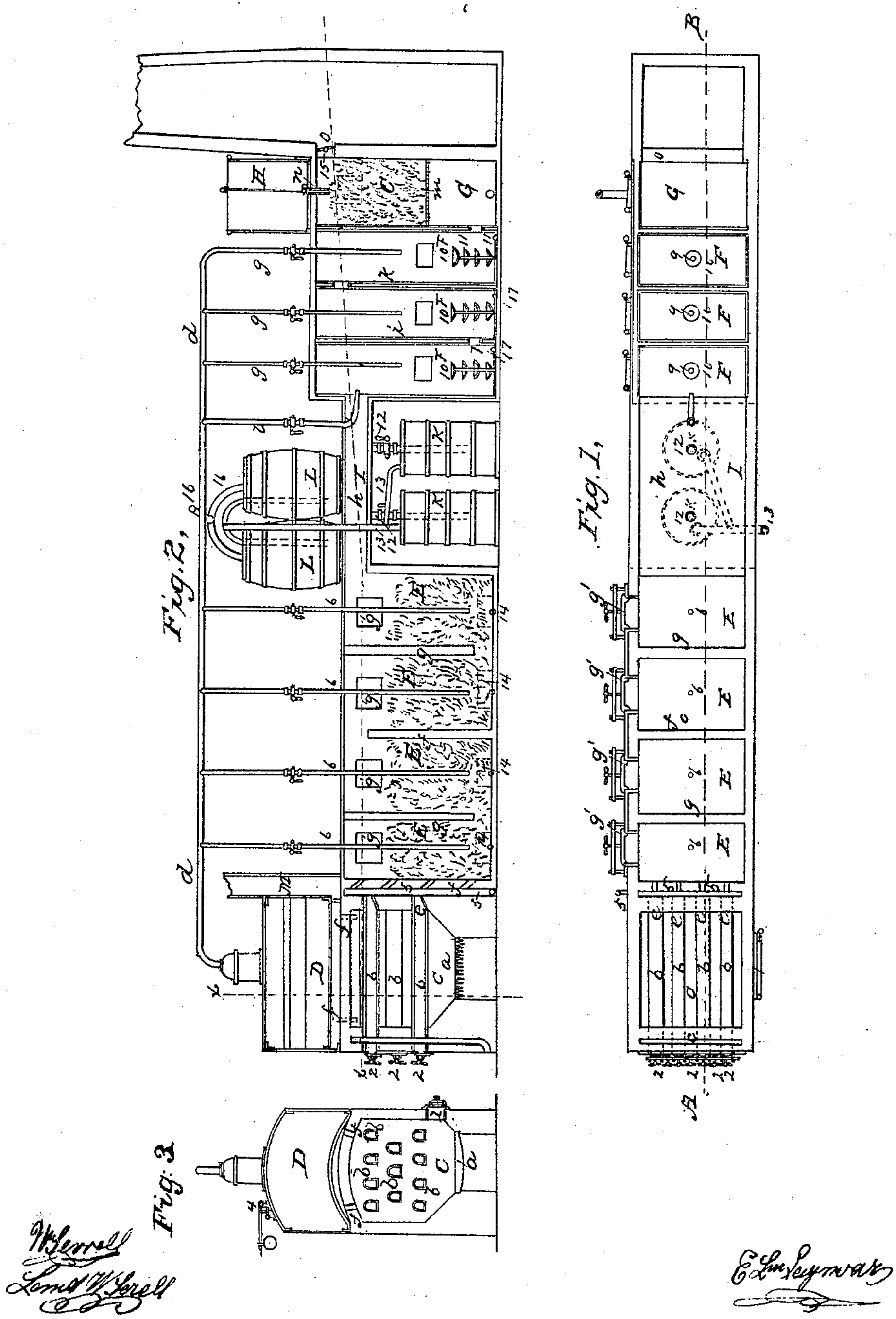
E. L. SEYMOUR.

