(No Model.) 2 Sheets—Sheet 1.

S. SMITH.

SULPHUR BURNER.

No. 421,201. Patented Feb. 11, 1890.

FIG. 1.

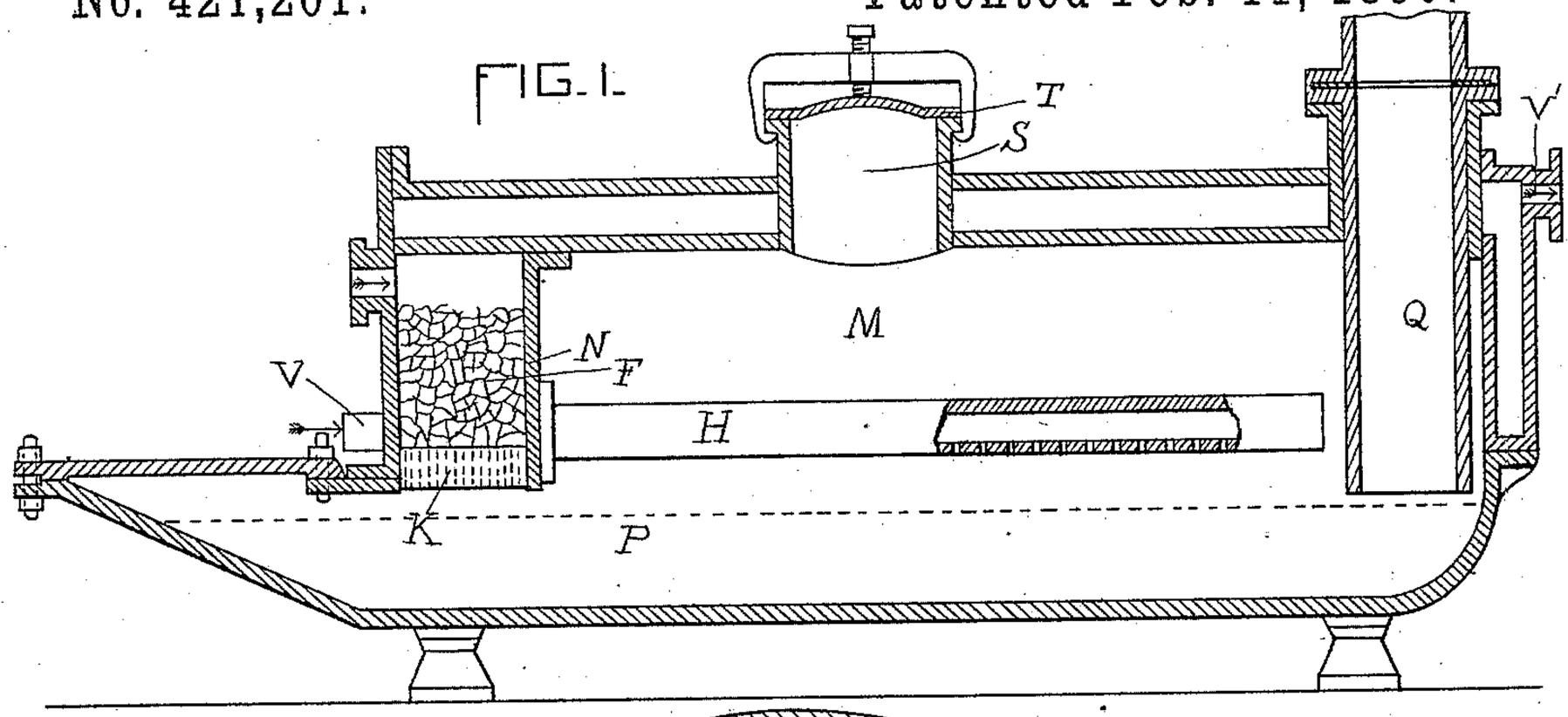


FIG. 4.

