C. CLAMOND.

Thermo-Electric Piles.

No. 151,568. Patented June 2, 1874.

Fig. 1

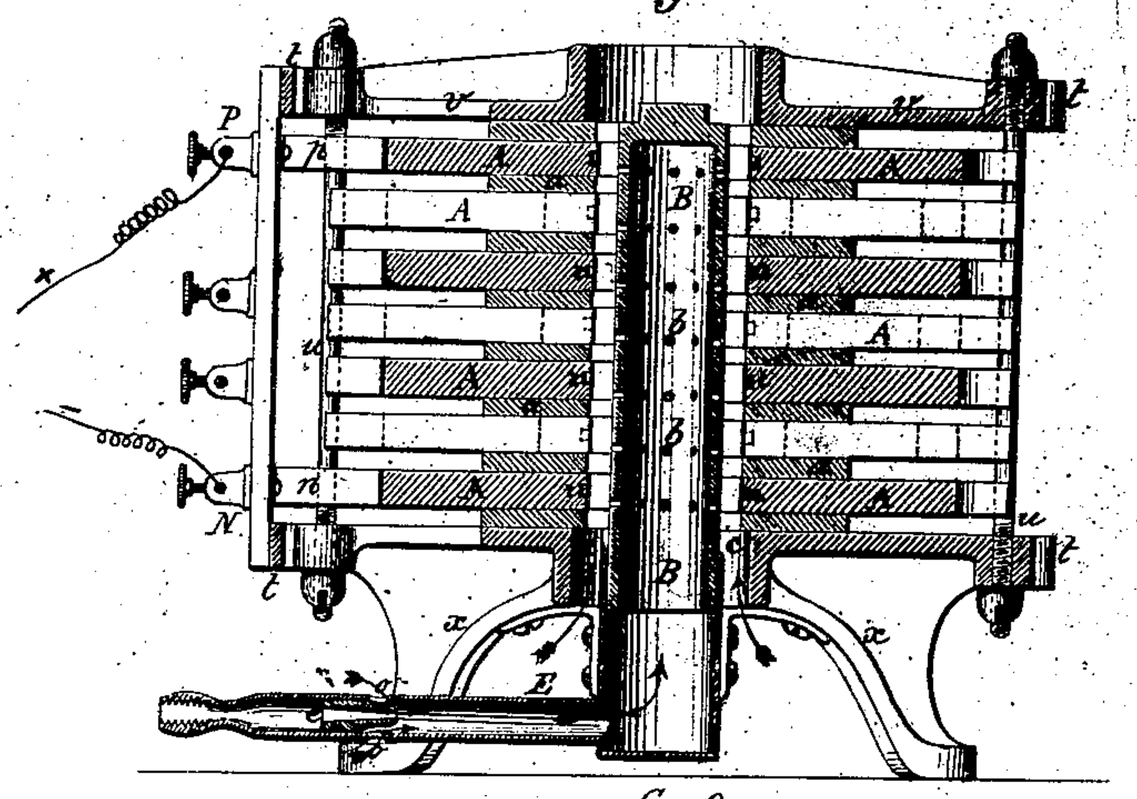


Fig. 2.

