UNITED STATES PATENT OFFICE.

CHARLES B. THWING, OF GALESBURG, ILLINOIS, ASSIGNOR TO LOUIS S. LANGVILLE, OF NEW YORK, N. Y.

THERMO-ELECTRIC ELEMENT.

SPECIFICATION forming part of Letters Patent No. 704,595, dated July 15, 1902.

Application filed June 14, 1901. Serial No. 64,533. (No specimens.)

To all whom it may concern:

Be it known that I, CHARLES B. THWING, of Galesburg, in the county of Knox and State of Illinois, have invented a new, original, and useful Improvement in Thermo-Electric Elements, of which the following is a specification.

My invention relates to the construction of thermo-electric elements; and its object is to increase the electromotive force, to render them more durable, and to cheapen their cost.

It is well known that the electromotive force generated by the unequal heating of the junction of a thermo-electric pair is very small, and it has been sought to find such alloys of metals as would make this electromotive force as large as possible. In the past attention has been directed mainly to the electropositive element of such pairs, which has usually been made of an alloy of antimony and another metal or metals, most commonly an alloy of antimony and zinc. While the alloys of antimony give an electromotive force as high as one-tenth volt when heated to a temperature not far below their melting-point, they have been found in practice to present such faults as to render them practically useless. Among the disadvantages incident to their use may be mentioned their high resistance, their low melting-point, and their fragile nature, owing to their crystalline structure. It has been necessary, therefore, to make such elements large both for conductivity and strength and to use extreme care not to heat them to a high temperature for fear of melting them. A yet more serious obstacle to the use of such alloys is the impossibility of joining the two elements of a pair in any manner that would not rapidly deteriorate and cause a fall in the output of the generator so great as to render it practically useless after a few months of use. I have therefore adopted for the positive element a metal as refractory as the nickel alloys commonly used for the negative element and have sought to increase the electromotive force by finding suitable alloys of nickel for said negative element. Thus if iron be used for the positive element it will give with a suitable negative element an electromotive force about one-half as high as that obtained from the antimony and zinc alloy, while at the same time possessing such superior conductivity and strength that four such elements occupy no more space than one of the antimony-zinc elements having an equal resistance, while the strength is enormously greater.

Another feature of importance resides in the fact that the high melting-point of the metals I use makes it possible to braze the joints together, thus enabling them to be heated to a red heat in use without in the slightest degree impairing either the mechanical strength or the electrical conductivity of the junction.

For the positive element, as above stated, I employ iron or any alloy in which iron predominates. For the negative element I employ an alloy of nickel and copper of the chemical composition Ni_3Cu_2, having the proportions, by weight, of seventeen hundred and forty-six parts nickel to twelve hundred and sixty-four parts copper. It will of course be understood that these exact proportions may be deviated from to some extent without greatly impairing the electrical qualities of the alloy. This alloy is very strong, ductile, and practically non-oxidizable. The pair may be assembled in any preferred form, the nature of the materials used being such as to readily adapt them to use in any desired situation. The elements may be cast one upon the other or joined by brazing or other hard-soldering. An alloy of copper and antimony in the proportions of nine of copper to one of antimony which has a melting-point slightly below that of copper may be employed for the solder, or copper itself may be used therefor, since its melting-point is lower than that of either of the metals used for the elements. The higher the melting-point of the solder the higher the temperature that may be employed in the operation of the generator.

I claim—

1. A thermo-electric couple, the negative element of which consists of an alloy of nickel and copper of the composition Ni_3Cu_2.

2. A thermo-electric couple having iron as the positive element, and an alloy of nickel and copper of the composition Ni_3Cu_2 as the negative element.

In witness whereof I have hereunto set my hand in the presence of two subscribing witnesses.

CHARLES B. THWING.

Witnesses:
SAMUEL S. McCLURE,
W. E. SIMONDS.