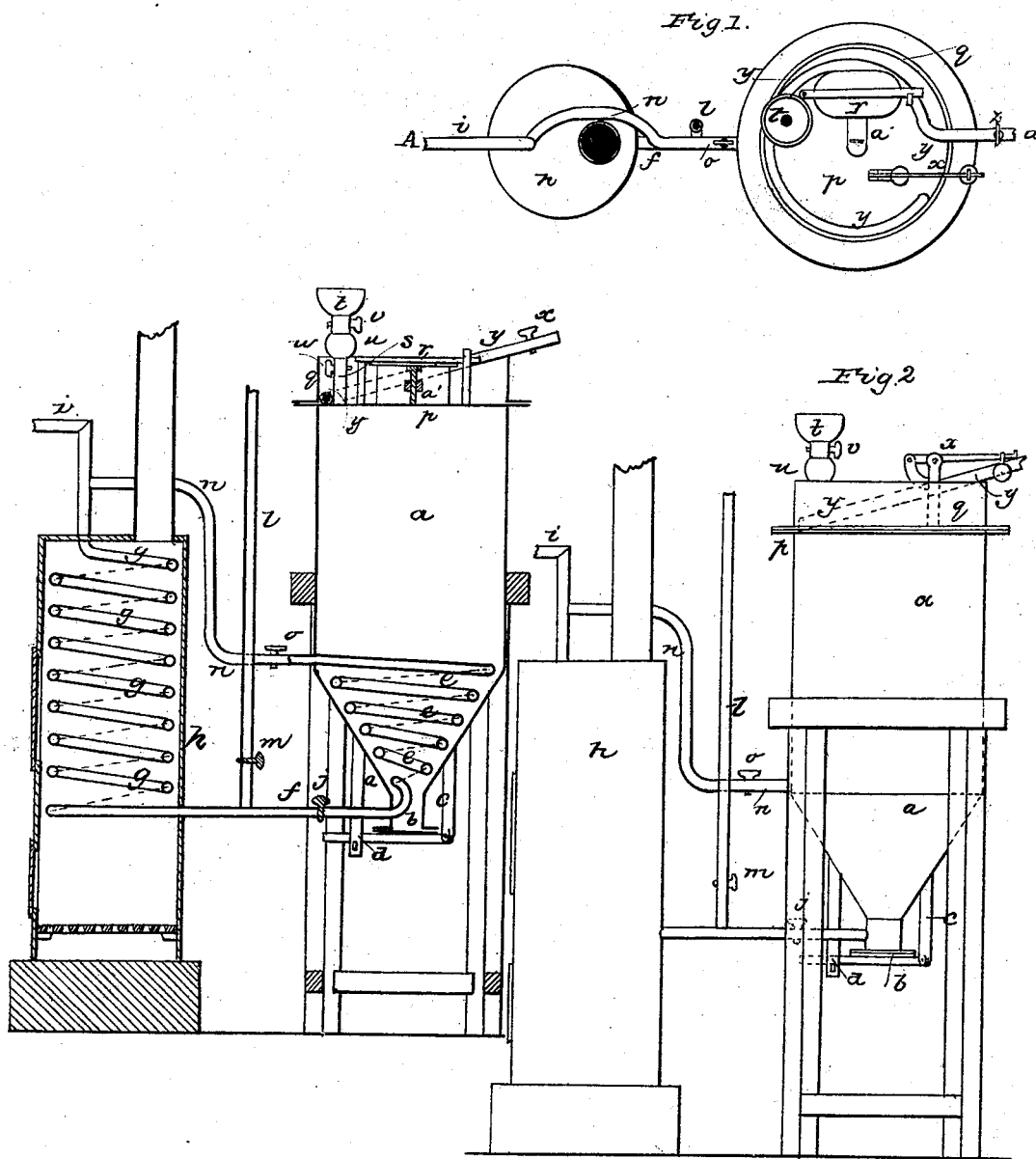


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## Method of Extracting Precious Metal from Ores.

