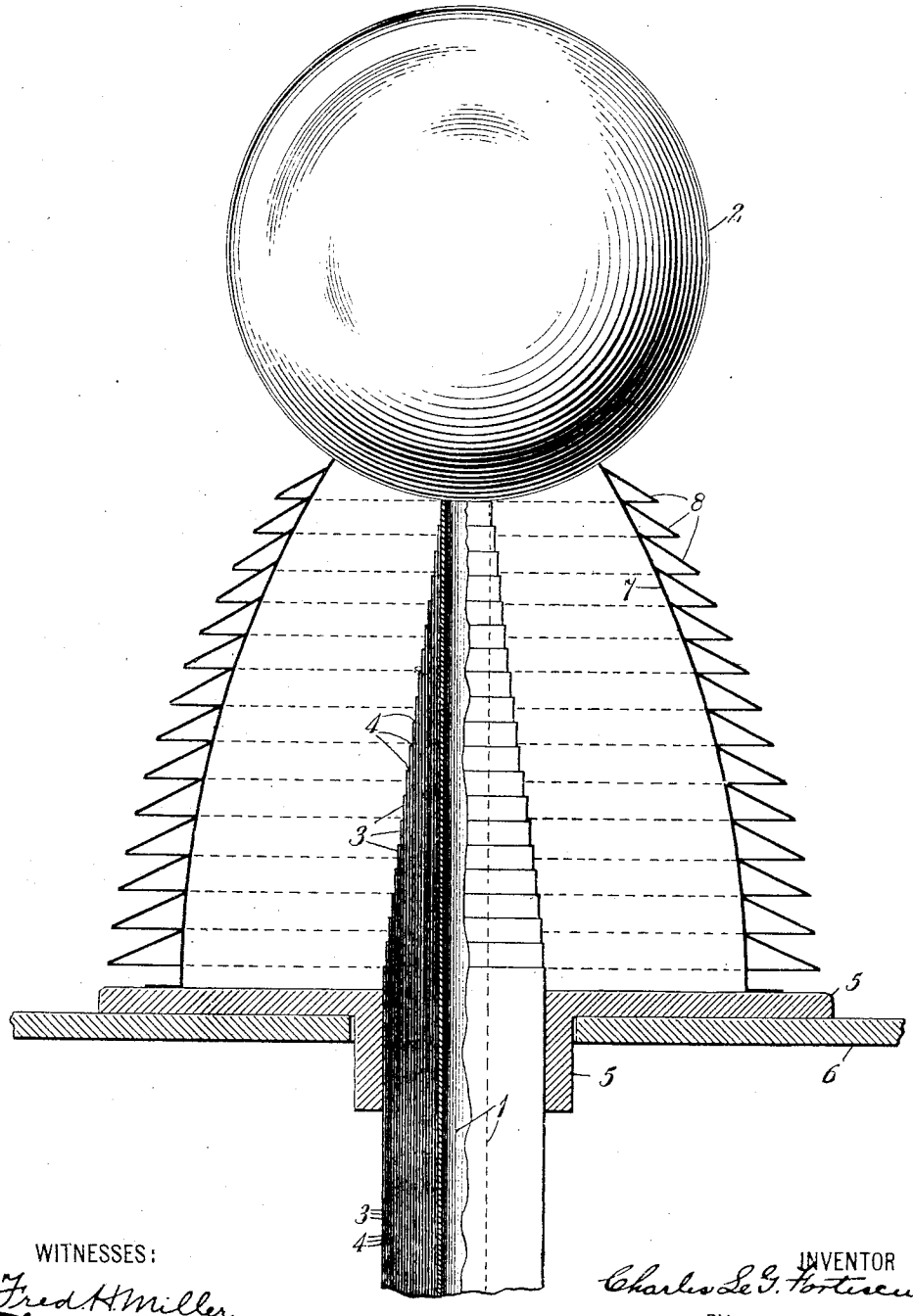
C. LE G. FORTESCUE.

TERMINAL BUSHING.

APPLICATION FILED NOV. 24, 1911.

1,129,468. Patented Feb. 23, 1915.



WITNESSES:

Fred. H. Miller

R. J. Barbour

INVENTOR

Charles Le G. Fortescue

BY

Wesley G. Carr

ATTORNEY

THE NORRIS PETERS CO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

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

TERMINAL BUSHING.

