C. D. BABCOCK.

OSCILLATION DETECTOR.

APPLICATION FILED OCT. 2, 1907.

906,991. **Patented Dec. 15, 1908.**

2 SHEETS—SHEET 1.

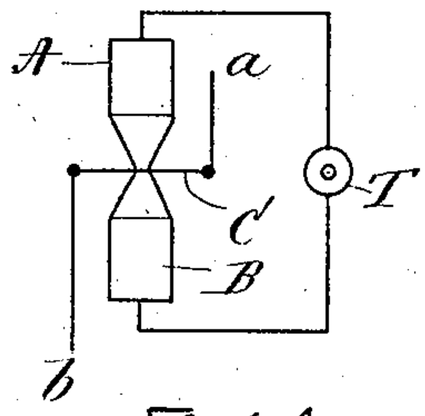

Fig. 1.

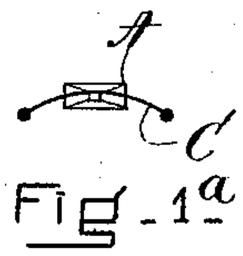

Fig. 1a

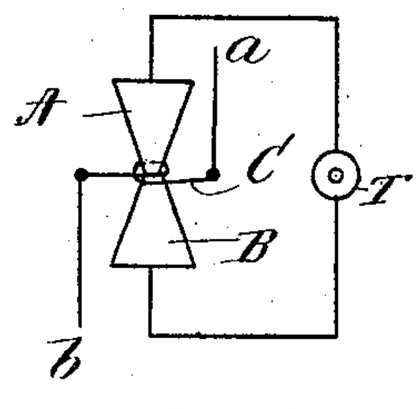

Fig. 2.

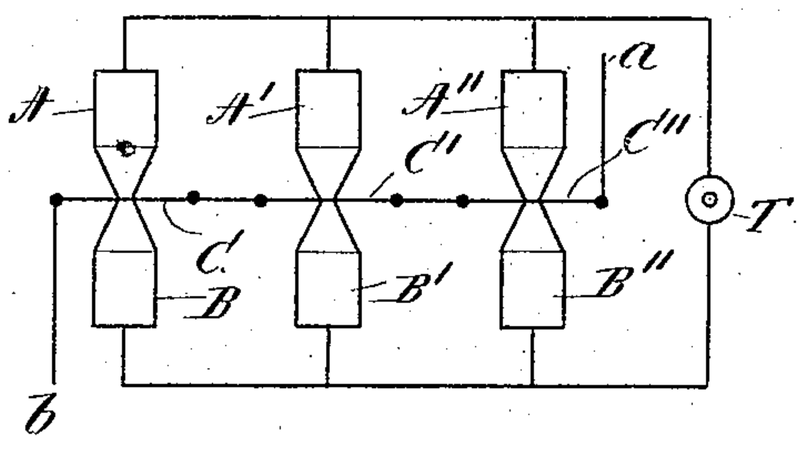

Fig. 3.

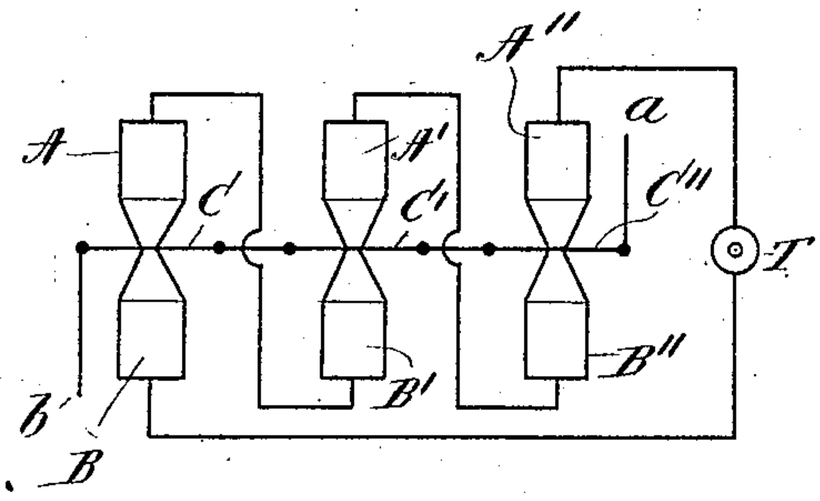

Fig. 4.

