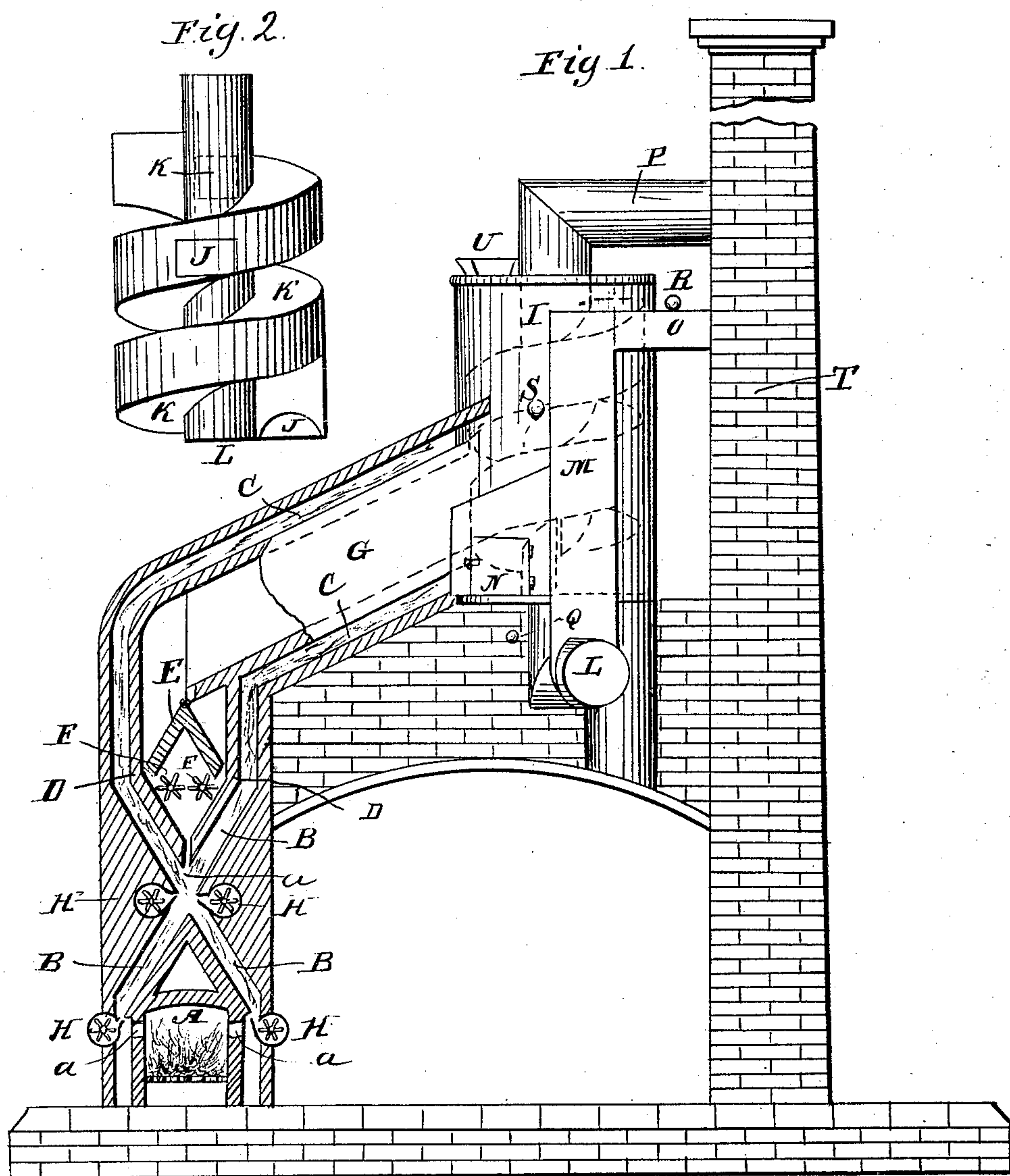


T. D. WORRALL.

Apparatus for Desulphurizing Quartz.

No. 57,430.

Patented Aug. 21, 1866.



Witnesses:
Jos. L. Coombs
Edw. J. Brown

Inventor:
T. D. Worrall

UNITED STATES PATENT OFFICE.

THOS. D. WORRALL, OF CENTRAL CITY, COLORADO TERRITORY.

IMPROVED APPARATUS FOR DESULPHURIZING QUARTZ.

Specification forming part of Letters Patent No. 57,420, dated August 21, 1866.

To all whom it may concern:

Be it known that I, THOMAS D. WORRALL, of Central City, in the county of Gilpin and Territory of Colorado, have invented certain new and useful Improvements in Furnaces for Desulphurizing Quartz Rock, Pyrites, and other metal-bearing substances; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon.

