No. 671,008. Patented Apr. 2, 1901.

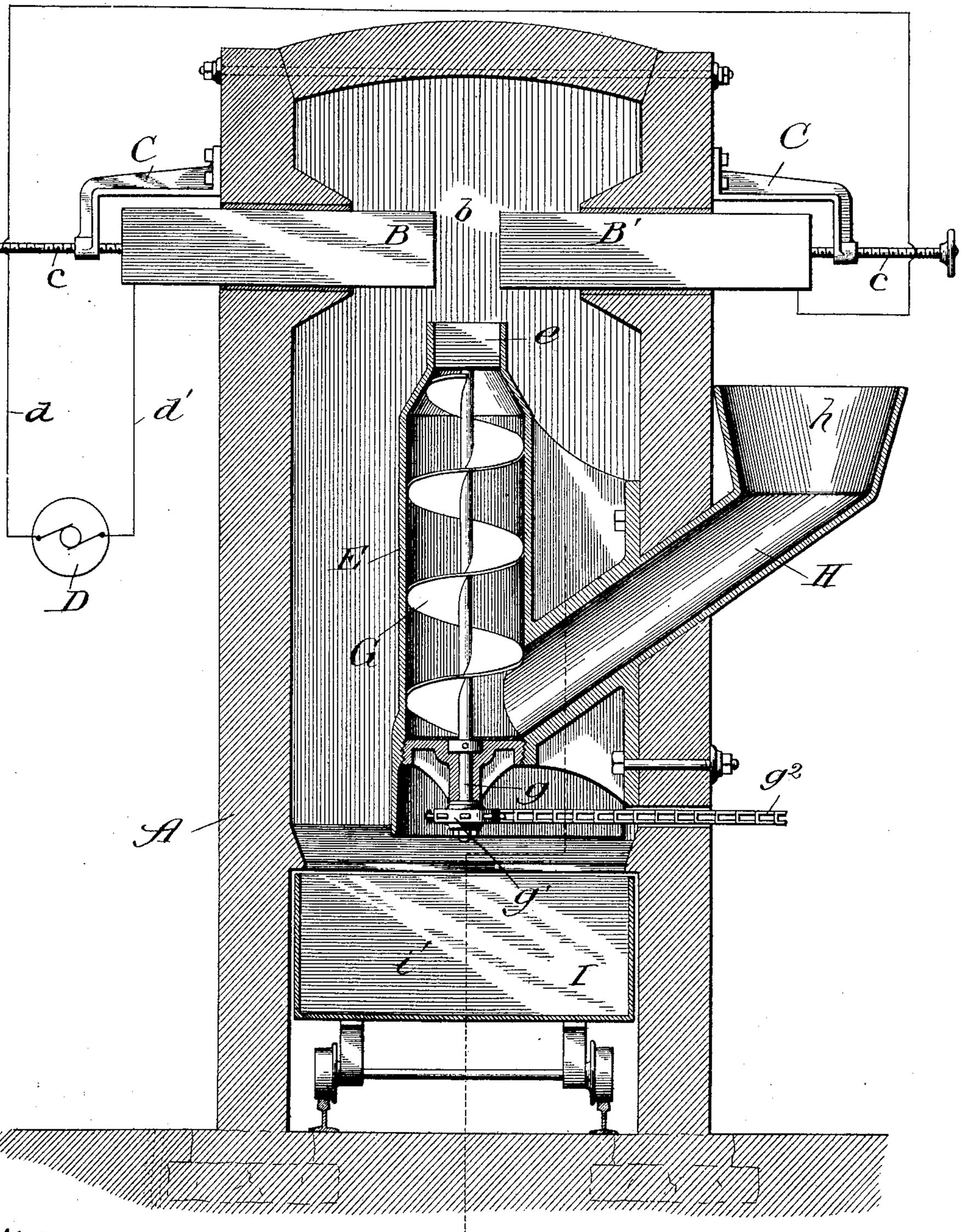
J. ZIMMERMAN & I. S. PRENNER.

APPARATUS FOR PRODUCING CALCIUM CARBID.

(Application filed Mar. 13, 1899.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.



