(No Model.)

2 Sheets—Sheet 1.

M. G. FARMER.

ELECTRIC CONVERTER.

No. 448,644. Patented Mar. 24, 1891.

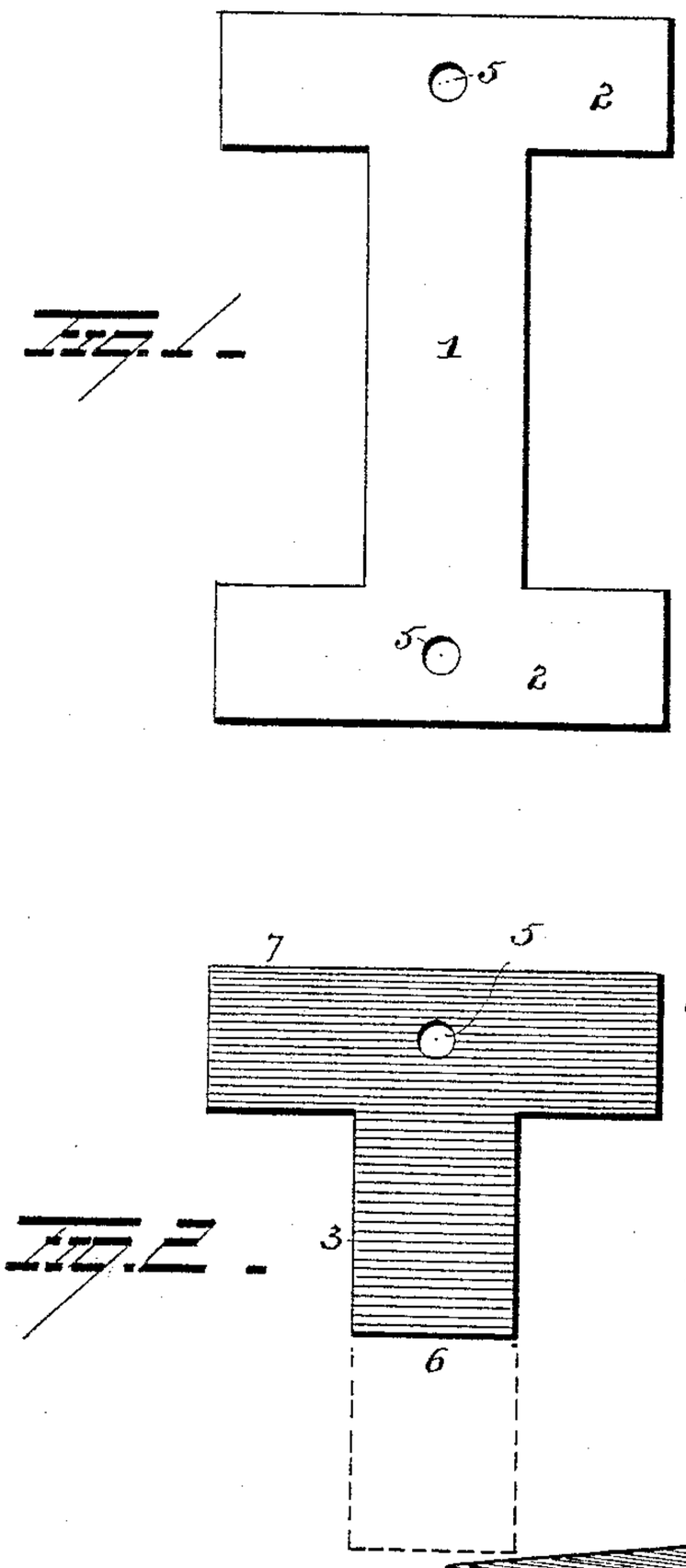

Fig. 1.

