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Patented Feb. 11, 1902.

W. D. C. SPIKE & J. T. JONES.  
ROASTING, SMELTING, AND MATTING FURNACE.

(Application filed Jan. 24, 1901.)

(No Model.)

2 Sheets—Sheet 1.

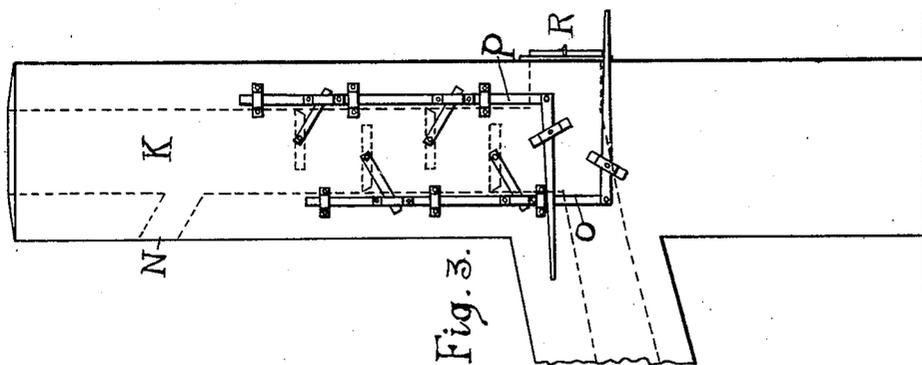


Fig. 3.

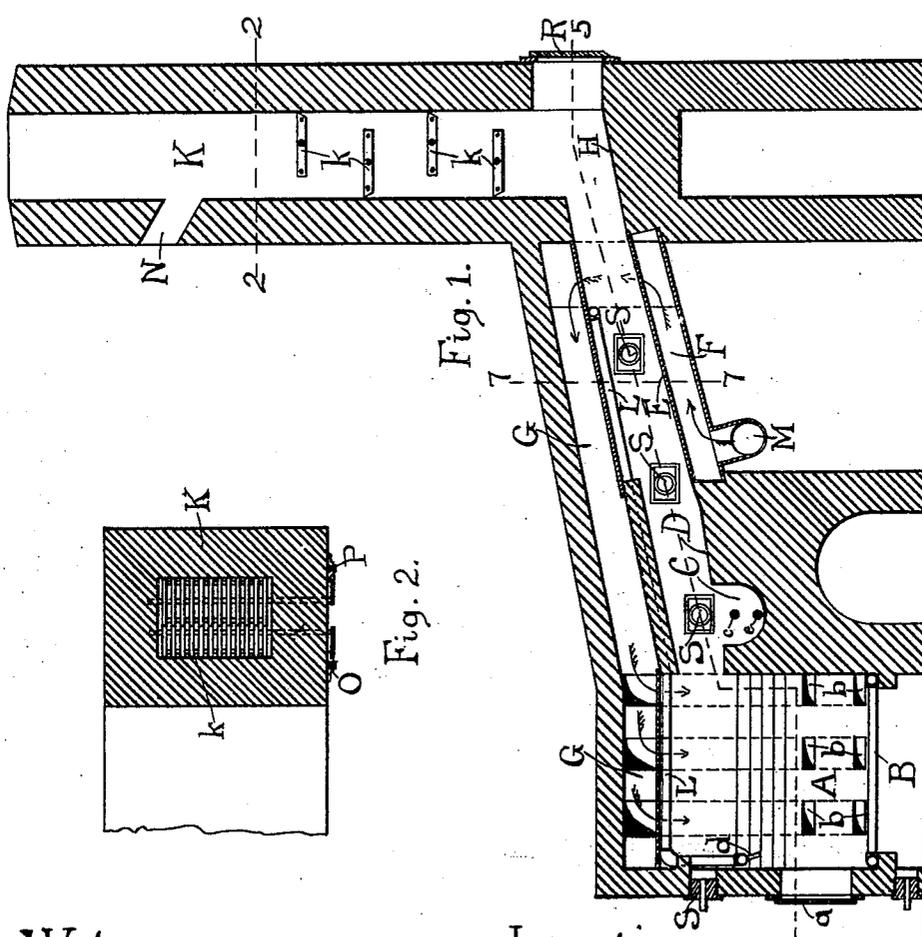


Fig. 1.

