

JOHN S. OLIVER.

Improvement in Process for Desulphurizing Ores.

Patented Feb. 27, 1872.

No. 124,077.

Fig. 4.

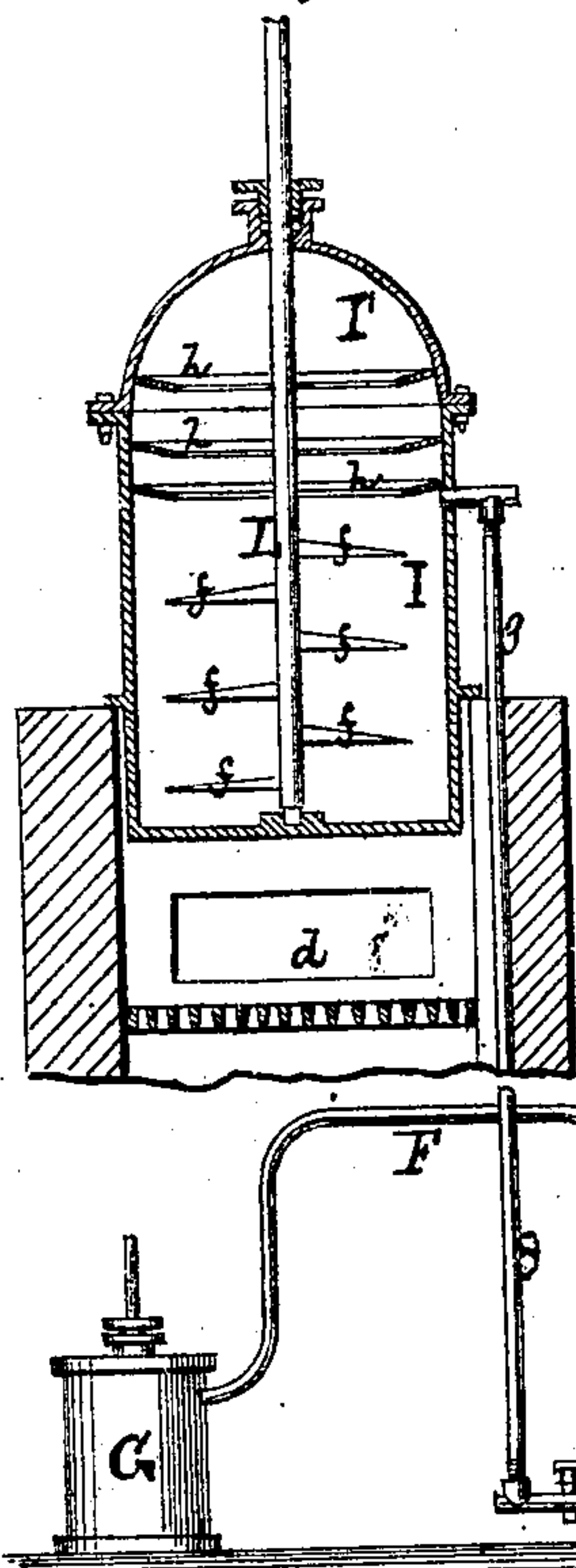


Fig. 1.

