

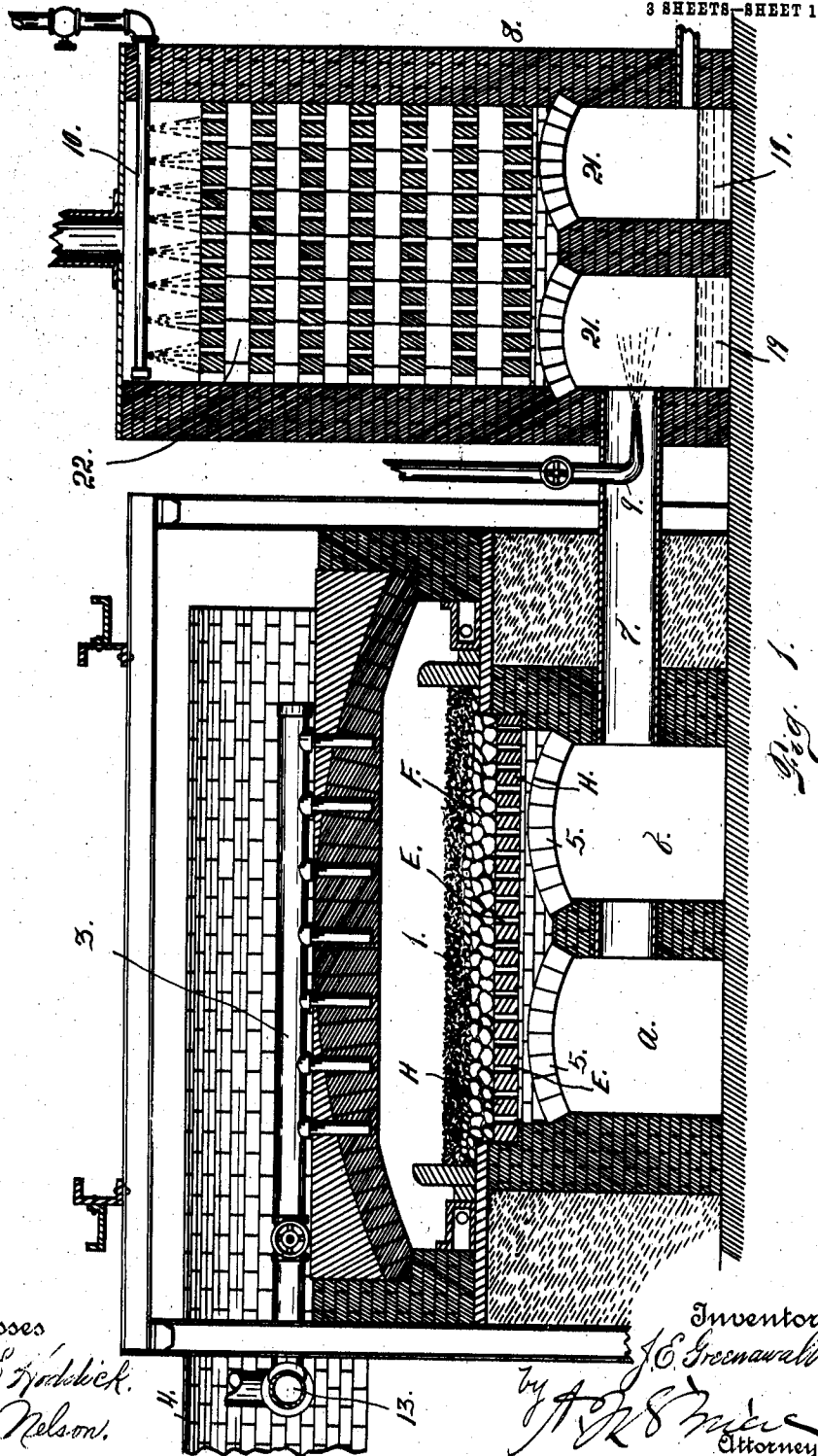
No. 839,065.

PATENTED DEC. 18, 1906.

