R. F. HALL.

ELECTRIC CABLE.

APPLICATION FILED JULY 24, 1905.

957,506. **Patented May 10, 1910.**

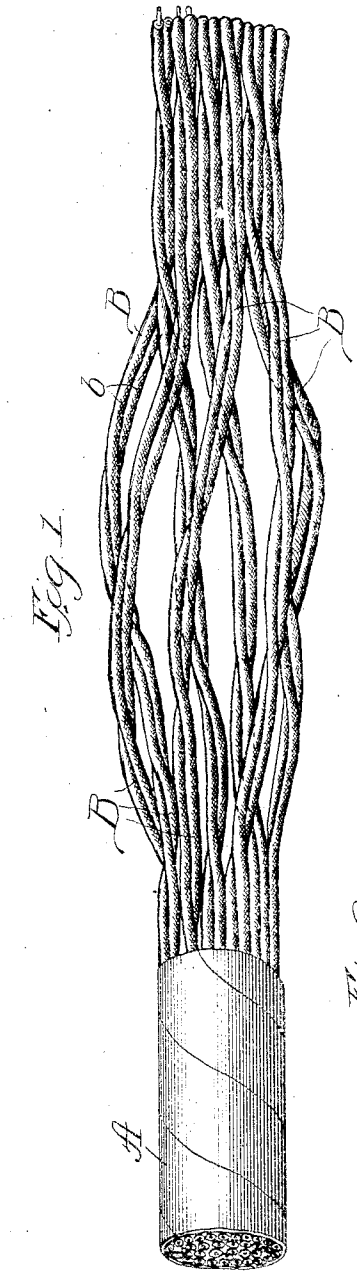

Fig 1.

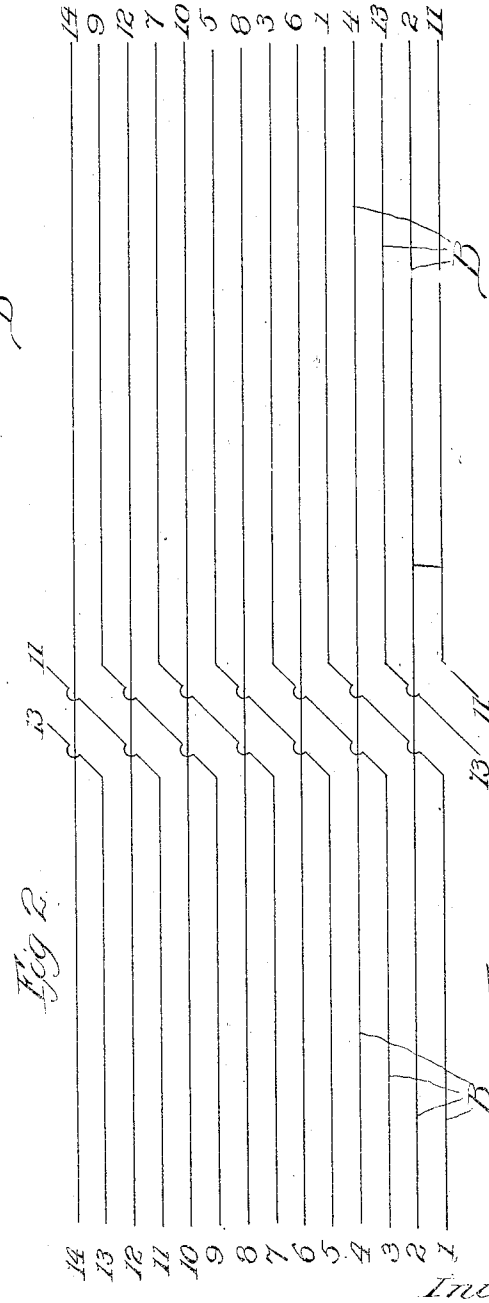

Fig 2.

Fig 3.

Witnesses:
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UNITED STATES PATENT OFFICE.

