A. SINDING-LARSEN.

METHOD AND MEANS FOR THE UTILIZATION OF THE THERMIC EFFECT OF CATHODE RAYS.

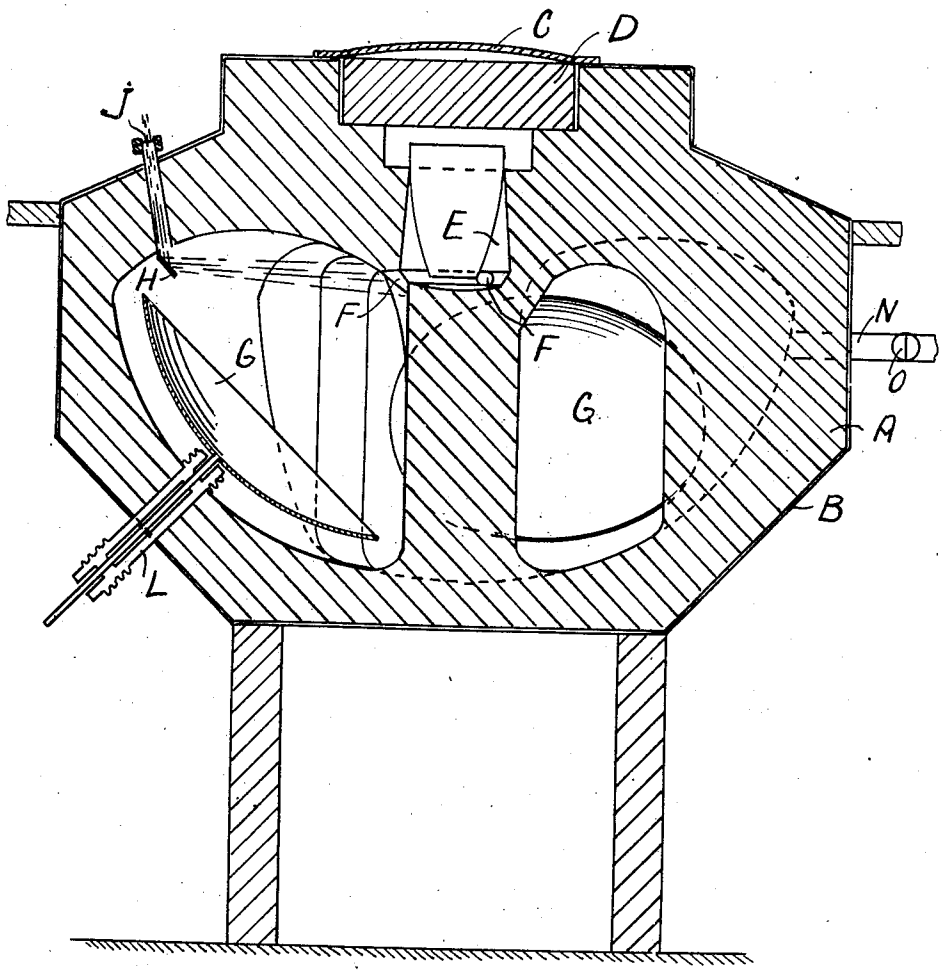
APPLICATION FILED OCT. 30, 1918.

1,326,794.

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2 SHEETS—SHEET 1.

FIG. 1.



