No. 791,021. PATENTED MAY 30, 1905.

C. LE G. FORTESCUE.

TRANSFORMER.

APPLICATION FILED SEPT. 30, 1903.

2 SHEETS—SHEET 1.

Fig. 1.

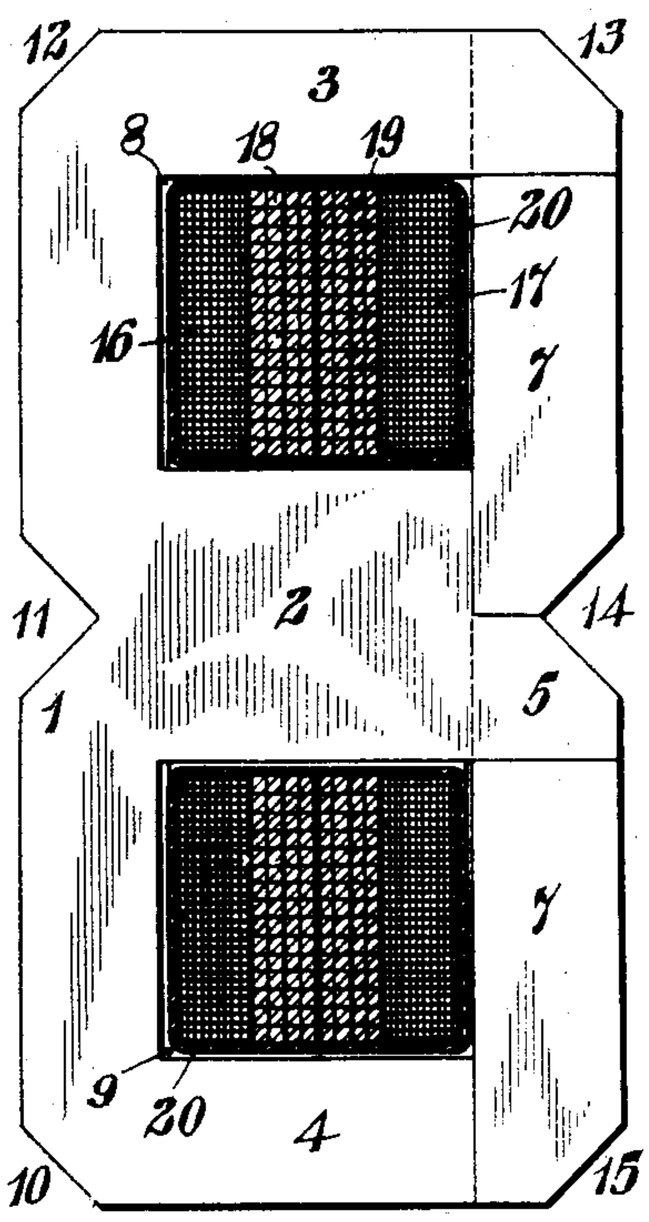
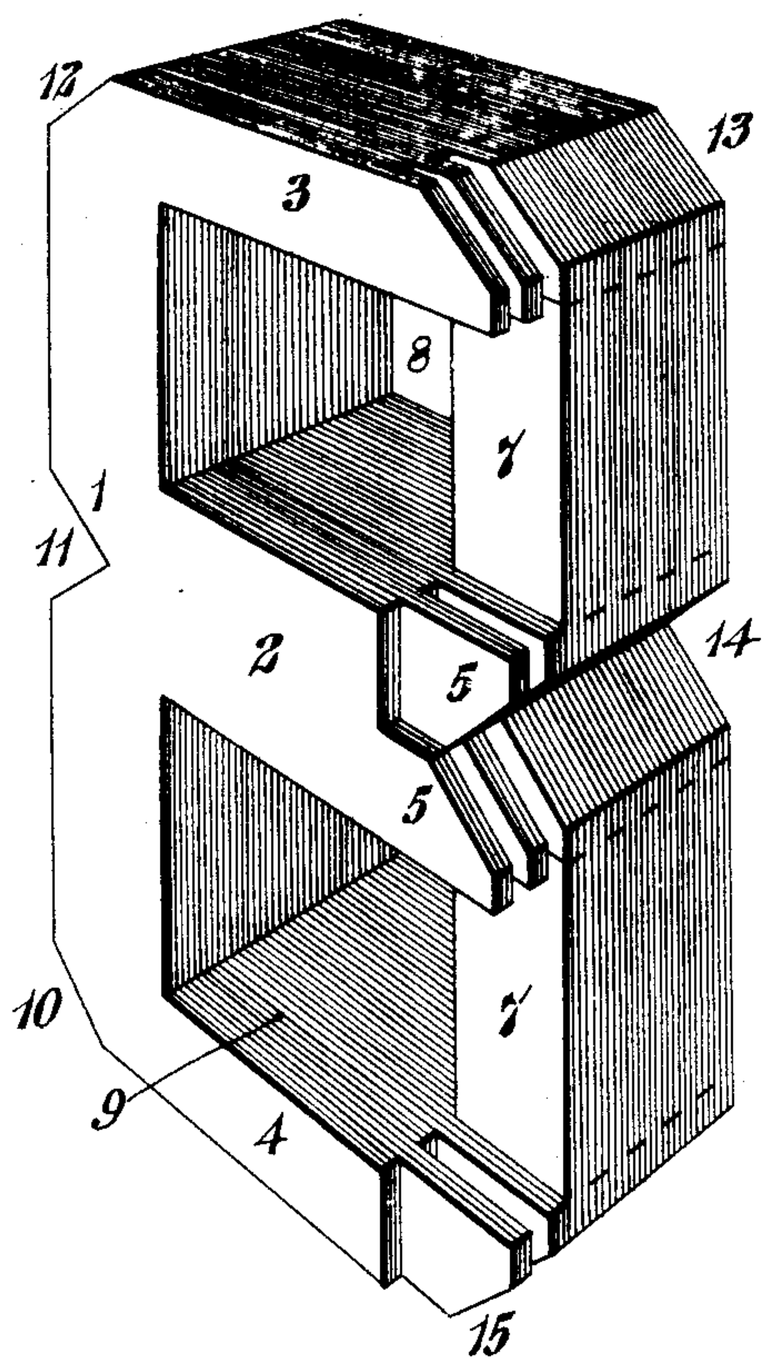


