

(No Model.)

J. B. WILLIAMS.
INSULATED ELECTRIC CONDUCTOR.

No. 471,587.

Patented Mar. 29, 1892.

Fig. 1.

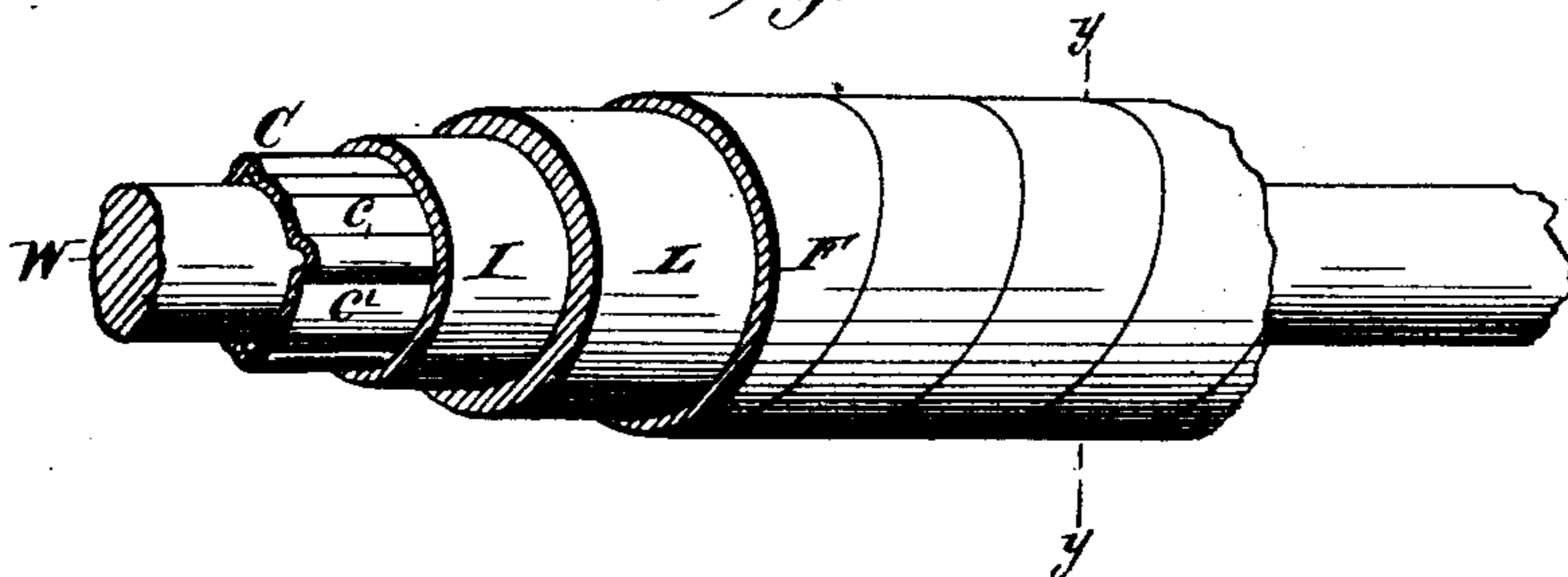


Fig. 2.

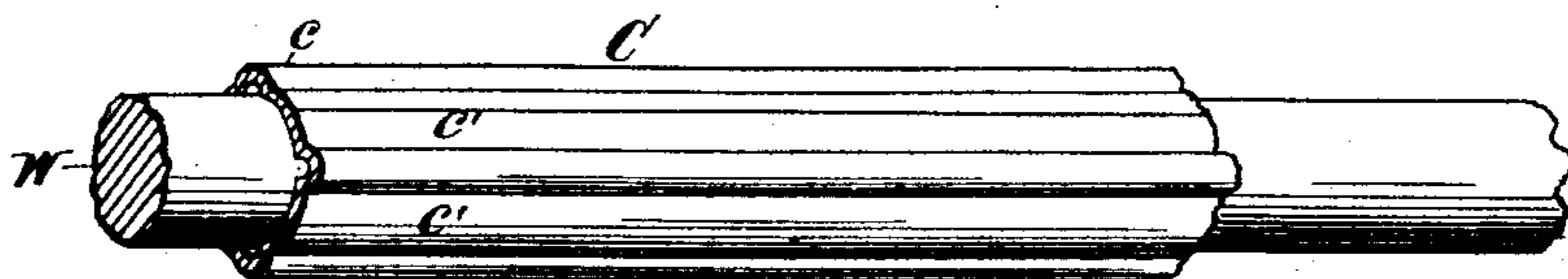


Fig. 3.

