

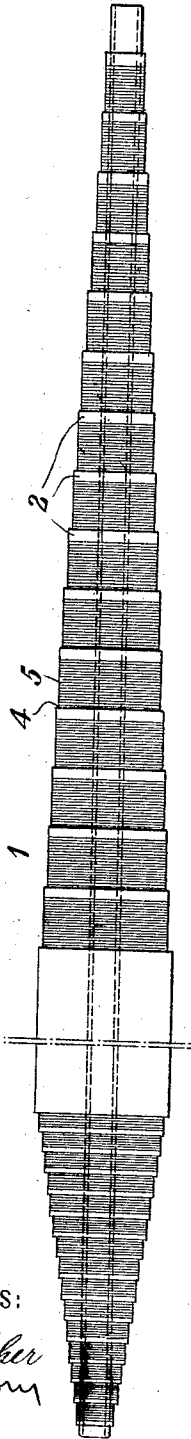
952,448

S. M. KINTNER.  
INSULATING BUSHING.  
APPLICATION FILED AUG. 8, 1908.

Patented Mar. 22, 1910.

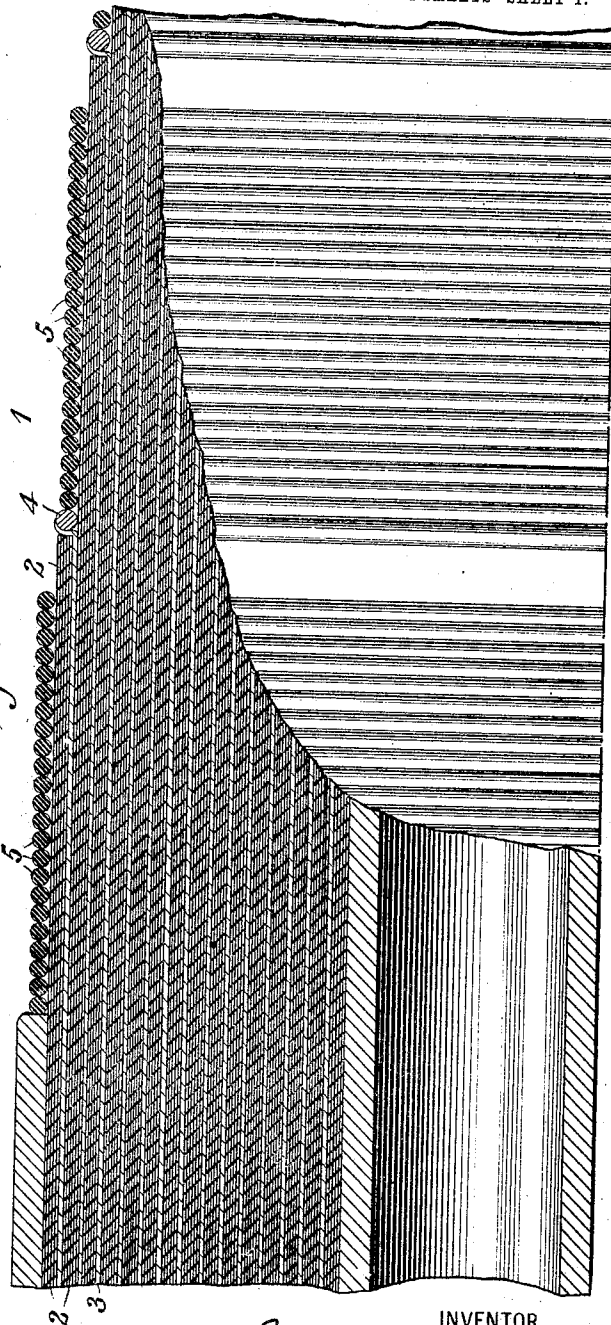
2 SHEETS—SHEET 1.

Fig. 1.



WITNESSES:  
*C. L. Belcher*  
*H. J. Garbony*

Fig. 2.



