C. LE G. FORTESCUE.

TRANSFORMER STRUCTURE.

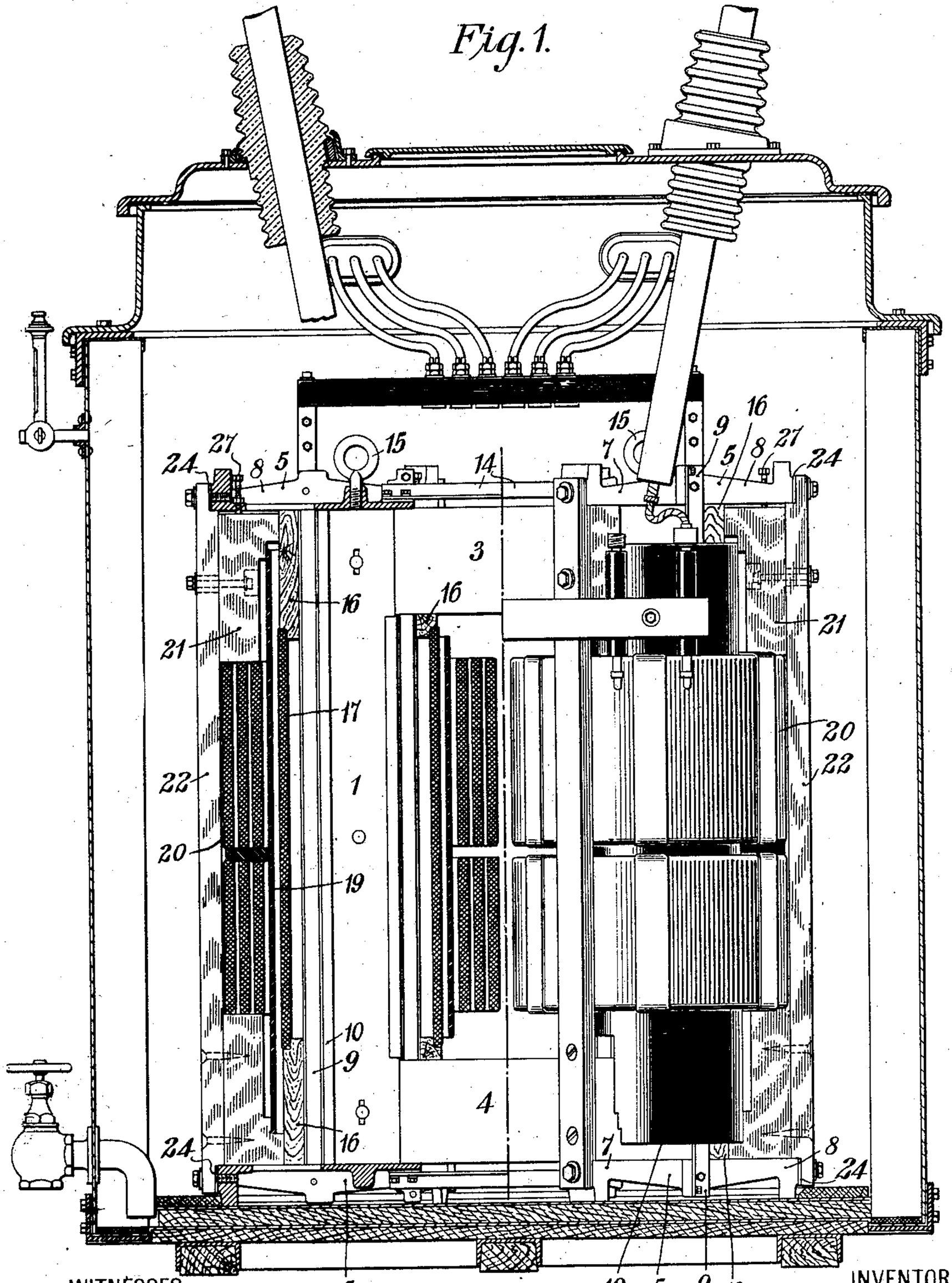
APPLICATION FILED JUNE 8, 1907.

914,941.

Patented Mar. 9, 1909.

2 SHEETS—SHEET 1.

Fig. 1.



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2 SHEETS—SHEET 2.

Fig. 2.

