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W. H. BRISTOL.

THERMO ELECTRIC COUPLE.

APPLICATION FILED DEC. 27, 1907.

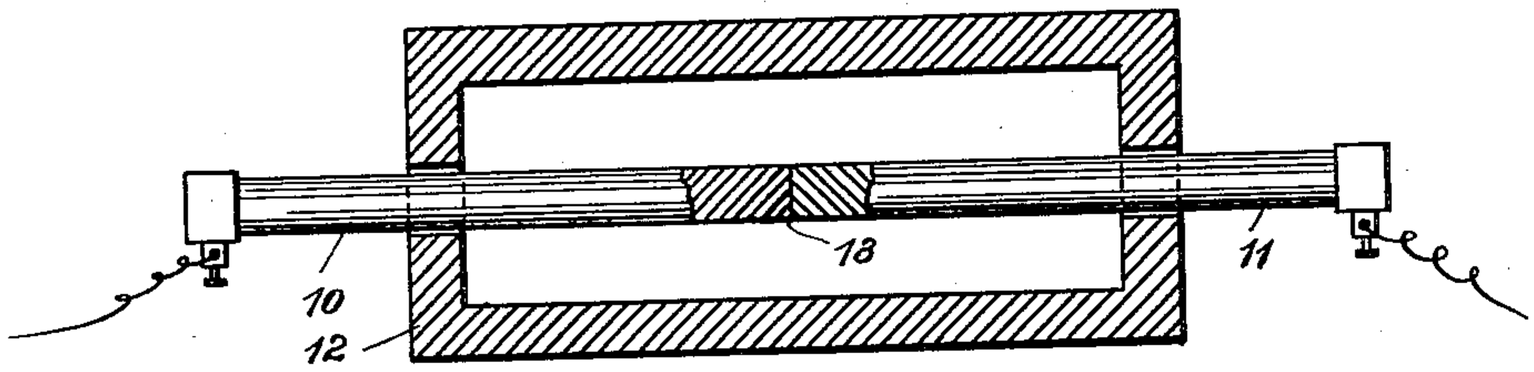

Fig. I.