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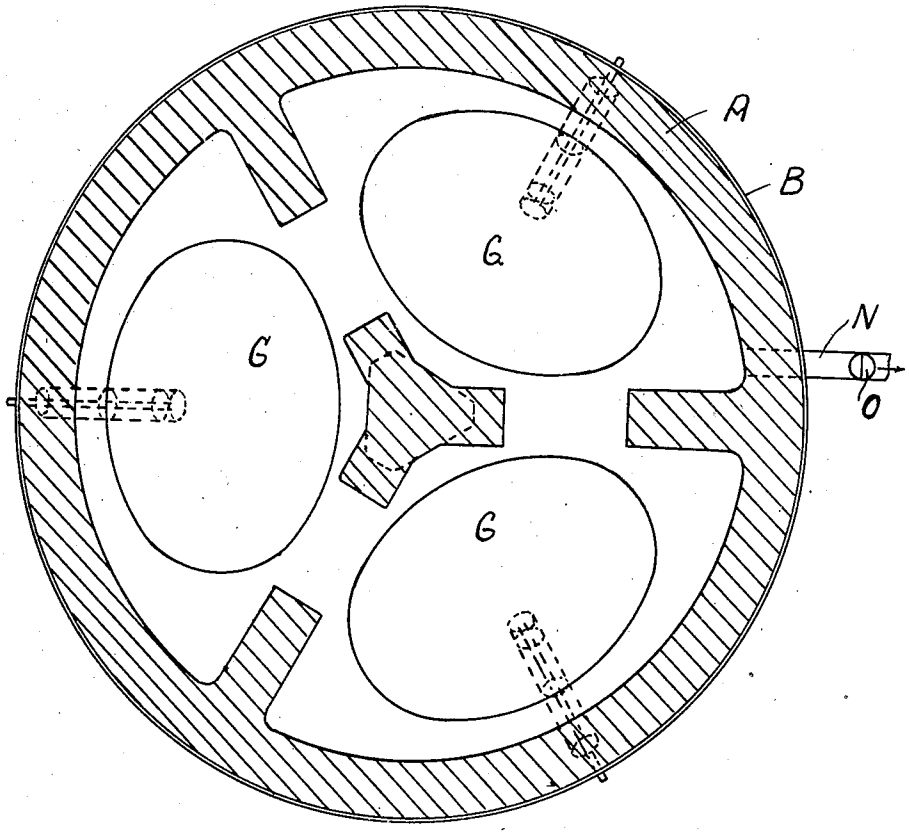
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2 SHEETS—SHEET 2.

FIG. 2.



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UNITED STATES PATENT OFFICE.

ALF SINDING-LARSEN, OF VESTRE AKER, NEAR CHRISTIANIA, NORWAY.

METHOD AND MEANS FOR THE UTILIZATION OF THE THERMIC EFFECT OF CATHODE-RAYS.

1,326,794. Specification of Letters Patent. Patented Dec. 30, 1919.

Application filed October 30, 1918. Serial No. 260,407.

To all whom it may concern:

Be it known that I, ALF SINDING-LARSEN, a subject of the King of Norway, of Vestre Aker, near Christiania, Norway, have invented certain new and useful Improvements in Methods and Means for the Utilization of the Thermic Effect of Cathode-Rays; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

This invention has for its object a method as well as means for the utilization of the thermic effect of cathode rays.

According to the present invention an efficient utilization of the thermic effect of cathode rays is obtained by means of collecting the rays by some known means so as to form a narrow pencil of a greater or less extension.

The object of this arrangement is not only to produce a concentrated action of the thermal power of the rays, but more particularly to allow of passing the rays from the comparatively wide space in which the cathode is arranged through a narrow opening to the space where the heat is to be utilized for instance for the purpose of heating a crucible. This arrangement enables the object to be heated of being placed in a compartment, which is efficiently insulated against loss of heat by radiation, so that substantially all the heat produced by the rays is taken up by the object to be heated, while comparatively only a small quantity of heat can be given off by radiation through the narrow opening. The collection of the rays to narrow pencils may be brought about by the use of concave cathode plates, by means of solenoids and in any other manner.

An embodiment of the invention is diagrammatically illustrated in the accompanying drawing, which shows a furnace for carrying the process into effect.

In the illustrated example it is presumed that three phase current is made use of, three cathods being provided. Each of the said cathodes is connected to its phase of the current. It is obvious however, that any other type of current may be used for carrying the invention into effect.

In the drawings Figure 1 is a vertical section of a furnace, and Fig. 2 is a horizontal section.

In the drawing A is the brickwork of the furnace inclosed in a casing B. In the top of the furnace is centrally arranged a heating compartment E, in which a crucible may for instance be placed. The compartment is closed by means of a block D, on which is placed a cover C.

