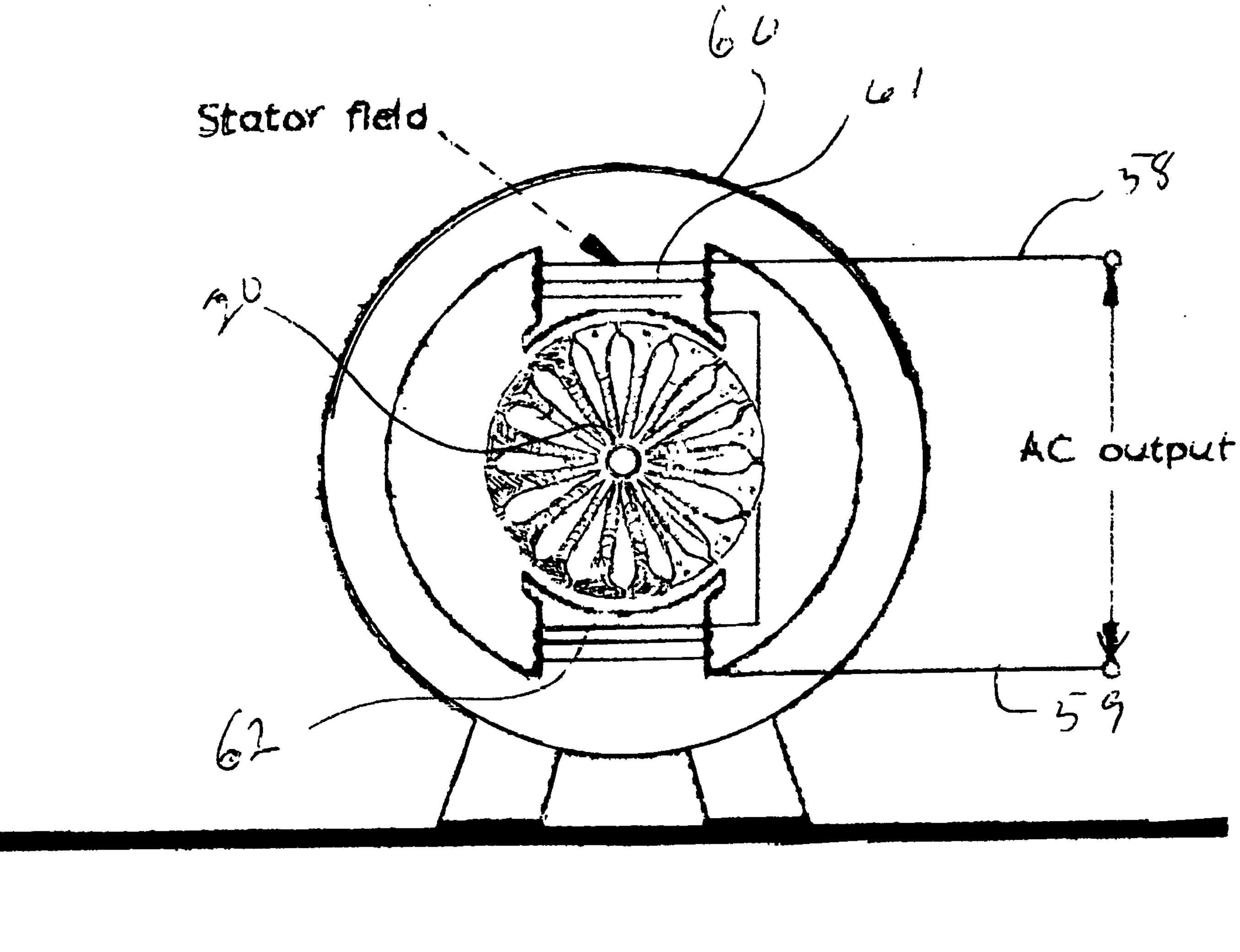


FIG 32

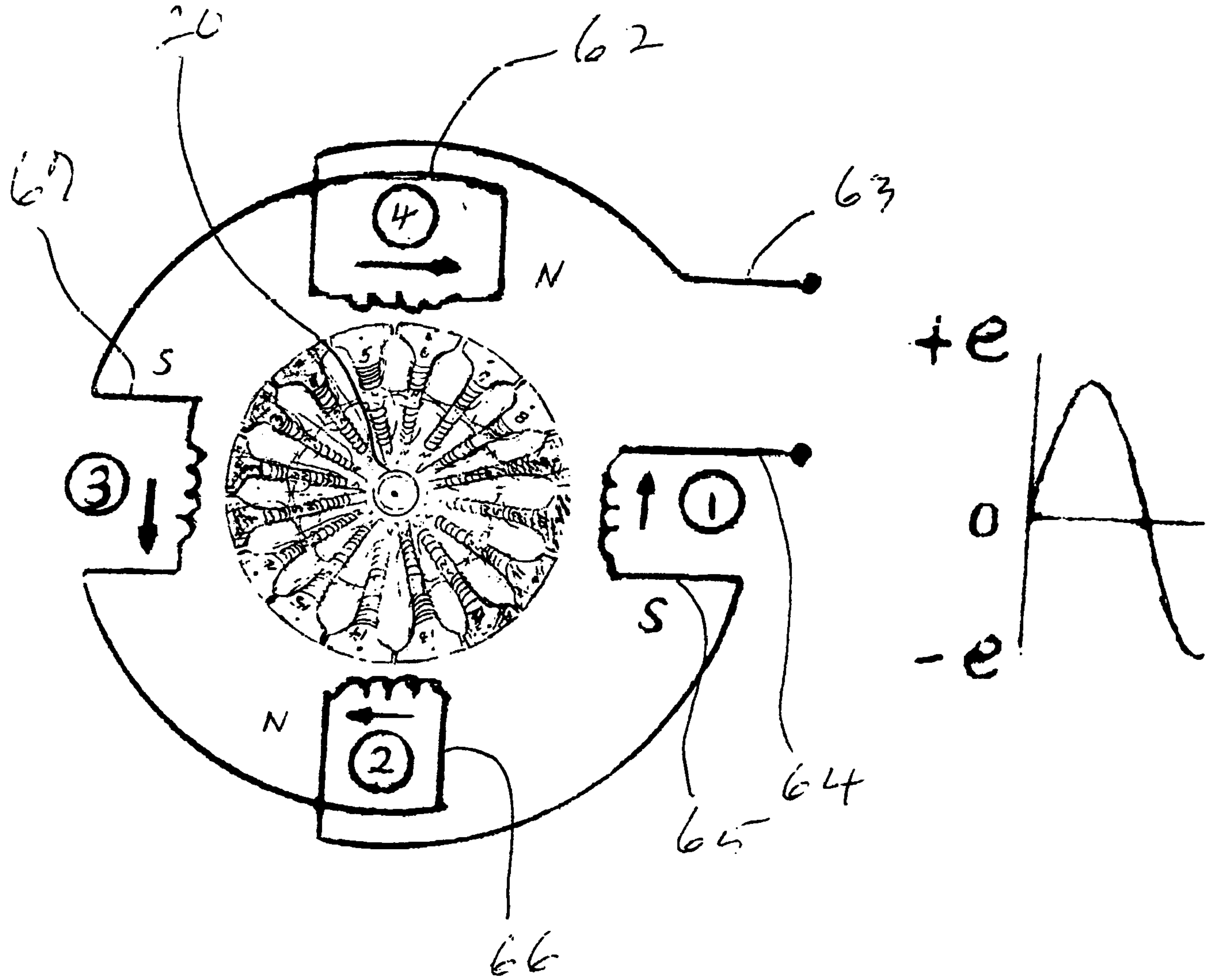


FIG 33

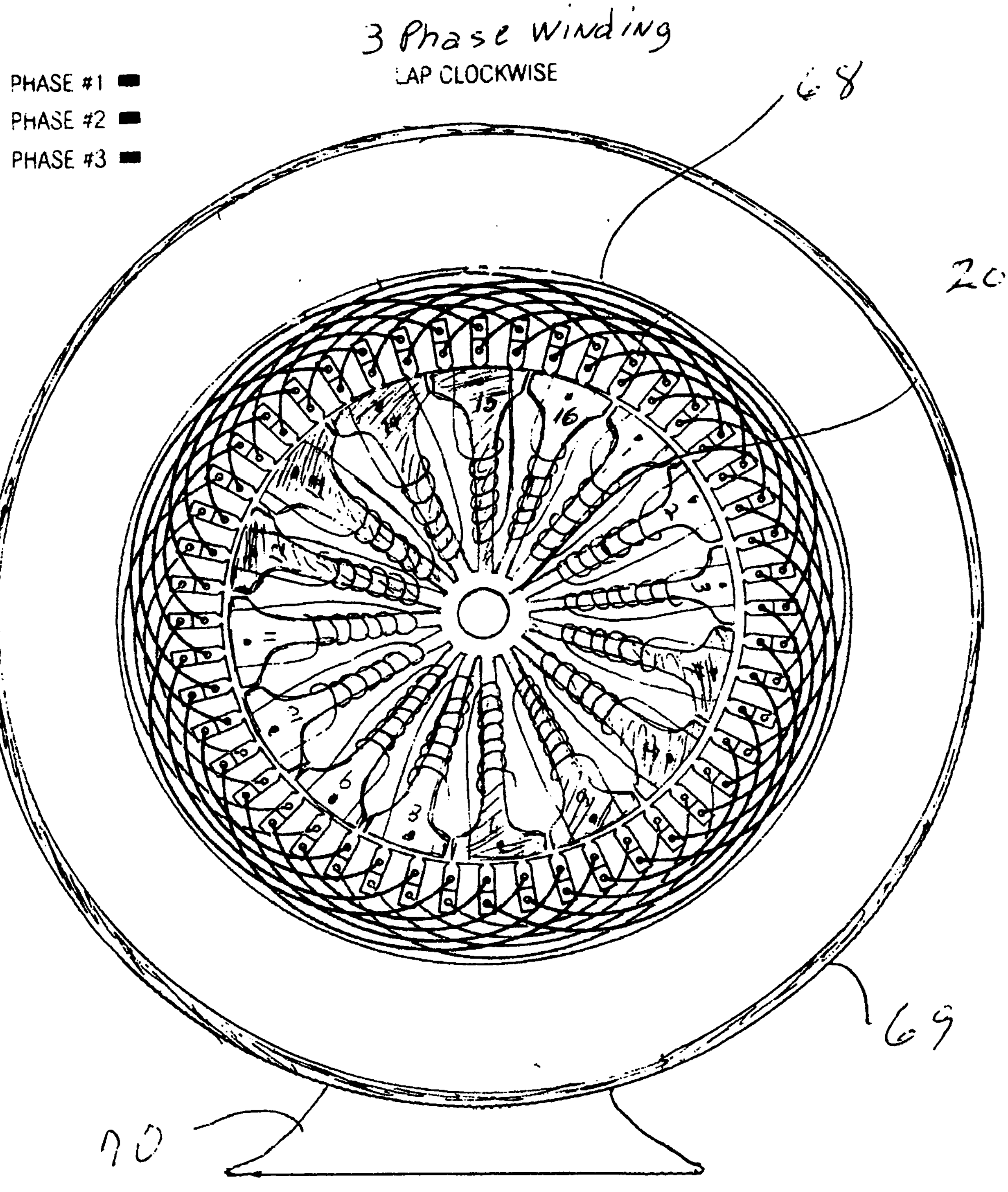

3 Phase Winding
LAP CLOCKWISE
PHASE #1
PHASE #2
PHASE #3
68
20
69
70

FIG 34

71

PHASE #1

PHASE #2

PHASE #3

LAP COUNTERCLOCKWISE

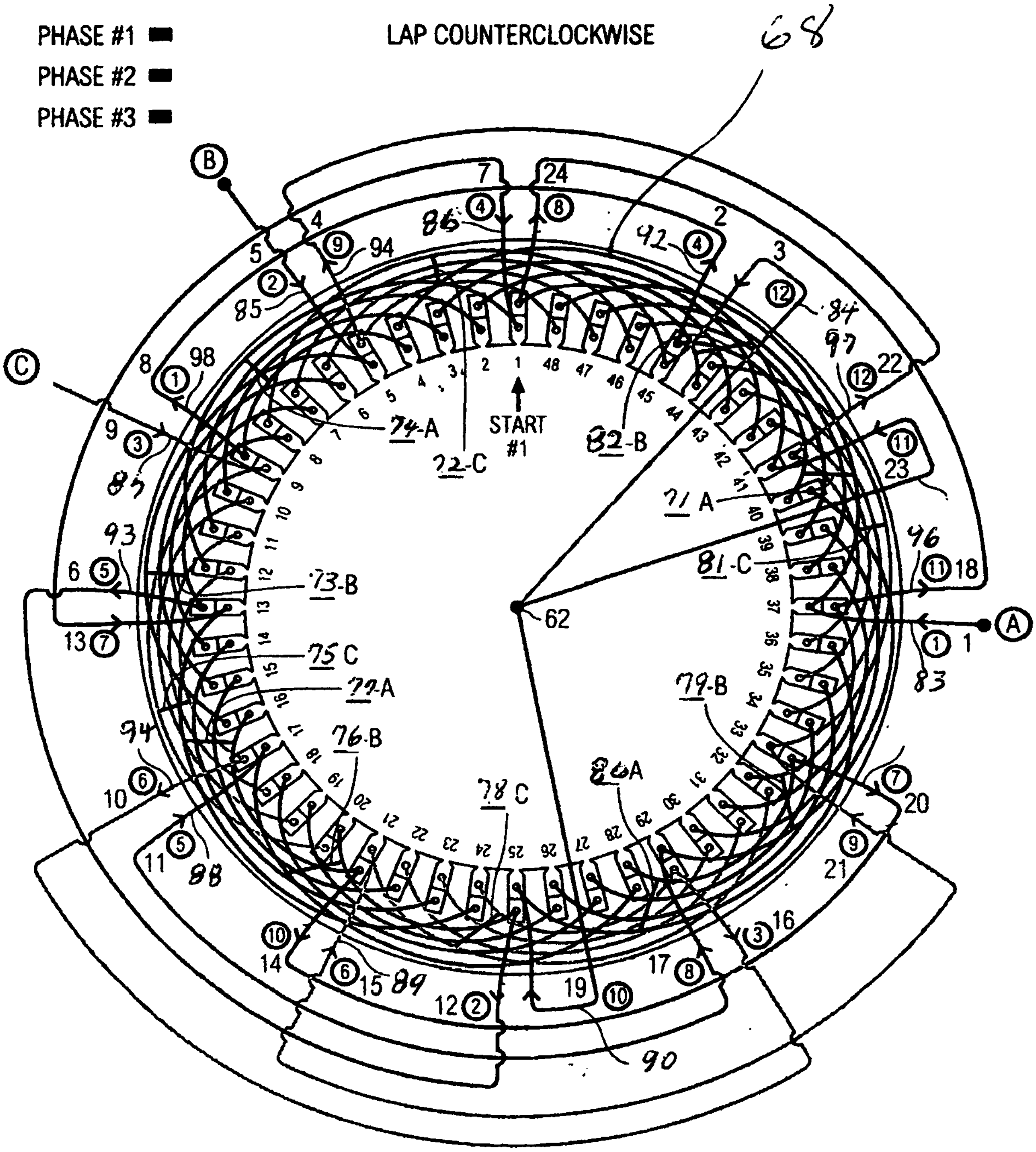


FIG 35

