G. J. VOKEL.

PYRO ELECTRIC GENERATOR.

APPLICATION FILED JAN. 15, 1908.

903,116. Patented Nov. 3, 1908.

2 SHEETS—SHEET 1.

Fig. 1.

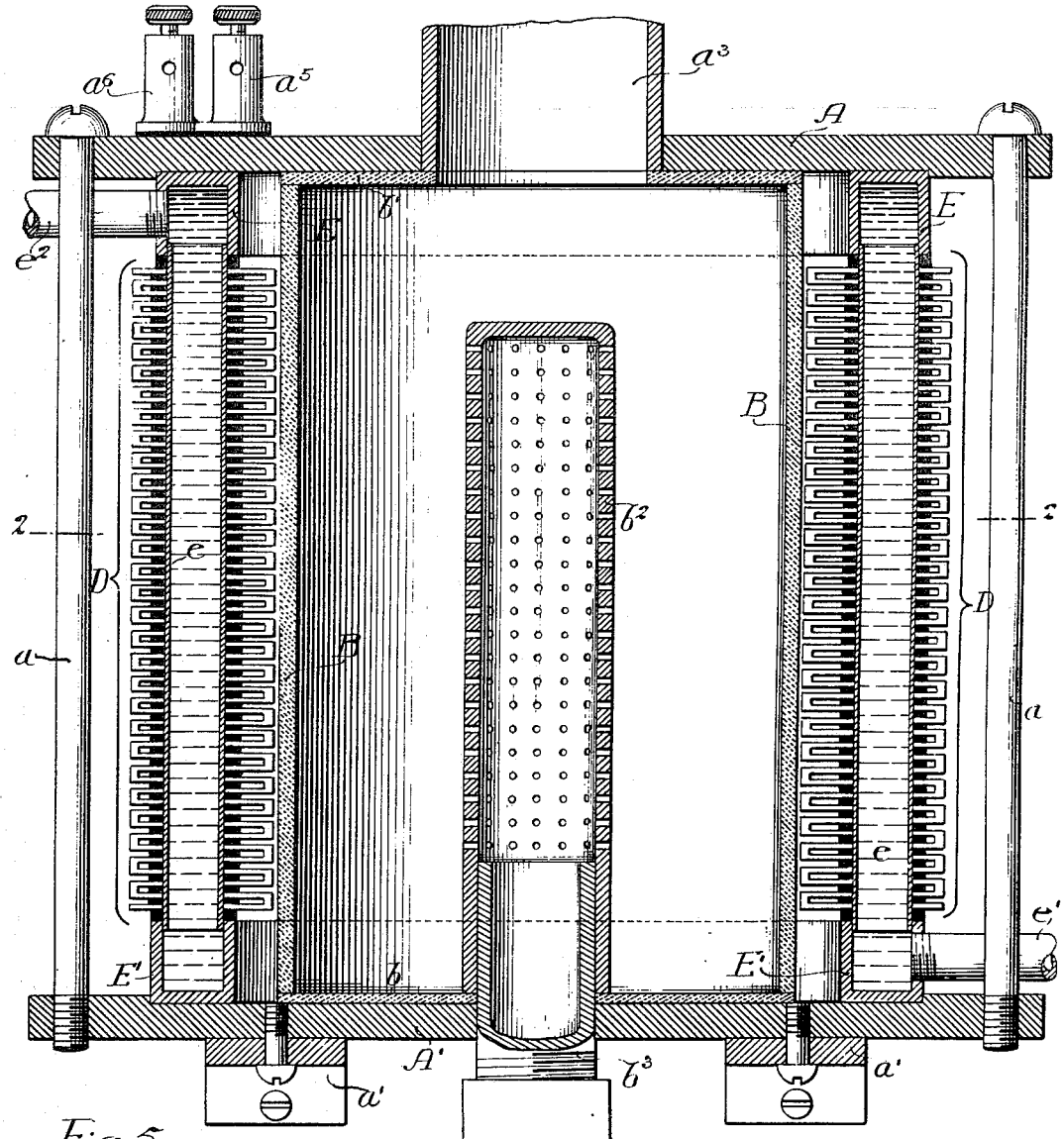
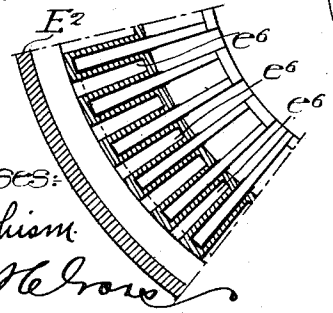
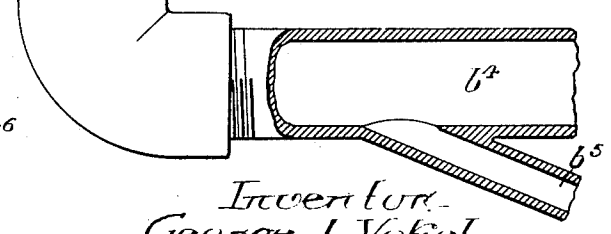


Fig. 5.





