(No Model.)

4 Sheets—Sheet 1.

S. Z. DE FERRANTI.

MEANS FOR DISTRIBUTING ELECTRIC ENERGY.

No. 389,838. Patented Sept. 18, 1888.

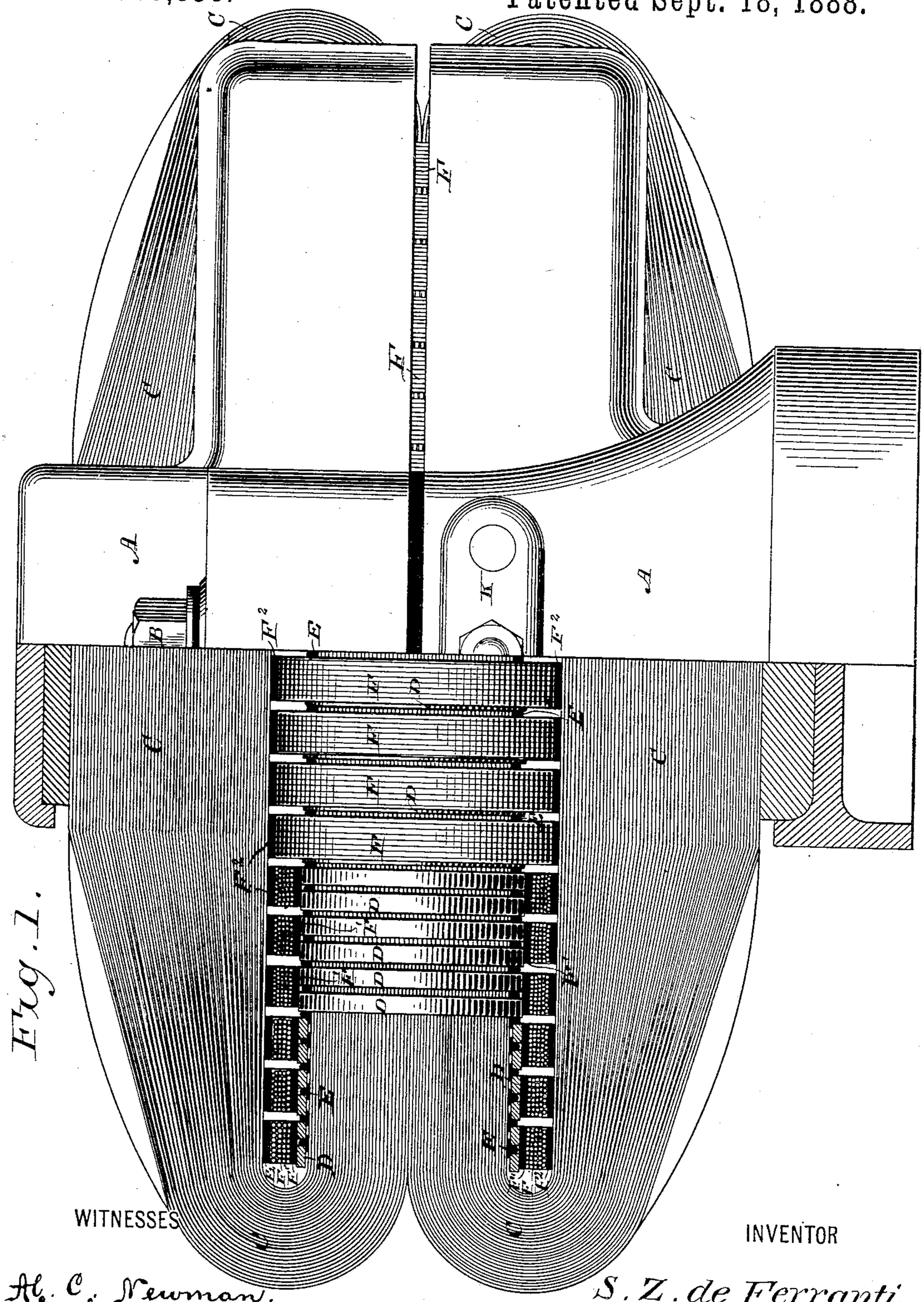

Fig. 1.

H. C. Newman,
O. S. Newman,

S. Z. de Ferranti,
By his Attorneys
Baldwin Davidson & Wright

(No Model.)

