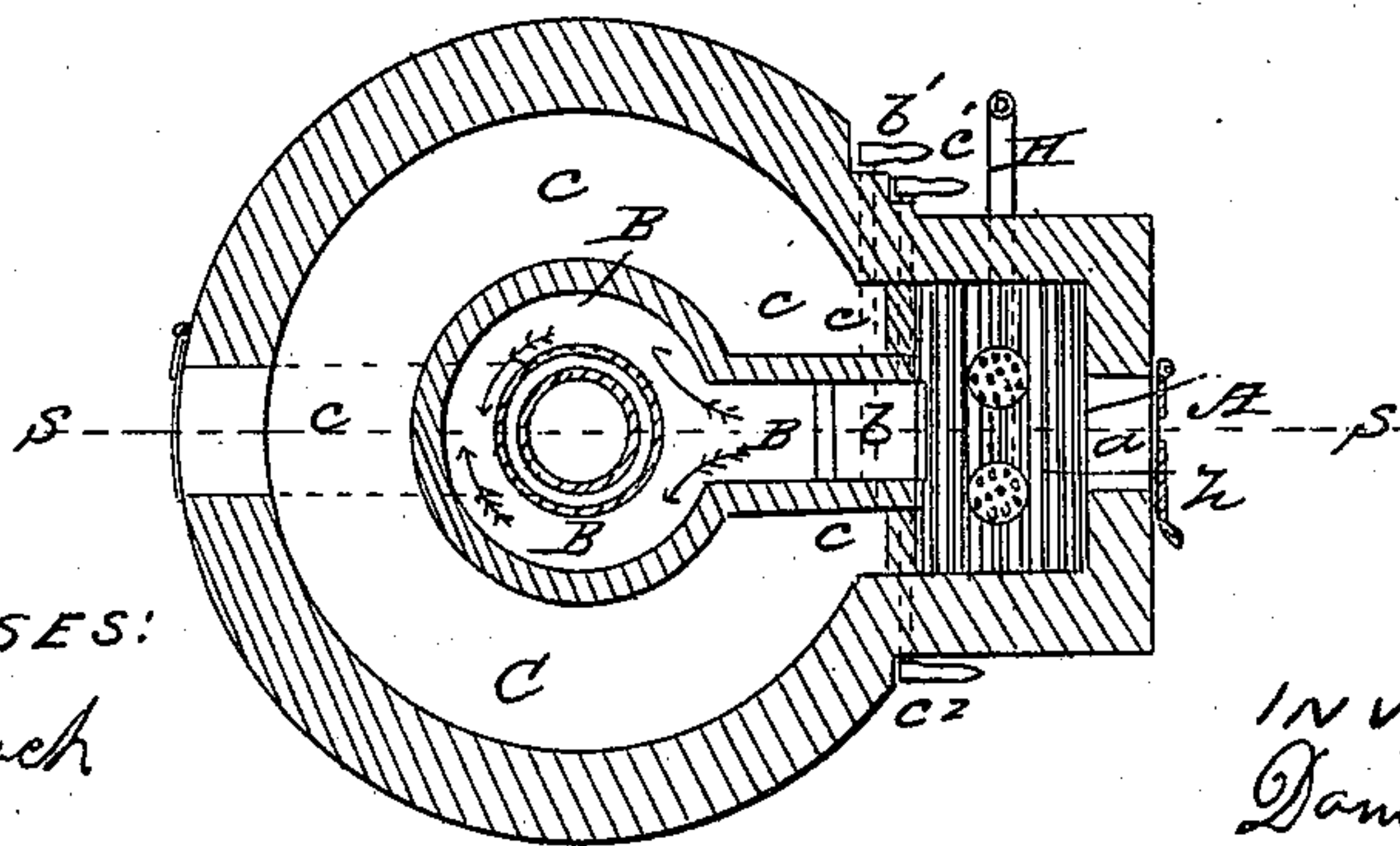