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2 SHEETS—SHEET 2.

Fig. 2.

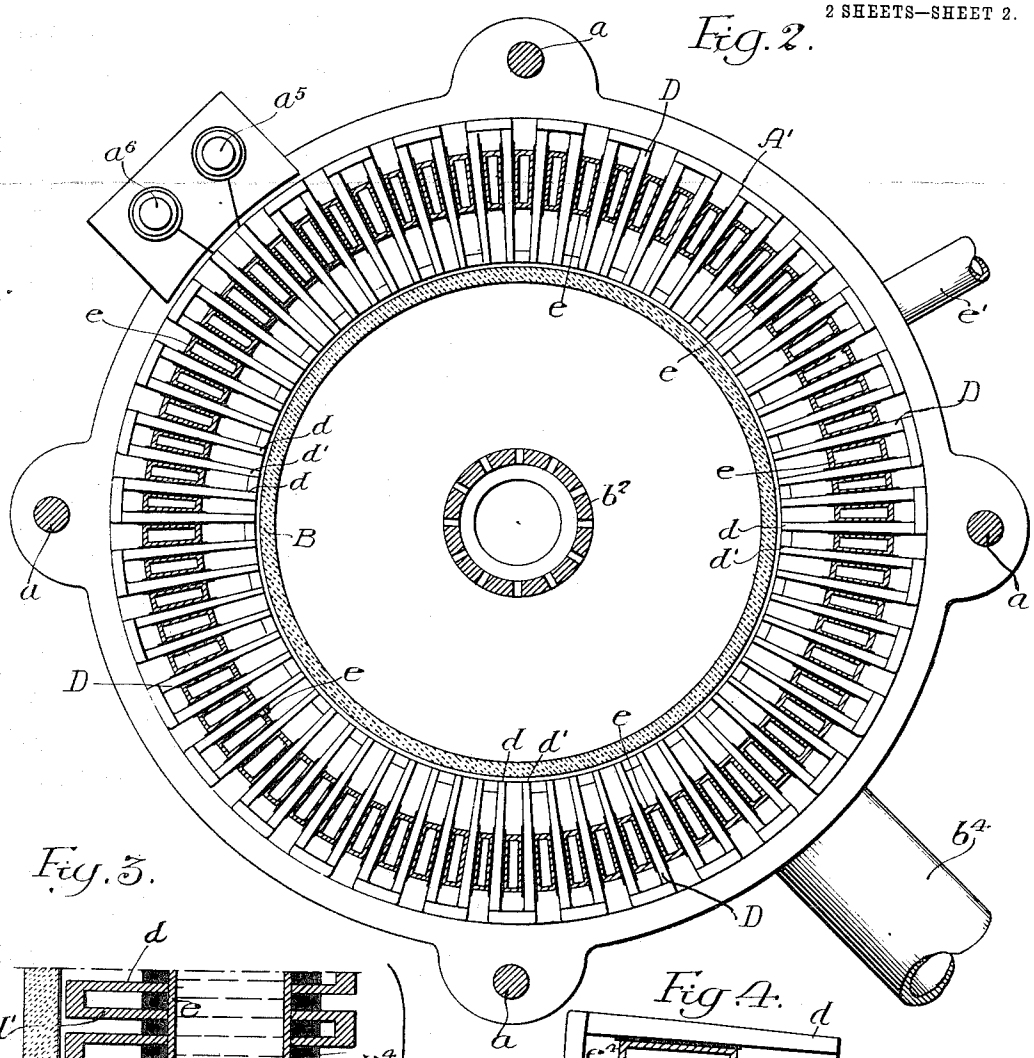


Fig. 3.