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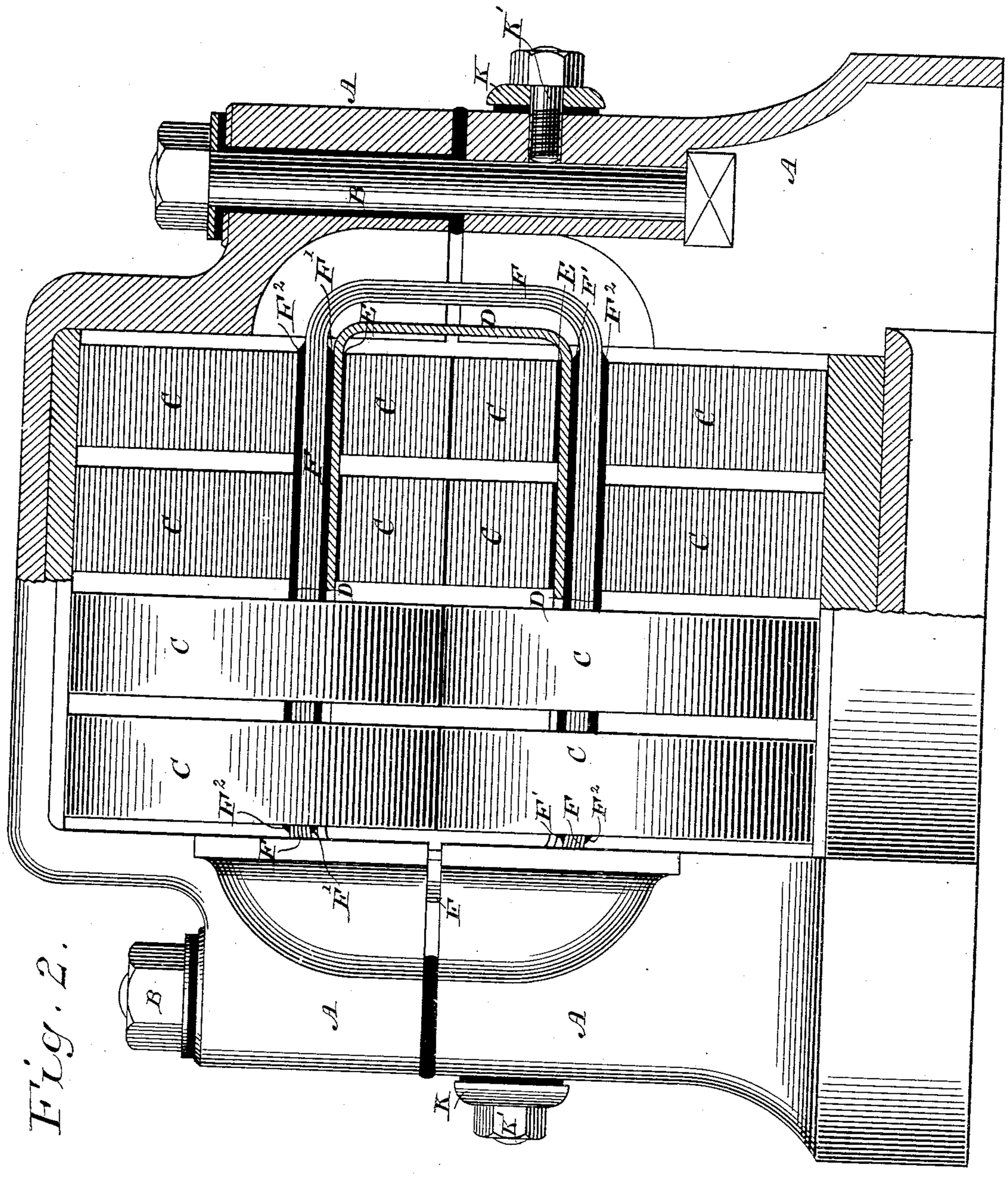

Fig. 2.

WITNESSES

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(No Model.)

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S. Z. DE FERRANTI.

