

(No Model.)

J. A. BARRETT.
ELECTRICAL CONDUCTOR.

No. 424,751.

Patented Apr. 1, 1890.

Fig. 1.

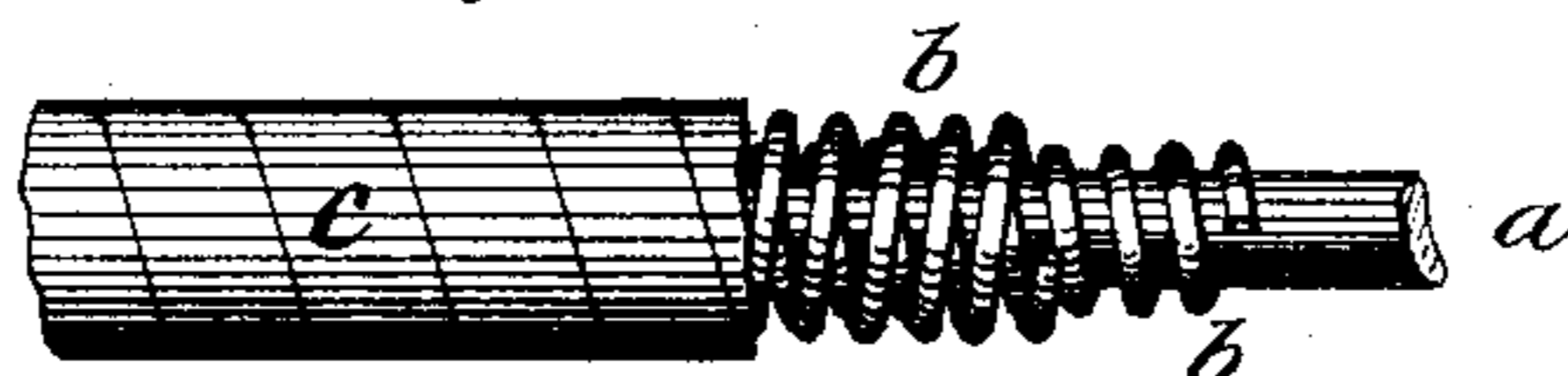


Fig. 2.



Fig. 3.

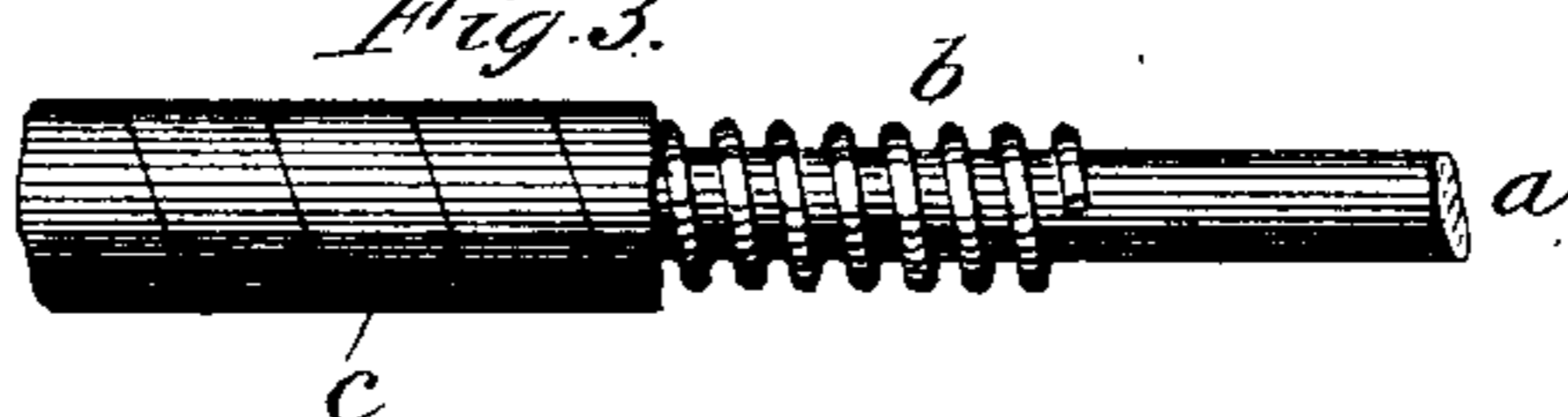


Fig. 4.