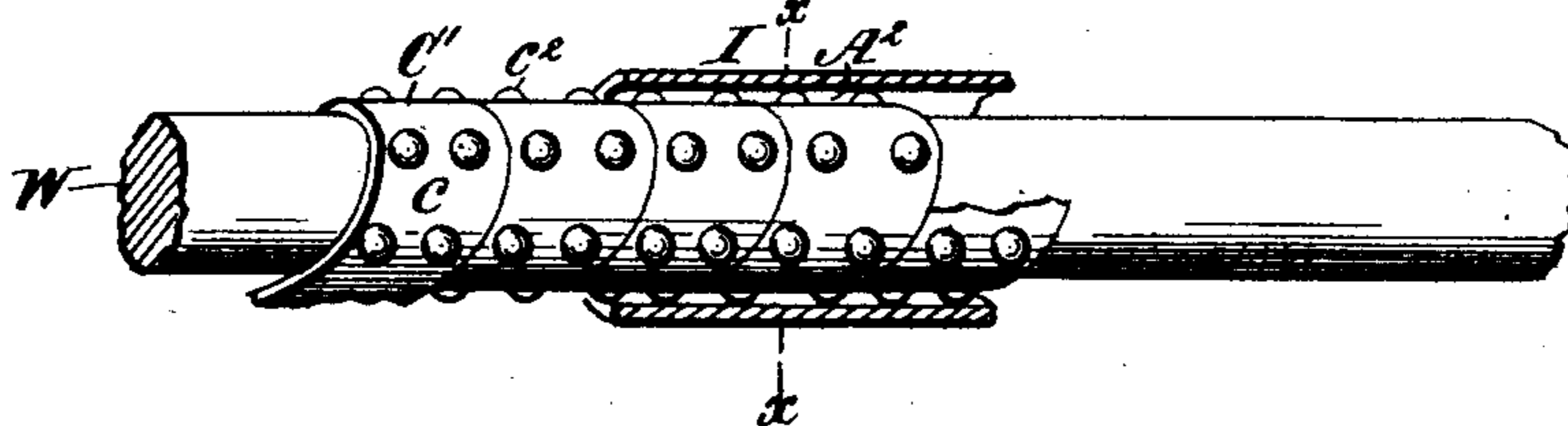


Fig. 4.

