No. 736,351. PATENTED AUG. 18, 1903.

K. T. BENNET & J. T. JOHANSSON.

ELECTRIC CABLE.

APPLICATION FILED OCT. 25, 1901.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 3.

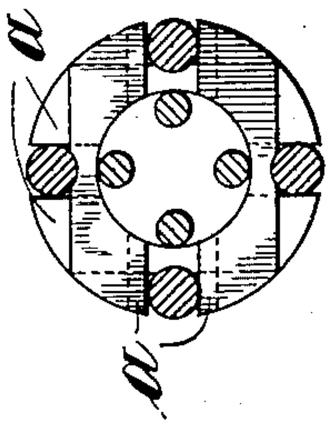

Fig. 4.

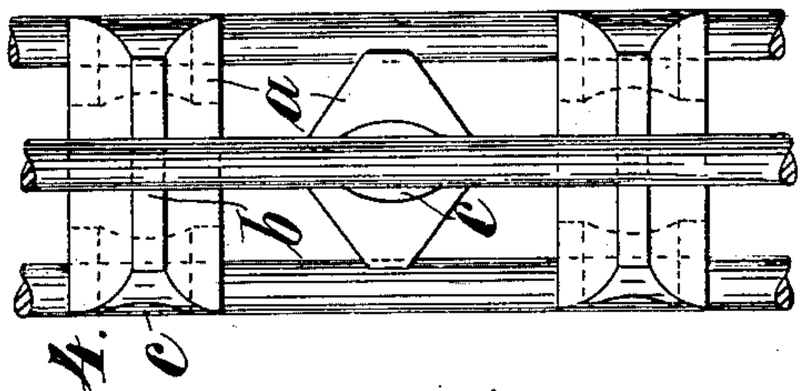

Fig. 2.