Making White Zinc.

No. 8,308.

Patented Aug. 26, 1851.



UNITED STATES PATENT OFFICE.

E. L. SEYMOUR, OF WILLIAMSBURG, NEW YORK.

IMPROVEMENT IN PROCESS OF REDUCING ORES BY ZINC COMPOUNDS.

Specification forming part of Letters Patent No. **8,308**, dated August 26, 1851.

To all whom it may concern:

Be it known that I, EDWARD LOUIS SEYMOUR, of Williamsburg, in the State of New York, have invented, made, and applied to use certain new and useful improvements in the means of treating metals and the ores of metals, and also feldspathic and magnesian rocks; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, making part of this specification, in which—

Figure 1 is a plan of the apparatus used by me; Fig. 2, a section thereof; Fig. 3, a cross-section of the furnace.

The same letters indicate like parts in all the figures.

My invention consists in the use, in combination, of several known principles or processes of metallurgical chemistry, which are hereinafter described, in the manufacture of zinc-white, by which I am enabled to treat ores containing any number of metals, and while converting the metallic zinc, its oxide or sulphuret, into the sulphate of the oxide of zinc, (to be finally converted into zinc-white or other pigments,) to separate all the other metals contained in the ores by virtue of the chemical affinity of zinc or its oxide for sulphuric acid formed in the manner described, with or without the aid of other chemical agents and affinities, according to the nature of the metals contained in the ores under treatment. For example, suppose the metals in solution to consist of the oxides of silver, copper, and zinc. Before using zinc or its oxide as a precipitant, it is more proper and advantageous to precipitate the silver first by means, for instance, of metallic copper, so as to have no other metal besides copper to separate afterward by means of zinc or its oxide. It will be seen clearly, therefore, that besides the chemical affinity of the oxide of zinc for sulphuric acid, I have to avail myself, in this instance, of that of copper—that is to say, of its oxide—for the acid in question. The same remark is applicable to chloride of sodium, the alkalies, alkaline earths, and their carbonates or chlorides, &c., which I have to use occasionally, in order to simplify the general process and to lose no time. These processes commence, first, by conducting the sulphurous gas resulting from the calcination of sulphureted ores of any description, in the presence of or conjointly with a regulated supply of atmospheric air and steam, both or either through strata of feldspathic rock, magnesian limestone, sulphurets of metals, or other substance, either partly calcined and lixiviated or not, thereby effecting the decomposition of any and all of these articles into their respective sulphates—that is, sulphates of alumina and potash or soda, sulphates of magnesia and lime, and sulphates of iron, copper, zinc, lead, &c., according to the nature of the ores or substances under treatment. In the second part of these processes the surplus or unused sulphurous gas, either direct or from the first part of the process, is to be treated in leaden chambers or other vessels, and be converted by any usual or known means into dilute sulphuric acid for use in making sulphates from ores or metals, whether connected with the manufacture of zinc-white or not, or treating the basic salts and the oxides formed by the calcination of the ores. In the third part of these processes whatever of the sulphurous gas and the nitrous gases (if such be used) evolved from the previous processes may be in surplus, after either or all of the preceding parts of this process, is made available without escape or loss by combining it with crude or raw ammonia or other alkaline substances, thereby producing the principal elements of artificial manures. In the fourth of these processes the decomposed or surplus sulphurous gas of the first operation, or the whole quantity evolved from the ore, when the second and third operations are not progressing, at the same time is led into one or more reservoirs, in which, water and metallic zinc being present, sulphate of zinc is formed and hydrogen gas is evolved. The sulphate of zinc is to be converted into white oxide of zinc by any known means, the sulphuric acid expelled combined with alkalies during this part of the process being made available for use in subsequent parts of the processes. The hydrogen gas is to be used for deoxidizing metallic oxides, or collected and used for the purpose of illumination when previously charged with carbon from essential oils or resinous matters, or any other ingredients known to be fit for the purpose, these several but successive, continuous, consecutive, or combined parts of this process being effected by one fire, which also heats the water in a boiler

to supply steam for use in the processes in the manner and by the means fully described.

