(No Model.) 2 Sheets—Sheet 1.

# E. THOMSON.

## WELDING OR OTHER DYNAMO.

No. 432,652. Patented July 22, 1890.

Fig. 1.

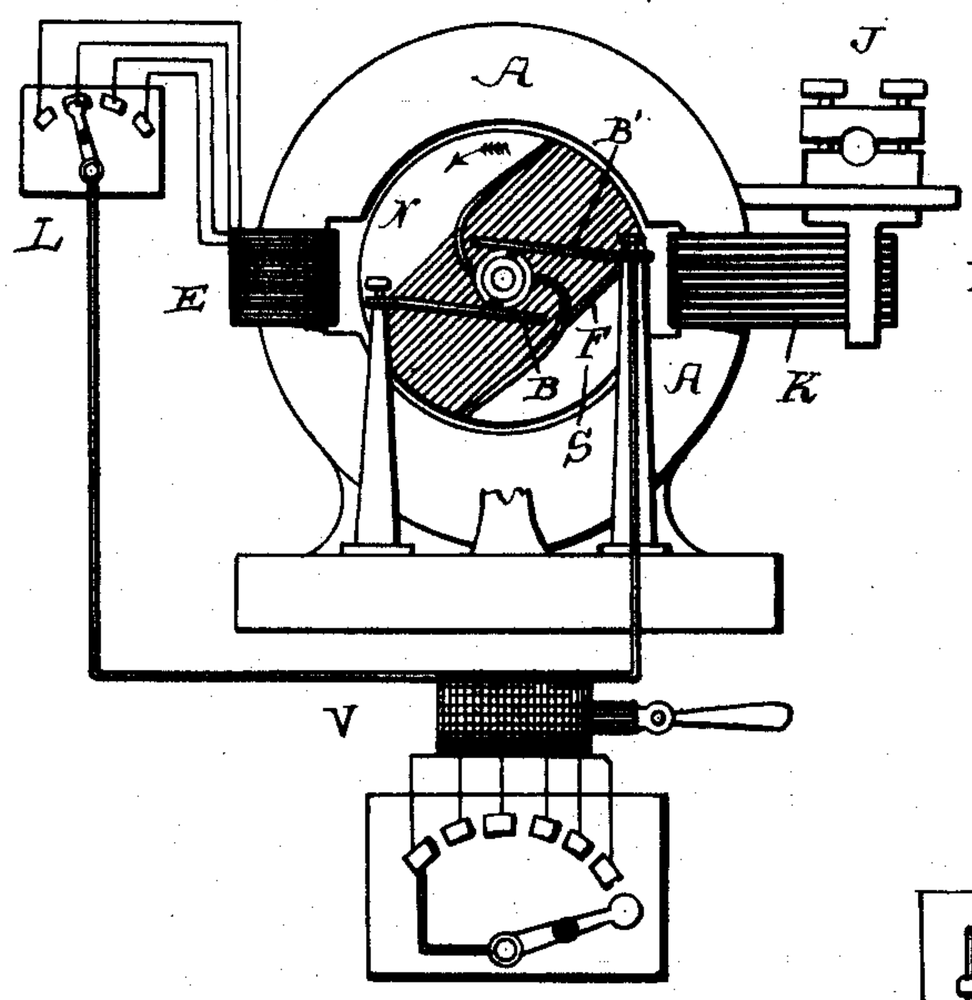



Fig. 2.