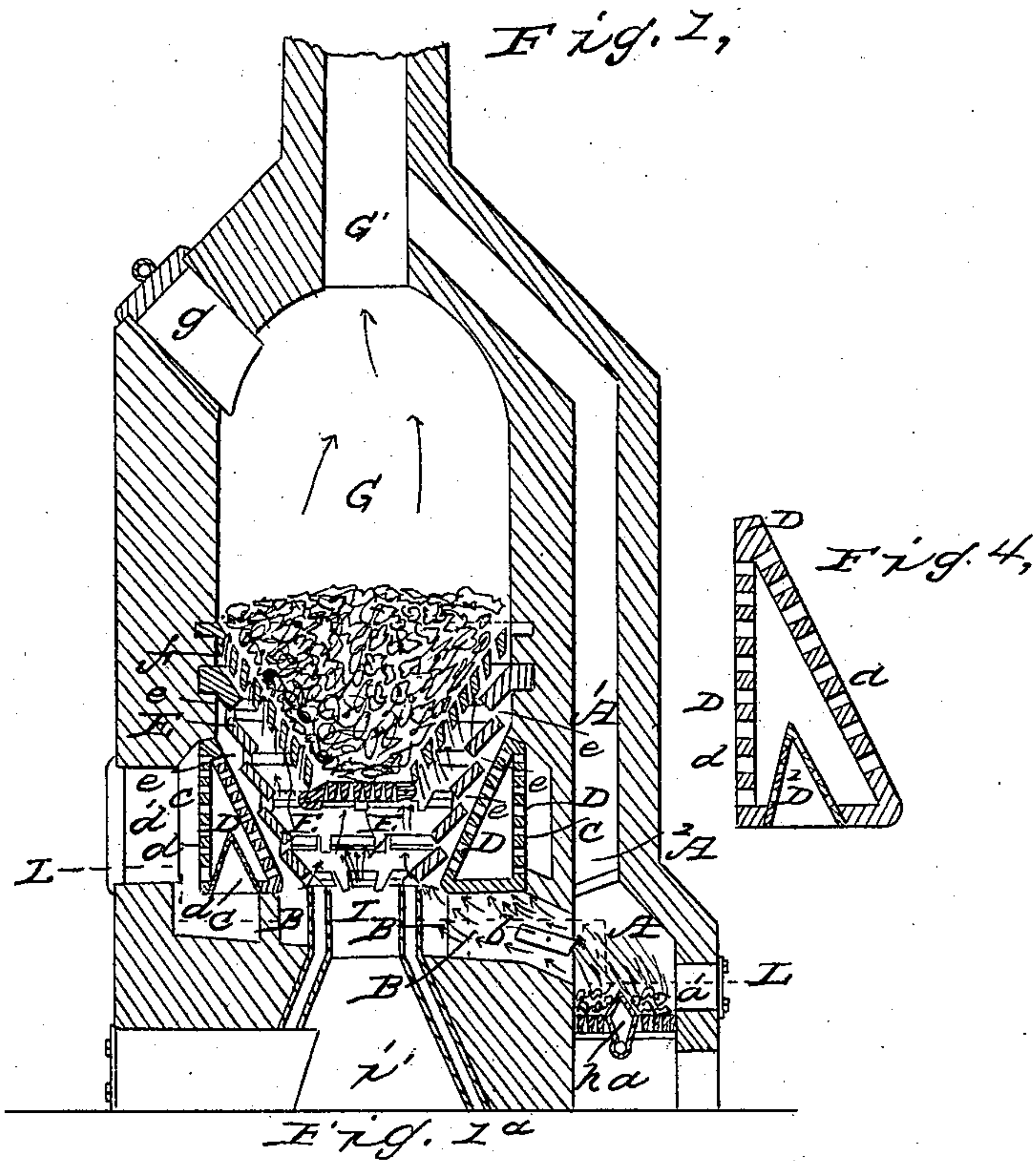