J. E. GREENAWALT.
PROCESS OF TREATING ORES.

APPLICATION FILED MAR. 27, 1905. RENEWED APR. 24, 1906.

3 SHEETS-SHEET 1.



Witnesses
Otho C. Fitchick.
Dena Nelson.

Inventor
J. E. Greenawalt.
by *[Signature]*
Attorney

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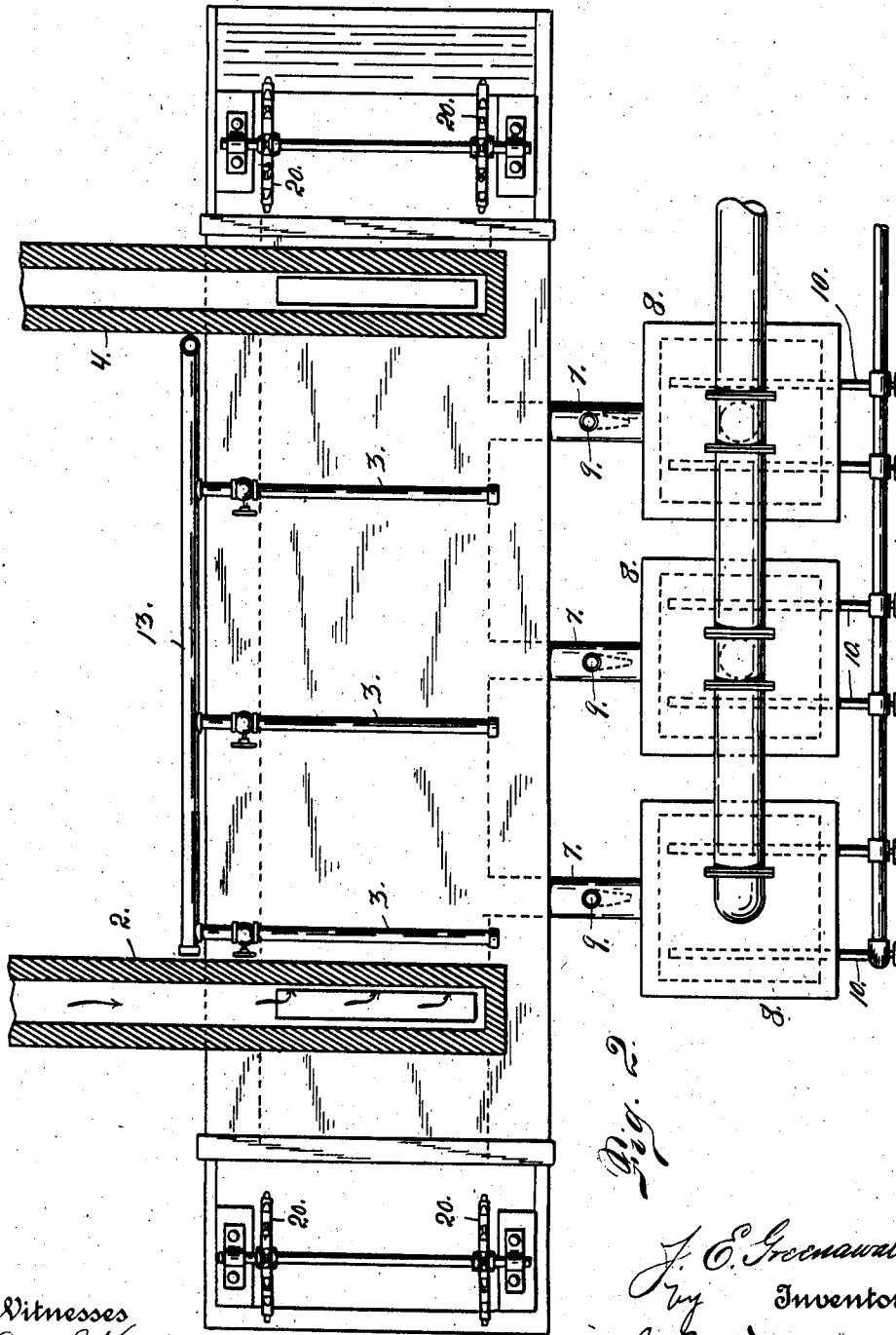


Fig. 2

Witnesses
Otho C. Hendrick.
Denna Nelson.

