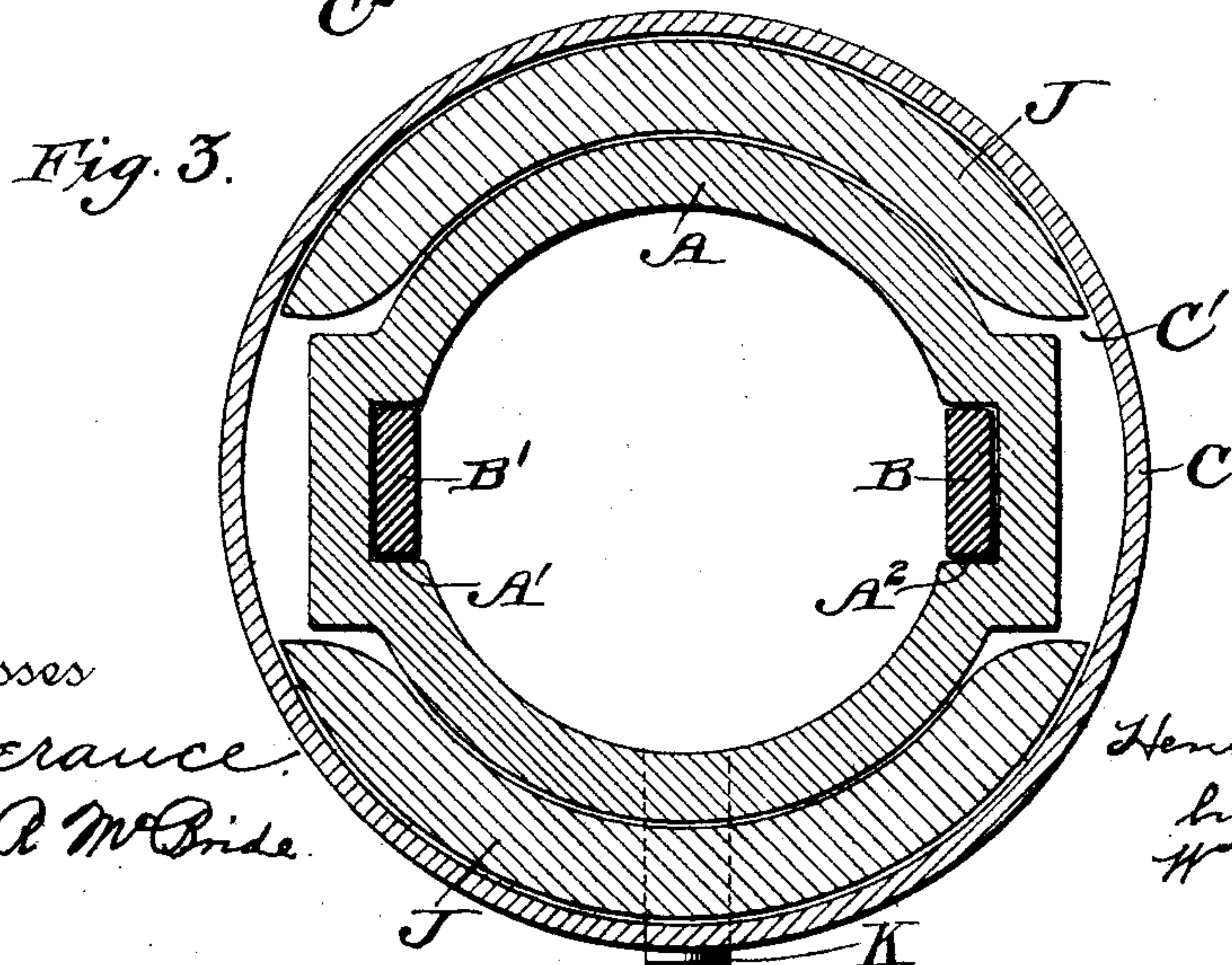