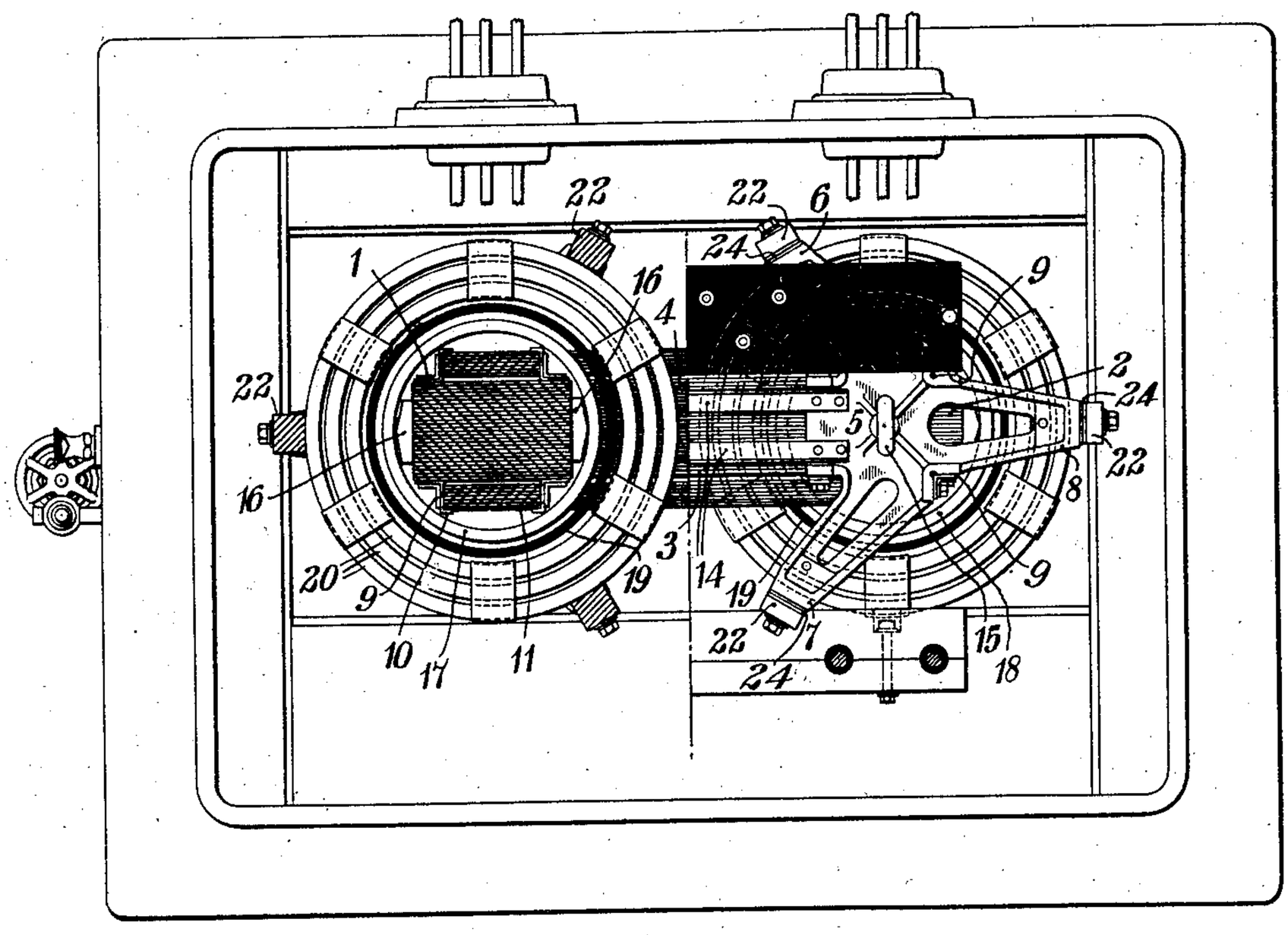

Fig. 3.

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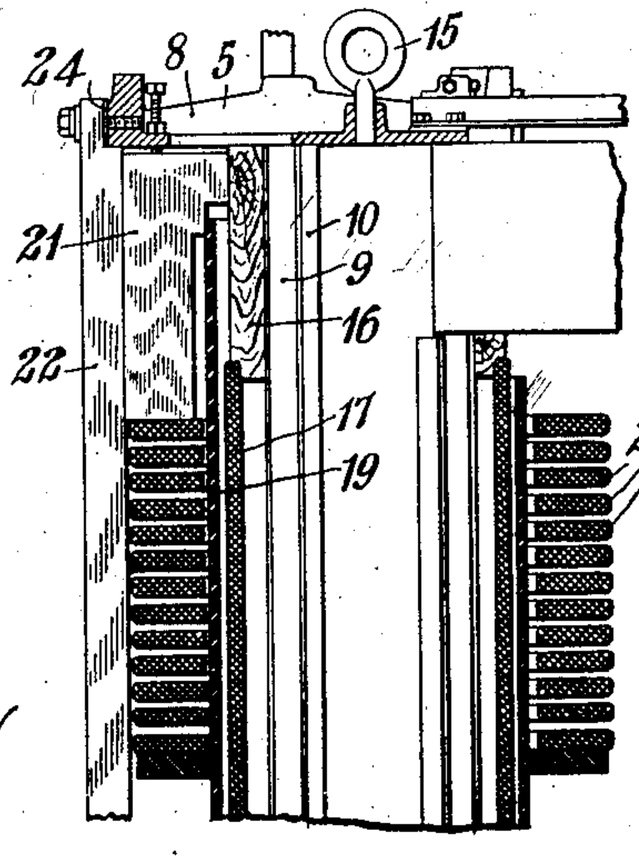

Fig. 4.