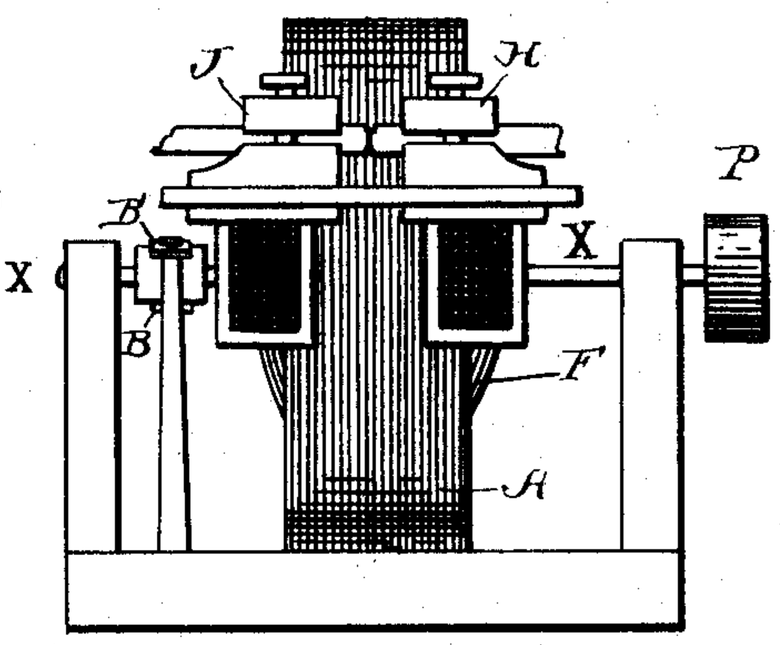



Fig. 4.

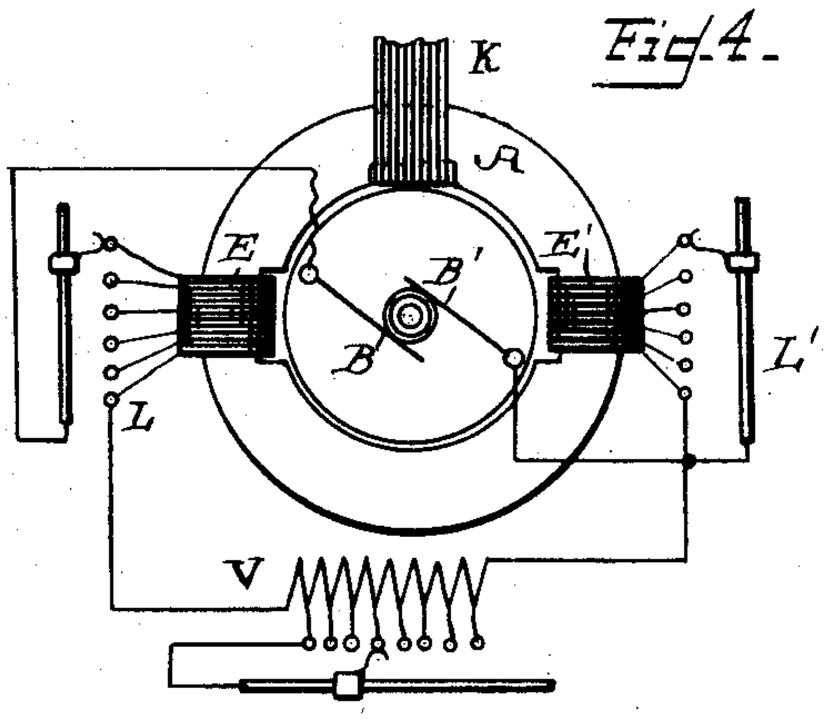



Fig. 3.

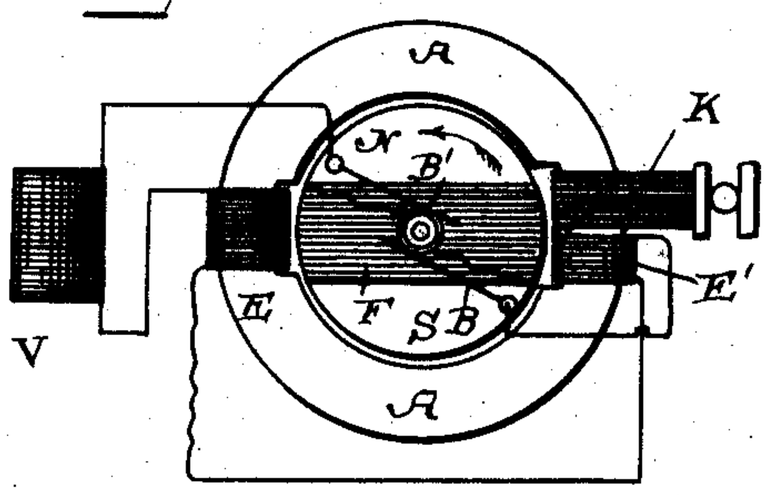



Fig. 7.

