

UNITED STATES PATENT OFFICE.

HENRY JOSHUA PHILLIPS, OF LONDON, ENGLAND, ASSIGNOR TO THE
GOLDEN LINK CONSOLIDATED GOLD MINES, LIMITED, OF SAME PLACE.

PROCESS OF EXTRACTING PRECIOUS METALS FROM THEIR ORES.

SPECIFICATION forming part of Letters Patent No. 661,074, dated November 6, 1900.

Application filed July 31, 1899. Serial No. 725,683. (No specimens.)

To all whom it may concern:

Be it known that I, HENRY JOSHUA PHILLIPS, professor of chemistry, a subject of the Queen of Great Britain, residing at 123 Palace Chambers, Westminster, in the city of London, England, have invented a new or Improved Process of Extracting Precious Metals from Their Ores; and I do hereby 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.

This invention has for its objects new or improved process for extracting precious metals from their ores as follows: The ore containing the precious metals to be extracted is (without roasting) first reduced to an impalpable powder or finely-comminuted condition by any well-known or suitable means and is then subjected to the action of S_2Cl_2 (known as "dichlorid of sulfur," "chlorid of sulfur," and "monochlorid of sulfur," all of which will hereinafter be referred to as "chlorid of sulfur") while heated (under heat and pressure) in a closed vessel, whereby the precious metals are converted into chlorids, which are then dissolved out in any suitable vessel by any suitable solvent and subsequently separated into metallic form by any known or suitable process.

According to this invention the precious metals are extracted from their ores as follows: The ore in the finely-divided condition, as aforesaid, is placed in a closed chamber or vessel of suitable size provided with arms or stirrers adapted to stir up the contents of said vessel (or said vessel may be arranged to revolve or otherwise arranged to dispense with any such internal stirrers) and adapted to be heated in any suitable way. For instance, said vessel may be provided with a jacket surrounding or partly surrounding same, through which superheated steam can be passed, or said jacket may be adapted to contain oil, which can either be heated in a separate vessel and circulated through said jacket, or said oil or other material contained in said jacket may be heated by a furnace, or direct heat may be applied to the exterior of said vessel, which heated vessel is or may be provided with a valve or valves, pressure-

gage, thermometer or pyrometer, or any of them.

The chlorid of sulfur (S_2Cl_2) employed according to this invention before being mixed with the ore is first converted into fumes or vapors, (hereinafter referred to as "vapor,") which may be effected either in the vessel containing the ore or in a separate vessel, and such vapor is brought into contact with the ore at such a temperature both of the vapor and ore in said vessel that said chlorid-of-sulfur vapor is dissociated, and the chlorin will thereupon combine with the precious metal or precious metals whatever the state or condition in which same exist in the ore, thus forming chlorids, (which latter can be subsequently treated as hereinafter described or in any other suitable manner,) and in order to thus form chlorids of the precious metals the temperature of said body of ore contained in said heated vessel must be raised to or maintained at such a point or points that the aforesaid vapors may be dissociated and the aforesaid chlorids of the precious metals thereby formed. If desired, however, the chlorid of sulfur without being vaporized, as aforesaid, may be mixed direct with the aforesaid ore in a vessel and then the temperature of same raised to such a point that chlorids will thereby be formed.

According to this invention the amount of chlorid of sulfur which is employed is proportioned according to the percentage of precious metal or precious metals and substances in conjunction therewith or present in the ore which will absorb chlorin under these conditions, which percentage can be ascertained by assay or analysis sufficiently accurately for the purpose, and, furthermore, the temperature to which the ore and chlorid of sulfur are raised may be varied according to the state of combination or otherwise of the precious metals in the ore.

Now according to this invention it has been discovered that chlorid of sulfur when converted into fumes or vapor and applied to ore containing the precious metals (in a finely-divided condition) will at certain temperature attack first of all the precious metals. For instance, in an ore containing gold and carbonate of lime, &c., the sulfur-chlorid

fumes or vapors will first of all only attack the gold, and this discovery enables the amount of chlorid of sulfur to be employed to be exactly ascertained and used proportionately or according to the precious metal or metals known to be present in the ore. The temperature employed may be about 210° centigrade for ordinary auriferous telluride ores; but any other suitable temperature may be employed, according to the varying nature of the ores or as desired. Having thus ascertained the amount of chlorid of sulfur required for extracting the precious metal or metals from any given body of ore, the chlorid of sulfur may be introduced into the aforesaid closed vessel containing such ore in the form of fumes or vapor, according to this invention, by placing the chlorid of sulfur in a separate vessel and therein subjecting it to heat, and thence the vapor is forced into the vessel containing the ore, or, if desired, said amount of chlorid of sulfur may be mixed with the ore or placed direct in the vessel containing said ore and the vessel then closed and the temperature raised in the aforesaid manner and for the aforesaid purposes, whereby the precious metals are attacked by the chlorid of sulfur and chlorids of the precious metal or precious metals present are thus formed. Having thus formed these chlorids, it is possible by raising the temperature still further to drive off the chlorine, thus leaving the precious metal or precious metals in a metallic state mixed with the ore, and same can then be extracted by any known means—such as concentrating, amalgamating, or cyaniding process—or the precious metal or metals can be recovered from said chlorids in the manner first above described.

By the use herein of the term “precious metal” or “precious metals” it is meant and intended to thereby refer to and include such material or substances as tellurium, selenium, or allied elements. For instance, in treating complex telluride gold-bearing ore the amount of S_2Cl_2 employed is proportioned not only to

the gold and applied as aforesaid, but also an additional proportion of S_2Cl_2 is employed, according to the amount of tellurium present in the ore and which it is desired to recover, whereby the tellurium can be extracted as well as the gold and separated therefrom.

Precious metal or precious metals can by this process be extracted from refractory or rebellious ores, or combined gold can thus be extracted, without the necessity of first roasting said ores.

Having now described my invention, what I claim as new, and desire to secure by Letters Patent of the United States, is—

1. The herein-described process for extracting precious metals from their ores, which consists in subjecting said ores to the action of vaporized chlorid of sulfur, substantially as described.

2. The process of extracting precious metals from their ores, which consists in pulverizing said ores and subjecting the same in a closed vessel under heat to the action of vaporized chlorid of sulfur, substantially as described.

3. The herein-described process for extracting precious metals from their ores, which consists in pulverizing said ores, subjecting the same in a closed vessel under heat to the action of chlorid of sulfur, the amount of chlorid of sulfur so employed being proportioned to the amount of gold or other precious metals in the ore and which it is desired to recover, raising the temperature of the mixed ore and chlorid of sulfur until the latter is dissociated and chlorids of the precious metals thereby formed and recovering the precious metal or metals from said chlorids in any well-known manner, substantially as described.

In witness whereof I have hereunto set my hand in presence of two witnesses.

HENRY JOSHUA PHILLIPS.

Witnesses:

H. D. JAMESON,
A. NUTTING.