

R. F. HALL.  
ELECTRIC CABLE.  
APPLICATION FILED MAR. 10, 1902.

NO MODEL.

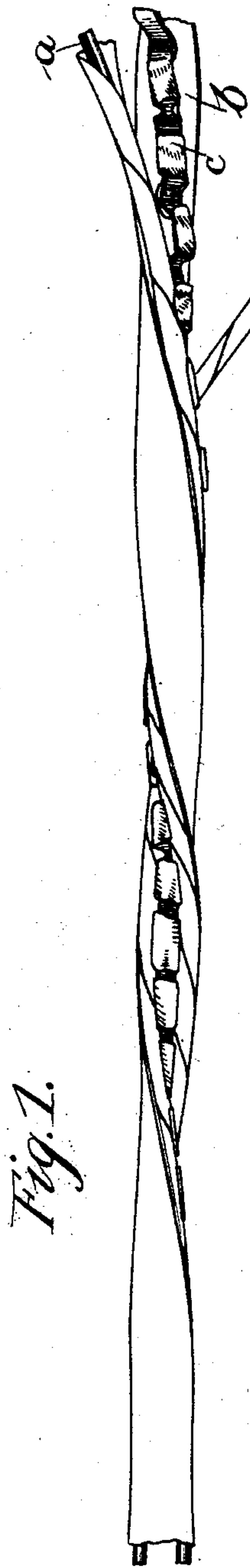


Fig. 1.

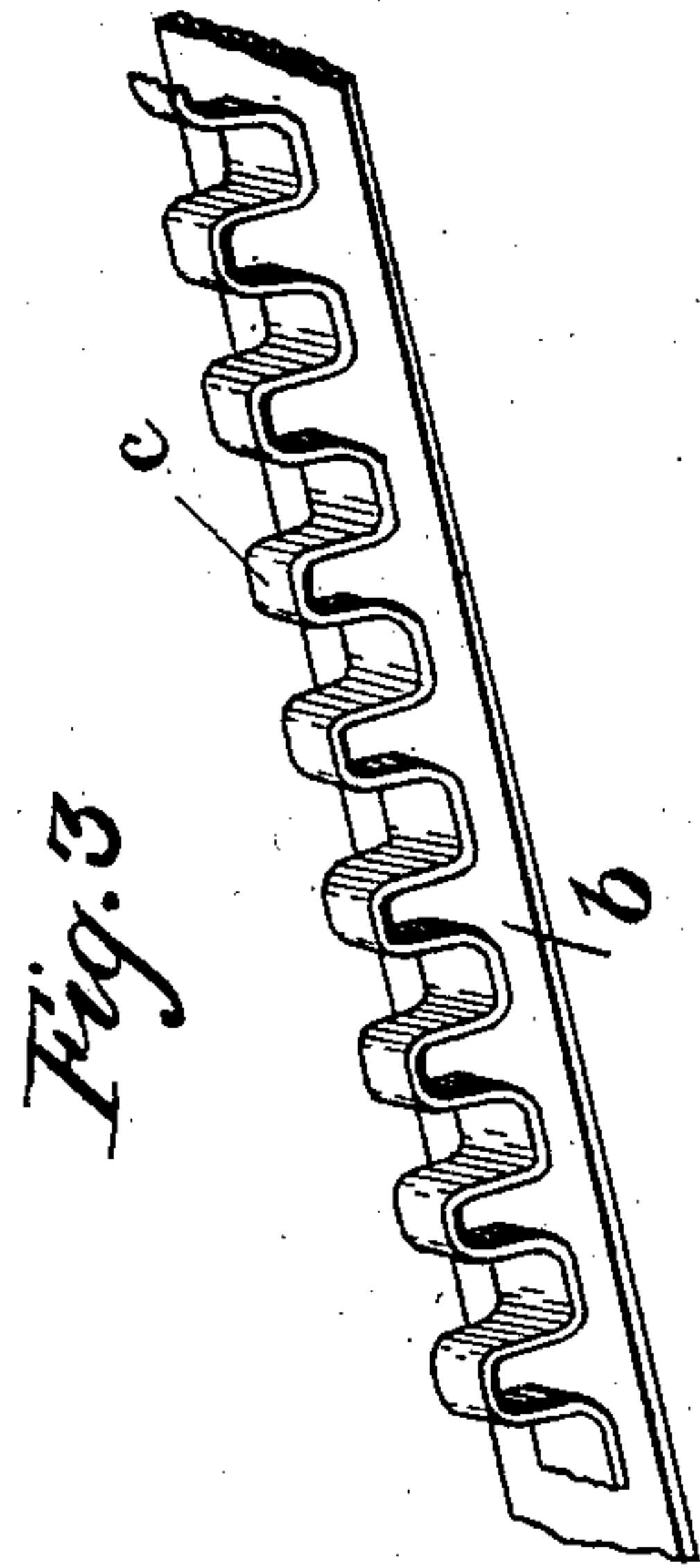


Fig. 3.