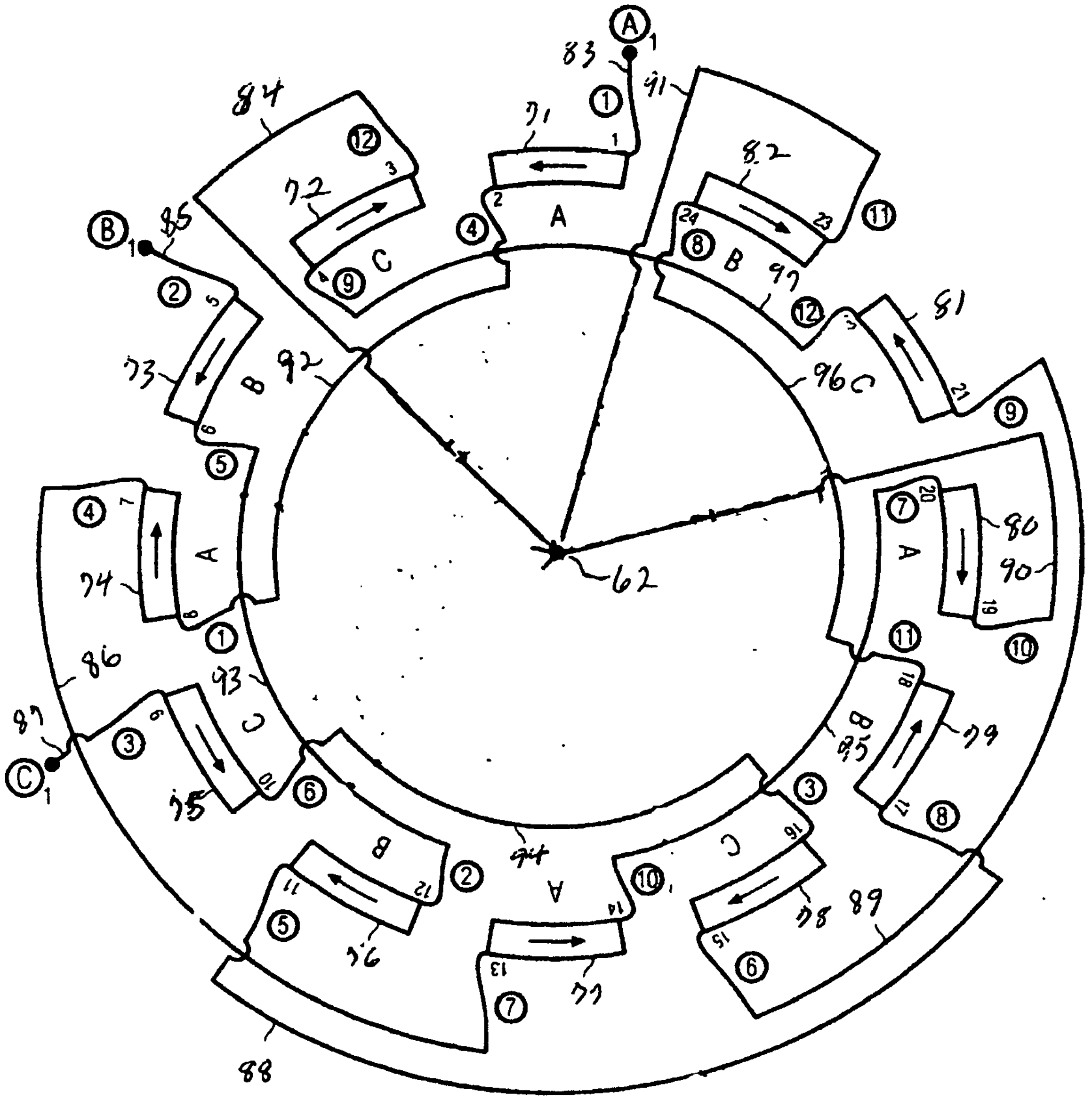


FIG 36

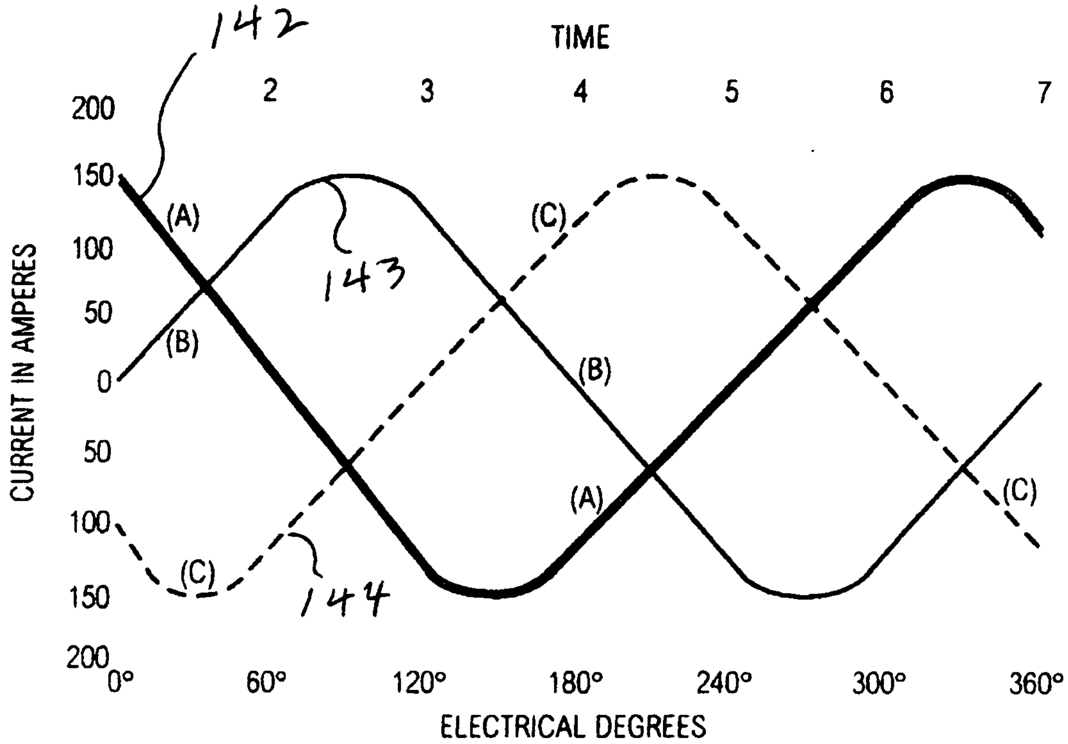

142
TIME
2
3
4
5
6
7
200
150
100
50
0
50
100
150
200
CURRENT IN AMPERES
(A)
(B)
(C)
143
(C)
(B)
(A)
(C)
144
0°
60°
120°
180°
240°
300°
360°
ELECTRICAL DEGREES

FIG 37

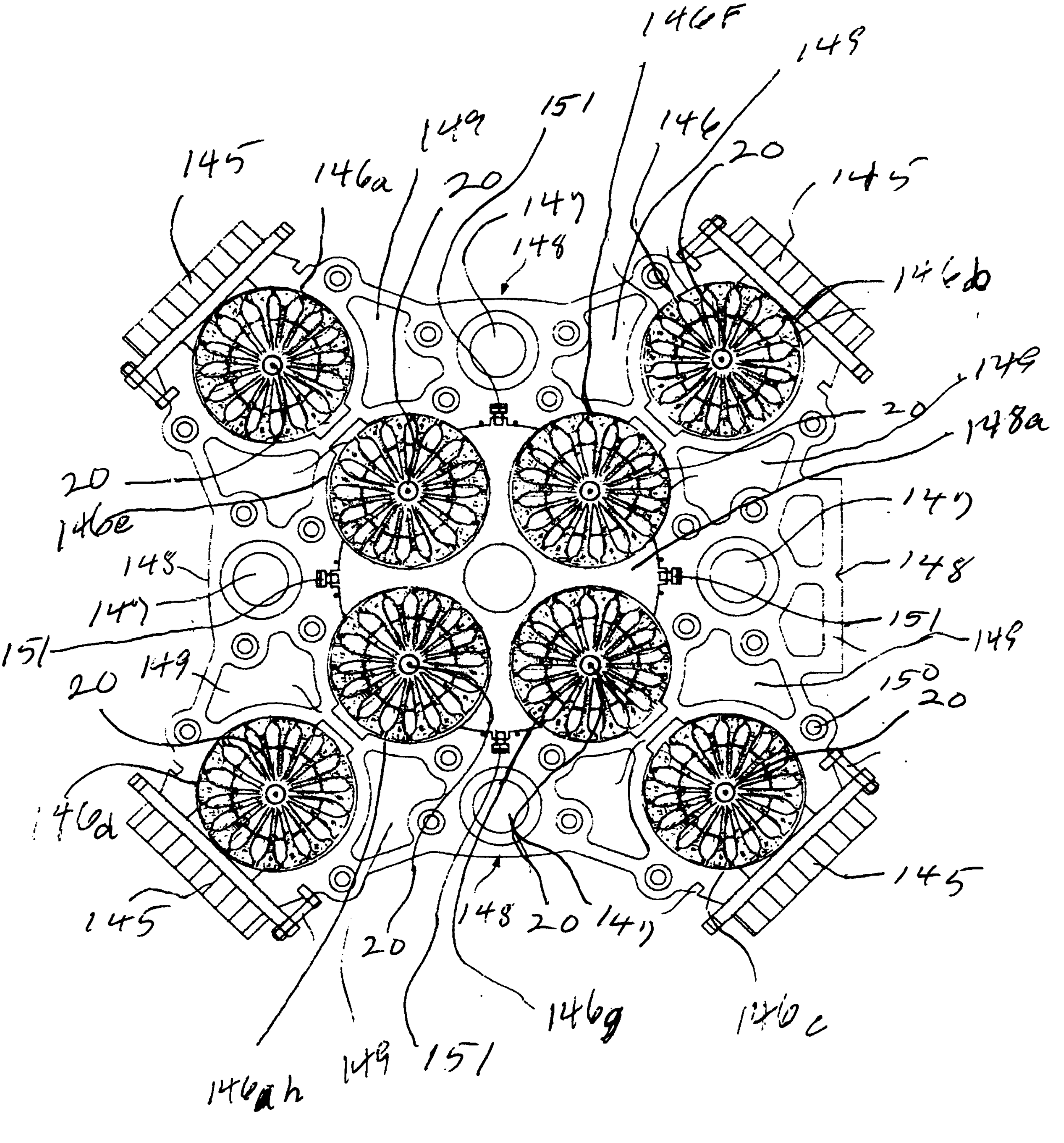
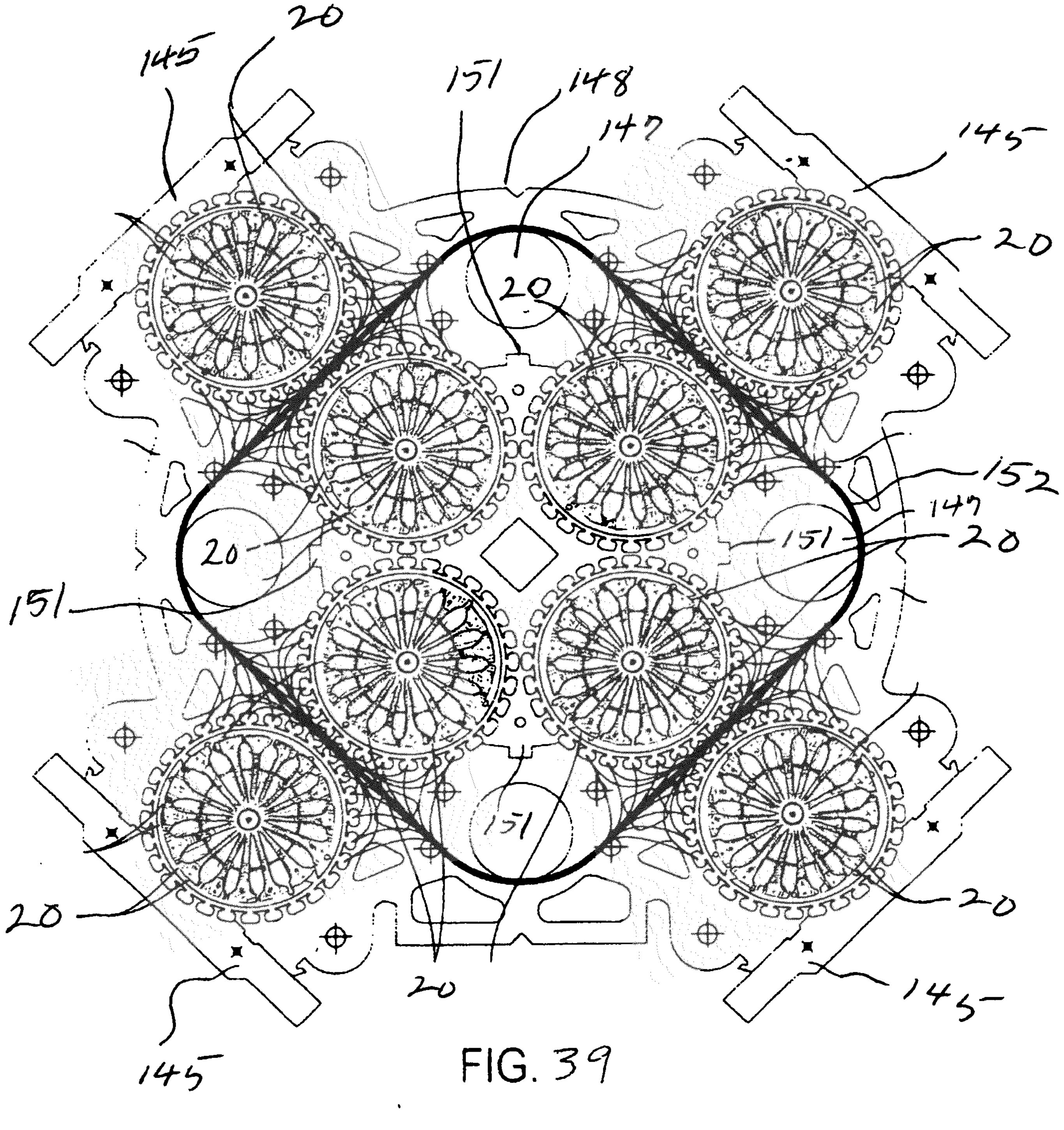

