Moses G. Farmer.

Imp'd Thermo Electric Pair.

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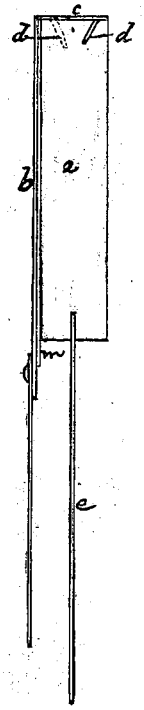
PATENTED APR 18 1871



Moses G. Farmer
by his Attys.
Cooke Hasbrouck & Gould

Witnesses.
Geo. L. Roberts
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United States Patent Office.

MOSES G. FARMER, OF SALEM, MASSACHUSETTS.

Letters Patent No. 113,864, dated April 18, 1871.

IMPROVEMENT IN THE CONSTRUCTION OF THERMO-ELECTRIC PAIRS.

The Schedule referred to in these Letters Patent and making part of the same.

To all whom it may concern:

Be it known that I, MOSES G. FARMER, of Salem, in the county of Essex and State of Massachusetts, have invented an Improved "Thermo-Electric Pair;" and I do hereby declare that the following, taken in connection with the drawing which accompanies and forms part of this specification, is a description of my invention sufficient to enable those skilled in the art to practice it.

It has been known for many years that, by joining the ends of two bars of different metals and heating them at one of their junctions an electric current can be excited, provided the other ends of the bars are kept at a lower temperature. Such currents have been so feeble, however, that batteries formed of such elements have been but little used, except in the hands of scientific men, for determining temperatures. They have been known as mellonis, and have generally been constructed of antimony and bismuth, a stronger current being obtained with these metals than with any others.

It has also been known that a stronger current can be obtained from certain alloys than from any of the pure metals.

One of the most effective combinations is that of a German-silver bar in conjunction with a bar formed from an alloy of antimony and zinc. These two alloys are cheap enough for common use, and have a melting point sufficiently high to admit of a large difference in temperature between the opposite ends of the bars.

On the other hand the alloy of antimony and zinc, in the proper proportions to produce an efficient current, is exceedingly brittle, and it is difficult to join a bar of it to a bar of German silver or other metal so as to secure a union of the two which will not be so imperfect as to offer great resistance to the current.

Moreover, the alloy of antimony and zinc has so great a specific resistance to the electric current that it is desirable to give to the bars formed from it a large cross-section in proportion to the cross-section of the German-silver element of the pair.

For the same reason it is important to bring a large surface into contact with the German silver at the junction.

It is also desirable that the whole of the surface in contact should be uniformly heated, especially when large, in order that cross-currents may not be produced by a difference in the temperatures of different parts of the surfaces in contact.

It is further desirable that the bars, when united in pairs, shall have such a form that a number of pairs may be easily combined into one battery without interfering with the conditions necessary for applying the heat easily and uniformly to the junctions of the several pairs combined.

The object of my present invention is to secure these conditions and advantages, to accomplish which I construct the bars as follows:

The German-silver bar is bent so that the part which is to be joined to the antimony-zinc bar shall extend over the end of the latter, while the other part lies parallel to its side.

This mode of construction will be readily understood from the drawing, where the antimony-zinc bar is represented by *a* and the German-silver bar is represented by *b c*, the part *c* being the part which is joined to the antimony-zinc bar.

The part *b* of the German-silver bar is to be insulated from the antimony-zinc bar by some non-conducting substance, like mica, shown at *m*.

It is important that the two bars shall be joined together as perfectly as possible.

The best method I have found to do this is to place the German-silver bar, when properly prepared, in a mold of the proper shape, and to cast the antimony-zinc bar upon it. The German silver is bent to the proper shape, and that part of it which is to be joined to the antimony-zinc bar is provided with projections or pins, which are to enter the end of the antimony-zinc bar. The object of these projections is to aid the adhesion of the two bars to each other. They may be formed in a variety of ways, such as by drilling holes into the German silver and inserting pins so that these pins shall project into the alloy of antimony and zinc when it is cast upon them.

Still another way is to punch partly out from the German silver V-shaped portions of it, and turn them up so as to project into the alloy. By such means the German-silver bar can be caused to take fast hold upon the antimony-zinc bar.

These spurs or projections are represented by *d d* in the drawing.

In order that the union between the German-silver bar and the antimony-zinc bar may be of the most intimate character, it is important to first cleanse the surface of the German silver and its projections thoroughly. This is best done by immersing it for a time in a dilute solution of sulphuric acid; then the end of the German silver is coated by dipping it first into a solution of the double-chloride of zinc and ammonia, (common soldering-acid,) and afterward into a melted alloy of about two parts tin and one of zinc. This gives a bright surface, to which melted antimony-zinc readily adheres when it is poured upon it.

A strip of German silver, or of copper tinned with

ordinary tinning-solder, is also inserted into the mold so as to be joined to the opposite end of the antimony-zinc bar, (by the operation of casting,) as seen in the drawing, where such strip is represented by *e*, said strip forming the continuation of the circuit when the pair is in operation.

When the mold is thus prepared by the introduction of the German-silver bar and the piece *e* the melted antimony-zinc is poured into the mold, and when cold the two bars and the piece *e* will be firmly joined together. The mica for separating the German silver from the antimony-zinc bar may be placed in the mold by the side of the German silver, and the melted antimony-zinc be then poured into the mold; or it may be inserted between the two after the pair is formed. I prefer the latter mode.

I have found in my experience thus far that it is better, on account of the unequal expansion of the two alloys, that the linear dimensions of the antimony-zinc bar at the heated junction should not exceed an inch.

It will be understood that the method of construction which I have described need not be limited to the particular alloys I have mentioned.

I claim—

1. A thermo-electric pair with the two elements lying side by side, but joined together across the end of one of them, substantially as described.

2. Projections upon one of the bars to aid in joining the two bars, substantially as described.

MOSES G. FARMER.

Witnesses:

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