No. 619,760. Patented Feb. 21, 1899.

T. B. KINRAIDE.

ELECTRICAL APPARATUS.

(Application filed May 5, 1898.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1

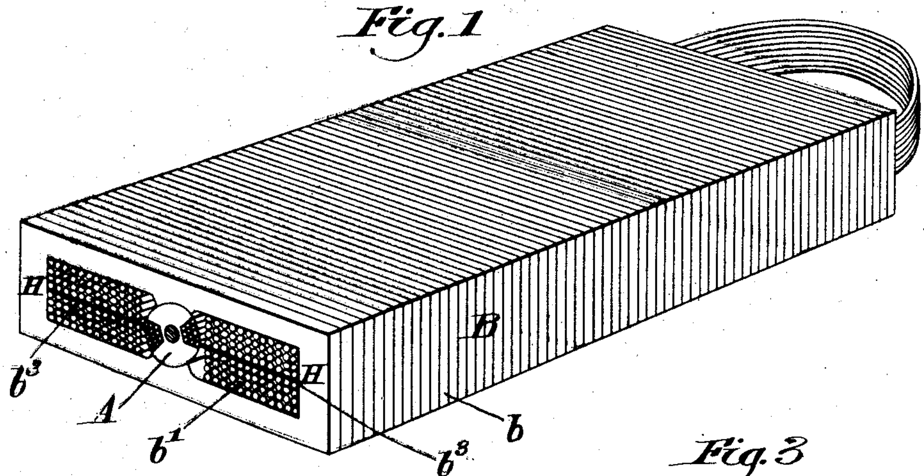


Fig. 2.

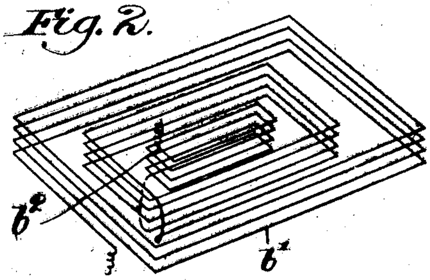


Fig. 3

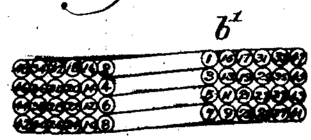


Fig. 4.

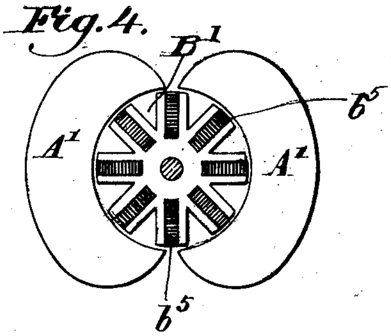
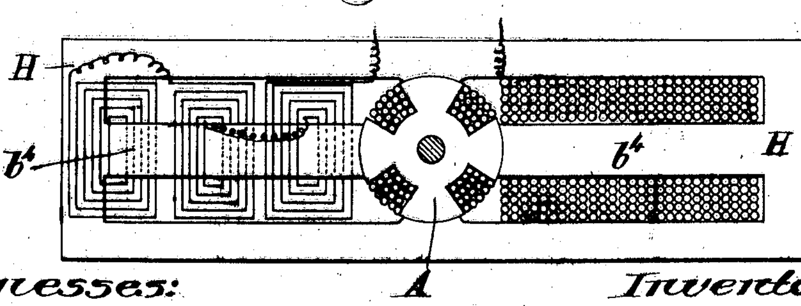


Fig. 5.



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No. 619,760.

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2 Sheets—Sheet 2.

Fig. 6.