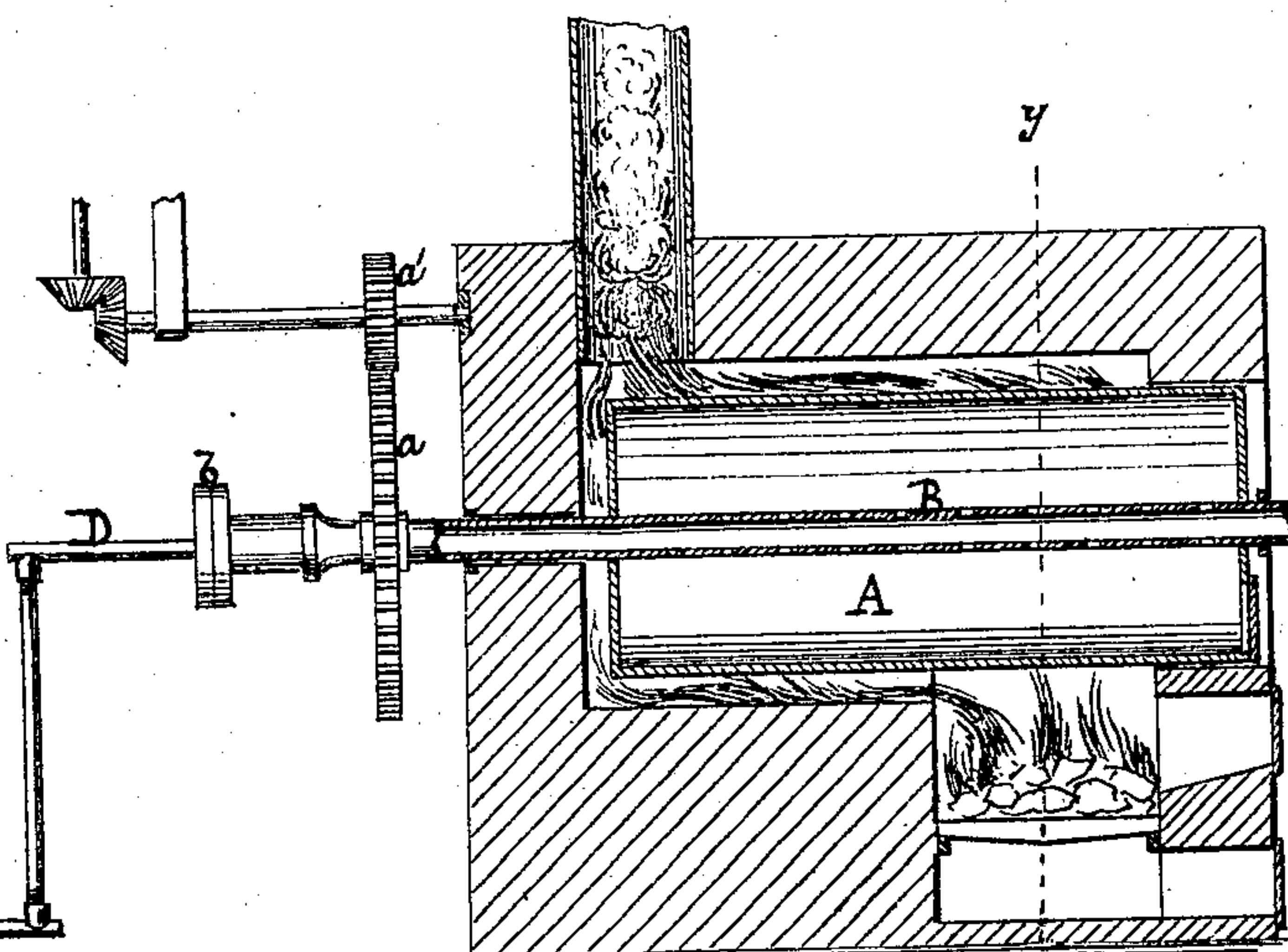


Fig. 2.