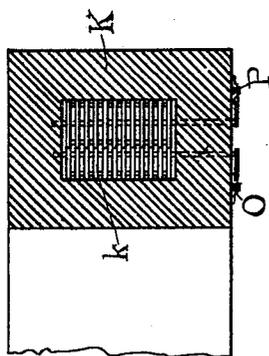


Fig. 2.

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2 Sheets—Sheet 2.

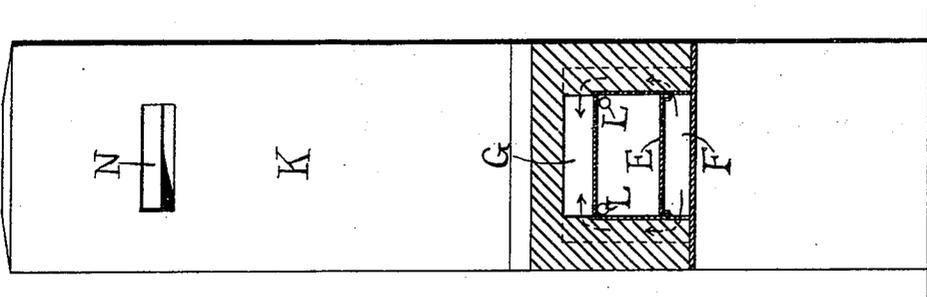


Fig. 7.

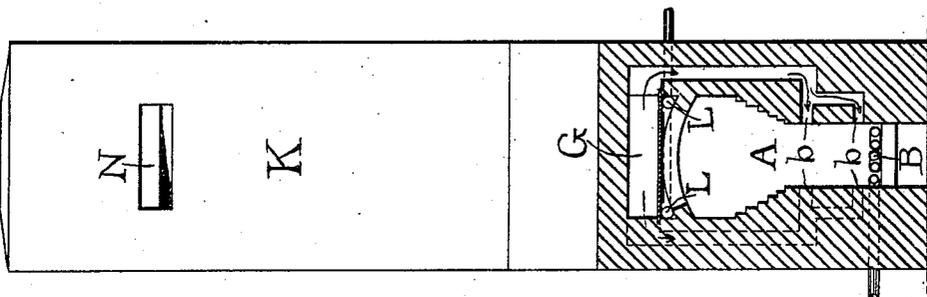


Fig. 6.

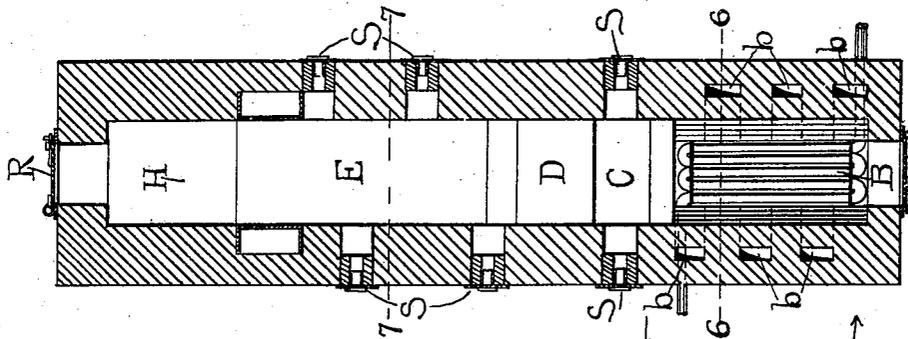


Fig. 5.