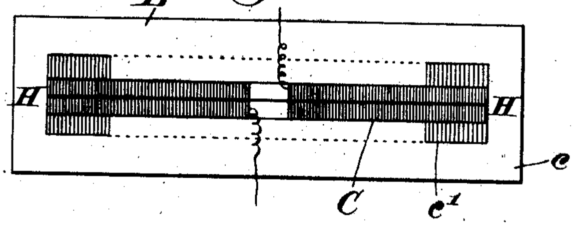


Fig. 7

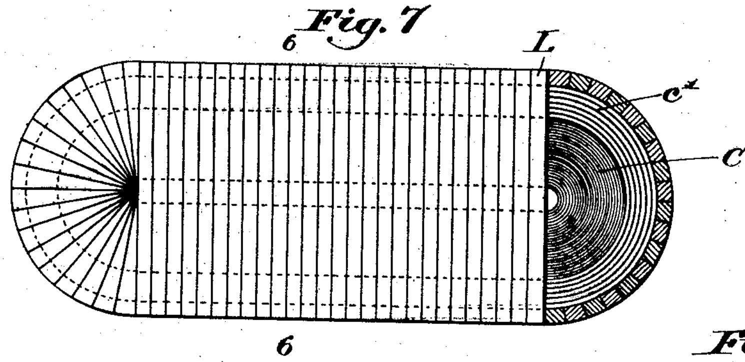


Fig. 9

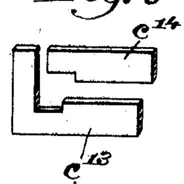


Fig. 8

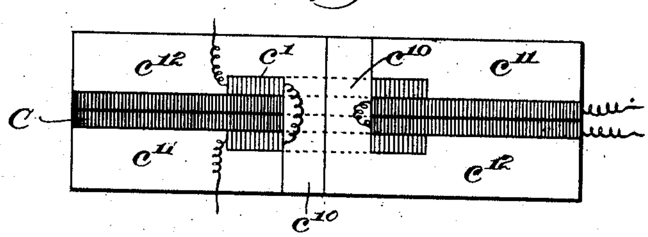


Fig. 10.

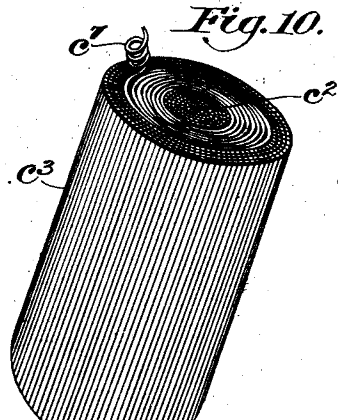
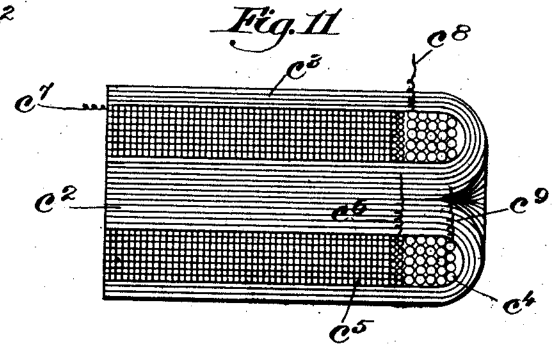


Fig. 11



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UNITED STATES PATENT OFFICE.

THOMAS B. KINRAIDE, OF BOSTON, MASSACHUSETTS.

ELECTRICAL APPARATUS.

SPECIFICATION forming part of Letters Patent No. 619,760, dated February 21, 1899.

Application filed May 5, 1898. Serial No. 679,800. (No model.)

To all whom it may concern:

Be it known that I, THOMAS B. KINRAIDE, of Boston, county of Suffolk, State of Massachusetts, have invented an Improvement in Dynamos, &c., of which the following description, in connection with the accompanying drawings, is a specification, like letters and figures on the drawings representing like parts.

My invention aims to accomplish an increased efficiency in electrical apparatus by means of a new winding thereof, which I have discovered to be the only proper winding for taking advantage of the natural impedance and inductance, so as to give a proper rise of potential in the direction desired only.