146F
149
151
149
146
20
145
146a
20
145
147
148
146b
149
20
148a
20
146e
147
148
148
147
151
151
149
20
149
150
20
146d
145
145
148
20
147
20
146g
146c
146h
149
151

FIG. 38

D5



145
20
151
148
147
145
20
20
152
147
151
20
20
151
151
20
20
145
145

FIG. 39

26

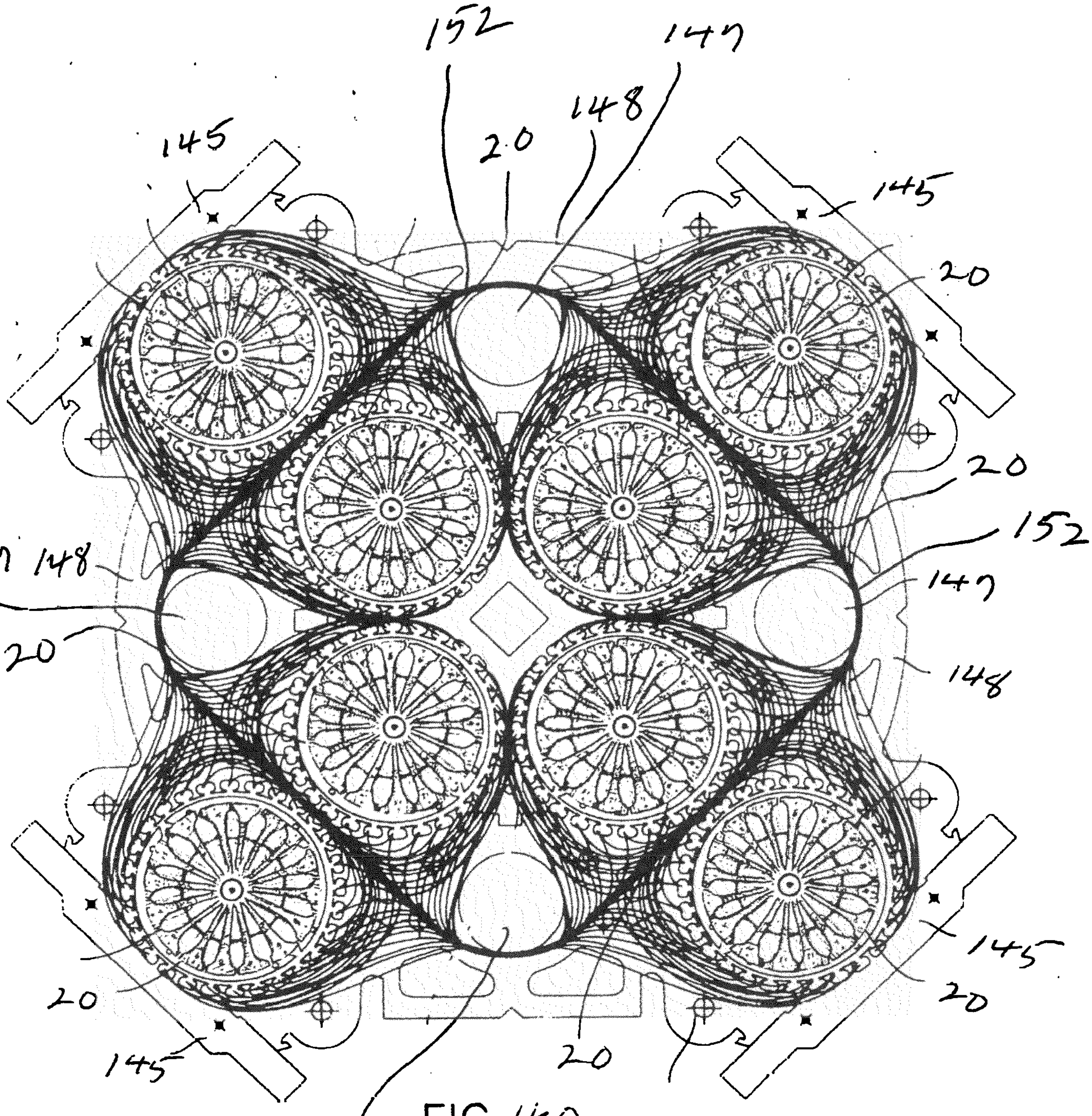

152
147
148
20
145
145
20