My entire invention relates to a desulphurizing-furnace so arranged that it will not only desulphurize quartz, but also save the gases driven from the pyrites and sulphurets for the purpose of converting them into sulphur, sulphuric acid, bisulphide of carbon, and any other chemical compound of which they may be made to form a part.

In the accompanying drawings, Figure 1 is a vertical section of the desulphurizing-furnace, built in a square form and of any suitable fire-proof material. Fig. 2 is the inside of a spiral furnace with double flue, for the purpose of securing either a double flame, through which pulverized quartz pyrites or other metal-bearing substances may fall while in contact with the flame, or through one of which flame may ascend while through the other quartz descends without coming in contact with the flame.

In Fig. 1, A is a fire-place in the furnace, for generating heat and flame. *a a* are openings in the sides of the fire-place, through which the flame escapes into the flue. B B B B are an X-shaped flue, up which the fire and smoke pass. C C are continuations of said flue. D D are a V-shaped receiver, with an opening at the bottom, (marked *d*.) E is an inverted-V-shaped distributor suspended by a hinge on the distributing end of a muffle-furnace, or securely fastened in that position. F F are fan-shaped distributors, made to revolve at the base of the distributor E, or in any other part of the furnace in which they may answer the purpose. G is a continuous muffle-furnace surrounded by the flues C C. H H H H are blow-pipes extending across the whole throat of the furnace, designed to operate in the flues B B and to condense the flames upon each other immediately under the opening of the receiver,

(marked *d*.) I is the wall of the furnace, which contains the spiral flues seen on Fig. 2. J J on that figure are openings designed to receive the fire and smoke from the upper and lower flues, C C, in Fig. 1.

K K in Fig. 2 indicate the direction of the spiral flue from which the sulphurous gases escape from the muffle-furnace G in Fig. 1. K' is an opening, through which the gases escape to and down the center of the furnace, passing out of the bottom of the flue at L in Fig. 1 into an ordinary receiving-chamber. (Not shown on the drawings.) M is a flue, built on the outside of the upper part of the furnace, for the escape of the smoke and carbonaceous gases from the spiral flue J, and descending to and joining the other flue at L. N is a small furnace, also connected with the flue M. O is an escape-flue, passing from M into a chimney-stack. P is an escape-flue, passing from the flue K into the chimney-stack. Q R S are gates or dampers to turn both gases and smoke into the chimney-stack when not required for other purposes. T is a chimney-stack. U is a receiving-hopper, through which the pulverized quartz is passed to the furnace.

Having given a description of the different parts of my furnace, I now proceed to describe its operation.

I start a fire in my fire-place at A, from which the flame ascends through the openings on either side at *a a*. The drums or air-generators being also set in motion, the blow-pipes operate in the confined flues B B and condense the flames upon each other below *d*. The flames then continue up the flue B, heating the receiver D, the muffle-furnace G, and the spiral flues J and K, and are either conducted into the receiver through L by closing the valve O or permitted to pass into the chimney-stack T. At the same time the quartz is passed into the hopper U, and enters the spiral flue K, passing over the heated surface which forms the floor of that flue, where it is dried and partly heated. From thence it falls into the continuous muffle-furnace G, and after passing through it is delivered onto the V-shaped distributing-plate E.

The object of hanging the plate upon a pivot or hinge is to secure equal distribution of the quartz.

It will be seen that by this arrangement, should the quartz pass in too great abundance onto and down one valve of the plate, it would so press upon it as to force the upper point under the chute, and thus regulate the exact amount of quartz desired to flow down each valve. By this plate the quartz is delivered onto the diamond-shaped receiver at its widest part D D. Here it falls upon the fan-distributors F F, and by these is delivered into the heated chamber formed by the V-plate. They also serve by their motion to increase the draft in the flue when it is desired to use the flue without any reference to saving and condensing the gases, and will by so doing augment the amount of oxygen used in desulphurizing and oxidizing the quartz, but will simply act as agitators where the draft is cut off, for the purpose of saving the gases. From these revolving agitators or distributors the quartz passes down the walls of the diamond-shaped receiver D D, and through the bottom, at the point where the flames are condensed upon each other, below *d*, and from thence down the flues B B, where the work of desulphurization is completed.

It will be seen that from the time that the quartz passes into the hopper U until it passes through the bottom of the diamond-shaped receiver at *d* it has been kept as free as possible from the air, smoke, and flame, only a sufficient amount being admitted to insure that the sulphurous gases pass into the receiver, the object of this being to collect the sulphurous fumes and gases and conduct them, in as pure a form as possible, into a receiver, so as to use them in the manufacture of sulphur, sulphuric acid, bisulphide of carbon, or any other chemical compound in which they can be used. These sulphurous gases are conducted down the flue K', and pass through to L, where they are mixed with the fumes or gases created in the combustion of fuel in the fire-place A, or by the combustion of carbon-oil or any other carbonaceous substances generated in the small furnace *n*, and thence into any ordinary receiving-chamber, for the purpose of being converted into the chemical compounds above named.