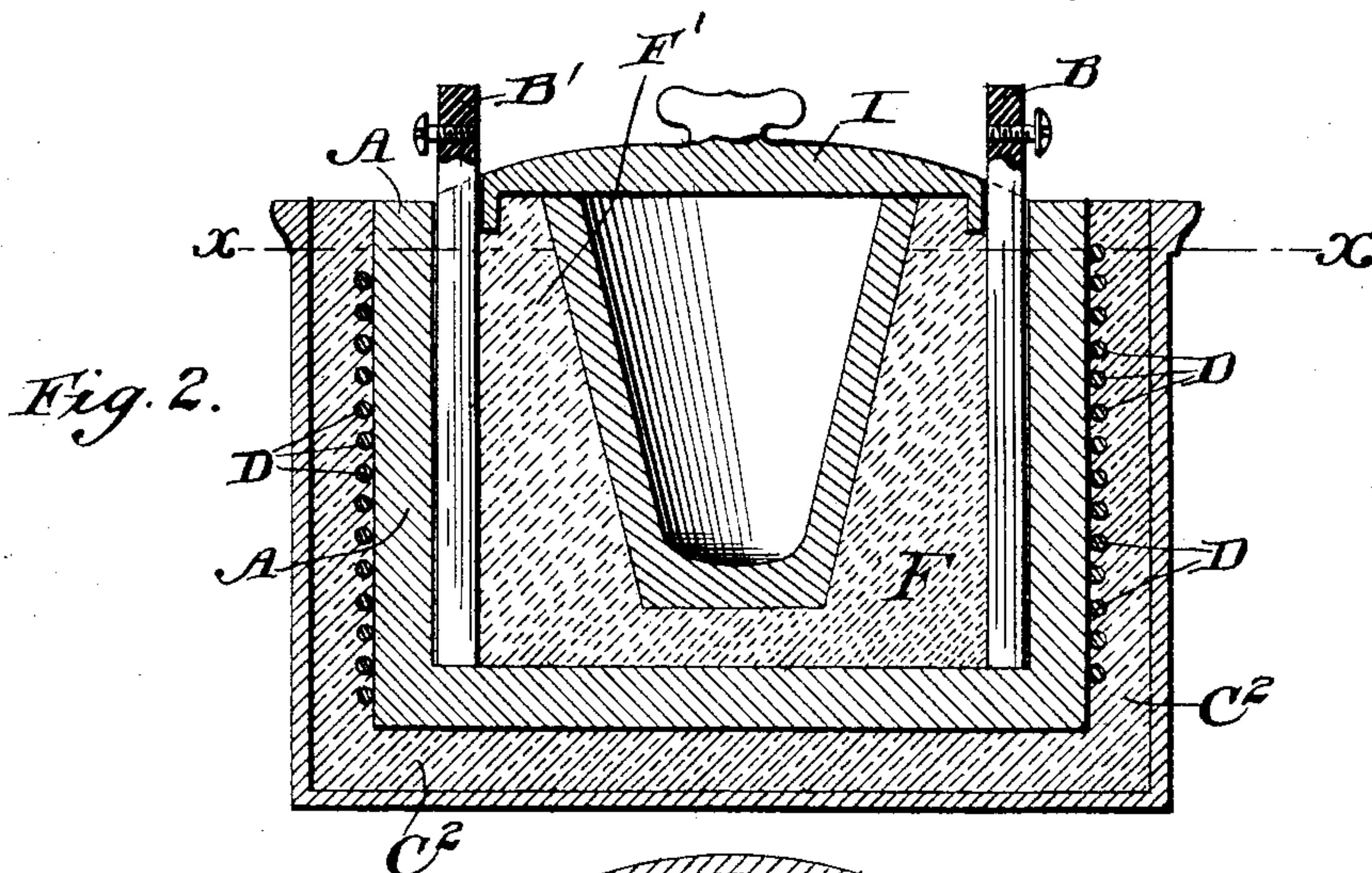
