No. 719,484. PATENTED FEB. 3, 1903.

H. MAXIM.

APPARATUS FOR ELECTROTHERMALLY TREATING MATERIALS.

APPLICATION FILED AUG. 17, 1898.

NO MODEL

3 SHEETS—SHEET 1.

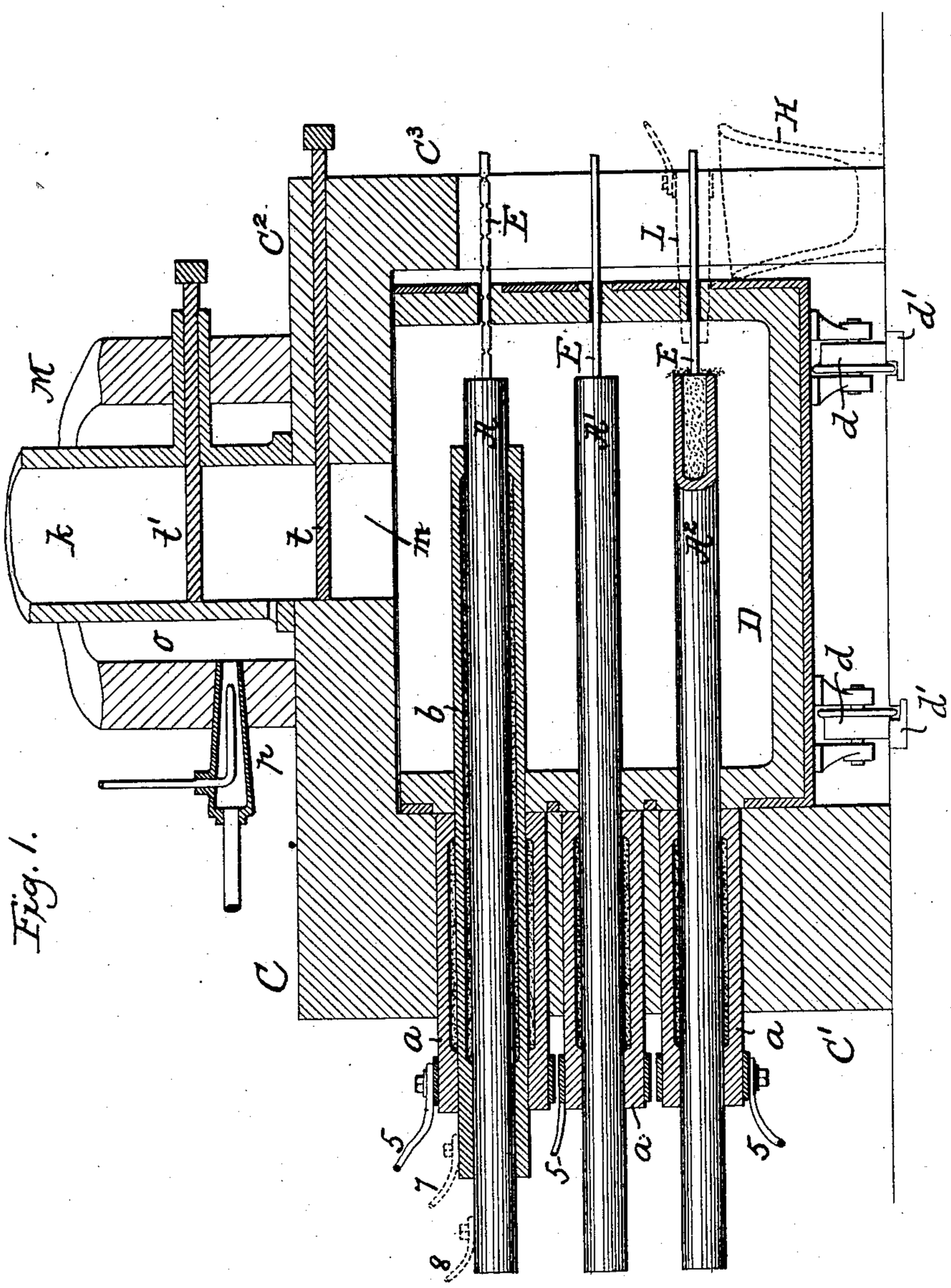

Fig. 1.

