

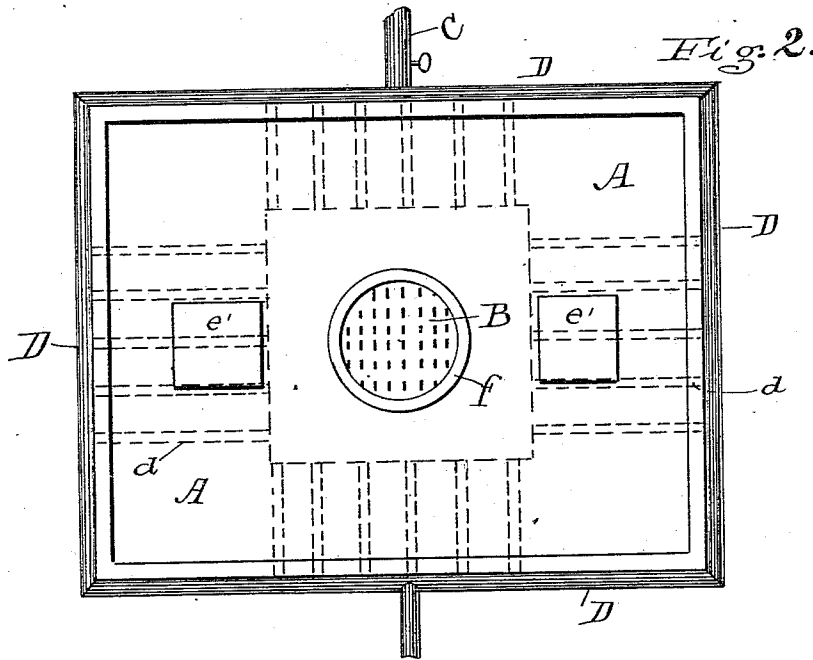
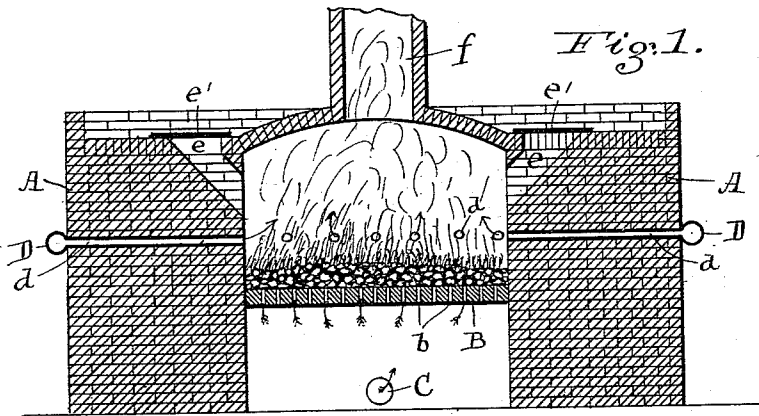
(Specimens )

F. L. BARTLETT.

PROCESS OF TREATING SILVER AND ZINC ORES.

No. 420,030.

Patented Jan. 28, 1890.



Witnesses:

*Charles J. Smith*  
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*Frank L. Bartlett*  
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# UNITED STATES PATENT OFFICE.

FRANK L. BARTLETT, OF PORTLAND, MAINE.

## PROCESS OF TREATING SILVER AND ZINC ORES.

SPECIFICATION forming part of Letters Patent No. 420,030, dated January 28, 1890.

Application filed July 20, 1889. Serial No. 318,100. (Specimens.)

*To all whom it may concern:*

Be it known that I, FRANK L. BARTLETT, a citizen of the United States, residing at Portland, in the county of Cumberland and State of Maine, have invented certain new and useful Improvements in the Process of Treating Silver and Zinc Ores; and I do 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, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to the treatment of the so-called "sulphuret" ores, more particularly such ores as contain large quantities of zinc in the form of zinc sulphuret, together with more or less silver, lead, copper, &c.

According to the methods hitherto in common use these ores have been carefully roasted to expel the sulphur and then smelted with an excess of some other ore containing no zinc. When the zinc was volatilized under these conditions without the presence of sulphur, it carried off with it large quantities of silver, which was not only lost, but if pigment was made greatly injured the quality of it. A further difficulty was occasioned by the action of the zinc on the slag, which was made thick and pasty by its presence, making it difficult to separate out the precious metals, and thus causing further losses. When the ore was treated in a raw or unroasted state large quantities of sulphuric acid, which is very destructive, were given off.

Many attempts have been made to expel the zinc without undue loss of silver, but, so far as I am aware, without success, for the reasons above stated.

The object of the present invention is to devise a method of treatment whereby the zinc may be carried off in the form of fume without taking with it any appreciable amount of silver, and the silver left behind in the slag to be again smelted by the usual methods.

The invention is based on the fact believed to be hitherto unknown that when ores containing silver and zinc are burned in the presence of an excess of sulphur the zinc escapes without taking with it any of the silver.