20
152
147 148
147
20
148
145
20
20
20
145

FIG. 40

147

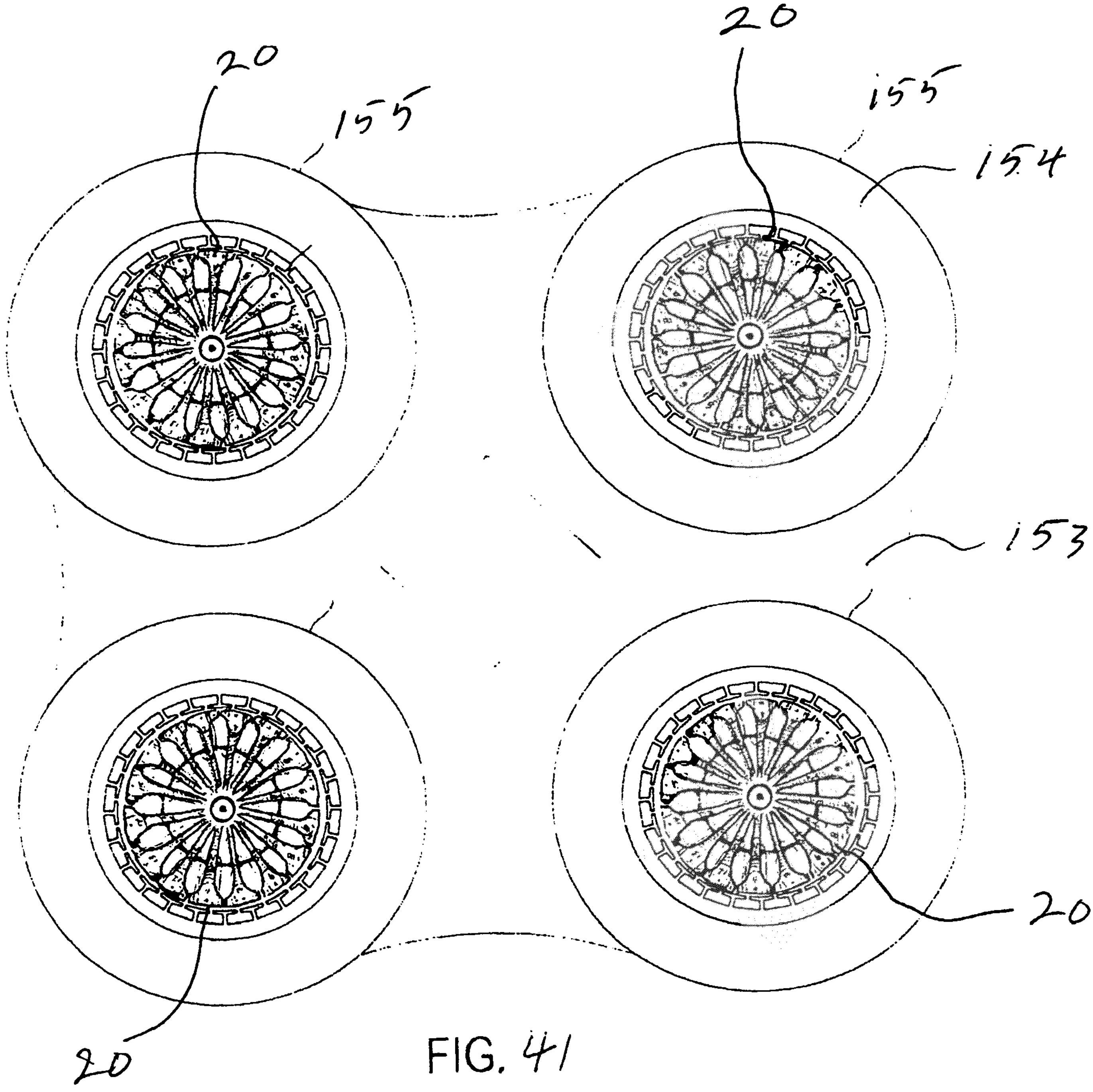


FIG. 41

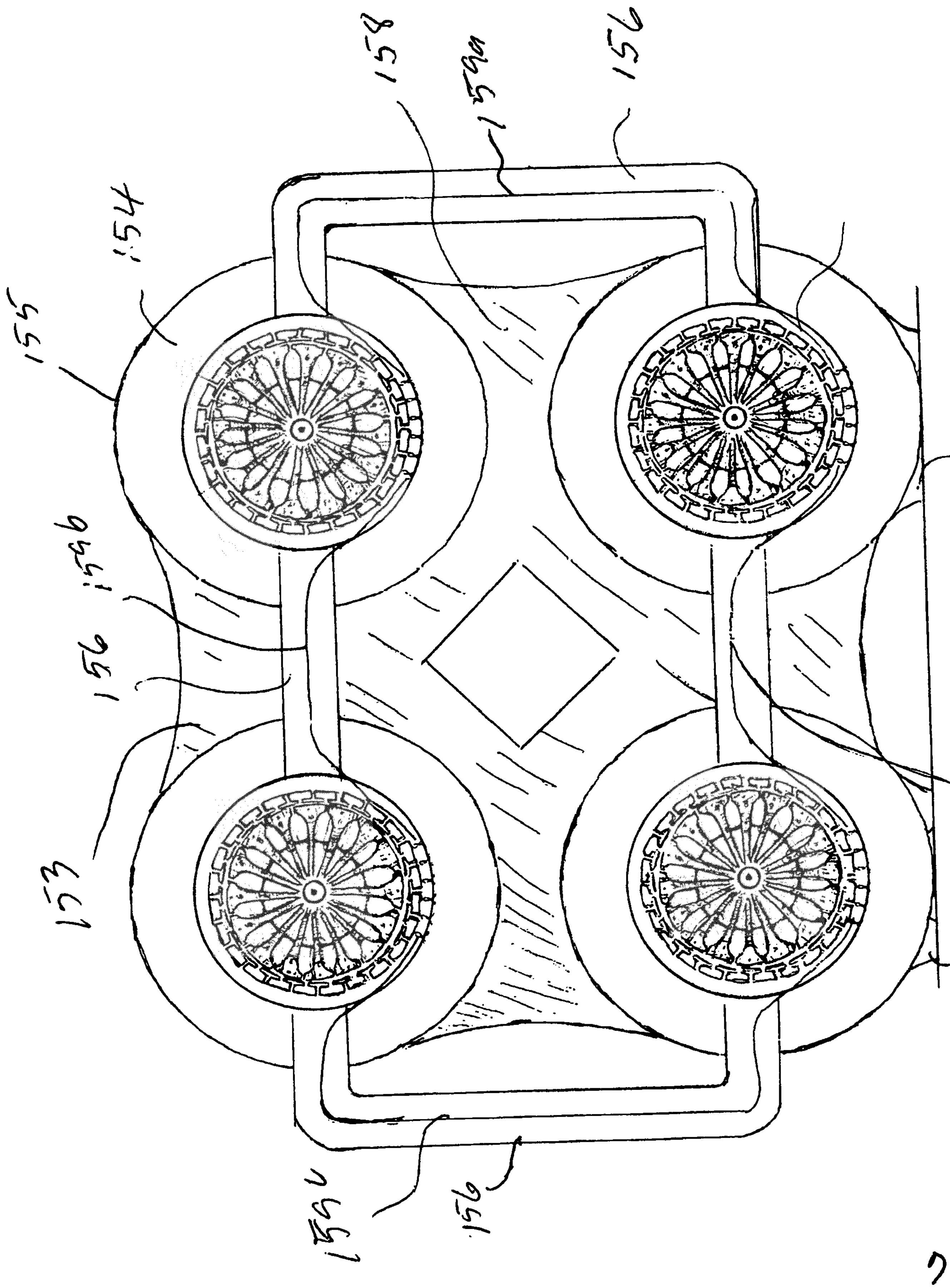


FIG 42

56

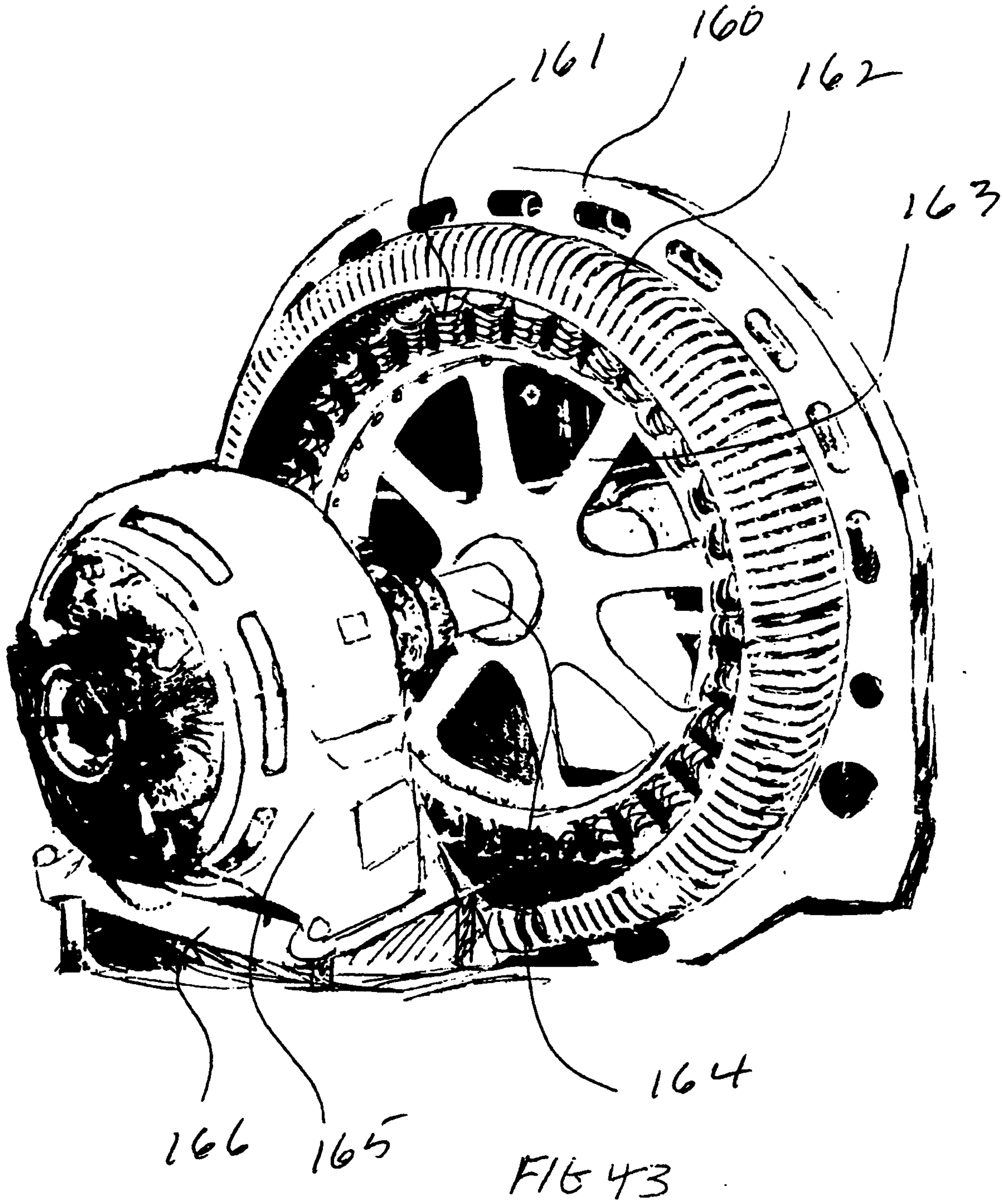


FIG 43

80

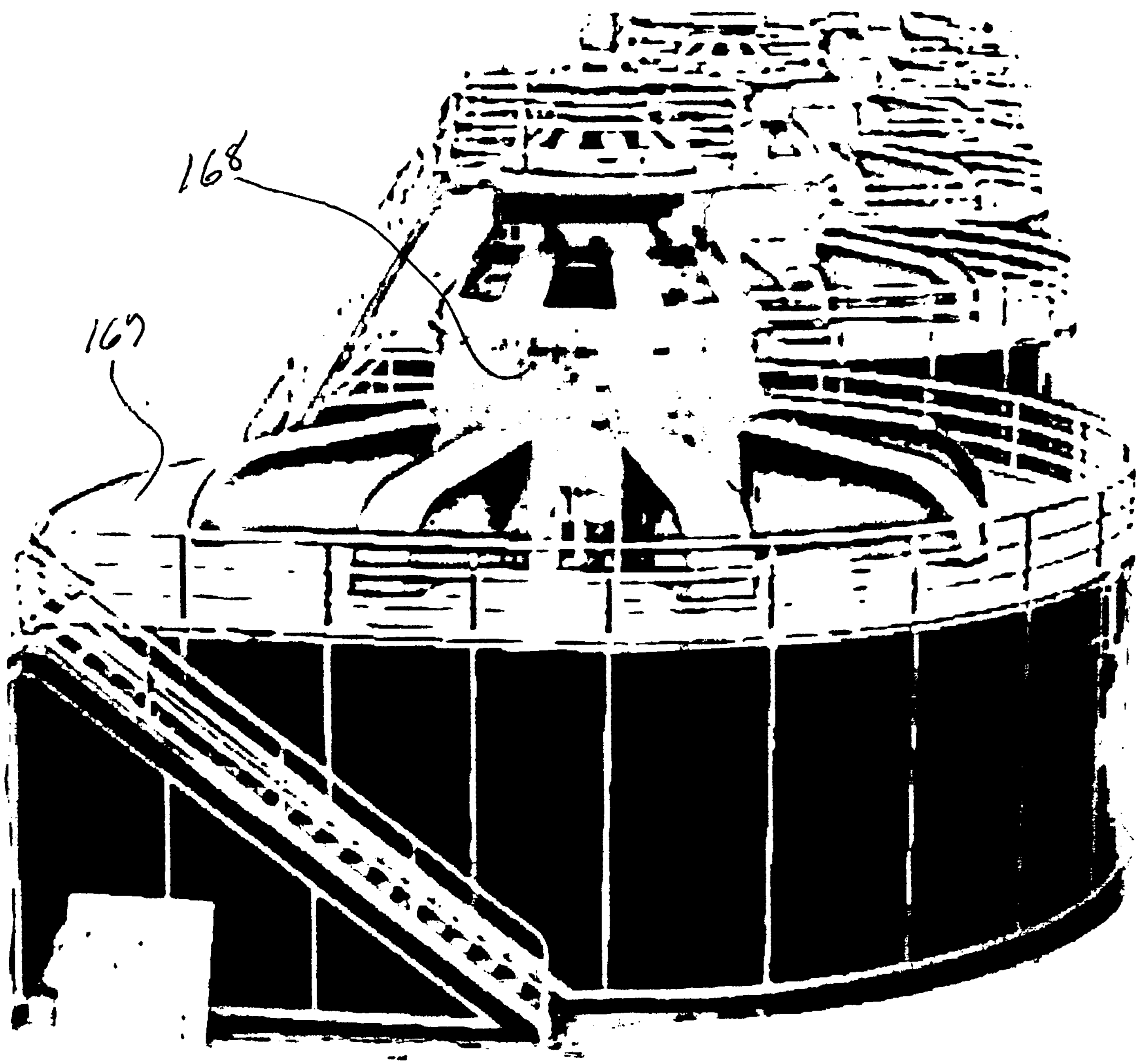


FIG 44

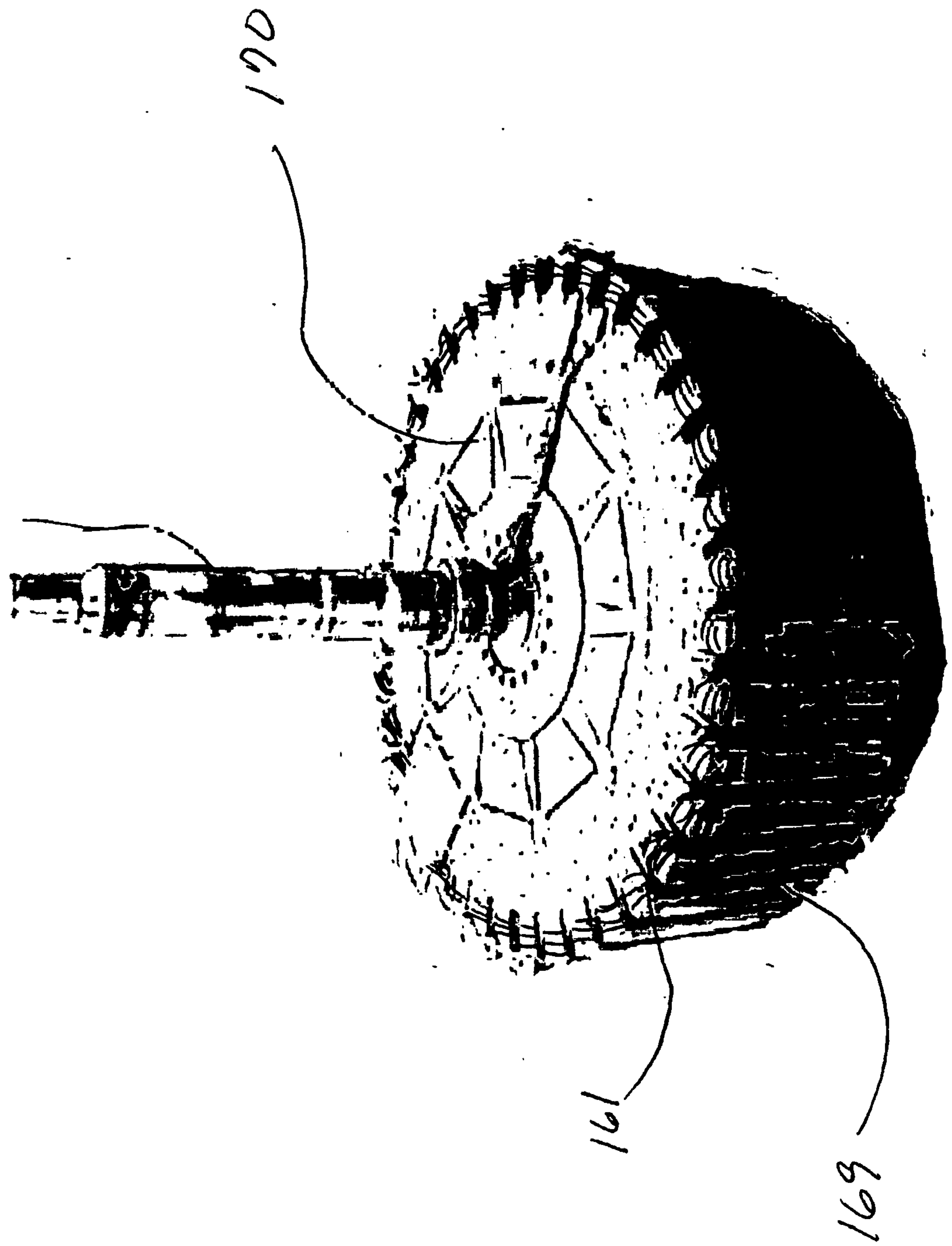


FIG 45