J. E. Greenawalt.
Inventor
A. J. Green
Attorney

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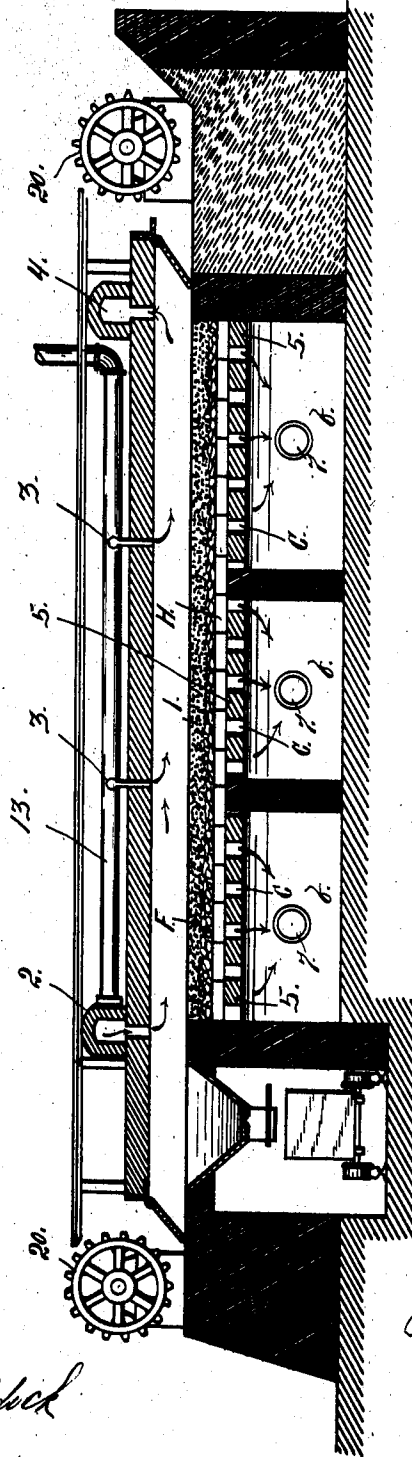


Fig. 3.

Witnesses

Otto C. Hatched
Dena Nelson.

J. E. Greenawalt.
by Inventor
A. S. Miller
Attorney

UNITED STATES PATENT OFFICE.

JOHN E. GREENAWALT, OF DENVER, COLORADO.

PROCESS OF TREATING ORES.

No. 839,065.

Specification of Letters Patent.

Patented Dec. 18, 1906.

Application filed March 27, 1905. Renewed April 24, 1906. Serial No. 313,402.

To all whom it may concern:

Be it known that I, JOHN E. GREENAWALT, a citizen of the United States, residing in the city and county of Denver and State of Colorado, have invented a certain new and useful Process of Treating Ore and other Material; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of this specification.

My invention relates to a process of treating ore or other material and, broadly stated, involves the placing of the material to be treated upon a porous bed, heating the material, and passing air or other gas down through the material and through the porous bed forming the support for the material.

It also involves the introduction of air or other gas above the porous bed and the material thereon, the said air or gas being introduced at a distance from a source of heat.

It furthermore involves the passage of the air or other gas or fumes down through the material and the porous bed, through the instrumentality of suction acting from below, and, finally, the invention embraces the condensation of the fumes or gases passed downwardly through the porous bed, whereby their values are recovered.

