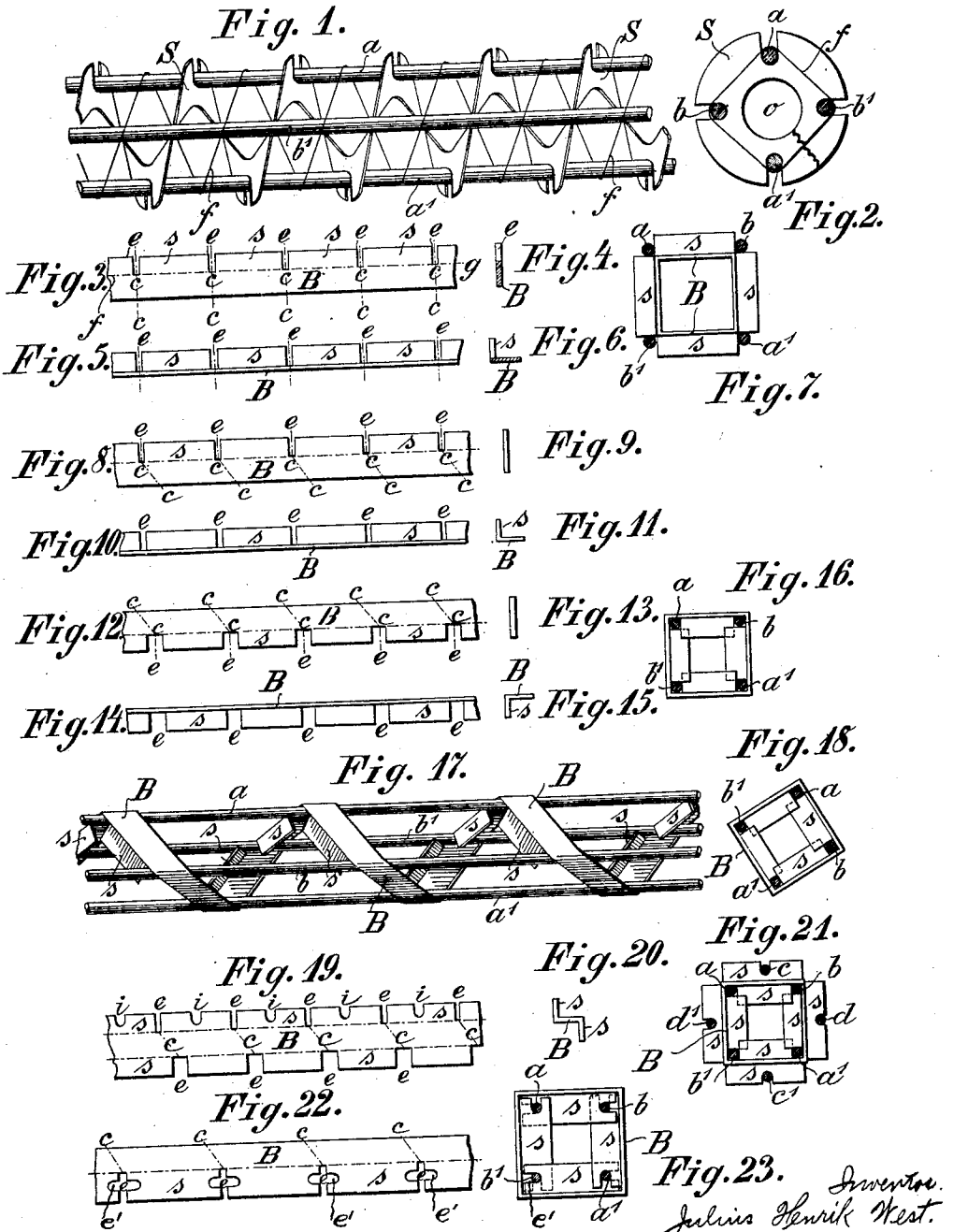


J. H. WEST.  
MANUFACTURE OF ELECTRIC CABLES.

(Application filed Sept. 21, 1901.)

(No Model.)



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# UNITED STATES PATENT OFFICE.

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## MANUFACTURE OF ELECTRIC CABLES.

SPECIFICATION forming part of Letters Patent No. 700,107, dated May 13, 1902.