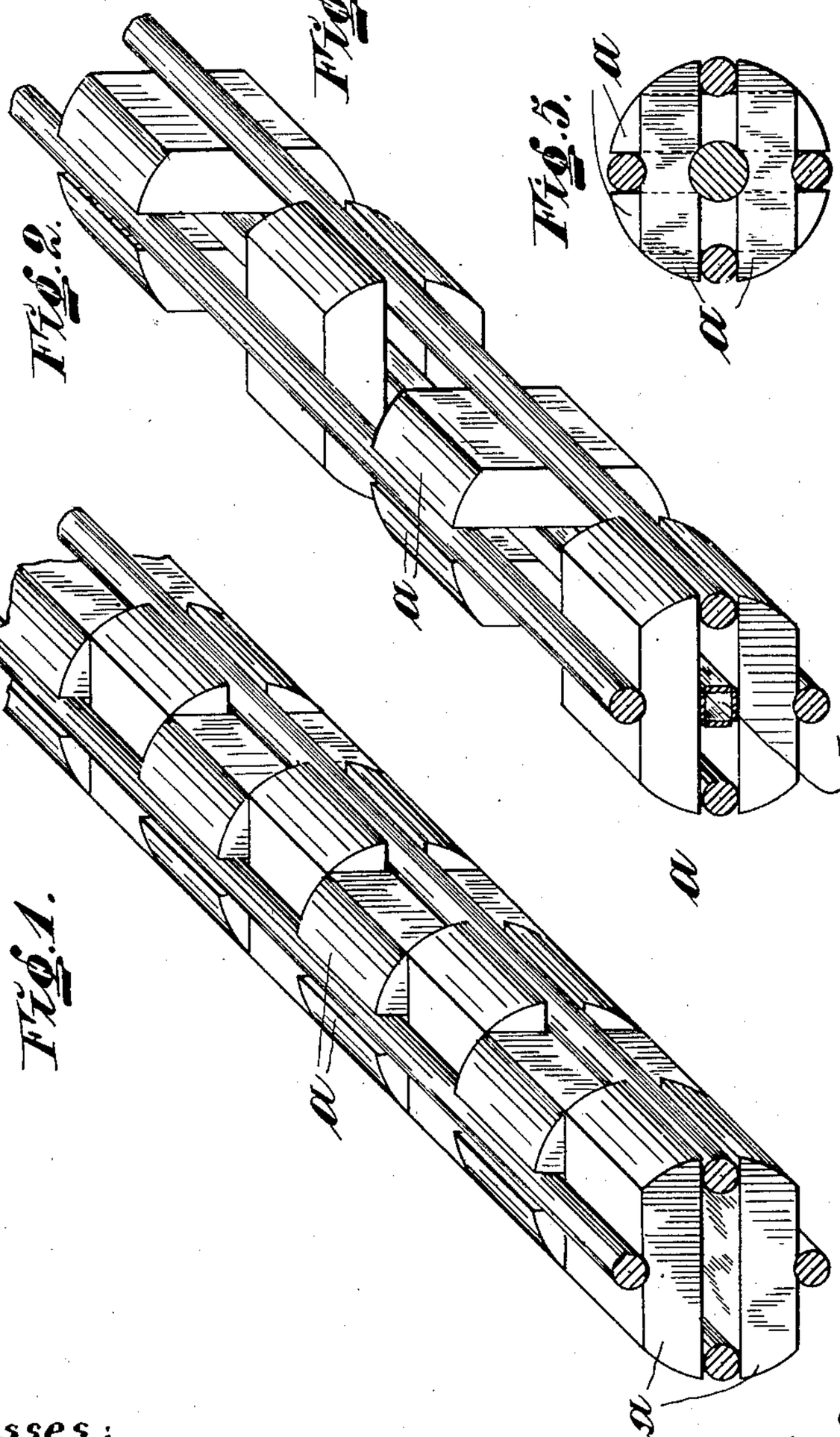

Fig. 5.

Fig. 1.

Witnesses:
H. M. Kuehne
Wm. M. Goldenberg

Inventors
Karl Tomas Bennet
Johan Thure Johansson
By Richards & Co
ATTORNEYS

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NO MODEL. 2 SHEETS—SHEET 2.