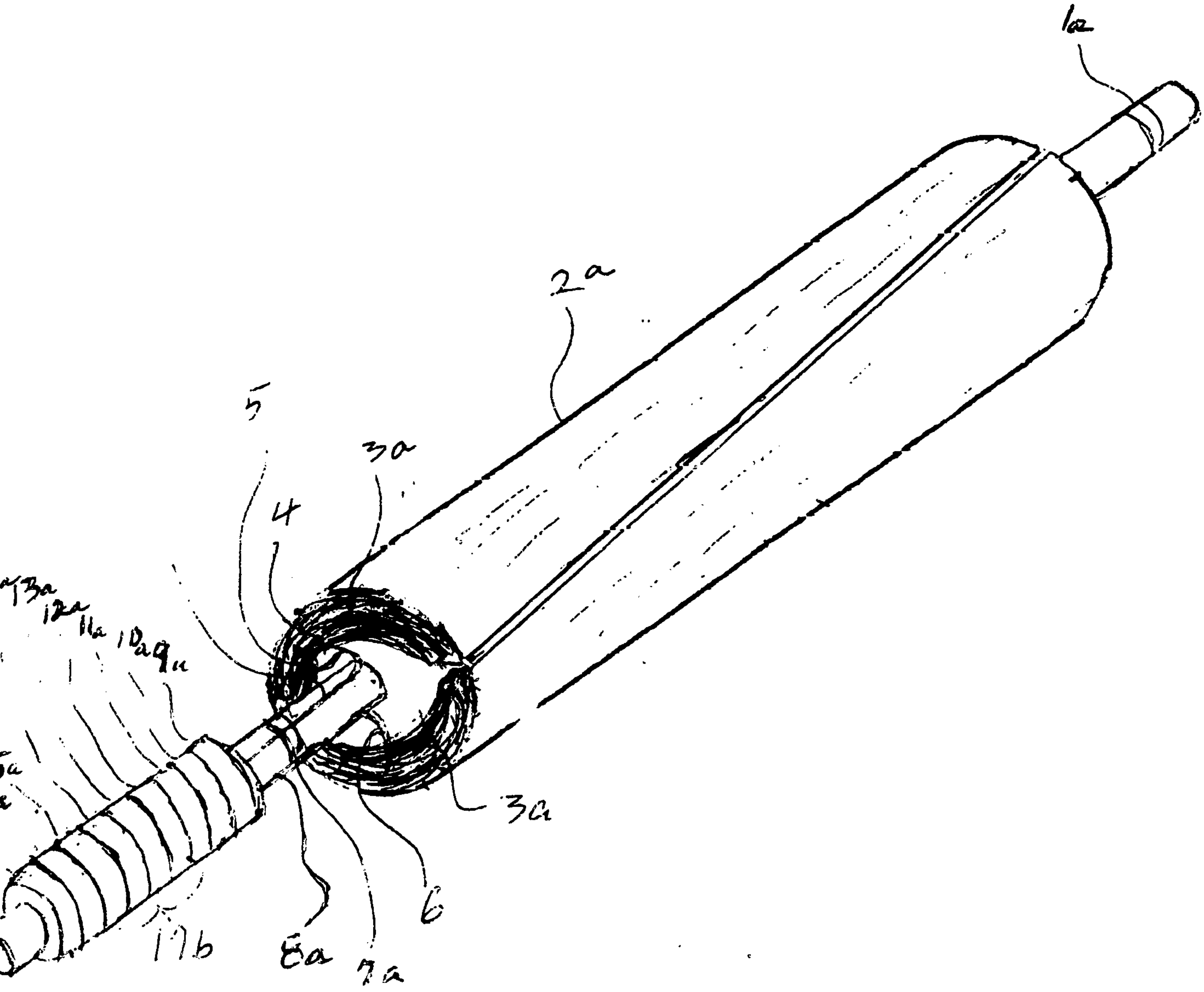


FIG 46

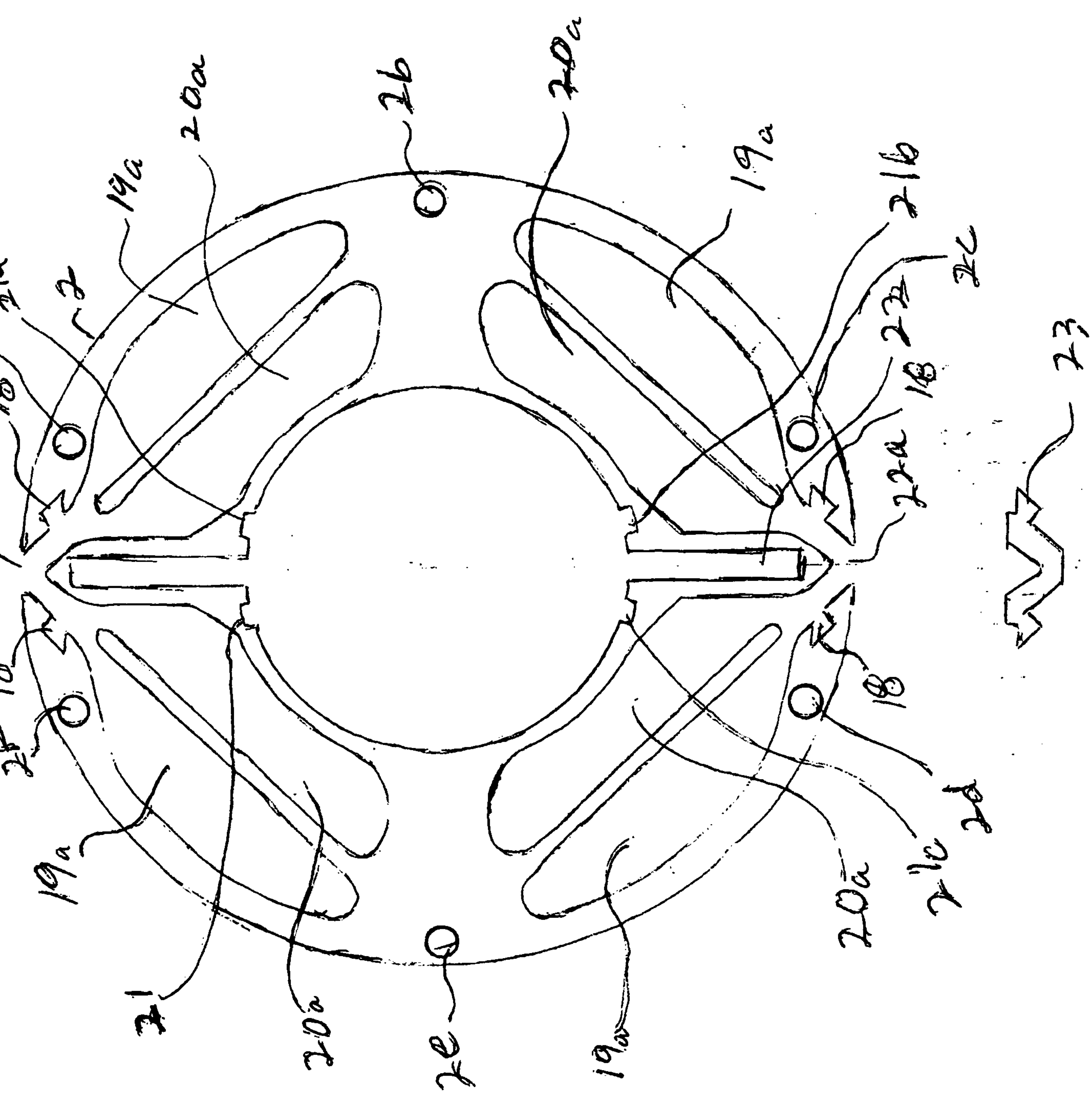
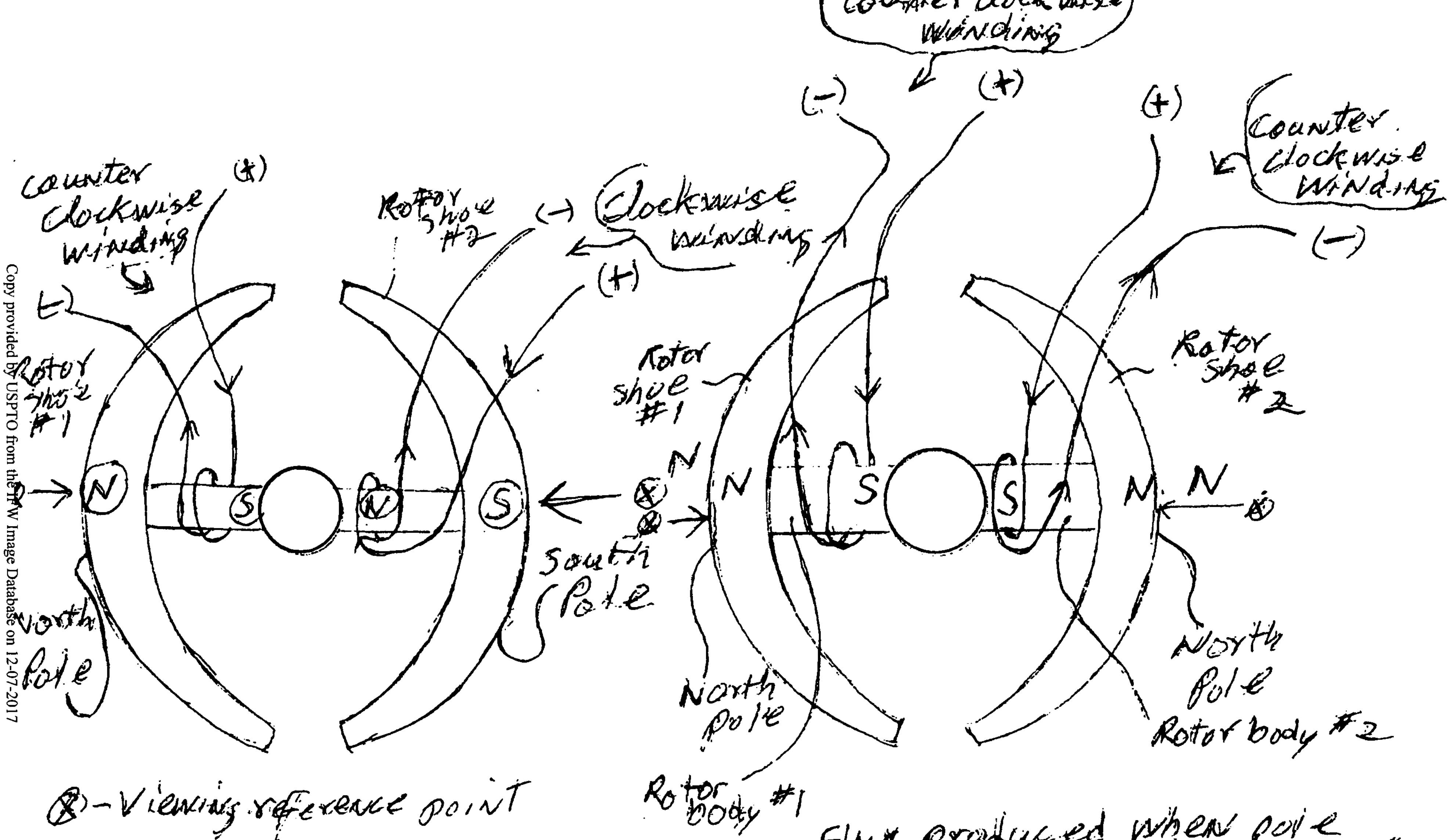


FIG 47



⊗ - Viewing reference point

Flux produced when pole is excited as a dipole.

North pole = 4000gauss

South pole 4000gauss

(+) = positive lead

Flux produced when pole is excited as a "unipole"

