

No. 759,981.

PATENTED MAY 17, 1904.

J. FRISCH.  
ELECTRIC CABLE.

APPLICATION FILED MAY 6, 1902.

NO MODEL.

Fig. 10.

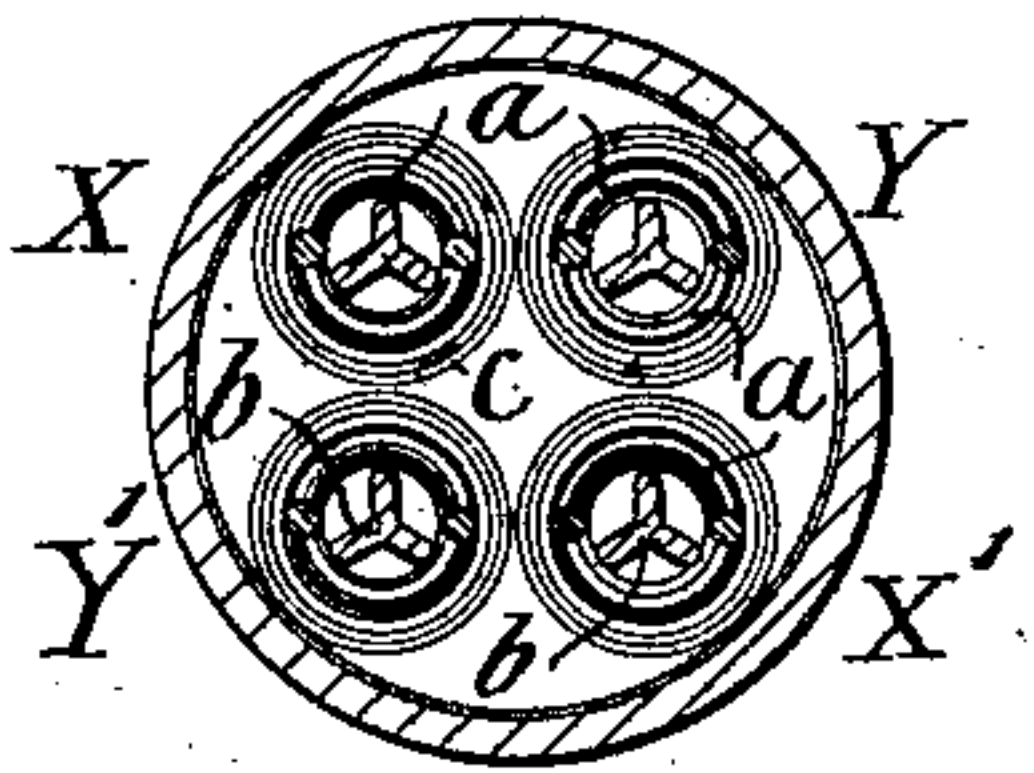


Fig. 9.