The lower part of the furnace is divided by three partitions in three compartments communicating with each other and inclose the electrodes G, which comprise concave plates carried at the end of insulators L introduced through the brickwork. In the axial direction of the electrodes a narrow opening F is provided between the said heating compartment E and the electrode compartments, the concavity of the electrode surfaces being so adapted as to cause the rays to cross one another or focus just in this narrow opening. The rear surfaces of the electrodes may be insulated and may be provided with cooling means. J is a tube with a mirror H inserted in the upper part of the brickwork. Through this tube the openings and their surroundings can be inspected so that the cathodes may be adjusted if the rays happen not to project exactly into the opening. N is a pipe with a valve O, communicating with a large vacuum container, in which a vacuum is maintained by means of a pump. The vacuum container is of such large volume as to compensate for accidental evolutions of gas in the cathode compartments.

In the illustrated example and also when other alternating current is made use of the electrodes alternately serve as cathodes and as anodes, special anodes being thus not necessary.

The crucible or other object to be heated may be grounded when alternating current is used and when direct current is employed the heating object may be connected to the positive pole of the source of current.

When direct current is used the cathode only needs to be concave.

I claim:

1. Method of utilizing the thermic effect of cathode rays consisting in collecting the

rays, so as to produce a narrow pencil of rays passing the so condensed rays through a narrow opening into a heat insulating chamber for inclosing the object to be heated and causing the rays to act upon the said object.

2. Apparatus for the utilization of the thermic effect of cathode rays comprising means for producing cathode rays, means for the collection of the rays so as to produce a narrow pencil of rays, a heat insulating body inclosing the object to be heated, a narrow opening in this heat insulating body and means to cause the pencil of rays to project through this narrow opening and on to the object to be heated.

3. In apparatus for the utilization of the thermic effect of cathode rays, electrodes, concave mirrors attached to said electrodes, said concave mirror electrodes arranged to alternately serve as cathodes and anodes.

4. Apparatus according to claim 2 in which a reduced pressure is maintained in the compartment containing the object to be heated, the said compartment being connected to a vacuum pump through a pipe in which is inserted a vacuum container of such a volume as to allow of an instantaneous compensation for accidental evolutions of gas.

5. Apparatus for the utilization of cathode rays as defined in claim 2 in which the cathodes producing the rays are constructed as concave mirrors.

6. Apparatus constructed in accordance with claim 2 in which the back of the electrode is electrically insulated and provided with a cooling arrangement.

7. Apparatus for the utilization of the thermic effect of cathode rays, comprising a furnace having an electrode chamber, means in said chamber for focusing cathode rays, a melting chamber separated from the electrode chamber and connected thereto by a small direct opening and said rays being focused in said opening.

8. Apparatus for the utilization of the thermic effect of cathode rays, comprising a furnace having a plurality of connected chambers, means in each chamber for focusing cathode rays, a heating and melting chamber separated from said connected chambers and having a direct opening connecting said heating and melting chamber with each furnace chamber, the cathode rays being focused in said openings.

9. Apparatus for the utilization of the thermic effect of cathode rays, comprising a furnace having a plurality of connected chambers, means in each chamber for focusing cathode rays, a heating and melting chamber separated from said connected chambers and having a direct opening connecting said heating and melting chamber with each furnace chamber, the cathode rays being focused in said openings, and means to maintain exhaustion of the connected chambers.

10. The method of utilizing the thermic effect of cathode rays, which comprises separately focusing the rays emanating from a plurality of electrodes through separate openings into a chamber containing the object to be heated.

11. The method of utilizing the thermic effect of cathode rays, which comprises maintaining electrodes in separate communicating exhausted chambers and separately focusing the rays from each electrode through a narrow opening into a closed chamber containing the object to be heated.

12. The method of utilizing the thermic effect of cathode rays, which comprises focusing the cathode rays at a small opening in the heating chamber, and heating an object in said chamber beyond the focus of the rays.

In testimony that I claim the foregoing as my invention, I have signed my name in presence of two subscribing witnesses.

ALF SINDING-LARSEN.

Witnesses:

C. FABRICIUS HANSEN,

EMAR W. DIESERUD.