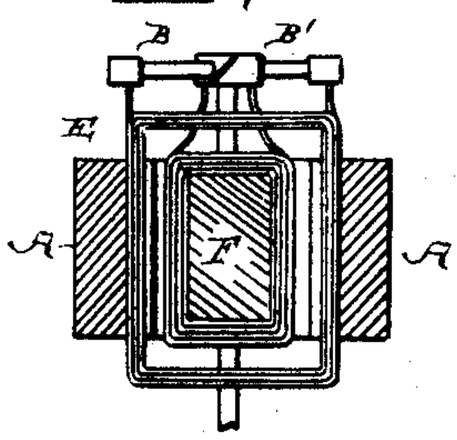



Fig. 6.

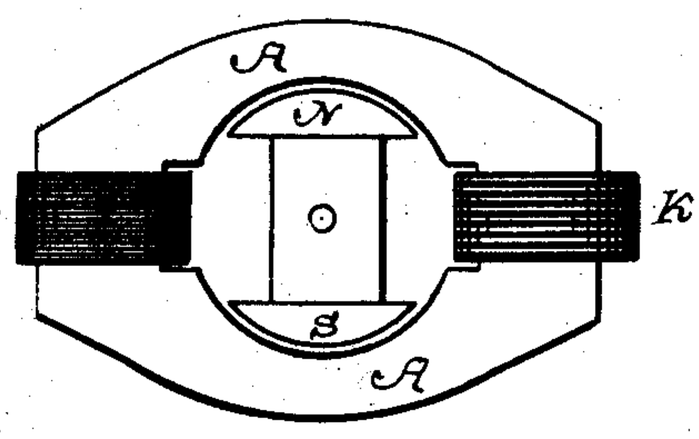
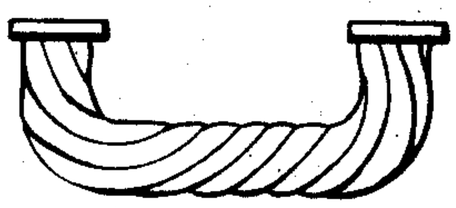



Fig. 5.



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(No Model.) 2 Sheets—Sheet 2.

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## WELDING OR OTHER DYNAMO.

No. 432,652. Patented July 22, 1890.

Fig. 8.

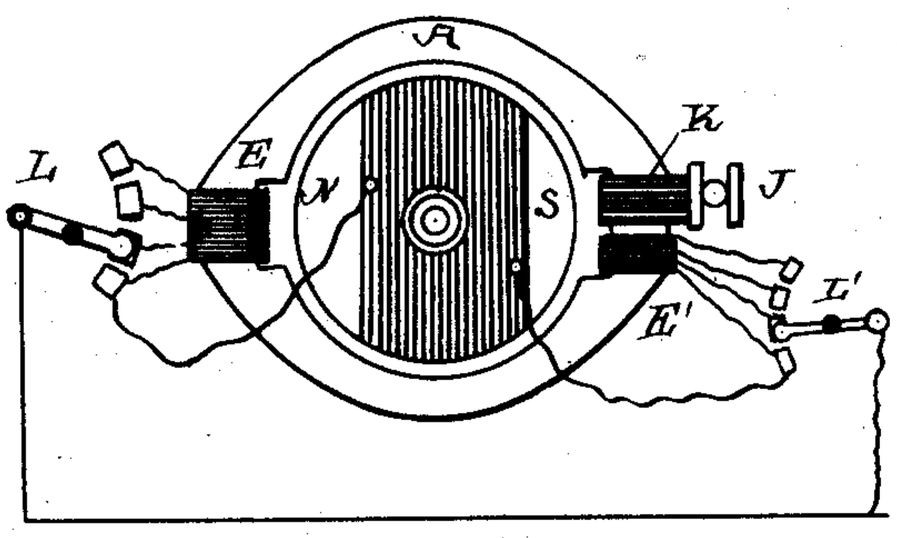



Fig. 9.