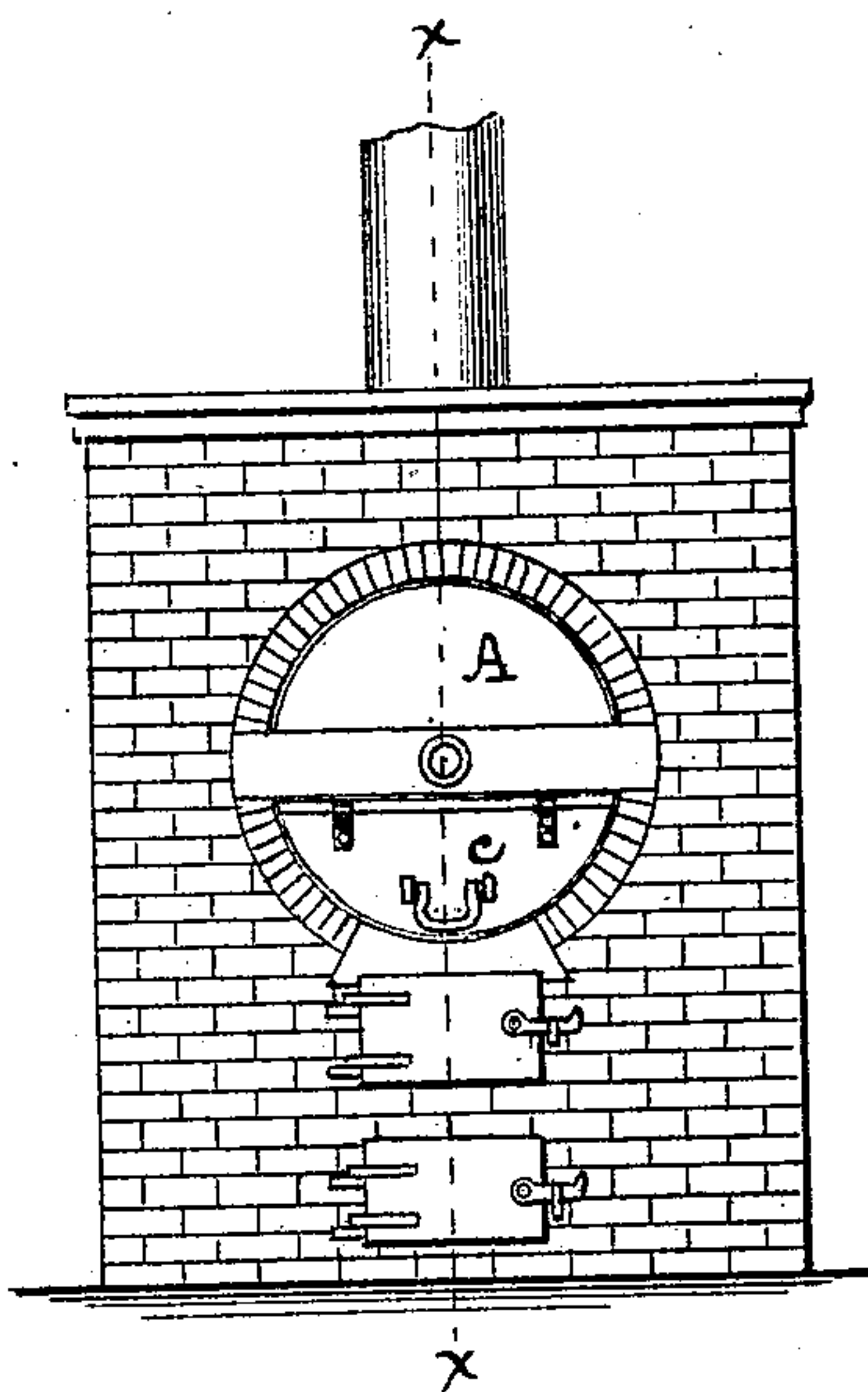