Application filed September 21, 1901. Serial No. 76,123. (No model.)

To all whom it may concern:

Be it known that I, JULIUS HENRIK WEST, engineer, a subject of the King of Denmark, residing at Halleschestrasse 20, Berlin, Germany, have invented a certain new and useful Improvement in the Manufacture of Electric Cables; 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, reference being had to the accompanying drawings, and to letters of reference marked thereon, which form a part of this specification.

Electric cables for the purpose of obtaining the lowest electrostatic capacity have been designed in which the wires are held apart by thin transverse insulating-walls having notches in which the wires are placed. In this manner the wires are insulated from one another almost entirely by air and can be placed as wide apart as desired without appreciably increasing the cost of the insulation.

The present invention relates to construction according to which the wires rest in notches of a helix made of an insulating substance, as paper or other suitable material. Such a helix can be cut from a tube or can be made in the hereinafter-described manner from a coiled and suitably cut and folded strip of paper or other material.

Referring to the drawings, in which like parts are similarly designated, Figure 1 is an elevation, and Fig. 2 a section, of one form of cable made in accordance with this invention. Fig. 3 is an elevation of a portion of a strip of insulating material provided with notches, and Fig. 4 a section of the same passing through one of the notches. Fig. 5 is an elevation, and Fig. 6 a section, of the strip shown in Figs. 3 and 4 after being folded; and Fig. 7 shows the strips bent to receive the wires. Figs. 8, 9, 10, and 11 are views corresponding to Figs. 3, 4, 5, and 6, showing a modification. Figs. 12, 13, 14, 15, 16, and 17 show a further modification. Fig. 18 is a transverse sectional view of Fig. 17. Figs. 19, 20, and 21 show the two modifications combined, and Figs. 22 and 23 a modification whereby the wires can be locked in position.

Fig. 1 is an elevation, and Fig. 2 a section, of a helix *SS*, which has been cut from a tube, drawn out after cutting, and the wires then in-

serted in the notches. The notches in which the wires rest can be made before or after cutting the tube and can be helically arranged around the tube, so that after having been drawn out the wires are slightly twisted. A thread *f* serves to hold the wires in the notches. Fig. 1 shows such a helix with four wires. The number of wires can of course be varied as desired, so that two, three, four, six, eight, or more wires can be insulated from one another. The construction of such paper coils offers no technical difficulties. Similar helical holders can be made from a paper strip in an equally simple manner. Figs. 3 and 4 show in elevation and cross-section, respectively, a narrow strip of paper with small notches *e*. The strip of paper is first folded on the dotted line *fg*, Fig. 3, so that the notched part is at right angles to the unnotched part, so as to form a strip similar to that shown in Fig. 5 in elevation and in Fig. 6 in section, thereby forming small ribs *s* at right angles to the plane of the strip *B*. If the strip be again folded on the dotted lines *cc* each time by ninety degrees, a frame is formed, as shown in Fig. 7, and in each of the corners *a*, *b*, *a'*, and *b'* of this frame, which is fairly stiff in consequence of the perpendicular ribs *s*, there may be placed a wire. In this manner only continuous four-sided frames would be formed; but if the dotted lines *cc* be drawn obliquely to the longitudinal direction of the strip *B*, as shown in Fig. 8, instead of perpendicularly, as shown in Fig. 3, and the strip be folded on these lines *cc*, so that the planes of the several sections of the strip *B* are at right angles one to another, a strip is obtained which, as in the case of the helix shown in Fig. 1, may be arranged to be coiled within the four wires. Such a helix is not circular in cross-section, but rectangular, as shown in Fig. 7. The paper helix constructed in this manner is located within the four wires, and the ribs are directed outwardly between the wires, as shown in Fig. 7; but the strip *B* can be wound around the wires on the exterior thereof with ribs *s* directed inwardly, so that a cross-section is obtained, as shown in Fig. 16. From this illustration it will be seen that the wires *a* *b* and *a'* *b'* are held locked in their positions by the two adjacent ends of succeeding ribs. For this purpose the notches *e*, Figs. 12 and 14, are made somewhat wider than in the before-mentioned pa-

per strips. Fig. 17 shows a piece of such a paper strip coiled around four wires.