D. MINTHORN.

Desulphurizing and Disintegrating Ores.

No. 52,875.

Patented Feb. 27, 1866.



WITNESSES:
Emil Vossnach
D. W. Johnson

INVENTOR:
Daniel Knithorn

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Fig. 2,

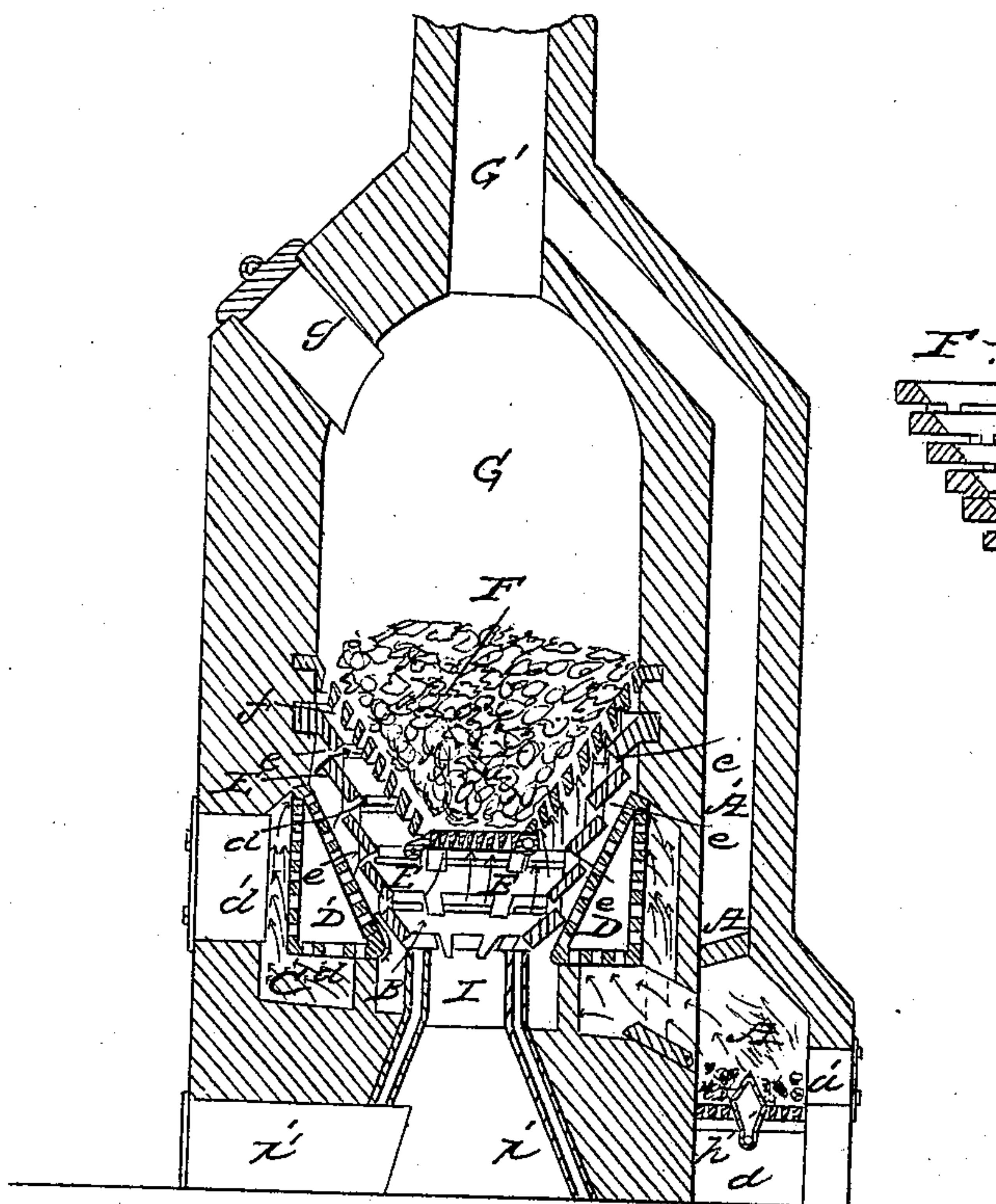


Fig. 3,

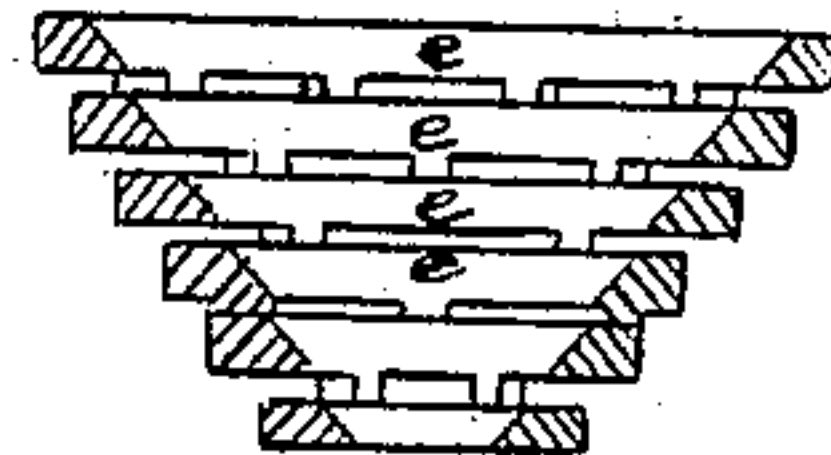
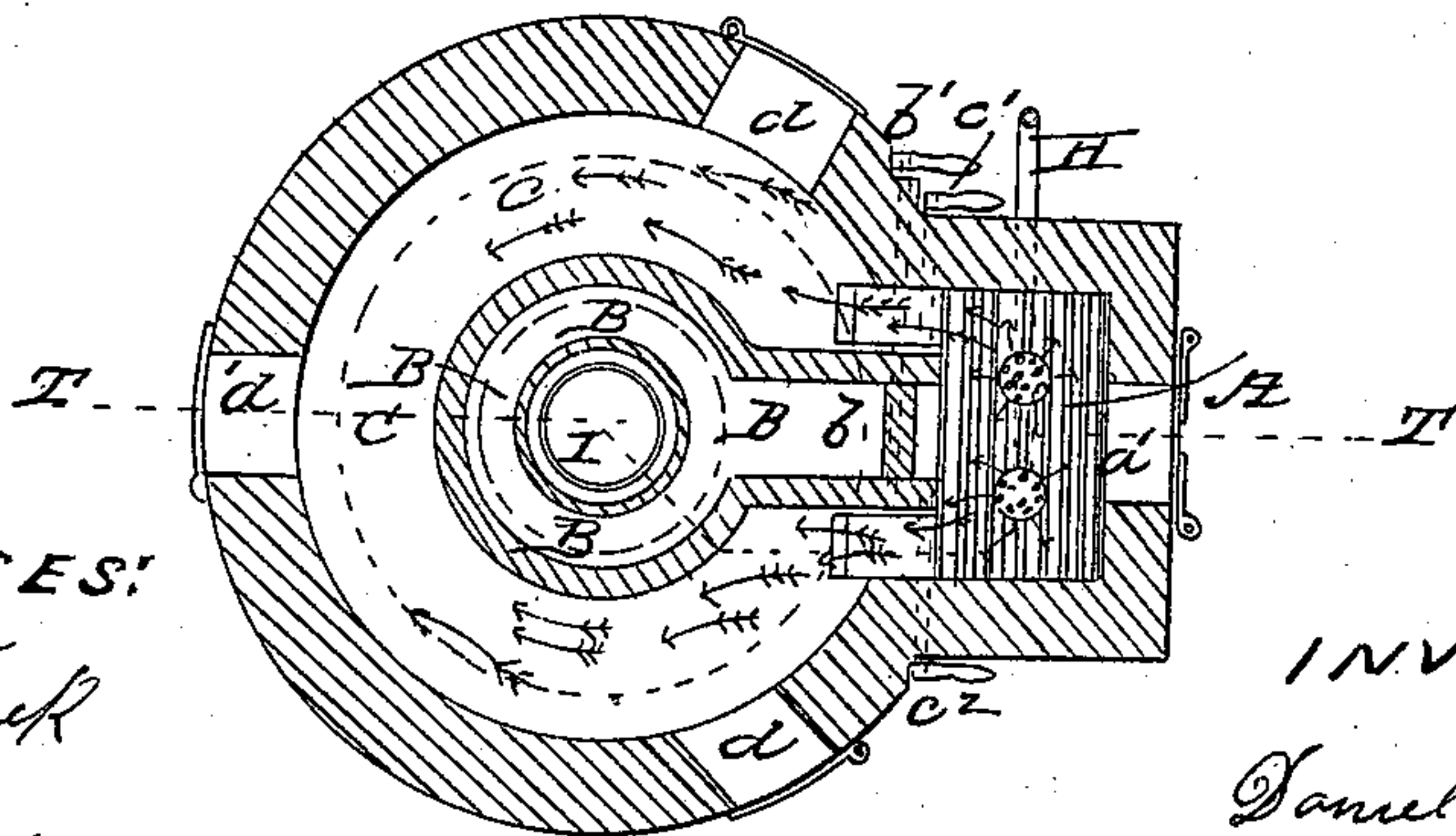