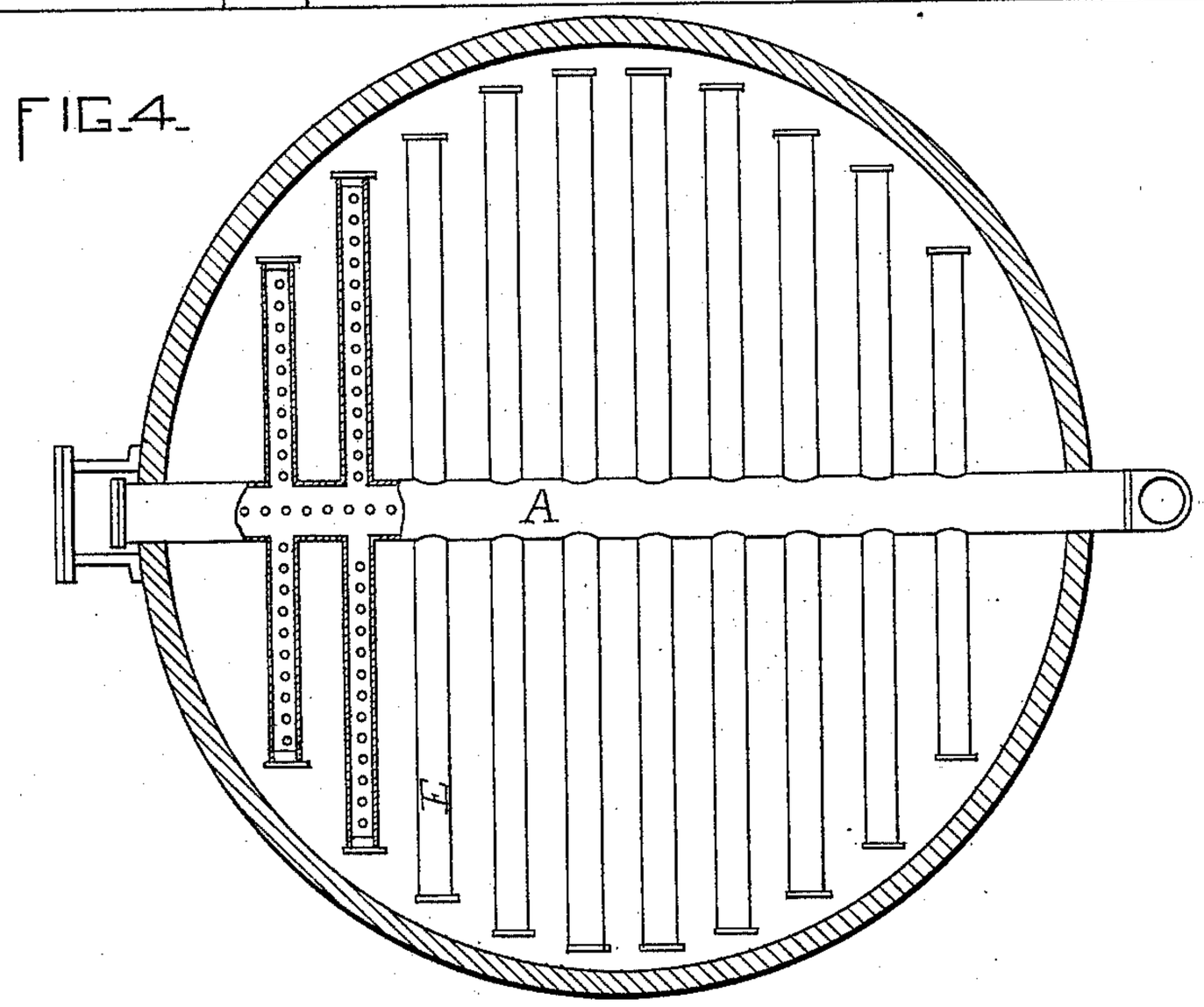
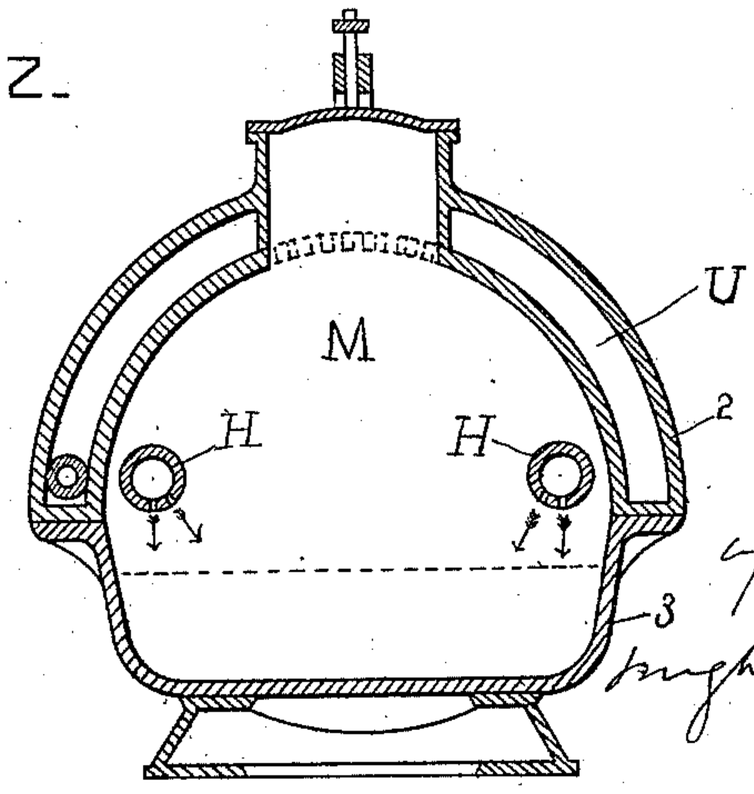