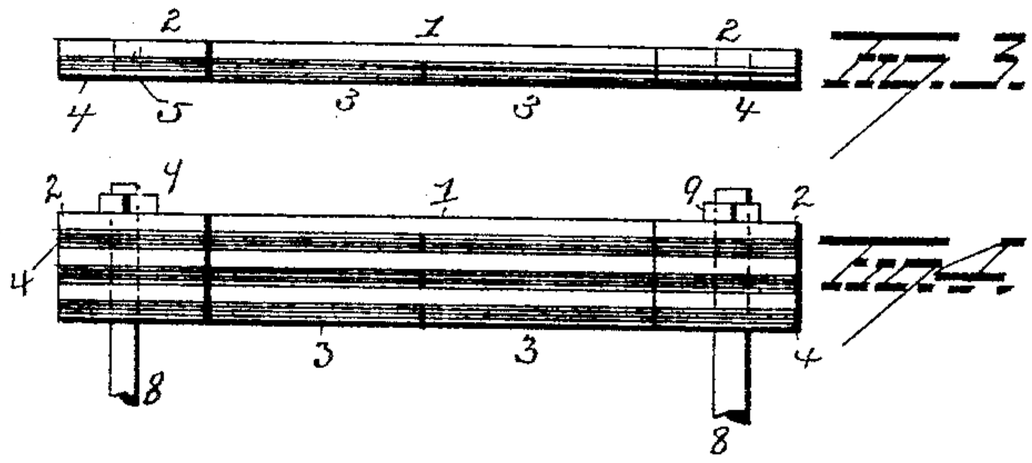

Fig. 3.

Fig. 4.

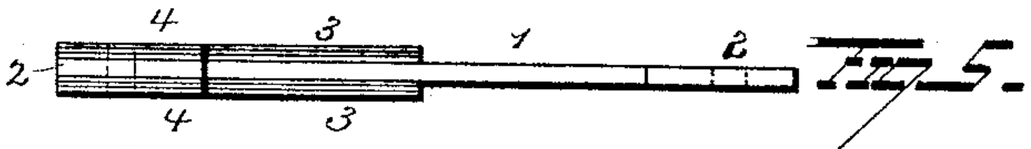

Fig. 5.

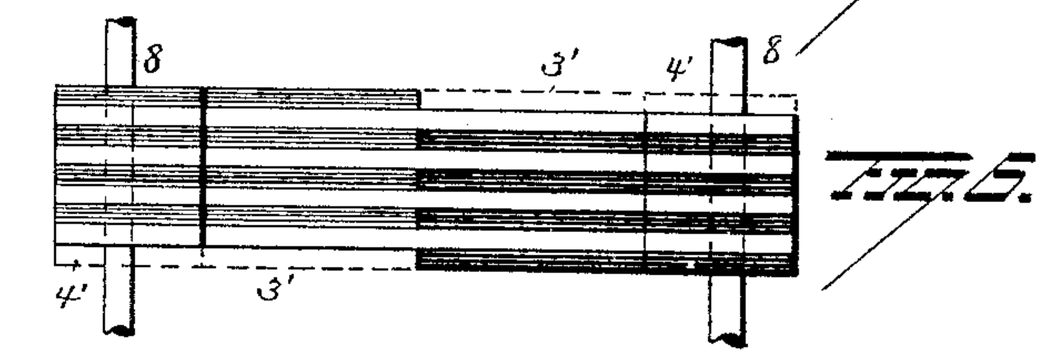

Fig. 6.

Fig. 2.

