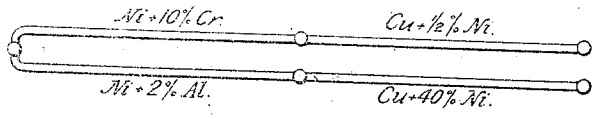
W. H. BRISTOL.

THERMO ELECTRIC COUPLE.

APPLICATION FILED AUG. 14, 1918.

1,315,205.

Patented Sept. 9, 1919.



Inventor
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By his Attorney
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UNITED STATES PATENT OFFICE.

WILLIAM H. BRISTOL, OF WATERBURY, CONNECTICUT, ASSIGNOR TO THE BRISTOL COMPANY, OF WATERBURY, CONNECTICUT, A CORPORATION OF CONNECTICUT.

THERMO-ELECTRIC COUPLE.

1,315,205. Specification of Letters Patent. Patented Sept. 9, 1919.

Application filed August 14, 1913. Serial No. 249,772

To all whom it may concern:

Be it known that I, WILLIAM H. BRISTOL, a citizen of the United States, and a resident of Waterbury, in the county of New Haven and State of Connecticut, have invented certain new and useful Improvements in Thermo-Electric Couples, of which the following is a specification.

The invention relates to thermo-electric couples, more particularly of the compound type as set forth in my prior U. S. Letters Patent No. 764177, of July 5th, 1904, said couples consisting of an active or fire end portion and an extension portion, the latter forming at the junctions with the former secondary couples whose thermo-electric effects under variations of temperature are arranged to neutralize each other.

This patent discloses more particularly the use of expensive and high resistance elements such as platinum and a platinum alloy for the primary couple; and it is the object of the present invention to provide a compound couple of which also the primary portion shall be composed of comparatively inexpensive base metal elements and the extension portion of inexpensive base metal elements, generally of not particularly high melting point and of comparatively low resistance, whereby said latter elements need not be of large cross-section and will possess sufficient flexibility to be conveniently bent and carried considerable distances. In the construction of couples of this character, difficulty has been experienced in obtaining uniformity in the manufacture of some of the alloys employed therein; and it is the particular object of the present invention to afford such a combination that the particular alloys composing the elements thereof shall be comparatively inexpensive and be readily manufactured within the commercial limits of uniformity. The novel combination permits, also, of ready correction due to any slight departure from standard proportions of the metals composing the two extension portions.

A further object of the invention is to combine such elements in a compound couple that a particularly high electro-motive force may be developed and of a comparatively straight line electro-motive force-temperature curve. Moreover, it will generally be desirable to have the elements of the primary couple of metals of comparatively high melting point, while the metals of the extension portion may be of a lower melting point, not, as a rule, being exposed to extreme temperatures.

The drawing illustrates, diagrammatically, the improved compound couple.

As elements for the primary couples various metals, or alloys, are suitable, for example—nickel, tungsten, nickel-chromium, nickel-aluminum, etc. A combination that is particularly suitable for the primary couple is that set forth in U. S. Patent No. 971767, granted Oct. 4″, 1910, to Albert L. Marsh, the same consisting of a nickel-chromium alloy (10% Cr.) as one element and a nickel-aluminum alloy (aluminum approximately 2%) as the other element. Such couple will give a practically straight line electro-motive force-temperature curve to substantially the working limit of the material. I have found that it is advantageous to make both of the elements of the extension portion of the couple of alloys of copper and nickel, one element being alloyed with from 30% to 60% of the latter metal, and the other with a small amount of the said nickel, for example less than 1% thereof, the proportion of alloying metal being determined by the neutralizing effect required. With the particular primary couple hereinbefore set forth and composed of elements of nickel with approximately ten per cent. (10%) of chromium and of nickel with approximately two per cent. (2%) of aluminum, particularly satisfactory results may be obtained by employing for the extension portion copper alloyed with approximately one-half of one per cent. (½%) of nickel in combination with the nickel chromium element, and copper with approximately forty per cent (40%) of nickel in combination with the nickel-aluminum element of said primary couple, as shown in the drawing. With this combination, an electro-motive force is developed which is from four to five times that of the platinum-rhodium couple. The junctions between the primary portion and extension portion of the couple, also, may be exposed to comparatively high temperatures without introducing serious errors of indication. The fact that the said extension portion, which consists of inexpensive and low resistance metal, possesses considerable

flexibility, permits, moreover, of this portion of the couple being conveniently extended even to considerable distances. The cold end of the couple may thus be removed to some remote point where the temperature is substantially uniform, or readily maintained so, and thereby errors of indication from fluctuations of temperature at the said cold end be obviated.

I claim:

1. A compound thermo-electric couple consisting of a primary portion, one part of which is an alloy containing nickel and a relatively small proportion of aluminum, and the other a nickel-chromium alloy; and an extension portion, one part of which is copper alloyed with a small amount and less than one (1%) per cent. of nickel, the same being combined with the nickel-chromium part of the primary portion, and the other an alloy of copper and nickel and combined with the nickel-aluminum alloy of the said primary portion.

2. A compound thermo-electric couple consisting of a primary portion, one part of which is an alloy containing nickel and approximately two (2%) per cent. of aluminum, and the other an alloy containing nickel and approximately ten (10%) per cent. of chromium; and an extension portion, one part of which is copper alloyed with approximately one-half of one (½%) per cent. of nickel, the same being combined with the nickel-chromium part of the primary portion, and the other an alloy containing copper and approximately forty (40%) per cent. of nickel and combined with the nickel-aluminum alloy of the said primary portion.

Signed at New York in the county of New York and State of New York this ninth day of August, A. D. 1918.

WILLIAM H. BRISTOL.