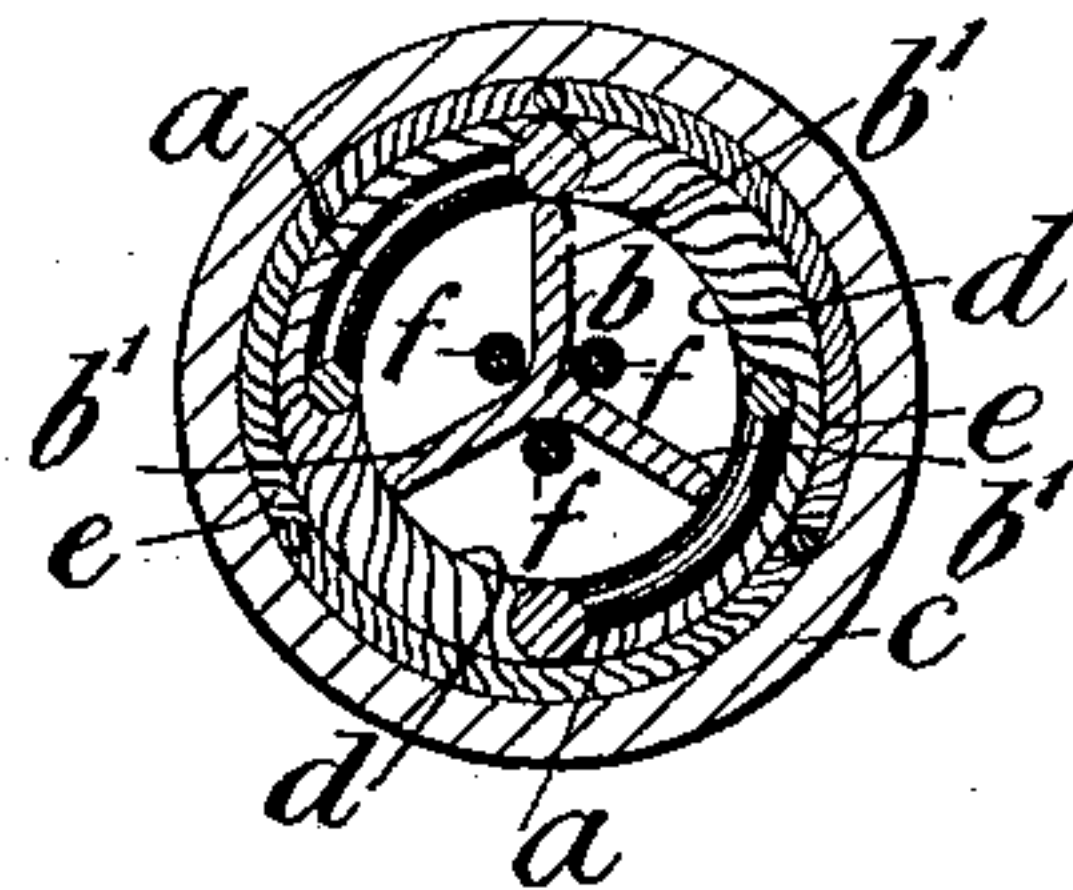


Fig. 2.

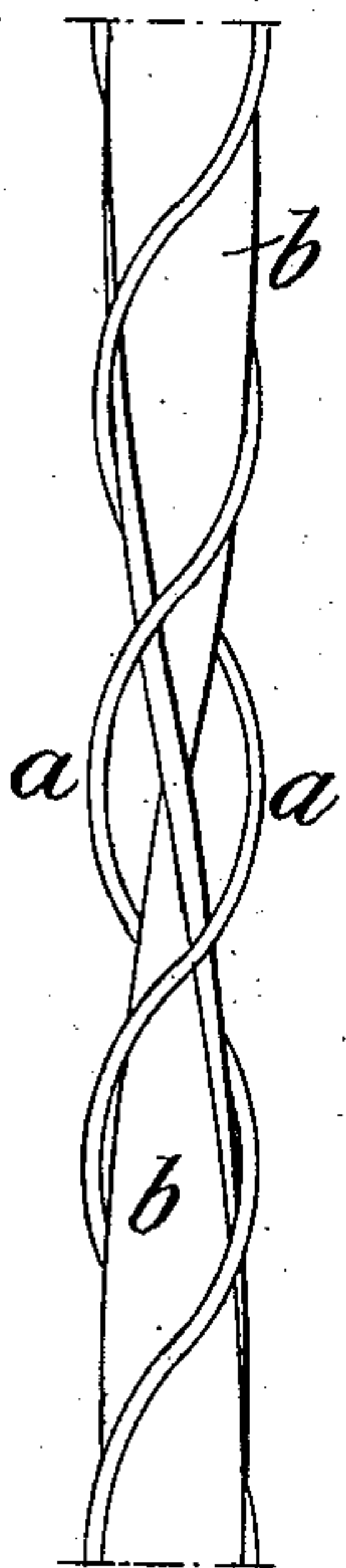


Fig. 4.