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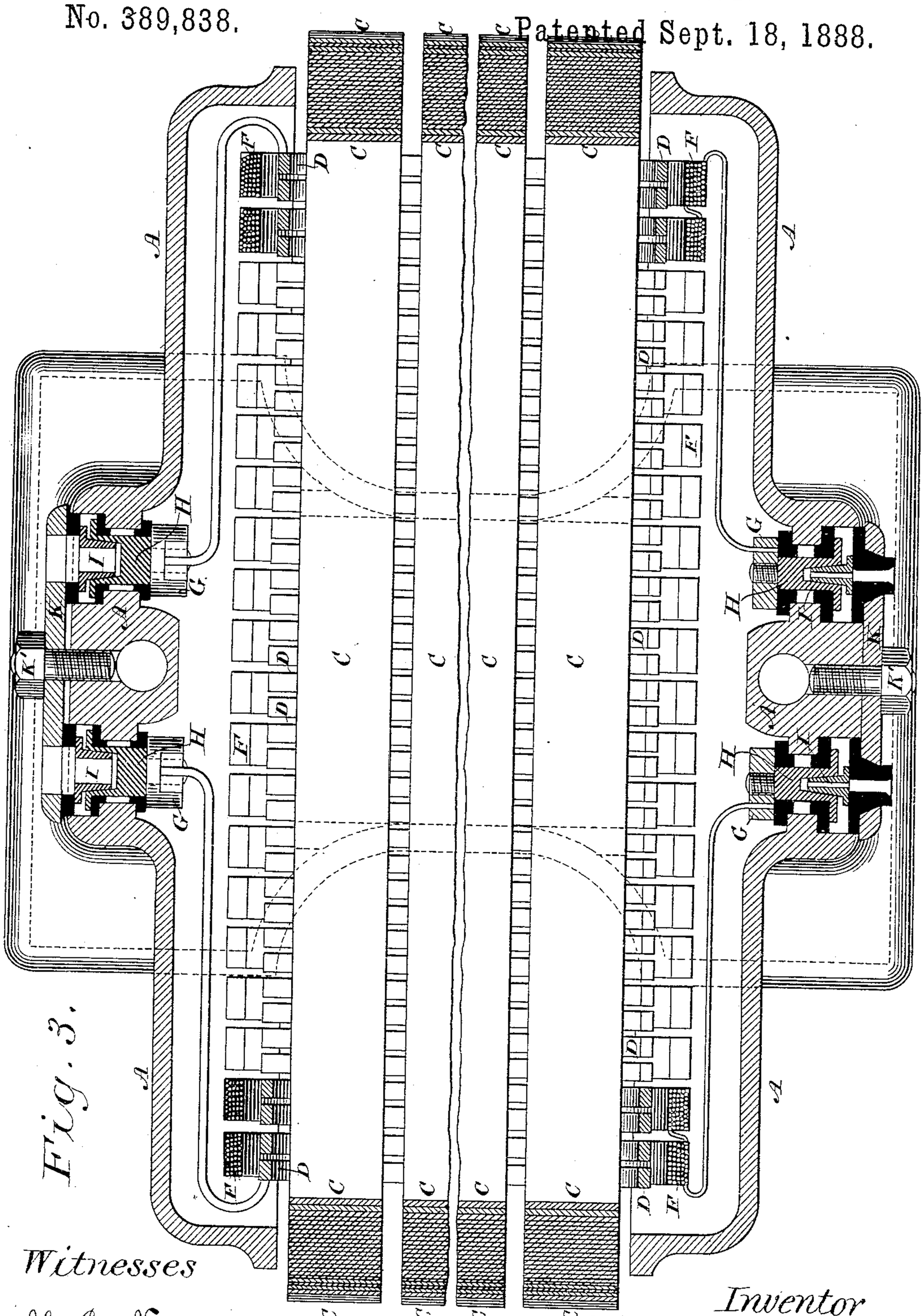

Witnesses

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E. S. Newman,

Inventor
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(No Model.)

4 Sheets—Sheet 4.

S. Z. DE FERRANTI.

MEANS FOR DISTRIBUTING ELECTRIC ENERGY.

No. 389,838. Patented Sept. 18, 1888.

Fig. 4.