I have illustrated my invention in several different forms of apparatus in order that it might be fully apprehended, and the details of these devices will be more fully understood from the following description, reference being had to the accompanying drawings, and the invention will be more particularly defined in the appended claims.

In the drawings, Figure 1 is a perspective view, partly diagrammatic, illustrating one manner of constructing a dynamo to embody the principles of my invention. Figs. 2 and 3 are diagrammatic figures illustrating the manner of winding. Fig. 4 is a vertical section showing the principles of my invention applied to a different form of dynamo. Fig. 5 is a central transverse section of another form of dynamo, the right hand thereof showing the windings in section and the left hand thereof illustrating, diagrammatically, the manner of winding. Fig. 6 is a vertical transverse section taken on the line 6 6, Fig. 7, showing my invention applied to a transformer. Fig. 7 is a top plan view, partly in section, of said transformer. Fig. 8 is a central vertical sectional view of another form of transformer. Fig. 9 illustrates in perspective the plates constituting the magnetic field of the latter transformer. Figs. 10 and 11 show, respectively, in perspective and central longitudinal section a modified form of transformer.

Referring to Fig. 1, it will be seen that I have provided a rotating field A and a stationary armature B, the latter being made up of laminated plates or stampings b and internal windings b'. If such a form of dynamo were to be built with usual windings, the wire would be wound around one or the other or all the iron walls constituting the shell or magnetic field of the armature B. Instead of this method of winding I inclose all the wires within the stampings and I wind the wire in a peculiar manner illustrated in Figs. 2 and 3, where it will be seen that beginning at the inner terminal b^2 the wire is carried in a winding parallel to the rotating field A in successive turns, as indicated by numbers in Fig. 3, so that the wire is built up in successive layers from the inside outward until half of the cavity (at one side the heavy line b^3, Fig. 1) within the stampings is entirely filled, and then the same method of winding is followed until the opposite half of the cavity is entirely filled, the outer layers of the two bodies of windings being joined in circuit, so that we have a U-shaped mass of windings with the opposite terminals thereof next to the rotating field A. This winding will be clearly understood by following the numbers in Fig. 3 and observing the graphic representation of said winding in Fig. 2, from which it appears that successive coils are made until opposite parallel layers are formed, (indicated, respectively, by the figures 1 3 5 7 and 2 4 6 8,) and then the same wire continues laying adjacent layers, (indicated, respectively, by the figures 9 11 13 15 on one side and 10 12 14 16 on the other side,) the same wire then being carried back in the next layer, as indicated on one side by 17 19 21 23 and on the other side by 18 20 22 24, and then the last peripheral coil made in the half of the cavity of the armature filled by the windings thus far described continues over to the other half of said cavity, being coiled in precisely the same manner as before, the turns, however, proceeding from the periphery inward in the reverse manner to that already explained. In other words, supposing the last peripheral turn on one side the line b^3 to be made by the wire 48, this wire is continued past the dividing-line b^3 to the side of the cavity, which we will suppose to be vacant, winding precisely as before the turns 48 47, 46 45, 44 43, 42 41, which form the outermost or peripheral layer adjacent the ends of the stampings b, the same wire being thence continued in its windings to form adjacent and within said outermost layer another layer, (represented by the figures on one side 40 38 36 34 and on the other side 39 37 35 33,) and so on, winding in successive layers