FIG. 2.



WITNESSES.
H. A. Macdonald.
W. B. Ramsay.

INVENTOR.
Sidney Smith.
by Wright Brown Quinby & Otis Atty's.

(No Model.) 2 Sheets—Sheet 2.

S. SMITH.

SULPHUR BURNER.

No. 421,201. Patented Feb. 11, 1890.

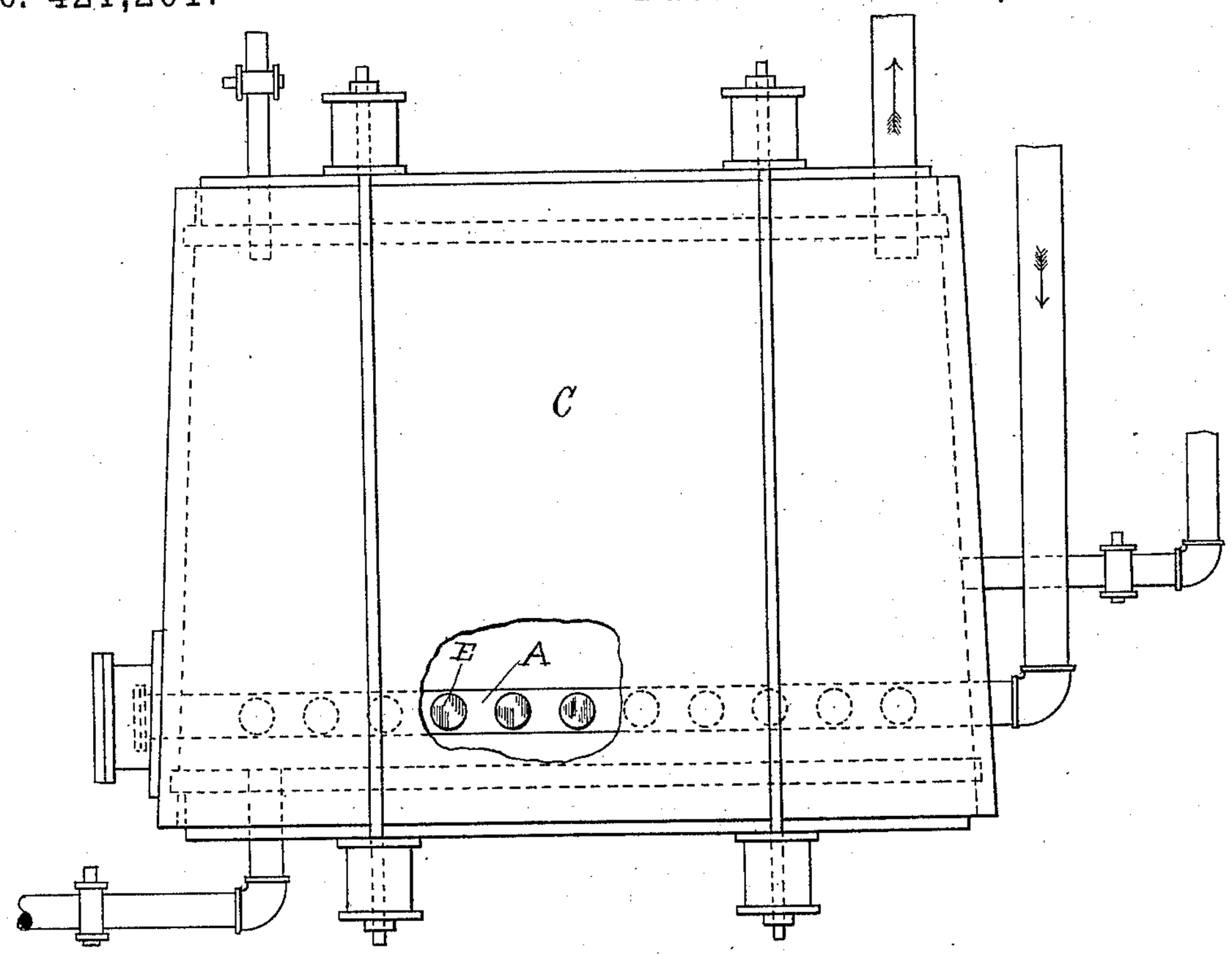


FIG. 3.