The process consists, broadly, of mixing the ore with a hydrocarbon fuel, adding an excess of sulphur in some suitable form if the ore does not contain an excess of sulphur, burning it in the presence of an air-blast forced uniformly through the mass from the under side thereof, and admitting air above the burning ore to destroy the sulphuric acid which would otherwise be given off.

By an excess of sulphur is meant a quantity equal to or exceeding the amount of the zinc content.

A fair example of the ores which it is designed to treat by this process would contain zinc, thirty per cent.; lead, ten per cent.; iron, ten per cent.; sulphur, twenty per cent.; silica, thirty per cent. To this should be added sulphur enough to equal the amount of zinc contained in the ore—as, for instance, fifty parts of iron and copper sulphide. If the ore contained sulphur equal to or greater in amount than the zinc, no sulphur would be added.

In carrying out the process I prefer to proceed as follows, viz: I take the raw ore and then crush it to a pea and grain size, and mix it with two-thirds, by weight, of finely-divided petroleum oils or residues, bituminous coal, saw-dust, or other flaming fuel. I then charge it into a furnace having a perforated hearth, in a shallow layer about four inches deep.

The "Wetherel hearth," so called, with some modifications, is well suited to my process. The ore is burned in presence of an air-blast, which is forced up through the perforated hearth, and a sufficient quantity of air is also forced in through openings in the sides of the furnace above the layer of ore. The zinc and lead, if any are present, are largely given off in the form of fume, and may be collected in a bag-room or by other suitable means. Part of the sulphur unites with the copper, iron, silver, and gold, and forms a cinder or scoria, which retains all the non-volatile metals, which may be subsequently treated in the ordinary manner by smelting. The sulphuric acid which would otherwise be formed is destroyed by the action of the hydrocarbon flame and the air which is admitted for this purpose above the burning ore. The combustion of the sulphur takes the place of a considerable portion of fuel and furnishes

a large proportion of the heat necessary to carry on the process.

The advantages of the process, it will thus be seen, are that by it raw ores can be worked; that portion of the zinc driven off is completely separated from the silver in the form of fume; the slag is kept largely free from zinc, so that the non-volatile metals may be readily smelted out by the ordinary process, and a cheap class of fuel, as sawdust, chips, and waste fine coal, may be used.

In the accompanying drawings I illustrate a furnace suitable for carrying my process into effect.

In the drawings, Figure 1 is a central vertical section on *x x* of Fig. 2. Fig. 2 is a plan view of the furnace.

A represents the walls of the furnace.

B is the hearth, having numerous perforations *b*. Beneath the hearth is an air-supply pipe C, through which air under pressure is introduced.

F is the outlet, connected with any suitable cooling or collecting apparatus.

*e e* are openings for charging in the ore, and *e' e'* are covers for the same.

*d d* are a set of air-supply pipes passing through the walls of the furnace and entering the combustion-chamber at a comparatively small distance above the hearth. These pipes are supplied with air from the pipe D. The ore and fuel are charged in through the openings *e e*, forming a shallow layer on the hearth or bottom B. Air is forced up through the perforated bottom B and through the layer of ore. Air is also blown in or allowed to enter through the pipes *d d*, for the purpose already pointed out.

It should be stated that unless a fuel is used containing much hydrocarbon sulphuric acid will be formed. Coke and anthracite coals alone cannot be used, since the necessary reaction upon the sulphur fumes will not take place except in the presence of a hydrocarbon flame.

I am aware that hydrocarbon fuel has been mixed with ores containing sulphur and burned by means of an air-blast forced through the mass for the purpose of expelling the sulphur; but, so far as I am aware, low-grade zinc ores have not been treated by burning them with hydrocarbon fuel and a quantity of sulphur equal to or greater than the amount of zinc in the ore for producing a zinc pigment and retaining the silver. The process therein described is particularly adapted to be used with high-grade ores containing from twenty-five to fifty per cent. of zinc. The zinc is not entirely expelled; but the zinc content is reduced, so that it may be treated by the scoriifying process set forth in my patent, No. 406,870, dated July 16, 1889, which is adapted to remove all the zinc from ores containing an amount less than twenty-five per cent.

In the present process the object is to drive off a certain proportion of the sulphur, zinc, and lead, but not to melt the ore. In fact, the aim is to form a clinker or scoria. If the ore were melted, it would be fatal to the working of the process. It is not in any sense a desulphurizing process, as it aims to retain quite a large percentage of the sulphur in the clinker, this also being an essential part of the process.

I claim—

The herein-described process of treating ores containing zinc and silver, which consists in mixing the ore with hydrocarbon fuel, supplying sufficient sulphur to produce an excess of the same, burning in the presence of an air-blast forced uniformly up through the whole mass of ore, and supplying air to unite with the products of combustion above said mass, substantially as shown.

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

FRANK L. BARTLETT.

Witnesses:

S. W. BATES,

WM. M. HAGGETT.