WITNESSES:

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J. T. Cammann

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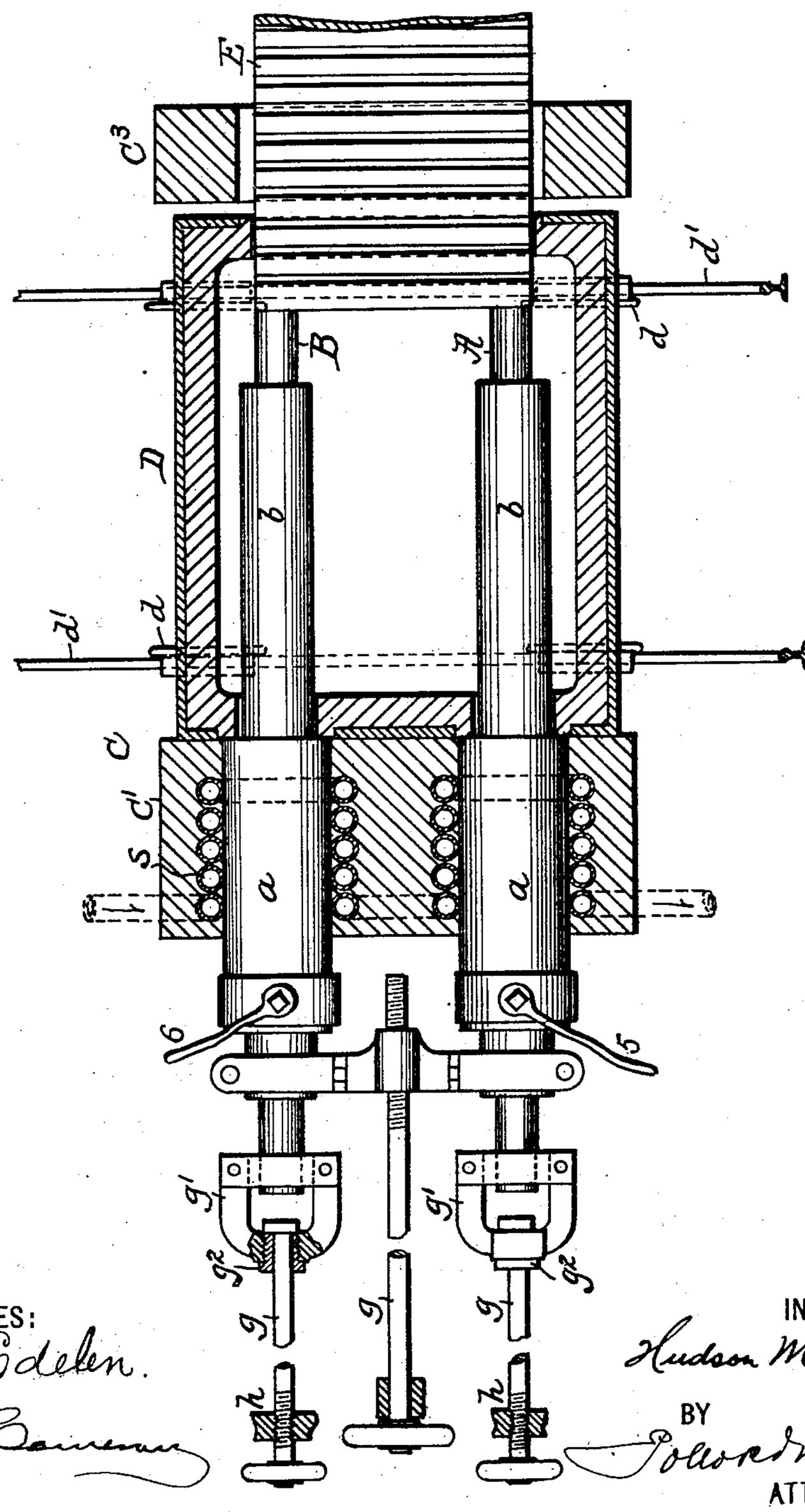
NO MODEL. 3 SHEETS—SHEET 2.