RODERIC F. HALL, OF EAST ORANGE, NEW JERSEY, ASSIGNOR TO WESTERN ELECTRIC COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

ELECTRIC CABLE.

957,506. Specification of Letters Patent. Patented May 10, 1910.

Application filed July 24, 1905. Serial No. 271,064.

To all whom it may concern:

Be it known that I, RODERIC F. HALL, citizen of the United States, residing at East Orange, in the county of Essex and State of New Jersey, have invented a certain new and useful Improvement in Electric Cables, 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 formed into a core in layers, the two wires of a pair constituting the two sides of a metallic circuit.

The object of my invention is the production of a cable in which a balance in capacity is preserved and in which the relations between the various conductors are such that for all practical purposes there will be no inductive action between the various circuits, thus eliminating inductive disturbances, such, for example, as cross-talk, when the cable is used for telephone purposes.

Briefly, my invention consists in transposing the twisted pairs forming the metallic circuits at intervals so as to change their relative positions, such transpositions being made during the manufacture of the cable at desired intervals in the continuous cable length and not merely at the junction point of said lengths.

My invention therefore comprises a cable, as an article of manufacture, having its pairs transposed with reference to each other at certain intervals in the cable length. It is not necessary to make such transpositions except, for example, at intervals of about every two hundred and fifty feet. The pairs are so transposed that no two pairs are adjacent except for this short distance. Hence if one pair should come under the inductive influence of another, this influence would be destroyed by the change in their relative positions. The two wires forming each pair may be twisted in a series of lays having a variable twist, and I prefer to form the core of pairs twisted in such manner. A cable made up of such pairs is less subject to inductive disturbances than the ordinary cables, there being less likelihood of the wires of one pair coming into parallel relation with the wires of another pair. When, as an additional precaution, the continuous pairs are also transposed at certain intervals the possibility of inductive disturbance is practically removed.

I will describe my invention more particularly by reference to the accompanying drawings, in which—

Figure 1 is a perspective view of a cable section with a portion of the inclosing sheath removed and the wires separated to show more clearly the transposition thereof in said section. Fig. 2 is a diagrammatic view showing the transposition of the pairs of wires with reference to each other. Fig. 3 is a diagrammatic view showing a pair of wires twisted with a variable lay, in accordance with my invention.

The core of the cable A is composed of a plurality of pairs of wires B, each formed of insulated conductors constituting a metallic circuit. In Fig. 3 I have shown the two wires *b b*, forming a pair, twisted together with a variable twist, so as to form a series of lays between the nodes *c*. The length of twist gradually increases from one node *c* to a maximum at the middle of the lay and decreases to the next succeeding node. This series of lays, having variable twists, is repeated successively throughout the length of the pair. I do not wish to limit myself to any particular kind of variable lay, however, and the length of the lay, the length of the longest and shortest twist, and the relative arrangement of the twists in each lay, obviously may be varied as desired.

The transposition of the pairs is shown diagrammatically in Fig. 2. Here a layer having fourteen pairs has one half of its pairs shifted over other pairs at a particular point in the cable lengths. As a result no two pairs which were adjacent before the transposition afterward continue in such relative positions. For example, pair 3, which, prior to the transposition, was between pairs 2 and 4, is shifted so that it lies between pairs 6 and 8. These transpositions, as before stated, are made during the manufacture of the cable, at desired intervals in its length, by shifting the continuous pairs with relation to each other, and without involving any splicing of the several conductors.

The twisting of the wires in variable lays tends to break up parallelism between the conductors of adjacent pairs, and the trans-

position removes a pair from its position between two adjacent pairs before a sufficient amount of parallelism has developed to produce cross-talk.

Having thus described my invention, what I claim is:

An article of manufacture comprising an electric cable made up of insulated continuous wires twisted in pairs, each pair being twisted with a variable lay, and the several pairs being transposed with reference to each other at intervals in their continuity.

In witness whereof, I hereunto subscribe my name this 14th day of July A. D., 1905.

RODERIC F. HALL.

Witnesses:

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GEORGE E. FOLK.