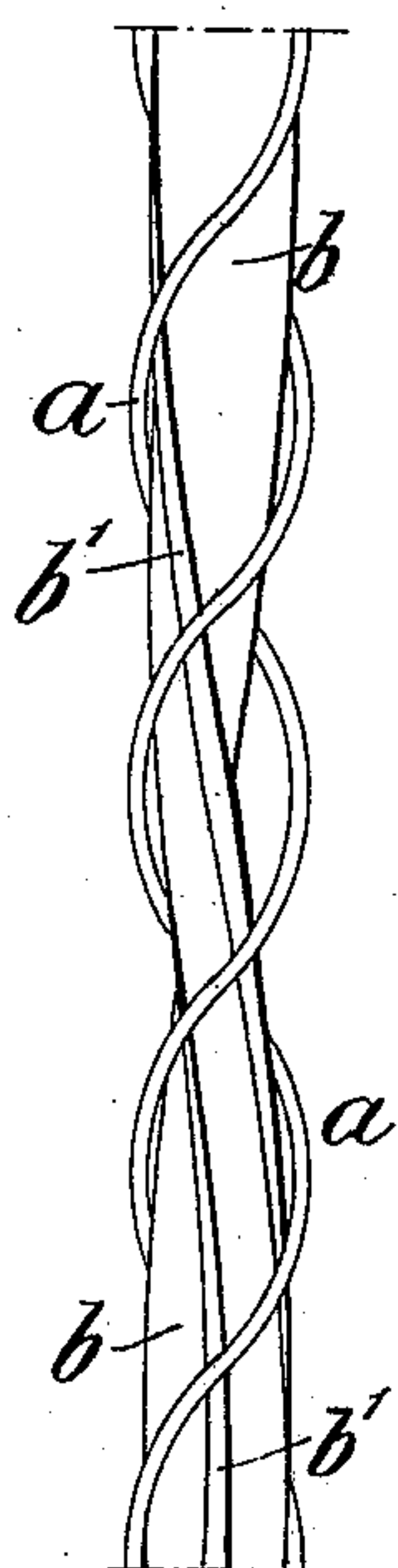


Fig. 6.

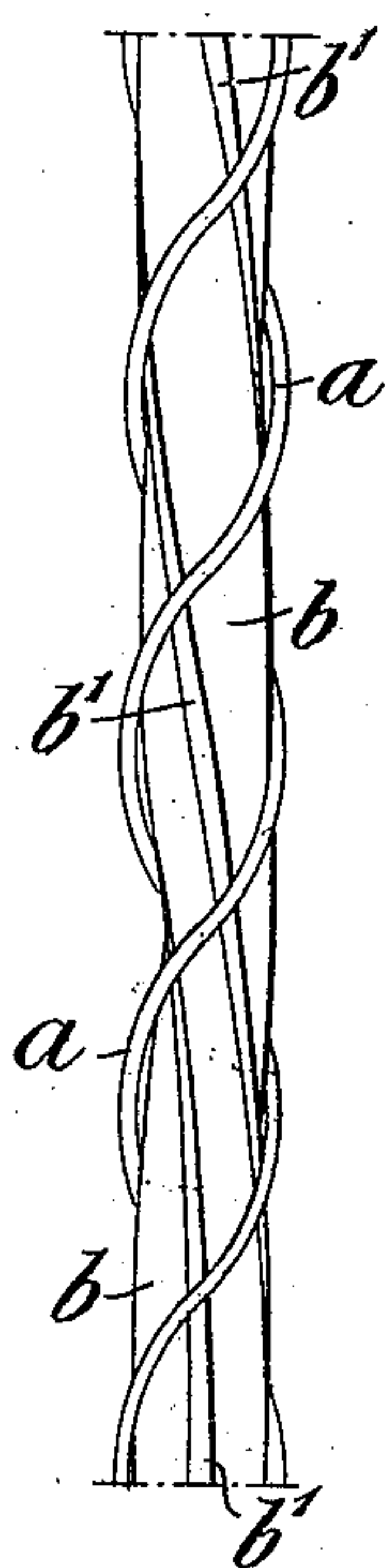


Fig. 8.