Fig. 2.



WITNESSES:

C. L. Belcher

F. H. Miller.

INVENTOR

Charles Le G. Fortescue

BY

Hedley & Sloan

ATTORNEY

PHOTO-LITHOGRAPHED BY SACHETT & WILHELMS LITHO & PTG. CO. NEW YORK.

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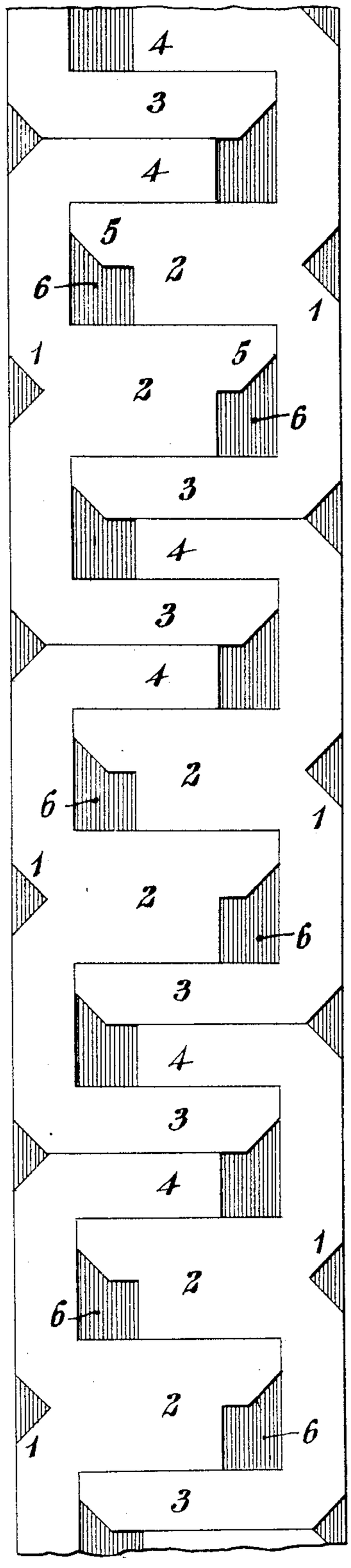
2 SHEETS—SHEET 2.

Fig. 3.



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UNITED STATES PATENT OFFICE.

CHARLES LE G. FORTESCUE, OF WILKINSBURG, PENNSYLVANIA, ASSIGNOR TO WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA.

TRANSFORMER.

SPECIFICATION forming part of Letters Patent No. 791,021, dated May 30, 1905.

Application filed September 30, 1903. Serial No. 175,223.

To all whom it may concern:

Be it known that I, CHARLES LE G. FORTESCUE, a subject of the King of Great Britain, and a resident of Wilkinsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Transformers, of which the following is a specification.

My invention relates to transformers employed in connection with alternating-current systems of distribution; and it has for its object to provide transformer core plates or punchings of such form as to insure a maximum economy of material and such as may be easily and expeditiously assembled without danger of injury to the coil insulation.

In the accompanying drawings, Figure 1 is a view in transverse section of a transformer constructed in accordance with my invention. Fig. 2 is a perspective view of a transformer-core, some of the plates being omitted. Fig. 3 is a view of a strip or blank of sheet-iron divided in accordance with my invention.

In the manufacture of transformers it is extremely desirable to provide core-plates of such form as to utilize a maximum percentage of the stock from which the plates are punched and also such as to provide a core having low reluctance to the magnetic flux. The core-plates heretofore generally used in the manufacture of transformers of the shell type possess the disadvantage of being difficult to assemble and requiring a large amount of labor in the operation; but one of the most serious objections to the use of the form of punchings most commonly employed is the cutting and tearing of the insulation during the assembling operation. These objections and others I avoid in a manner to be hereinafter more fully described.

