

UNITED STATES PATENT OFFICE.

CLARENCE B. SPRAGUE, OF SALT LAKE CITY, UTAH, ASSIGNOR TO UNITED STATES SMELTING, REFINING & MINING COMPANY, A CORPORATION OF MAINE.

METHOD OF TREATING CORROSIVE GASEOUS FUMES OR SMOKE.

No. 931,515.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, CLARENCE B. SPRAGUE, a citizen of the United States, residing at Salt Lake City, in the county of Salt Lake and State of Utah, have invented certain new and useful Improvements in Methods of Treating Corrosive Gaseous Fumes or Smoke; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The invention relates to the treatment of corrosive gaseous fumes or smoke such as are produced in the roasting or other treatment of sulfid ores for the purpose of removing from the smoke valuable metals and metallic compounds, or compounds and substances which might be injurious to vegetable and animal life if allowed to escape into the atmosphere.

It is well known that the gaseous fumes or smoke produced in the treatment of sulfid ores, especially the sulfid ores of copper and lead having a high per cent. of sulfur, contain large quantities of sulfur dioxide which exists in the smoke in a gaseous state. It is not the purpose of the present invention to remove this gas from the smoke. The smoke produced in the treatment of many sulfid ores, either because of the composition of the ore or because of the character of the treatment to which the ores are subjected, also contains more or less sulfuric acid and other corrosive compounds which exist in the gaseous products as a vapor or in a finely divided liquid or solid state held in suspension. These minute particles of condensed sulfuric acid and other soluble corrosive compounds collect upon the minute particles of solid matter known as fume, which are always present in the smoke, and are deposited with the fume upon the surrounding vegetation when the smoke is discharged into the atmosphere, and have an injurious corrosive action upon such vegetation. The solid fume, in addition to valuable metals and metallic compounds, also frequently contains poisonous compounds of arsenic and other substances which not only are injurious to vegetation but also render any vegetation upon which they may collect unfit for food or fodder.

It is the object of the present invention to remove the corrosive constituents and fume

from the smoke produced in the roasting or other treatment of such sulfid ores so that the smoke may be discharged into the atmosphere without injury to the surrounding vegetation, and any values contained in the fume may be reclaimed if desired.

In cases where the gaseous fumes or smoke produced in the treatment of ores are free from sulfuric acid and other corrosive compounds, it has been the practice to some extent to remove the fume by filtration through cotton or woolen bags for the purpose of recovering the values contained in the fume. It has heretofore been considered impracticable, however, to successfully filter the smoke produced in the treatment of many of the sulfid ores, and especially the smoke produced in the roasting and smelting of the sulfid ores of lead and copper, because of the inevitable presence in the smoke of sulfuric acid and other corrosive compounds which would quickly destroy the filtering fabric.

I have discovered that the minute particles of sulfuric acid or other corrosive compounds held in suspension in the smoke from ore roasting and other furnaces may be successfully neutralized so as to enable the filtration of the smoke through the fabric by mingling with the smoke a pulverulent neutralizing agent which is practically unaffected by the sulfur dioxide and which is held in suspension in the smoke for a sufficient length of time to unite with the corrosive compounds therein. The smoke thus neutralized may then be passed through cloth bags without injury to the bags, and thus the solid fume be completely removed therefrom. The invention in its broader aspects contemplates mingling the pulverulent neutralizing agent with the smoke in any suitable manner.

I have also found that a substantially complete neutralization of the smoke may be successfully effected by introducing a pulverulent neutralizing agent into the smoke on its way from the furnace to the filtering fabric, and this manner of mingling the neutralizing agent with the smoke forms a further feature of the invention.

The neutralizing agent may be mingled with the smoke at any desired point, and the smoke, after it is cooled to a temperature which will not injuriously affect the fabric through which it is to be filtered, is passed

through cloth bags or other suitable form of filtering fabric. At the temperature best suited for the filtration of gases through cloth, there is no deposition of moisture, but such temperatures are below the condensing point of sulfuric acid, and the sulfuric acid contained within the smoke will therefore be condensed before the smoke reaches the filtering fabric, and will exist in minute particles held in suspension in the smoke. These minute particles will readily unite with the finely divided neutralizing agent with which they are brought into intimate relation to form non-corrosive compounds. The acidity of any acid salts held in suspension in the fumes or gas will also be neutralized by the neutralizing agent, and any soluble salts or heavy metals, such as iron or copper, which have become moist or adhesive, and which would have a destructive or corrosive action, will be decomposed by the neutralizing agent, and non-corrosive and unobjectionable compounds formed. The smoke as it comes to the filtering fabric will therefore contain no corrosive compounds, and may be filtered through the fabric without injury thereto. By this treatment, therefore, metals, metallic compounds, and poisonous and injurious compounds contained within the fume, and the corrosive and injurious compounds held in suspension, are removed from the smoke before it is discharged into the atmosphere. The danger of injury to vegetation is thus eliminated or reduced to a minimum, and the solid fume is collected so that any values contained therein may be reclaimed if desired by the proper subsequent treatment.

The invention in its broader aspects contemplates the use of any suitable neutralizing agent which in a pulverulent form has the property of neutralizing acids and the acidity of acid salts, or of decomposing the soluble salts of heavy metals such as iron and copper when in solution. Oxid of zinc, oxid of magnesia, oxid or hydroxid of calcium, oxid or hydroxid of barium, the carbonate and bicarbonate of said bases, or the oxids, hydroxids, carbonates or bicarbonates of sodium and potassium have this property to a greater or less degree, and are adapted for use as the neutralizing agent. I have found, however, that zinc oxid is especially effective in securing a complete neutralization of the corrosive compounds in the smoke when mingled with the smoke in a pulverulent form, and the use of this oxid, either alone or in connection with other neutralizing compounds as the neutralizing agent constitutes a further feature of the invention.

