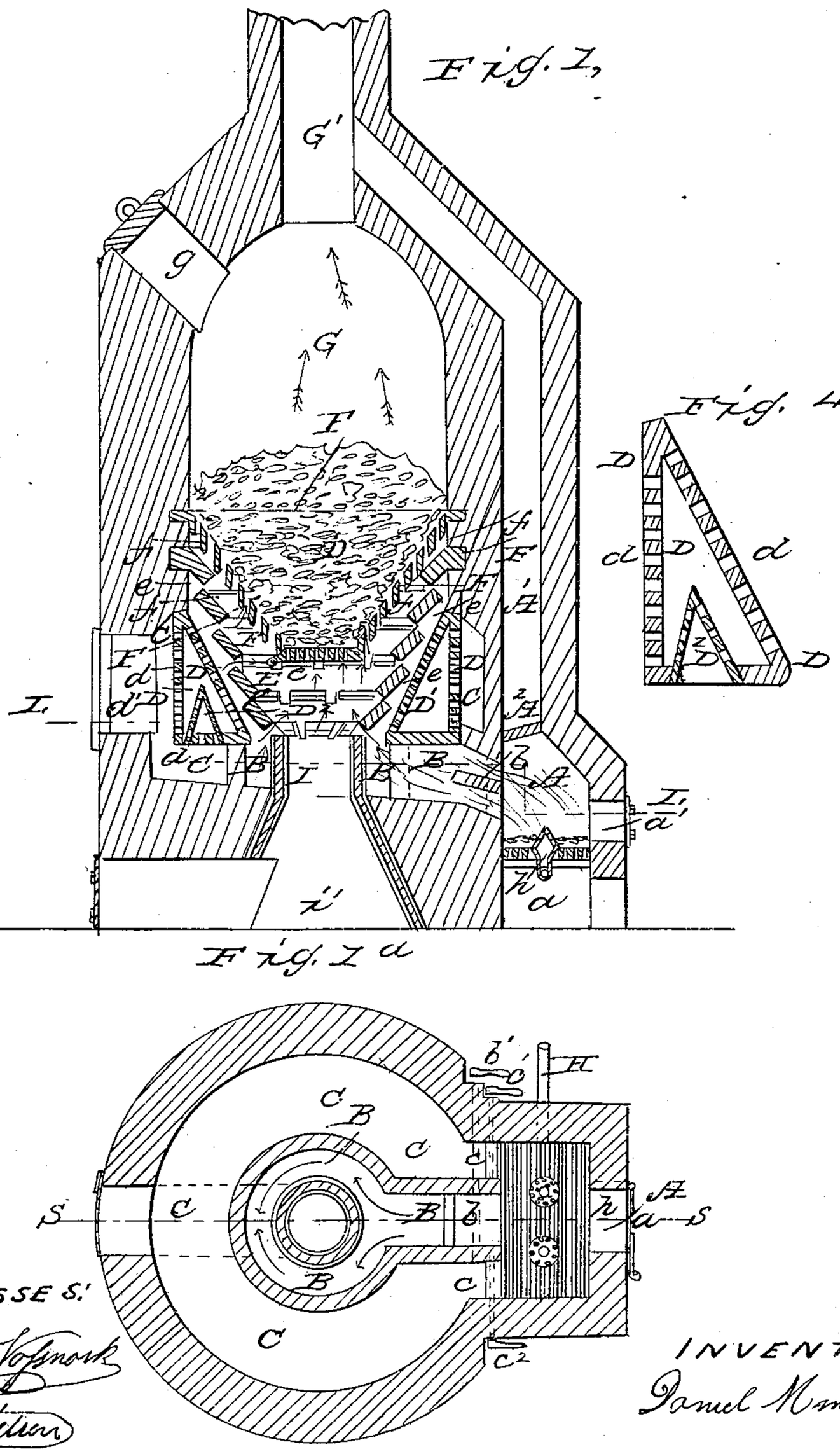
2 Sheets—Sheet 1.

D. MINTHORN.

Furnace for Desulphurizing Ores.

No. 50,836. Patented Nov. 7, 1865.



2 Sheets—Sheet 2.

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Furnace for Desulphurizing Ores.