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

TRANSFORMER STRUCTURE.

No. 914,941. Specification of Letters Patent. Patented March 9, 1909.

Application filed June 8, 1907. Serial No. 378,012.

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 Transformer Structures, of which the following is a specification.

My invention relates to electrical transformers, and it has for its object to provide simple, practical and exceptionally effective means for securing together the parts of the core structure of a transformer and for supporting and maintaining the coils thereof in a substantially invariable relation with respect to each other and to the core.

Figure 1, of the accompanying drawings, is a view, partially in elevation and partially in vertical section, of a transformer that embodies my invention, the casing being shown in section for the sake of clearness of illustration. Fig. 2 is a view, partially in plan and partially in transverse section, of the transformer shown in Fig. 1. Fig. 3 is a perspective view, of a portion of one of the parts of the transformer of Fig. 1, and Fig. 4 is a vertical sectional view of a transformer of a modified form.

The transformer is provided with a laminated magnetizable core comprising two vertical and substantially parallel legs or members 1 and 2 of cruciform cross section and cross members 3 and 4 that connect their respective ends. At the ends of the legs are brackets 5, each of which is here shown as comprising three arms 6, 7, and 8 disposed at angles of substantially 120° from each other. The brackets at the opposite ends of each leg are connected by means of angle iron bars 9 that are located in the longitudinal reëntrant angular recesses in the legs and serve to clamp together the laminæ of the main portion of the legs of the core, reversely bent angle pieces 10 being interposed between the angle iron bars 9 and the core legs for the purpose of clamping the smaller side portions 11 of the legs to the main portions. The sides of the angle iron bars 9 are cut away at their ends, as indicated in Fig. 3, so as to form flat strips that project through the end members of the core between the laminæ. The respective brackets 5 at the top and the bottom of the core, are connected by means of transversely extending angle iron bars 14. Thus it is seen that the core laminæ of the transformer are rigidly secured together and supported by the frame comprising the end brackets 5, the vertical angle iron bars 9, and the cross angle iron bars 14, eye bolts 15 screwed into the top brackets 5 being provided for the purpose of lifting the transformer.

Immediately surrounding the respective core legs 1 and 2 and supported concentrically but out of engagement therewith by means of spacing blocks 16, are coils 17 and 18 that constitute the low voltage winding of the transformer, the spaces between the coils and the core legs serving as ducts through which oil or other medium, in which the transformer is immersed, may circulate in order to effect cooling thereof.

Mounted concentrically with the core legs, but out of engagement therewith, as well as all other conducting parts of the transformer, are cylinders 19 of insulating material of high dielectric strength, and outside of the cylinders 19, and mounted concentrically therewith and with the core legs, are a plurality of coils 20 constituting the high voltage winding of a transformer.

The cylinders 19 and the coils 20 are supported in position by means of blocks 21 that are secured to bars 22, the ends of which are bolted to the arms of the brackets 5 at the top and bottom of the core, the coils 20 being spaced apart and maintained concentric with each other by means of spacing blocks that are bound thereto at convenient intervals. The bars 22 support and maintain the coils 20 concentric with the insulating cylinders 19, but out of engagement therewith, means for effecting adjustment of their positions being provided by means of thin spacing plates 24, a greater or smaller number of which may be interposed between the ends of the arms of the brackets 5 and the bars 22. The pressure applied to the blocks 21 between which the cylinders 19 and the coils 20 are clamped may be adjusted by means of bolts 27 that are screw-threaded through the arms of the brackets 5.

Although the coils and the insulating cylinders are preferably supported in concentric relation to each other and to the core legs, they may also be arranged eccentrically, as may be desired in some cases in order to increase the insulation distance between the inner sides of the two sets of coils which are nearest the top and bottom cross members

3 and 4, such an arrangement being shown in Fig. 4 in which the cylinders 19 and high voltage coils 25 are supported in eccentric relation to the coils 17 and to each other. The high voltage coils 25 of Fig. 4 are also of annular form instead of being cylindrical, as in Fig. 1. Thus it is seen that the cylinders 19 are supported and maintained out of engagement with both the high and the low voltage coils without the use of interposed spacing blocks or strips, such as have been usually employed, and which provide surfaces with comparatively short paths over which high voltage charges may creep between the windings or between the high voltage winding and the core.