1,129,468. Specification of Letters Patent. Patented Feb. 23, 1915.

Application filed November 24, 1911. Serial No. 662,186.

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 Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Terminal Bushings, of which the following is a specification.

My invention relates to terminal bushings for electrical apparatus and it has special reference to such bushings as are adapted for use with very high-voltage electrical apparatus and are liable to be subjected to adverse weather conditions.

The object of my invention is to provide a terminal bushing of the class above indicated that shall be particularly adapted for use with high-voltage transformers, circuit breakers or other devices which are inclosed in metal cases.

In Patent No. 952,913, granted March 22, 1910, to the Westinghouse Electric & Manufacturing Company, upon an application filed by J. C. Dow, is shown and described a high-voltage terminal bushing comprising alternate layers of insulating and conducting materials constituting so-called condenser-type insulation. When insulating structures of this character are subjected to moisture and adverse weather conditions, their voltage-sustaining power and insulating properties are diminished.

It has been my aim to provide a structure having the advantages of the condenser-type insulation and, at the same time, embodying means for preventing its rapid deterioration under adverse conditions. In order to accomplish this result, I provide an exterior insulating structure or casing which extends between the conducting members, separated by the insulating structure as a whole, and completely envelops the surface of the bushing proper which would otherwise be exposed. The insulating casing is so shaped, in general, as to conform to the electrostatic field of force in accordance with the principles set forth in co-pending application, Serial No. 558,744, filed April 30, 1910, by K. C. Randall, S. W. Farnsworth and myself, but, on the surface of the casing, I provide a series of annular flanges that are so proportioned that their edges terminate in surfaces which conform to the electrostatic lines of force produced by the difference in potential between the two conducting members.

The single figure of the accompanying drawing is a partially sectional elevation of a terminal bushing constructed in accordance with my invention.

Referring to the drawing, the terminal structure here shown comprises an inner tube 1 of conducting material which terminates at its upper end in a conducting sphere 2 of relatively large size, a plurality of concentric cylindrical insulating members 3 which are separated by relatively thin conducting cylinders 4, the outer surface being stepped or tapered since the cylinders 3 and 4 are graduated in length, with the longest next to the conducting tube 1 and the shortest fitting into a flange collar 5 which constitute a part of a transformer casing or tank 6.

I believe that there is concentration of stress at the ends of the conducting cylinders 4 which is largely responsible for the deterioration of the bushings of this character, as heretofore constructed, when subjected to adverse conditions. I have accordingly provided an outer shell 7 of insulating material, the body of which is relatively thin and is in the form of a section of a hollow ellipsoid, the surfaces of which are so shaped as to conform to the electrostatic field of force existing between the conducting members 2 and 5.

The outer surface of the shell 7 is provided with a plurality of drooping annular projections 8 which are somewhat analogous to the petticoats with which high-voltage insulators are provided but are so proportioned that their edges terminate substantially in an imaginary surface which conforms to the electrostatic field of force above referred to though not necessarily of the specific form and dimensions shown. As is brought out in the Randall, Farnsworth and Fortescue application, to which reference has been made, the projections 8 would be unnecessary and might be harmful, so far as the insulating properties are concerned, provided the outer surface of the spheroidal member could be maintained perfectly clean. However, for use in the open air, where water and dirt are liable to be deposited, it is of advantage to provide a greater surface distance between the conducting members

than is provided by a smooth shell between the members 2 and 5.

It is evident that the amount of the insulating material is considerably reduced by the use of the condenser-type insulating bushing which directly separates the tube 1 from the collar 5, while the surface distance over the insulating shell 7 is very great and, not only protects the end surface of the condenser-type bushing, but is itself so constructed as to be very unlikely to receive any electrical injury.

The sphere 2 is made relatively large in order to improve the form of the electrostatic field and the distribution of the flux of which it is constituted.

My insulating structure is, of course, not limited to use with transformers or any other particular electrical apparatus, and I desire that my invention shall only be restricted by the appended claims.

I claim as my invention:

1. The combination with an insulating sleeve, an inner conducting member extending therethrough and terminating in an enlargement at one end of the sleeve, and an outer conducting member intermediate the ends of the sleeve, of a shell of insulating material surrounding a portion of the sleeve between the intermediate conducting member and the end enlargement and materially separated from the sleeve and shaped to conform substantially to the field of force produced by the difference of potential between the conducting members.