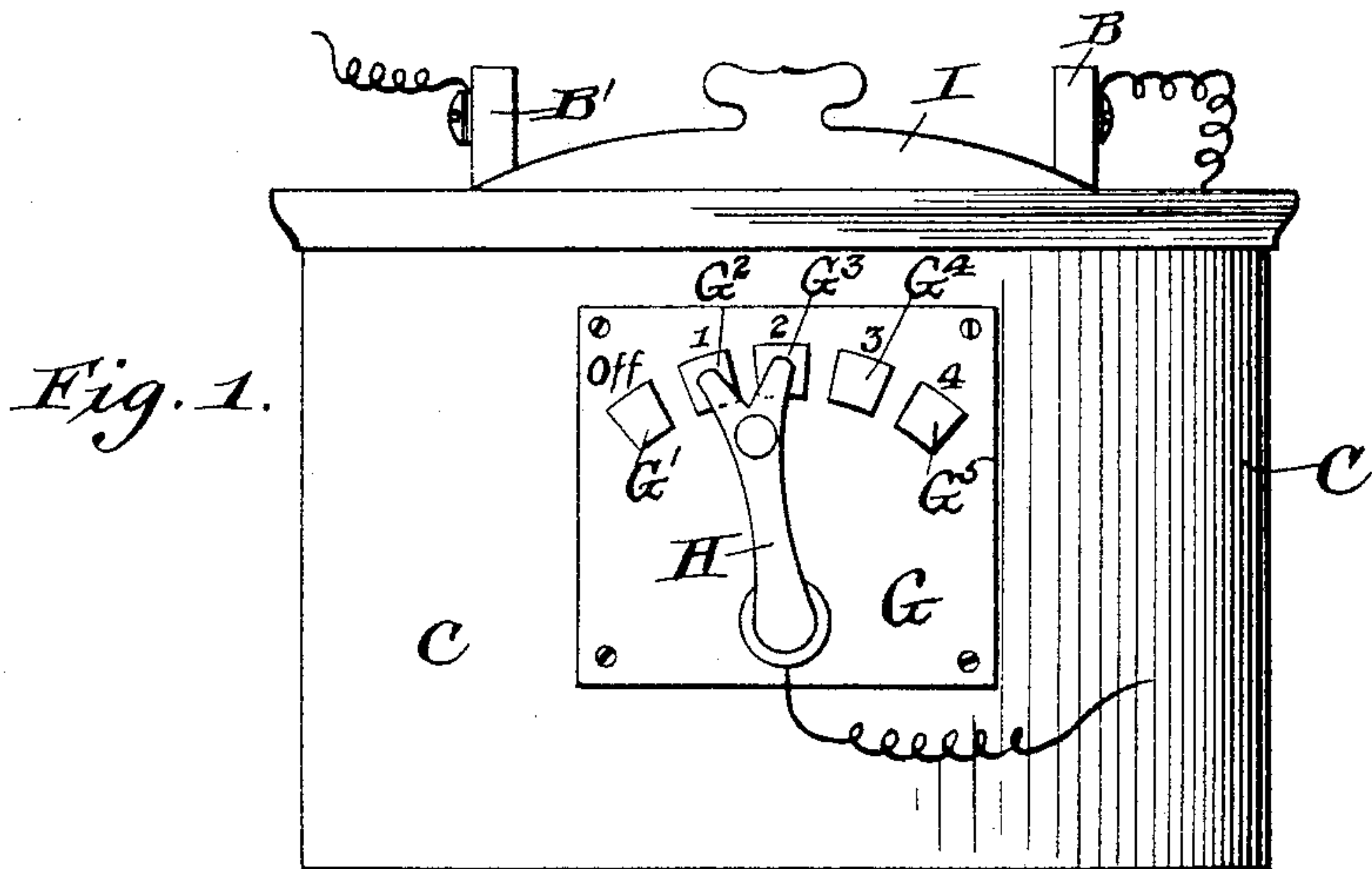