Fig. 2.



WITNESSES:

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NO MODEL. 3 SHEETS—SHEET 3.

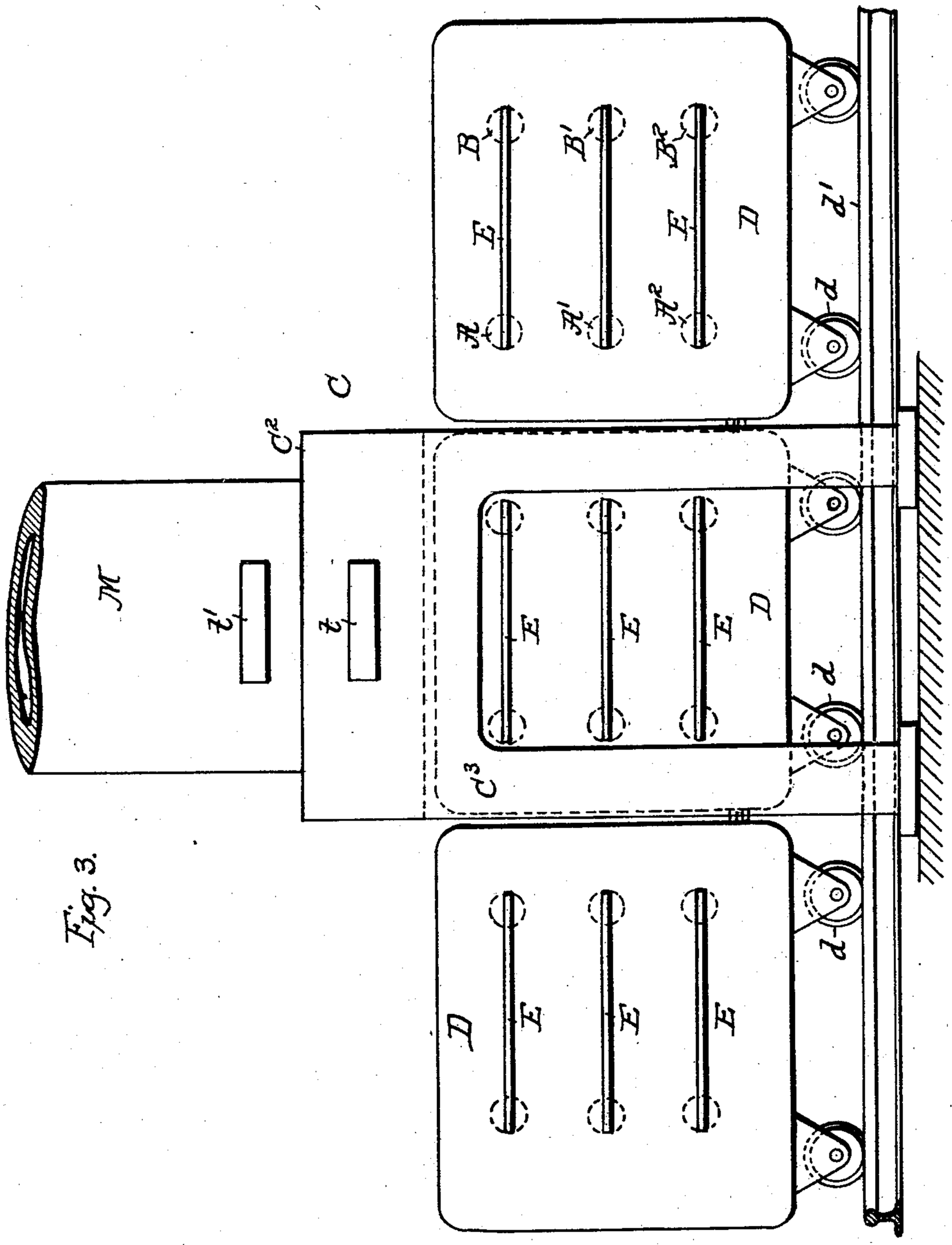

Fig. 3.