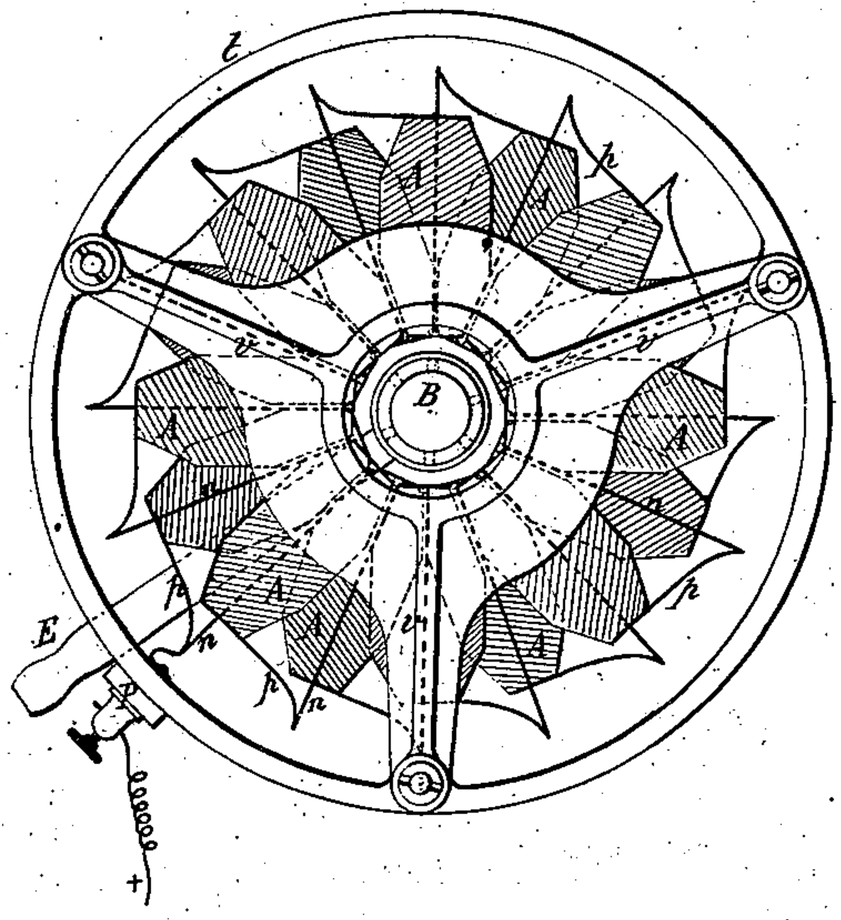


Fig. 3

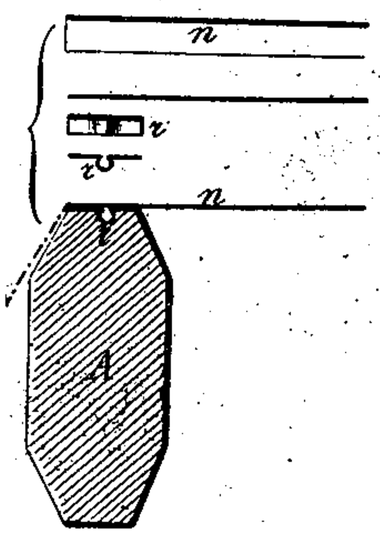
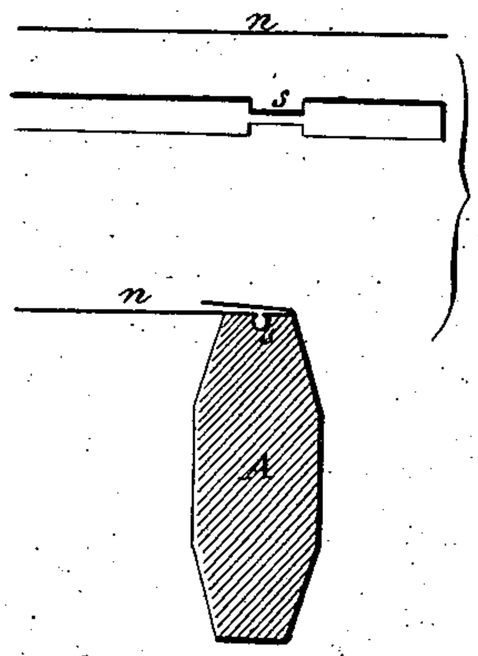


Fig. 4



Witnesses:

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Wm. G. Chaffee

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by atty D. Bolton

UNITED STATES PATENT OFFICE.

CHARLES CLAMOND, OF PARIS, FRANCE.

IMPROVEMENT IN THERMO-ELECTRIC PILES.

Specification forming part of Letters Patent No. **151,568**, dated June 2, 1874; application filed May 22, 1874.

To all whom it may concern:

Be it known that I, CHARLES CLAMOND, of Paris, France, have invented certain new and useful Improvements in Thermo-Electric Piles, of which the following is a specification:

In my improved thermo-electric battery the grouping of the bars is cylindrical; but for batteries of large dimensions I can impart to the assembled bars a rectilinear contour. In this case the bars would be arranged in superposed rows.

It is noticeable that thermo-electric bars, as heretofore made, preserve their property for but a short time. Under the continued action of heat, and the successive heatings and coolings to which they are subjected, they acquire an internal resistance, which constantly increases, while the electric force remains the same, which resistance, in time, becomes such that the current generated by the heat can give but a very feeble and almost inappreciable quantity of electricity. Sometimes, indeed, there takes place even a complete solution of continuity, which reduces the electric effect to almost nothing. I have ascertained that this grave defect is due to two causes. On the one hand, the surface of contact of the metal strip or blade with the crystallized metal or mineral becomes oxidized, and consequently resistant to the passage of the current. On the other hand, the crystallized bar cracks or presents cleavages, which, though imperceptible to the naked eye, increase and permit the oxidation to extend into the interior of the bar, which thus becomes more and more resistant. These causes have the effect of rapidly impairing the efficiency of the battery.

I remedy the above-noted difficulties, first, by new method of uniting the metallic strip or blade with the part of the bar exposed to the heat; second, by casting the bars in heated molds.