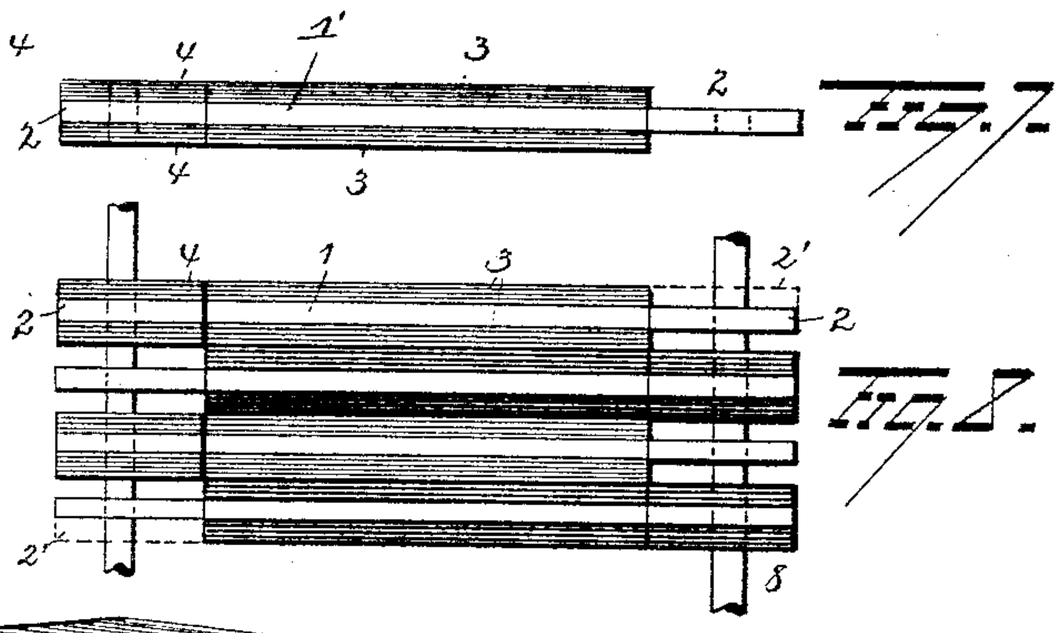

Fig. 7.

Fig. 8.

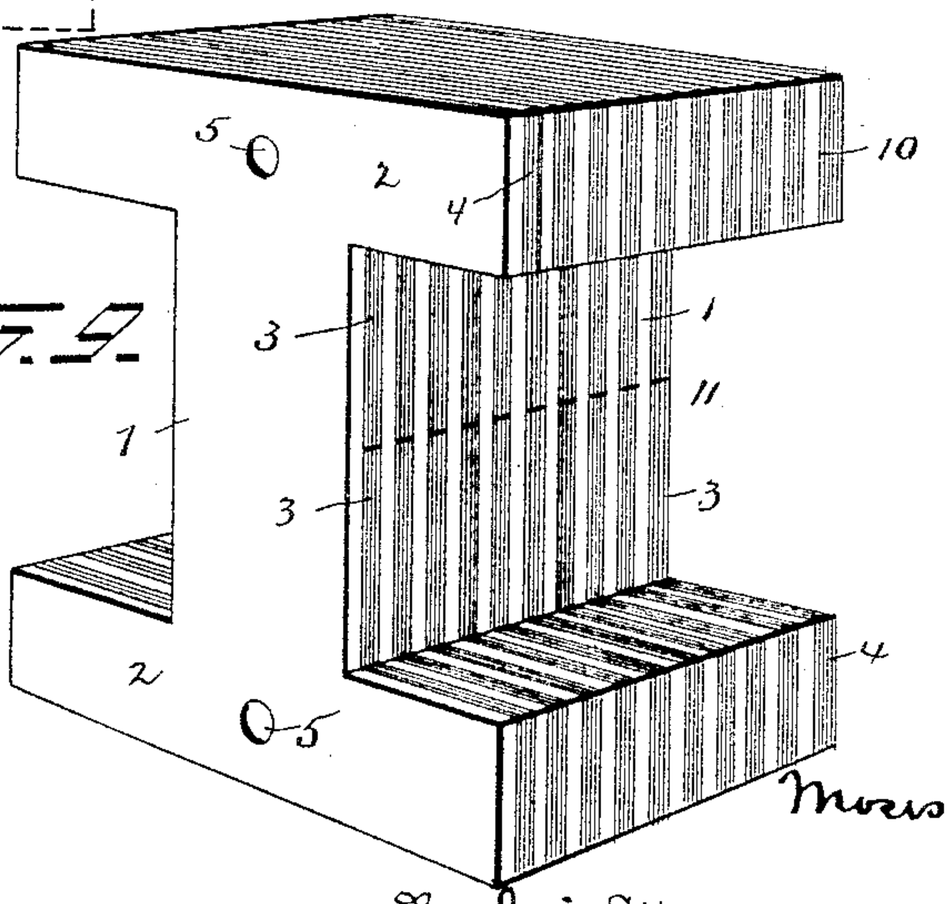

Fig. 9.