My object in these devices is to introduce metal-bearing ores to gradually-increased heated surfaces and flame, and to keep them in contact with said surfaces a sufficient time to insure that sulphur, arsenic, and other substances that prevent successful amalgamation have been removed before submitting them to that degree of heat at which there may be danger of the sulphur and iron contained in the ores forming a flux, in which the gold and silver may be embedded, as in a matrix, from which they could not be extracted without great difficulty.

I do not desire to confine myself to the combinations shown in this furnace, but wish to use each part of the furnace singly or in any other combination that may be desired; neither

do I confine myself to any particular material out of which my furnace or any part of my furnace may be constructed, but propose to use any suitable material.

Having thus described my invention and the mode of carrying it into effect, what I claim, and desire to secure by Letters Patent, is—

1. Operating a blow-pipe in a confined space or flue up which flame is passing, for the purpose of intensifying the heat through which metal-bearing substances in a pulverized or partly pulverized condition are passing, for the purposes set forth.

2. Operating blow-pipes up flues that form a junction, so that when the flames meet they may be condensed upon each other, and thus intensified for the purpose of desulphurizing and oxidizing metalliferous ores passing through said flames, as set forth.

3. An X-shaped flue so constructed that the fire, starting from extreme points at the base, must meet in the center of the flue, and this whether used with or without blow-pipes, for the purpose set forth.

4. The furnace A, with open sides communicating with flues, in connection with the blow-pipes H H H H and the X-shaped flues, substantially as set forth.

5. The V or diamond shaped receiver, with perforated base, for the purpose of heating quartz or other metal-bearing substances when passing over its inner surface while the fire is passing over its outer surface, and of delivering the same either into flues below onto heated plates through simple flame, through flame condensed upon itself by means of two or more blow-pipes playing from opposite directions, or upon a hearth upon which flame has been condensed by blow-pipes.

6. The revolving fan-distributors in the V or diamond shaped receiver in flues in a muffle-furnace or in an open-chimney stack, for the purpose of suspending pulverized quartz and other metal-bearing substances in their downward descent, and of distributing the same in or upon heated surfaces or through flame, for the purposes set forth.

7. In combination with the V-shaped receiver D D and the spiral furnace I, a continuous muffle-furnace of any shape or dimensions—horizontal, semi-horizontal, or perpendicular—through which ores containing sulphur or other volatile agents may pass, for the purpose of simple desulphurization, or for the purpose of driving off sulphur, arsenic, or any other chemical agent which it may be desirable to save for scientific or commercial purposes.

8. One or more inverted-V-shaped plates, either firmly built in the flue or suspended by hinges at the distributing end of a muffle or other furnace or ordinary spout, for the purpose of distributing pulverized quartz falling upon it, in the manner and for the purposes set forth.

9. The V or diamond shaped receiver D D,

in combination with the inverted-V-shaped distributor E, for the purpose set forth, or any other similar purpose.

10. The spiral furnace, with either a double or single flue, for the purpose of securing a slow and gradual descent of pulverized quartz or pyrites while fire is ascending in or under said flues.

11. So constructing said spiral furnace and the conducting-flues connected therewith that while heat and flame are ascending one flue and the quartz, sulphurets, or other metal-bearing substances are descending the other, said substances shall not only be freed from their sulphur for the purpose of metallurgical success, but the sulphurous gases and other volatile agents may be collected and converted into any chemical or commercial agent of which they may be made to form parts.

12. Desulphurizing ores and driving from them arsenic and other chemical agents, for the purpose of securing successful amalgamation and chlorination or smelting, and, simulta-

neously with this, converting the sulphurous gases, arsenic, or other agents into useful articles for chemical or commercial purposes.

13. Conducting the gases arising from the combustion of carbonaceous substances which have been used to supply heat for the desulphurizing-furnace into a receiver, to be united with the sulphurous gases, for the purpose set forth.

14. The furnace N, connected with the conducting-pipes M and K', for the purpose of supplying any deficiency of carbonaceous gases that may be lacking from furnace A, for the purpose set forth.

15. The use of carbon-oil for the purpose of supplying the equivalents of carbon necessary to the manufacture of the chemical compounds, as set forth.

THOS. D. WORRALL.

Witnesses:

JOS. L. COOMBS,
EDM. F. BROWN.