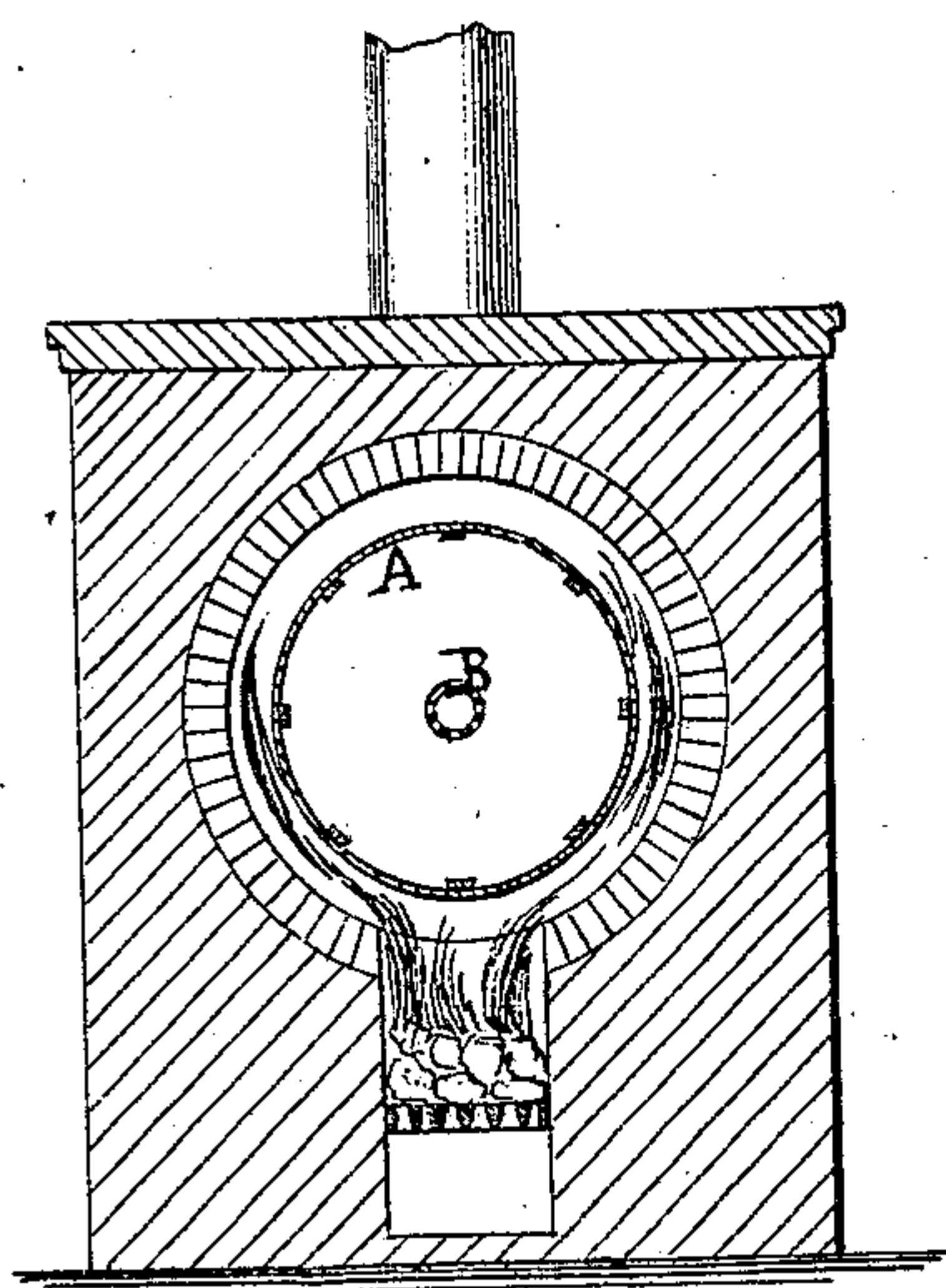