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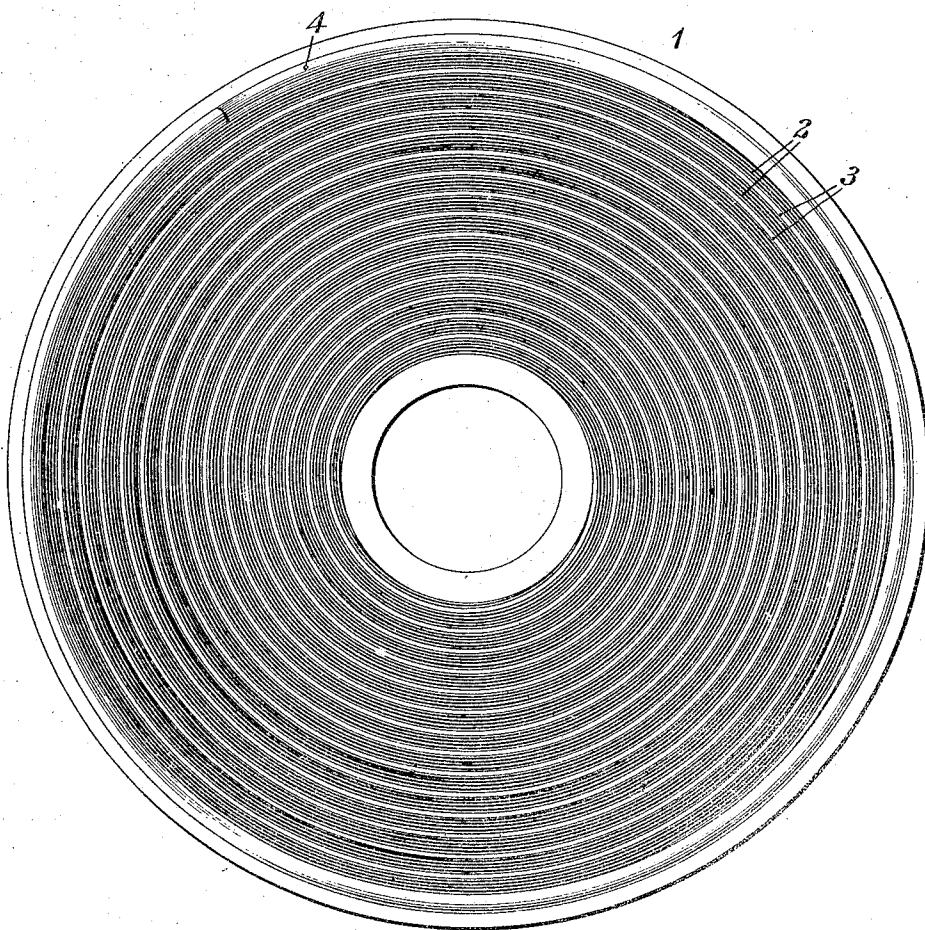
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2 SHEETS—SHEET 2.

*Fig. 3.*



WITNESSES:

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# UNITED STATES PATENT OFFICE.

SAMUEL M. KINTNER, OF PITTSBURG, PENNSYLVANIA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, OF EAST PITTSBURG, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

## INSULATING-BUSHING.

952,448.

Specification of Letters Patent. Patented Mar. 22, 1910.

Application filed August 8, 1908. Serial No. 447,607.

### *To all whom it may concern:*

Be it known that I, SAMUEL M. KINTNER, a citizen of the United States, and a resident of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Insulating-Bushings, of which the following is a specification.

My invention relates to insulators for high potential electrical circuits and it has special reference to device of this character in which alternate layers of suitable insulating and conducting materials are employed for the purpose of providing a series of condensers between the external surfaces of the insulator. Insulation of this general type has been used in the prior art and is known as the condenser type insulation. When this insulation is utilized for bushings or sleeves for the electrical separation of conducting leads from conducting casings or tanks, in which transformers and other electrical apparatus are contained, it has been found desirable to taper the ends of the cylindrical bushing in order to increase the surface or creepage distance between the conducting cylinders which constitute the condenser plates. It is a well known fact that the electrostatic leakage or discharge of electricity in the air is materially increased when the charged conductors are provided with sharp points or sharp edges.

According to my present invention I provide an insulating bushing, constructed as above indicated, with alternate layers of insulating and conducting materials but, instead of continuously tapering the ends of the bushing, I make successive layers of insulating material of varying lengths, thereby forming a stepped structure in which the surface distance is even greater. The ends of the conducting cylinders which are exposed are wrapped over and soldered to rings of conducting material of circular cross section in order to do away with the usual sharp edges of the cylinders from which a considerable electrostatic leakage is found to take place.

Figure 1 of the accompanying drawings is an elevation of an insulating bushing constructed in accordance with my invention, Fig. 2 is a sectional view which discloses the structure of the bushing shown in Fig. 1 and

Fig. 3 is an end view, on a larger scale, of the same bushing.