H. G. O'NEILL.

ELECTRICALLY AND CHEMICALLY HEATED CRUCIBLE.

No. 538,271.

Patented Apr. 30, 1895.



Witnesses

Everance
Charles A. McBride

Inventor

Henry G. O'Neill
by *W. H. Babcock*
Attorney

(No Model.)

2 Sheets—Sheet 2.

H. G. O'NEILL.

ELECTRICALLY AND CHEMICALLY HEATED CRUCIBLE.

No. 538,271.

Patented Apr. 30, 1895.

Fig. 4.

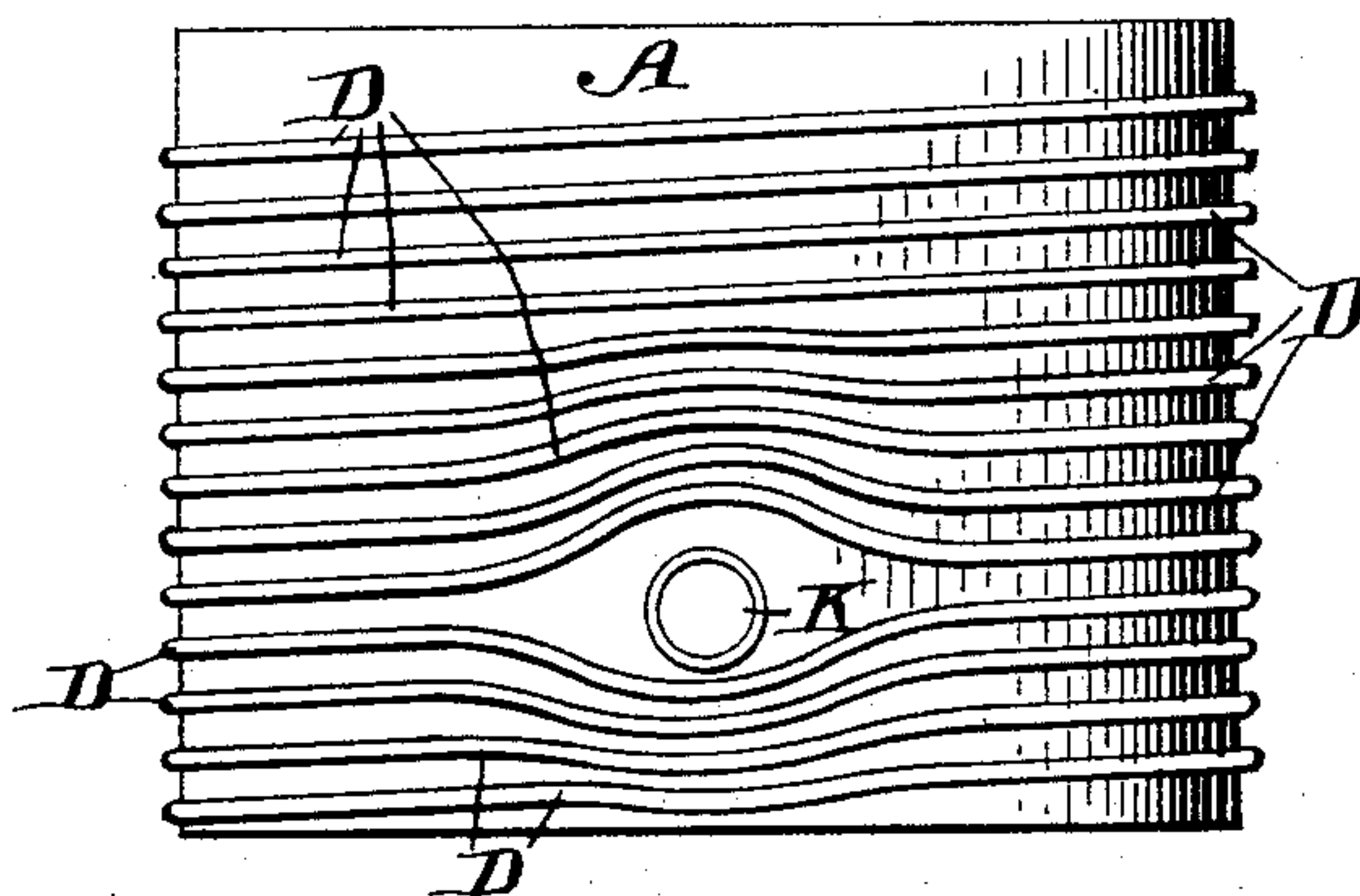
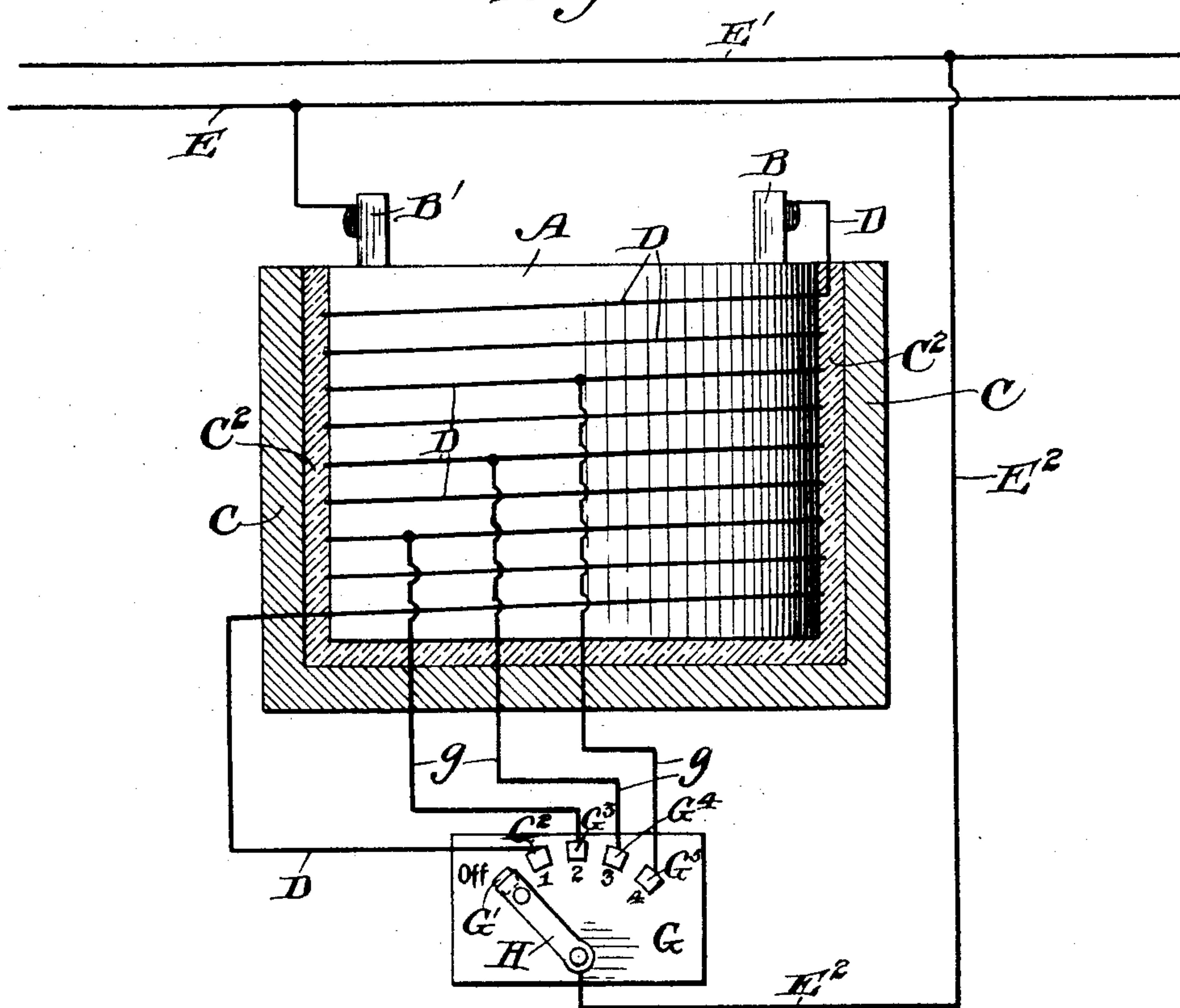


Fig. 5.



Witnesses

Everance
Park & McBride.

