

UNITED STATES PATENT OFFICE.

RICHARD S. McCULLOH, OF PRINCETON, NEW JERSEY.

PROCESS OF REDUCING GOLD BULLION.

Specification forming part of Letters Patent No. 7,670, dated September 24, 1850.

To all whom it may concern:

Be it known that I, RICHARD S. McCULLOH, late of the city of Philadelphia, and now residing in Princeton, New Jersey, have invented and discovered a new, useful, and important Method of Separating Silver and other Impurities from Gold Bullion, the same being an improvement in the art of refining gold for coinage and other purposes, of which the following is a specification.

For the full and exact understanding of my discovery I will describe so much of the methods heretofore known and now usually practiced as is necessary. They consist, in part, of the operation of "quartation," as it is called—that is, of melting and intimately combining with the gold bullion to be refined two to three times its weight of silver. To extract this silver, together with that and all impurities originally contained in the gold bullion itself, from the mixed alloy of gold and silver then requires that it be granulated by pouring it, while melted, into water, and subsequently that it be digested, either in sulphuric acid concentrated to 66° Baumé at the high temperature of the ebullition thereof and in costly platinum vessels, or in nitric acid of 36° Baumé at temperatures not lower than 212° Fahrenheit, or the boiling-point of water, and in fragile vessels of glass, porcelain, or earthenware. The chief objections to these methods are, first, the withdrawing of large quantities of silver from use as circulating capital; second, the great labor, expense, and delay attending the successive granulation, separation, and recovery from solution of that silver; third, the loss of interest; fourth, the wastage of silver; fifth, the very high cost and expensive repairs of the large platinum retorts required in the sulphuric-acid process, and the frequent breaking of the vessels used in the nitric-acid process, attended with more or less loss of the precious contents thereof.

The improvement and advantages in the art of refining gold attained by my invention and discovery are, first, the comparatively easy separation from gold bullion of the impurities with which it is in combination without using silver for quartation, without waste of silver, and without costly apparatus; second, much greater economy of time, labor, and expense; third, the saving of interest; fourth, the use of lower tem-

peratures than in the usual methods, and vessels of lead not subject to fracture; fifth, the rendering of the work of the refiner more simple, expeditious, and free from the necessity of his constant attention, also less injurious to his health, and no longer a nuisance if conducted in densely-populated places.

The nature of my invention and discovery consists in bringing gold bullion containing silver or other impurities into a loose, divided, pulverulent, or spongy state, texture, or disintegrated molecular condition, so that all impurities it may contain can readily be removed by acids.

The obtaining of gold in such a state or reducing it from a compact to a disintegrated condition, that it may be attacked by acids, forms no part or object of the methods now in use, and it is this preliminary mechanical operation which gives to my improvement in the art of refining gold the great advantage of dispensing with the use of large quantities of silver, thus causing economy in labor, time, and expense.

To enable those skilled in the art of refining gold bullion to understand and use my invention and discovery, I now describe its nature and operation, to wit:

First. The gold bullion to be refined may be of any quality. My first or preparatory operation is to make an adulterated alloy or mixture by melting and mechanically stirring the gold bullion with a sufficient quantity of zinc, usually two or three times the weight of the gold bullion to be refined, and after the melted alloy has been well stirred it is granulated by pouring it into water, according to the usual methods.

Secondly. The granulated alloy is treated, in wooden vats lined with lead, with dilute sulphuric acid, which removes the zinc employed for adulteration and leaves impure or argentiferous gold in a finely-divided pulverulent or spongy state or in a disintegrated molecular condition. The hydrogen which escapes during this operation should be conducted by wooden or other pipes into the open air. In this second operation heat is not used or required, and but little more acid is employed than will form sulphate of zinc with that metal used for adulteration; or, in other words, the

acid is used in nearly atomic proportions. The object sought by the two operations just described is only to operate on the gold bullion in such a manner as to reduce it to a disintegrated or spongy state, in which it shall no longer be capable of resisting or protecting the impurities it may contain from the reaction of acids, as it does when in compact form or consistence, which resistance or protection has been the chief obstacle with which the art of refining has heretofore had to contend.

Thirdly. When I have obtained the gold bullion in a pulverulent or spongy state, incapable of resisting the reaction of acids, by thus treating an alloy of it with dilute sulphuric acid all the silver which may have been originally combined with it is still retained by it, dilute sulphuric acid being incapable of extracting any portion thereof. To remove this silver I digest the disintegrated bullion, as in the methods now employed, either in nitric or sulphuric acid, with heat and in any suitable vessel, sulphate of zinc being first entirely removed by washing.

Finally. The operations are terminated by cupelling the refined gold or melting it with such fluxes as borax, niter, &c., and casting it into ingots or bars. If the operations have been properly performed these ingots will be ductile and of a firmness varying from 98.5 to 95.5 percent., the residual impurity being silver, and from the solution thereof in nitric or sulphuric acid the silver extracted from the gold bullion is then to be recovered by the usual and well-known chemical methods now in use.

For the purpose of explaining the principle which characterizes my invention and discovery, and the several modes in which I have contemplated its application in the art of refining gold bullion, I now state, first, in reference to my first operation above described, that it may be varied by melting the gold bullion to be refined with a sufficient quantity of some other metal or metals baser than silver—such as iron,

copper, &c.—to render the alloy base enough for the action of acid, as used in the second operation; secondly, that, in reference to the second operation above described, it may be varied by using muriatic, nitric, or other acid instead of dilute sulphuric acid; thirdly, that as the processes, first, of alloying and granulating, and, secondly, of treating the alloyed gold bullion with acids, are intended, as above mentioned, only to sufficiently disintegrate that bullion, they may be varied in several ways. Thus, for example, if the gold bullion be brittle, or if it be rendered brittle by combining it with small quantities of certain metals—such as lead, solder, &c.—then it may be reduced to a finely-divided pulverulent state or disintegrated molecular condition by other means, such as grinding, percussion, &c.

What I particularly claim as my invention and discovery, and desire to secure by Letters Patent as a new and useful improvement in the art of refining gold bullion, is—

1. The reduction of argentiferous and other gold bullion, as a preparatory process in the art of refining thereof, into a pulverulent or spongy state, or a disintegrated molecular condition, by the means particularly of fusion therewith, and the subsequent removal by acids therefrom, of zinc or other metal baser than silver which will produce the desired effect, for the purpose of then separating by acids from such gold bullion the silver and other impurities which it may contain, without quartation with silver or any intermediate process, in order to fit the gold for coinage and other uses.

2. In addition to the above processes, the pulverizing, by grinding, crushing, or percussion, of gold bullion rendered brittle by union with lead, solder, or other like base metal, for the purpose set forth in the specification.

RICHD. S. McCULLOH.

Witnesses:

WOODS BAKER,
JAS. S. GREEN.