North pole = 100gauss

North pole = 100gauss

FIG 48

Excitation
North pole

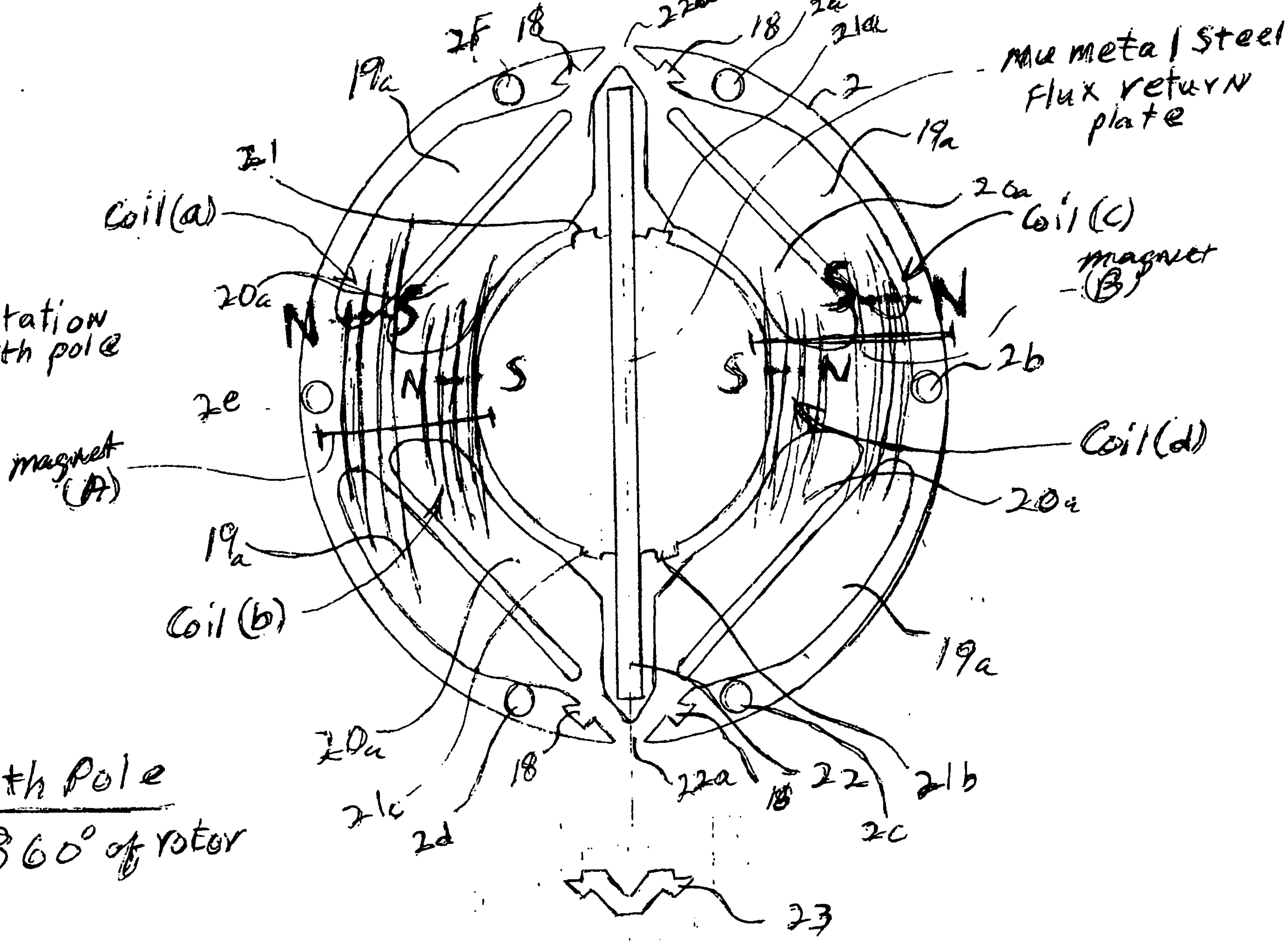
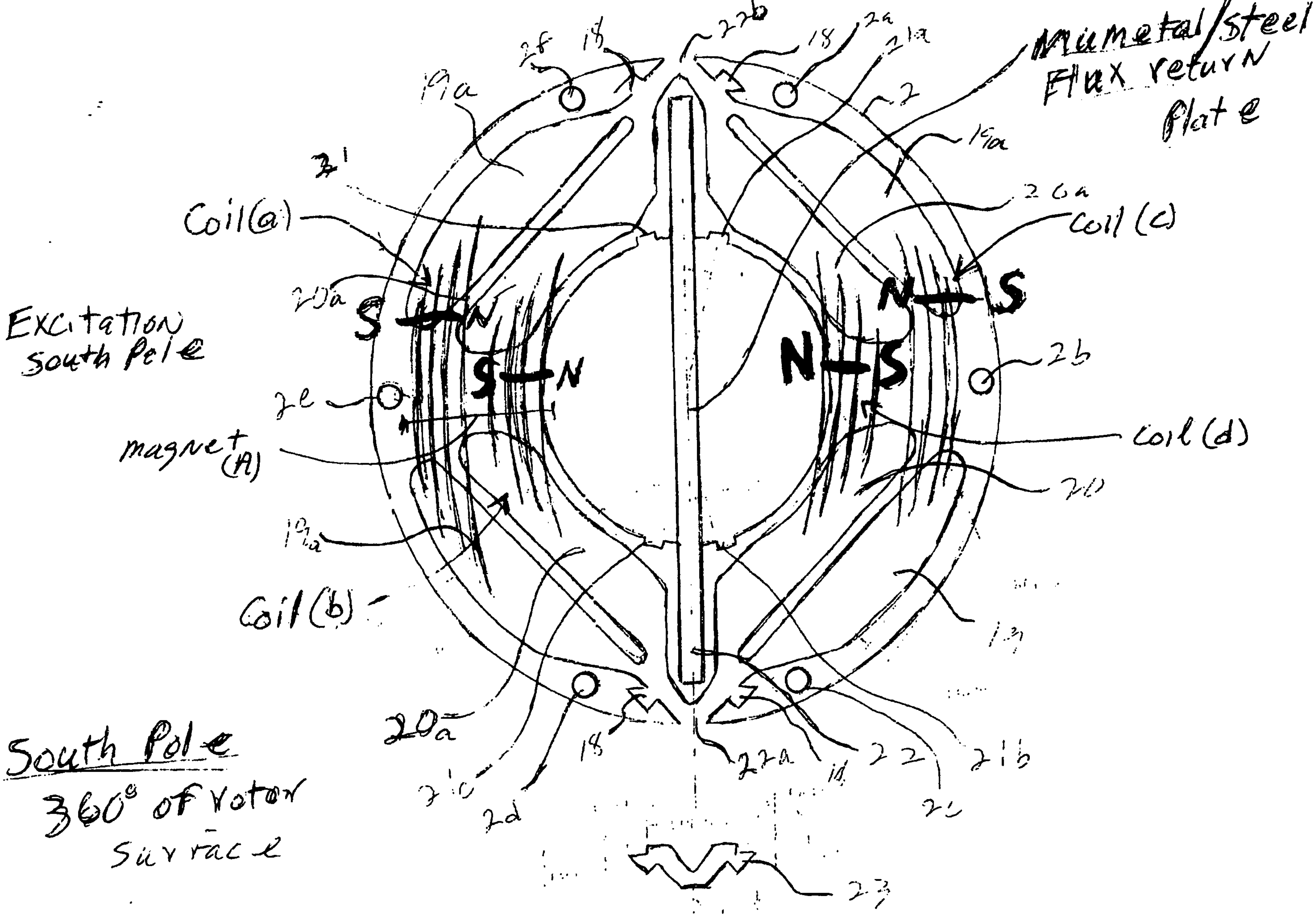


FIG 49

North Pole
360° of rotor

86



Mumetal/steel Flux return plate
Excitation South Pole
Coil(a)
Coil(b)
Coil (c)
Coil (d)
magnet (A)
South Pole
360° of rotor surface
S
N
S
N
N
S
N
S
2f
18
22b
18
2a
21a
2
19a
19a
2'
26a
20a
2e
2b
20
19a
19
20a
18
22a
14
22
21b
21'
2d
2c
23

FIG 50

89

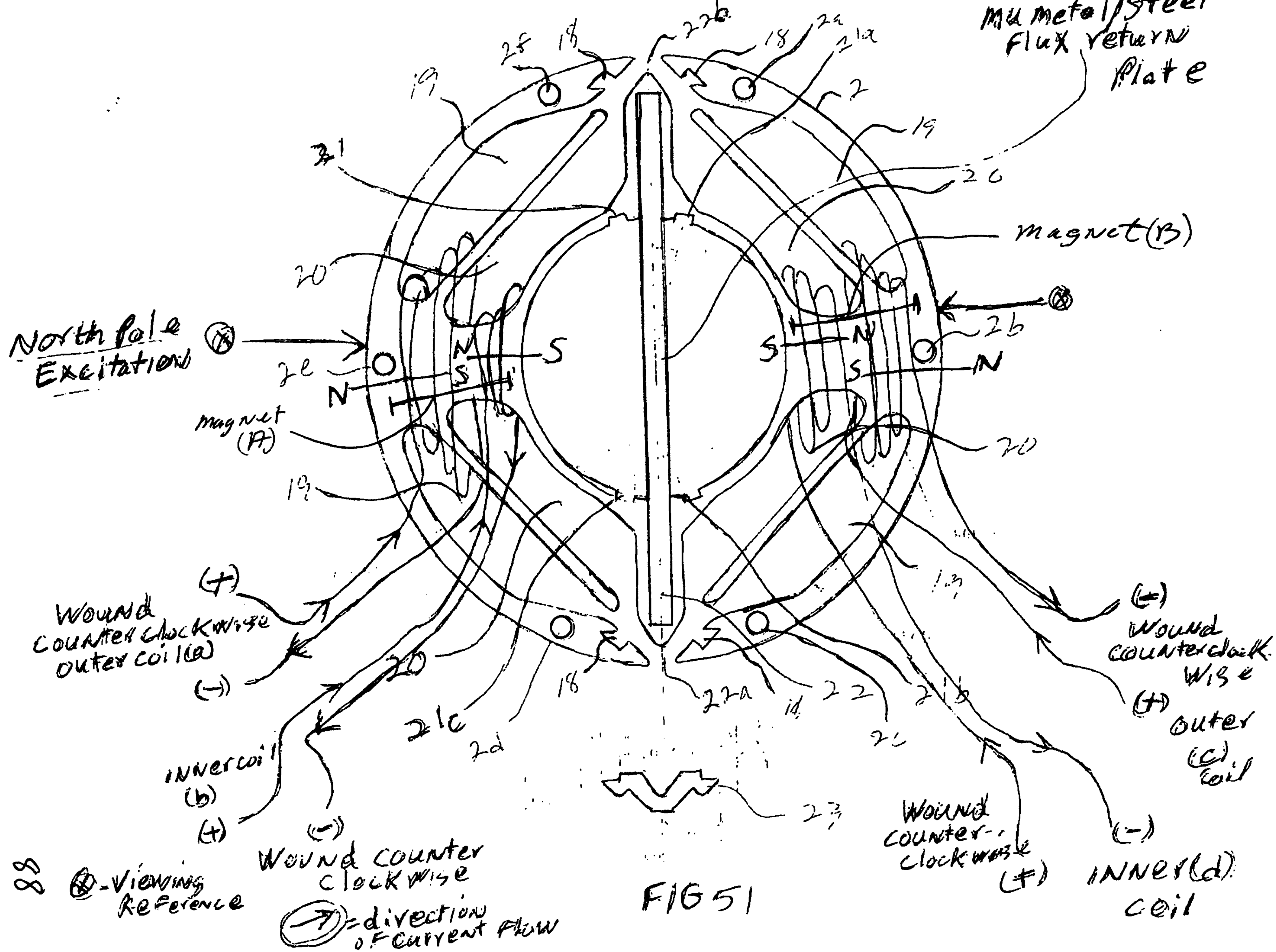

Mu metal/steel Flux return Plate
magnet (B)
North Pole Excitation
magnet (A)
N
S
N
S
S
N
S
N
2a
21a
2
19
18
22b
18
2f
19
21
26
20
2e
2b
20
19
19
20
18
22a
14
22
21b
2c
21c
2d
23
(+)
Wound counter clockwise outer coil (a)
(−)
inner coil (b)
(+)
(−)
Wound counter clockwise
(+)
Wound counterclockwise
(+) outer (c) coil
Wound counter-clockwise
(+)
(−)
INNER (d) coil
⊗-Viewing Reference
=direction of current flow

FIG 51

88

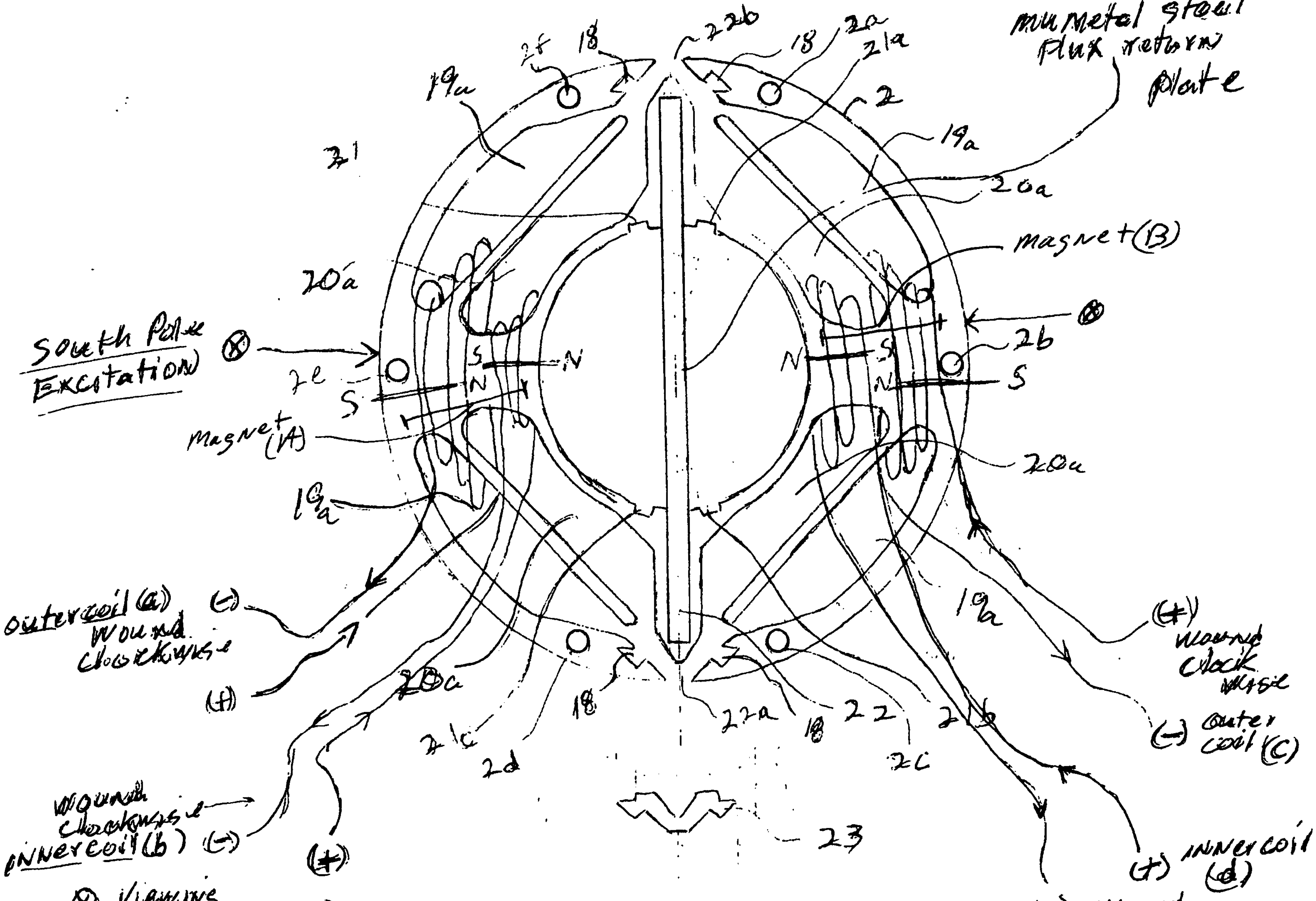
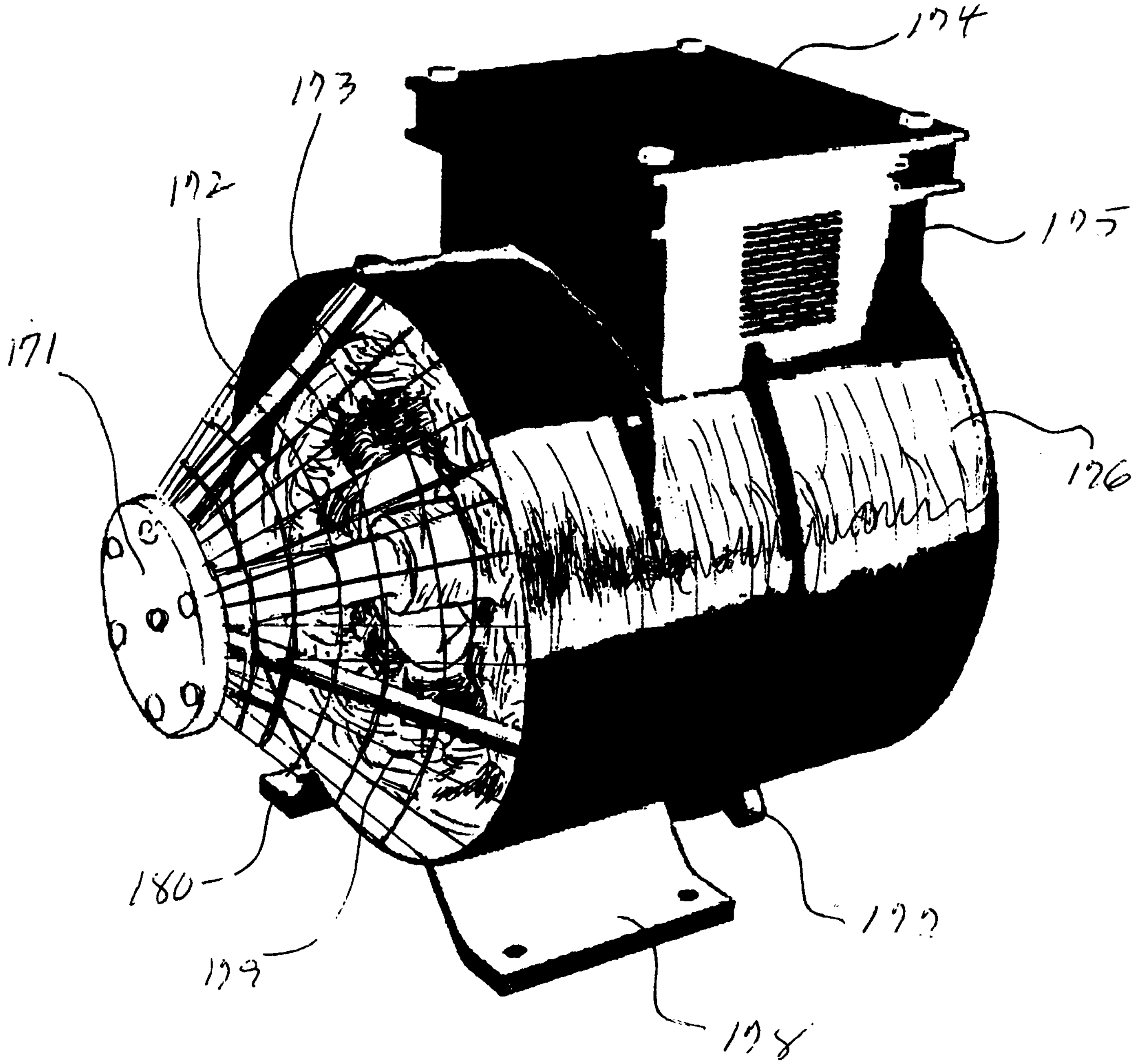

