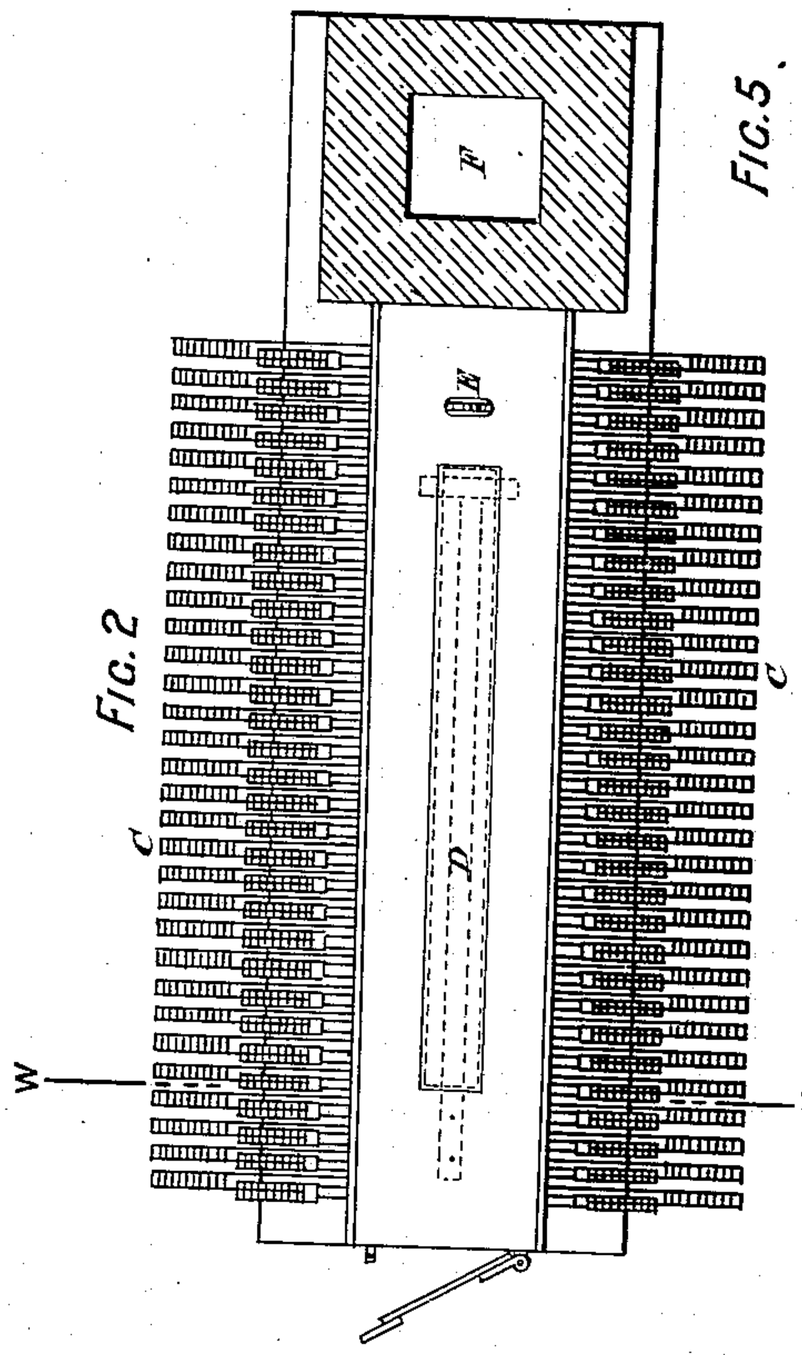
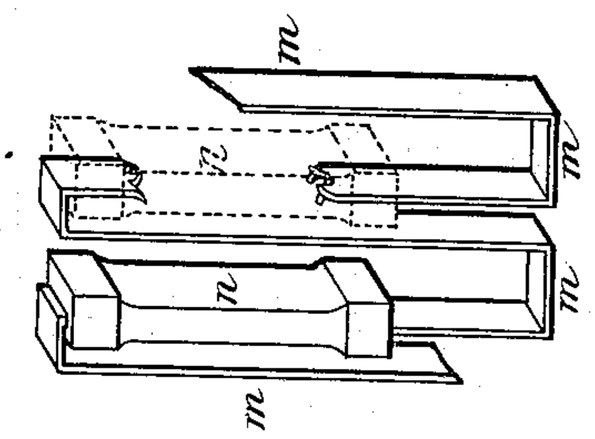
(No Model.)

