

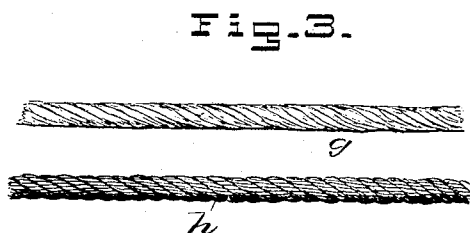
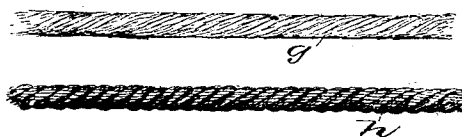
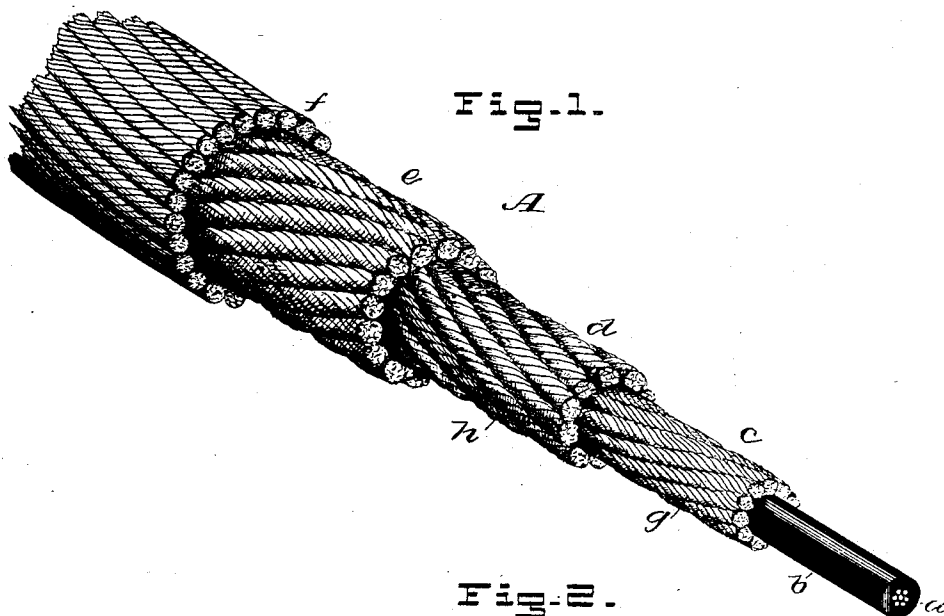
(No Model.)

S. TROTT & F. A. HAMILTON.

SUBMARINE TELEGRAPH CABLE.

No. 271,548.

Patented Jan. 30, 1883.



WITNESSES:

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UNITED STATES PATENT OFFICE.

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SUBMARINE-TELEGRAPH CABLE.

SPECIFICATION forming part of Letters Patent No. 271,548, dated January 30, 1883.

Application filed March 24, 1882. (No model.) Patented in England July 4, 1882, No. 3,142.

To all whom it may concern:

Be it known that we, SAMUEL TROTT and FREDERIC ADAM HAMILTON, both of the city of Halifax, in the Province of Nova Scotia, in the Dominion of Canada, have invented a new and useful Improvement in Submarine-Telegraph Cables, of which the following is a specification.

Our invention relates to submarine electric cables; and it consists in a cable composed of a central insulated conductor and a series of spiral or helical servings of non-metallic fibers, yarns, or cords laid alternately left and right, the fibers, yarns, or cords of each serving being twisted in a direction the reverse of that in which they are wound about the conductor.

In the accompanying drawings, Figure 1 represents a short section of our improved cable, showing the successive layers or servings, the direction in which they are wound or laid about the conductor, and the direction in which the yarns or cords of each serving are twisted; Figs. 2 and 3, separate yarns or cords, enlarged.

