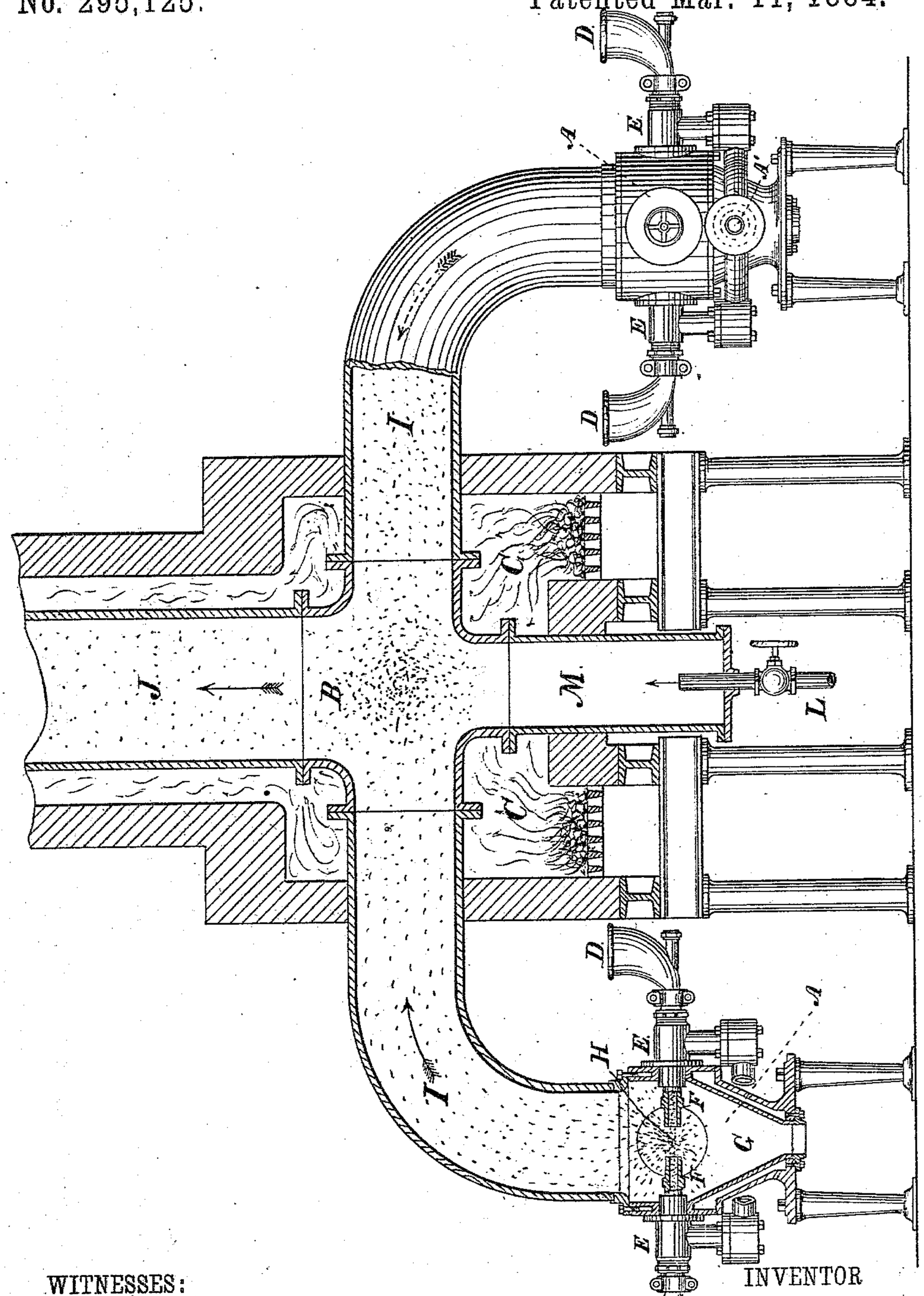
(No Model.)

F. A. LUCKENBACH.

METHOD OF PULVERIZING, DESULPHURIZING AND OTHERWISE TREATING METALLIFEROUS ORES.