In the accompanying drawings, C represents the furnace, *a* the fire-grate, and 1 the fire-door.

3 3 are flues in the crown of the furnace, by which the fire-heat passes to heat the water in the boiler D, which has a safety-valve, 4, and a steam-pipe, *d*, going the whole length above the other parts of the apparatus.

b b b are iron or clay muffles, set within the furnace C, with doors 2 2 2, and the wall inclosing the furnace is built with air-flues *c c*, so arranged as to admit a current of air, which is slightly warmed as it passes into openings in the muffles just within the doors 2.

At *e e* are the mouths of the muffles *b b b*, and at this end are provided small air-flues 5, so set that they admit a current of air from without to unite with the sulphurous gases driven out by the heat from the materials that are under treatment in the muffles.

At M is the chimney to the furnace C. The draft or supply of air into the flues *c* and muffles and fire in the furnace C and flues 5 may either be the natural induction of the atmospheric air, or the supply may be increased by blowers and regulated by cocks or valves in any convenient manner. The sulphurous gases from the materials under treatment in the muffles and the air entering by the flues 5 commingle in the large air-tight chamber E, formed of brick or masonry, or any fit material, and constructed in any usual manner to secure permanency. The standing division *f* not reaching quite to the top of the chamber E, and the hanging divisions *g* not reaching quite to the bottom, are to be constructed to divide the chamber E and form receptacles for sulphureted ores of any nature, whether previously calcined and lixiviated or not, or any other ores, whether they be found in a metallic state or as oxides, as also feldspathic rock and magnesian limestone to be converted into their respective sulphates, and by subsequent treatment of the metallic sulphates with metallic zinc or its oxides separated from each other, either with or without the aid of the chemical agents or affinities, as before stated, the finally-resulting sulphate of zinc being converted into zinc-white by any known means.

At 6 6 6 are pipes and cocks from the steam-pipe *d*, above which steam, uniting with the sulphurous gas from the materials in the muffles *b b* and the air from the flues 5, passes successively below either of the hanging partitions *g* and over the standing partitions *f*, and operates to convert the contents of the chambers, as above stated, into sulphates of the material it comes in contact with. The commingled current of sulphurous gas, air, and steam that is not absorbed by and united with the materials in the chambers E goes forward into and through the long horizontal flue *h* until it arrives in the chamber F. This chamber is lined with lead, and is fitted with one partition, *i*, having an opening, 7, near the bottom, to the space between the partition *i* and the next partition, *k*, which has an opening, 8, near the top, into the third division of the chamber F.

At 14 are pipes to draw off any liquid contents of the chamber E.

At *l* is a pipe and cock from the steam-pipe *d*, to admit a regulated current of steam, when needful, into the end of the flue *h* by a nozzle turned toward the chamber F, to accelerate the passage of the sulphurous gas into the chamber F.

At 9 9 9 are pipes and cocks admitting a regulated supply of steam from the pipe *d* above into the lower parts of the chamber F; and at 10 10 10 are vessels containing nitric acid, this acting with the surplus sulphurous gas from the first chamber, E, and with the steam from the pipes 9, condensed in the lower parts of the chamber F in the form of dilute sulphuric acid, and may be drawn off for use by pipes 17 on each division; or, in lieu of leaden chambers, I use any other known means of converting the sulphurous gas into sulphuric acid. The sulphurous and nitrous gases that are in surplus or that are not taken up in the previously-described parts of this process are to be passed out by an opening, 11, toward the bottom, at the right-hand end of the chamber F, into the ammonia-chamber G, which has a grating, *m*, across it, to support a quantity of pumice-stone, coke, or other similar and fit material.