Fig. 3.



Witnesses:

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IMPROVEMENT IN PROCESSES FOR DESULPHURIZING ORES.

Specification forming part of Letters Patent No. 124,077, dated February 27, 1872.

To all whom it may concern:

Be it known that I, JOHN S. OLIVER, of the city of New York, in the county and State of New York, have invented a new and Improved Process for Desulphurizing Ores; and I hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawing, which forms part of this specification.

The object of my invention is to entirely remove sulphur and such other substances as vaporize under heat from crushed or pulverulent ores, as well as to carbonize and draw off the oil contained in the ore, and as well, also, as to collect the phosphorus, cadmium, sulphur, antimony, arsenic, selenium, &c., evolved from the ores that bear the same in the form of a precipitation or crystallization. To such ends my invention consists in the process of roasting crushed ores in a retort in which a substantial vacuum may be obtained and maintained by means of an attached exhaust-pump, and in which the pulverulent ore may be properly agitated during the roasting operation, whereby the sulphur, antimony, phosphorus, arsenic, cadmium, selenium, and other foreign substances in the ore which will vaporize under heat may be condensed and collected, and the ore, if silver or gold bearing, left in a condition suitable for amalgamating processes, and, if iron ore, in a fine condition for being smelted by well-known processes to produce steel of a superior quality.

The accompanying drawing illustrates an apparatus of suitable construction for putting my process into practical operation.

Figure 1 shows a vertical longitudinal section (on the plane of the line *x x*, Fig. 2) of a revolving retort and its furnace, a side elevation of a condensing-chamber, and of an exhaust-pump, and pipes connecting the different parts of the apparatus. Fig. 2 is a front-end view of the retort. Fig. 3 is a vertical cross-section of the same taken on the plane of the line *y y*, Fig. 1; and Fig. 4 is a vertical central section of an upright retort provided with suitable agitating mechanism, and, for convenience, it is shown as connected with the same condensing-chamber and pump as the revolving retort shown in Fig. 1.

A designates a cylindrical retort, mounted on a shaft, B, and arranged to be revolved

over or within a suitable furnace, C. Cog-gearing *a a'*, or any other suitable means, may be employed for rotating the retort A. The shaft B is made hollow or tubular for a part or the whole of its length, except that the rear end must be closed, and the shaft is perforated so as to communicate with the interior of the retort. A pipe, D, is connected to this shaft B, a suitable stuffing-box, *b*, being employed at the point of connection, so that the shaft B may revolve without disturbing the pipe D. The said pipe D is let into a condensing chamber or vessel, E, and from this condensing chamber or vessel a pipe, F, leads to an exhaust-pump, G, of any suitable construction. By reference to Fig. 1, it will be obvious that a vacuum may be created and maintained in the retort A and condensing-vessel E by means of the exhaust-pump G. The retort should be so arranged in its surrounding masonry that one end will be accessible for putting in and removing the charge of ore. In Fig. 2 the front end of the retort, which is the exposed end, is shown as provided with a door, *c*, which may be opened and closed for putting in and withdrawing the charge of ore. In Fig. 4 I have shown a stationary retort, I, mounted over a furnace, *d*. This retort is shown as provided with a removable cover, I', which can be lifted off when it is desired to charge or discharge the retort. This retort may be hung on trunnions, so that it can be tipped for receiving and delivering the charge. A vertical shaft, L, is arranged within the retort, and this shaft is provided with arms *f f*, which serve as stirrers; and some of the arms *f*—the lower ones—are preferably made in the form of the wings of a propeller-wheel, so as to work upward the charge from the bottom, so that all the ore may be subjected to the same degree of heat. A thorough agitation or stirring of the charge may thus be effected. For convenience, I have shown this retort I I' connected by a pipe, *g*, to the condensing-vessel E, and from thence to the exhaust-pump G. But there is no necessary connection between the retort A and that I I', though, indeed, such arrangement is practicable, the exhaust-pump G being capable of creating and maintaining a substantial vacuum in both the retorts A and I I'; and, indeed, other retorts may be connected to the same exhaust-pump,

if desirable. The upper portion of the retort I I' is provided with projecting shelves *h h*, for receiving crystallizations, as will be presently described. I prefer to have the pipes D and *g* made in sections, so that they may be taken apart for cleaning.