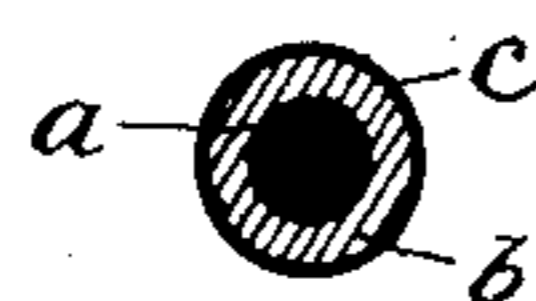


Fig. 5.

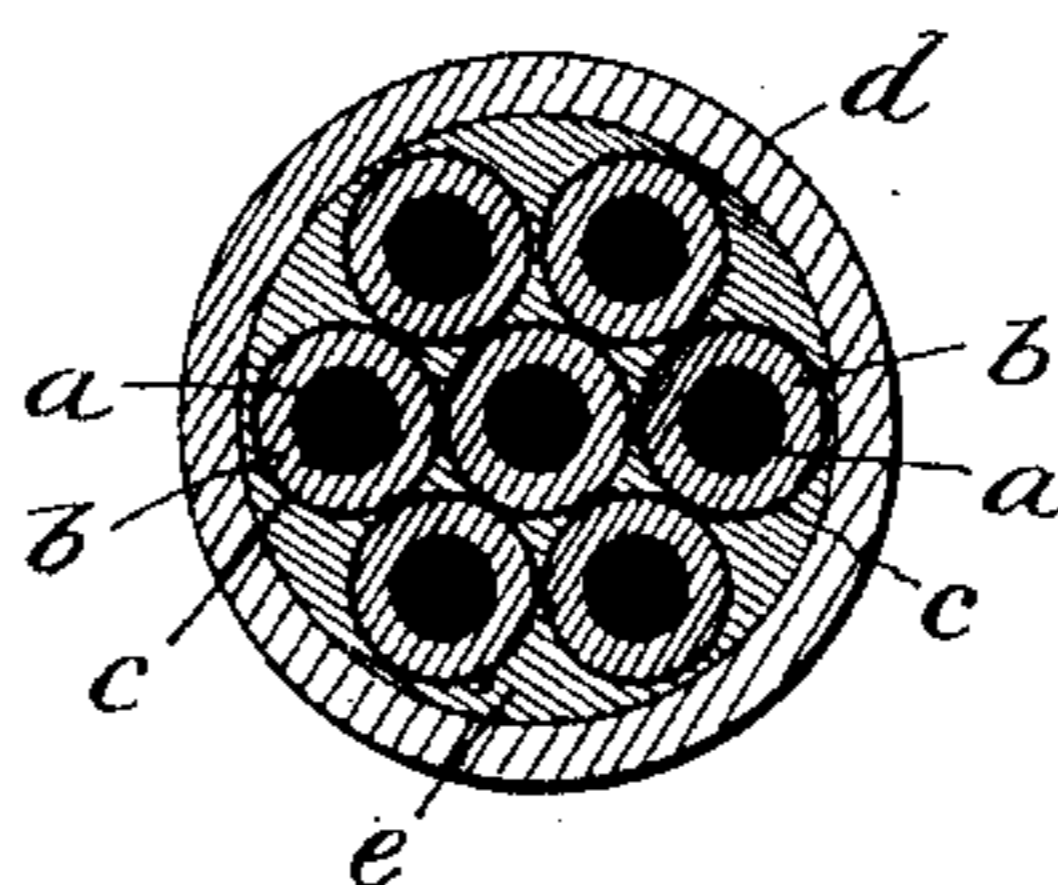


Fig. 6.