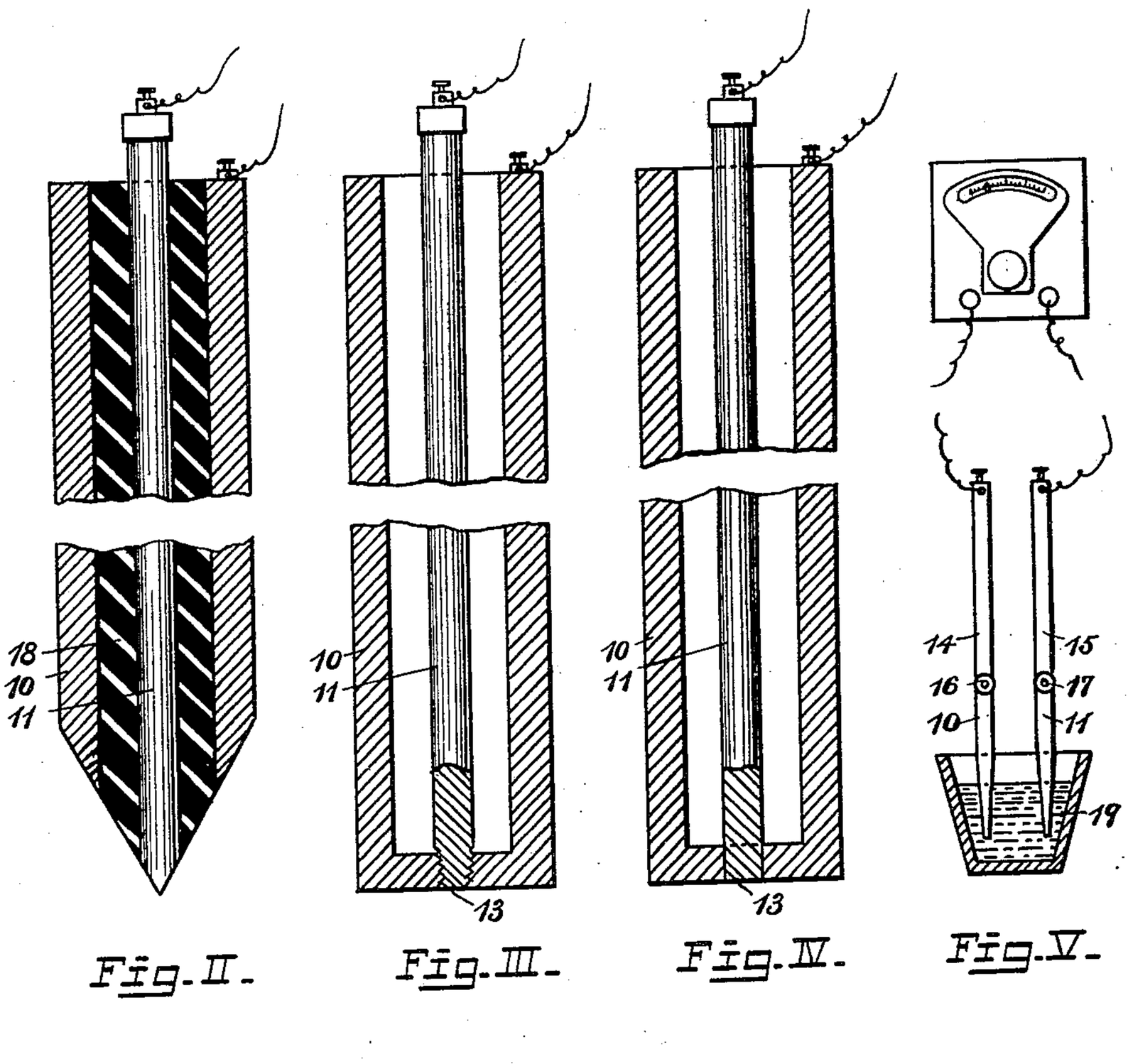

Fig. II. Fig. III. Fig. IV. Fig. V.

Witnesses:
A. Faber du Faur
Sally O. Yudizky.

William H. Bristol Inventor
By his Attorney Wedd & Schuetz

UNITED STATES PATENT OFFICE.

WILLIAM H. BRISTOL, OF NEW YORK, N. Y.

THERMO-ELECTRIC COUPLE.

No. 885,430. Specification of Letters Patent. Patented April 21, 1908.

Application filed December 27, 1907. Serial No. 408,316.

To all whom it may concern:

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

My invention relates to thermo-electric couples and generators; and it has for its object a thermo-electric couple whose elements are capable of withstanding extremely high temperatures and which do not appreciably alloy with most molten metals.

In the accompanying drawings—Figure 1 shows a thermo-electric couple inserted into a section of a furnace. Figs. 2 to 5 show various forms of thermo-electric couples.

It is well known that thermo-electric couples consisting of the platinum-rhodium elements, or of elements of the baser metals cannot be used for the measurement of temperatures above 3000° Fahr. and are practically useless for the purpose of measuring the temperatures of baths of molten metals, particularly gold and silver. In the use of such couples in baths of molten metals, it has been found that they readily alloy with the same, thereby affecting the purity of the bath as well as deteriorating or destroying the couple itself.

It is the object of my invention to devise a couple having elements such as will resist temperatures considerably above 3000° Fahr.; and elements such as will not alloy appreciably with most molten metals.

I have found that a substantial thermo-electric effect may be produced by employing as the two elements of a thermo-electric couple, different forms, kinds or grades of carbon or graphite. A couple composed of the so-called "Acheson graphite", an artificial and extremely pure product, and a rod of the natural graphite made up with some suitable binding material gives a very satisfactory thermo-electric indication. I have also found that a thermo-electric effect may be produced from the same kind of carbon or graphite by varying the same as in density, or by altering the kind, nature or quantity of the binding material employed, or by an intermixture of various impurities, such as for example—sodium silicate, barium chlorid, etc. Couples may be made having one element of the pure carbon or graphite, and the other of the same or different carbon or graphite varied as above described.

