

W. H. BRISTOL.
THERMO ELECTRIC COUPLE.
APPLICATION FILED MAR. 5, 1904.

NO MODEL.

Fig. 1.

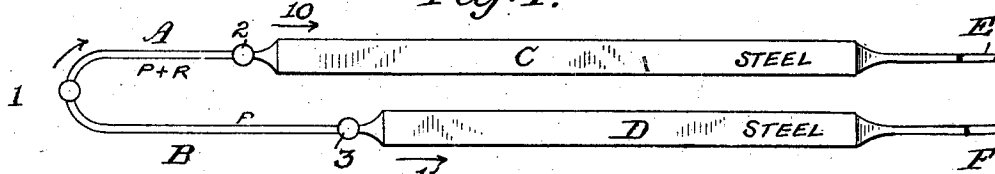


Fig. 2.

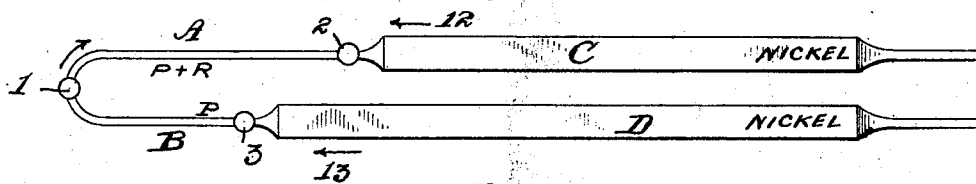


Fig. 3.

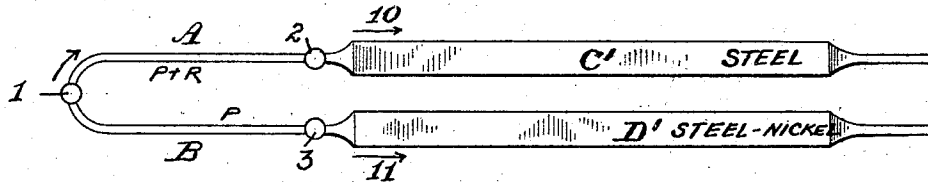


Fig. 4.

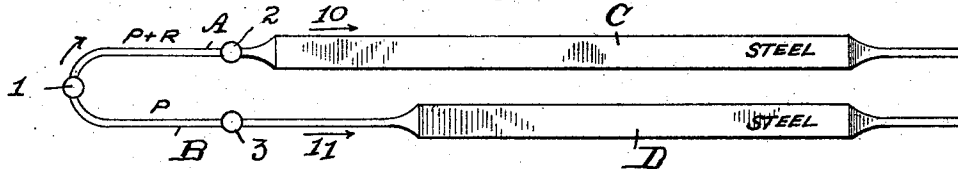


Fig. 5.

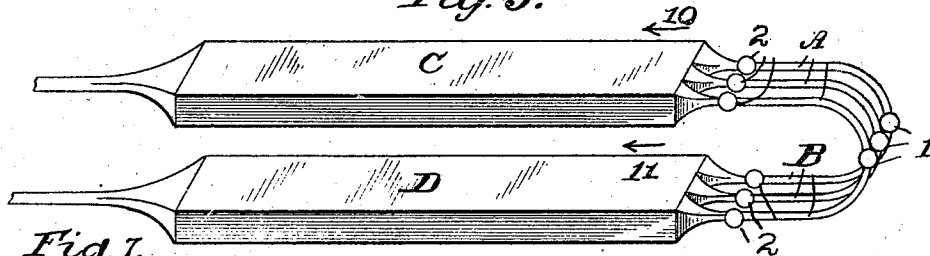
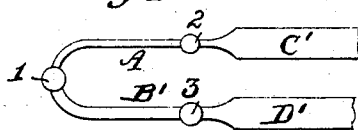
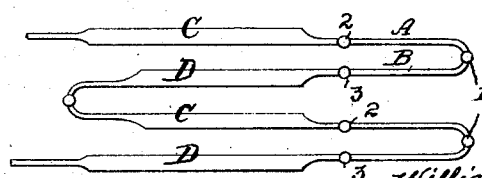


Fig. 1.



Witnesses
Wm. F. Donnelly
Caena H. Yuditzky.

Fig. 6



Inventor:
William H. Bristol
By his Attorney W. H. Bristol.

UNITED STATES PATENT OFFICE.