WITNESSES:

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UNITED STATES PATENT OFFICE.

HUDSON MAXIM, OF LONDON, ENGLAND.

APPARATUS FOR ELECTROTHERMALLY TREATING MATERIALS.

SPECIFICATION forming part of Letters Patent No. 719,484, dated February 3, 1903.

Application filed August 17, 1898. Serial No. 688,837. (No model.)

To all whom it may concern:

Be it known that I, HUDSON MAXIM, a citizen of the United States of America, residing at No. 377 Norwood road, London, S. E., England, have invented certain new and useful Improvements in Apparatus for Electrothermally Treating Materials, of which the following is a specification.

The present invention relates generally to an improved apparatus for electrothermally treating materials, and has particular reference to the manufacture of calcium carbid and other carbids and the reduction of ores.

The main object of the invention is to provide an apparatus which may be employed for the rapid and economical production of calcium carbid or other carbids; and with this object in view the invention consists of a furnace, preferably in the form of a crucible, mounted so as to be brought into and out of operative relation with a plurality of electrodes which enter the crucible through ports on one side, while on the opposite side an exit-port for the treated material is provided and means for simultaneously withdrawing the electrodes from the furnace. By this means the heat zone is moved through the furnace as the material is converted, and when the desired product is formed the electrodes may be wholly withdrawn, the furnace moved to one side to allow the product to cool, and a second crucible moved in place, to the end that the operation may be continued without unnecessary loss of time. Preferably the electrodes each consist of an inner and outer carbon member having an interposed third member, the two inner members being capable of movement relative to the outer member.

With this general understanding of the improvements a detailed description thereof will now be given with reference to the accompanying drawings, forming a part hereof.

In said drawings, Figure 1 is a vertical sectional elevation of an apparatus containing the invention and adapted to carry out the process. Fig. 2 is a horizontal section of the same. Fig. 3 is an end view thereof.

Referring to the drawings, the furnace structure C, of highly-refractory material, such as fire-clay, consists of an end wall C′, arranged to support one or more pairs of electrodes A B, A′ B′, and A^2 B^2, a top portion C^2, arranged to close the upper portion of the furnace or crucible proper, and another end wall C^3, more or less open and forming a partial support for the top portion. Such a structure provides open sides of such width and height as to permit the furnace or crucible D to be moved into position and then when more or less of its contained material has been reduced or converted moved out of the structure to permit another furnace or crucible to be moved into position to replace that which was previously in place. To render these furnaces or crucibles D easy of movement, they may be mounted on wheels *d* upon a track *d′*, extending through the structure, and the furnaces or crucibles may be moved along this track in any suitable manner, either manually or by any suitable power. The pairs of electrodes arranged parallel to one another are mounted in the end wall C′ of the structure, so as to be capable of being moved into and out of the furnace or crucible, the wall of the furnace or crucible being properly perforated in line with the electrodes to permit their insertion and withdrawal. Each of the electrodes is supported and moved longitudinally with respect to carbon sleeves or tubular electrodes *a*, which are directly supported by the end wall of the structure, suitable leads or wires 5 6 being connected with said sleeves and extending to a suitable generator for supplying the electric current needed in the furnace. In some instances, as in the case with the uppermost pair of electrodes A B, the electrodes may each be received within an intermediate carbon sleeve or tubular electrode *b*, which extends a considerable distance into the furnace, so as to support the inner portion thereof and prevent them from becoming unduly heated or destroyed, the sleeve being arranged for longitudinal movement both with respect to the electrodes themselves and to the outermost sleeves. To insure perfect electrical contact between the sleeves and the electrodes, the sleeves may be counterbored and filled with a compact body of pulverized carbon.