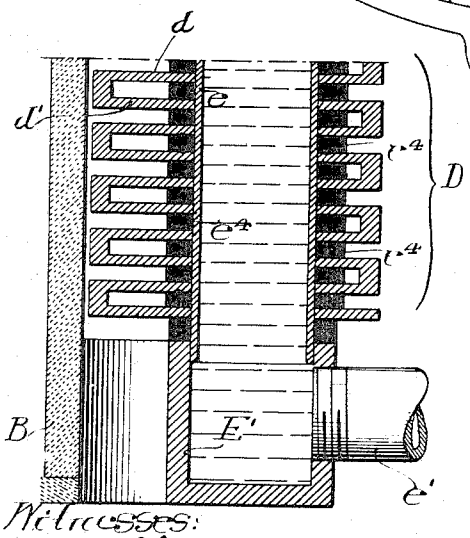
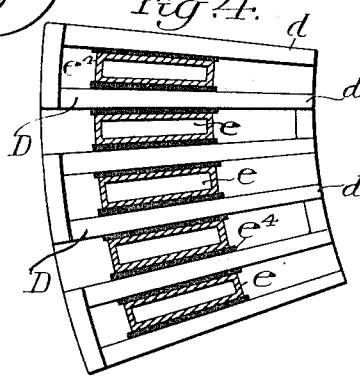


Fig. 4.



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UNITED STATES PATENT OFFICE.

GEORGE J. VOKEL, OF PHILADELPHIA, PENNSYLVANIA.

PYRO-ELECTRIC GENERATOR.

No. 903,116. Specification of Letters Patent. Patented Nov. 3, 1908.

Application filed January 15, 1908. Serial No. 410,890.

To all whom it may concern:

Be it known that I, GEORGE J. VOKEL, a citizen of the United States, residing in Philadelphia, Pennsylvania, have invented certain Improvements in Pyro-Electric Generators, of which the following is a specification.

One object of my invention is to provide a device designed to directly convert the energy developed by a burner or other suitable source of heat into an electric current; it being particularly desired to provide a pyro-electric generator which shall, in addition to being compact and efficient, be of a substantial construction, with its parts so arranged as to require but little attention or repairs.

Another object of the invention is to provide a generator of the above noted type, in which the thermo couples shall be provided with cooling means of improved arrangement and construction.

These and other advantageous ends I secure as hereinafter set forth, reference being had to the accompanying drawings, in which;—

Figure 1, is a vertical section illustrating my improved generator; Fig. 2, is a horizontal section taken on the line 2—2, Fig. 1; Fig. 3, is an enlarged fragmentary vertical section, illustrating the arrangement and construction of certain of the detail parts of my device; Fig. 4, is a horizontal section further illustrating the structure shown in Fig. 3; and Fig. 5, is a vertical section illustrating a possible modification of my device.

In the above drawings A and A′ are two substantially circular plates or disks, usually of iron, held together by a suitable number of bolts a extending between them and mounted in the present instance upon a suitable supporting structure of which the brackets are indicated at a'.

Confined between the plates is a cylinder B preferably of lava or other refractory material capable of withstanding high temperatures, and this in the present instance has at its ends circular plates b and b' of similar material placed between it and the plates A and A′. It is, however, to be understood that in many cases this cylinder may be omitted without departing from my invention, as it is employed mainly to protect the thermo couples hereafter described, from the direct action of the heated gasses or products of combustion. Where the objections from this cause are not vital the cylinder would not be used.

Extending axially within the cylinder B in this case is a burner b^2 connected to a supply pipe b^3 which extends through the bottom plate B′ and is connected to a source of air and acetylene or other suitable fule delivered through pipes b^4 and b^5 respectively. This burner extends well through the cylinder B and is designed to produce an intense heat when operated therein under forced draft, there being in the upper plate A an outlet pipe or chimney a^3 to permit of the escape of the products of combustion.

Surrounding the burner and placed in planes substantially radial thereto are a series of sets of thermo couples D, of which each couple is composed of strips d and d' formed of two different metals, in the present instance iron and nickel, lying parallel with each other and connected together at one end.

The various couples of each set D are in this case connected in series, and the various sets may in turn be connected together electrically in the manner well known in the electrical art to secure the desired voltage or current capacity for the generator.

It will be noted that while the inner ends of the couples are immediately adjacent to the lava cylinder B, or when this is omitted, to the space containing the burner, their outer ends are as far as possible from said burner and exposed to the cooling action of air.

In order to increase the difference in temperature between the inner and outer ends of the couples, I place between each set D thereof, a vertically extending water tube e and connect these tubes at the top by an annular conduit or ring E, similarly connecting their lower ends by a second annular conduit E′.

An inlet e^2 is provided for the ring E and an outlet e' is provided for the ring E′ and it will be noted that the members of the various couples are separated from each other and from the cooling tubes e by insulating material e^4. This latter is preferably some noncombustible substance such as mica or the like, and of such a nature as to be unlikely to break and unaffected by the heat or

other conditions to which it is exposed in my device.