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(No Model.) 2 Sheets—Sheet 2.

M. G. FARMER.

ELECTRIC CONVERTER.

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Fig. 10.

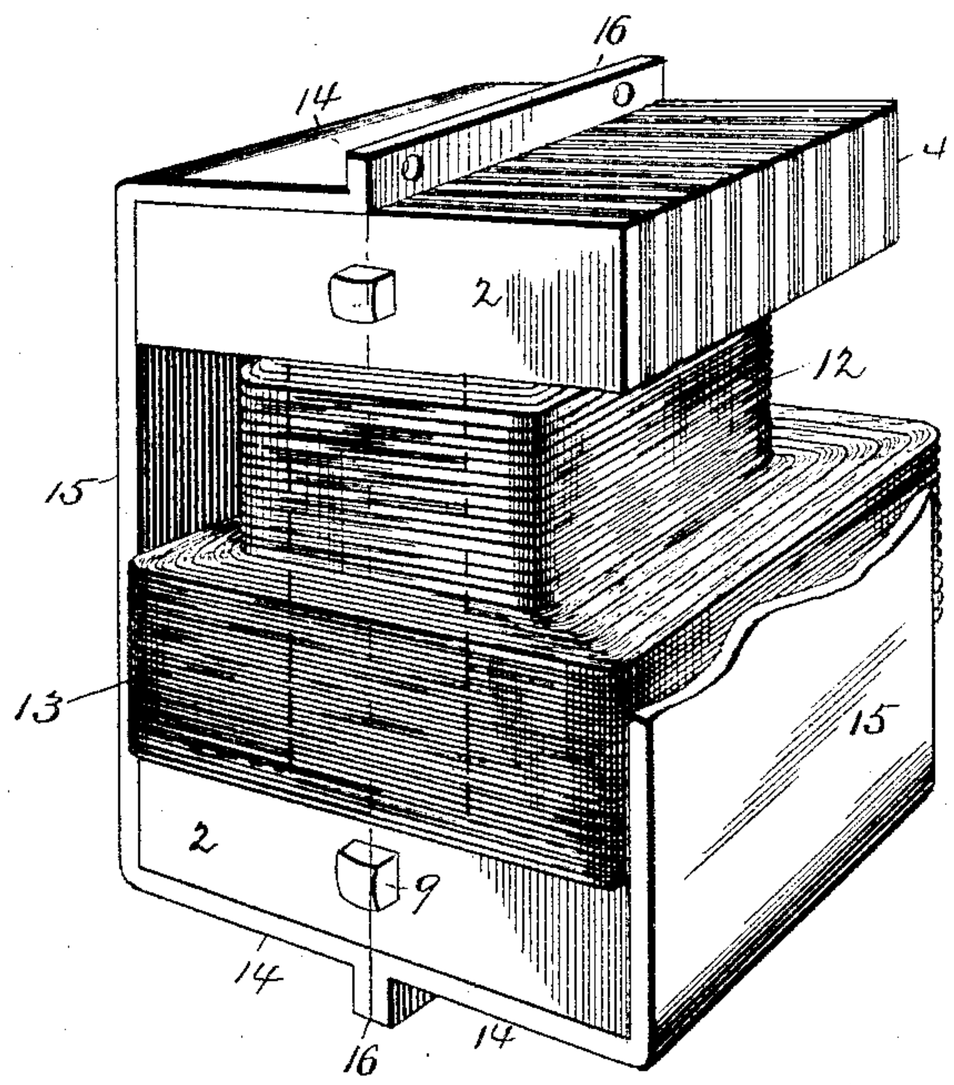
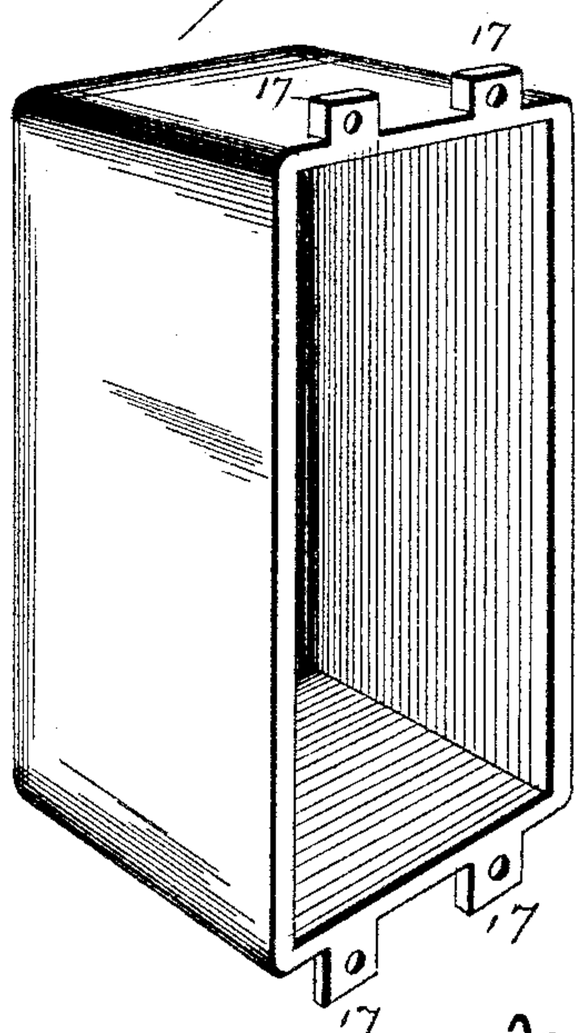