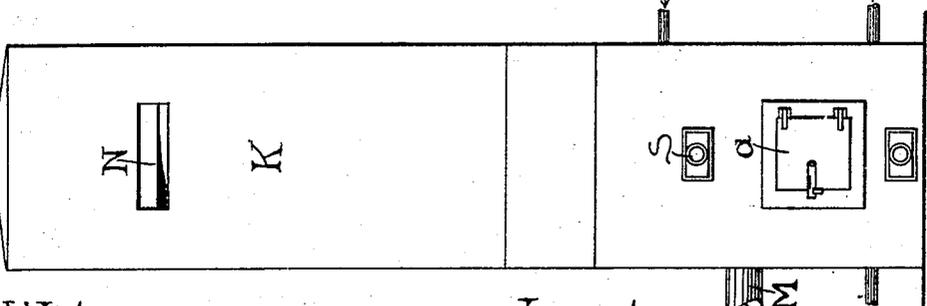


Fig. 4.

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# UNITED STATES PATENT OFFICE.

WILLIAM D. C. SPIKE AND JAMES T. JONES, OF TACOMA, WASHINGTON.

## ROASTING, SMELTING, AND MATTING FURNACE.

SPECIFICATION forming part of Letters Patent No. 693,076, dated February 11, 1902.

Application filed January 24, 1901. Serial No. 44,524. (No model.)

*To all whom it may concern:*

Be it known that we, WILLIAM D. C. SPIKE and JAMES T. JONES, citizens of the United States, residing at Tacoma, in the county of Pierce and State of Washington, have jointly invented new and useful Improvements in Roasting, Smelting, and Matting Furnaces, of which the following is a specification.

Our invention pertains to furnaces for reducing rich mineral ores.

The objects of our invention are, first, to provide a roasting, smelting, and matting furnace that can be equipped and operated at the individual mine, and, second, to provide a means for reducing ores at the mines to bullion, and thus save the expense of transporting the ore in bulk to large smelters located at a distance. We attain these objects by the apparatus illustrated in the accompanying drawings, in which—

Figure 1 is a vertical section lengthwise of our invention. Fig. 2 is a horizontal cross-section of the smoke-flue at 2 2, showing the construction of the roasting-grates located therein. Fig. 3 is a side elevation of the smoke-flue, showing the lever mechanism for operating the roasting-grates located therein. Fig. 4 is a front elevation of our invention. Fig. 5 is a plan section of our invention at the broken line 5 5. Fig. 6 is a vertical cross-section through the furnace at 6 6, and Fig. 7 is a cross-section at 7 7.

Similar letters refer to similar parts in the several views.

Our invention comprises a combustion-furnace A, having a water-coil-pipe grate B, a metal-well C, a melting-hearth D, a roasting-hearth E, with superheating-air-blast flues F and G below and above the roasting-chamber, a charging-hearth H, and smoke-flue K, having a multiple of preliminary-roasting grates *k k* located therein. The combustion-chamber A is provided with a feed-door *a* and is designed to burn wood or other fuel. The water-coil grate B is a part of the water-feed to a steam-boiler (not shown) and heats the water prior to entering the boiler. The air-blast is admitted to the fire through the outlets *b b*, located alternately on opposite sides of the furnace and connected with the superheating-air-blast flue G at the top of the combustion-chamber. It will be observed that

these outlets are so constructed as to discharge air immediately above the coil-grate and also at points higher up or near the top of the fuel, (see Fig. 6,) and thus produce complete combustion. In order to produce a more intense heat, a steam-coil L is located in the top of the combustion and roasting chambers and steam is forced therethrough from a steam-boiler (not shown in the drawings) and becoming highly superheated is discharged into the combustion-chamber through a multiple of outlets at *d*. The superheated steam thus discharged into the carbon fuel and uniting with the gas therefrom a highly inflammable combination gas is formed, which produces a combustion resulting in a very intense heat. The products of combustion pass over the metal well and the melting, roasting, and charging hearths and up the flue, around and through the preliminary-roasting grates located therein. The air-blast is forced by a suitable blast-fan (not shown in the drawings) through the pipe M and the flues F and G. The cold air thus passing in direct contact with the hearth and roof of the roasting and combustion chambers protects them from injury from the intense heat, the air becoming heated by contact with the surfaces of the same, thus giving a hot blast to the combustion-furnace.