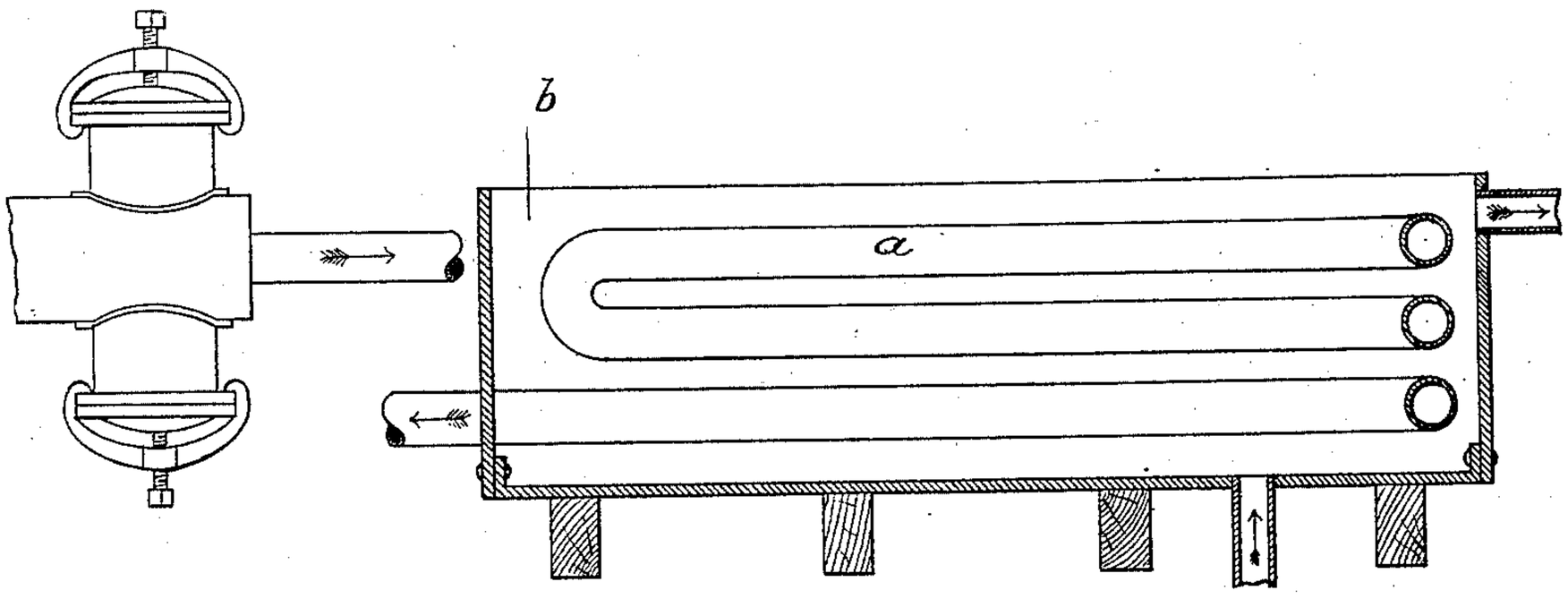


FIG. 5.

WITNESSES.
A. F. Macdonald.
W. B. Ramsay.

INVENTOR.
Sidney Smith
by Wright Brown & Quinby.
Attys.

UNITED STATES PATENT OFFICE.

SIDNEY SMITH, OF CAMBRIDGE, MASSACHUSETTS.

SULPHUR-BURNER.

SPECIFICATION forming part of Letters Patent No. 421,201, dated February 11, 1890.

Application filed April 2, 1889. Serial No. 305,751. (No model.)

To all whom it may concern:

Be it known that I, SIDNEY SMITH, of Cambridge, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Sulphur-Ovens, of which the following is a specification.

This invention has for its object the construction of an oven for burning sulphur with the formation of sulphurous-acid gas, which is subsequently cooled in any convenient manner and absorbed in any suitable liquor containing a base, such as magnesium or lime. It is a well-known fact that combustion of any substance takes place to best effect when the necessary oxygen is brought in contact with it in a finely-divided, highly-heated state, for it is under such conditions that the affinity of the two substances is most rapidly and completely satisfied. This principle is to be borne in mind in connection with my improved sulphur oven or burner for the production of sulphurous-acid gas. "Bisulphite-liquor," so called, is an acid solution containing sulphurous-acid gas in combination with some base, as lime or magnesia. In practice the cooled gas is passed into and absorbed by the base, which is already in solution. That the required amount of gas may be absorbed as quickly as possible it is necessary that the mixed gases from the oven should contain as high a per cent. of sulphurous-acid gas as possible with the smallest obtainable mixture of air. Accordingly the oven must be made air-tight and only the chemical equivalent of oxygen necessary for the complete combustion of the charge of sulphur admitted.