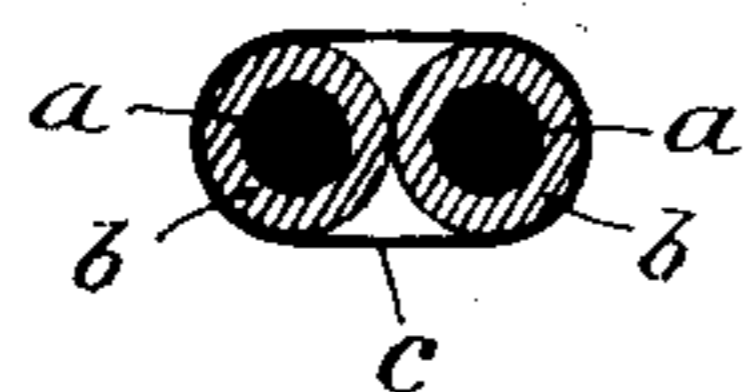
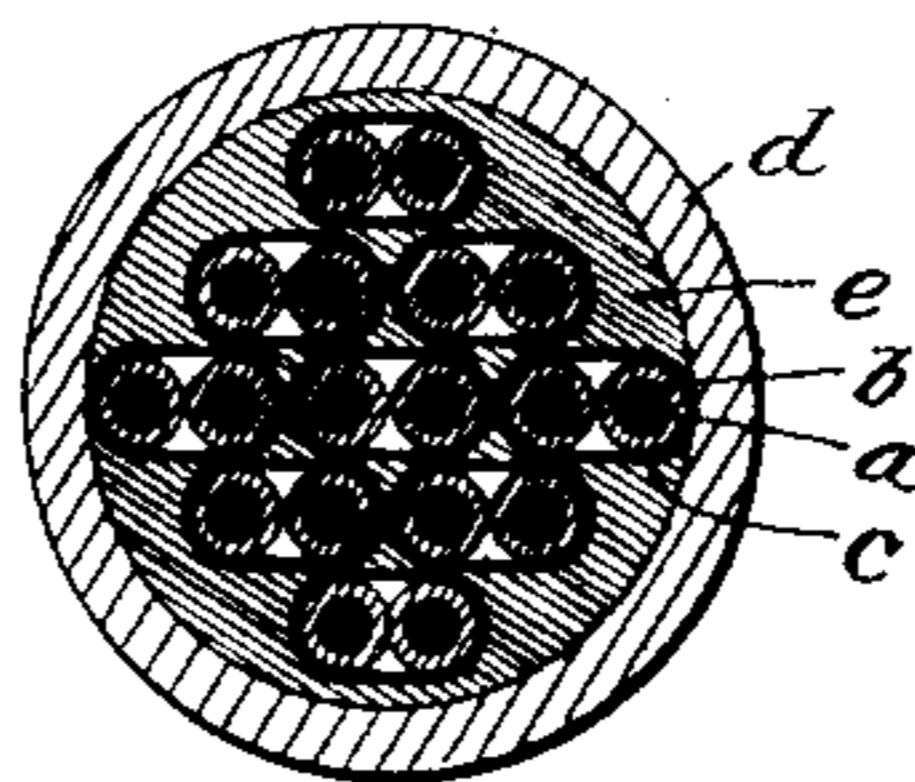


Fig. 7.



WITNESSES:

E. D. Myers
S. C. Field

John A. Barrett, INVENTOR

BY
McFisher Worthington
ATTORNEYS

UNITED STATES PATENT OFFICE.

JOHN A. BARRETT, OF BROOKLYN, NEW YORK.

ELECTRICAL CONDUCTOR.

SPECIFICATION forming part of Letters Patent No. 424,751, dated April 1, 1890.

Application filed November 6, 1889. Serial No. 329,398. (No model.)

To all whom it may concern:

Be it known that I, JOHN A. BARRETT, a citizen of the United States, residing at Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Electrical Conductors; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to the manufacture of insulated electrical conductors, being more particularly designed for application to that class which may be termed "lead-covered cables." In cables of this character it is important to separate the several conductors by a dielectric of the lowest practicable specific inductive capacity. The separating medium in such cables is usually of a composite character, and, though various methods of manufacture have been proposed, the following method is the most commonly practiced commercially. The wires which are to form the conductors are severally covered to a prescribed thickness with a wrapping or braid or web of cotton or jute or other similar material. These covered conductors are then bunched together in any desired number or arrangement and bound together by a fibrous or meshed wrapping of any convenient nature or material to form the so-called "core" of the cable. The core thus constructed is usually placed in a hot-air chamber for the purpose of expelling the moisture present in the fibrous material. The dry core is then commonly treated with a penetrating bath of heated wax or gum or oil, or with heated compounds of wax, resin, asphalt, or similar materials with oil, for the purpose of filling the fibrous structure of the core where applied with such a material as will to some degree remove its hygroscopic nature and seal it against the subsequent absorption of moisture. Finally, the cable-core, having been prepared and treated with the sealing material substantially as above described, is furnished with a protecting-covering as nearly as possible impervious to water, in order to preserve the insulating properties of the core, and of such a chemical and mechanical nature as to resist decay and damage from the external