In connection with the pairs of electrodes there will be provided a high-resistance piece or conductor E, which may be of calcium carbid of plate form, entered through openings in the opposite end of the furnace or crucible

against the ends of the pairs of electrodes to form a transverse and initial conductor for the current passing from one electrode to the other, which by the passage of the electric current will provide a body of fused or highly-incandescent material to start the operation. As soon as the product commences to be formed this conductor will become dissipated and replaced by the fused or highly-incandescent product, which, being a conductor, will continue to insure unbroken passage of the current from one electrode to the other. As the electrodes are more or less gradually retreated from the incandescent portion and at the same time somewhat attenuating such portion, it will be brought into contact with the fresh adjacent portions of the material under treatment, so that a continuing incandescent conductor is provided which constantly forms added fresh product integral with the previously-formed product, with the result that a slab of the desired product will have been made and extended through the furnace or crucible as the ends of the electrodes approach the inner wall of the furnace. When the electrodes are wholly withdrawn from the furnace or crucible, the latter will be moved outward from the structure and the formed product allowed to cool and be removed at the pleasure of the attendant.

Any suitable means may be provided for moving the electrodes through the furnace at such speeds as may be found desirable, and means will also be provided where one or more carbon sleeves are also used in connection with electrodes for moving them. One such means is illustrated in Fig. 2, consisting of suitably-mounted screw-rods *g*, here represented as being capable of being turned by hand in supporting-nuts *h*, the inner ends of the rods being connected to the electrodes and to the sleeves, so that by turning the screw-rods the electrodes and sleeves may be moved along and through the furnace in the act of placing them in operative position for the start of the operation and in the act of withdrawing or retreating them as the operation continues, and finally removing them wholly from the furnace or crucible at the completion of the operation. To facilitate the entire removal or replacing of the electrodes, the screw-rods *g* may engage with removable heads *g'* on the ends of the electrodes, or these heads may have removable screw-threaded plugs g^2 to allow disconnection of the screw-rods from the electrodes.

Instead of the single leads or wires before described extending from a single generator and such leads extending to one of the sleeves, depending upon close electrical contact between the electrode and the sleeves and between the sleeves themselves for the passage of the current, it is obvious that each of the sleeves or one or more of them and the electrodes may each have independent connections with the generator or with independent generators, as indicated by the dotted lines 7 8 in Fig. 1.

The movable furnaces or crucibles D, as before mentioned, will be open at their tops, so as to permit the feed of a body of materials thereinto to more or less fill them. This feed of materials may be had in a separate structure or in the same structure C and may take place as soon as the empty furnace or crucible arrives in position in the structure. For this purpose the structure may support a preliminary heater M, having a chamber *k* capable of containing a quantity of the material to be treated—such, for instance, as carbonate of calcium and coal—and arranged to be discharged through a valved opening *m* in the top of the structure in such quantities as the attendant may desire.

Means may be provided for more or less cooling the carbon sleeves and electrodes as they are gradually withdrawn from the furnace or crucible, and for this purpose a circulation of water may be had in more or less close contact with the sleeves to lower their temperature as much as possible. In the present instance this cooling is effected by a series of vertical pipes or tubes *s*, built in the end of the structure on either side of the sleeves, connected with a supply of cold water and having a lead-off pipe for insuring the circulation.

What is claimed is—

1. The combination of a crucible having a plurality of electrode ports or openings on one side thereof, and an opening opposite said ports, with a plurality of electrodes entering the crucible through said ports and means for simultaneously and progressively withdrawing said electrodes from the crucible.

2. The combination of a crucible having a plurality of electrode ports or openings on one side and an opening on the opposite side thereof with a plurality of electrodes entering the crucible through said ports, each of said electrodes consisting of an inner and outer carbon member with an interposed third member, the two inner members being adapted to move within the outer member and maintain electrical contact therewith and means for imparting such movement to said members.

In witness whereof I have hereunto set my hand in the presence of two witnesses.

HUDSON MAXIM.

Witnesses:
GEO. H. GRAHAM,
M. S. FLEMING.