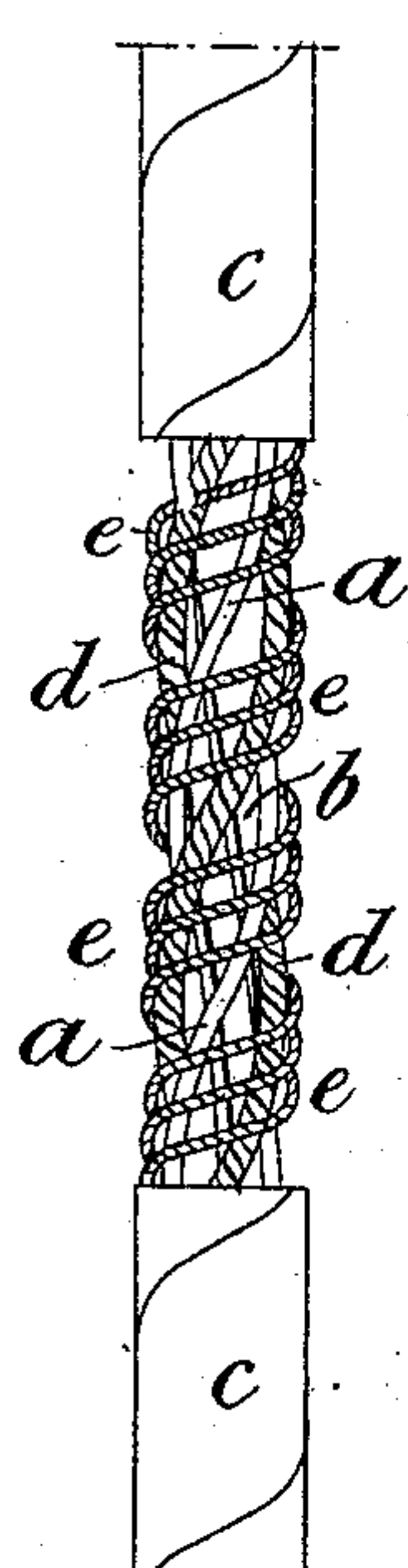


Fig. 1.

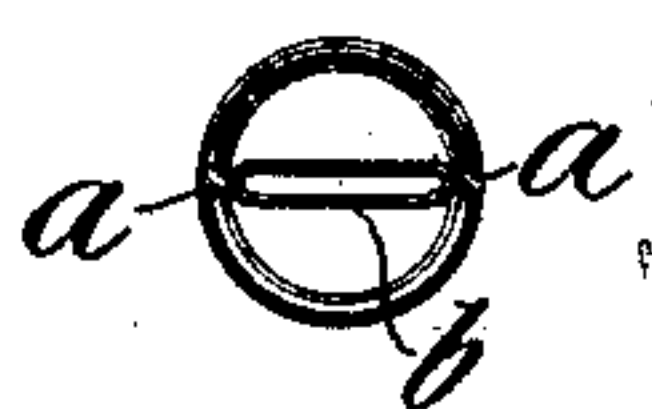


Fig. 3.



Fig. 5.