Inventor

Henry G. O'Neill
by
Henry Babcock
Attorney

UNITED STATES PATENT OFFICE.

HENRY G. O'NEILL, OF BOSTON, MASSACHUSETTS, ASSIGNOR TO EDWARD JEWELL, OF SAME PLACE, AND CHARLES W. WELCH, OF STOUGHTON, MASSACHUSETTS.

ELECTRICALLY AND CHEMICALLY HEATED CRUCIBLE.

SPECIFICATION forming part of Letters Patent No. 538,271, dated April 30, 1895.

Application filed March 24, 1894. Serial No. 504,952. (No model.)

To all whom it may concern:

Be it known that I, HENRY G. O'NEILL, a citizen of the United States, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Electrically and Chemically Heated Crucibles Containing Rheostats; 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.

This invention relates to the art of heating by electrical and chemical means, that is to say by means in which the electric current generates heat by the combustion or other chemical action which it causes or facilitates, as well as directly by overcoming the resistance of conductors and other purely physical methods of heat-evolution. More especially this invention relates to electrically and chemically heated crucibles and other like articles, in which a very high temperature is necessary for the reduction of their contents. This invention is designed to produce high temperatures, readily controlled, with the least possible outlay of energy.

Heretofore, in devices of this character, owing to the inconstancy of the resistance, it has generally been found necessary to use liquid rheostats, in which, on an average, one half of the total energy employed was lost; not more than half being utilized in the crucible itself. Finely pulverized material of a carbonaceous nature has been used in such crucibles as a resistance, but it has been open to two serious objections—insufficient resisting power, especially when heated, and contaminating the surrounding air with fine carbonaceous clouds, rendering delicate chemical manipulations impossible, and causing much other inconvenience. Moreover such crucibles and similar articles, as heretofore constructed, have generally lost a large percentage of heat units by radiation through the crucible walls and have also disintegrated very soon under the intense heat prevailing within them.

My invention remedies the above defects, dispensing with the need for a liquid rheostat, avoiding the production of clouds of carbonaceous material, and locking in and utilizing almost all the heat that is generated.

To these ends my said invention consists in the construction and combination of parts, hereinafter particularly set forth and claimed.

In the accompanying drawings, Figure 1 represents a front elevation of an electrochemically heated crucible or small furnace embodying my invention. Fig. 2 represents a vertical central section through the same. Fig. 3 represents a horizontal section on the line $x-x$ of Fig. 2. Fig. 4 represents a front elevation of the interior receptacle or crucible proper and the wire resistance wound thereon; and Fig. 5 represents a diagram of the circuits and regulating devices the exterior receptacle being shown in section and a contact arm being shown of a slightly different form from that in Fig. 1.

A designates this crucible or inner receptacle which may have any convenient form and consists of a mixture of diatomaceous earth and kaolin or fire clay molded and fired as is usual in pottery making. Molded asbestos may be substituted therefor. At diametrically opposite points two recesses A' A^2 are formed in its inner face to receive and hold the bar electrodes B and B', preferably of compressed carbon, which are interchangeable and renewable.

C represents an outer receptacle of non conducting material, large enough to leave a space C' between it and the sides and bottom of the inner receptacle A, which space is filled with diatomaceous earth C^2 or some other comminuted insulating and fire proof material. The tops of the two receptacles A and C are on a level.

A resistance D of wire, carbon or other conducting material is wound around the inner receptacle A, one of its ends being connected to electrode B while the other end is connected to the contact plate G hereinafter described. The other electrode B' is in connection with wire E one of the feed wires of an

electric circuit. From the other feed wire E' of the said circuit a wire E² extends to a movable switch or contact arm H hereinafter described. This at will is in contact with plate G; and the circuit is completed through a conducting medium F which is placed within the receptacle A so as to be in contact with the said electrodes. For this conducting medium F I prefer to employ lamp-black mixed with diatomaceous earth though other forms of carbon may be used in this mixture; the amount of the latter regulating the resistance of the mixture, and also the increase thereof tending to keep such resistance more constant as the temperature increases. The mixture of diatomaceous earth prevents the surrounding air from being clouded by particles of carbon, in filling the crucible and when they are agitated by the escaping products of combustion.