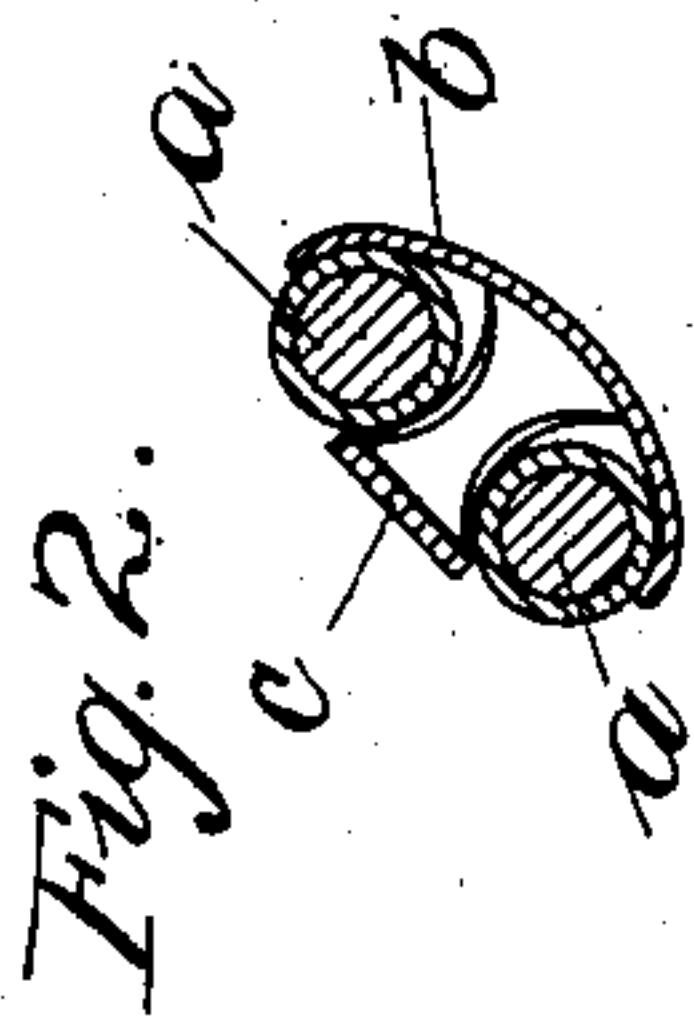


Fig. 2.

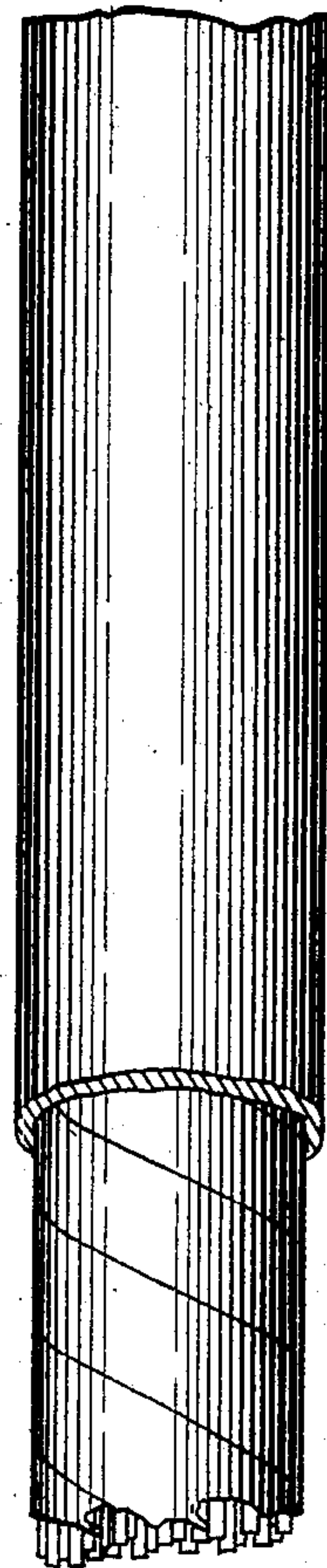


Fig. 4.

Witnesses:

E. H. Ellett, Jr.  
W. H. Leach.

Inventor:

Roderic F. Hall.

By George P. Barton

Attorney.

# UNITED STATES PATENT OFFICE.

RODERIC F. HALL, OF NEW YORK, N. Y., ASSIGNOR TO WESTERN  
ELECTRIC COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION  
OF ILLINOIS.

## ELECTRIC CABLE.

SPECIFICATION forming part of Letters Patent No. 720,023, dated February 10, 1903.

Application filed March 10, 1902. Serial No. 97,409. (No model.)