No. 54,412.

Patented May 1, 1866.



**WITNESSES**

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VAN BUREN RYERSON, OF NEW YORK, N. Y.

## IMPROVED METHOD OF EXTRACTING PRECIOUS METALS FROM ORES.

Specification forming part of Letters Patent No. 54,412, dated May 1, 1866.

*To all whom it may concern:*

Be it known that I, VAN BUREN RYERSON, of the city, county, and State of New York, have invented a new Process for Separating Gold or Silver from the Ores containing Sulphurets of the Baser Metals; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, making part of this specification, in which—

Figure 1 is a plan of the apparatus which I use for working my said process; Fig. 2, a side elevation, and Fig. 3 a vertical section, thereof, taken in the plane of the line A a of Fig. 1.

The same letters indicate like parts in all the figures.

It is well known that in gold and silver ores particles of the precious metals are found enveloped in the sulphurets of the baser metals, so that, however these ores may be pulverized, much of the precious metals fails to be taken up by the mercury in the process of amalgamation by reason of being coated with the sulphurets.

My said invention relates to a process for treating the pulverized or granulated ore by means of which the sulphurets are changed into liquid sulphates, which entirely frees the particles of the precious metals, so that they will be taken up by the mercury in the process of amalgamation; and my said new process for producing the said result consists in subjecting the pulverized or granulated ore with superheated steam in a suitable vessel.

My said invention also consists in combining with the said process for decomposing the sulphurets the process of subjecting the ore so decomposed to the action of mercury and steam, the better to take up the particles of precious metals by amalgamation.

The following is a description of the apparatus in which I have worked my said process successfully.

In the accompanying drawings, *a* represents the decomposing-vessel, which I prefer to make of a cylindrical form, with the lower part conical and with a central discharge-aperture at bottom, which is closed by a plate, *b*, hinged to a hanger, *c*, and secured in place by a key, *d*, or other suitable means. Inside of the conical part of this vessel there is a spiral coil of pipe, *e*, perforated with small holes along the

bottom for the discharge of numerous small jets of steam into the vessel. This coil of pipe is connected by a pipe, *f*, with a coil of pipe, *g*, placed within a suitable furnace, *h*, and the upper end of this latter coil is connected by a pipe, *i*, with the steam-chamber of a suitable steam-boiler, that the steam in passing through the coil *g* may be superheated, and the connecting-pipe *f* is provided with a hand-valve, *j*, near the decomposing-vessel, and between the superheater and the valve there is a branch pipe, *l*, open to the atmosphere at the upper end, and provided with a hand-valve, *m*, for the discharge of superheated steam whenever desired. The steam-pipe *i* above the superheater communicates by means of a branch pipe, *n*, directly with the upper end of the spiral coil *e* in the decomposing-vessel, and this branch pipe *n* is provided with a hand-valve, *o*, so that saturated steam directly from the boiler may be admitted in jets to the inside of the decomposing-vessel when the supply of superheated steam is shut off.

The top *p* of the decomposing-vessel has a surrounding rim, *q*, to form a vessel to contain water, that the said top may act as a condenser of vapors inside the decomposing-vessel. The top is formed with a man-hole and man-hole plate, *r*, through which the ore to be treated is introduced into the decomposing-vessel, and with a pipe, *s*, through which mercury is to be introduced into the decomposing-vessel. The upper end of this pipe *s* is funnel-shaped, as at *t*, and below the funnel it is formed with an enlarged chamber, *u*, and between the funnel and enlarged chamber there is a hand-valve, *v*, and another such valve, *w*, below the enlarged chamber. This is for the introduction of mercury into the decomposing-vessel. The mercury is put in the funnel *t* while the valves are closed. The valve *v* is then opened to permit the mercury to run into the enlarged chamber *u*, and the valve *v* is then closed and the valve *w* opened to permit the mercury to run into the decomposing-vessel without the escape of steam. The vessel should be provided with a safety-valve, as at *x*.