Fig. 11.



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UNITED STATES PATENT OFFICE.

MOSES G. FARMER, OF ELIOT, MAINE.

ELECTRIC CONVERTER.

SPECIFICATION forming part of Letters Patent No. 448,644, dated March 24, 1891.

Application filed October 11, 1890. Serial No. 367,785. (No model.)

To all whom it may concern:

Be it known that I, MOSES G. FARMER, a citizen of the United States, residing at Eliot, in the county of York and State of Maine, have invented certain new and useful Improvements in Electric Converters; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention has reference to improvements in electrical converters or inductoriums for converting by induction currents of a given tension into currents of a different tension; and my improvements have special reference to the construction of the core of the converter and to the magnetic shield for confining the magnetic lines of force upon the inducing and induced coils. In apparatus of this kind the core is frequently built up of laminæ of iron, separated from each other by thin layers of insulating material, such as paper, card-board, &c., and in many cases the laminæ of magnetic material are placed directly in contact with each other without the intervention of insulating material. In both constructions there is this defect, that the assembling of the laminæ which constitute the core is tedious and complicated, and in the case where insulating partitions between the laminæ are used the building up of the core requires great care and nicety of manipulation. When no insulating portions are used, the rapidity of magnetization and demagnetization of the core is in a great measure lost, so that inductoriums made with such cores are very little better than if the cores were made of solid pieces. By my invention these defects are overcome in that I retain the principle of laminating the core; but in place of the insulating material for separating the magnetic laminæ I use very thin sheets of non-magnetic metal, each of which, together with two magnetic laminæ soldered or sweated to it, constitutes a core element, and all these elements may be assembled to build up a core of any desired cross-section in an expeditious and easy manner. I have also found that the efficiency of the converter is increased when each magnetic laminæ is made either shorter than the whole length of the core, or when it is made in two parts, which together have the length of the core, but are not in direct or solid contact, so that the core may be laminated not only in planes parallel to its axis, but also in planes at right angles thereto.