In cases where the quantities of sulfuric acid and other corrosive compounds in the smoke are comparatively small, I prefer to use pulverulent zinc oxid alone to neutralize

the smoke, since a comparatively small quantity of this oxid when mingled with the smoke will effectively and completely neutralize the sulfuric acid and other corrosive compounds.

In cases where the per cent. of sulfuric acid and corrosive compounds is comparatively large, I have found that an effective and complete neutralization of the smoke may be secured by introducing into the smoke finely divided slaked lime and at the same time or thereafter introducing a small amount of zinc oxid. The slaked lime unites with the greater portion of the sulfuric acid and other corrosive compounds contained within the smoke, and the zinc oxid completes the neutralization by uniting with whatever corrosive compounds would remain in the smoke but for its introduction.

In practicing the invention, the neutralizing agent may be introduced into the smoke on its way from the furnace to the filtering fabric at any desired point, and in any suitable manner. For instance, it may be successfully introduced into a flue through which the smoke passes by blowing it into the flue, or by an ordinary roller feed, the velocity of the gases being such in either case that the neutralizing agent is held in suspension in the smoke a sufficient length of time to unite with the corrosive compounds therein. The neutralizing agent may also be successfully introduced into the smoke by feeding it into the inlet of the fan which blows the gases into the bag-house where the smoke is filtered. In the latter case, the solid particles of the neutralizing agent are thoroughly mixed with the gases, and are held in suspension a sufficient length of time to effect the thorough neutralization of the corrosive compounds before the smoke comes in contact with the filter bags.

In using zinc oxid as the neutralizing agent, it may be advantageously intermingled with the smoke by providing a special furnace in which suitable quantities of zinc ore are roasted, and discharging the zinc oxid produced in this furnace into the flue through which the smoke to be treated passes. The zinc oxid fume produced in the furnace, and discharged into the flue, is in a state of fine subdivision, and is thoroughly intermingled with the gases and their accompanying fume. The oxid, therefore, is brought into intimate relation with the fine particles of sulfuric acid or other corrosive compound held in suspension in the gases, or which may have collected on the particles of fume, and combines with these compounds to form non-corrosive compounds. The sulfur dioxid in the gases is practically without effect on the zinc oxid, and the zinc oxid therefore need be present only in sufficient quantities to neutralize the sulfuric acid and corrosive compounds.

The form of apparatus utilized in practicing the invention is not material, and it may be of any well known or usual construction.

5 Having set forth the nature and object of the invention, what I claim is:—

1. The method of treating corrosive gaseous fumes or smoke from ore treating furnaces for the purpose of removing injurious or valuable compounds therefrom consisting in introducing into the smoke on its way from the furnace a pulverulent neutralizing agent which is held in suspension in the smoke and unites with the corrosive compounds therein to form non-corrosive compounds, substantially as described.

2. The method of treating corrosive gaseous fumes or smoke from ore treating furnaces for the purpose of removing injurious or valuable compounds therefrom, consisting in introducing into the smoke on its way from the furnace a pulverulent neutralizing agent which is held in suspension in the smoke and unites with the corrosive compounds therein to form non-corrosive compounds, and thereafter filtering the smoke to remove the fume, substantially as described.

3. The method of treating corrosive gaseous fumes or smoke from ore treating furnaces for the purpose of removing injurious or valuable compounds therefrom, consisting in introducing into the smoke on its way from the furnace a pulverulent neutralizing agent comprising zinc oxid, which is held in suspension in the smoke and unites with the corrosive compounds to form non-corrosive compounds, and thereafter filtering the smoke to remove the fume, substantially as described.

4. The method of neutralizing the corrosive constituents of corrosive gaseous fumes or smoke consisting in mingling therewith a pulverulent neutralizing agent which is held in suspension therein and unites with the corrosive compounds to form non-corrosive compounds, substantially as described.

5. The method of treating corrosive gaseous fumes or smoke for the purpose of removing injurious or valuable compounds therefrom consisting in mingling with the smoke a pulverulent neutralizing agent which is held in suspension therein and unites with the corrosive compounds to form non-corrosive compounds, and thereafter passing the smoke through a filtering fabric to remove the fume, substantially as described.

6. The method of treating corrosive gaseous fumes or smoke for the purpose of removing injurious or valuable compounds therefrom consisting in mingling with the smoke a pulverulent neutralizing agent, such as pulverulent lime, which unites with the major portion of the corrosive compounds, completing the neutralization by mingling pulverulent zinc oxid with the smoke, and thereafter passing the smoke through a filtering fabric to remove the fume, substantially as described.

7. The method of treating corrosive gaseous fumes or smoke for the purpose of removing injurious or valuable compounds therefrom, consisting in mingling therewith a pulverulent neutralizing agent which unites with the corrosive compounds in the smoke to form non-corrosive compounds, and thereafter filtering the smoke to remove the fume, substantially as described.

8. The method of treating corrosive gaseous fumes or smoke for the purpose of removing injurious or valuable compounds therefrom, consisting in mingling therewith a pulverulent neutralizing agent comprising zinc oxid, which unites with the corrosive compounds in the smoke to form non-corrosive compounds, and thereafter filtering the smoke to remove the fume, substantially as described.

In testimony whereof I affix my signature, in presence of two witnesses.

CLARENCE B. SPRAGUE.

Witnesses:

ANDREW HOWAT,
R. H. BUTTERFIELD.