WILLIAM H. BRISTOL, OF HOBOKEN, NEW JERSEY.

THERMO-ELECTRIC COUPLE.

SPECIFICATION forming part of Letters Patent No. 764,177, dated July 5, 1904.

Application filed March 5, 1904. Serial No. 196,740. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM H. BRISTOL, a citizen of the United States of America, residing at Hoboken, in the county of Hudson and State of New Jersey, have invented certain new and useful Improvements in Thermo-Electric Couples, of which the following is a specification.

My invention has reference to improvements in thermo-electric couples, and particularly to those adapted for use in pyrometers for measuring high temperatures—such, for instance, as platinum and platinum-alloy couples—and has for its object to reduce the cost of such instruments by substituting for a portion or portions of the higher-priced material a low-priced material, all being so arranged that the junctions of the several elements are subjected to different temperatures.

Heretofore it has been proposed to join two elements adapted to withstand extremely high temperatures with conductors less capable of resisting high temperatures, but of greater conductivity, and to maintain said conductors and their junctions at a comparatively low temperature by means of a protective insulation surrounded by a water-jacket.

According to my invention I connect with the elements of high fusing-points conductors of comparatively low resistance and having their junctions exposed to a temperature lower than or equal to the junction of the primary elements, whereby the use of special cooling means can be dispensed with. The junctions of the secondary couples can be brought quite close to the heated junction of the primary couple and are so arranged that the electromotive forces of the secondary couples, due to the heat conducted thereto, are balanced and neutralize each other, leaving the result the same as if the primary couple were extended as the unit to the cold ends.

The nature of my invention will best be understood when described in connection with the accompanying drawings, in which—

Figure 1 represents a plan view of a thermo-electric couple embodying my invention. Figs. 2, 3, and 4 are similar views illustrating modified forms. Fig. 5 illustrates in perspective another modified form. Fig. 6 is a

plan view showing a plurality of couples arranged in series, and Fig. 7 is a plan of a modified form.

Similar letters and numerals of reference designate corresponding parts throughout the several views of the drawings.

Referring now to the drawings, the letters A and B designate the elements of a thermo-electric couple joined together at 1 in the usual manner and composed, for example, of metals or alloys having high fusing-points and capable of resisting extremely high temperatures without rapid deterioration—such, for instance, as platinum and an alloy of platinum and rhodium. It is well known that these materials are possessed of comparatively low electrical conductivity and are very expensive. To reduce the cost of the couple as a whole, I propose to make use of conductors C and D of substantially the same shape and area of cross-section, but of a material which, although of a lower melting-point, is very inexpensive compared with platinum or other metals or alloys of extremely high fusing-points—such, for instance, as steel or nickel or alloys thereof. The size of these conductors can therefore be made such as to offer very little resistance to the passage of the current, and this resistance will not be appreciably varied by changes in temperature.

Referring now to Fig. 1, wherein I have indicated the conductors C and D as being made of steel, the junctures 2 and 3 of said conductors with the primary elements A and B are made at such points that said junctions will not receive the full heat, but only radiated or conducted heat, the points of junction being so determined in accordance to the use to which the instrument is to be put that they will not be subjected to sufficient temperatures to injure the conductors C and D. In view of the fact that different metals or metals and alloys meet at the junctions 2 and 3 secondary couples are formed, which tend to produce currents in opposite directions in the circuit, as indicated by arrows 10 11 in Fig. 1. When both conductors C and D are made from the same metal, as steel, Fig. 1, the electromotive force at the junction 3 would exceed that of the junction 2, and consequently the second-

ary currents would not neutralize each other, and for this reason I so arrange the relative positions of the junctions 2 and 3 that the junction 3 is further removed from the primary junction 1, which is subjected to the full heat to be measured, than the junction 2 to such an extent that the current generated by the thermo-electric element as a whole will be in proportion to the difference of temperature between the hot and cold ends independent of the secondary couples formed by the conductors C and D in view of their connection with the primary couple.

In Fig. 2 I have shown the conductors C and D made of a metal different from steel, such as nickel, in which case the electromotive forces produced at the several junctions would tend to produce currents in the directions of the arrows 12 and 13. In other respects the description of Fig. 1 applies. While in Figs. 1 and 2 I have shown the conductors C and D made in each instance of like material, and the junctions 2 and 3, located at different distances from the primary junction 1, it is evident that neutralization of the electromotive forces in the secondary couples can be effected by the use of dissimilar metals or alloys, Fig. 3, for the conductors C' and D', while the junctions 2 and 3 are equally distant from the primary junction 1. The same effect can be produced by providing conductors C and D of different conductivity of heat—for instance, as shown in Fig. 4, where the inner terminal of one conductor, D, is considerably reduced in area of cross-section near one of the junctions so as to render it of lower heat conductivity.