the same wire until said wire ends up with the last coil 2 1 of the last or innermost layer lying in line with the first or starting layer with which the winding was begun at the opposite end of the wire, the first coil 1 2 being at one terminal of the entire winding and the last coil 2 1 being at the other terminal thereof. The result is that as the field A rotates, thereby disturbing the induced magnetic conditions of the magnetic body B, which for the time being has become an induced magnet, the magnetic lines of the body B, when released from their inducing source, follow the usual law of induced magnets, and fall away from the region of the field A toward H, causing usual fluctuations in the winding of the armature, and the lines of force in the magnetic field provided by the enveloping body or jacket B fall on the wires of the windings and outwardly toward the ends thereof at H, thereby creating the greatest impedance at the adjacent portion of the windings and removing from the inner portions of the windings the hindrance of the lines of magnetic force, so that the rise of potential of the entire winding is free to take place at the terminals of the windings adjacent the field A, and consequently a high-potential region is maintained immediately adjacent the rotating field, and a low-potential region in the winding is maintained at the remote portions of the winding adjacent the parts marked H in Fig. 1. In Fig. 5 I have shown the same principle of winding applied to an armature made up of different-shaped stampings, the stampings shown in Fig. 5 having a central core portion b^4, around which the wire is wound. The principle of winding, however, is the same as before explained—that is to say, the current has to pass from the low-potential or outer portion of the armature along the entire length of the whole winding before it can reach the high-potential or inner portion of the armature adjacent the rotating field. This is different from previous windings in that the old way of winding would be to start, for instance, at the same end as in my winding; but instead of winding the wire outward in layers transversely to the portion b^4, as indicated, the wire would be wound directly on the portion b^4 in a spiral form throughout the length of said portion b^4, and then back again to the start in a second layer, and so on back and forth in layers extending parallel to the length of the armature instead of extending transversely thereto, and the result would be that the current would simply have to pass throughout the length of wire of one layer in order to pass from the low-potential region to the high-potential region of the armature, and then the current in traveling farther along the winding would pass back again along the next layer, traveling from the high-potential region to the low-potential region, and so on back and forth, according to the number of layers, until finally it would reach the outgoing terminal. I repeat, therefore, that the distinction of my winding thereover is that all the current as it is generated by the falling of the magnetic lines of force from the field A toward the end H is drawn off without impedance from the end of the winding away from which the lines of force are falling, and this takes place throughout the successive turns of the winding until every turn thereof back to the very end H discharges freely all its current in the one direction, all discharge in an opposite direction being prevented by the impedance of the lines of magnetic force at and falling toward the high magnetic potential ends H. Accordingly an armature constructed as shown in Fig. 5 would present constant high potential adjacent the rotating field, and the potential would be raised under the most favorable conditions, inasmuch as the lines of force of the surrounding magnetic field would be continually falling across the turns of wire back so as continually to keep releasing one and the same end of the winding from their impeding influence, while continuing to choke the opposite ends thereof adjacent H.