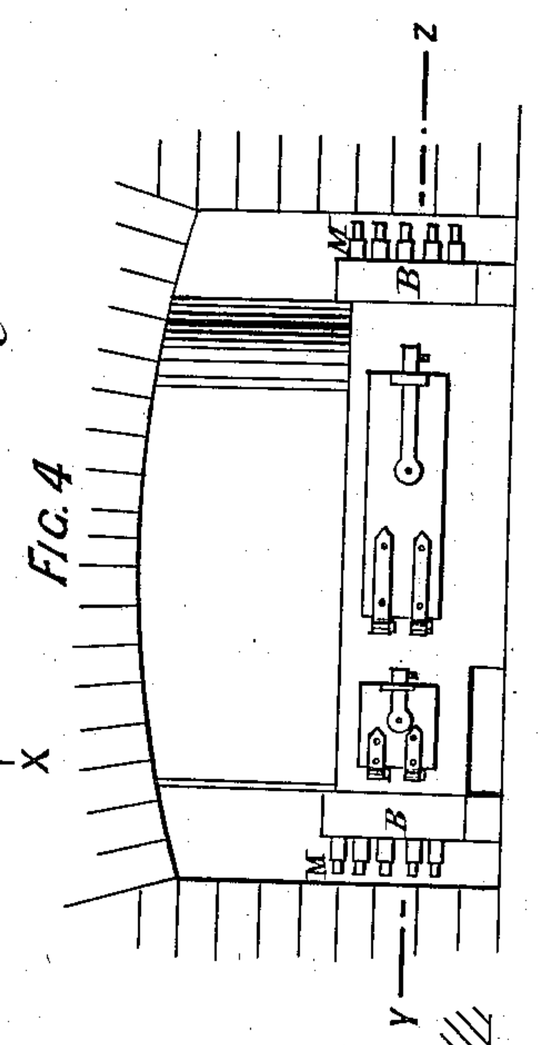
W. S. DE L. ROBERTS & J. S. MOLLISON.

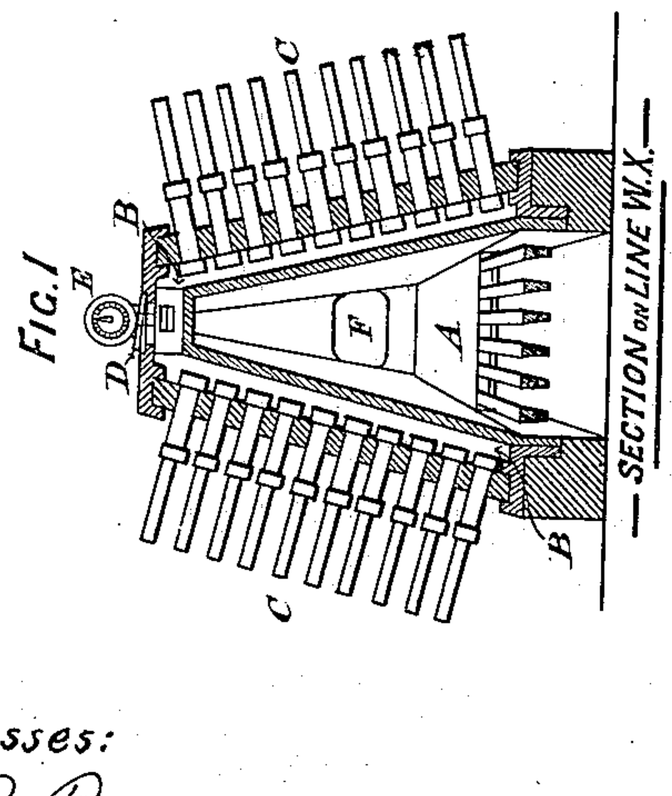
THERMO ELECTRIC GENERATOR.