At H, above the chamber G, is a tank or vessel fit to contain a quantity of raw carbonate or caustic ammonia, or any other cheap alkali in solution. This tank has a pipe, *n*, and valve to permit a regulated quantity of the ammonia or alkaline solution to descend into the upper part of the chamber G through the coke or pumice-stone, in which they meet the surplus sulphurous or nitrous gases from the previous operations, and fall to the bottom of the chamber G in the form of alkaline salts or solution containing the most important element of artificial manure, and in a fit state to mix with other substances for agricultural purposes.

I is the lower part of the flue *h*, under which are vessels K, to contain water and the metallic zinc, and at 12 12 are pipes to admit sulphurous gas from the flue *h* into the lower parts of the vessels *k*, in which it operates to form sulphuric acid, which converts the metallic zinc into sulphate of zinc and the hydrogen of the water into hydrogen gas, which, ascending by its levity and partial pressure, passes by the pipes 13 from the upper part of the vessels *k* into the vessels L, above the flue *h*, which are fitted with pipes 16, to lead the gas into any convenient receptacle, where it can be purified by lime or lime-water or other substance for any future use.

Beyond the chamber *o* is a final flue to any common chimney, having a damper, 15, by which the exit of any gases may be so regulated as to maintain a slight pressure of the

gases, if so needed, in the next and other previous parts of the apparatus.

By these descriptions of the several processes employed it will be understood that sulphureted ores of iron, zinc, copper, lead, or any other metal being placed in the muffles and subjected to the usual process of wasting or calcining, the sulphurous gas evolved is not suffered to escape into the atmosphere and cause detriment and annoyance to the vicinity, but is applied to use in such a manner that when it is small in quantity it may be employed first and entirely in the production of the sulphate of zinc, that may be afterward converted into oxide of zinc, to be used as a white paint or pigment, by evaporation and calcination or any other known process, and that when the ores contain a large portion of sulphur the sulphurous gas evolved in the calcination is so directed that all the foregoing processes may be progressing at the same instant of time, and feldspathic or magnesian rocks, or ores of any description, metallic zinc and raw carbonate, or caustic ammonia, or any other substances that have an affinity for combining with sulphurous gas, may all be converted into their respective sulphates and other salts, for use in the arts, by thus retaining the hitherto noxious sulphurous gas and placing it, in combination with steam and atmospheric air, in active contact and combination with substances having an affinity for it and for the sulphurous gas formed in the processes, thereby producing merchantable and commercial articles, and at the same time protecting the general healthiness of the vicinity, instead of acting injuriously upon either animal or vegetable health or life.

The hydrogen gas evolved in the described mode of converting metallic zinc into sulphate of zinc is made available for illumination or other useful purposes. The diluted sulphuric acid found in the chamber F can be used in producing oxygen or chlorine gases for chemical and metallurgical purposes, the first by making it act upon peroxide of manganese, the second by combining it with the same peroxide and chloride of sodium or common salt; but the principal virtue of the diluted sulphuric acid formed in the chamber F will be to make it act on the basic salts and the oxides formed during the calcination of ores, to convert such basic salts and such oxides into perfect sulphates of the metal then under treatment; and by introducing this diluted sulphuric acid in any convenient manner among the substances in the chambers E, and abstracting the portion that has percolated to the bottom of the chambers E by the pipes 14, and repeatedly returning the solution into the chamber again by any convenient means, the substances under treatment will be more rapidly converted into their respective sulphates by the solution acting conjointly with the sulphurous gas evolved from the ores under treatment in the furnaces.

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

The use, in combination, of the several processes described for the manufacture of zinc-white as a specific means of treating ores containing any number of metals and separating the metals from each other by virtue of the chemical affinity of zinc or its oxide for sulphuric acid, as described, and this I claim with or without the aid of other chemical agents or affinities, substantially as described.

In witness whereof I have hereunto set my signature this 4th day of October, 1850.

E. LOUIS SEYMOUR.

Witnesses:

WM. SERRELL,

LEMUEL W. SERRELL.