

T. A. EDISON.  
INDUCTION CONVERTER.

No. 534,208.

Patented Feb. 12, 1895.

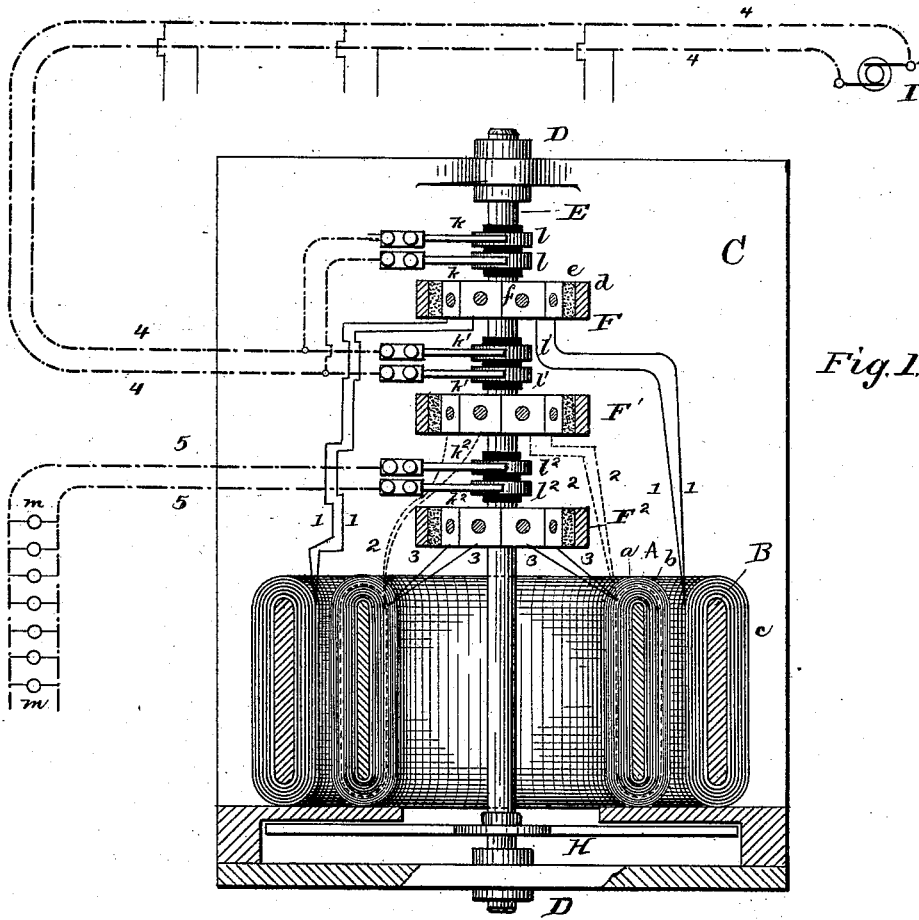


Fig. 1.

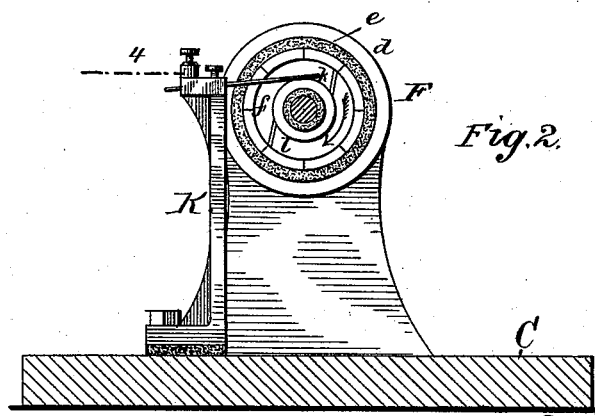


Fig. 2.

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Fig. 3.