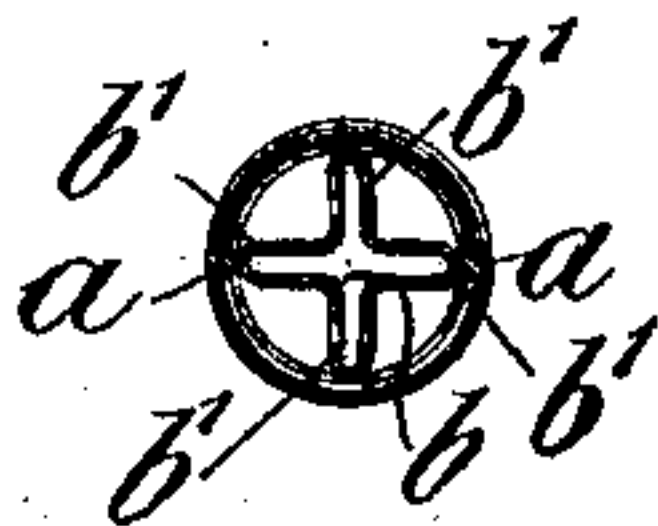
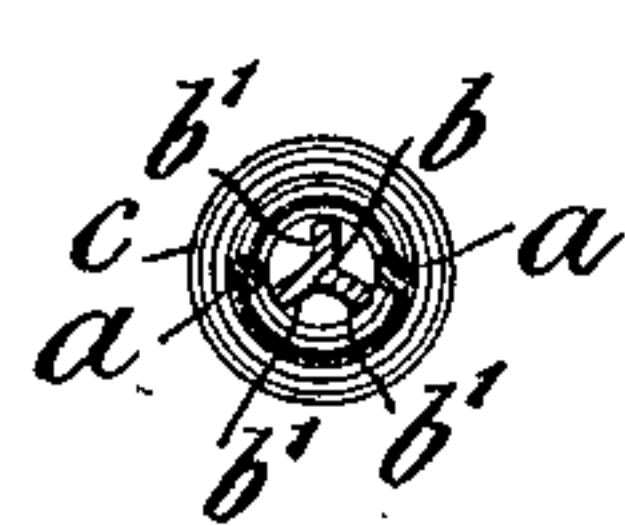


Fig. 7.



WITNESSES:

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# UNITED STATES PATENT OFFICE.

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## ELECTRIC CABLE.

SPECIFICATION forming part of Letters Patent No. 759,981, dated May 17, 1904.

Application filed May 5, 1902. Serial No. 106,018. (No model.)

*To all whom it may concern:*

Be it known that I, JOHANNES FRISCH, a subject of the German Emperor, residing at Mülheim-on-the-Rhine, in the German Empire, have invented new and useful Improvements in Electric Cables, of which the following is a specification.

This invention relates to electric cables or conductors wherein the electrostatic capacity is reduced to a minimum by means of air-spaces, the present improvements being specially applicable in cases where with a view to effecting the above object the points of contact between the conductor and the insulating material are reduced.

In the accompanying drawings, which illustrate "air-space" cables or conductors constructed according to this invention, Figure 1 is a transverse section showing conducting-wires laid up spirally about an insulating-core of flat transverse section. Fig. 2 is an elevation thereof wherein the core is arranged as a spiral. Figs. 3 and 4 are respectively similar views to Figs. 1 and 2, the insulating-core being triangular in transverse section, while in Figs. 5 and 6, which also represent views similar to Figs. 1 and 2, the insulating-core is cruciform in transverse section. Fig. 7 is a transverse section of the construction shown in Fig. 3 served with an outer protective covering. Fig. 8 is an elevation illustrating the means of separating the conductors and of preventing contact between them and the outer covering. Fig. 9 is a transverse section corresponding with Fig. 8 drawn to a larger scale. Fig. 10 illustrates in transverse section an arrangement of four groups of conductors united to form a cable.

In constructing a cable according to the present invention the conducting wire or wires *a a* are laid up spirally about an insulating-core *b*, which may be straight or spiral and of any suitable shape in transverse section—as, for example, flat, triangular, or polygonal, star-shaped or cruciform, the latter shapes being obtained by forming or providing the material of the core with longitudinal ribs or promi-

nences *b'*. The ribs may be rendered spiral by twisting the core, as shown in the drawings, and when such spiral ribs are employed the conducting-wires *a a* are laid up about the same in a spire of opposite winding, whereby the points of contact, which occur at intervals only, are considerably reduced, thus providing ample air insulation, whereby the reduction of the electrostatic capacity of the cable is insured. The conductor may be served with an outer protective covering *c* in any well-known manner, and several conductors may be united or laid up in the usual way to form a cable.