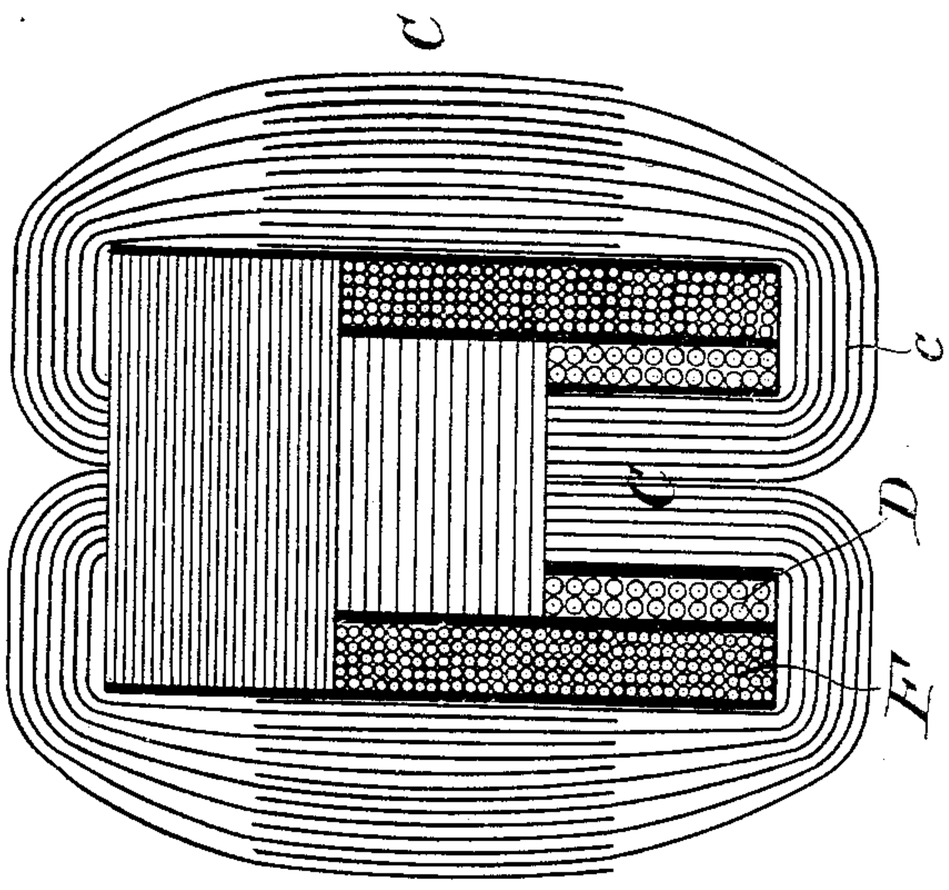
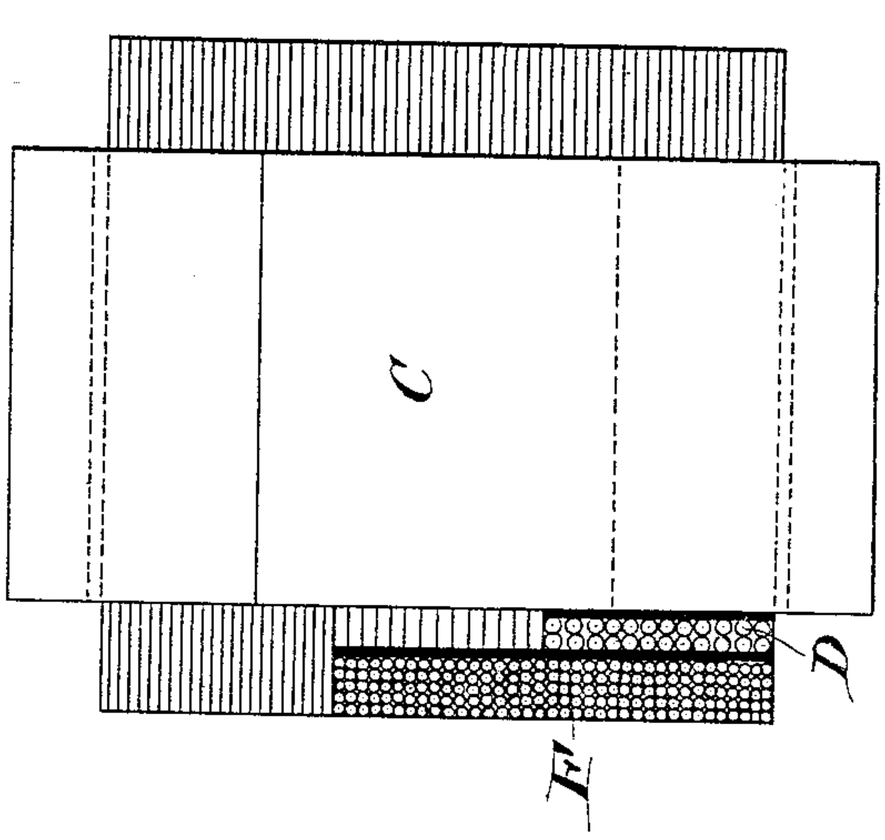


Fig. 5.