No. 295,125. Patented Mar. 11, 1884.



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FREDERIC A. LUCKENBACH, OF NEW YORK, N. Y., ASSIGNOR TO THE PNEUMATIC PULVERIZER COMPANY, OF SAME PLACE.

METHOD OF PULVERIZING, DESULPHURIZING, AND OTHERWISE TREATING METALLIFEROUS ORES.

SPECIFICATION forming part of Letters Patent No. 295,125, dated March 11, 1884.

Application filed February 9, 1882. Renewed January 11, 1884. (No model.)

To all whom it may concern:

Be it known that I, FREDERIC A. LUCKENBACH, a citizen of the United States, and residing in the city, county, and State of New York, have invented an Improved Method of Pulverizing, Desulphurizing, and otherwise Treating Metalliferous Ores and other Substances; and I hereby declare that the following is a clear, full, and exact description thereof.

The object of my invention is to provide a simple and practical method or process by which a more perfect decomposition or other chemical transformation of metalliferous ores or other substances containing sulphur or objectionable elements to be eliminated may be effected, and the sulphur, arsenic, or other objectionable elements contained therein may be eliminated more completely, with greater certainty, and with less cost than has heretofore been accomplished by other means.

The essential feature of my invention consists in a novel method or process for the treatment of metalliferous ores and other substances, by subjecting the same to the action of compressed gases or vapors at high temperatures and pressures.

The object of my invention is partly accomplished by the employment of certain apparatus described in Letters Patent granted to myself and others, dated February 22, 1881, No. 238,044, by which apparatus granulated ores or other substances are introduced into opposing currents of compressed air, steam, gases, or vapors, by which the concussion and attrition of the fragments reduce the ores or other substances to a finely-pulverized condition.

In practice, I have found that the employment of compressed air, with the pressure required for the purpose, is objectionable for the present purpose, because too expensive; also, that for the present purpose the use of steam at ordinary pressures and temperatures (even if superheated, unless such superheating be carried to the point of dryness) produces too much moisture or condensation both in the apparatus and the materials pulverized, thereby rendering the result unsatisfactory. I have, however, found that if steam or other gases be used at very high pressures, and at so high a temperature as to render it thoroughly dry, (say at 600° to 800° Fahrenheit,) very superior results are obtained, inasmuch as when the granulated ores or other solid substances are introduced into concentrated currents of steam or other gases, under the conditions named, the powerful penetrating heat causes a partial disintegration of the materials previous to the concussion or attrition of the fragments at the convergent or discharging point of the opposing currents; and in this way such materials are better prepared for the subsequent steps of the operation.

I find that by subjecting metalliferous ores in a pulverized condition to the action of highly-superheated dry steam, chlorine, or other vapors or gases, under suitable pressure, under the conditions specified by me, sulphides, arsenides, and other compounds become decomposed and the objectionable elements are quickly eliminated, and the ores and other substances are reduced in a condition which greatly facilitates the final separation of the precious metals contained therein.

The simplest form of apparatus adapted for carrying out my new method or process is that shown in the drawing attached. In this apparatus two or more opposing currents of superheated steam or other suitable heated vapors or gases under pressure are used, and the apparatus is so constructed and arranged that the currents will charge themselves with the granulated ores or other substances when they are placed in suitable receptacles or hoppers in near proximity thereto, and will carry and propel them against each other at a focal point. This apparatus is novel in several respects, and is made the subject of special claim in an application for a patent now being prepared; but I do not confine my new method or process to any special form of apparatus, or even to an apparatus in which two or more opposing currents are employed, as other forms having but one current may be employed with some advantage and effect; neither do I confine myself to any special form for heating or superheating the steam or other heated vapors or gases, as that may be accomplished by various forms of apparatus well known.

In carrying out my invention, suitable heating and superheating steam or gas generators are placed in proper position, having pipes attached thereto and properly connected with the apparatus for carrying out my new method or process and for conducting the gases thereto.