The magnetic shield which I provide I construct in two parts, closely fitting the pole-pieces of the core and so shaped as to be easily mounted and dismounted. All this will more fully appear from the following detailed description, with reference to the accompanying drawings, in which—

I have shown in Figure 1 a face view of a non-magnetic metallic laminæ entering into the construction of my improved converter-core; in Fig. 2, a like view of a magnetic laminæ; Figs. 3 and 4, edge views of one form of a core element and an assemblage of the same respectively in accordance with my invention. Figs. 5 and 6 are like views of another form of a core element and of an assemblage of the same. Figs. 7 and 8 are edge views of still another form of a core element and an assemblage of the same, respectively. Fig. 9 is a perspective view of one form of my improved converter-core. Fig. 10 is a perspective view of a converter or inductorium constructed in accordance with my invention, showing a portion of the magnetic shield broken away; and Fig. 11 is a perspective view of a cup-shaped magnetic shield.

In the construction of my improved converter-core I use a great number of thin sheets of non-magnetic metal, shaped as shown in Fig. 1—that is to say, with a shank 1 and a cross-head 2 formed at each end of the shank. These non-magnetic laminæ may be made of zinc, brass, copper, or other like metal, and they are covered on both sides with a thin adherent film of tin or other easily-fusible non-magnetic metal. This is done by the ordinary process of tanning, and it is of no consequence whether in this process the edges of the laminæ are also tinned or not, except as will be hereinafter set forth.

For each laminæ of non-magnetic metal I provide two laminæ of soft iron, which are also tinned on both sides, and are therefore preferably cut from the ordinary tinned sheet-iron. These magnetic laminæ are shaped as shown in Fig. 2—that is to say, with a shank

3 and a cross-head 4 at one end of the shank only. The shank 3 and the cross-head 4 have the same width as the like elements in the non-magnetic laminæ, and the length of the cross-head 4 is equal to that of the cross-head 2, while the shank of the magnetic laminæ may be made either of the same length as the shank 1, as indicated in dotted lines in Fig. 2, or, by preference, it may be made only half the length of the shank of the non-magnetic laminæ, as indicated in solid lines in Fig. 2.

Having provided a great number of these magnetic and non-magnetic laminæ, they may be put together to form a core element in a variety of ways. In Fig. 3 one such core element is shown, and it will be seen that it is made of non-magnetic laminæ, with two magnetic laminæ applied with the ends of their short shanks toward each other on the same side of the non-magnetic laminæ.

As has been stated above, the laminæ are tinned on each side, and when applied to each other in the manner indicated in Fig. 3 they are heated under pressure until the tinned surfaces in contact become fused or sweated together.

By reference to Figs. 1 and 2 it will be seen that in the center of each cross-head there is a perforation 5, and it will be clear that when a core element like that shown in Fig. 3 is completed the perforations in the magnetic laminæ will coincide with the perforations in the non-magnetic laminæ. If desired, these perforations may be made after the sweating together of the magnetic and non-magnetic laminæ; but under all circumstances they must be in each core element in precisely the same position in the cross-heads.

The end edges 6 of the shanks of the magnetic laminæ need not be carefully made to be in close magnetic contact, and, in fact, I have found that these edges may with advantage be out of contact or separated from each other by a thin film of tin, which in the process of making the core element will eventually be forced between them. The long edges 7 of the cross-heads of the magnetic laminæ, however, must be free from tin or any other non-magnetic substance, for reasons which will hereinafter more fully appear.

The core elements shown in Fig. 3 are assembled to form a converter core in the manner indicated in Fig. 4—that is to say, they are piled upon each other or strung upon two bolts 8 8, by means of which and by suitable nuts 9 9 they are bolted together. As will be seen by reference to Fig. 4, the core elements are so piled upon each other that the magnetic laminæ of one is separated from the magnetic laminæ of the next succeeding one by a non-magnetic laminæ. When the core elements are thus assembled, the core has the shape shown in Fig. 9, the assembled cross-heads constituting the flanges 10 of the core 11, upon which the layers of insulated wire of the transformer are coiled. In Fig. 10 the coils of insulated wire are shown applied to the core, the coarse wire 12 in this instance being shown next to the core and the fine wire 13 covering the coarse wire; but, as is well understood, this arrangement may be reversed. In Fig. 5 another form of core-unit is shown. In this case it will be seen that each unit consists, as in the construction so far described, of a lamina of non-magnetic metal and two laminæ of magnetic metal; but in this case the magnetic laminæ are sweated to opposite sides on the same end of the non-magnetic laminæ. When such core elements are assembled, as indicated in Fig. 6, the group formed is substantially like that shown in Fig. 4, except that the terminal plates show a break of continuity, which is remedied by the addition at each end of the magnetic laminæ, as indicated in dotted lines at 3′ 4′.