Fig. 2, a



WITNESSES:

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UNITED STATES PATENT OFFICE.

DANIEL MINTHORN, OF NEW YORK, N. Y.

IMPROVEMENT IN DESULPHURIZING AND DISENTEGRATING ORES.

Specification forming part of Letters Patent No. 52,875, dated February 27, 1866.

To all whom it may concern:

Be it known that I, DANIEL MINTHORN, of the city, county, and State of New York, have invented a new and Improved Process, which I call an "Isomeric Diaphragm Process," for Deoxidizing, Desulphurizing, and Disintegrating Mineral Ores and Rocks; and I do hereby declare that the following in a full and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which represent the furnace by which I prefer to carry out my invention.

In my improved furnace I employ a receptacle containing the material to be treated in a distinct and separate chamber from the one in which the heat is generated, but which is connected with such chamber by passages, which may be opened and closed by dampers as the various stages of the process require, and so that the escaping products of combustion and gases may be thrown into and among the material to be treated, or pass through a separate and distinct exit-flue into the chimney above.

Within the chamber in which the ore is treated is hung or placed the basket-shaped ore-receptacle. This receptacle may be stationary or made to rock upon trunnions, and has apertures in the sides or bottom, which apertures may be made of any form or style so that they allow the passage of the gases used for treating ores or minerals, to pass into and through the receptacle and material. I arrange below the basket-shaped ore-receptacle a series of brick flues so located that when placed they shall form a chimney the sides of which are nearly parallel to the basket, and from which flues the heat and gases shall pass to the chamber underneath the receptacle. I place in this furnace my improved apparatus for purifying hydrogen gas, and this furnace is particularly adapted to its use, although I do not limit my use of this furnace and its claims to novelty to the features relating to this application alone, but include also the relative arrangement and location of ore-receptacle, in combination with the chamber in which it is placed and its connection with the fire-chamber. This furnace may be constructed without my "isomeric diaphragm," and used for the various metallurgical operations carried on in treating-furnaces.

I employ superheated steam, and place an

intervening chamber or diaphragm between the fire-chamber and the mineral ores to be treated. I fill the intervening chamber or diaphragm with iron borings, filings, scraps, &c., using cast-iron by preference; but any other substance may serve, whether very finely divided or not, which will absorb or appropriate oxygen from steam and leave the hydrogen and products of combustion to be used in treating the ores. I prefer to make this chamber in the form of a hollow square or of a circular belt. When such form is not adopted, or even when it is, I introduce within the chamber hollow projections rising from below in a conical, cylindrical, or other suitable form, perforated at the sides. If cylinders, they are by preference fire-brick seggars. If cones, I prefer to use thin cast-iron, perforated, as a core or lining. On these conical frames are placed cones of plaster-of-paris with perforations corresponding to those in the castings. In case the diaphragm is spacious the object of the cones is to keep the cast-iron borings from packing or settling down, so as not to obstruct essentially the superheated steam and deoxidized flame when passing into the receptacle where the material to be treated is placed. Another object of the cones is to produce side currents throughout the cast-iron borings, so as to pervade the diaphragm more perfectly.

By my improved process the hydrogen becomes most effective for disintegrating and desulphurizing mineral ores because the affinity of pure hydrogen for its atomical proportion of oxygen is so strong that it will take up oxygen from out of the heated mineral oxides; hence it disintegrates the most perfect in degree of any process in use.

In order that others may understand and apply my invention, I will proceed to explain the same and to describe its construction and operation by the aid of the drawings, which form a part of this specification.