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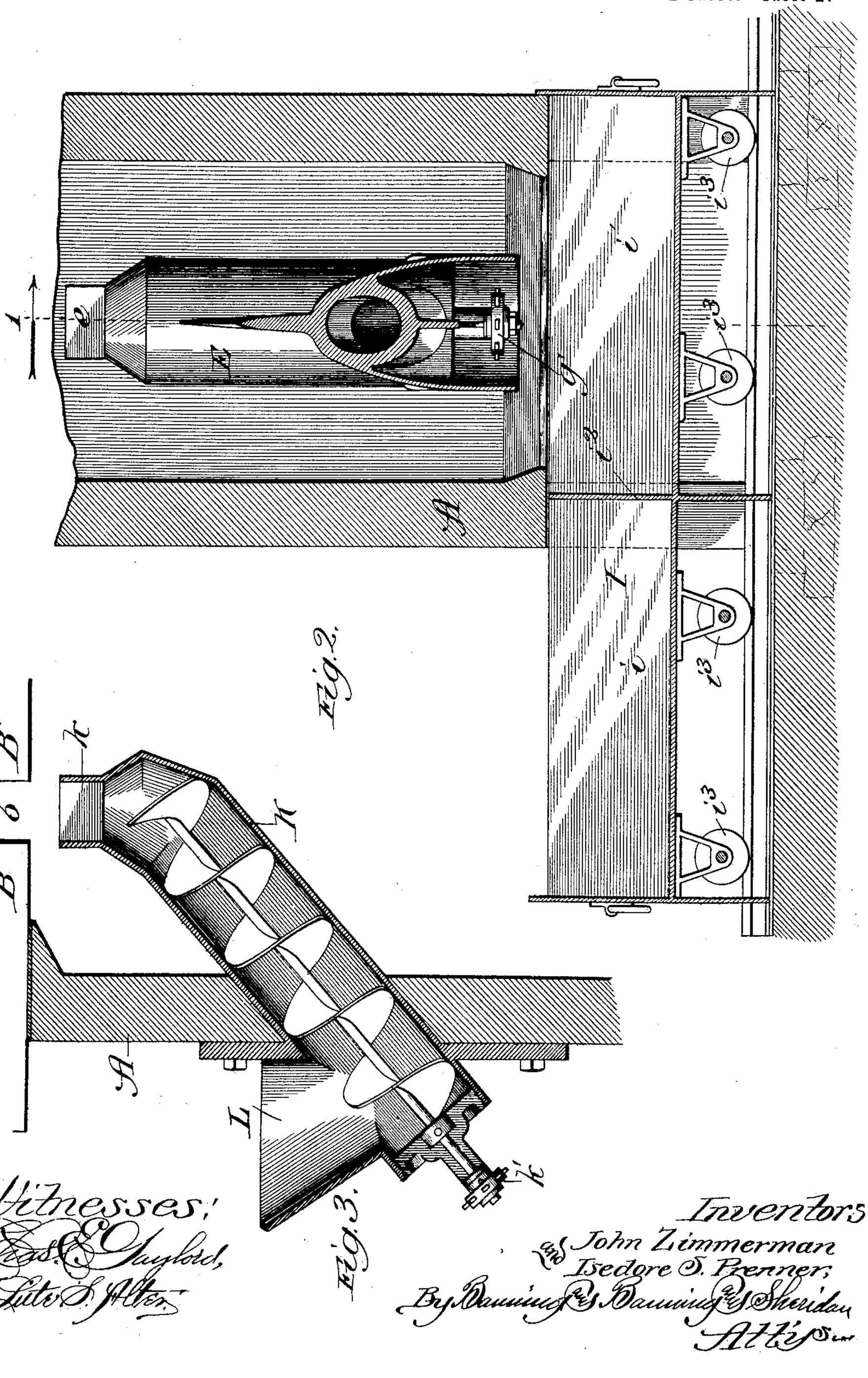

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UNITED STATES PATENT OFFICE.

JOHN ZIMMERMAN AND ISEDORE SOL PRENNER, OF CHICAGO, ILLINOIS.

APPARATUS FOR PRODUCING CALCIUM CARBID.

SPECIFICATION forming part of Letters Patent No. 671,008, dated April 2, 1901.

Application filed March 13, 1899. Serial No. 708,929. (No model.)