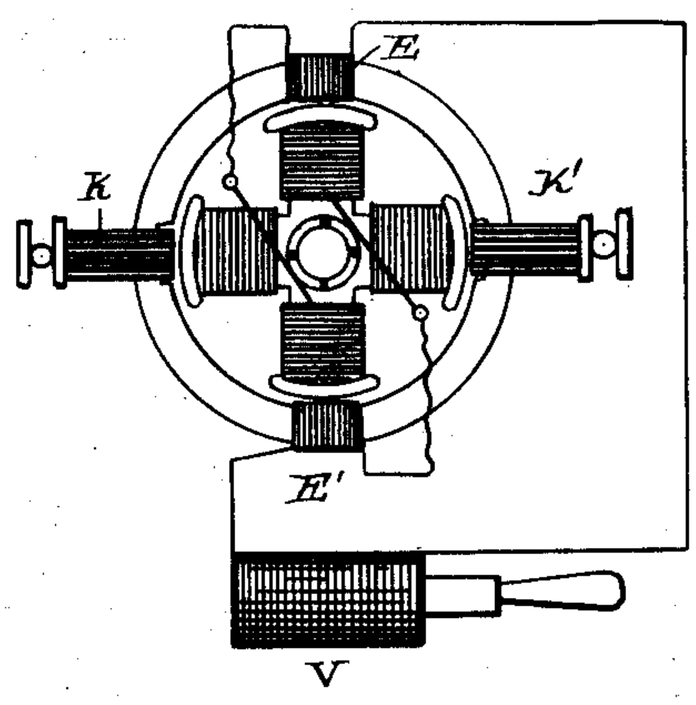
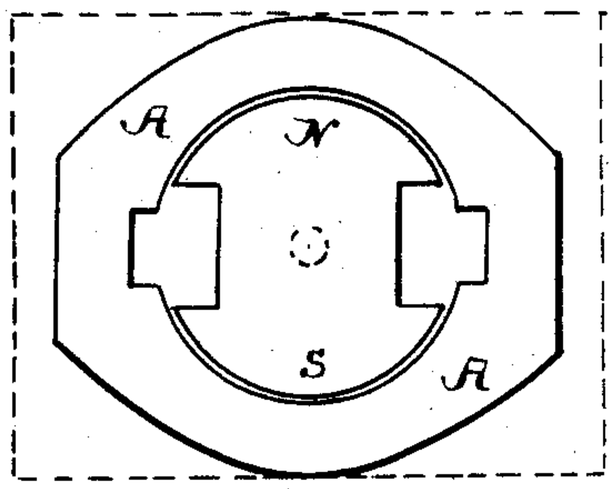



Fig. 10.

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# UNITED STATES PATENT OFFICE.

ELIHU THOMSON, OF LYNN, MASSACHUSETTS.

## WELDING OR OTHER DYNAMO.

SPECIFICATION forming part of Letters Patent No. 432,652, dated July 22, 1890.

Application filed January 22, 1889. Serial No. 297,162. (No model.)

*To all whom it may concern:*

Be it known that I, ELIHU THOMSON, a citzen of the United States, and a resident of Lynn, in the county of Essex and State of Massachusetts, have invented certain new and useful Welding or other Dynamos, of which the following is a specification.

My invention relates to the construction of dynamo-machines for delivering currents of large volume and low electro-motive force such as are suitable for electric welding and other metal-working operations.

The object of my invention is to secure great compactness, regulability, simplicity, and effectiveness, and to enable the welding currents to be carried directly to the work without collecting brushes or rings.

My invention relates to the particular construction of a machine in which are employed a revolving field-magnet, a stationary coil or conductor in which currents are developed by the revolution of the field-magnet for supplying the exciting-current of the machine, a second stationary conductor or circuit in which the heavy currents supplied to the work are developed by the revolution of the field-magnet, and a commutator on the shaft of the revolving field-magnet for commuting the exciting-currents before they reach the revolving field-coils. The first-named coil I term the "exciter-supply coil" or "conductor." The latter I term the "working-supply coil" or "conductor."

My invention consists, first, in regulating or governing the current supplied to the work by means of a coil or conductor of variable reaction or self-induction interposed in the circuit of the exciting-current between the exciter-supply coil and the commutator, so as to be traversed by the alternating currents before they are commuted to pass through the revolving field-magnet as a straight or unidirectional current.

My invention consists, further, in the particular manner of disposing the exciter and work supply conductors upon the stationary armature-core to which they are applied and in other details of construction and combinations of parts to be more particularly hereinafter described, and then specified in the claims.

In my improved construction of machine the field-magnet consists of a core of iron mounted at or about the center of its magnetic axis and adapted to be rotated within a ring-shaped core of iron having applied to it a stationary coil or conductor wound in a plane intersecting the armature and constituting the exciter-supply source, a second stationary conductor which passes around the inside of the endless core and terminates on the exterior in the work-holding clamps or supports, and a commutator in the circuit of the supply source and field-magnet coil, as hereinafter more particularly described.