The terminals of the generator are indicated at a^5 and a^6 and in the present instance, are mounted in a suitable manner upon the top of the plate A. Under operating conditions liquid or gaseous fuel is delivered, preferably under forced draft, to the burner b^2 and is burned within the chamber formed by the cylinder B and the plates b and b' or when said cylinder is omitted, within the space inclosed by the thermo couples so that the inner ends of the strips constituting the thermo couples are intensely heated. Water is at the same time circulated through the rings E and E′ and the tubes e, and under these conditions there is set up between the terminals of each couple a difference of potential dependent upon the conditions well known in this art; the various sets and couples being so connected as to secure any desired voltage and current capacity at the terminals a^5 and a^6.

It is obvious that any desired metals may be employed in place of the iron and nickel heretofore specified, and, if desired, in place of arranging the couples in vertical sets, they may be arranged in any other manner which may be found advisable or convenient. Similarly, while I preferably supply the water tubes between the sets of couples from the top and bottom rings E and E′, I may in some cases completely inclose the various sets of thermo couples by a water jacket E^2 and connect this to vertical tubes e^6, which, as before, extend between the couples so as to insure the effectual cooling of their outer ends in the manner indicated in Fig. 5.

By using forced draft it is obvious that a relatively larger amount of energy may be developed in a generator of a comparatively small size, while owing to the general arrangement of the various sets of couples and their cooling apparatus, the electrical efficiency of the device is high for this type of apparatus.

I claim:

1. A pyro-electric generator having a number of thermo couples arranged in a plurality of sets, with a plurality of conduits for cooling fluid extending vertically between the sets of couples intermediate the ends of the elements constituting said couples.

2. A pyro-electric generator having a plurality of thermo couples arranged to form a hollow cylinder, means for heating one end of each couple, and a cooling device consisting of a plurality of conduits extending substantially parallel with the axis of the cylinder between the thermo couples intermediate their ends.

3. A pyro-electric generator having a plurality of thermo couples arranged in the form of a hollow cylinder, means for heating the inner ends of said couples, and a cooling device consisting of a plurality of conduits extending substantially parallel with the axis of the cylinder between the thermo couples intermediate their ends.

4. A pyro-electric generator having a plurality of thermo couples arranged in the form of a hollow cylinder supported with its axis vertical, means for heating the inner ends of said couples, a cooling device consisting of a plurality of conduits extending vertically between the thermo couples intermediate their ends, and means for supplying cooling fluid to said tubes.

5. A pyro-electric generator including a plurality of sets of thermo couples arranged radially to form a hollow cylinder, means for heating the inner ends of said couples, a plurality of vertical tubes extending between the sets of couples intermediate their ends, means for supplying cooling fluid to said tubes, and heating means for the couples.

6. The combination in a pyro-electric generator of a series of radially extending thermo couples supported in vertical sets to form a hollow cylinder, vertically extending tubes between said sets, means for supplying cooling fluid to said tubes, and means for heating the couples.

7. The combination in a pyro-electric generator of a number of thermo couples supported in sets to form a hollow structure, tubes between said sets, hollow rings respectively connected to the ends of said tubes, heating means for the generator, with conduits for supplying cooling fluid to said rings and tubes.

8. A pyro-electric generator consisting of a supporting framework, a cylinder of refractory material, heating means within said cylinder, a plurality of thermo couples arranged radially around said refractory cylinder, a series of tubes between the various sets of thermo couples, and means for supplying cooling fluid to said tubes.

9. A pyro-electric generator consisting of an upper and a lower plate, means for mechanically connecting said plates, a cylinder of refractory material confined between said plates, a plurality of sets of thermo couples arranged around the outside of said cylinder in the form of a hollow cylinder, a series of water tubes extending between said sets of couples, with means for supplying water to said tubes.

10. A pyro-electric generator consisting of an upper and a lower plate, means for mechanically connecting said plates, heating means mounted between the plates, a plurality of sets of thermo couples arranged around the outside of said heating means in the form of a hollow cylinder, a series of water tubes extending between said sets of couples, with two hollow rings respectively

connected to the tops and bottoms of said tubes.

11. A pyro-electric generator consisting of a supporting framework, a plurality of sets of thermo couples carried by said framework and arranged to form a hollow cylinder, a series of flat tubes extending vertically between the various sets of couples, insulating material between the metal of the couples and said tubes, means for supplying cooling fluid to the tubes, and heating means for the generator.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

GEORGE J. VOKEL.

Witnesses.
WM. E. SHUPE,
WM. A. BARR.