In operating our device a suitably-devised charging apparatus (not shown in the drawings) deposits the ore to be treated through the chute-hole N in uniform quantities onto the upper preliminary-roasting grate, from whence it is dumped to the next lower grate until all are uniformly loaded. When the ore is sufficiently roasted, the grates are turned by means of the lever mechanism O and P, Fig. 3, dumping the ore on the charging-hearth H. The grates are at once refilled with raw ore, and the ore on H is evenly spread over the inclined roasting-hearth E, where it is exposed to the more intense heat of the furnace. The door R, on a level with the charging-hearth, enables the operator to work and spread the ore. The observation-holes S S admit of inspecting the ore to determine when it is sufficiently roasted. The roasted ore is then pushed down onto the melting-hearth D and a fresh supply is let down from the preliminary-roasting grates and spread

over E, as already described, while the grates *k k* are recharged with raw ore. The roasted ore placed on the hearth D, being subjected to the intense heat direct from the combustion-furnace, gradually melts and runs into the metal-well C, where the slag and the bullion are separately drawn off at intervals through the ports *c* and *e*.

The operation as herein described may be continued indefinitely.

In the construction of our invention we do not limit ourselves to dimensions or proportions, but will build the several parts with sizes and proportions varied to meet the requirements of the locality and the amount and character of the ores to be reduced.

Having thus described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. In a roasting, smelting and matting furnace, the combination with the combustion-chamber, and smoke-stack, of the metal-well, melting-hearth and roasting-hearth located adjacent to each other and communicating one with another and located between the combustion-chamber and smoke-stack, and the preliminary-roasting means, consisting of a number of tilting grate-bars located one above the other in the smoke-stack at opposite sides of the stack, the inner ends of the grate-bars along one side of the stack extending over the bars projecting from the other side and adapted when tilted to discharge their contents onto the opposite set of grate-bars, and the inner ends of both sets of bars terminating short of the adjacent wall of the stack to cause the products of combustion to pass in a zigzag course through the stack and around the grate-bars, substantially as described.

2. In a roasting and smelting furnace, the combination with the smoke-stack, the combustion-chamber having air-flues leading thereinto, and the metal-well, melting-hearth and roasting-hearth, located adjacent to each other and communicating one with another and located between the combustion-chamber and smoke-stack, of the blast-flue lying above and extending from the roasting-hearth to the combustion-chamber and discharging into the

air-flues of said chamber, and an air-flue extending beneath the roasting-hearth and in communication with the blast-flue which lies above said hearth, substantially as described.

3. In a roasting and smelting furnace, the combination with the combustion-chamber provided with grate-bars and having air-flues leading thereinto at multiple points above the grate-bars, said points arranged at different levels, of the roasting-hearth, and the blast-flue extending from the bottom, around the sides, and over the top of the roasting-hearth to the combustion-chamber and discharging into the flues leading into the combustion-chamber, substantially as described.

4. In a roasting and smelting furnace, the combination with the combustion-chamber provided with grate-bars and having air-flues leading thereinto above the grate-bars, and the roasting-hearth, of the air-blast flue extending from over the roasting-hearth to the combustion-chamber and discharging into the air-flues of said chamber, and the steam-pipes lying above the roasting-hearth and combustion-chamber and extending from one to the other and discharging into the combustion-chamber, substantially as described.

5. A roasting and smelting furnace, comprising the combustion-chamber having air-flues opening into it, and the smoke-stack, the metal-well, melting-hearth and roasting-hearth located between the combustion-chamber and smoke-stack, the preliminary-roasting means consisting of the tilting grate-bars located one above the other in the smoke-stack, the air-blast flue lying both below and above the roasting-hearth and extending over the combustion-chamber and discharging into the air-flues of the same, and the steam-pipes lying over the roasting-hearth and the combustion-chamber and discharging into said chamber, substantially as described.

In testimony whereof we affix our signatures in the presence of two witnesses.

WM. D. C. SPIKE.  
JAMES T. JONES.

Witnesses:

G. W. BULLARD,  
A. H. DENMAN.