conditions to which it may be subjected. At present lead pipe is extensively employed as the external impervious protecting-sheath. Various incidental modifications of this process may exist; but the product in all cases is essentially the same. The non-conducting material which separates the several conductors is composed, chiefly, of the fibrous covering first placed upon the wires and the so called "insulating compound" or "sealing material" which has by any of several well-known methods been caused to penetrate and fill up to a great extent the pores and interstitial spaces throughout the fibrous material.

I proceed, in the construction of a cable according to my invention, upon different principles from the foregoing. It is well known that dry air is very much lower in specific inductive capacity than any of the solids which are generally used as the sealing material in this class of cables, and if the air which is already inclosed can be retained and not expelled by the sealing material in applying the latter the desired reduction in specific inductive capacity will be secured.

There are well-known instances where to meet special conditions, cables have been constructed and used in which dry-cotton-insulated cores have been placed in a sheath of lead pipe without other filling than the air which surrounds and penetrates the core, the sealing material being left entirely absent. In these cases the inductive capacity between the wires is found to be low; but such cores are found in practice to be generally unserviceable, chiefly from the fact that any defect or opening in the protecting-sheath, even of a very minute character, renders a considerable length of the core liable to the intrusion of moisture and the consequent loss of insulating properties. It has also been proposed to introduce at intervals in the lead pipe containing such dry cores plugs or lengths of sealing material for the purpose of confining any damage from access of water or moisture within the limits of the section of cable between two adjacent plugs of sealing material. I have devised a form of electrical conductor in which a considerable quantity of air is retained in the insulating-spaces at the same time that the sealing ma-

terial is applied throughout the entire length of the cable.

Accordingly my invention consists, primarily, in an electrical conductor so covered with a fibrous or other separating medium as to afford in the covering numerous interstitial air-spaces, around which is placed a non-conducting envelope capable of confining the air in such spaces and of retarding or preventing application of the sealing material from driving out the air originally inclosed within the insulating structure.

The invention further consists in two or more wires made up in a group, each wire being covered with fibrous or meshed material containing air, with a non-conducting envelope surrounding the group, capable of retarding or preventing the expulsion of the air by the sealing material when it is applied in the manufacture of the cable.

The invention further consists in a cable in which are assembled the individual conductors or groups of conductors independently covered, as above described, by a fibrous, meshed, or honeycombed covering surrounded by a non-conducting envelope, whether or not an external armor of lead or other material is employed.

In the drawings which form part of this specification, Figures 1, 2, and 3 are views illustrating the invention in several modifications. Fig. 4 is a transverse section of one modification. Fig. 5 is a transverse section of a bunched cable, showing a number of separate wires, each insulated according to my invention and all laid into a bunch and an external covering of moisture-proof material. Fig. 6 is a section showing a pair of air-spaced wires having a single moisture-proof sheath. Fig. 7 is a transverse section showing a cable composed of a number of pairs of wires, each pair being arranged and insulated as shown at Fig. 6.

In Figs. 1, 2, and 3 I have shown common methods by which the conductor may be surrounded by fibrous or meshed material in such manner as to embody with it a considerable proportion of air, together with a non-conducting envelope capable of preventing the sealing material when applied from expelling the air contained within the fibrous or meshed structure. In Fig. 1, *a* is the conductor, *b* and *b* are double layers of the fibrous material wrapped thereon, and *c* is a spirally-applied tape of non-conducting material of such a nature—paper, for instance—as to prevent or retard the free penetration of the sealing material. In Fig. 2 the conductor *a* has the braided covering *b*, surrounded by the above-described tape of non-conducting material *c*. In Fig. 3 a single wrapping *b* is used.