Referring to the drawing, the bushing or sleeve 1 which embodies my invention and is adapted for the insulation of transformer leads or the conducting leads of other electrical devices, comprises a series of substantially concentric cylinders 2 and 3 which are disposed in alternation and are composed, respectively, of insulating and conducting material. The cylinders 2 and 3 are of such different lengths that the assembled bushing is provided with tapering ends and the conducting cylinders 3 are formed of tin foil or other thin metal plate and are so proportioned that their surface areas are substantially equal and their extreme ends are exposed. Rings 4 of conducting material, which are circular in cross section, are fitted over each outer insulating cylinder close to the end of the next larger insulating cylinder and is electrically connected to the exposed end of the adjacent conducting cylinder which is wrapped around and soldered to it. By this means, the sharp edges of the conducting cylinders, which would otherwise encourage leakage, are merged into the rings 4 which have no sharp points or edges exposed to the surrounding air. It has been found in practice that the voltage-sustaining or resisting power of the whole insulating bushing is materially increased by the means just described, since the usual static leakage or discharge which tends to destroy the insulating properties of the surrounding air is practically avoided. The cylindrical surface of each step adjacent to one of the metal rings 4 is wrapped with cord or rope 5 which is coated with insulating varnish in order to improve the structure of the bushing and to still further increase the surface leakage distance between the conducting plates.

In order that the complete bushing may constitute a solid mass from which the air is entirely excluded I prefer to construct the bushing as set forth in Patent No. 858,385, granted July 2, 1907, to the Westinghouse Electric & Manufacturing Company as assignee of Emil Haefely, sheets of tin foil or other suitable conducting material being interposed at desired intervals between the convolutions of the insulating material dur-

ing the construction of the bushing. It will probably be found preferable, in most cases, to first build up a substantially cylindrical bushing and afterward turn off the ends of the outer insulating layers in order to produce the tapered or stepped structure illustrated in Fig. 1 of the drawings.

The structure described is of considerable importance and advantage when the bushing is used for the insulation of relatively high-voltage leads, since the conducting plates constitute elements of a condenser and are electro-statically charged to a greater or less degree.

Although the tapered end construction provides a material surface or creepage distance between the exposed ends of successive conducting cylinders, if electro-static discharges are permitted to occur at these points, the voltage-sustaining or resisting power of the surrounding air will be materially reduced in accordance with well known principles.

It is to be understood that structural changes may be effected within the spirit and scope of my invention and I desire that only such limitations shall be imposed as are indicated in the appended claims.

I claim as my invention:

1. An insulating medium comprising alternate layers of insulating and conducting materials, and round rod or wire conductors into which the exposed ends of the conducting layers are merged.
2. An insulating bushing comprising a plurality of substantially concentric cylinders of conducting material separated by insulating cylinders, and conducting rings of substantially circular cross section into which the exposed ends of the conducting cylinders are merged.
3. An insulating bushing comprising a plurality of substantially concentric metal cylinders of varying lengths separated by insulating cylinders, and conducting rings of substantially circular cross section into which the exposed ends of the conducting cylinders are merged.
4. An insulating bushing comprising a

plurality of concentric cylinders of conducting material separated by insulating cylinders, the metal cylinders being of substantially equal areas, and rings of circular cross section into which the exposed ends of the conducting cylinders are merged.

5. An insulating bushing comprising a plurality of continuous convolutions of suitable insulating material and separate convolutions of conducting material interposed in the bushing at intervals to provide a plurality of substantially concentric metal cylinders, and conducting rings of substantially circular cross section into which the exposed ends of the conducting cylinders are merged.

6. An insulating medium comprising alternate layers of insulating and conducting materials producing a series of condensers, and means for reducing electro-static leakage from the exposed ends of the conducting layers.

7. An insulating bushing comprising a plurality of substantially concentric cylinders of conducting material separated by insulating cylinders, and means for reducing electro-static leakage from the exposed ends of the conducting cylinders.

8. An insulating bushing comprising a series of conducting cylinders of different lengths and a series of insulating cylinders of different lengths concentrically assembled in alternation, the conducting cylinders having rounded ends to reduce electro-static leakage.

9. An insulating bushing comprising a plurality of concentrically disposed conducting cylinders of different lengths having enlarged rounded ends and a plurality of insulating cylinders of different lengths concentrically and alternately disposed with reference to the conducting cylinders.

In testimony whereof, I have hereunto subscribed my name this 30th day of July, 1908.

SAMUEL M. KINTNER.

Witnesses:

HOWARD L. BEACH,  
BIRNEY HINES.