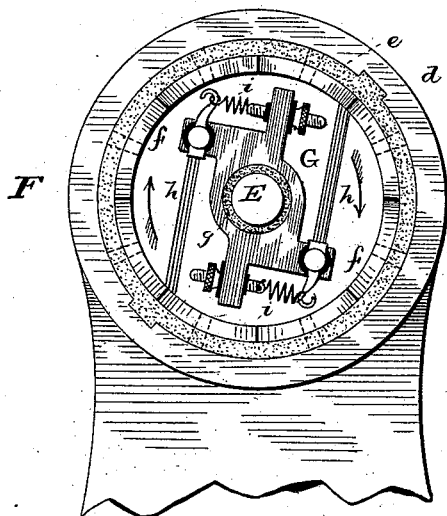
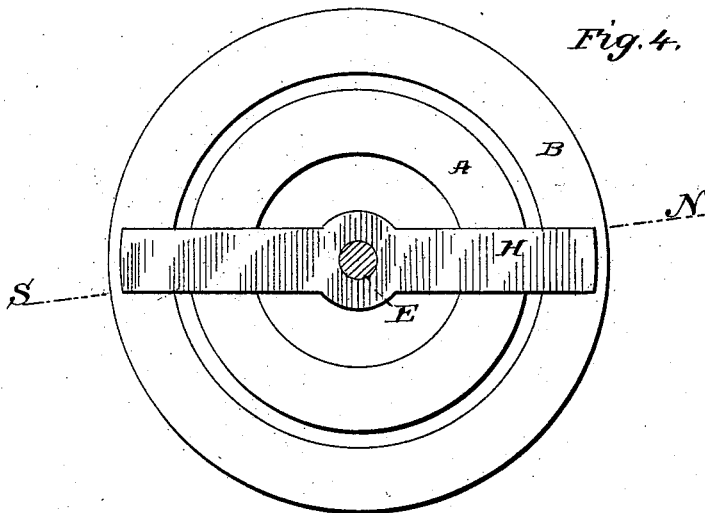


Fig. 4.



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Fig. 5.

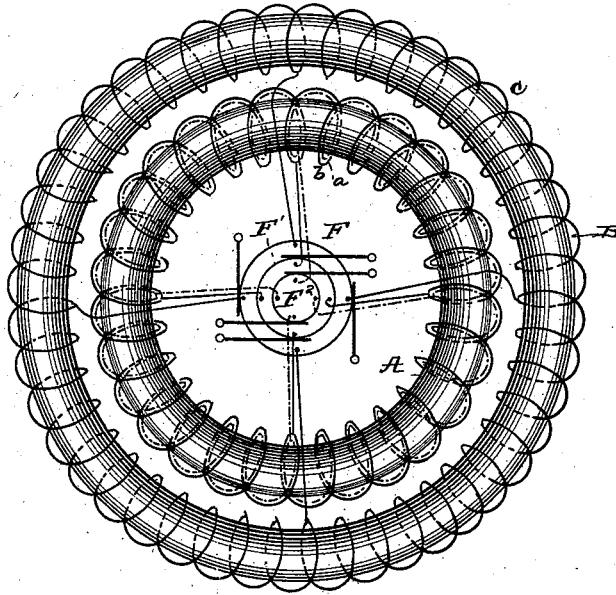
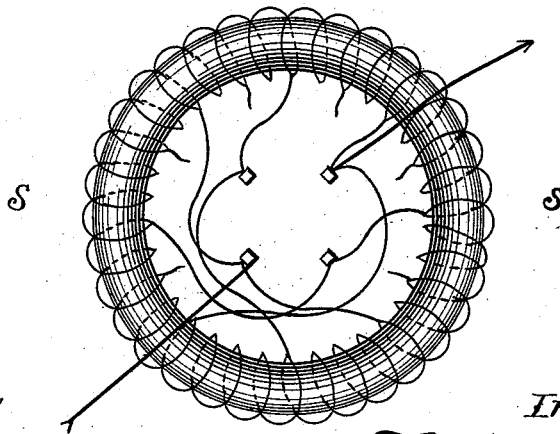


Fig. 6.



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# UNITED STATES PATENT OFFICE.

THOMAS A. EDISON, OF LLEWELLYN PARK, NEW JERSEY.

## INDUCTION-CONVERTER.

SPECIFICATION forming part of Letters Patent No. 534,208, dated February 12, 1895.

Application filed May 21, 1888. Serial No. 274,587. (No model.)

*To all whom it may concern:*

Be it known that I, THOMAS A. EDISON, of Llewellyn Park, in the county of Essex and State of New Jersey, have invented a certain new and useful Improvement in Induction-Converters, (Case No. 772,) of which the following is a specification.