In the transverse section, Fig. 4, the conductor *a* is shown surrounded by a covering *b* of fibrous or meshed material and inclosed by an envelope of non-conducting material *c*, to which the sealing material has been applied externally.

Fig. 5 shows a complete bunched cable having the conductors *a*, each insulated in accordance with the above description by the fibrous air-containing covering *b*, inclosed in envelope *c*, and the whole inclosed in the lead sheath *d*, between which and the cable structure is placed the filling of sealing material *e*, so that the latter surrounds individually all the wires of the core without penetrating into the fibrous covering of each conductor.

Fig. 6 shows a group of two wires *a*, each having the fibrous air-containing covering *b* and the envelope *c*, of non-conducting material, surrounding the group, to which the sealing material may be applied.

Fig. 7 shows a telephone-cable made up of groups, each composed of two wires arranged as described with reference to Fig. 6.

In carrying my invention into practical effect I prefer, first, to serve the wire with a hard cord, strip, or string of non-conducting material, preferably of low hygroscopic quality, in whatever manner and to whatever thickness may be required for the particular purpose to which the conductor is to be devoted, provided only that a sufficient volume of air is embodied with this covering, and I wrap about this one or more thicknesses of a close covering—such, for instance, as paper—so as to give the whole structure the requisite smoothness and roundness, and to prevent the sealing material—such as oil, wax, gum, rubber, gutta-percha, or other material or compound—from penetrating in such a manner as to drive out the air from the interior spaces when such substances are applied to the structure for the purpose of insulating and protecting the interior from the admission of moisture.

I claim as my invention—

1. In electric cables of that class in which the conductor is surrounded by a non-conducting covering and a sealing or filling material, the combination of an electrical conductor, a fibrous or meshed air-containing covering for the same, a surrounding non-conducting envelope adapted to confine the contained air, and a sealing material applied to the exterior of the envelope.

2. In electric cables of that class in which the conductor is surrounded by a non-conducting covering and a sealing or filling material, the combination of two or more electrical conductors, each surrounded by a fibrous or meshed air-containing covering, a non-conducting envelope surrounding the group of such wires and adapted to confine the contained air, and a sealing material applied to the exterior of the envelope.

3. In electric cables of that class in which the conductor is surrounded by a non-conducting covering and a sealing or filling material, a cable consisting of a group of electrical conductors, each of which is surrounded, first, by a fibrous or meshed air-containing covering, and, second, by a non-conducting envelope adapted to confine the contained

air, and a sealing material applied to the exterior of each one of the groups constituting the cable.

4. In electric cables of that class in which the conductor is surrounded by a non-conducting covering and a sealing or filling material, a cable composed of separate groups, each group containing two or more wires, each wire surrounded by a fibrous or meshed air-containing covering, and each group of wires surrounded by a non-conducting envelope adapted to confine the contained air, and a sealing material applied to the exterior of each group of wires constituting the cable.

5. In electric cables of that class in which the conductor is surrounded by a non-conducting covering and a sealing or filling material, the combination of a group of electrical conductors, each surrounded by a fibrous or meshed air-containing covering, a non-conducting envelope surrounding the group of such wires and adapted to confine the contained air, a sealing material applied to the exterior of the envelope, and a surrounding sheath of lead.

6. In electric cables of that class in which the conductor is surrounded by a non-conducting covering and a sealing or filling ma-

terial, a cable consisting of a group of electrical conductors, each of which is surrounded, first, by a fibrous or meshed air-containing covering, and, second, by a non-conducting envelope adapted to confine the contained air, a sealing material applied to the exterior of the envelope of each of the wires constituting the cable, and a surrounding sheath of lead.

7. In electric cables of that class in which the conductor is surrounded by a non-conducting covering and a sealing or filling material, a cable composed of separate groups, each group containing two or more wires, each wire surrounded by a fibrous or meshed air-containing covering, and each group of wires surrounded by a non-conducting envelope adapted to confine the contained air, a sealing material applied to the exterior of the envelope of each group of wires constituting the cable, and a sheath of lead surrounding the core thus constructed.

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

JOHN A. BARRETT.

Witnesses:

FERNANDO SOLINGER,
O. F. HIBBARD.