The main portion of the iron core consists of plates 1 of substantially **E** shape, the middle cross-bar 2 being of substantially double the width of the end cross-bars 3 and 4 and having a stepped portion 5, due to the removal of a square portion 6, the side of the square being equal to the width of the end cross-bars. The end cross-bar 4 is shorter than the bar 3 by an amount equal to its width.

The side bars 7 are of sufficient length to span the uninclosed sides of the openings 8 and 9 and the width of an end cross-bar. The double rectangles forming the core are completed by placing the bars 7 at right angles to the cross-bars, so that their inner ends fit into the stepped portions of the middle cross-bar 2 and their outer ends into the spaces between the ends of the bars 3. The corners of the rectangles may be cut away, as shown at 10, 11, 12, 13, 14, and 15, in order to decrease the weight of the core, or the plates may be left with sharp corners, if preferred.

A plurality of the **E**-plates are preferably placed together to form a group in order to facilitate the assembling, and alternate groups are reversed with respect to each other, substantially as shown in Fig. 2, in order to reduce the reluctance of the core. The requisite number of the groups of **E**-plates to form the core are built up, and the coils 16, 17, 18, and 19 are then placed in position around the central part 2 and within the spaces 8 and 9.

Non-conducting material 20 of suitable form and dimensions is placed in the rectangles before the coils are assembled, and the projecting portions are subsequently carefully wrapped about the coils. The side bars 7 are then placed in position substantially as indicated in Figs. 1 and 2. Herein lies a great advantage of my improvement over the construction commonly employed in that the major portion of the core may be assembled separately from the coils. Heretofore the coils were first assembled and then wrapped with non-conducting material and bound together by means of tape or cord, after which the entire core was built up around the coils. It is unnecessary to bind together the coils of a transformer constructed in accordance with my invention, and it is desirable not to do so, since the coils may then be more easily removed for repairs.

In Fig. 3 I have shown how the **E**-plates may be punched from strips of sheet metal so

as to afford a maximum economy of material, the shaded portions indicating the waste material. The sheet-metal blanks 21 are wider than the E-plates by an amount equal to the width of the end cross-bars 3 and 4. The plates 7 may be punched from new sheet-metal blanks with little or no waste, or they may be punched from waste material resulting from the manufacture of plates used in other electrical apparatus, as may be found convenient or desirable.

It is evident from the description and drawings that a transformer may be constructed in accordance with my invention at a minimum expense of labor and material and without injury to the non-conducting material surrounding the coils, that the coils may be easily and expeditiously removed from the core for repairs without disturbing the main portion of such core, and that the core of a transformer so constructed has a low degree of reluctance to the magnetic flux.

The forms of the several parts and their relative proportions may be somewhat varied within the scope of my invention, and I therefore disclaim any intention to restrict the invention to any narrower limits than may be imposed by the prior art and the demands of satisfactory service.

I claim as my invention—

1. A laminated transformer-core consisting of successive E-shaped elements the middle cross-bars of which have stepped free ends and the end cross-bars of which are of substantially one-half the width of the middle cross-bars and of unequal length, and separate plates at right angles to the cross-bars and completing the rectangular inclosures for the winding.

2. A laminated transformer-core consisting of successive E-shaped elements, some of which are transposed with respect to the others, the middle cross-bars of which have stepped free ends and the end cross-bars of which are of substantially one-half the width of the middle cross-bars and of unequal length, and separate plates at right angles to the cross-bars and completing the rectangular inclosures for the winding.

3. A laminated transformer-core consisting of successive groups of E-shaped elements alternately transposed with respect to each other the middle cross-bars of which have stepped free ends and the end cross-bars of which are of substantially one-half the width of the middle cross-bars and of unequal length, and separate plates at right angles to the cross-bars and completing the rectangular inclosures for the winding.

4. A laminated transformer-core comprising a plurality of alternately-reversed sets of E-shaped plates the middle cross-bars of which have stepped free ends and the end cross-bars of which are of substantially one-half the width of the middle bar, and independent sets of bars the ends of which are seated in the steps in the middle bars and in the spaces between the longer end bars.

5. A transformer core-plate of E shape, the end bars of which are substantially one-half the width of the middle bar and of unequal length and the middle bar of which has a stepped free end forming two lengths the shorter of which is adjacent to the longer end bar.

6. An electrical transformer comprising a plurality of groups of alternately-reversed E-shaped plates having middle bars provided with stepped free ends and end bars of substantially one-half the width of the middle bars and of unequal length, coils surrounding the middle bars and groups of straight bars the ends of which fit into the steps in the ends of the middle bars and between the ends of the longer end bars.

7. An electrical transformer comprising coils and a core surrounding the same, said core comprising a set of superposed, E-shaped plates and two sets of removable plates for closing the spaces between the end and middle bars of the E-shaped structure.

In testimony whereof I have hereunto subscribed my name this 28th day of September, 1903.

CHARLES LE G. FORTESCUE.

Witnesses:

I. L. GRIFFITH,

BIRNEY HINES.