

UNITED STATES PATENT OFFICE.

BENJAMIN F. PENNIMAN, OF SAN FRANCISCO, CALIFORNIA.

IMPROVEMENT IN PURIFYING AND AMALGAMATING GOLD AND SILVER BEARING SANDS, &c.

Specification forming part of Letters Patent No. **180,058**, dated July 18, 1876; application filed February 23, 1876.

To all whom it may concern:

Be it known that I, BENJAMIN F. PENNIMAN, of the city and county of San Francisco, State of California, have invented a new and useful process for the purifying and amalgamating with quicksilver the auriferous or argentiferous sand, gravel, or earth found on the shores of the sea, and other portions of the United States of America, containing the precious metals gold, silver, &c.; and I do declare that the following is a full, clear, and exact description of the same—

The object of my invention being to neutralize and destroy the sulphur and all other impurities found in the sand, gravel, &c., above-mentioned, by the use of certain chemicals, hereafter named, mixed with the sand, gravel, &c., and quicksilver and water, that are to be treated, and then subjecting the same to the action of steam, superheated or not, or to a direct fire-heat. By this means the sand, gravel, &c., may be freed from their impurities, so that their precious metals, gold, silver, &c., can be the more readily and properly amalgamated with quicksilver. In this manner sand, gravel, &c., containing sulphur and other impurities, may be made to yield up their precious metals, by being more easily and perfectly amalgamated with quicksilver than by the present ordinary methods of gathering the precious metals from the sand, gravel, &c., in which the action of quicksilver or mercury is, to a very great extent, prejudiced by the presence of the impurities found in the sand, gravel, &c.

To enable others skilled in the art to which it appertains to compound and use my process, I will proceed to describe in detail the manner and process of its composition and operation.

The auriferous or argentiferous sand, gravel, &c., that is intended to be treated, are first placed in a pan or pans and mixed with caustic soda, nitrate of soda, soda-ash, and borax, either in solution or in a dry state; then the heat is applied, either in the form of steam or by fire-heat, and the whole body, consisting of sand, gravel, &c., with the addition of water, is then put in motion in the

pan or pans by the use of mullers, and the quicksilver for amalgamating is then applied, the heat being raised to 200°, varying, if necessary, according to the nature of the sand, &c., to be treated. From time to time cold water is let into the pans while in motion, and their contents drawn off through the outlets in the side of the pans, one above the other, and more sand, quicksilver, &c., thrown into the pans, should the latter be necessary, thus making the working of the process continuous, till the clean up-takes place, when the amalgam is found upon the bottom of the pans, to be taken up and retorted.

The proportion of chemicals which I propose to use in treating auriferous or argentiferous sands, &c., would be, for one ton of either, four (4) pounds of caustic soda, three (3) pounds of nitrate of soda, two (2) pounds of soda-ash, and two (2) pounds of borax; but these proportions may be varied to suit the exigencies of the case; and to avoid waste, and to obtain the best results in the most economical manner, it may be advisable, before operating upon a large quantity of sand, &c., to begin with a few experiments, for the purpose of determining, with exactitude, the proportions of the chemicals required.

In a similar manner it may be found convenient and advantageous in some cases to replace the nitrate of soda with saltpeter; and under circumstances when all the chemicals cannot be obtained, and a partial effect would still be desirable, the use of some of them only, involving, however, the use of at least one of an acid and one of an alkaline nature, in combination with the steam or other heat, in the manner described, may be adopted; but I prefer the chemicals and their proportions, or their equivalents, which I have herein mentioned.

The process for cleansing the auriferous or argentiferous sands, gravel, &c., so that the precious metals they contain can be more readily amalgamated with quicksilver, being continuous, its operation is subject only to the good judgment of those who may use my process as described; the same may be said respecting the quantity of quicksilver or mer-

cury to be used in amalgamating, in accordance with the richness of the sand, &c., to be treated.

I claim as my invention—

The herein-described process for treating and amalgamating auriferous or argentiferous sands, gravel, earth, &c., which consists in mixing them with caustic soda, soda-ash, ni-

trate soda, and borax, substantially in the manner and proportions specified, and then amalgamating in the usual way, substantially as herein set forth.

BENJAMIN F. PENNIMAN.

Witnesses:

JOHN HAMILL,
B. J. SHAY.