Submarine cables are liable to injury from a variety of causes, as is now well understood, and as a consequence repairs have frequently to be made, involving difficulty and expense and working delay and vast injury to business and public interests in general. We have had a great deal of personal and practical experience in the laying and repair of ocean-cables, and have thus been enabled to observe and to closely study the causes of deterioration therein, and the primary cause we find to be the corrosion of the wires or metallic strands almost universally employed, producing at once a weakening of the wires or their complete disruption, and a chemical action which eats away the other matters of which the cables are composed. The use of wires was, however, for a long time deemed essential in order to give the required weight and strength to the cable, and to prevent knuckling or kinking, and by most persons is still deemed of vital importance. By practical tests and experiments we have, however, succeeded in demonstrating that the use of wires other than the central conductor is not only unnecessary but is highly undesirable, and that a cable com-

posed simply of an insulated central conductor and a series of right and left spiral servings of non-metallic fibers will last a great length of time without liability to deterioration or injury, provided the yarns or cords of each serving be twisted in a direction the reverse of the winding of the spiral serving which they form. This point or feature constitutes the gist and substance of our invention, and, though at first sight apparently a trifling consideration, is vital to the success of the plan, and without its observance it is impracticable to produce a cable which will answer for practical and actual use under water in the manner of ordinary ocean-cables. The reason of this is that if the yarns or cords of each serving be similar—that is to say, if they be twisted in the same direction in forming them—the cable will kink or knuckle in use, notwithstanding the servings be wound alternately in left and right hand spirals about the conductor, and as a consequence the conductor will be forced out through the side of the cable and through the insulating sheath or covering which surrounds it within the windings or servings. That this is a fact has been demonstrated by actual experience. By our plan the twist of the yarn or cord counteracts the spiral winding of the yarn or cord about the cable, so that instead of depending upon the reversal of the spirals to balance the twisting or kinking tendency the yarns or cords of each serving are made to accomplish this object, which is done most effectually.

It will be seen that where the yarns or cords of each layer or serving have individually the same twist, the twist will be beneficial in alternate layers or servings, but highly injurious in all the intermediate servings, because in the latter the twist and the direction of winding about the core will be the same. Hence there will be two forces working together in the intermediate layers to produce a twisting of the cable in one direction, and two forces working against and counterbalancing each other in the remaining and alternating courses. Thus there will be in one direction practically no tendency to twist, and in the other a strong tendency so to do, produced by the joint and similar action of the lay of the spirals and the

twist of the strands of which the spirals are composed.

A cable consisting of an insulated central conductor and a series of spiral servings of non-metallic fibers or yarns wound alternately to the right and to the left was patented several years since in England, and an experimental cable was constructed in accordance with the patent; but we are informed that said cable was abandoned because rendered worthless by the kinking or knuckling of the cable, as above explained, and was therefore abandoned.

Referring now to the drawings, A represents the cable as a whole, composed of a central conductor, *a*, enveloped by a sheath or insulating-covering, *b*, of gutta-percha or other insulating substance, and a series of spiral servings, *c d e f*, wound alternately left and right, as shown in Fig. 1. As also shown in Fig. 1 and again in Figs. 2 and 3, each serving is formed of yarns or cords twisted in a reverse direction to that in which it is laid or is to be laid upon the cable.

In some cases the servings may be formed wholly of yarns—that is to say, of simple straight fibers twisted together, as at *g*—and in others the twisted strands will be in turn twisted together to form a cord or fine rope, as at *h*; but in the latter case the twisting together of the several prepared stands must be in a reverse direction to the twist of the fibers in forming such stands, and the final twist of the cord must be in a direction opposite to that in which the spiral formed of it is to lie.

We do not claim broadly a cable composed of a central insulated conductor and an enveloping body composed wholly of non-metallic fibers; nor do we claim such a cable when the spirals are laid alternately in reverse di-

rections, but composed of yarns, strands, or cords twisted in one and the same direction, such construction being old and, in our opinion, worthless.

The servings will be coated, saturated, or filled with tar, bitumen, asphalt, or other cheap and durable insulating material, and may be wrapped with yarn, tape, or other binding material, or used without, as preferred, such matters depending upon the circumstances of each particular case in which the cable is to be used.

It is obvious that the laying on of the spirals may begin either to the right or to the left, the essential point in this regard being that succeeding spirals shall reverse their directions.

Having thus described our invention, what we claim is—

1. A submarine electric cable consisting of an insulated conductor and a series of spiral servings of non-metallic cords or yarns wound spirally about said core in alternate right and left hand spirals, the cords or yarns of each serving being twisted in a direction the reverse of that in which the serving is wound about the conductor.

2. The herein-described cable, consisting of core *a*, insulating-envelope *b*, and servings *c d e f*, of non-metallic yarns or cords, the yarns or cords of servings *c e* being twisted in a right-hand direction and laid in left-hand spirals, and those of servings *d f* being twisted in a left-hand direction and laid in right-hand spirals, or vice versa.

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