The nature of these improvements will be readily understood by reference to the accompanying drawing, in which—

Figure 1 is a vertical central section, and Fig. 2 is a plan, of my improved pile. Figs. 3 and 4 represent, in detail, the manner of uniting the blades or strips with the bars.

The elements A A A are grooved in the form of circular crowns, isolated one from the other by mica or amianthus. In this instance I employ disks or washers *a a a* of amianthus. The elements A A, superposed one on the other, form a cylinder, to the interior of which heat is applied. The heat can be obtained by means of gas, which is used as follows: A tube, B, of refractory earth, closed at top and pierced with small holes *b* in its sides, is placed within the central chamber of the pile, leaving between it and the inner ends of the bars an annular space, open above and below to the atmosphere. To the base of the tube B is attached the cylinder C, closed at bottom and communicating with the pipe E, which connects with the source of gas-supply. This pipe is provided with Bunsen burner *e*, which mingles gas with the air entering through holes *o o*. The mixture of gas and air passes to the refractory tube B, whence it issues through the holes *b* into the annular space around the tube, where it is burnt in contact with the air entering said annular space through the lower opening *c*. This air, being of necessity preliminarily heated, renders the combustion very perfect. The bars thus are heated both by radiation from the refractory tube B, which soon becomes red hot, and by direct action of the flame and products of combustion, which are brought in contact with the inner ends of the bars. Each bar is provided with two blades or strips, *p n*, that serve to collect the electric current. The former, *p*, is situated on the exterior at the positive pole, the latter, *n*, is fitted to the inner part of the bar at the negative pole. The manner of uniting these strips with electrodes of the buttons N P depends upon the nature of the current to be developed, whether tension or quantity. In Fig. 2 the strips are represented as arranged for tension. The strips *p* are attached in the usual way to the exterior and cold part of the bar. The union of the strips *n* with the bars, said strips being in contact with the inner and heated portions of the bars, is, however, effected during the casting of the bars and in the following manner: The metallic strip, placed in advance in the mold, is provided with a small appendage that, during the casting of the bar, will be taken and incorporated in the material of the bar itself. This appendage is a metallic ring or bent, *r*, united, by

solder, with strips *n*, and formed of a small strip narrower than *n*, as seen in Fig. 3; or this ring may be formed in the strip *n* itself, which is reduced in width at the part *s*, which is then bent up into ring form, as shown. The extremity of the strip *n* is folded over, in order to double the thickness. The width of the metal that forms the ring should be a little less than half of that that forms the strip *n*. The strip *n*, thus furnished with a bent or ring, is, after being thoroughly cleaned, placed in the mold and suitably arranged, and the metal or mineral constituting the body of the bar is run in and envelops the ring *r*, which is thus incorporated into the bar and assumes an intimate and permanent contact between the strip and the bar.

In making the bars, I make use of any suitable thermo-electric substance, preferably the compound metal known as Marcus' metal, composed of about two parts of antimony to one part of zinc. Whatever may be the metal employed, it is impossible to avoid cracking and cleavage so long as it is run into cool molds, since, under such conditions, crystallization cannot be uniform and regular. I completely obviate this grave defect by preliminarily heating the molds to a degree bordering on the fusing-point of the metal or mineral to be cast. The latter, melted and agitated in a crucible, is run into the heated molds, which are then placed in a medium, where they will cool quite slowly. I thus obtain bars which are perfectly homogeneous, and consequently will not crack.

The elements A are held together between two plates or skeleton frames, *t*, bound together by tie-rods *u* passing through their arms *v*. The lower plate is cast with supporting-feet *x*.

In case coke is used for heating, the coke is inclosed in a cast or wrought iron tube or column within and concentric with the pile, and of a sufficiently-contracted diameter to leave around it the annular space required for radiation. The coke rests on a grate, through which passes the air needed for combustion. The products of combustion escape through a lateral orifice to the chimney. For small piles coke can be replaced by charcoal or artificial fuel.

Having described my invention, what I claim, and desire to secure by Letters Patent, is—

1. The mode of uniting the negative strip with the bar by means of a metallic ring or bent, soldered to or making part of the strip, and incorporated into the body of the bar by casting, substantially as set forth.

2. The manufacture of the bars of thermo-electric piles, by casting the same in molds preliminarily heated to near the fusing-point of the thermo-electric material, as set forth.

3. The combination, with the elements A, of the central perforated radiating cylinder B, made of refractory material, the pipe E, and the Bunsen burner *e*, the same being arranged and operating together, as herein shown and set forth.

In testimony whereof I have signed my name to this specification before two subscribing witnesses.

C. CLAMOND.

Witnesses:
DAVID T. S. FULLER,
ALBERT CAHEN.