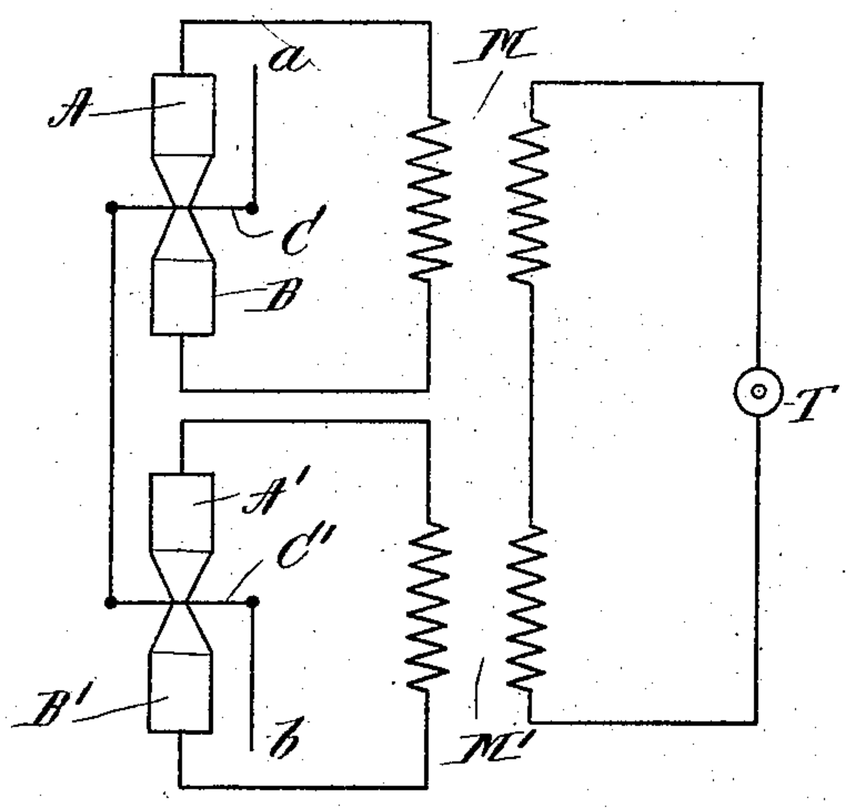

Fig. 5.

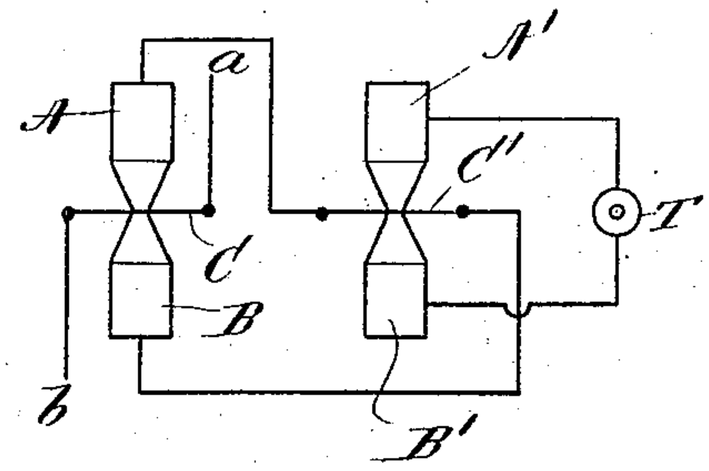

Fig. 6.

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2 SHEETS—SHEET 2.

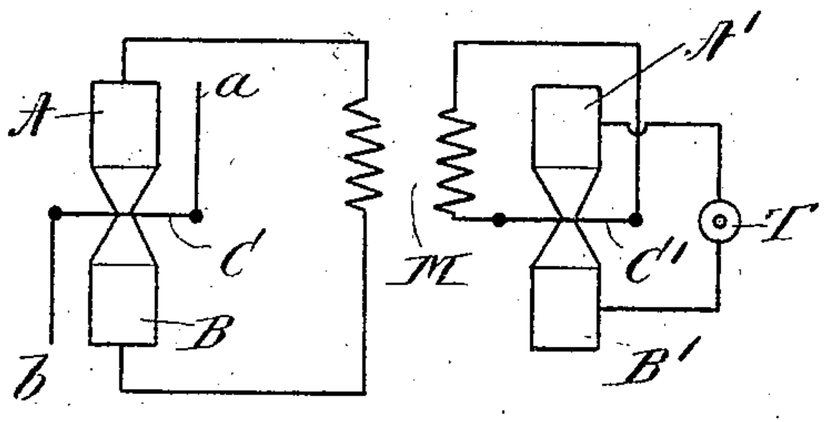

Fig. 7.