I have so far described the use of magnetic laminæ the shanks of which are only half as long as the shanks of the non-magnetic laminæ; but, as stated above, the shanks in both laminæ may have the same length, in which case the core-unit will appear as in Fig. 7, and the assemblage of the same will appear as in Fig. 8. At each end plate, therefore, the cross-head will have a depression which may be filled out by a supplemental cross-head 4′ of non-magnetic material 2′, as indicated in dotted lines. In this construction the magnetic cross-heads in the alternate core-units will be missing, and I have found that the efficiency of conversion is thereby not only not impaired, but is actually improved. If so desired, the gaps between the successive cross-heads may be filled out by non-magnetic material. It will be noticed that in this construction there are between two successive non-magnetic laminæ two magnetic laminæ; but these two are not in magnetic contact, since the surfaces of the iron are tinned. We have therefore in this instance, as in the other forms described, alternate layers of iron and non-magnetic material, the successive laminæ of non-magnetic material, however, being composed, alternately, of tinned zinc, brass, or copper and of two thin layers of tin, respectively.

When the converter-core is finished in the manner hereinbefore described and the coils of insulated wires have been applied, the magnetic shield bridging the polar terminals of the core is applied. By preference this magnetic shield is made of two heavy bands of soft iron, constructed as shown in Fig. 10—that is to say, each of a plate of iron extending from the middle of one flange of the core and in contact therewith, as indicated at 14, then bent around the edge of said flange, and extending down to the other flange of the core, as indicated at 15, where it is again bent at right angles, extending to the middle of this second flange. This band is, besides, provided with an upright flange 16 at each end, and the two bands when assembled upon the core in the manner shown in Fig. 10 are joined

by their flanges 16 and form a magnetic shield, or, more correctly speaking, a magnetic circuit, for the lines of force. This shield, therefore, being composed of two separable parts, may be slipped onto the converter when otherwise finished, and may be removed for inspection and repair.

While I use by preference the construction of magnetic shield thus described with reference to Fig. 10, I may also use the hood or cap-shaped construction indicated in Fig. 11, which in effect is nothing but a housing of iron inclosing the converter on all sides. It is made like the construction shown in Fig. 10, in two parts, each part being provided with lugs 17 17, by means of which the said parts are coupled together. I have found, however, that a complete magnetic circuit or path for the magnetic lines of force between the pole-terminals must not necessarily inclose the converter upon all sides, and the construction shown in Fig. 10 being the cheaper and having the same efficiency as a hood or cup I use by preference a magnetic shield or circuit composed of two angular bands of soft iron.

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

1. A core for an electrical converter or inductorium, composed of laminæ of tinned iron with laminæ of non-magnetic metal interposed between them, substantially as set forth.

2. A core element for an electrical converter or inductorium, consisting of a sheet of non-magnetic metal having one or more laminæ of iron fused to its surface or surfaces, substantially as described.

3. A core element for an electrical converter or inductorium, consisting of a thin sheet of non-magnetic metal formed with a shank and a cross-head at each end, in combination with two laminæ of iron, each formed with a shank having half the length of the shank of the sheet of non-magnetic metal and a single cross-head and fused to the sheet of non-magnetic metal, substantially as set forth.

4. A core element for an electrical converter or inductorium, consisting of an **I**-shaped lamina of non-magnetic metal, in combination with two **T**-shaped laminæ of magnetic metal fused to and covering the non-magnetic lamina, substantially as described.

5. In an electrical converter or inductorium, the combination of a laminated core having free polar terminals with a magnetic shield composed of two flanged angle-irons closely fitting the poles of the core and each other, substantially as set forth.

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

MOSES G. FARMER.

Witnesses:
SARAH J. FARMER,
FRANCIS KEEFE.