WITNESSES

H. C. Neuman,
O. S. Neuman.

INVENTOR

S. Z. de Ferranti,

By his Attorneys

Baldwin Davidson & Wright.

UNITED STATES PATENT OFFICE.

SEBASTIAN ZIANI DE FERRANTI, OF LONDON, ENGLAND.

MEANS FOR DISTRIBUTING ELECTRIC ENERGY.

SPECIFICATION forming part of Letters Patent No. 389,838, dated September 18, 1888.

Original application filed April 18, 1887, Serial No. 235,792. Divided and this application filed April 17, 1888. Serial No. 270,956.

(No model.) Patented in England December 9, 1885, No. 15,141, and December 11, 1885, No. 15,251; in France December 9, 1886, No. 180,176; in Belgium January 8, 1887, No. 75,875, and in Italy March 31, 1887, No. 21,119.

To all whom it may concern:

Be it known that I, SEBASTIAN ZIANI DE FERRANTI, a subject of the Queen of Great Britain, residing at St. Benet Chambers, Fenchurch Street, in the city of London, England, electrician, have invented certain new and useful Improved Means for Distributing Electric Energy, of which the following is a specification.

Letters Patent on this invention have been granted me in the following countries: Great Britain, No. 15,141, December 9, 1885, and December 11, 1885, No. 15,251; France, No. 180,176, December 9, 1886; Italy, No. 21,119, March 31, 1887, and Belgium, No. 75,875, January 8, 1887.

My invention relates to what are known as "electrical converters," by means of which currents of one intensity may be converted into currents of a different intensity in all systems of distribution where such conversion is required—as, for instance, for electric lighting, motive power, &c.; and more especially my invention relates to systems in which dynamo-electric machines generating alternating currents of high intensity are employed and such currents converted into currents of lower intensity at or near the places where the lights are to be exhibited or the energy utilized.

In the annexed drawings, Figure 1 shows a side elevation, one-half in section, of a converter constructed in accordance with my invention. Fig. 2 is an end elevation, one-half in section. Fig. 3 is a horizontal section of the same. A portion is broken out or omitted from the center of the apparatus to reduce the dimensions of the figure. Figs. 4 and 5 are views showing a converter of the same general structure, but different in detail—*i. e.*, the core is not in sections and there are no air-spaces, such as shown in the other figures.

A A is a cast-iron frame or casing, made in two main parts, which are held together by bolts B B. By way of precaution the parts of the frame are more or less insulated from each other.

C C C represent pieces, strips, or ribbons of soft Swedish iron, about one thirty-second of an inch in thickness, formed into bundles. The different ribbons in each bundle are not in metallic contact, being separated by paper. The paper is cemented to the ribbons. Each ribbon, strip, or layer is thus covered on one side for one-half of the length, and for the other half it is covered upon the other side. The ribbons, after receiving the windings upon them, are bent around and made to overlap at their ends, and where they so overlap the two ends of each ribbon are in metallic contact. Thus each ribbon or strip forms a loop or hoop in which there is a complete magnetic circuit.

In the converter shown by the drawings, Figs. 1, 2, and 3, four such bundles of ribbons C C are indicated; but the number and dimensions will vary according to the size and capacity of the converter. Around the central part of each bundle a taping is applied to keep it together, and then before the ends of the ribbons are brought together the coil or spiral of copper rod D is passed around the bundle so that the coil D surrounds the central parts of the four bundles. To separate the coil D from the bundles, short insulators or chairs E E, of vulcanized fiber or vulcanite, are inserted. Over the coils D, I apply rings F F, previously prepared and wound upon a former. Erch ring consists of an inner layer, F′, of insulated material, (paper saturated with shellac varnish is that which I employ.) Over this is a winding of copper wire, insulated in the usual way with cotton, and over this again is another layer, F^2, of the same insulating material. The insulating material, F′ F^2, is applied only at the upper and under surfaces of the ring. At the ends of the ring where the wire is at a distance from the other metal it has no other covering but the cotton wound around it.

The wire which I employ in the converter shown by the drawings has a sectional area about one twenty-fourth that of the rod D, and the number of convolutions is twenty-four for each turn which the spiral D makes around the core of iron ribbon C.