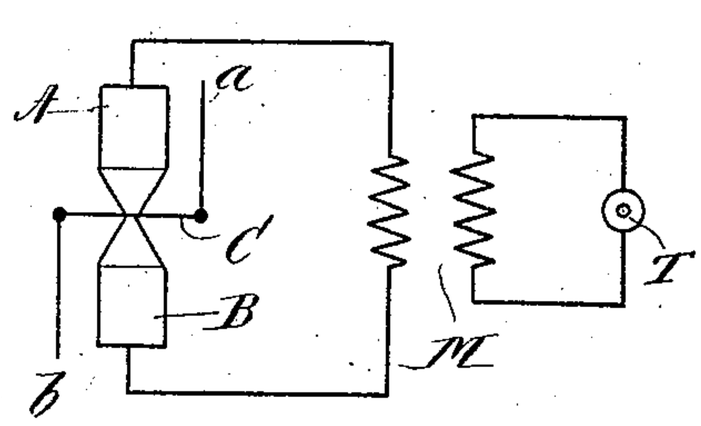

Fig. 8.

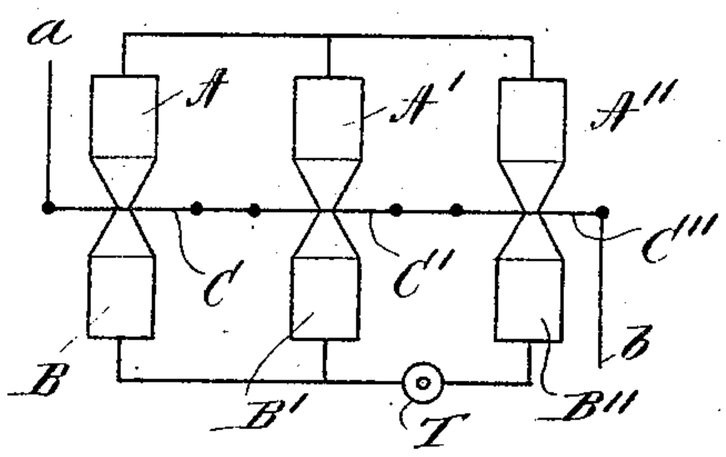

Fig. 9.

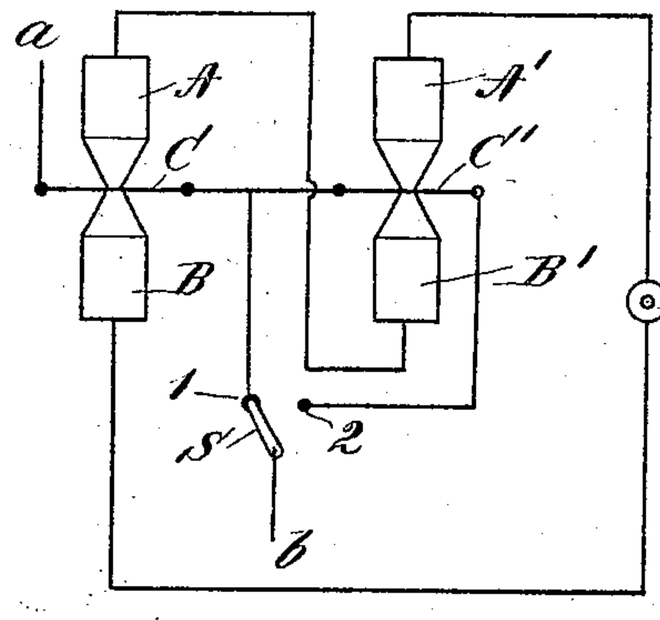

Fig. 10.

