UNITED STATES PATENT OFFICE.

BENJN. F. PENNIMAN, OF NEW YORK, N. Y.

IMPROVED PROCESS FOR PURIFYING COAL AND ORES.

Specification forming part of Letters Patent No. **44,817**, dated October 25, 1864.

To all whom it may concern:

Be it known that I, BENJAMIN F. PENNIMAN, of New York, in the county and State of New York, have invented certain new and useful Improvements in Purifying Coal and Ores; and I do hereby declare that the following is a full, clear, and exact description of the same.

The object of my invention is to neutralize and destroy the sulphur and other impurities that are found in coal and ores; and it consists in mixing certain chemicals with the minerals that are to be treated, and then subjecting them to the action of steam. By this means impure coal may be freed from sulphur and rendered available for those purposes—such as forging, smelting, the manufacture of gas, and the like—for which it may otherwise have been wholly unsuitable. Ores of iron containing sulphur, and that therefore produce "red-short" iron, may be purified to improve the quantity and quality of the yield, and ores of gold may be more easily and perfectly amalgamated than by the present ordinary process, in which the action of the mercury is to a very great extent prejudiced by the presence of sulphur, notwithstanding the action of any moderate amount of fire that may be brought to bear upon it.

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

The coal or other mineral that is intended to be treated is placed in a retort or tank and mixed with caustic soda, carbonate of soda, nitric acid, and borax, either in solution or in a dry state, and the tank is then closed and steam admitted for a few hours. After the steam has been shut off and the tank opened and allowed to cool, the water may be drawn off and the purified mineral applied to the purpose or use for which it was intended.

The proportions of the chemicals which I prefer to use in treating, for instance, a ton of common soft coal, that is ordinarily impregnated with sulphur, are one pound of caustic soda, three pounds of carbonate of soda or sal-soda, a couple of ounces of nitric acid, and one pound of borax; but these proportions may be varied to suit the exigencies of the case; and to avoid waste and to obtain the best result in the most economical manner, it may be advisable, before operating upon a large quantity of ore or mineral that had not been previously treated in this manner, to begin with a few experiments for the purpose of determining with exactitude the proportions required. In a similar manner it may be found convenient and advantageous in some cases to replace the soda with common salt and lime, and the nitric acid and borax with saltpeter, and under circumstances where all the material could not 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 in the manner described, may be adopted; but I prefer the materials and proportions, or their equivalents, which I have hereinabove mentioned, and I make no claim to the use of salt, niter, potash, and lime. The duration of the action of the steam should be from six to ten hours, in accordance with the pressure and temperature employed, as it is manifest that with the use of a high pressure and superheated steam the operation may be more quickly performed.

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

The process, substantially as described, of mixing coal or other minerals with acid and alkaline agents, consisting of caustic soda, carbonate of soda, nitric acid, and borax, and subjecting them to the action of steam in the manner and for the purpose specified.

BENJN. F. PENNIMAN.

Witnesses:

SAMUEL GOULD,

WM. KEMBLE HALL.