Various kinds of clays may serve, and I have found 15% to 20% of Bavarian clay, which is practically free from iron, to be particularly satisfactory in this respect.

In using a couple of this character, the two elements 10 and 11 are preferably in the form of hollow cylinders or rods. In Fig. 1 the couple is shown in the form of a long rod passing through a section of the furnace 12, the two elements form one continuous rod being molded together at the hot end or junction 13 which is located at a portion of the furnace, the temperature of which it is desired to measure. Figs. 2 to 4 show the elements 10 in the form of a rod and the element 11 in the form of a hollow cylinder surrounding the same. In Fig. 2 the two elements are shown separated by the insulating material 18 and are pointed as shown, the same being adapted to be dipped into baths of molten metal such as the bath 19, Fig. 5, which figure also shows a couple with separated elements. In both cases, the molten metal itself forms the connection between the two elements, as fully set forth in my prior U. S. Patent #764,176 of July 5, 1904.

Fig. 3 shows a couple composed of an outer cylinder 10 as one of the elements, and an inner rod 11 screwed into same, or as shown in Fig. 4 simply molded thereto and forming the hot end or junction 13.

Owing to the high thermal conductivity of the carbon or graphite employed, as well as to save in the amount of this material, I prefer to compound the couple by utilizing other and cheaper elements 14 and 15 in connection therewith. These elements form thermo-electric connections 16 and 17 between the carbon or graphite rods, the elements being selected of such material and so arranged that the thermo-electric effects produced at said connections neutralize each other, as fully set forth in my prior U. S. patent #764,177 of July 5, 1904.

In the case of the element 10 being of the "Acheson" or artificial graphite, and the element 11 of the natural graphite as prepared with suitable clay binding material, I have found that an adequate compensation may be effected by connecting to the element 10, the element 15 consisting of approximately 5% of nickel and 95% of iron;

and to the element 11, the element 14 of copper.

By employing a couple of the character herein set forth, both of whose elements are capable of resisting extreme temperatures and both of which do not appreciably alloy with most molten metals, I obtain an inexpensive couple for measuring temperatures beyond the range of the present thermo-electric couples as well as a couple capable of being used to determine the temperature of most molten metals.

From the foregoing it will be noted that my invention consists essentially in the new thermo-electric couple both of whose elements consist of carbon in some form, kind or quality, one or both of such elements containing some impurity, such that a substantial thermo-electric effect is produced by heating the junction of the two elements.

I claim:—

1. A thermo-electric couple, the two elements which consist of graphite.

2. A thermo-electric couple, one element of which consists of substantially pure carbon, and the other of carbon containing an impurity.

3. A thermo-electric couple, one element of which consists of substantially of pure graphite, and the other graphite containing an impurity.

4. A thermo-electric couple, the two elements of which consist of carbon, and one of the elements containing a clay.

5. A thermo-electric couple, the two elements of which consist of carbon, and each containing a different clay.

6. A thermo-electric couple, the two elements which consist of carbon, and one of the elements containing a clay substantially free from iron.

7. A thermo-electric couple, the two elements of which consist of carbon, and one of the elements containing Bavarian clay.

8. A thermo-electric couple, the two elements of which consist of graphite, and one of the elements containing a binding material.

9. A thermo-electric couple, the two elements of which consist of graphite, and each containing a binding material.

10. A thermo-electric couple, the two elements of which consist of graphite, and one of the elements containing a clay.

11. A thermo-electric couple, the two elements of which consist of graphite, and each containing a different clay.

12. A thermo-electric couple, the two elements of which consist of graphite, and one of the elements containing a clay substantially free from iron.

13. A thermo-electric couple, the two elements of which consist of graphite, and one of the elements containing Bavarian clay.

Signed at New York, in the county of New York and State of New York this 26th day of December A. D. 1907.

WILLIAM H. BRISTOL.

Witnesses:

FREDK. F. SCHUETZ,

SALLY O. YUDIZBY.