To all whom it may concern:

Be it known that we, JOHN ZIMMERMAN and ISEDORE SOL PRENNER, citizens of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Apparatus for Producing Calcium Carbid, of which the following is a specification.

Our invention relates to that class of apparatus in which a mixture of lime and carbon may be introduced and subjected to the heat of an electric arc for the purpose of melting the same and forming the material known as "calcium carbid."

The principal object of our invention is to provide a simple, economical, and efficient electroheating furnace for the production of calcium carbid.

A further object of our invention is to provide a furnace for producing calcium carbid with mechanism for feeding the mixture of lime and carbon continuously into position between the arc and from below the arc.

Other objects of the invention will appear from an examination of the drawings and the following description and claims.

The invention consists in the features, combinations, and details of construction and arrangement hereinafter described and claimed.

In the accompanying drawings, Figure 1 is a vertical sectional elevation of a furnace constructed in accordance with our improvements; Fig. 2, a vertical sectional elevation of a portion of the furnace, taken on the irregular line 2 of Fig. 1; and Fig. 3, a sectional detail view of a modification hereinafter described.

In the production of calcium carbid by the electromelting process it is well known that there are various objections and disadvantages attending the same, the principal one being the waste of heat due to the fact that the process has to be carried on intermittently and that the entire heat of the arc is not utilized. Further, the old type of furnace must always be accessible, so that considerable waste is entailed, owing to the loss of radiant energy.

The principal object of our invention therefore is to provide a simple, economical, and efficient electromelting furnace for the production of calcium carbid and to provide it with means for feeding the mixture from below, so that as it is fed to the arc it completely fills the same and utilizes the entire heat of the arc, and with apparatus for the withdrawal of the resultant product without in any way interfering with the continuity of the process or permitting the temperature of the external air to affect the heat of the furnace, all of which will more fully hereinafter appear.

In constructing an apparatus in accordance with our improvements, as shown in Figs. 1 and 2, we provide a furnace having the inclosing walls A, of any desired kind of refractory material, such as fire-brick. Introduced through openings in the side walls of the furnace and preferably near the upper portion thereof are two electrodes B and B′, arranged so as to form an arc *b*, into which a mixture of lime and carbon may be fed. It is highly desirable to have means for adjusting the electrodes to obtain the correct arc, as well as to compensate for the consumption of the electrodes. In order to accomplish this result, we provide brackets C, which are secured to the furnace-walls and provided with adjusting-screws *c*, adapted to contact the electrodes and push the same in whenever desirable or necessary. To furnish current for the arc, we prefer to provide a dynamo D of the alternating type and connect its poles with each electrode by means of the wire cables *d* and *d*′. It will be noticed from an inspection of the drawings that the arc formed by these electrodes is practically a rectangular arc, and in order to fill it completely and prevent the waste of radiant energy or calorific rays it is desirable to feed the mixture of lime and carbon into the arc in a rectangular form and of substantially the same size as the arc. This could not be done by feeding it in loose form; but if granulated it would fall away before reaching the arc. It is therefore desirable that the mixture of lime and carbon, with a suitable binder—such as borax, graphite and iron, or molasses—should be formed in a pasty condition by proportionate quantities of the ingredients and compressed automatically, so that it may be fed to the arc and fall away as soon as melted. In order to accomplish this result, we provide what we term a "feed-

ing-chamber" E, which is preferably arranged underneath and in line with the arc. The discharge *e* of this feeding-chamber is smaller in diameter than the main portion and is also rectangular in cross-section and of the same size as the desired arc, so that as the feed and compressing screw G is rotated in the direction of the hands of a watch the material is fed upwardly and compressed as it passes through the discharge-opening. It will be understood from an inspection of Fig. 1 that the discharge-opening of this feeding-chamber is arranged a slight distance from the arc—just sufficient to take it without the melting-point—and so that the compressed stick or column of mixed lime, carbon, and binder may enter the arc and be melted by the time that it has reached the upper portion thereof, when it falls away and allows the following material to be acted on, all in a continuous manner. The rotating feed-compressing screw is operated by means of a shaft *g*, a sprocket-wheel *g'*, and a sprocket-chain g^2, connected with any prime mover—such as a driving-shaft, an engine, motor, or other mechanism.