As shown in the drawings, each ring is made to overlap two convolutions of the coil D, and it contains forty-eight turns of wire. The rings F F should be applied around the bundle C while the shellac insulation is still in a more or less plastic condition. The wires of the rings F F are then connected electrically from ring to ring, so as to form a continuous circuit through all the rings from end to end of the apparatus. The terminal wires of the series of rings are then brought out and are electrically connected with the metal blocks G G, which are secured in their places by the screw-pieces H H. These pieces have flanges upon them, and insulated washers are embraced between the flanges and the blocks G. These insulating-washers are inserted into apertures provided in the frame A to receive them. In each piece H there is a conical recess adapted to receive a ferrule, I, and to these ferrules the circuit-connections may be made. K is a cover-plate with apertures in it, through which circuit-connections pass, the holes in the cover-plate being bushed with insulating-washers. The circuit-connections, with the rings F F, are thus effected simply by screwing up the bolt K', which secures the cover, and thereby forcibly thrusting the ferrules I into the conical recesses in the screw-pieces H H.

The copper coil or spiral D, intended to form part of the lamp-circuit, is similarly brought to terminals on the other side of the machine. The connections are made in the manner already described, except that the dimensions are different and that, this being the low-tension circuit, the thickness of the insulating material is diminished. A lesser separation of the metallic parts will here suffice.

It will be observed in this machine free spaces for ventilation are left between the several bundles C, and between these and the coil D, and again between the coils and the rings of coiled wire F; but no claim is made to such specific features in this case, as they are claimed by me in another application filed April 18, 1887, No. 235,792, and now pending, of which this case is a division.

In Figs. 4 and 5 another form is shown. The core C is not split up into groups, nor are the windings D F disposed in the same way as in the other figures.

The converters which I have described in this specification may be used not only for reducing from a high tension to a low, but also for increasing from a low tension to a high, or simply for transferring energy from one circuit to another. I make these converters of all sizes, from a few ounces in weight for telephonic use and for other purposes where the amount of electrical energy to be converted is small up to a ton or more in weight where the electrical energy to be converted is large. Beyond the latter dimensions it may, perhaps, be more convenient to employ several converters to supply the same circuit.

A principal feature of my invention is that the coils may be wound and the iron plates, strips, or laminæ be subsequently placed in position and overlapped or brought into metallic contact in such manner as to form a series of independent closed magnetic circuits extending through and around the outside of the coils; or the coils may in the form of converter shown be wound upon the plates, strips, or laminæ, the ends of which may then be brought together to form independent insulated closed magnetic circuits enveloping the coils. The scope of the invention is not, therefore, limited by the structural details shown; but, on the contrary, the converter above described is exhibited merely as a practical and efficient embodiment of the invention.

By overlapping the layers of iron forming the closed magnetic circuits superior results are believed to be attained in that the converter is not so liable to become heated, and by constructing the converter in the manner suggested it is obvious that the parts may be made and assembled without difficulty.

Any patentable subject-matter herein shown or described, but not claimed, forms the subject-matter of my original application above mentioned, of which this case is a division.

I claim as my invention—

1. An electrical converter consisting of strips, ribbons, or layers of iron placed one over the other and carrying a primary and secondary winding, and having their ends doubled back on either side over the exterior of the winding, such strips or layers being insulated from one another and the ends of each strip or layer brought together in electrical contact, so as to form a series of loops or bands insulated from one another, but each forming in itself an independent closed magnetic circuit, substantially as described.

2. An electrical converter substantially such as described, consisting of the combination of primary and secondary coils, strips, layers, or laminæ of iron arranged in part within the coils and formed into a series of closed magnetic circuits extending through and outside the coils by overlapping such strips or layers, and insulating material separating the layers of iron forming the magnetic circuits.

3. An electrical converter substantially such as described, consisting of the combination of primary and secondary coils, strips, layers, or laminæ of iron, arranged in part within the coils and formed into a series of closed magnetic circuits extending through and outside the coils by bringing the ends of such strips or layers together in metallic contact, and insulating material separating the layers of iron forming the magnetic circuits.

4. An electrical converter substantially such as described, consisting of the combination of primary and secondary coils, strips, layers, or laminæ of iron arranged in part

within the coils and formed into a series of independent parallel closed magnetic circuits lying in planes at right angles to the windings of the coils and extending through and outside the coils on opposite sides thereof by bringing the ends of such strips, layers, or laminæ of iron together in metallic contact, and insulating material separating the layers of iron forming the magnetic circuits.

In testimony whereof I have hereunto subscribed my name.

SEBASTIAN ZIANI DE FERRANTI.

Witnesses:
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HERBERT E. DALE,
Both of 17 *Gracechurch Street, London, E. C.*