My invention relates to induction converters or transformers designed to be used with currents continuous in one direction, and whose function is to convert a continuous current of high tension, such as can be conveyed by conductors of small size, into a continuous current of lower tension suitable for use for incandescent electric lighting and like purposes.

In my Patent No. 287,516, dated October 30, 1883, is set forth an apparatus of this character consisting of a rotating armature wound with two continuous coils—a primary coil of fine wire and a secondary coil of coarser wire, each coil being provided with a separate commutator, and a stationary field magnet between whose poles said armature revolves, whereby the high tension continuous current introduced into the fine coil is transformed into a low tension continuous current in the coarse coil.

The object of my present invention is to avoid the necessity of rotating such heavy parts as the armature, in a device of this character, and to do away with sparking at the commutators, whereby the necessity for having an attendant at the transformer is done away with, and the apparatus can be left to itself, as an alternating current transformer is.

The main feature of my invention is the employment in a converter in connection with stationary armature coils, of a stationary field magnet provided with a commutator for shifting its poles whereby the lines of force are shifted and the armature wires are made to cut the same. I prefer to employ a stationary continuously wound ring armature, and stationary continuously wound ring field magnet concentric therewith, such armature and field magnet being both provided with commutators, the brushes of which are continuously rotated. The stationary ring armature may be wound with two coils each wound continuously and each connected to the segments

of a commutator, preferably after the manner of a Gramme ring—one of these coils being a primary coil of fine wire and high resistance, the other a secondary coil of comparatively coarse wire and low resistance. The stationary ring field magnet is also wound and connected to a commutator preferably like a Gramme ring coil. The brushes of the field magnet commutator are set at right angles to those of the armature commutators, and all the commutator brushes are revolved. The effect of this is that the inductive effect of the field magnet and the fine coil, when a high tension continuous current is introduced into them, produces a low tension continuous current in the coarse or secondary coil.

My invention is illustrated in the accompanying drawings, in which—

Figure 1, is a partial top view and partial horizontal section of an apparatus embodying said invention; Fig. 2, an end view of one of the commutator; Fig. 3, an enlarged cross section of the commutator. Fig. 4, illustrates the means for revolving the commutator brushes. Fig. 5, is a diagram of the winding, and Fig. 6, a diagram illustrating a modified form of winding.

A is an iron ring wound with two continuous coils, a fine wire coil *a* and a coarse wire coil *b*. External and concentric to this armature ring A is another iron ring B wound with a single continuous coil *c* of high resistance. These parts are mounted upon a suitable bed plate C, at the ends of which standards D D rise which form bearings for a shaft E which extends centrally through the ring A.

F is the field magnet commutator which encircles the shaft E but does not turn there-with, being supported by a standard G rising from the bed plate. Such commutator consists of an external metal ring *d*, a ring *e* of insulating material within the same, and a series of contact plates or bars *f f* separated by insulation, secured within said insulating ring. To the plates *f f* connections 1, 1, are made at intervals from the continuous field coil *c*, preferably as illustrated in the diagram Fig. 5. Inside this hollow commutator there is placed upon an insulating collar *g* on the shaft E so as to turn with said shaft, a brush holding frame G, upon which are pivoted two brushes or other current collectors *h h*, held

against the plates *ff* by adjustable springs *ii*. By thus placing the brushes inside the commutator, when the shaft revolves, the centrifugal force tends to hold the brushes firmly against the commutator contacts whereby sparking due to bad contact is prevented.

The connections from the external circuit to the brushes *h h* may be made by means of stationary springs *k k* supported by one or more standards *K* and bearing on metal collars *ll* mounted upon but insulated from the shaft *E*, from which collars suitable connections extend to said brushes.

It will be seen that the current passes through the field coil in two divisions, and two poles are formed, which when the commutator brushes are revolved are shifted rapidly around the ring, whereby the required shifting of the lines of force is attained.

*F'* and *F<sup>2</sup>*, are commutators similarly constructed and arranged to that just described, and provided with similarly mounted and arranged internal current collectors.

Connections 2, 2, from the fine or primary armature coil *a* are made to the commutator *F'*, and connections 3, 3, from the coarse or secondary coil *b* extend to commutator *F<sup>2</sup>*. The external circuit connections to *F'* are from springs *k' k'* bearing on insulated collars *l' l'*, and those to *F<sup>2</sup>* are from springs *k<sup>2</sup> k<sup>2</sup>*, on insulated collars *l<sup>2</sup> l<sup>2</sup>*.