In carrying out or practicing my improved process I prefer to utilize a porous-hearth roasting-furnace of the type set forth in my application filed December 27, 1901, Serial No. 87,510. An important improvement over the process described in my said original application lies in the fact that by virtue of my improved process I am able to recover any values which have become volatilized, and therefore mingle with the fumes arising from the material under treatment within the furnace. By virtue of the old process, or that set forth in my original application, no provision was made for recovering the values of these fumes, since the air or other gas employed in the treatment of the material upon the porous hearth was passed through the hearth and through the material from below. Consequently the volatilized values mingling with the fumes would naturally pass out of the furnace and into the stack with the waste gases or products of combustion. In my improved process the necessary air or other gas

for supporting combustion within the furnace may be introduced to the roasting-chamber from the top of the furnace and delivered to the roasting or oxidizing chamber above the porous hearth and above the bed of material under treatment thereon, the said air being introduced at a distance from the source of heat or the point where the producer-gas employed is delivered to the roasting-chamber. By virtue of my improved process I not only recover the precious-metal values contained in the fumes, but I am also able to treat the sulfurous fumes for the manufacture of sulfuric acid.

There are certain ores carrying the precious metals in such combinations that when the ore is roasted a considerable percentage of the gold and silver volatilizes in the form of fumes, and in the ordinary furnace these valuable fumes mix with the products of combustion and dust of the furnace and pass into dust-chambers and the furnace-stack. Experience has shown that it is a difficult matter to completely precipitate and recover these values after they are mixed or mingled with the large volume of fuel-gases and dust arising from the ore or other material under treatment. In my invention, by reason of a downward suction through the hearth, these fumes are drawn downwardly through the hearth and deposited in a condensing-chamber in a comparatively pure state. By this arrangement the valuable constituents of the gases are concentrated in a small current as compared with the total volume of fumes from the furnace proper.

In the operation of the invention the suction is always downward, or, in other words, a portion of the gases in the furnace proper are made to percolate downward through the ore, and the volatile metallic and sulfurous fumes pass with this current into the condensing-chamber. It is also evident that if a surplus of air be mingled with the fixed gases above the bed the oxidation and heating of the ore can be greatly and economically promoted. Again, by incorporating a suitable catalytic agent—such as platinized asbestos, ferric oxid, &c.—in the porous bed a considerable proportion of the sulfurous anhydrid can be cheaply and economically converted into sulfuric anhydrid, and thus into sulfuric acid, in the condensing-chamber.

Suitable mechanism for practicing my improved process will now be described, refer-

ence being made to the accompanying drawings, in which—

Figure 1 is a cross-section of the furnace, the condensing-chamber being shown in vertical section. Fig. 2 is a top plan view of the furnace shown on a smaller scale, the flues for the introduction of the heat or fuel gases at one end of the furnace and for the escape of the waste gases at the opposite extremity of the furnace being shown in horizontal section. Fig. 3 is a central longitudinal section taken through the furnace on the same scale as Fig. 2.

The same reference characters indicate the same parts in all the views.

When ore is roasted upon a porous bed of the character illustrated in the drawings, rabbling mechanism is necessary for the purpose of stirring the ore and advancing it longitudinally on the hearth, whereby new surfaces of the ore are constantly exposed to the action of the heat. In the furnace illustrated in the drawings I contemplate the use of rabbling mechanism, as will be readily observed from an inspection thereof. The rabbles themselves, however, are not illustrated; but it must be understood that their employment will be required. To this end I have shown sprocket-wheels 20 at each end of the furnace, which the endless rabble-chains (not shown) would engage in actual practice. In these drawings the ore to be roasted or treated is supposed to be placed upon the porous bed 1. This bed constitutes the hearth of the furnace, and the ore is rabbled over this hearth by suitable mechanical rabbles. (Not shown, but heretofore briefly described.) The furnace is heated by means of producer-gas introduced through the flue 2 and is supplied at intervals with air through a series of pipes 3, having nozzles passing through the top of the furnace, enough pipes and nozzles being employed to give the desired or necessary distribution, the air being supplied to the pipes 3 from a main pipe 13, connected with any suitable source of air-supply. The air so introduced mingles with the producer-gas, furnishing the necessary heat for the roasting operation, and the waste gases pass through the flue 4 to the chimney or stack. Directly underneath the porous hearth or bed are large chambers *a* and *b*, which are divided by suitable cross-walls into compartments, so that the volume of gases drawn through the hearth may be concentrated and regulated in the different compartments. The hearth is constructed upon a series of arches in the form of solid rings 5, having spaces *C* of about four inches in width between them. These spaces are covered by a course of bricks *H*, set on edge and about one inch apart, leaving intermediate spaces *E* communicating with the spaces *C* between the arches 5. Upon these bricks is placed a layer of coarse gravel or ore *F* and then a

layer of smaller pieces until the last four inches, which consist of sand or fine ore.