The conducting-wires *a a* may be prevented from coming into contact by means of projections or notches in the core or by cord, tape, paper strip, or similar medium *d*. In the case of the projections or notches on the core the wire would be arranged so as either to bear against the former or to be laid in the latter, while in the case of the cord, &c., *d* this may be laid up between the conducting-wires *a a*, and if its cross section or diameter be greater than that of the wires (see, for example, in Figs. 8 and 9) it will support the outer covering *c*, which may be taping or braiding, without the latter touching the wires *a a*.

In substitution for or in addition to the cord, &c., *d*, above referred to, there may be laid up or wound spirally about the conducting-wires other cords *e e*. Upon the application of the outer insulation or protective covering *c* to the group such covering rests solely upon the cords *d* of larger diameter than and arranged between the conducting-wires *a a* or upon the cords *e e*, which are spirally wound about the said cords *d* and the conducting-wires *a a*. Thus the latter cannot come into contact with the said covering *c* even although the covering may be subjected to external pressure, and there are, moreover, air-spaces intervening between the conducting-wires *a a* and between the latter and the outer insulation or covering *c*.

Instead of employing cord, &c., as above described, iron wires or wire strands, either bare



or served with a thin insulation, may be laid up or spirally wound between or around the conducting-wires, or such iron wires  $f f$  may be laid up in the grooves or angles formed by the ribs  $b'$  of the insulating-core  $b$ , which latter being twisted oppositely to that of the conducting-wires  $a a$  causes the iron wires to frequently cross the paths of the conducting-wires. If wire strands be used in place of the iron wires, the wires of the strands may be insulated from each other by oxidizing, enameling, or similar means. By the use of these wires the self-induction of the conductors is strengthened and the electrostatic capacity further reduced.

The conducting-wires  $a a$  of the groups thus obtained may be employed in any desired connection either as one loop or if they contain iron wires then preferably all the wires of one group for the "flow" and all the wires of another group for the "return." In this instance such two groups may with advantage be twisted in opposite directions or they may be first laid up together and then twisted with the other double groups of the cable. When employing four such groups of conducting-wires united in any well-known manner, as illustrated in Fig. 10, all the conductors of one group—say  $X$ , consisting of one, two, three, four, or more wires—may be used for one current and the conductors of the diagonally opposite group  $X'$  for the return-current either for one loop or for several loops, similar connections being effected as regards the other diagonally opposing groups  $Y$  and  $Y'$ . The groups thus arranged may then be used for superimposing.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. An air-space electric cable having a core of insulating material angular in cross-section, and conducting-wires wound spirally about

the said core, so as to touch the apices of the core only, substantially as herein described.

2. An air-space electric cable having a core of insulating material formed with longitudinal prominences which project radially, and conducting-wires wound spirally about the said core so as to touch the latter exclusively at the points where the wires cross the edges of the said prominences, substantially as herein described.

3. An air-space electric cable having a twisted core of insulating material formed with longitudinal prominences which project radially, and conducting-wires wound spirally about the said core in a direction opposite to that in which the core is twisted, substantially as herein described.

4. In an air-space electric cable the combination with a core of insulating material, formed with longitudinal prominences which project radially, of conducting-wires wound spirally about the longitudinal prominences of said core alternately with windings of cord or the like, an outer winding of wires and a protective covering of insulating material, substantially as set forth.

5. In an air-space electric cable, the combination with a twisted core  $b$  composed of insulating material and provided with longitudinal prominences  $b'$  projecting radially from substantially the axis of the core, of conducting-wires  $a$  and insulating-windings  $d$  and  $e$ , wound spirally about the said core in a direction opposite to that in which the core is twisted, substantially as herein described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHANNES FRISCH.

Witnesses:

CARL SCHMITT,

CHARLES LESIMPLE.