I will first describe the operation of my process as the same may be put into practice by the retort A and its attached mechanism. The charge of pulverulent or crushed iron ore is put into the retort A, and the door *c* closed tightly. The exhaust-pump is then set to work, and the rotation of the retort begun. Of course all portions of the ore are subjected to the heat from the fire in the same manner as the coffee in a coffee-roaster. The heat required to roast the pulverulent ore in a vacuum is from, say, 100° to 400° Fahrenheit, according to circumstances. The vaporized elements in the ore are drawn off by the exhaust-pump, and pass into the water in the condensing-vessel E, from which they are collectable and separable in the usual way. Some of the vapors will adhere to the pipe D in the form of crystals or sublimates, and to collect the same the pipe must be disjointed occasionally, say once a day, if the retort be in constant use, when the sections can be easily scraped and the crystals collected. The sulphuric vapors will pass into the condenser and be precipitated or become mixed with the water therein, and by a distillation of this water we obtain sulphurous acid.

I will now describe the operation of my process when carried out by means of the retort I I' and its attached mechanism. This retort is more especially designed for treating ores which contain, in appreciable proportion, cadmium, used for oil-paints for portraits, selenium, used for medicinal purposes by homeopathic physicians, phosphorus, arsenic, and antimony. By means of my process they may all be collected in the form of crystals or sublimates. The charge of pulverulent ore is placed in the retort I and the cover I' secured down tightly. The exhaust-pump G is set in motion, and the shaft L rotated by any suitable gearing or pulleys. The vapors rise, and those of some of the substances in the ore adhere to the sides of the retort and lodge upon the shelves *h h*; for instance, cadmium will be found in a beautiful crystallized state at the top portion of the retort, and below this a zone of selenium; but some of the vapors will be drawn off by the exhaust-pump and collected, as before described, from the condenser and pipe D. My process for roasting ores in a vacuum created by an exhaust-pump enables me to collect the valuable vapors, such as sulphur, phosphorus, antimony, cadmium, selenium, arsenic, &c., and at the same time produce superior results in respect to the ores roasted. In the case of iron ore, a very superior quality of iron is produced—a kind which yields the finest steel, as I have found by actual experi-

ment—one reason being that the foreign substances heated in a vacuum by my process cannot combine with the oxygen of the air, and hence can be more thoroughly extracted and separated from the metal in the ore than is possible in the ordinary process of roasting, in which these substances combine both with the oxygen of the air and the metals in the ore, thus causing them to be separated with difficulty.

I will here remark that in treating ores, particularly iron ores which contain little or no valuable foreign substances, the condensing-vessel E may be dispensed with, and the retort connected directly to the exhaust-pump.

I am aware of reissued Letters Patent of the United States, No. 3,266, wherein a retort is shown which is charged by "filling it with small pieces of wood, sawdust, peat, turf, bog, or coal, together with fragments of metallic ores, in alternate layers," which retort is placed over a fire; that the end of a steam-pipe is arranged in the neck of the retort, so as to blow steam through and out of the neck of the retort in order to create a vacuum in the retort. I contend that a vacuum is not, in fact, created by this mechanism, nor, indeed, a substantial vacuum.

By my process I create a substantial vacuum in my retort by means of an exhaust-pump, and there are many other points of difference between the process described in that patent and the process described in my application. I wish, therefore, to be distinctly understood as not claiming any part of the process which is described in said reissued Letters Patent, No. 3,266.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The process of roasting ores, in order to free them from all the substances detrimental to the subsequent treatment of the metal obtained, by agitating the same during the roasting operation in a chamber or retort in which a substantial vacuum is maintained, substantially as herein specified.

2. The combination of the revolving retort A with the exhaust-pump G, substantially as and for the purpose herein specified.

3. The combination of the revolving retort A, condensing-vessel E, and exhaust-pump G, substantially as and for the purposes herein specified.

4. The combination, with the retort I I', provided with a stirrer, L *f f*, of the exhaust-pump G, substantially as and for the purpose herein specified.

5. The combination of the retort I I', condenser E, and exhaust-pump G, substantially as and for the purpose herein specified.

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Witnesses:

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