Mounted upon and carried by the shaft *E* in proximity to the rings *A B* is a small iron bar *H*. This bar is so set with relation to the field brushes and the lines of force that it is not central in the field of force and therefore tends to advance and place itself centrally; but its movement shifts the commutator brushes so as to shift the field poles, so that a continuous movement of the bar *H* and of the three pairs of commutator brushes is produced.

*I* represents a dynamo electric machine or other source of continuous current of high tension, from which a circuit 4 4 extends. To this circuit, in multiple arc are connected, through the springs *k k* and *k' k'* and the commutators *F* and *F'*, the field coil *c* and the fine wire armature coil *a*. From the coarse wire armature coil *b*, through commutator *F<sup>2</sup>* and springs *k<sup>2</sup> k<sup>2</sup>*, the low tension circuit 5 5 extends, this circuit having connected with it incandescent electric lamps or other translating devices *m m* in multiple arc or other suitable way.

Fig. 6 illustrates a modified form of connections which may be used for each of the three coils of the apparatus, though for simplicity of illustration, I have shown merely a single coil so connected. This is such an arrangement as is shown in my application, Case No. 716, filed March 8, 1887, Serial No. 230,090, in which connections are made from opposite points of a continuous ring coil to the same commutator block. This arrangement divides the rings each into a number of divisions, producing a multipolar arrangement,

the poles being continuously shifted by the revolution of the commutator brushes. The letters *N, S, N, S*, in this figure indicate four poles of the field ring in this arrangement. Only four commutator segments are shown in the drawings but it is evident that there may be any desired convenient number, and the broken connections from the coils indicate intermediate connections to commutator blocks not shown.

It will be seen that in the apparatus above described the high tension continuous current introduced into the coils *a* and *c* produces by induction a low tension continuous current in the coil *b*, and further that this is done without the revolution of heavy parts such as the armature, the field magnet and their commutators, but simply by the rotation of the current collectors; and this rotation is accomplished in a very simple and effective manner by the shifting of the lines of force. It will be seen also that there is no sparking in this apparatus, due to variations in load, since any field produced by one of the armature coils is neutralized by the other, and the field magnet lines of force not being disturbed or distorted by armature lines are symmetrical on both sides of the commutating point. This absence of spark and the consequent absence of the necessity for shifting the commutator brushes, as well as the fact of there being no revolution of heavy parts so that continual attention to bearings, &c., is not required, are the principal advantages of the apparatus, since it is not liable to derangement and does not require the presence of an attendant.

What I claim is—

1. In an induction converter, the combination of a stationary field coil and a stationary armature with two coils, said field coil and one armature coil being connected in multiple arc to a source of current by means of commutators, and the second armature coil being connected to the consumption circuit, substantially as described.

2. In an induction converter, the combination of a stationary armature having two sets of coils, a stationary field magnet, and a stationary commutator for each of said sets of coils provided with revolving current collectors, substantially as set forth.

3. In an induction converter, the combination of a stationary armature having two sets of coils, a stationary field magnet, a stationary commutator provided with movable brushes for each set of armature coils, and a commutator for shifting the poles of the field magnet, substantially as set forth.

4. In an induction converter, the combination of a stationary annular armature wound with two sets of coils, a stationary commutator provided with movable brushes for each set of armature coils, an annular field magnet, and a commutator for shifting the poles of said field magnet, substantially as set forth.

5. In an induction converter, the combina-

tion of a stationary annular armature wound with two continuous coils, each connected at intervals to blocks of a stationary commutator, revolving current collectors bearing on each of said commutators, a stationary annular field magnet having a continuous coil connected at intervals to blocks of a stationary commutator, and revolving current collectors bearing on said commutator, substantially as set forth.

arate stationary annular field magnet, a commutator for shifting the poles of said field magnet, a shaft carrying the commutator brushes, and a magnetic bar on said shaft in proximity to said field magnet, substantially as set forth.

This specification signed and witnessed this 7th day of May, 1888.

THOS. A. EDISON.

Witnesses:

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A. W. KIDDLE.

6. In an induction converter, the combination of a stationary annular armature, a sep-