mu metal steel flux return plate
22b
18
2a
21a
2f
19a
2
21
20a
magnet (B)
⊗
2b
South Pole Excitation ⊗
2e
S
N
magnet (A)
20a
19a
outer coil (a) wound clockwise (-)
(+)
20a
18
22a
22
2c
21b
21c
2d
(+) wound clockwise
(-) outer coil (C)
wound clockwise inner coil (b) (-)
(+)
23
(+) inner coil (d)
(-) wound clockwise
⊗-Viewing reference (→)
direction of current flow

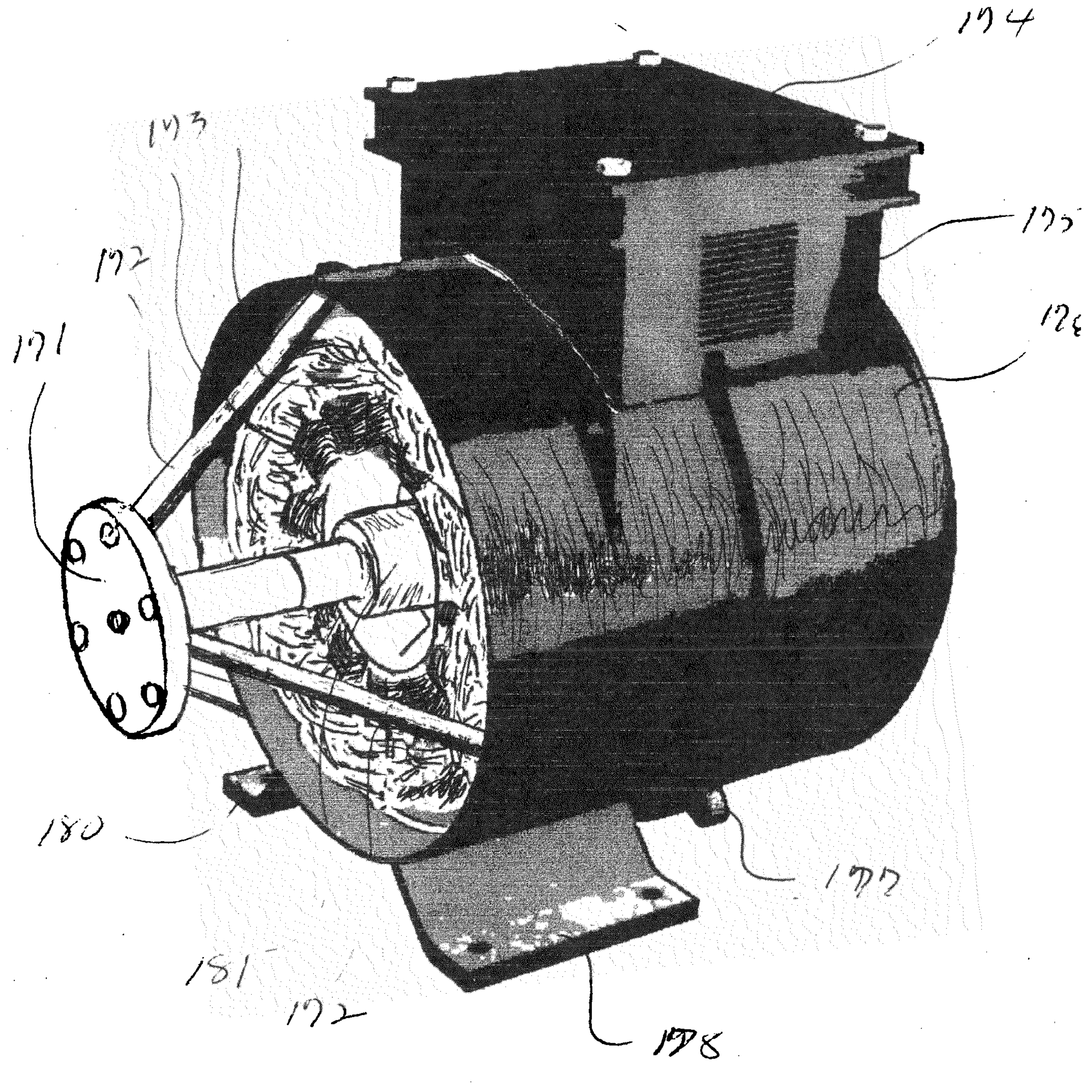
FIG 52

89

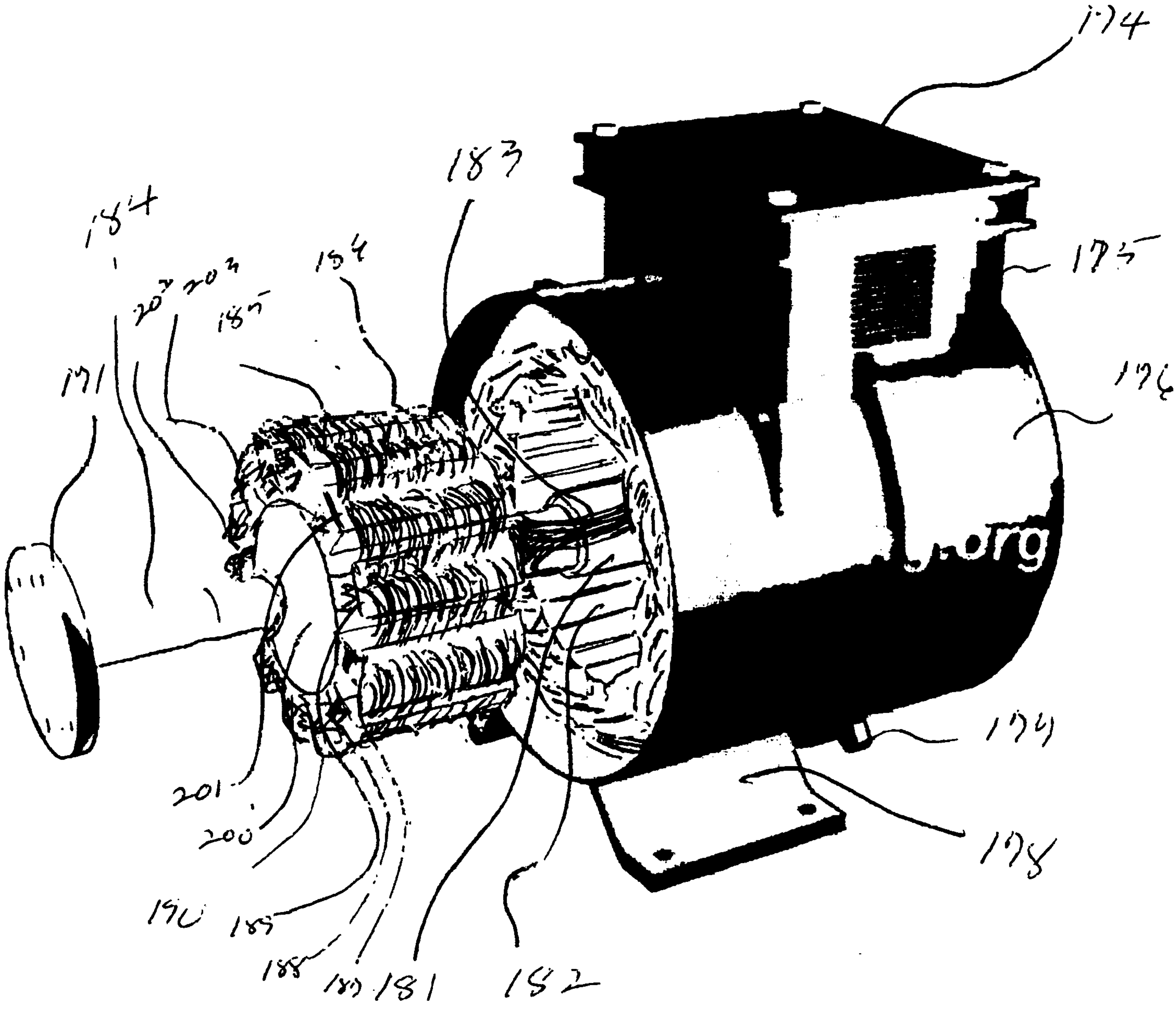


53

90

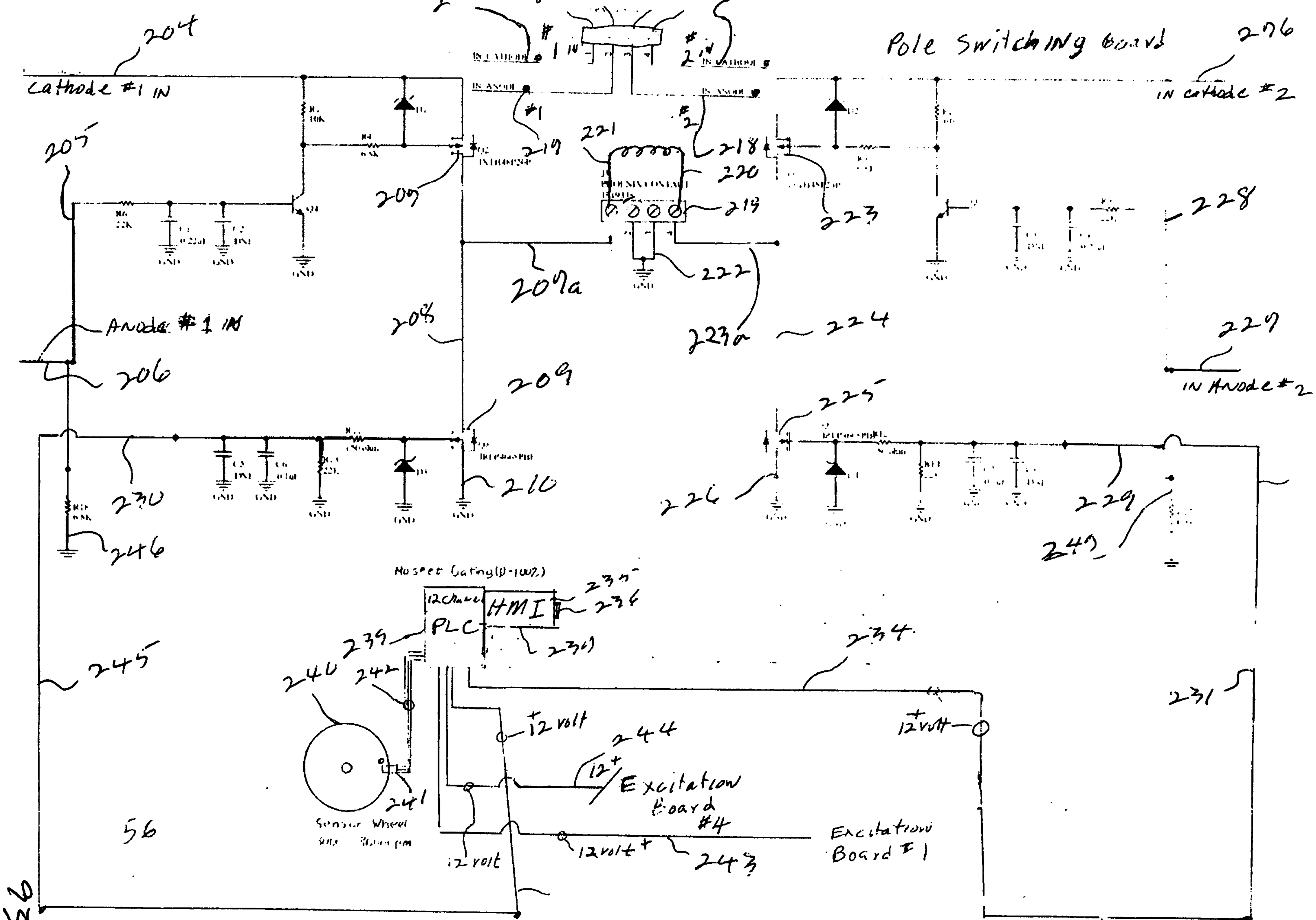


54


174
183
184
185
171
175
176
.org
179
178
201
200
190
189
188
181
182

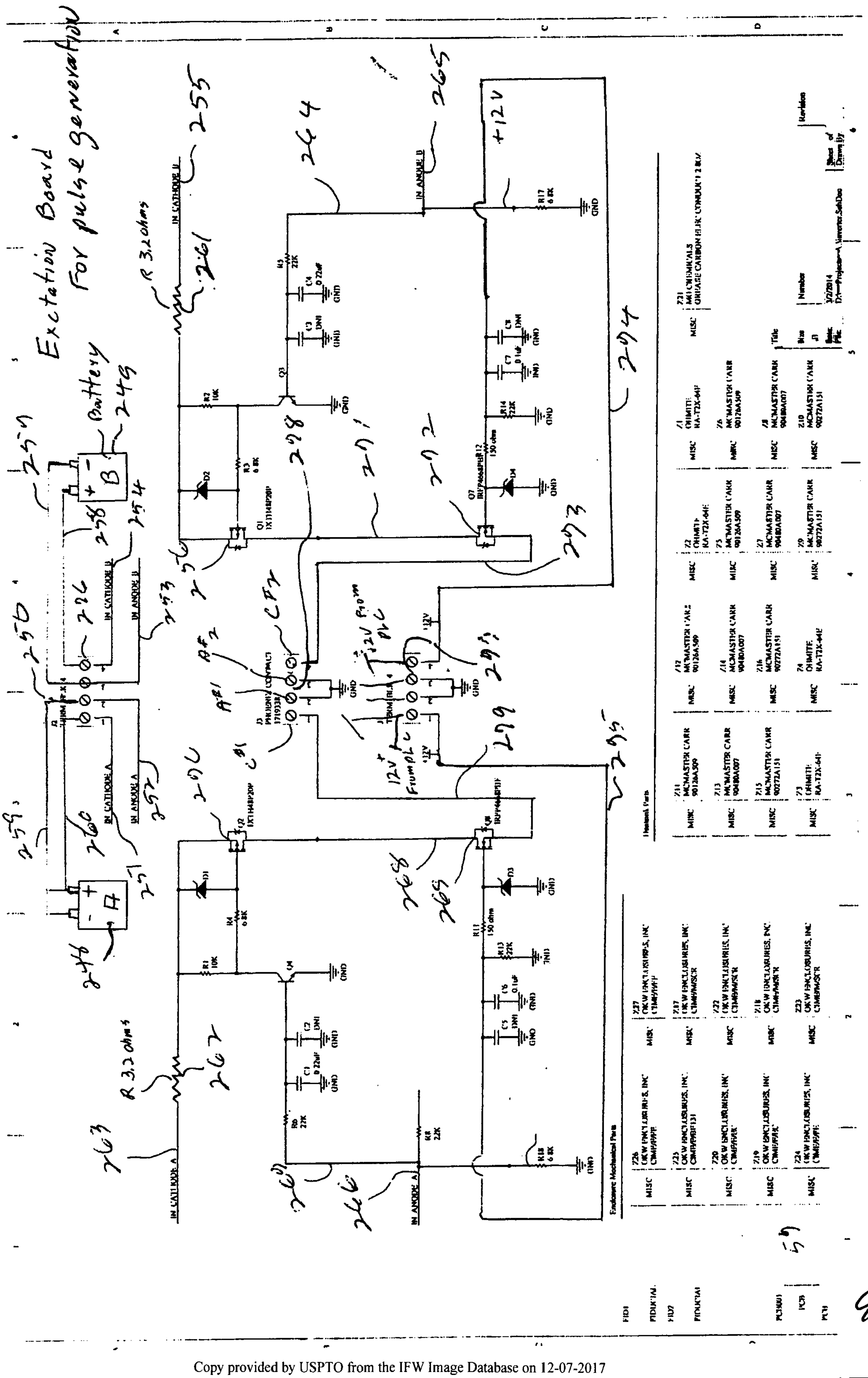
55

92



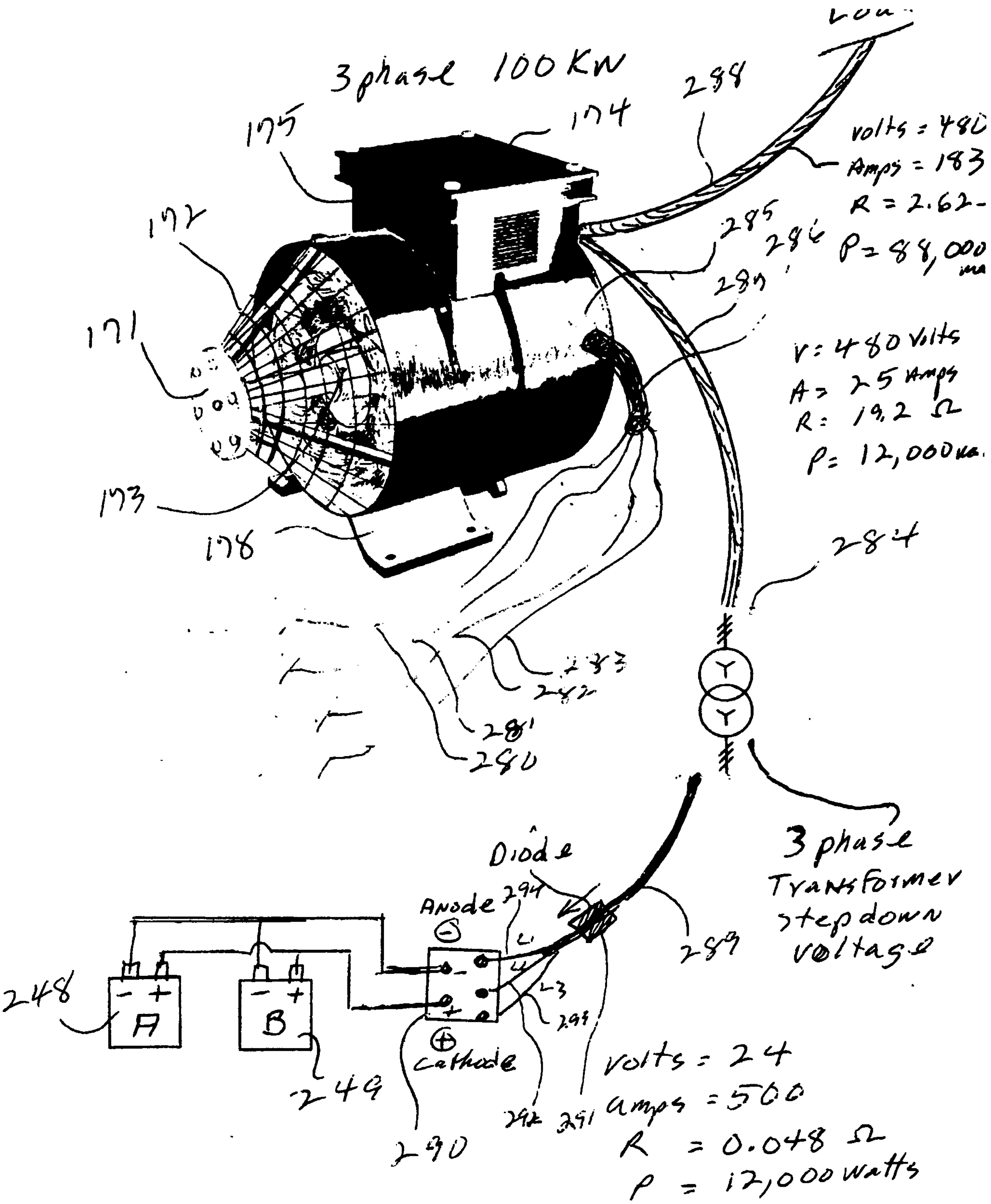
Pole Switching Board
Cathode #1 IN
Anode #1 IN
IN cathode #2
IN Anode #2
#1 IN
#2 IN
#1
#2
204
205
206
207
207a
208
209