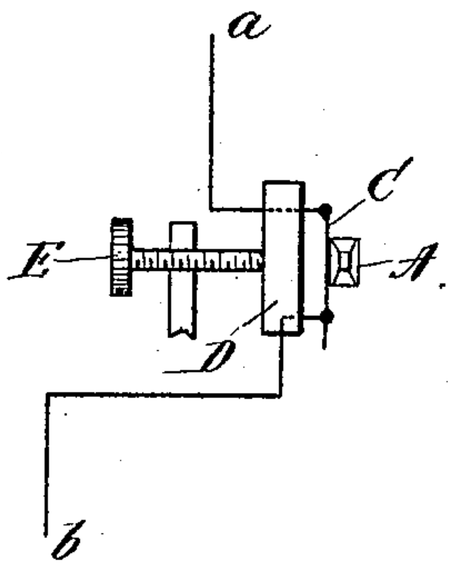

Fig. 11.

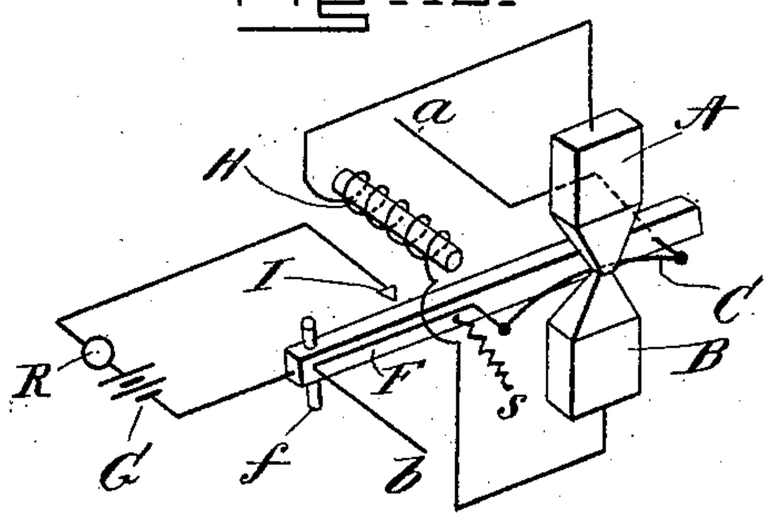

Fig. 12.

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UNITED STATES PATENT OFFICE.

CLIFFORD D. BABCOCK, OF NEW YORK, N. Y., ASSIGNOR TO UNITED WIRELESS TELEGRAPH COMPANY, OF NEW YORK, N. Y., A CORPORATION OF MAINE.

OSCILLATION-DETECTOR.

No. 906,991. Specification of Letters Patent. Patented Dec. 15, 1908.

Application filed October 2, 1907. Serial No. 395,492.

To all whom it may concern:

Be it known that I, CLIFFORD D. BABCOCK, 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 a new and useful Improvement in Oscillation-Detectors, of which the following is a specification.

My invention relates to detectors of the thermo-electric type for feeble electric currents and, more especially, the high frequency electric currents or oscillations developed in wireless telegraph or wireless telephone receiving systems.

In all oscillation detectors of the thermo-electric type, so far as I am aware, the oscillations to be detected are created in, or are conveyed directly to, a circuit which includes the thermo-electric elements and thereby heats the junction or couple formed by said elements. Experience has shown that thermo-electric oscillation detectors so constructed are not stable and soon lose their sensitiveness, requiring therefore more or less frequent adjustment or variation of the point at which one of the elements makes contact with the other.

The object of the present invention is to provide an oscillation detector of the thermo-electric type which shall not be subject to the foregoing defects and limitations and which shall be capable of developing a larger amount of thermo-electric energy when acted upon by a given amount of electrical energy than those of the type in which the received electrical energy is conveyed directly to the circuit which includes the thermo-couple.

With this object in view my invention comprises a thermo-electric couple consisting preferably of two elements widely separated in the thermo-electric scale and forming a perfect electrical contact, in combination with means such as a short conductor of small diameter associated with said thermo-electric couple and adjacent thereto whereby the energy of the oscillations to be detected may be converted into heat and thereby elevate the temperature of said thermo-electric couple.

The drawings which accompany and form a part of this specification illustrate in diagram several embodiments of my invention whereby the foregoing objects have been accomplished in practice; but it will be understood that said embodiments which have been chosen for illustrating the invention may be subjected to a wide range of variation without departing from the principle thereof.