If the paper strip B be provided on each side with ribs *s*, Fig. 19, so as to be substantially Z shape in cross-section, as shown in Fig. 20, of which the ribs on one side are each provided with a special notch *i* and the strip be coiled up helically, a cross-section according to Fig. 21 is obtained in which the standing strip at one side of the web of the Z shape is turned inwardly between wires, while that on the other side of the web is turned outwardly and is adapted to carry wires *c* in the notches *i*. In this case the two types—viz., those illustrated by Figs. 7 to 11 and Figs. 12 to 17, respectively—are combined so as to insulate eight wires from one another by means of a strip of paper.

When the arrangement shown in Figs. 7 to 11 is used, it is necessary, as in the case of Figs. 1 and 2, to coil a single thread helically around the bundle of wires for the purpose of holding them in the notches.

When several bundles of wires as heretofore constructed are combined to form a single cable, it is advantageous to wind a thin strip of paper around each bundle of wires for the purpose of protecting the wires of one bundle from those of the adjacent bundles or to surround it in some other manner with paper. In the case of cables according to this invention, however, it is not necessary to protect all the bundles of wire in this manner; but it is sufficient to coil the paper around each alternate bundle and to leave the other bundles uncovered. Furthermore, similar protection can be attained by forming the notches in a strip, such as shown in Figs. 12 and 14, in the manner shown in Fig. 22. When such a paper strip is coiled in the before-mentioned manner around the wires, a cross-section is obtained such as shown in Fig. 23, where each notch *e* has a transverse notch *e'*, so that the notches will form before folding a substantially cross shape, and after folding each perpendicular rib *s* will have two lateral notches *e'*. In this case the wires are located and securely held or locked so far within the frame of paper that it is impossible for the wires of adjacent bundles to come into contact with one another.

Having thus described my invention, what I claim as new therein, and desire to secure by Letters Patent, is—

1. In combination, a helix of insulating material having notches in its sides and wires held in said notches, substantially as described.

2. In combination, a helix of insulating material having notches in its sides or edges, wires in said notches and a cord to hold the wires in position, substantially as described.

3. In combination, a helix of a continuous strip of insulating material having notches formed in its exterior and interior edges, and wires in said notches, substantially as described.

4. In combination, a helix of insulating material having notches in its sides or edges arranged in a spiral line about the helix and wires held in said notches, substantially as described.

5. In combination, a helix of a flat strip of insulating material folded longitudinally, so as to form an upstanding edge having notches therein, wires in said notches and a cord to hold the wires therein, substantially as described.

6. In combination, a helix of a flat strip of insulating material folded longitudinally, so as to form an upstanding edge having notches in said edge, wires in said notches, the portions of the standing strip between the notches capable of being turned between the wires toward or from the center, substantially as described.

7. A helix of a flat strip of insulating material having two longitudinal folds and both edges of the strip having notches, in combination with wires held in said notches, the parts between the notches on one edge of the strip projecting from the center and those on the other edge toward the center, substantially as described.

8. A helix of a flat strip of insulating material folded longitudinally so as to be substantially Z shape in section and having notches in its edges, in combination with wires held in said notches, the parts between the notches of the strip on one edge projecting between the wires from the center of the helix and those on the opposite edge projecting between the wires toward the center, substantially as described.

9. In combination, a helix of a flat strip of paper folded longitudinally and notches cut from one edge of the strip to the line of fold and notches intermediate them of lesser depth, and wires held in said notches, substantially as described.

10. In combination, a helix of a flat strip of paper having two parallel longitudinal folds and notches in each side of the strip from each edge to the adjacent longitudinal fold, the wires in said notches, the sides of the strip between the notches on one side projecting between wires and outward from the center of the helix, and those on the other side projecting between wires toward the center of the helix, substantially as described.

11. In combination, a helix formed of a flat strip of paper having a longitudinal fold, and cross-shaped notches extending from one edge to said fold to form upstanding portions with lateral notches in said upstanding portions, substantially as described.

In testimony that I claim the foregoing as my invention I have signed my name in presence of two subscribing witnesses.

JULIUS HENRIK WEST.

Witnesses:

WOLDEMAR HAUPT,  
HENRY HASPER.