210
217
218
219
220
221
222
223
223a
224
225
226
228
229
230
231
234
235
236
237
239
240
241
242
243
244
245
246
247
276
Mosfet Gating (0-100%)
12 Chanel PLC
HMI
12 volt
+12 volt
12+
Excitation Board #4
Excitation Board #1
12 volt+
Sensor Wheel
56

FIG 56



Excitation Board
For pulse generation
Battery
R 3.2 ohms
R 3.3 ohms
+12V
IN CATHODE A
IN ANODE A
IN CATHODE B
IN ANODE B

FIG 57


3 phase 100 KW
175
174
288
volts = 480
Amps = 183
R = 2.62
P = 88,000
172
285
286
287
171
V: 480 volts
A: 25 Amps
R: 19.2 Ω
P: 12,000
173
178
284
283
282
281
280
Diode
Anode
294
289
3 phase
Transformer
stepdown
voltage
248
A
B
Cathode
293
249
volts = 24
amps = 500
R = 0.048 Ω
P = 12,000 watts
292
291
290

58

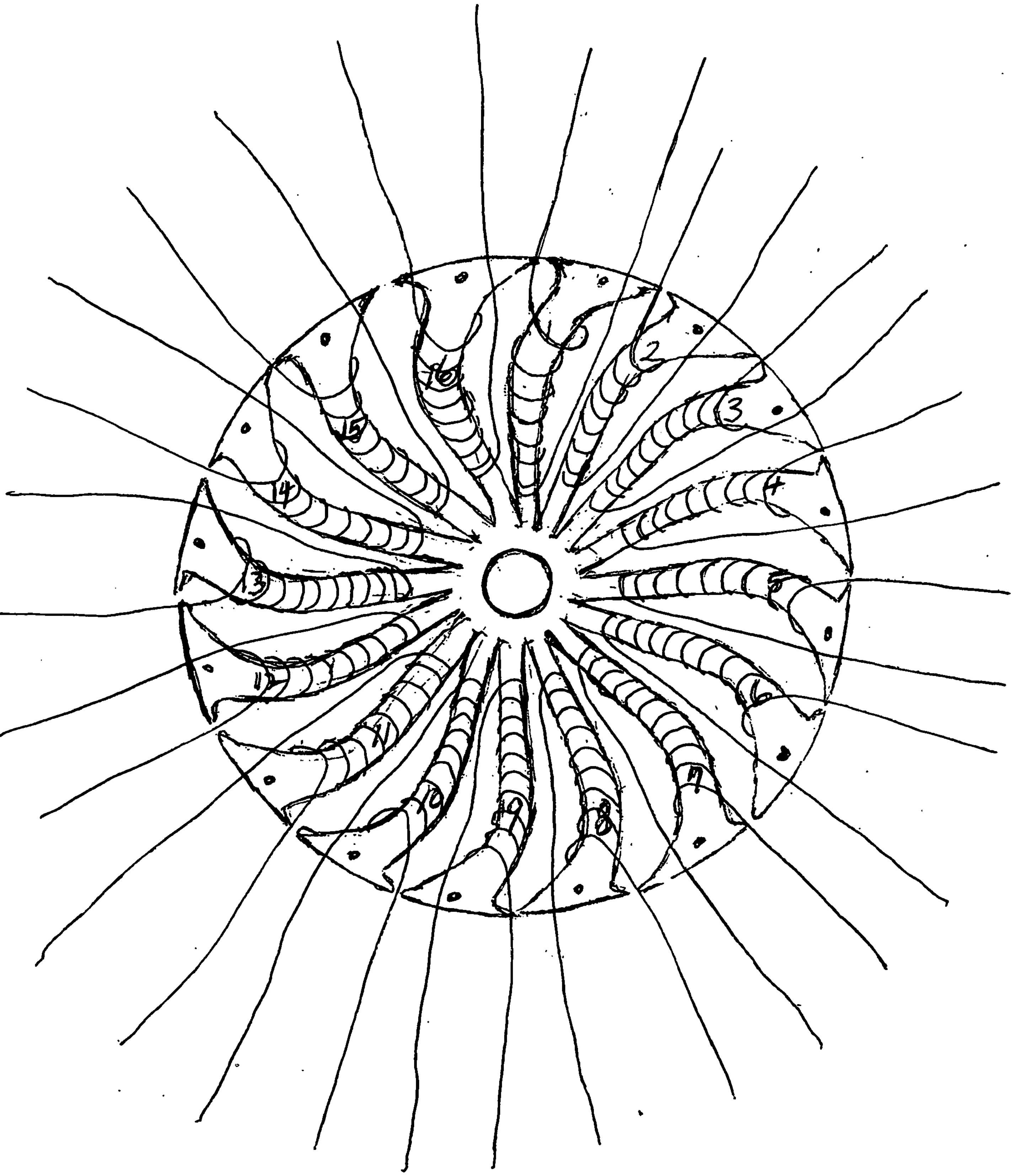


FIG 59

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