In the accompanying drawings, forming a part of this specification, Figure 1 represents a longitudinal section of my improved oven. Fig. 2 represents a transverse section of the same. Fig. 3 represents a vertical section of one of the absorption-tanks. Fig. 4 represents a horizontal section of said tank. Fig. 5 represents a vertical section of the cooler.

The same letters represent the same parts in all the figures.

In my improved oven air for combustion is furnished by any suitable compressor, which is put in connection with the combustion-chamber M of the oven. The air first enters an iron box N, which is packed with fire-brick F or other refractory material broken up into lumps or fragments, so as to afford large areas of heated surface, with which the air passing through said box comes in contact. The box N is provided at the bottom with a large number of small perforations K with rough edges, through which the air is forced in small streams upon the already ignited charge P of sulphur in the lower portions of the chamber M. Furthermore, two pipes H extend horizontally on either side the entire length of the oven from the box N. Said pipes are provided with two rows of perforations so placed that the air enters them from the box N and streams directly downward upon the sulphur and also at an angle upon the surface thereof. As the temperature of the interior of the combustion-chamber rises with the heat of combustion, the refractory material in the box N becomes heated, and in turn preheats the air from the compressor before it comes in contact with the sulphur. The oxygen in the air-supply is thus preheated and finely divided, two conditions essential for perfect combustion. Furthermore, the oxygen is thoroughly diffused by the lateral pipes.

For the purpose of observing and controlling the progress of the combustion an opening closed by mica is provided at the front of the oven above the surface of sulphur.