To supply the mixture of lime and carbon and binder to the compressing-chamber, we provide its lower portion with an inclined chute H, having a hopper *h* at the upper portion thereof, into which the mixture may be shoveled. This hopper, it will be understood, can be of any size to hold any desired amount of material, so that the process can be carried on continuously, or until all the material is consumed.

It is desirable that the resultant product of calcium carbid may be withdrawn from the furnace without in any way interfering with the operation thereof. In order to accomplish this result, we provide the lower part of the furnace with a movable receptacle I, having two chambers *i* and *i'*, separated by means of the partition i^2. When the machine is in operation, the chamber *i* is the first arranged under the arc, so that the molten mixture may fall and be caught therein. As soon as the same is filled the receptacle is pulled over on its wheels i^3, so that the second chamber *i'* is brought under the arc, and while this chamber is being filled the first-named chamber is emptied without in any way interfering with the process of reduction or permitting the cold external air to enter the furnace.

In Fig. 3 we have shown a modified arrangement of the feeding-chamber, in which the chamber K is arranged at an incline to the arc and with its compressing discharge-opening *k* arranged vertically under the arc. It will be seen, further, that the feeding-chamber extends outside of the walls of the furnace, so that the driving sprocket-wheel *k'* may be operated on from outside of the furnace. This arrangement also dispenses with the inclined chute and permits a hopper L to be attached directly to the compressing-chamber. It will be understood that we do not consider this a departure from the invention, but merely one of the various modifications to which it is susceptible.

An important and essential feature which enters into the construction and operation of our furnace is in compressing and feeding the raw material to and between the electrodes from below and in line with the arc of the electrodes, which is had by and through the feeding duct or chamber and the contracted neck thereof and the feeding device operating within such duct or chamber. The raw material is compressed as it is forced through the neck and formed into the shape of a continuous cake or core, which at its projected end comes between and is subjected to the arc of the electrodes, and is thereby melted for the molten material to flow back over the end of the cake or core and down and over the sides of the feed duct or chamber.

The feed duct or chamber is located wholly within the body of the furnace subject to the heating of the arc, so that such duct or chamber becomes heated and transmits heat to the raw material, and in addition the heat from the molten material flowing over the duct or chamber adds its heat to the raw material.

The plastic raw material as it is forced through the duct or chamber gathers heat from the furnace and heat from the molten material, and by the progressive advance toward the electric arc under the heat to which it is subjected, which heat increases as the arc is approached, is brought to a high degree of heat, by which perfect, thorough, and complete amalgamation of the component parts of the carbid is insured at a great saving and economy of heat.

The body of the cake or core, as it is being compressed and formed in the neck, and the raw material within the duct or chamber are prevented from any intermixture with the molten material by such material flowing down and over the neck and forming a seal at the neck against any entrance of material into the duct or chamber, and at the same time such sealing does not interfere in the least with the advance of the cake or core through the neck, as the material being in the molten state will not adhere to the neck around the cake or core sufficiently firm, so as not to be broken by the advance of the cake or core.

We claim—

1. In an apparatus for producing calcium carbid, the combination of a furnace-chamber, electrodes arranged in the chamber transversely thereof, a vertical feed duct or chamber located within the furnace-chamber and having its mouth or discharge in line with and below the arcing-space of the electrodes, and mechanism for compressing a mixture of carbon and lime directly in the feed duct or chamber and within the furnace-chamber and feeding the mixture upwardly into the arcing-space, substantially as described.

2. In an apparatus for producing calcium carbid, the combination of a furnace, two electrodes extending transversely through the side walls of the furnace into the furnace-chamber, a vertical feed duct or chamber having its mouth or discharge in line with and below the arcing-space of the electrodes, and mechanism for compressing a mixture of carbon and lime in the feed duct or chamber directly in the furnace-chamber and feeding the mixture through the mouth or discharge of the feed duct or chamber into the arcing-space from below, substantially as described.

3. In an apparatus for producing calcium carbid, the combination of a furnace, two electrodes extending transversely through the side walls of the furnace into the furnace-chamber and connected with a source of electric energy, a feeding and compressing chamber located within the furnace-chamber and provided with a mouth or discharge-opening of smaller diameter than the diameter of the chamber and located in line with and below the arcing-space, and means for forcing a mixture of carbon and lime through the feeding and compressing chamber and out of its mouth or discharge-opening directly into the arcing-space within the furnace-chamber, substantially as described.