2. The combination with conducting members of unlike potential, of an interposed insulating structure having high insulating properties, and an outer shell of insulating material surrounding and spaced from the highly insulating structure and conforming substantially to the electrostatic field produced by the difference in potential between the conducting members.

3. The combination with conducting members of unlike potential, of an interposed insulating structure having high insulating properties, and an outer shell of insulating material surrounding the highly insulating structure and conforming substantially to the electrostatic field produced by the difference in potential between the conducting members, the outer surface of the insulating shell being provided with annular projections which terminate substantially in a second surface conforming with the said electrostatic field.

4. The combination with a conducting plate, an insulating sleeve extending through an opening therein, a conducting member extending through the sleeve and terminating at its outer end in an enlargement, of an insulating shell surrounding the end of the sleeve between the enlargement and the conducting wall and having its surfaces shaped to conform substantially to electrostatic field of force existing between the conducting members and provided on its outer surface with drooping annular projections which terminate in an imaginary surface which also conforms substantially to said field of force, the shell being materially spaced from the portion of the bushing which it surrounds.

5. The combination with conducting members of unlike potential, of an interposed insulating structure, and an insulating shell surrounding and spaced from said structure, said shell having an outer surface that conforms substantially to the electrostatic field between said conducting members and a series of drooping annular projections that also conform substantially to said electrostatic field.

6. The combination with a conducting plate, a conductor extending through an opening therein, and a spherically curved conducting body of relatively large diameter upon one end of the conductor, a spherically convex surface of said body being presented toward the conducting plate, of a bushing surrounding the conductor and interposed between the conductor and said conducting plate, said bushing being composed of alternate layers of insulating and conducting materials, and the end portion of the bushing being in substantially the form of a truncated cone with its smaller end adjacent to said body.

7. The combination with a conductor, and a spherically curved conducting body of relatively large diameter upon one end thereof, of a bushing surrounding the conductor and composed of alternate layers of insulating and conducting materials, the end portion of the bushing being in substantially the form of a truncated cone with its smaller end adjacent to said body, and a spherically convex surface of said body being presented toward the bushing.

8. The combination with an apertured conducting member, and a conductor projecting through the aperture therein, of a spherically curved conducting body of relatively large diameter upon one end of the conductor, a spherically convex surface of said body being presented toward the conducting member, and a bushing surrounding the conductor and composed of alternate layers of insulating and conducting materials, the portion of said bushing extending between the conducting member and the said body being in substantially the form of a truncated cone.

9. The combination with a conductor and a spherically curved conducting body of relatively large diameter upon one end thereof, of a bushing surrounding the conductor and composed of alternate layers of insulating and conducting materials, the end

portion of the bushing being stepped and in substantially the form of a truncated cone with its smaller end adjacent to said body, and a spherically convex surface of said body being presented toward the bushing.

10. The combination with an apertured conducting member, and a conductor projecting through the aperture therein, of a spherically curved conducting body of relatively large diameter upon one end of the conductor, said body presenting a spherically convex surface to the said member, and a bushing surrounding the conductor and composed of alternate layers of insulating and conducting materials, the portion of said bushing extending between the conducting member and the said body being provided with annular steps and being also in substantially the form of a truncated cone.

11. The combination with an apertured conducting member, a conductor projecting therethrough, of a rounded conducting body of relatively large diameter upon one end of the conductor, a bushing surrounding the conductor, and an insulating shell spaced from and surrounding the portion of the bushing which extends between the conducting member and the rounded body, said shell conforming to the electrostatic field intercepting said rounded body.

12. The combination with an apertured conducting member, a conductor projecting therethrough, of a rounded conducting body of relatively large diameter upon one end of the conductor, a bushing surrounding the conductor composed of alternate layers of insulating and conducting materials, a portion of said bushing extending between the conducting member and the rounded body being in substantially the form of a truncated cone, and an insulating shell spaced from and surrounding said truncated cone portion of the bushing, said shell conforming substantially to the electrostatic field intercepting the rounded body.

In testimony whereof, I have hereunto subscribed my name this 21st day of Nov. 1911.

CHARLES LE G. FORTESCUE.

Witnesses:
E. G. REED,
B. B. HINES.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."