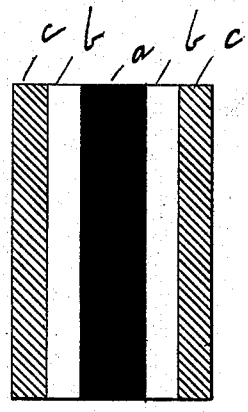
(No Model.)

J. J. WILLIAMSON.

MANUFACTURE OF COMPOUND ELECTRIC WIRE.

No. 295,966. Patented Apr. 1, 1884.



Jno J Williamson
INVENTOR

WITNESSES
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UNITED STATES PATENT OFFICE.

JOHN J. WILLIAMSON, OF BOSTON, MASSACHUSETTS.

MANUFACTURE OF COMPOUND ELECTRIC WIRE.

SPECIFICATION forming part of Letters Patent No. 295,966, dated April 1, 1884.

Application filed July 23, 1883. (No model.)

To all whom it may concern:

Be it known that I, JOHN J. WILLIAMSON, of Boston, in the county of Suffolk and State of Massachusetts, a citizen of the United States, have invented a new and useful Improvement in the Manufacture of Compound Electric Conductors, of which the following is a full, clear, and exact description, reference being had to the drawing which accompanies this specification as a part thereof.

Compound electrical conducting-wire has heretofore been principally made by plating steel or iron with copper by electrolysis and reducing it by drawing, or leaving it unreduced and the copper uncondensed, or by winding iron or steel wire with copper ribbon.

In order to facilitate the manufacture and decrease the liability of fracture, I employ a wire of combined iron and steel, made in the usual way, and reduced to wire billets and rods and then plated by electrolysis. By this means the steel forms the center of the wire, the iron is exterior to the steel, and the copper is exterior to the iron.

The usual way of making what is technically known as "combined iron and steel" is by inclosing the steel in an iron envelope, and then, after heating, reducing the envelope, which may be considered as an iron crucible, and the steel contained in it together. By this means a perfect union of iron and steel is obtained of uniform or nearly uniform coefficience of extension, and the iron exterior has a higher degree of electric conductivity than the steel core, and of course any quality of strength and durability can be secured. This basis of compound iron and steel is a good electric conductor in itself, and a copper surface will increase its conductivity, while the steel core gives great supporting strength and the iron a high modulus of fragility, while the modifications of the tensile strength are much less at atmospheric changes of temperature than in iron or steel alone. Of course, the copper plating may be done upon wire and the wire immediately used without wire-drawing; but in such case there would be that liability of occluded hydrogen to act as a resistance in the passage of the current from any defects of plating, which would be partially, if not wholly, excluded if the wire were drawn or passed through a die and condensed, and there would be less certainty of a continuous copper conductor if the wire were not passed in a die after plating with copper than if it were, because copper is one of the metals which flows when cold under compression and work. I prefer, in order to get results, to plate the billet or wire rod of combined iron and steel, rather than the wire, and to plate a wire of a larger diameter than I propose to use and draw it to size, rather than plate it and then use it without drawing. Having plated the wire or wire-rod or large wire with copper, I then draw it to the requisite size, and the copper, iron, and steel will reduce proportionately.

If desired, and in many cases it would probably be best, the combined iron and steel wire may be "galvanized" with zinc or tin before being plated with copper. By this means a very perfect connection will be made between the copper and the iron, and if tin be used, as tin is a metal of low conductivity, the electric current will be carried mostly by the copper.

Of course, in wire-drawing a copper-coated billet, rod, or wire to its requisite size, if there be any steel employed in the article to be drawn, it will be necessary to anneal the material from time to time. Now, if copper be plated directly upon steel, the melting-point of steel and the melting-point of copper being much nearer to each other than the melting-point of copper and the melting-point of iron, in annealing there will be more danger of the steel taking up the copper and the copper taking up the steel than in cases where iron and copper are in contact, and much more than in cases where iron and tin and copper and bronze are in contact, as in the case where tin film is placed on iron first, or in other ways, the copper and steel injuring each other; hence it will readily be seen that the employment of combined iron and steel, in which iron is necessarily upon the exterior of the steel, is greatly different from the employment of steel alone, and that it facilitates the manufacture.

There is very little difference between the tensile strength of steel and of combined iron and steel under favorable circumstances. At temperatures and conditions which are less favorable the tensile strength of combined iron

and steel has been shown to be most advantageous, and it is not so liable to fracture at low atmospheric temperatures as steel.

The drawing illustrates an enlarged longitudinal section of the wire described.

a is the steel center. *b* is the iron exterior, and *c* is the copper covering.

The thickness of the steel, of the iron, or of the copper can readily be regulated—those of the steel and of the iron in the early stages of manufacture; that of the copper in the deposit made by the battery.

I claim as my invention and desire to secure by Letters Patent of the United States—

1. The improved electrical conductor herein described, consisting of a combined iron and steel core, of which steel is the central thread, with a copper envelope, substantially as and for the purposes described.

2. The improved electrical conductor herein described, consisting of a combined iron and steel core, of which steel is the center thread, plated with zinc, tin, or other proper material, and provided with a copper envelope, substantially as and for the purposes described.

JNO. J. WILLIAMSON.

Witnesses:

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