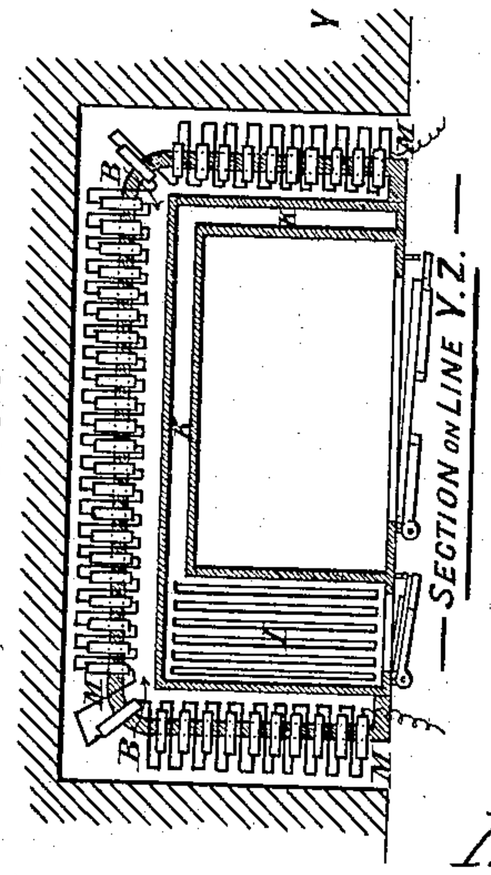
No. 412,669. Patented Oct. 8, 1889.











Witnesses:
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UNITED STATES PATENT OFFICE.

WILLIAM S. DE L. ROBERTS AND JAMES SMITH MOLLISON, OF SYDNEY, NEW SOUTH WALES.

THERMO-ELECTRIC GENERATOR.

SPECIFICATION forming part of Letters Patent No. 412,669, dated October 8, 1889.

Application filed February 9, 1889. Serial No. 299,330. (No model.)

To all whom it may concern:

Be it known that we, WILLIAM SCARLETT DE LISLE ROBERTS and JAMES SMITH MOLLISON, subjects of the Queen of Great Britain and Ireland, and residents of Sydney, in the Colony of New South Wales, have invented certain new and useful Improvements in Atmospheric Thermo-Electric Generators; and we do hereby declare that the following is a full, clear, and exact description of the same.

This invention relates to certain improvements in the construction of those thermo-electric generators where thermo-electric couples are used.

The first part of our invention consists of a stove or furnace which is surrounded by an air-tight hot-air chamber, the outer walls of which are composed of any suitable non-combustible insulating material, preferably a mixture of fire-clay and asbestus. The couples are so inserted into the insulating-wall that for a portion of their length they shall project into the hot-air chamber. The heat in this chamber is regulated by a pyro safety-valve fixed in any convenient position in the upper part of the chamber. All risk of overheating the chamber will thus be avoided and a uniform heat imparted to the couples that project within the hot-air chamber.

The invention further relates to a novel form of the thermo-electric couples without any joint or soldering at the junction of the metals. This is effected during the process of casting by fusing the two metals together. By adopting this mode of forming the couples the inconvenience hitherto experienced from the extra resistance and consequent diminution of the electric current, due to the loosening of the joint by unequal expansion and contraction of the metals, will entirely cease.

In carrying out the invention a furnace or stove of any convenient form may be employed; but for the generation of a large current of electricity for lighting public buildings or streets it is preferable to use a long narrow stove, the length being proportional to the size of the furnace. The stove or furnace is surrounded by an air-space, which is inclosed on its outer side by a wall composed of any suitable insulating non-combustible material, preferably a mixture of fire-clay and asbestus. Into this insulating-wall are fixed the thermo-electric couples, which should project within the air-space for a portion of their length, for reasons hereinafter more particularly specified. In order to prevent overheating in the air-chamber, a pyro safety-valve and pyro-gage of any suitable design are placed at the highest part of the air-chamber. Although no particular design of pyrometer is specified, it is preferable to employ one composed of two metals which expand in different ratios, such as cast-iron and zinc. On the air-chamber becoming heated to the limit of safety the pyro safety-valve is so adjusted that the expansion of the zinc or other metal shall lift the pyro safety-valve, and thus allow the overheated air to escape, while at the same time permitting cold air to enter the chamber through a valve placed near its lowest part; or, without diminishing the efficiency of the apparatus to any perceptible extent, an inlet-passage near the lowest part of the air-chamber may be kept permanently open.

In constructing thermo-electric couples the mode usually adopted hitherto has been to solder the ends of the elements to the negative and positive connecting-pieces, or to simply cast the ends of the elements onto connecting-pieces composed of such metals as tinned iron or copper.