When lime or similar material is employed, mixed with carbon of any kind, so great is its decomposition when highly heated that the continuity of operation is interrupted and a uniform and steady heating cannot be obtained, owing to the rapid generation of gas that forces its way upward, disturbing the resistance, and always interrupting the current partially or wholly. By the use of diatomaceous earth in the mixture instead of lime all the disadvantages are eliminated and the objections above stated are overcome.

To regulate at will the resistance surrounding the inner receptacle A I provide the outer receptacle C with a series of contact plates G' G² G³ G⁴ G⁵, which are connected by wires g to the resistance D at different points of its length. The outside of the said receptacle A is also provided with a pivoted contact arm H which may be shifted from one of these plates to another for the purpose of cutting out more or less of the said resistance from the circuit. The contact plate G² which provides for the maximum resistance, usually about four ohms, is connected by its wire g with one end of the resistance D, the other end of the said resistance being connected to a feed wire, while the contact arm H is connected to another feed wire in the same circuit which is closed through the said resistance. Of course the regulating of the amount of resistance by shifting the said arm increases or decreases at will the available strength of current and the heat producing effect. The contact end of the said arm H is shown bifurcated in Fig. 1 so as to rest on two contact plates at once; but this is not necessary. The current will of course be directed through the plate communicating with the less resistance. A lid I may be employed for the said inner receptacle or crucible A, being preferably composed of earthenware or other refractory material.

Spacing pieces J are inserted between the inner and outer receptacles A and B, being

supported by the diatomaceous earth C² in the space C' which latter they maintain of equal width at all points.

A tube or passage K, extending from the outside of the outer receptacle to the inside of the inner receptacle, allows the insertion of rods or other articles the ends of which are to be heated; or muffles may be run in through this passage and withdrawn also through the same; or any suitable vessel F' containing a substance to be acted on by intense heat may be introduced within the said inner receptacle and crucible and withdrawn therefrom at will.

The operation is as follows: When the electric current is turned on, it leaps from particle to particle of the mixture F which is in a very minute state of subdivision. Molecular arching is really established. Under this action the carbon in mixture F becomes incandescent very quickly. The atmospheric oxygen unites with the carbon and the resulting gas ignites, giving the heat of combustion also. To this is added the heat of resistance from the resistance D. So intense is the heat thus produced that carbon itself is vaporized, showing the temperature to be over 3,000° centigrade.

I find by experience that the reduction of the most refractory metal or ore on a small scale may be accomplished at an outlay of about twelve hundred watts of energy.

The devices hereinbefore described may be used for electric and chemical heating purposes wherever applicable, as well as for crucibles and other metal reducing apparatus.

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

1. In an electro-chemical crucible or furnace a mixture of diatomaceous earth and carbonaceous material with a containing receptacle and electric circuit connections arranged and adapted to send a current of electricity through the said mixture substantially as set forth.

2. The combination of a crucible or receptacle with electrodes contained therein, electrical circuit connections to the said electrodes and a mixture of diatomaceous earth and carbonaceous material interposed between the said electrodes substantially as set forth.

3. In combination with a mixture of diatomaceous earth and carbonaceous material and electrical connections making circuit through such mixture, a receptacle containing the same, a resistance wound on the said receptacle and electrical circuit connections through the said resistance substantially as set forth.

4. In combination with a receptacle and a mass of comminuted conducting material contained within the same, a resistance wound on the said receptacle a movable contact arm and series of contact plates and their connections for cutting more or less of the said re-

sistance out of circuit, and electrical conductors making circuit through the said resistance and the said mass substantially as set forth.

- 5 5. In electro-chemical heating devices, the combination of a comminuted mixture of diatomaceous earth and carbonaceous material with electric circuit devices arranged to send

a current through the same substantially as set forth.

In testimony whereof I affix my signature in presence of two witnesses.

HENRY G. O'NEILL. [L. S.]

Witnesses:

CARL F. A. SIEDHOF,
PELATIAH R. TRIPP.

10