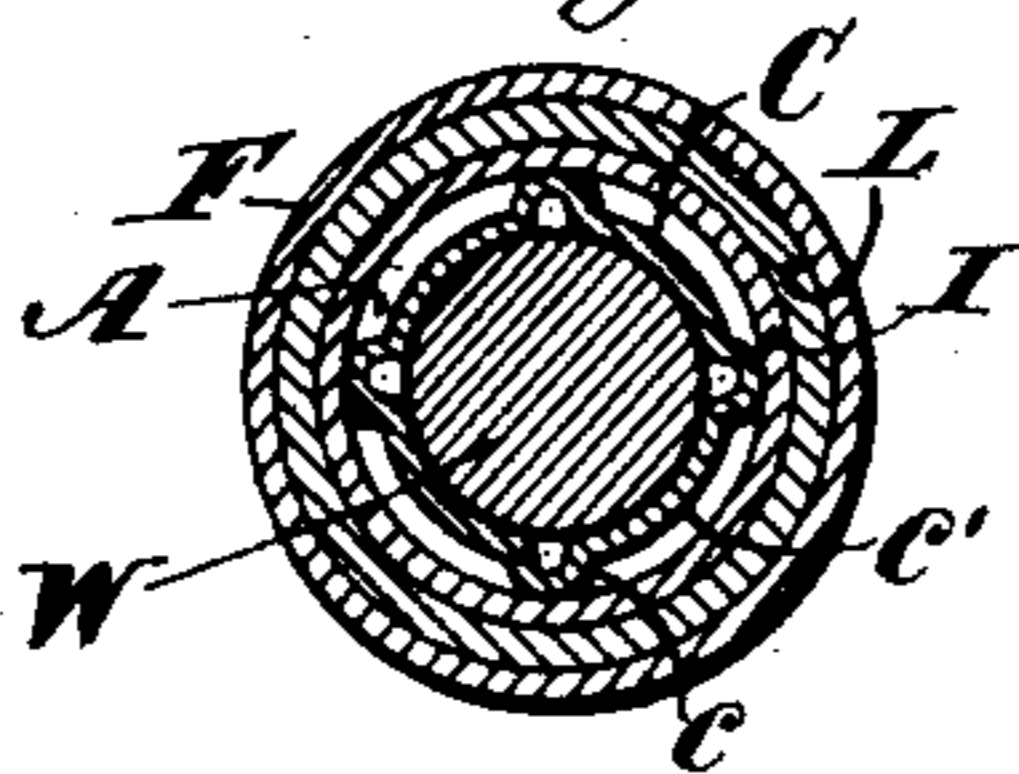
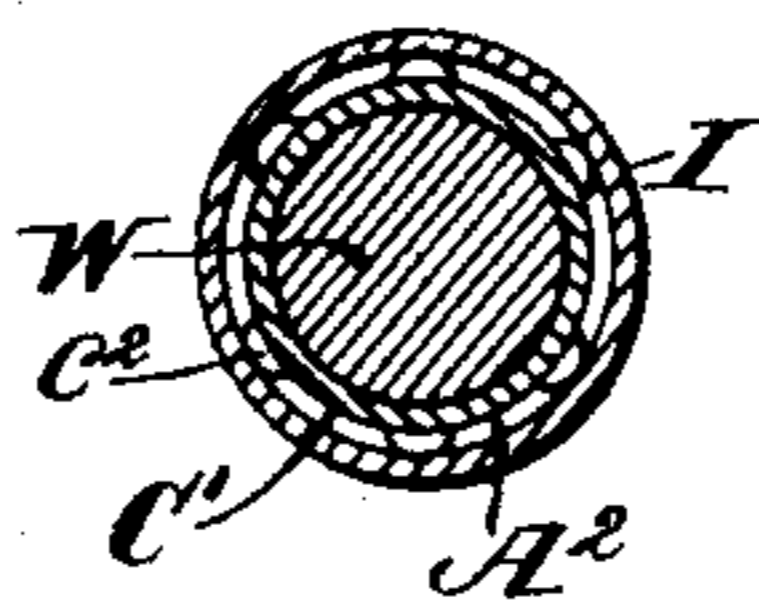


Fig. 5.



Witnesses.

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UNITED STATES PATENT OFFICE.

JAMES B. WILLIAMS, OF OAKLAND, CALIFORNIA.

INSULATED ELECTRIC CONDUCTOR.

SPECIFICATION forming part of Letters Patent No. 471,587, dated March 29, 1892.

Application filed July 10, 1890. Serial No. 358,268. (No model.)

To all whom it may concern:

Be it known that I, JAMES B. WILLIAMS, a citizen of the United States, residing at Oakland, Alameda county, California, have invented certain new and useful Improvements in Insulated Electric Conductors; and I do declare the following to be a full, clear, and exact description of the invention, such as it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters marked thereon, which form part of this specification.

The object of my invention is to produce an insulated electric conductor which shall have a higher insulation-resistance and a lower electrostatic capacity than insulated conductors made in the manner now usually employed—i. e., by placing the insulating-layer or dielectric in direct contact with the conductor or in contact with a layer of fibrous material closely wrapped around the conductor, the size of the conductor, the thickness of the dielectric, and the kind of material used and the conditions of use being the same in both cases.

The novelty of my invention consists in the means employed to attain this object and in the construction and adaptation of the parts; and it consists primarily in interposing between the insulating-layer or dielectric and the conductor air-spaces, preferably made continuous, together with certain intermediate and supplementary aids to insulation, whereby the efficiency of the insulation is materially increased.

In the drawings in which the same letters refer to the same parts in all of the figures, Figure 1 is a perspective view of a chosen form of my invention, showing the successive layers of material cut away so as to display the different coverings of the conductor in their relative positions. Fig. 2 is a similar view of the conductor provided with the intermediate covering or separating device. Fig. 3 is a similar view of the conductor provided with a different form of said device. Fig. 4 is a central transverse section on the plane of the line $y y$ in Fig. 1. Fig. 5 is a similar section on the plane of the line $x x$ in Fig. 3.

In all the views the parts are shown in relative positions only and not in necessarily relative sizes.

In the drawings, W represents the central metallic conductor. I have shown it in cylindrical form, and it may be single, stranded, or tubular; but it should be substantially circular in cross-section.

