UNITED STATES PATENT OFFICE.

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

EXTRACTION OF PRECIOUS METALS FROM THEIR ORES.

SPECIFICATION forming part of Letters Patent No. 683,325, dated September 24, 1901.

Application filed November 13, 1899. Serial No. 736,872. (No specimens.)

To all whom it may concern:

Be it known that I, HENRY JOSHUA PHILLIPS, Fellow of the Institute of Chemistry, a subject of the Queen of Great Britain, residing at 123 Palace Chambers, Westminster, London, England, have invented certain new and useful Improvements in or Relating to the Extraction of Precious Metals from Certain of Their Ores, of which the following is a specification.

This invention has for its object improvements in or relating to the extraction of precious metals from their ores, and relates, primarily, to so treating refractory or rebellious gold-bearing ores that the gold therein can then be extracted by means of the well-known cyaniding or amalgamation or other suitable processes, and, furthermore, besides effecting the extraction of the gold, other metals—such as tellurium, arsenic, or antimony—present in said ore may be preserved therein and subsequently also extracted—for instance, in treating telluride ore according to this invention the tellurium, arsenic, antimony, &c., (or any of them,) as well as the gold, may be extracted, as hereinafter set forth.

There exists in certain parts of the world, notably in Hungary, West Australia, and Colorado, a certain class of gold-bearing minerals in which the gold is said to be or appears to be in actual combination with such elements as tellurium, arsenic, antimony, &c., and hitherto it has been found necessary or usual to subject such ore to a preliminary roasting before treatment by the well-known cyanid or chlorination process. Now according to the present invention such preliminary roasting can be and is dispensed with, and the elements which are combined with the gold are dissolved in the manner and by the means hereinafter described, thus dissociating the gold from its combinations, and thereby rendering the gold free to be acted upon and extracted by any well-known cyanid or other suitable process for recovering free gold from the ore.

According to the present invention it has been found that if ores containing telluride, arsenide, or antimonide of gold (or such like gold-bearing ores) be acted upon under heat and pressure by a weak or dilute solution of the polysulfids of the alkalies or alkaline earths—say 0.5 to three per cent. of the polysulfid in solution—the said weak solution will have a selective action and will dissolve such elements so combined with the gold without dissolving the gold or only an inappreciable amount thereof, (if any,) thus leaving practically the whole of the gold in a free metallic state, which can then be treated by the well-known cyanid or other desirable process for recovering gold. For instance, the gold having thus been dissociated from its combinations the latter may now be washed out of the ore, leaving its gold in the free metallic state in the ore, and the whole of the free gold in the ore can then be treated by cyaniding, &c., as aforesaid.

It is an object of the present invention to use only sufficient polysulfid, under heat and pressure, to exercise a selective action upon and dissolve the elements which are combined with the gold without dissolving the gold itself.

This invention may be carried out as follows: The ore to be treated is first reduced to powder or a finely-comminuted condition and placed in any suitable vessel or receptacle capable of being tightly closed and when closed of withstanding considerable pressure when the mixture is heated. The ore is mixed with the weak polysulfid solution—say about equal weights of the solution and of the ore—and the vessel or receptacle having been sealed or tightly closed the ore is now heated in said vessel by any suitable means to a suitable temperature—say about 100° to 200° centigrade—and maintained under said heat and the consequential pressure until such elements which are combined with the gold have been dissolved. The dissolving of said combinations is effected very rapidly under the heat and pressure—say in one to three hours, depending, however, upon varying conditions, notably the temperature employed and the facilities provided for mixing or stirring the ore while same is being acted on. For instance, if the ore be placed in a revolving drum and heated to, say, 200° centigrade, or thereabout, the solution of the combina-

tions would be much sooner accomplished than if the mixture were heated to 100° centigrade only without agitation of the mixture.

As a modification of the foregoing process the ore in the condition hereinbefore described and the aforesaid weak or dilute solution hereinbefore described may be placed together in a suitable vessel or receptacle capable of being sealed or tightly closed (advantageously a receptacle of very large size) and allowed to remain in said vessel for a prolonged period out of contact with the external air and without applying artificial heat or pressure, (or only very moderate heat or pressure may be applied—for instance, the closed vessels may be exposed to the heat of the sun with a view to shortening such period,) and ultimately the gold will be dissociated and its combinations dissolved, and the former can then be recovered by the ordinary cyaniding or other suitable process, as aforesaid.

The amount of the polysulfid employed in the aforesaid weak solution is proportioned according to the amount of and nature of the constituents of the ore soluble in said solution, this proportion being determined either from the known constitution of said ore or ascertained by chemical analysis of said ore. For instance, with an ore containing tellurium in other states than as well as telluride of gold, such tellurium, as well as the tellurium combined with the gold, will be dissolved, and therefore a sufficient amount of polysulfid must be introduced to dissolve all such tellurium, but always such polysulfid must be introduced in such a weak solution as not to dissolve the gold, and for this purpose any amount of the said weak solution may be introduced until the combined gold has been dissociated. This also applies equally in the case of antimony or arsenic in the ores.

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

The herein-described method of extracting precious metals from refractory sulfid or telluride ores without roasting; which consists in subjecting the ore without roasting and in the form of a powder—under heat and pressure—to the action of alkaline polysulfids in solution of such weakness that same will have a selective action namely will dissolve the elements which are combined with the gold and for which the polysulfids have a greater affinity than for gold without dissolving the gold itself which latter is thus dissociated and can then be recovered by any known suitable process for recovering free gold.

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

HENRY JOSHUA PHILLIPS.

Witnesses:
FRANCIS W. FRIGOUT,
H. D. JAMESON.