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Fig. 2,

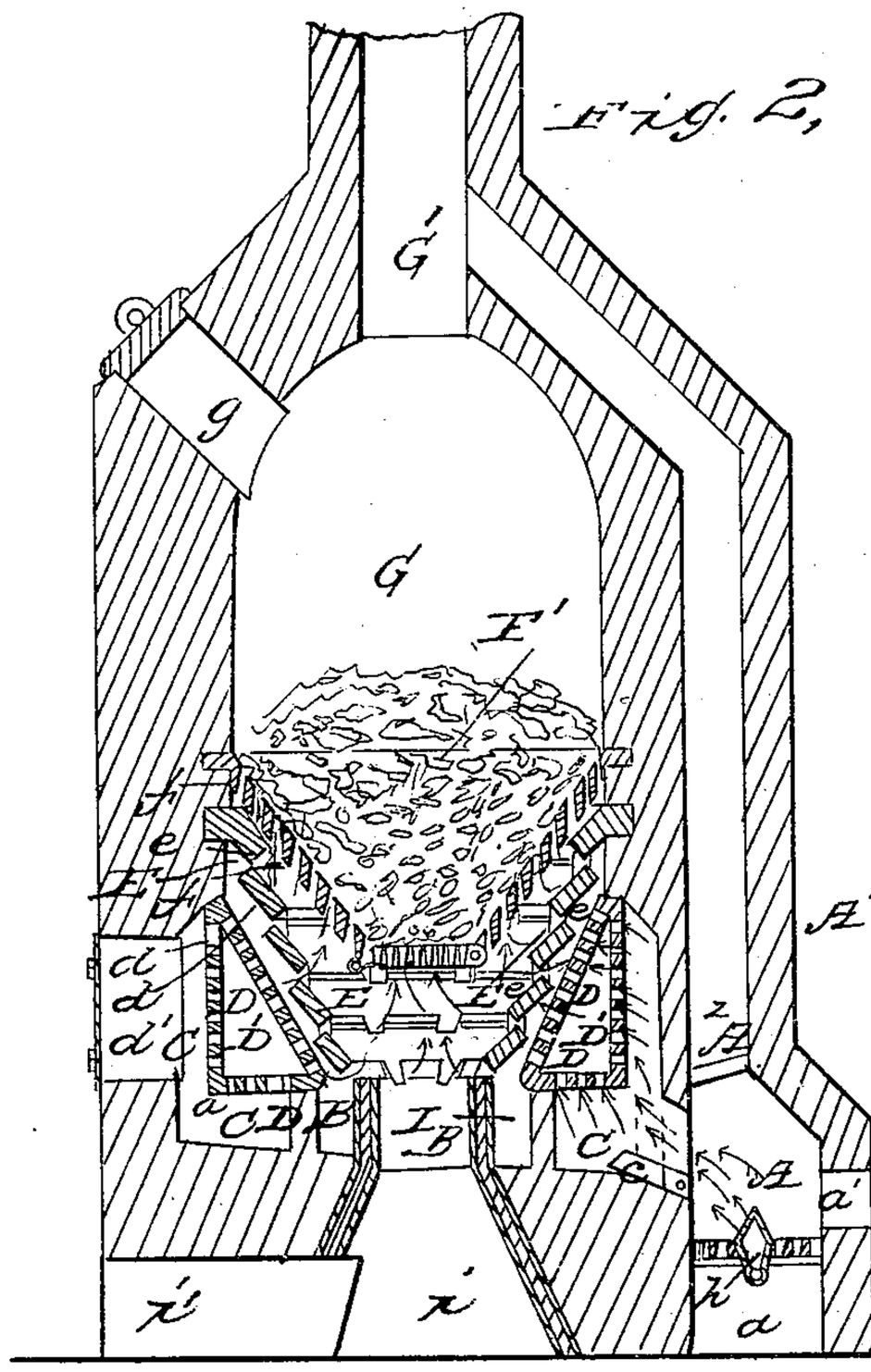
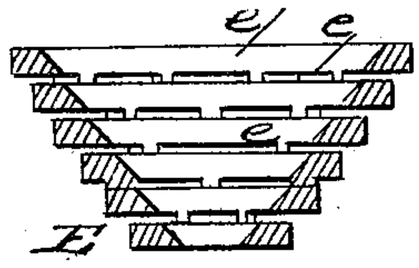
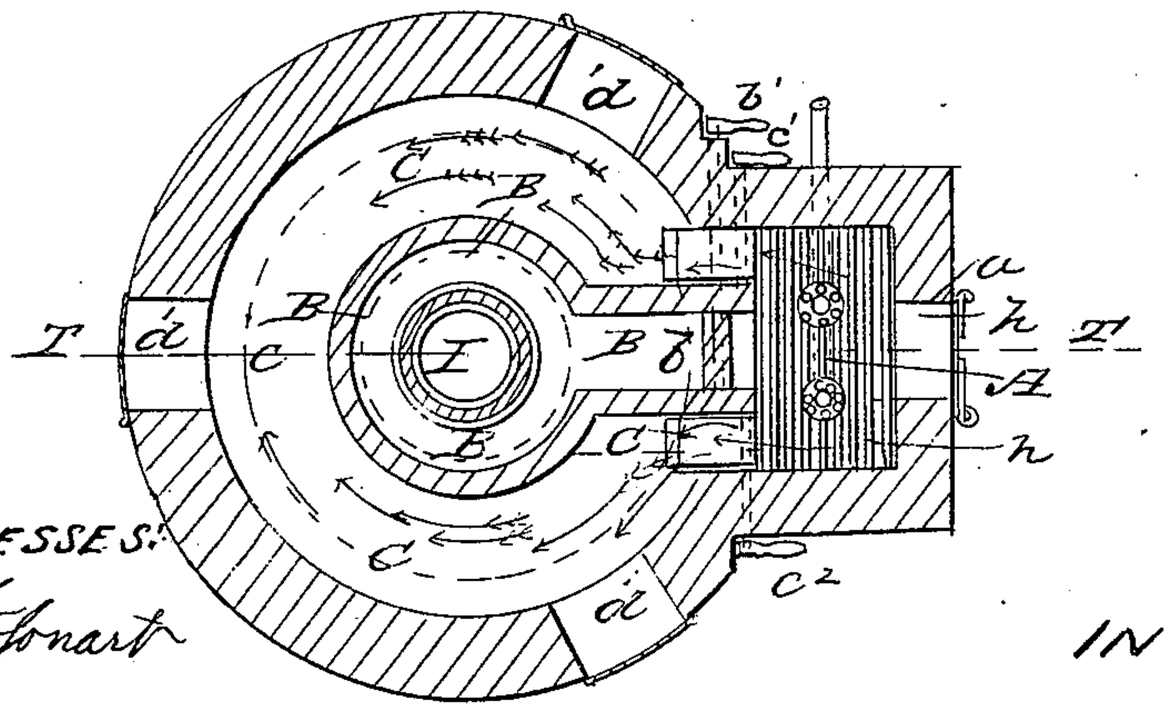