In the drawings, Figure 1 shows a thermo-electric couple having a signal-indicating device serially connected therewith. Fig. 1ª is an end view of one of the elements of a thermo-electric couple shown in Fig. 1 with the other element removed. Fig. 2 shows a modification of the detector shown in Fig. 1. Fig. 3 shows a detector having a plurality of thermo-electric couples connected in multiple with respect to the signal-indicating device. Fig. 4 shows an oscillation detector consisting of a plurality of thermo-electric couples connected in series with respect to the signal-indicating device. Fig. 5 shows an oscillation detector consisting of a plurality of thermo-electric couples each having its circuit inductively related with the signal-indicating device. Fig. 6 shows an oscillation detector consisting of a thermo-electric couple connected in series with means for heating a second thermo-electric couple and a signal-indicating device associated with the latter. Fig. 7 shows an oscillation detector in which the circuit of a thermo-electric couple is inductively related with a circuit which includes means for heating a second thermo-electric couple. Fig. 8 shows an oscillation detector consisting of a thermo-electric couple having its circuit inductively related to the signal-indicating device. Fig. 9 shows an oscillation detector consisting of a plurality of thermo-electric couples connected in multiple-series with respect to a signal-indicating device. Fig. 10 shows an arrangement whereby one or more thermo-electric couples may be associated with the circuit conveying the oscillations to be detected. Fig. 11 is a fragmentary view showing one way in which the heating means may be adjusted with respect to the thermo-electric couple. Fig. 12 shows partly in perspective and partly in diagram one way in which a thermo-electric couple may be employed to operate a relay.

In the figures, A and B are thermo-electric elements, such for example, as bismuth and tellurium, respectively, or steel and gelena or some other metallic sulfid, respectively. However I do not limit myself as to the material of said elements inasmuch as they may be formed of any suitable materials which lie far apart in the thermo-electric scale.

C may be a short length of conductor of small diameter such for example as a bit of one-half mil platinum wire or a bit of three-quarter mil carbon filament. The conductor C may be arranged with respect to the junction of the elements A B in any suitable manner. As shown in Fig. 1ª, it is bent around said junction and in Fig. 2 a single turn of the conductor C is placed around the junction. The elements A and B may have any suitable shape and as shown the area of contact of one with the other is made small. This contact is a perfect electrical contact and may be made in any suitable manner as, for example, by soldering one element to the other or by mechanically pressing them in firm contact with each other.

T is a signal-indicating device which may be associated with a circuit including the elements A and B in any suitable manner. The heating conductor C is included in the circuit which carries the oscillations to be detected. This circuit is shown as terminating at the points *a* and *b*. The points *a* and *b* may be connected with a wireless telegraph or wireless telephone system, or other system in which the oscillations or currents to be detected are developed, in any of the usual ways in which oscillation detectors are associated with such systems, as for example, by including the conductor *a* C *b* in an antenna or in a tuned circuit associated with such antenna.

In Fig. 3 the thermo-electric couples A B, A′ B′, A″ B″, are connected in multiple with respect to the signal-indicating device T, which may be a telephone-receiver, and three heating members C C′ C″ are connected in series with the circuit *a b* which conveys the oscillations to be detected, said heating members being associated with and adjacent to the thermo-electric couples, respectively. In Fig. 4 the three thermo-electric couples are connected in series with the signal-indicating device T. By means of the arrangement shown in Fig. 3 the thermo-electric current passing through the telephone T is increased and by means of the arrangement shown in Fig. 4 the thermo-electric potential is increased.

As shown in Fig. 5 the signal-indicating device may be associated with two thermo-electric couples by means of the transformers M M′ which are arranged so that the currents developed in the circuit of the device T are in the same direction.

In Fig. 6 the thermo-electric currents developed by the couple A B heat the conductor C′ which in turn causes the couple A′ B′ to develop thermo-electric currents which operate the telephone T. A modification of the arrangement shown in Fig. 6 is illustrated in Fig. 7 in which the thermo-electric currents developed by the couple A B are translated by the transformer M, which may be a step-up transformer or a step-down transformer, to the heating member C′, which, by elevating the temperature of the couple A′ B′, causes said couple to develop currents in the circuit of the device T.

In Fig. 8, the device T is associated inductively with the circuit of the couple A B by means of the transformer M.