In Fig. 4 I have indicated the field at A' and have provided a rotating armature B', made up of stampings in usual manner, the difference over a usual dynamo being, however, that I have wound the armature as already described, b^5 indicating a ribbon winding, which begins adjacent the core of the armature and winds in successive layers thence outwardly in a radial direction, so that, for the reason already explained, there is a constant region of high potential adjacent the periphery of the armature and the inner terminals at the core are low potential. This is not only of advantage in that it gets all the benefit of the cutting lines of force in the magnetic field in the most natural manner as they fall across the turns successively from the inner to the outer portions of the windings, but also it requires only one terminal to be provided for the high-potential-current delivery from the apparatus, thereby permitting the return-conductor of the circuit to be correspondingly light and inexpensive for the extremely low voltage duty required of it.

In Figs. 6 and 7 I have shown a secondary C, wound in the same manner already described in detail and as shown in Fig. 1, the iron field c being cut away at c' to receive a primary preferably wound also on the same principle as the secondary. This produces what may be termed "a magnetic oscillator," in which all the lines of force of the magnetic field (whether closed or open) are permitted on an interruption of the current in the primary to fall across the secondary, so as to cut all the turns thereof successively from the center toward H and progressively throughout the length of the wire. In a transformer wound in the old way the lines of force would cut successive turns, to be sure, but would not cut said turns progressively along the whole wire, inasmuch as the windings would be transverse to the direction that I employ. This will be more readily understood viewing Figs. 10 and 11, which show the magnetic field as made up of wires forming at the center a core c^2 and bent around the outside of the windings to form a jacket c^3. The old way of making a transformer in this form would have been to wind the primary along the core c^2 from one end to the other and then wind the secondary over the primary in successive layers parallel to the core back and forth. My winding, it will be seen, is entirely different from this, for I wind the primary c^4 at one end, as clearly indicated, and then wind the secondary c^5 in successive layers transversely to the core c^2 instead of parallel thereto, so that all the current passes out from the delivery or outgoing terminal c^7 without any impedance, because as the lines of force fall and cut the turns, beginning at c^7 and falling back toward the opposite terminal c^6, the wire is left free to discharge its current in one direction only, and this continues until all the wire is left free back to its terminal c^6. In Fig. 8 I have shown a form of transformer wound on the same plan, but having a central core c^{10} and opposite disk-like magnetic fields c^{11} c^{12}, connected therewith, the stampings in this case being made up of pieces c^{13} c^{14} (shown in detail in Fig. 9) and put together in an obvious manner.

Having described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In an electrical apparatus, a body producing a magnetic field, a winding within the influence of said body, means to maintain high-potential and low-potential regions respectively in opposite parts of said magnetic field, and means to cause fluctuations of said field, said winding being wound to present conditions of electrical potential related inversely to the magnetic potential of the field, and having decreasing potential throughout its entire length from its high-potential region to its low-potential region, substantially as described.

2. In an electrical apparatus, an enveloping body providing a magnetic field for the apparatus, a winding arranged in and subject to the influence of said field, means to set up conditions of potential high and low relatively to each other in different regions of said field, and means to cause fluctuations of said field, said winding having its terminals adjacent the region from which the magnetic lines fall on a fluctuation of said field, said winding being similarly wound from its said terminals to its intermediate portion, the latter being adjacent the region toward which said magnetic lines fall, and being wound to present decreasing potential throughout its entire length from its said respective terminals to its said intermediate portion, substantially as described.

3. In an electrical apparatus, a body providing a magnetic field for the apparatus, a winding arranged in and subject to the influence of said field, means to set up conditions of potential high and low relatively to each other in different regions of said field, a primary winding restricted to the region of said field toward which the magnetic lines fall, said first-mentioned winding being wound in said field to present conditions of electrical potential related inversely to the magnetic potential of the field, said winding having decreasing potential throughout its entire length from its high-potential region to its low-potential region, substantially as described.

4. In an electrical apparatus, a magnetizable shell or jacket providing a magnetic field for the apparatus, a winding arranged in and subject to the influence of said field, means to set up conditions of potential high and low relatively to each other in different regions of said field, a primary winding restricted to the region of said field toward which the magnetic lines fall, said first-mentioned winding having its terminals adjacent the region away from which the magnetic lines fall, being similarly wound from its said terminals to its intermediate portion, the latter being adjacent said primary winding, and said first-mentioned winding being wound to have its potential decreasing throughout its entire length from its said respective terminals to its said intermediate portion, substantially as described.

5. In an electrical apparatus, a thin, flat secondary winding wound in two similar bodies side by side proceeding from the intermediate portion of the winding constituting the secondary and each of said bodies winding in successive layers or coils progressively shorter throughout its length from the periphery to the central portion thereof, and a primary winding restricted to the peripheral portion of said secondary, part thereof being on one side and part on the opposite side of said secondary, substantially as described.

6. In an electrical apparatus, a thin, flat secondary winding wound in two similar bodies side by side proceeding from the intermediate portion of the secondary and each winding in successive layers or coils progressively shorter throughout its length from the periphery to the central portion thereof, and a primary winding restricted to the peripheral portion of said secondary, part thereof being on one side and part on the opposite side of said secondary, and a magnetic jacket or body inclosing said windings, substantially as described.

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

THOMAS B. KINRAIDE.

Witnesses:
GEO. H. MAXWELL,
JOHN C. EDWARDS.