The exciter-supply coil or conductor may be applied as one coil or conductor upon a particular part of the armature or core, or as two or more portions on different parts of the core, respectively. All or a portion of said conductor or coil is upon a different part of the armature from the work-supply conductor. Thus, if one exciter-supply coil is used upon the core, the work-supply conductor is applied, preferably, on the opposite side of the core, so as to be as far displaced therefrom as possible. If two or more exciter-supply coils are used, however, one or more of them may be, and one at least preferably is placed, near to the work-supply armature-conductor, (if one only of the latter be employed,) the other exciter-coil or portion of the coil being differently situated. Under other conditions—as, for instance, where two work-supply conductors are applied to different parts of the core or armature—it is perfectly practicable to use two or more exciter-supply coils, both wound upon different parts of the core from the work-supply conductors.

In the accompanying drawings, Figure 1 is a side elevation of a machine embodying my invention. (This figure illustrates diagrammatically the regulating appliances.) Fig. 2 is an end elevation of the machine. Fig. 3 shows a preferred relation of the exciter and work supply conductors. Fig. 4 shows a modified disposition. Fig. 5 shows a preferred construction of work-supply conductor. Fig. 6 shows a modified form of endless core for the exciter and work conductors. Fig. 7 shows a modification in the disposition of the exciter-supply coil. Fig. 8 shows a modified

arrangement. Fig. 9 illustrates the extension of the principle to a revolving field-magnet with four poles. Fig. 10 shows how the plates from which the core of the field-magnet and the armature are built up may be punched from a single sheet.

In Figs. 1 and 2, N S are the poles of the revolving field-magnet. (Here shown as resembling in form the armature of an early well-known type of Siemens machine.) The field-magnet is mounted on a suitable shaft X X, to which power is applied by pulley P to rotate the field-magnet.

A A is the iron of the armature, which is here shown as a laminated ring with spaces cut away for the exciter-supply coil E and work-supply conductor K, as shown. A commutator of two half-circles with brushes B B′ bearing thereon, as shown, has its segments connected, respectively, with the terminals of the field-coil F. The brushes are connected, respectively, with the appropriate terminals of the exciting-coil E, (variable in effect.) Interposed, by preference, in the exciter-circuit is a variable self-inductor V, whose magnetic circuit or iron core is variable, or the amount of wire on the core and in the circuit of which is variable, as indicated in the figure, or which is variable in any other desired way. The work-supply conductor K terminates in two clamps J H for holding pieces of metal to be welded or worked in accordance with my former inventions. The work-supply conductor K may consist of only one turn, or two or three turns around the armature-core A A. The exciter-supply coil E is preferably wound in sections, and a switch L is used to vary the number of sections included in circuit for use. During operation the current, which is generated in E and excites the field, is varied by V, so as to control the potential and current of the work-supply conductor K in obvious manner.

In Fig. 3 a portion E′ of the exciter-supply coil or conductor is shown applied adjacent to the work-supply conductor K, while the other portion E is applied to the opposite portion, as before. This renders the excitation of the machine dependent less upon the closure of the work-circuit by a good conductor than was the case in Fig. 1. In Fig. 1 the machine excites most promptly when the work-circuit K is well closed by metal pieces, and might fail to act with quite small pieces. The reason for this is that there is a tendency to the shunting of the magnetism developed by the field-magnet through the iron of the stationary armature on that side on which the work-supply conductor is placed, so that the magnetism does not pass through and excite current in the coil E, excepting to a limited extent. If, however, the circuit of K were well closed, the current developed in it would beat back the magnetism, tending to pass by it and force it to pass through the opposite side of the core. The same reactive tendency is exerted by the part E′, Fig. 3, of the exciter-supply coil located on the same part of the core with K. The action is then better balanced and the machine can excite itself with greater promptness, especially in cases where the closure of the circuit of K is impaired at the work. The machine, Fig. 1, is in fact like a series dynamo in properties, in that to excite itself it requires the work-circuit to be closed.

The structure, Fig. 3, is more like a compound wound dynamo, in that it will excite with the work-circuit open, and the coils E E′ may be so proportioned as to give approximately constant potential in the work-circuit. Again, if coil E be diminished in effect and E′ made of more turns, the effects may approach those of a shunt-wound dynamo, or a fall of potential may take place when the work-circuit is too well closed or the resistance is too small.