C is the intermediate covering or separating device, placed between the conductor W and the insulating-layer or dielectric I. Its purposes are, first, to prevent the insulating-layer from coming into direct contact with the conductor; second, to provide air-spaces between them; third, to support the insulating-layer and keep it substantially concentric with the conductor, and, fourth, to furnish comparatively few paths by which the electric current can escape from the conductor. This covering or separating device may consist of any suitable material possessing insulating properties and which remains elastic and more or less flexible under ordinary conditions of manufacture and use.

By the terms "elastic" and "more or less flexible" I mean that if the insulated conductor is to be kept comparatively straight during its manufacture, placing, and use the materials need to be elastic only and possess only a very slight degree of flexibility; but if it is to be bent under these conditions the degree of flexibility required will be greater and sufficient to prevent buckling or rupture. By the term "ordinary conditions" I mean such conditions as insulated conductors of the class herein described would naturally be subjected to by an intelligent and skilled workman—for instance, that the insulated electric conductor during the manufacture, placing, and use thereof should be kept as straight as possible, and that if bent or coiled the curves should be large.

When the intermediate covering C is made in the form illustrated in Figs. 1, 2, and 4, it is provided with raised portions or corrugations c , the outer edges of which are substantially equidistant from the axis of the conductor and from each other and which serve to support the insulating-layer or dielectric I and keep it away from those portions of the covering c' which are directly in contact with

the conductor W, forming between the dielectric and the covering C air-spaces A, which in the form illustrated in these figures are substantially parallel to the axis of the conductor.

5 In this form I may under some conditions provide the device with means for preventing the corrugations from being flattened against the conductor when subjected to external pressure, and this feature of my invention
10 will be made the subject of a separate application for Letters Patent.

I is the insulating-layer or dielectric, surrounding the intermediate covering C and which touches only the outer portions thereof,
15 and it is made sufficiently stiff to prevent its collapsing under usual conditions and touching the surface c' , which forms the inner wall of the air-passage A.

L is a protecting-covering, usually made of
20 lead and applied over the dielectric in the usual manner, and F represents a further covering or layer composed of fibrous material saturated with a water-proof compound and outside the covering L when its use is deemed
25 desirable.

In Figs. 3 and 5 I have illustrated a second form of this intermediate covering or separating device. In these figures, W is the conductor. C' is the covering, which is provided
30 with bosses or projections c^2 , which have the same functions as the corrugations in the device first described. This covering is made of strips of insulating material previously prepared and wound around the conductor. The
35 dielectric I is placed around the covering in the manner hereinafter stated, forming the air-spaces A².

The general nature of my invention will be readily understood from the above description, and I now propose to describe the best
40 means known to me of carrying out the same and to specify the materials which should preferably be employed therein and the methods of constructing and putting together the
45 several parts. The intermediate covering or its equivalent, and which I also call the "separating device" on account of its obvious functions, I make preferably of some thick fibrous material—such as paper—which can be made
50 to possess insulating properties by saturating it with an insulating varnish or paint—such as a good Japan drier—containing a large quantity of shellac, which can be formed while hot into the desired shape, and which
55 will retain its position when cold or under ordinary conditions. If the material employed be not of itself sufficiently rigid to resist the usual conditions of external pressure, I may reinforce it, as above suggested. The same
60 end may be effected by thickening the covering at certain points or by adding external longitudinal strips thereto by cement or otherwise before it is applied to the conductor; but however it is formed it should be made
65 wherever it touches the exterior surface of the conductor to closely adhere thereto by a

cement suitable to the conditions of its manufacture and use—for instance, shellac dissolved in alcohol—and should so support the
70 insulating-layer or dielectric that it will not come into contact with the conductor. The second form of the separating device C' may be made of any suitable material possessing
75 insulating properties—for instance, of vulcanized soft rubber—and is treated with suitable cements to cause it to adhere to the surface of the conductor. It is obvious that the bosses or projections are to be made sufficiently
80 close together to support the dielectric. However formed or of whatever material this device is made, if made of separate pieces afterward united, their edges should be closely
85 cemented and the points of contact between it and the dielectric should be as few in number as possible.

Other equivalents of the intermediate covering or separating device will readily occur to the minds of persons skilled in the art, and it is obvious that I may in this respect make
90 wide modifications in detail without departing from the essential features of my invention.