Figure 1 represents a vertical section of the apparatus on the line S S in Fig. 1^a. Fig. 1^a is a ground plan of the apparatus in the same condition on the line L L in Fig. 1. In these figures the damper *b* is open, and the mineral ores are being heated by the flame of the furnace and superheated steam, which mingled currents are represented by the red and yellow colors and red darts.

Figs. 2 and 2^a represent the same apparatus

in a different condition. Fig. 2 is a section of the same on the line T T in Fig. 2^a. Fig. 2^a is a ground plan of the apparatus when the flues *c c* are opened and *b* is closed. Both these latter figures represent the damper *b* as closed and the dampers *c c* as open, so as to let the superheated steam and flame pass through the diaphragm D, producing hydrogen, which is represented by the green darts. The flame and superheated steam in the chamber C, before entering the diaphragm D, are represented by blue and red darts.

Similar letters of reference indicate like parts in all the drawings.

The letter A represents the furnace or chamber in which the fuel is burned. A' represents extra fuel to kindle the fire. A² represents damper to extra fuel. *a* represents the ash-pit. *a'* represents the door of the furnace. B represents the fuel for heating the ores by flame and superheated steam. *b* represents the damper to flue-chamber B. *b'* represents the handle of the damper *b*. C represents the flue-chamber between the furnace and diaphragm. *c* represents the dampers to chamber. *c'* represents the right handle to damper *c*. *c*² represents the left handle to damper *c*. D represents the walls of the isomeric diaphragm. D' represents the diaphragm-chamber, containing cast-iron borings, filings, &c. D² represents a perforated cone of plaster supported on a perforated cone of iron, as before intimated. *d* represents the apertures or openings for the flame through the walls of the diaphragm. *d'* represents fire-brick doors or openings into the diaphragm to be luted when closed. E represents an inclined wall-floor of fire-brick, formed with lugs resting on and overlapping each other, so as to shed, by their own specific gravity, the disintegrated ores or particles into the reservoir *i'*, the whole resting on the cast-iron and fire-brick cylinder I. *e* represents the openings between and through the inclined floor of fire-brick, with lugs for the flame and gas to pass through. F represents the iron basket containing the ores. *f* represents the openings through the basket. F' represents the ores in a heated state. G represents the receptacle for the ores or minerals. G' represents the chimney. *g* represents the door or opening to fill receptacle. H represents the pipe communicating superheated steam. *h* represents the jet or distributor of superheated steam. I represents a casing of cast-iron covered with fire-brick, which forms a strong support for the central portion of the inclined fire-brick floor or funnel-bottom E, while *i* and *i'* represent the spaces at the base, as before explained, together with the particles disintegrated.

The base of the cone D² is open, and it receives the gases and steam from C, and distributes the same in small streams through its perforations. Such cones are not so important when the diaphragm is in the annular or hollow form represented as when the diaphragm extends across the whole area; but in either case the iron borings are liable to

pack down and form so thick and dense a body that the gases cannot well pass through, and the perforated cones D², of which I can employ as many as may be preferred, greatly aid in reducing the thickness of the stratum to be traversed and projecting the gas laterally in all directions into the borings.

The basket F is capable of being readily removed and replaced in a manner not well represented in the drawings, but which will present no difficulty to skilled workmen, it being necessary simply to lift the warped or burned-out basket from the ledge or shelf on which it is supported, and to remove it laterally and introduce another through a large door in the side of G. (Not represented.) The form of this basket F presents the thickest mass of ore F' near the center of the apparatus, where the reflection of the heat from the surrounding parts is most intense, and where the decomposed steam and other gases flowing through the apertures *e* through the inclined floor or funnel-shaped casing of fire-brick E strikes most directly. I propose in some cases to form the basket F so that it shall rest upon and be partially supported by the funnel E over nearly the whole of its surface. I can, if preferred, dispense with the basket F altogether, or reduce it to a mere apron of perforated metal or wire-cloth, resting upon the fire-brick E, with a suitable door or stop for the hole at the lowermost point, through which the desulphurized or disintegrated material F' can be discharged by opening the door.