The present arrangement renders the insulation particularly effective between the high voltage winding and the top and bottom cross members of the core, and also between the portions of the windings that are located within the rectangle formed by the core, because these parts are separated only by spaces, the supporting means being applied outside of the rectangle of the core, at such points as to afford only long surface distances over which charges may creep.

I claim as my invention:

1. In a transformer, the combination with a magnetizable core comprising a plurality of substantially parallel legs, and cross members joining the same, of brackets at the ends of the respective core legs, and means for clamping each core leg between and substantially concentric with the brackets at the ends thereof.

2. In a transformer, the combination with a magnetizable core comprising a plurality of substantially parallel legs, and cross members joining the same, of brackets at the ends of the core legs, means for connecting the brackets at the respective ends of the coré, means for clamping the core legs between and substantially concentric with the brackets at the ends thereof, coils surrounding the legs, and means for maintaining the coils in substantially invariable relations with respect to the said legs.

3. In a transformer, the combination with a magnetizable core comprising a plurality of substantially parallel legs and cross members joining the same, of a bracket at each end of the core legs, means for connecting the brackets at the respective ends of the core, means for clamping the core legs between and substantially concentric with the brackets at the ends thereof, coils surrounding the core legs, and means secured to the brackets and supporting and maintaining the coils in substantially invariable relations with respect to the core legs.

4. In a transformer, the combination with a magnetizable core comprising a plurality of substantially parallel legs, and core members joining the legs at their ends, of brackets at the ends of the core legs, means for connecting the brackets at the respective ends of the core, and means for clamping the core legs between and substantially concentric with the brackets at the ends thereof.

5. In a transformer, the combination with a laminated magnetizable core comprising a plurality of substantially parallel cruciform legs, and cross members joining the same at their ends, of brackets at the ends of the core legs, and means located in the reëntrant angles of the core legs for connecting the brackets at opposite ends thereof.

6. In a transformer, the combination with a laminated magnetizable core comprising a plurality of substantially parallel cruciform legs, and cross members joining the same at their ends, of brackets at the ends of the core legs, means for connecting the brackets at the respective ends of the core, and means for clamping the core legs between and substantially concentrically with the brackets at the ends thereof, said means being located in the reëntrant angles of the core legs.

7. In a transformer, the combination with a laminated core comprising a plurality of substantially parallel cruciform legs and cross members joining the same at their ends, of brackets at the ends of the core legs, means located in the reëntrant angles of the core legs for connecting the brackets at opposite ends thereof, coils surrounding the core legs, bars secured to the outer extremities of the brackets and provided with means for supporting the said coils in substantially invariable relations with respect to the core legs.

8. In a transformer, the combination with a laminated core comprising a plurality of substantially parallel cruciform legs, and cross members joining the same at their ends, of brackets at the ends of the core legs, means located in the reëntrant angles of the core legs for connecting the brackets at opposite ends thereof, two sets of coils surrounding the core legs, an insulating cylinder between the two sets of coils, and means secured to the outer ends of the brackets and provided with means for supporting the insulating cylinder and the outer set of coils out of engagement with each other and the inner set of coils.

9. In a transformer, the combination with a magnetizable core comprising a plurality of legs, and cross members joining the same at their ends, of primary and secondary coils, insulating barriers between the said coils having notches in their ends for the cross members of the core, and means for supporting the barriers out of engagement with the said coils.

10. In a transformer, the combination with primary and secondary coils, of an insulating barrier between the coils, and means

for supporting the same out of engagement with the coils.

11. In a transformer, the combination with a magnetizable core comprising a plurality of substantially parallel legs, and primary and secondary coils disposed one within the other upon each core leg, of means attached to the core for supporting the said coils substantially concentric with the core legs and with each other.

12. In a transformer, the combination with a magnetizable core comprising a plurality of substantially parallel legs, primary and secondary coils disposed one within the other upon each core leg, and insulating barriers between the primary and secondary coils, of means attached to the core for supporting said coils, and barriers substantially concentric with the core legs and with one another.

13. In a transformer, the combination with a magnetizable core comprising one or more legs, and coils disposed one within the other upon each core leg, of means for securing the core parts together and for supporting the coils substantially concentric with the core legs and with each other.

14. In a transformer, the combination with a magnetizable core comprising one or more legs, coils disposed one within the other upon each core leg, and insulating barriers between the coils, of means for securing the core parts together and for supporting said coils and barriers substantially concentric with the core legs and with one another.

In testimony whereof, I have hereunto subscribed my name this 31st day of May, 1907.

CHARLES LE G. FORTESCUE.

Witnesses:
OTTO S. SCHAIRER,
BIRNEY HINES.