The gases are drawn through the ore-bed and the porous hearth into the chambers *a* and *b* and thence through pipes 7 into condensing-chambers 8 by the suction created by means of a steam-jet pipe 9 entering each pipe 7 or other suitable suction-producing apparatus. Each chamber 8 is provided with a number of condensing compartments 21 formed in its lower portion, while its upper portion is filled with brick checker-work 22, constructed substantially as shown in the drawings, whereby the fumes may pass upwardly therethrough and the condensing-water flow downwardly to the reservoirs 19 in the bottom of each chamber, the said reservoirs being supplied with water from perforated pipes 10, mounted in the top of the condensing-chamber. The condensed or precipitated values may be easily recovered from the reservoirs 19.

Having thus described my invention, what I claim is—

1. The herein-described process of treating ore or other material, consisting in placing the material upon a porous bed, subjecting the same to heat and passing a portion of the resulting fumes or gases, down through the porous bed.

2. The herein-described fume-recovery process, consisting in placing the fume-producing material as ore upon a porous bed, subjecting the same to heat, passing the fumes or a portion thereof down through the bed, and finally precipitating the fumes so passed through the bed.

3. The herein-described process of recovering values from the fumes or gases arising while roasting ore, consisting in placing the ore upon a porous bed, subjecting the same to heat, and passing the resulting fumes or a portion thereof down through the bed.

4. A process of recovering values from the fumes arising from ore while roasting, consisting in placing the ore upon a porous bed, subjecting the same to heat, passing the resulting fumes or a portion thereof down through the bed, and finally condensing the fumes.

5. An ore-treating process consisting in placing the ore upon a porous bed, subjecting the same to heat, and passing the resulting fumes or a portion thereof down through the bed by suction acting from beneath the bed.

6. The herein-described ore-treating process, consisting in placing a bed of ore upon a porous hearth, containing a catalytic agent, subjecting the ore to heat, and passing the resulting fumes or a portion thereof down through the ore-bed and through the porous hearth.

7. A process of treating ore, consisting in placing a bed of ore upon a porous hearth, containing a catalytic agent, subjecting the

ore to heat, passing the resulting gases or a portion thereof down through the ore-bed and through the porous hearth, and finally condensing the fumes or gases.

5 8. An ore-treating process consisting in placing a bed of ore upon a porous hearth, containing a catalytic agent, subjecting the ore to heat, passing the resulting fumes or gases or a portion thereof down through the
10 ore-bed and through the porous hearth, through the instrumentality of suction acting from beneath the porous bed or hearth.

9. The herein-described process of treating ore or other material, consisting in placing a
15 layer of the material upon a porous bed, subjecting the material to heat, and passing air or other gases down through the layer of material and through the porous bed.

10. The herein-described process of treating
20 ore or other material consisting in placing

a layer of the material upon a porous bed, subjecting the same to heat, introducing air or other gas above the bed at a distance from the source of heat or fuel-supply, and passing the air down through the layer of material
25 and through the porous bed.

11. The herein-described ore roasting or oxidizing process, consisting of placing a bed of ore upon a porous hearth, subjecting the same to heat, introducing air or other gas
30 above the bed at a distance from the source of heat or fuel-supply, and passing the air or other gas down through the ore-bed and through the porous hearth.

In testimony whereof I affix my signature
35 in presence of two witnesses.

JOHN E. GREENAWALT.

Witnesses:

DENA NELSON,
A. J. O'BRIEN.