It will be understood of course that the currents developed in the circuit of the thermo-couples by oscillations created in the receiving system by electro-magnetic waves from wireless telegraph or telephone transmitting systems, are pulsating currents which may of course be translated by a transformer to the signal-indicating device, as shown in Figs. 5 and 8, or to another heating element, as shown in Fig. 7.

In Fig. 9 the thermo-electric couples A B, A′ B′, and A″ B″ are connected in multiple series with respect to the signal-indicating device T.

In Fig. 10 the switch S which coöperates with the contacts 1 and 2 may be employed to regulate the number of thermo-electric couples employed in a receiving system. The heating member C may be a much larger conductor than the heating member C′. In such case when receiving signals from near-by stations, the heating member C′ may be cut out in order to protect the same from the received oscillations from said near-by station which might fuse said member. The oscillations developed in the receiving system by electro-magnetic waves transmitted from stations located at greater distances from the receiving system might not develop sufficient heat in the conductor C to cause the development in the circuit of the couple A B of a detectable current, and therefore for long distance communication, the switch S may be placed on contact 2 so as to bring the heating member C′ into operative relation with the circuit *a b*.

In Fig. 11 the heating member C is shown mounted upon the support D which by means of the screw E may be moved with respect to the thermo-electric couple, of which one element A, is shown in said figure. The object of this construction is to prevent one or more of a number of sets of oscillations developed by different transmitting systems in the circuit *a b* from affecting the thermo-electric couple. By varying the position of the heating member C with respect to the couple, oscillations of small amplitude and which therefore would raise the temperature of the couple to a relatively small degree, may be prevented from effecting the development of thermo-electric currents in the circuit of the couple by separating the couple and the heating member. When the heating member and couple are separated sufficiently to prevent oscillations of relatively small amplitude from affecting the couple, oscilla-

tions of relatively larger amplitude will develop in said heating member sufficient heat to cause the couple to develop currents which may be detected by the telephone T.

In Fig. 12, the heating member C is mounted on the armature F which is pivoted at *f* and normally held by the spring *s* so that the heating member contacts with the junction between A and B. Upon the energization of the thermo-couple, the magnet H, energized by the thermo-electric currents, attracts the armature F and closes the circuit of the relay R and battery G at the point I.

Inasmuch as the heating members C C′ C″ must be rapidly responsive to the oscillations to be received, the thermo-couple with its heating member may be placed in a suitable liquid or gaseous heat-absorbing medium.

I claim:

1. An oscillation detector comprising a thermo-electric couple and a local circuit passing through the same in combination with means associated with said couple and adjacent thereto for converting the energy of the oscillations to be detected into heat and thereby elevating the temperature of said thermo-electric couple.

2. An oscillation detector comprising a local circuit and a thermo-electric couple therein in combination with a conductor associated therewith and adjacent thereto for converting the energy of the oscillations to be detected into heat and thereby elevating the temperature of said thermo-electric couple.

3. An oscillation detector comprising a local circuit and two elements widely separated in the thermo-electric scale in said circuit and forming a perfect electrical contact in combination with means associated therewith and adjacent thereto for converting the energy of the oscillations to be detected into heat and thereby elevating the temperature of said thermo-electric couple.

4. An oscillation detector comprising a thermo-electric couple, a local circuit including the same, a signal-indicating device associated with said local circuit, a circuit independent of said thermo-electric couple, and means in said circuit for converting the energy of the oscillations to be detected into heat and thereby elevating the temperature of said thermo-electric couple.

5. An oscillation detector comprising a thermo-electric couple, a local circuit serially connected therewith, a signal-indicating device associated with said local circuit, a circuit independent of said thermo-electric couple and means included in the last mentioned circuit for converting the energy of the oscillations to be detected into heat and thereby elevating the temperature of said thermo-electric couple.

6. An oscillation detector comprising a plurality of thermo-electric couples, a local circuit connecting said thermo-electric couples in series, a signal-indicating device associated with said local circuit and means associated with and adjacent to each of said thermo-electric couples for converting the energy of the oscillations to be detected into heat and thereby elevating the temperature of said thermo-electric couple.

In testimony whereof, I have hereunto subscribed my name.

CLIFFORD D. BABCOCK.

Witnesses:

CHAS. J. ATTEND,

LORETTA T. NOCE.