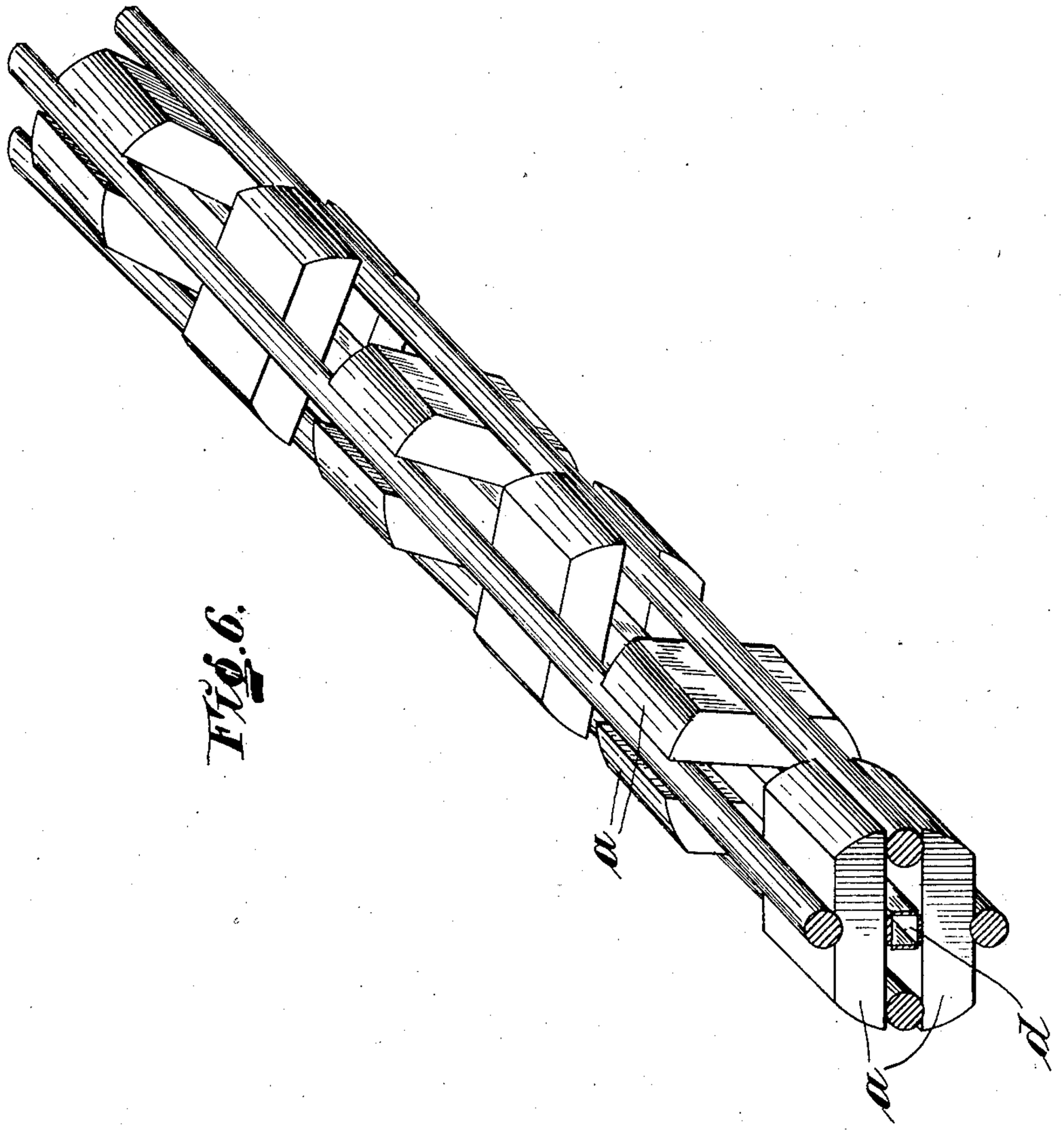

FIG. 6.

Witnesses:

N. M. Kuehnel
Wm. M. Golden Jr.

Inventors
Karl Tomas Bennet
Johan Thure Johansson

By Richards & Co
ATTORNEYS

No. 736,351. Patented August 18, 1903.

UNITED STATES PATENT OFFICE.

KARL TOMAS BENNET, OF HELSINGBORG, AND JOHAN THURE JOHANSSON, OF STOCKHOLM, SWEDEN.

ELECTRIC CABLE.

SPECIFICATION forming part of Letters Patent No. 736,351, dated August 18, 1903.

Application filed October 25, 1901. Serial No. 80,002. (No model.)

To all whom it may concern:

Be it known that we, KARL TOMAS BENNET, engineer, a resident of Drottninggatan No. 37, Helsingborg, and JOHAN THURE JOHANSSON, foreman, a resident of Högbergsgatan 37 C, Stockholm, in the Kingdom of Sweden, subjects of the King of Sweden and Norway, have invented certain new and useful Improvements in Electric Cables, of which the following is a specification, reference being made to the accompanying drawings.

The present invention relates to electric cables, chiefly for long-distance telephoning.

The purpose of the invention is to construct the cables in such a manner as to give them a high power of resistance to external pressure, while they possess great flexibility and a small electrostatic capacity. These results are gained by using distance-pieces of special construction and of suitable insulating material for holding the wires in their proper relative position.

Cables constructed in accordance with this invention are illustrated in the accompanying drawings.

Figure 1 shows a perspective view and a section of such a cable. Fig. 2 shows in like manner a modified arrangement of the cable shown in Fig. 1. In Fig. 3 is shown a section, and in Fig. 4 a side view, of still another modification, while Fig. 5 represents a section of a cable in which the inner wires shown in Fig. 3 are substituted by a single telegraph-wire. Fig. 6 is a perspective view showing a sufficient length of cable to indicate the twist of the wires. In all figures the covering serving to insulate the wires outward and protect them from external influences is left out for the sake of clearness.

In the cable shown in Fig. 1 the four wires are kept in their proper relative position by pieces *a*, consisting of an insulating material—for instance, wood, fiber, or ebonite—and forming parts of a cylinder, so that the cable-covering can be applied directly around the distance-pieces *a* and the conductors, whereby the diameter of the cable will not be greater than what is just necessary. The distance-pieces are arranged in pairs opposite each other in such a manner as to cause each pair to embrace or clamp in place two wires belonging to the same circuit, (and consequently diagonally opposite each other,) while the two remaining wires belonging to the other double-wire circuit will bear on the outsides of same distance-pieces. Two succeeding pairs of distance-pieces are arranged crosswise, so that the two wires placed between the distance-pieces at one pair will fall outside at the next pair, while the two wires falling outside at the first pair of distance-pieces will be between the distance-pieces at the next pair.