In making our thermo-electric couples we do not confine ourselves to the use of any particular metal or alloys, but we employ two metals or alloys that melt at different temperatures. The metal or alloy of which the connecting-pieces are formed should melt at a lower temperature than the metal or alloy used for the elements. From experience we find that the metal and alloy that give the best results are malleable zinc for the connecting-pieces and an alloy of antimony and zinc for the elements. In order to thoroughly unite the two parts of the couples, the malleable-zinc connecting-pieces are placed within a mold and the alloy of antimony and zinc cast round them. As the zinc will melt at a slightly-lower temperature than the alloy of antimony and zinc, the malleable zinc will,

during the process of casting, melt into the alloy, and will thus form one united whole, without joint, and with an alloy at the ends of the elements containing a slight excess of zinc. The couples thus constructed are then placed in a frame, packed with the insulating non-combustible material above referred to, and placed in the outer wall of the air-chamber which surrounds the furnace. The ends of the couples are made to project a portion of their length within the air-chamber, so that the ends within the chamber may be affected equally by the hot air circulating therein. The air which becomes heated at the hottest or lowest part of the air-chamber will ascend to the highest or coolest part of the same, where, being partially cooled, it will then descend, thus creating a circulation which will continue until the temperature has been equalized throughout the chamber. For domestic purposes the couples may be connected to an air-chamber attached to an ordinary cooking-range, so that during the process of cooking the couples may convey the electricity generated to a set of electric accumulators, and the electricity there stored for subsequent use.

In the accompanying drawings, Figure 1 is a section of the form of furnace we propose to employ for medium and large installations. Fig. 2 is a plan of the same. Figs. 3 and 4 show our thermo-electric generator applied to an ordinary cooking-stove, Fig. 3 being a sectional plan, and Fig. 4 an elevation, of the apparatus. Fig. 5 is a perspective view of the thermo-electric couples.

In Figs. 1 and 2, A represents the furnace; B, the hot-air chamber that surrounds it; C C, the thermo-electric couples, which may be so arranged as to generate either a large current or great electro-motive force, as required. D is the pyro safety-valve, so arranged as to allow the overheated air to escape; E, the pyro-gage, to indicate the rise or fall of temperature within the air-chamber. F is the furnace chimney or uptake.

In Figs. 3 and 4, representing a domestic cooking-range, (which may be connected with a set of secondary electric accumulators,) I is the fire-grate. K K is the flue area for heating the oven and the hot-air chamber B. The thermo-electric couples are shown at M M, projecting, as before described, a portion of their length into the hot-air chamber B.

Fig. 5 is a perspective view of our thermo-electric couples. The two parts of our thermo-electric couples are composed of metals or alloys (see Fig. 5) that melt at different temperatures. In this view *m m* are the positive and negative connecting-pieces, composed preferably of malleable zinc, which melts at a low temperature. *n n* are the elements, composed preferably of an alloy of antimony and zinc, which melts at a much higher temperature than the zinc. The ends of the zinc connecting-pieces are inserted into a mold and the alloy of antimony and zinc cast round them. The result will be that the zinc ends will partially fuse and combine with the alloy of antimony and zinc, forming at the two ends of the elements a second alloy of antimony and zinc, having a slight excess of zinc. The couples will thus be rendered more effective and durable.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is—

1. In thermo-electric generators, the hot-air chamber, in combination with the projecting thermo-electric couples, the separate inner furnace-chamber, and a heat-regulating valve, substantially as described, and as illustrated in the drawings.

2. In thermo-electric generators, the combination of the hot-air chamber and thermo-electric couples with a pyro safety-valve and pyro-gage, substantially as described, and for the purpose herein set forth.

3. In a thermo-electric generator, a couple composed of two metals or alloys which melt at different temperatures, cast one upon or about the other, so that the metal or alloy of which the element is composed shall, while in process of casting, cause the partial fusing of the metal or alloy of which the connecting-pieces are composed, and another alloy be thus formed at the point of union of the metals or alloys, substantially as described, and for the purpose herein set forth.

In witness whereof we have hereunto set our hands in presence of two witnesses.

W. S. DE L. ROBERTS.
JAMES SMITH MOLLISON.

Witnesses:
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