The insulating-layer or dielectric I consists either of a single layer or of two or more
95 single layers united to form one general layer composed of any well-known insulating material suitable for use in this connection. Under some conditions of use the dielectric may be separately formed into tubes and the
100 conductor already provided with the separating device placed within the same. Under many conditions of use it is desirable that the layers C and I should be further protected from moisture or breakage or crushing
105 in of layer I by the forcible contact of the finished conductor with other bodies, and to effect this purpose I apply upon the dielectric I a covering L, which is usually made of
110 lead, and when this material is employed it may be placed in position in the usual manner by a lead press, and if the material of the dielectric is such that it is apt to be injured
115 by the heat of the press a thin layer of paper saturated with good paraffine-wax and carefully applied to the outside of the dielectric will be found to afford efficient protection.
120 In any case the dielectric should be kept as cool as possible in its passage through the press and the lead sheath should be chilled thereafter at once. If desired, a layer F, of suitable material, may be formed outside of
125 the covering L as a further protection. It is preferably put on in the form of a tape or braid and is saturated with a good water-proof paint, one containing a large quantity of elastic flexible bituminous matter, for instance. The purpose of this layer is to protect the layer immediately underneath it
130 from the action of moisture or gaseous vapors, and serves at the same time to seal up any minute holes which may exist in the lead sheath, if one is used. Such a covering

may be also placed directly over the insulating-layer in cases where no lead sheath is employed, and the materials of the said insulating-layer are of such a nature that its use is practicable.

The ends of the insulated conductor should always be sealed with water-proof tape during the process of manufacture whenever practicable, and when finished should always be sealed by this or other suitable means, otherwise the insulation-resistance of the conductor is liable to rapidly diminish, owing to the effect of moisture and vapors which may enter the air-spaces attacking the insulating material.

It is evident that my invention is not applicable to conductors of small size on account of the difficulty of properly forming and placing the intermediate covering or separating device and the surrounding dielectric in position. The limit of size will depend upon the materials used, the method chosen for forming the device, and the conditions of its subsequent use.

My invention can be applied to concentric cables if special care is taken in selecting the materials which are used in the manufacture of the different layers and in the manner in which these different layers are formed on the conductors; but the feasibility of so doing depends upon the circumstances of each case and can scarcely be predetermined.

The principle upon which the efficiency of my invention depends is that comparatively few paths are furnished by which the electric current can escape from the conductor.

I do not require that the air-passages between the separating device and the dielectric should be continuous or communicating in order to attain this object; but I find a great advantage in making them so, because a current of warm dry air may be passed through the air-spaces of the insulated conductor, even after it is placed in position, to remove any moisture which may get inside of the air-passages.

The construction illustrated in Figs. 3 and 5—that is, the covering with bosses or projections—is not claimed in this application, as it forms the subject-matter of an application filed by me April 9, 1891, Serial No. 388,289.

What I claim as new is—

1. The combination of a conducting-wire

and a corrugated covering of insulating material surrounding said wire.

2. In combination, an electric conductor, an exterior insulating-layer I, and an intermediate corrugated covering C, whereby air-spaces are formed between the conductor and the exterior layer, substantially as shown and described.

3. The combination of an electric conductor W, an exterior insulating-layer I, and means placed intermediate the same, composed of insulating material closely adhering to the conductor and having portions thereof permanently projecting from its exterior surface and in close contact with the interior surface of the exterior layer, whereby air-spaces are formed between the conductor and the exterior layer.

4. The combination, with an electric conductor and an exterior insulating-layer, of an intermediate corrugated covering, the folds of which form, with the exterior layer, the walls of continuous air-passages, as set forth.

5. The combination, with an electric conductor and an exterior insulating-layer, of the intermediate covering composed of a more or less flexible material possessing insulating properties and closely adhering to the surface of the conductor and provided with raised portions c, the outer surfaces of which are substantially equidistant from the axis of the conductor and which serve as a support for said exterior insulating-layer and form therewith the continuous air-passages A.

6. An insulated electric conductor comprising the conductor W, the insulating-layer I, the corrugated covering C, intermediate the conductor and layer I, and the protecting covering or sheath L, substantially as shown and described.

7. An insulated electric conductor comprising the conductor W, the insulating-layer I, the corrugated covering C between the conductor and layer I, the protecting layer or sheath L next the layer I, and the outer water-proof covering F, substantially as shown and described.

In testimony whereof I affix my signature in presence of two witnesses.

JAMES B. WILLIAMS.

Witnesses:

WM. RAIMOND BAIRD,
WILLIAM M. ERNST.