Fig. 2. a

Fig. 3,





WITNESSES:

Emil Fofonart

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UNITED STATES PATENT OFFICE.

DANIEL MINTHORN, OF NEW YORK, N. Y.

IMPROVED ISOMERIC-DIAPHRAGM FURNACE FOR DESULPHURIZING ORES.

Specification forming part of Letters Patent No. **50,836,** dated November 7, 1865.

To all whom it may concern:

Be it known that I, DANIEL MINTHORN, of the city of New York, in the county and State of New York, have invented a new and Improved Furnace for the Treating of Mineral Ores, Rocks, &c., which I denominate an "Isomeric-Diaphragm Furnace;" and I do hereby declare the following to be a full and exact description of the same, reference being had to the accompanying drawings and letters of reference marked thereon.

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, which may be stationary or made to rock upon trunnions, and has apertures in the side 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 chamber the sides of which are nearly parallel to the basket, and from which flues the heat and the 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 novelty 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 each of these conical frames is placed a cone 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. 1ª. Fig. 1ª 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 color and red darts. Figs. 2 and 2ª represent the same apparatus in a different condition. Fig. 2 is a section of the same on the line T T

in Fig. 2ª. Fig. 2ª 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 flue to kindle the fire. A^2 represents damper to extra flue. *a* represents the ash-pit. *a′* represents the door of the furnace. B represents the flue for heating the ores by flame and superheated steam. *b* represents the damper to flue-chamber B. *b′* represents the handle to 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. D^2 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 cylinders 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 opening 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 distributer 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 D^2 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 D^2, of which I can employ as many as may be preferred, greatly aid in reducing the thickness of the stratum to be traversed and in projecting the gases 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, strike 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 A^2 open, the smoke and pyroligneous acid are made to pass off in the chimney without coming in contact with the minerals or ores to be desulphurized and disintegrated. After the fire is thoroughly ignited the damper A^2 is closed and the damper *b* is opened. Superheated steam is then admitted through the perforated pipe *h* from a generating apparatus, (not represented,) and the mineral ores F′ are heated by the products of combustion or gases resulting from passing superheated steam into the burning fuel contained in the fire-chamber, according to the patented process of William E. Hagan. When the ores F′ in the receptacle G have been sufficiently heated 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 are marked *e*.

Fig. 4 represents a cross-section of the diaphragm D and one of the cones D^2 on a larger scale than in Fig. 1.

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:

1. The intervening chamber or diaphragm containing iron-borings or equivalent material, whether stationary or rotary, between a fire-chamber and an ore-receptacle, for the purposes above specified.

2. In connection with the above, the annular or equivalent hollow form of the said diaphragm.

3. The perforated cones or hollow projections in the chamber or diaphragm D, arranged substantially in the manner and for the purposes herein set forth.

4. The inclined plates, forming a tunnel-bottomed furnace for collecting the disintegrated material, arranged relatively to the ore-chamber G F and to the other parts substantially in the manner and for the purposes herein set forth.

5. The within-described arrangement of the dishing grate or basket F relatively to the annular or hollow diaphragm D so as to facilitate the presentation of a thicker stratum of the ore near the center, where the currents of gases and steam strike directly, than near the edges, where they strike with less force, substantially as herein specified.

6. The arrangement of the passages A′, B, and C and dampers A^2, *b*, and *c*, for changing the direction of the heat and gases, substantially as and for the purposes herein described and set forth.

DANIEL MINTHORN.

Witnesses:
EMIL VOSSNACK,
D. W. STETSON.