By the term "double-wire circuit" is meant that the two wires form the positive and negative wires or conductors of the circuit, and, as shown, the two wires belonging to the same circuit are arranged diagonally opposite each other.

In the cable shown in Fig. 2 the distance-pieces *a* are arranged in the same manner as in the cable shown in Fig. 1, excepting that the respective pairs of distance-pieces are placed at some distance apart and not close together, as shown in the latter figure. When the pairs of distance-pieces are apart from each other, the total surface of contact between the wires and distance-pieces in a given unit of length will evidently be smaller than when the pairs of distance-pieces are close together, and thus the electrostatic capacity of the cable will in the former case be smaller than in the latter, while at the same time the weight per unit length of the cable will be smaller and its flexibility increased. The electrostatic capacity of the cable can be still further reduced by giving such shape to the distance-pieces that their surfaces of contact with the wires will not exceed what is necessary for a steady support and retention of the wires or conductors. For this purpose and with a view to diminish the weight of the cable the distance-pieces may be made as shown in Fig. 3 and particularly in Fig. 4. The distance-pieces (shown as examples in these figures) are so shaped that their sections, taken parallel to the plane of the wires passing outside the same, are tapering outward, (see Fig. 4,) so that the bearing-surfaces *b* offered by them to the wires at their outside will extend but slightly in the longitudinal direction of the cable. At the in-

ner and each other facing surfaces of contact between the distance-pieces and the wires are recesses *c*, so that contact occurs between the pieces and wires only near those edges of the pieces which run transversely in the cable. The total surface of contact per unit of length between the distance-pieces and the wires, and consequently the electrostatic capacity of the cable, is accordingly reduced to a minimum without diminishing the security of the position of the wires in the cable.

As shown in Figs. 1, 2, and 3, the wires may be slightly sunk into the distance-pieces at the surfaces turned outward, (and evidently also at those turned inward,) the wires being thus kept more securely in position. When the wires are held in position in the cable in the manner stated, a longitudinal central space is formed in the cable, which space may be used for receiving either any other wires for short-distance telephoning, Fig. 3, or a single conductor or wire for telegraphing, Fig. 5.

In Fig. 2 are shown strips *d*, to which the distance-pieces are pasted (or secured in other manner) so as to be brought into their proper distances apart when put together with one another and with the wires in the manufacture of the cable.

Having now described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. In cables, consisting of four wires, which are arranged in the form of a square in cross-section, and the diagonal ones of which form a double-wire circuit, distance-pieces consisting of an insulating material and arranged in pairs, each pair clamping the wires of the one double-wire circuit, while the wires of the other double-wire circuit rest against the outwardly-turned sides of the same pieces, any two successive pairs of distance-pieces being arranged crosswise to one another.

2. In cables, consisting of four wires, which are arranged in the form of a square in cross-section and the diagonal ones of which form a double-wire circuit, distance-pieces consisting of an insulating material and arranged in pairs, each pair clamping the wires of the one double-wire circuit, while the wires of the other double-wire circuit rest against the outwardly-turned sides of the same piece, any two successive pairs of distance-pieces being arranged crosswise to one another, and a plurality of wires located in the central space, formed by the distance-pieces.

3. In combination, four wires arranged in the form of a square in cross-section, and the diagonal ones of which form the positive and negative wires of a circuit distance-pieces of insulating material arranged in pairs, each pair clamping the wires of one circuit and having the wires of the other circuit resting against their outer sides, and a wire conductor arranged within the square formed by the four wires, substantially as described.

In witness whereof we have hereunto set our hands in presence of two witnesses.

KARL TOMAS BENNET.
JOHAN THURE JOHANSSON.

Witnesses:
HANS B. OHLSSON,
CARL TH. SUNDHOLM.