In Fig. 4 the work-supply conductor is shown applied at right angles with the two exciter-supply coils E E′, both of which are variable in number of turns, as indicated, whereby the degree of excitation acquired at any speed may be varied.

Fig. 5 shows the preferred construction of the work-supply conductor K. It is made of a bundle of copper wires, preferably insulated, twisted by one turn in the part inductively acted upon by the core, and united at their ends to conducting-blocks leading to the clamps. The object of this arrangement is to avoid the loss of energy from the short-circuiting of the developed currents in the body of the conductor and through its terminal. Such tendency arises from the fact that different parts of the conductor where it is made of large section are at different portions in a transverse direction of considerable difference of potential. By giving the parts a half-twist, as described, however, that part which at one end of the conductor is in a position to be of low potential is at the other end in a position to have a higher potential, the result being a tendency to equalization of potentials in the conductor and a freedom from short-circuiting.

Fig. 6 indicates one of the preferred relations of shape to be given to the field core and armature of Fig. 1. Both structures should be made of sheet-iron or well laminated in a plane at right angles to the shaft. The plates may be cut from sheets, as indicated in Fig. 10, of the relative sizes there shown nearly.

Fig. 8 shows the same structure as Fig. 3, with a means for varying the turns in use in either coils E E′. For large or heavy work at J the number of turns of E should be increased and coil E′ cut out or diminished.

There is nothing to prevent the apparatus being made with more poles—as four, &c.—on the field-magnet, Fig. 9. This variation will be obvious at a glance. Two work-supply conductors K K′ can thus be acted on at one time, if desired.

In Fig. 7 the coil E, instead of being wound on, as in Figs. 1 to 4, is wound in a hollow coil surrounding the field itself, as shown. This is a very effective construction, inasmuch as its action depends directly on induction from the field-magnet revolved.

Fig. 10 shows how, by punching the sheets of iron, the parts for the field and armature cores are both obtained. This will be evident on inspection of the figure.

What I claim as my invention is—

1. The combination, substantially as described, of a revolving field-magnet consisting of an electro-magnet mounted on an axis, pivoted at or about the center of its magnetic axis, an endless core of iron surrounding the field-magnet, a stationary exciter-supply coil or conductor applied to the core and wound in a plane intersecting the armature, a commutator on the field-magnet shaft in circuit between the revolving field-magnet coil and the stationary exciter-supply coil, and a stationary work-supply conductor passing around the inside of the endless core and terminating on the outside in work-holding clamps.

2. The combination, with the revolving field-magnet and stationary core or carrier, of a work-supply conductor applied to said core and an exciter-supply conductor, one part of which is applied adjacent to the first conductor and another to a part of the core more remote.

3. The combination, with the ring or endless core and revolving field-magnet, of a work-supply conductor and an exciter-supply coil wound in two portions or sections, one applied parallel or adjacent to the work-supply conductor and the other at an opposite point of the core.

4. The combination, with the stationary core A and revolving magnet, of a conductor K of low resistance connected to the work and two coils E E′, one near to the conductor K and the other upon a different portion of the core.

5. The combination, with the stationary core A and a revolving field-magnet revolving within the same, of an exciter-supply coil or coils through which said core is threaded, the work-supply conductor also applied to said core and terminating in work-holding clamps, a commutator in the circuit of the field-magnet and exciter-supply, and a variable reactive coil in the alternating portion of the circuit, including the supply-coil and field-magnet coil.

6. The combination, with the endless core, of the work-supply conductor and two variable coils supplying exciting-current, one wound on the core adjacent to the work-supply conductor and the other at an opposite point, as and for the purpose described.

7. The combination, substantially as described, with the ring-core A, having an exciter-supply coil E, through which said core is threaded, of a revolving field-magnet F, mounted on an axis transverse to its magnetic axis and at or about the center thereof, a commutator for rectifying the currents of the supply-coil in the field-magnet coil, and a work-supply conductor K, consisting of a twisted cable which passes across the inside of the core A and terminates on the outside thereof in the work-holding clamps for an electric metal-working apparatus.

Signed at Lynn, in the county of Essex and State of Massachusetts, this 17th day of January, A. D. 1889.

ELIHU THOMSON.

Witnesses:
J. W. GIBBONEY,
E. W. RICE, Jr.