In the drawing, which is partly in elevation and partly sectional, A A represent in each that part of the apparatus into which the granulated ores or other substances are introduced, and in which they receive the first effect of their contact with the superheated steam or other heated gases or vapors.

B represents a retort or reheating chamber in which the finely-pulverized ores or other substances receive their second contact with the superheated steam or other heated vapors or gases under an increased temperature, and into which additional gases, vapors, or pulverized materials may be introduced for producing special effects.

C C represent a furnace or heated oven, in which the retort is heated to the required temperature.

In practice, the superheated steam or other heated vapors or gases is or are introduced into the apparatus A A at A′ in the elevation. It passes into chambers E E E E, and is forced into and discharged from tubes F F within the chamber G. The granulated ores or other substances are introduced into hoppers D D D D by any suitable means. The heated gases, raised to high temperature and pressure, passing through tubes F F, cause a partial vacuum in the hoppers D D D D, by which the granulated materials are drawn into and combined with the current of highly-heated gases, causing an instant expansion and consequent partial disintegration of them into smaller fragments, and by the power and velocity of the opposing currents the disintegrated or partially-disintegrated materials are forced into violent concussion or attrition at the convergent or focal point H, which causes a more perfect pulverization and intermingling contact of the finely-comminuted materials with the highly-superheated steam or other heated vapors and gases employed. The discharged currents, pulverized and at that time partly-desulphurized substances carried by and thoroughly intermingled with the heated gases or vapors, are then carried by the force of the current (which should be an exhaust-current) through the exhaust chamber or chambers I I of each apparatus employed, with a retort or reheating-chamber, B. Into this retort currents are forced, (from opposite directions when more than one pulverizing apparatus is used,) and they meet at a convergent or focal point within the retort B, which is heated by furnace C C sufficiently to raise the temperature of the materials to be treated, and carry out the process of desulphurizing or other eliminating action on the pulverized materials within and passing through the same, thereby effecting a more complete decomposition and elimination of the objectionable compounds. After this the combined volumes are discharged through a pipe or chamber—such as J—into reservoirs or receptacles suitably connected and prepared to receive them.

Other suitable gases or vapors or finely-pulverized solid materials or substances may be employed for and combined with the superheated steam. For producing special effects, the additional gases or materials may be introduced with the superheated steam in apparatus A A, or they may be introduced directly into the retort B through tube L and chamber M, in such manner that the injected current of gases or materials will come into contact with the opposing currents within the retort B at the junction or convergent point, by which a thorough intermingling of the several currents of gases and finely-pulverized materials will be effected.

I am aware that metalliferous ores and other substances have heretofore been treated by or with superheated steam not under pressure, and not brought in contact with the ores, as described by me; also, that such ores have, under conditions different from those described by me, been treated, in connection with hydrocarbon, chlorine, and other gases, for decomposing and eliminating sulphur and other objectionable elements contained therein; but the means employed and the manner of applying them have proved inefficient and unsatisfactory. These I do not claim; nor do I claim here the mere pulverizing of the ores by introducing them into opposing currents discharged at a focal point, as claimed in the Patent No. 238,044, except when such currents are used under conditions not described in said patent—to wit, under conditions of heat and pressure suitable to cause them to act to disintegrate the ores subjected to them, and to serve to eliminate the objectionable elements.

What I claim as new is—

1. The herein-described process of treating metalliferous ores or similar substances, consisting of the following steps: first, subjecting them to a concentrated current of highly-superheated dry steam or other heated vapors or gases or currents charged with materials for which the elements of such ores have affinities; second, pulverizing such ores or materials by impact with other bodies by the force of such current; third, converging the products to a second retort or heating chamber; fourth, subjecting the products in such second retort or heating chamber to the action of additional gases or materials, for the purpose of further elimination of objectionable elements.

2. The herein-described process of treating metalliferous ores or similar substances, consisting of the following steps: first, subjecting them to a concentrated current of highly-superheated dry steam or other heated vapors or gases or currents charged with materials for which the elements of said ores have affinities; second, pulverizing them by impact with other bodies by the force of such current.

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