The oven proper is made of cast-iron sections 2 3, Fig. 2, tightly bolted together, forming a combustion-chamber of any suitable shape. To one end of the chamber, on the inside, is fixed the iron box N and the two pipes H H, extending over the sulphur. At the other end is a vertical pipe Q, reaching nearly to the surface of the sulphur for the purpose of carrying off the sulphurous-acid gas to the cooling apparatus and absorption-tanks.

A man-hole S and a removable plate T provide for charging and cleaning the oven.

For cooling the oven the section is made hollow to form a water space or jacket U, which receives cold water through a pipe V, and discharges the water after it has been heated through a pipe V′.

From the oven the heated gases pass through any convenient length of large iron pipe,

whose joints are bolted together and made tight with washers of lead or otherwise. The gases thus partially cooled pass through a cooling apparatus proper, which consists of a series of lead pipes *a*, immersed in a box *b*, supplied with cold water, the supply of which is constantly renewed. Both the lead pipes and the iron ones mentioned above are fitted with removable connections and plates, so as to be readily cleansed or examined.

From the cooling apparatus the gases pass to a series of wooden absorption-tanks *c*, containing the base (lime or magnesia) in solution. These tanks, which may be of any convenient number, are all tightly closed, except the last of the series, which remains open at the top, and are connected in such a manner by lead pipes that the gases which are unabsorbed in one tank pass on to the next. The gases on entering each tank *c* pass through a horizontal lead pipe A, with lateral branches E near the bottom of the tank, said pipes being provided with a series of holes on their under sides. Said perforated pipes A E thoroughly distribute or diffuse the gases over the bottom of each tank. By this careful diffusion of the gases over the bottoms of the tanks a very effective absorption of the gases as they rise through the solution is insured.

It has been usual heretofore to draw the gases from the oven to and through the tanks of the series by a pump or air-exhausting apparatus connected with the last tank. It will be observed that my arrangement, whereby ordinary atmospheric air is forced into the furnace, as described, thereby causing said air to combine with the gases and pass successively to and through the cooler and the absorption-tanks, has the important advantage of preserving the air-pump or forcing apparatus from the deleterious action of the gases to which the said pump would be exposed if it were arranged to draw the gases to and through the series of tanks by being connected with the last tank of the series.

The supply of atmospheric air under pressure to the oven in a preheated condition in accordance with my invention has the additional advantage of supplying oxygen in a more concentrated form with a consequent more rapid production of sulphurous-acid gas, and the desired strength of bisulphite-liquor is thus more quickly obtained.

I claim—

1. The combination, substantially as hereinbefore set forth, of a sulphur-oven having an air-receiving box arranged to be heated by the combustion in the oven, broken refractory material in said box, means for forcing atmospheric air under pressure into said box, a plurality of outlets from the air-box arranged to subdivide the heated air and direct it upon the burning sulphur in the oven, a cooler through which the mixed gases pass from the oven, and a series of absorption-tanks, each having a system of perforated pipes near its bottom, which pipes receive the gases and diffuse the same through the liquid in the tanks, as set forth.

2. In a sulphur-oven, an air-heater consisting of a box or receptacle containing refractory material and provided with an air-inlet and with a plurality of outlets arranged to subdivide the heated air and direct it upon the burning sulphur, as set forth.

3. In a sulphur-oven, the combination of the combustion-chamber, the air-heater consisting of an air-box arranged to be heated by the combustion in the chamber and the refractory material in the air-box, and the perforated pipes extending from the air-box over the sulphur in the combustion-chamber, as set forth.

4. The combination of the combustion-chamber and the air-heater, consisting of a box therein containing refractory material, and having perforations K in its bottom over the sulphur, as set forth.

5. The combination of a sulphur-oven, an air-heating box therein, a blower or air-forcing apparatus communicating with the air-box, and a plurality of outlets, whereby air heated in said box is distributed over the burning sulphur, as set forth.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 20th day of March, A. D. 1889.

SIDNEY SMITH.

Witnesses:
FRED. W. SMITH,
C. F. BROWN.