*To all whom it may concern:*

Be it known that I, RODERIC F. HALL, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented a certain new and useful Improvement in Electric Cables, (Case No. 5,) of which the following is a full, clear, concise, and exact description.

My invention relates to electric cables of the class in which the conductors are made up in pairs, the two wires of a pair forming the two sides of a metallic circuit and being symmetrically disposed with respect to each other and to other circuits for the purpose of eliminating inductive disturbances—as, for example, cross-talk—when the cables are used for telephonic purposes.

My invention is of very great advantage in telephone-cables, such as those employed for long-distance or toll line service, requiring low resistance and at the same time low static capacity. In such cables the conductors are of considerable size, ranging from No. 16 to as large as even No. 9 copper wire.

The object of my invention is to provide for mechanically holding the wires of each pair as far separated as is consistent with keeping the size of the core of the cable within proper compass, while at the same time providing all the air-space possible—that is to say, as a general proposition, the greater the amount of air-space between the wires of a pair the better, since air has a lower specific inductive capacity than any solid material; but some solid insulating material must be interposed to securely hold the wires of the different strands at a uniform distance apart in order that the required symmetrical relation as to position may be maintained with respect to the wires of each pair with each other and with other circuits of the same cable or outside circuits within inductive influence. Different plans have been proposed—as, for example, to thread the wires through disks of paper, wood, or the like material or through notches in such disks; but none of these schemes have been found commercially practicable, principally on account of the liability of the wires of a given pair to become displaced with respect to other pairs, thus bring-

ing one of the wires of a pair a greater distance than its mate under the disturbing influence of some current in a near circuit. In fact, all the plans heretofore suggested or employed for obtaining wide separation, while using a small amount of solid separating material, and thus securing a large amount of air insulation, have not found favor; but resort is still had to the old and common plan of simply twisting the wires directly together in pairs about a common axis, the entire space between them being filled with solid material—that is to say, the old plan of covering the wire with a sufficient thickness of paper or winding of other fibrous material and then simply twisting two wires directly together one upon the other has been heretofore considered the best practice.

Speaking generally, my invention consists in combining with each pair of wires as the wires are being twisted together a strip of specially-prepared paper formed of two portions. One part of the paper is a strip of some width, which I term the “backing.” To one side of this is attached another strip, which is gathered in folds or crimped. The strip forming the backing prevents the displacement of the two wires, while the crimped or looped strip attached thereto presents its edges between the two wires of the pair to maintain the wires at a uniform distance apart. The two wires being twisted together will lie along on each side of the edges of the loops, and the backing will form, as it were, a trough, the wires being thus securely retained in a definite and uniform relation with one another, while leaving a large amount of air insulation between them.

My invention will be more readily understood by reference to the accompanying drawings, in which—

Figure 1 is a plan view of a pair of wires twisted together and held in position by my paper strip. Fig. 2 is a sectional view thereof. Fig. 3 is a perspective view illustrative of my paper strip; and Fig. 4 is a sectional view of a cable the core of which is made up of a number of pairs of conductors.

The copper wires *a a*, constituting the pair of conductors, are first covered with insulat-



ing material, preferably a winding of paper, as shown. The paper strip consists of the backing *b*, to which is glued or otherwise secured the looped separating-piece *c*, as shown.

5 The strip and the wires being thus prepared are then twisted together, as indicated in Fig. 1, so that the edges of the loops will come between the wires of the pair and be somewhat compressed, while the backing will be wrapped

10 about the wires. The wires having thus been formed in pairs are stranded—that is to say, laid up into cores in the usual way. The two wires of each pair are prevented from becoming displaced or separated by reason of the

15 backing *b*, while the loops of the narrower or front piece *c* are interposed to maintain the wires at a uniform distance apart throughout their entire length as to each pair of wires.

I have in practice used Manila paper for the

20 strips, making the backing half an inch wide and the separating or looped piece one-fourth of an inch wide, such widths being suited to wires of No. 12 size, more or less. Other varieties of paper, as that from wood-pulp, may

25 also be employed.

Having thus described my invention, I

claim as new and desire to secure by Letters Patent—

1. Twisted wires *a a* constituting a pair of conductors, combined with the paper strip 30 having the backing *b* inclosing the wires to prevent their separation, and the separating-piece *c* formed in loops and attached to the backing, the edges of the paper forming the loops being interposed between the conduc- 35 tors to maintain said wires at a uniform distance apart, while affording air-spaces between them, substantially as shown and described.

2. An electric cable comprising a core made 40 up of pairs of twisted wires, the wires forming the different pairs being held in position by a paper strip consisting of a backing *b* and a looped separating-piece *c*, substantially as specified. 45

In witness whereof I hereunto subscribe my name this 17th day of February, A. D. 1902.

RODERIC F. HALL.

Witnesses:

A. P. MORRIS,  
ARTHUR LOCKWOOD.