4. In an apparatus for producing calcium carbid, the combination of a furnace, two electrodes extending transversely through the walls of the furnace into the furnace-chamber and connected with a source of electric energy, a feed duct or chamber located within the furnace-chamber and provided with a mouth or discharge-opening of less diameter than the diameter of the duct or chamber and arranged adjacent to and in line with and below the arcing-space to compress the mixture as it is discharged, and a rotatable helical screw in the feed duct or chamber operating to feed the materials of the mixture upwardly and force such material in a compressed form directly into the arcing-space through the mouth of the feed duct or chamber within the furnace-chamber, substantially as described.

5. In an apparatus for producing calcium carbid, the combination of a furnace, two electrodes extending transversely through the side walls of the furnace into the furnace-chamber, screw mechanism for adjusting the electrodes, a feed duct or chamber located within the furnace-chamber and below the electrodes and provided with a mouth or discharge-opening of less diameter than the chamber to compress the mixture as it is discharged from below through the mouth or discharge-opening in line with the arcing-space, and a feed-screw in the feed duct or chamber for advancing and compressing the material for the mixture wholly within the furnace-chamber and forcing the compressed mixture in a direct line into the arcing-space from below, substantially as described.

6. In an apparatus for producing calcium carbid, the combination of a furnace, two electrodes extending transversely through the side walls of the furnace into the furnace-chamber and connected with a source of electric energy, a feed duct or chamber located within the furnace-chamber and arranged directly under the arcing-space of the electrodes, and provided with a mouth or discharge-opening of less diameter than the body of the duct or chamber to compress the mixture as it is discharged upwardly in line with the arcing-space, and a rotatable helical screw in the feed duct or chamber operating to force the material of the mixture upwardly within the duct or chamber and within the furnace-chamber and feed the mixture in a compressed state through the mouth or discharge-opening directly into the arcing-space, substantially as described.

7. In an apparatus for producing calcium carbid, the combination of a furnace, two electrodes extending transversely through the side walls of the furnace into the furnace-chamber and connected with a source of electric energy, a feeding and compressing duct or chamber located within the furnace-chamber and arranged directly under the arcing-space and provided with a mouth or discharge-opening of less diameter than the body of the duct or chamber to compress the mixture as it is forced upward and discharged in direct line with the arcing-space, a rotatable helical screw in the feed duct or chamber operating to compact, compress and force upwardly the material of the mixture to be discharged in a solid form through the mouth or discharge-opening directly into the arcing-space, and an inclined channel or hopper for furnishing the material constantly to the feed duct or chamber, substantially as described.

8. In an apparatus for producing calcium carbid, the combination of a furnace, two electrodes extending transversely through the side walls of the furnace into the furnace-chamber and connected with a source of electric energy, a rectangular arcing-space between the electrodes, screw mechanism for adjusting the electrodes and regulating the size of the arcing-space, a compressing and feeding duct or chamber located within the furnace-chamber in direct line with and under the arcing-space and provided with a mouth or discharge-opening rectangular in shape and of smaller diameter than the diameter of the feed duct or chamber to compress the mixture as it is forced upward and out at the mouth or discharge-opening in direct line with the arcing-space, a helical screw operating in the feed duct or chamber for forcing and feeding the material upward and out in a compressed state through the mouth or discharge-opening into the arcing-space, and a hopper connected with the feed duct or chamber for furnishing a continuous supply of carbid-producing materials to the feed duct or chamber, substantially as described.

9. In an apparatus for producing calcium carbid, a feed duct or chamber located wholly

within the furnace-chamber and having a mouth or discharge-opening located in line with and under the arcing-space of an electric furnace, and means for forcing the raw material upward through the duct or chamber to the smelting-point of the arcing-space, substantially as described.

10. In an apparatus for producing calcium carbid, a feed duct or chamber for the raw material located wholly within the furnace-chamber of an electric furnace, a contracted mouth or discharge-opening at the upper end of the feed duct or chamber located in direct line with and under the arcing-space of the electrodes of the furnace, and means for forcing the raw material upward against the shoulder formed by the contracted mouth or opening, thereby compressing the material and feeding it as a cake or core through the mouth or opening directly into the arcing-space at the smelting-point, substantially as described.

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