To use my invention and process the fire is kindled in the ordinary way in the furnace A, and by the aid of the extra flue A', with the damper A² open, the smoke and pyroligneous acid are made to pass off in the chimney without coming in contact with the materials or ores to be desulphurized and disintegrated. After the fuel is thoroughly ignited the damper A² is closed and the damper *b* is opened. The damper A² is closed and the damper *b* is opened, and the mineral ores F' are heated by the products of combustion. When the ores F' in the receptacle G have been sufficiently heated, superheated steam is then admitted, through the perforated pipe *h*, from a generating apparatus, (not represented,) and the flue B, connecting the fire-chamber A with the ore-receptacle, is closed by a suitable damper, *b*, and the dampers *c c*, connecting the fire-chamber with the diaphragm D, are then opened, and the nascent gases escaping from and produced by the admission of steam to contact with the glowing fuel, as before named, will pass into and through the diaphragm, forming hydrogen to be brought into contact with the ore or material placed in the receptacle above. The object of this diaphragm and the materials placed therein is to absorb oxygen and purify the hydrogen produced by the fire and superheated steam, for the purposes hereinbefore named. While I have herein described a kind of furnace applicable to the use of this diaphragm, I do not confine my

application to the particular form or style of furnace described. I can obtain the advantages, in great part, by different styles, so long as there is an intervening chamber, diaphragm, or purifier between the materials to be treated and the escaping gases produced by the combustion, hereinbefore named, with superheated steam.

Instead of the precise arrangement described my diaphragm D may be placed, if preferred, upon a bridge-wall of a reverberatory furnace having the plane of its sides parallel to the sides of the bridge-wall and perpendicular to the plane of the bed, or it may be made to rotate on any suitable axis; or it may be of other forms or shapes and located in other parts of the furnace, it being necessary simply that the gases produced by the combustion hereinbefore named shall pass into and through it.

I do not confine my improvement to the process of William E. Hagan, by passing the superheated steam through the fuel, though I prefer that style of furnace, but use it superheated over the fuel as well.

Fig. 3 represents a slight modification of the part E E. I consider this modification a desirable one in most cases. It is a central vertical section. The portions which are made of fire-brick are marked E, and the spaces between e.

Fig. 4 represents a cross-section of the diaphragm D and one of the cones D² on a larger scale than in Fig. 1.

When steam is heated by intimate contact with the products of combustion, in the manner invented by Hagan and adopted by me, as aforesaid, without actual contact with the fuel itself, it becomes intensely superheated and ready to undergo decomposition, but is not in a position to combine its hydrogen with the carbon of the fuel, because it is elevated out of contact therewith. It is in this condition that I present the steam to the iron filings, &c., in the diaphragm D, and the result is the

absorption of the oxygen from the steam, leaving the hydrogen pure.

My invention in the complete form here presented is superior to that of M. B. Mason, patented January 3, 1865, in the important fact that Mason depends on the carbon of the fuel to decompose his steam, such decomposition necessarily resulting in the production not of pure or uncombined hydrogen, like mine, but of a hydrocarbon due to the union of a portion of the carbon with the hydrogen so soon as the latter is liberated from the oxygen. Hydrocarbon gases are not as valuable for my purpose as the uncombined hydrogen.

I do not claim as my invention the process when the gases mixed with steam are carried through the central spaces, B, and thus presented to the ores F' without having passed through the diaphragm D'. My peculiar method is only used when the passage C is open to receive the superheated steam.

I do not claim to have discovered that cast-iron borings sufficiently heated will absorb the oxygen from steam; nor do I claim the application of superheated steam as a disintegrator, deoxidizer, and desulphurizer of ores, except when the same has been previously treated as herein described; but,

Having now fully described my invention, what I claim as new therein, and desire to secure by Letters Patent, is as follows:

The use of uncombined hydrogen at a high temperature, for the purpose of deoxidizing, desulphurizing, and disintegrating mineral ores by applying steam, either with or without the products of combustion, through a chamber containing iron turnings or other suitable absorbent of oxygen, in the manner substantially as herein set forth.

DANIEL MINTHORN.

Witnesses:

EMIL VOSSNACK,
D. W. STETSON.