A pipe, *y*, extends from the inside of the decomposing-vessel through the top, is coiled in the condensing-vessel for a short distance, and its discharge-aperture, which is above the condenser, should be provided with a hand-valve, *z*.

There is a hole in the top of the decomposing-vessel, which is the bottom of the condensing-vessel, which hole is governed by a screw or other suitable valve, *a'*, and this is for the purpose of admitting a stream of water to the inside of the decomposing-vessel to condense any vapors of mercury at the time the decomposed mass is discharged.

The manner in which I work my said process in the apparatus above described is as follows: The discharge-aperture at the bottom of the decomposing-vessel being closed, I introduce the charge of pulverized or granulated ore through the man-hole at top and close it up tight. Steam is then admitted from the boiler, so as to pass through the coil in the furnace *h* and there superheated to, say, from 800° to 1,200° Fahrenheit. I then close the valves *m* and *o* and open the valve *j* in the pipe *f*, to admit the superheated steam to the spiral coil *e*, from which it escapes through the small holes into the decomposing-vessel in numerous small jets, and these jets pass up through the charge of ore, agitating and coming into contact with all the particles, and in the course of time the sulphurets are decomposed by the action of the superheated steam into liquid sulphates. The steam, after passing up through the charge, escapes into the atmosphere through the pipe *g*, the valve *z* being kept partially opened for that purpose. The process is thus worked for about half an hour. Some kinds of ore require to be thus treated for a longer time than others, but I have found half an hour to be about the average time required. After the decomposition has been effected I shut off the superheated steam, introduce the required charge of mercury through the pipe *s*, as above described, fill the condensing-vessel *p q* with water, and admit saturated steam directly from the boiler to the spiral coil *e*, and this, in escaping in small jets at the bottom of the charge of decomposed ore, keeps the mass in agitation. During the working of the decomposing process the vessel and the charge of ore will have become so highly heated that the mercury will be thereby evaporated and rise to the top of the vessel, where it is condensed by coming in contact with the top, and thus condensed will fall in fine particles through the agitated mass of decomposed ore and take up and amalgamate the particles of precious metals which are thereby carried to the bottom. This is continued for a few minutes, and then I shut off the steam and discharge a stream of water by the valve *a'* to

condense all the vapors, and the whole is then discharged into a suitable receiver.

When the superheated steam is shut off from the coil in the decomposing-vessel the valve *m* in the pipe *l* must be opened to permit the steam to escape from the superheating-coil *g*, and as the amalgamating process occupies but three or four minutes the waste of steam will be but slight.

The mode of working the process as above described is suitable for decomposing the ores containing gold, and, as described, it will also decompose the ores containing silver; but as that would also convert the silver into a sulphate, I introduce with the charge of ore common salt varying in quantity with the richness of the ore, about one-half the weight of the charge being a fair average proportion; and I prefer also to add with the salt from one to three per cent. of peroxide of iron to prevent the chlorine evolved from acting on the vessel.

Although I have above described the apparatus which I deem best for the purpose, I do not wish to be understood as limiting my claim of invention to the use of such apparatus, as my said process may be worked in apparatus differently constructed and arranged.

In the usual modes of roasting by steam the sulphur is carried away and the ores changed from a sulphuret to an oxide, and in this condition amalgamation of the precious metals is nearly as difficult as before roasting.

By the process above described the sulphurets of the base metals are changed into sulphates or sulphites which are soluble, and thus leave the precious metals free to be amalgamated.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The process of decomposing the sulphurets found in admixture in the ores of gold and silver by subjecting such ores in the pulverized or granulated state to the action of superheated steam so as to convert the sulphurets into sulphates and sulphites, substantially as and for the purpose described.

2. In combination with the said process for decomposing such ores, the process, substantially as herein described, of amalgamating the particles of the precious metals with mercury.

V. B. RYERSON.

Witnesses:

WM. H. BISHOP,  
ANDREW DE LACY.