In general the construction must be such as to neutralize the electromotive forces at the junctions of the conductors C and D with the primary couple A B, and this can be accomplished, as hereinbefore described, either by employing different metals or alloys, by properly arranging the relative positions of the junctions 2 and 3, or by using conductors of different conductivity of heat.

As usual, the outer ends of the conductors C and D may be connected directly with leads E and F, and they may be reduced at their outer ends or cooled at said ends in a usual manner.

In order to increase the sensitiveness of the couple and to diminish the resistance to the flow of current, I make use of the construction shown in Fig. 5, wherein I employ a plurality of primary elements A and B, all said elements being connected to common conductors C and D, of inexpensive material, or to a series of such conductors united to common leads. As before, the conductors C and D form neutral couples.

To obtain a higher electromotive force than could be produced by a single couple, a number of couples could be arranged in series, as shown in Fig. 6. The conductors C and D

are composed or formed as described in connection with the preceding figures.

While I have hereinbefore stated that neutralization of the electromotive forces in the secondary couples could be effected by the use of dissimilar metals or alloys for the conductors C' and D', while the junctions 2 and 3 are equally distant from the primary junction 1, Fig. 3, it is evident that the same result can be produced by making one of the elements, as B', of the primary couple larger in area or of different form in cross-section, so as to conduct heat more rapidly to the corresponding junction 3 of said element with the conductor D' of the secondary couple.

It is of course to be understood that the junctions of the cool ends with the leads, which latter are generally made of copper, produce additional couples, which, however, absolutely neutralize each other when the conductors C and D are respectively of the same material, while when they are of different material there will be a very small constant difference in electromotive force at the cold ends if the temperature is maintained constant. This would have no effect on the readings of the instrument due to changes in electromotive force at the primary couple when the instrument is used as a pyrometer for measuring the heat at the primary junction 1.

What I claim as new is—

1. A thermo-electric couple comprising a primary couple and conductors of different material from the primary couple joined to the latter to form secondary couples neutralizing each other, substantially as described.

2. A thermo-electric couple comprising a primary couple and conductors of different material from the primary couple joined to the latter at different distances from the junction of the primary couple, substantially as described.

3. A thermo-electric couple comprising a primary couple and conductors of different material from the primary couple joined to the latter to form secondary couples of different area of cross-section at and adjoining the secondary junctions, so as to neutralize each other, substantially as described.

4. A thermo-electric couple comprising a primary couple having one of its elements of larger area or of different cross-section and conductors of different materials from the primary couples joined to the latter to form secondary couples neutralizing each other, substantially as described.

5. A thermo-electric couple comprising a primary couple and conductors of different material from the primary couple, but both said conductors being of like material and joined to the primary couple at different distances from the junction of the primary couple so as to form secondary couples neutralizing each other, substantially as described.

6. A thermo-electric couple comprising a primary couple and conductors of different material from the primary couple, but both said conductors being of like material and
5 joined to the primary couple to constitute secondary couples neutralizing each other, substantially as described.

10 7. A thermo-electric couple comprising a primary couple consisting of a plurality of primary elements joined to each other, conductors of different material from the primary couple and joined to the latter to form secondary couples neutralizing each other, substantially as described.

15 8. A thermo-electric couple comprising a primary couple and conductors of different material from the primary couple and of larger area of cross-section; said conductors being joined to the primary couple to form secondary couples neutralizing each other, substantially as described.
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9. A thermo-electric battery comprising a plurality of primary couples and a plurality of conductors of different material from the primary couples; said couples and conductors
25 being joined in series and said conductors forming secondary couples neutralizing each other, substantially as described.

10. A thermo-electric couple comprising a primary couple and conductors of different
30 material from the primary couple, said conductors being of different material, the one from the other, and joined to the primary couple to form secondary couples neutralizing each other, substantially as described. 35

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

WILLIAM H. BRISTOL.

Witnesses:

A. FABER DU FAUR, Jr.,
RAENA H. YUDIZKY.