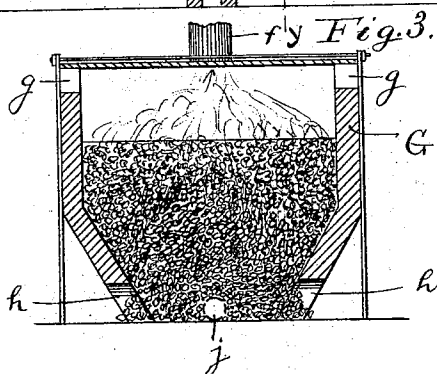
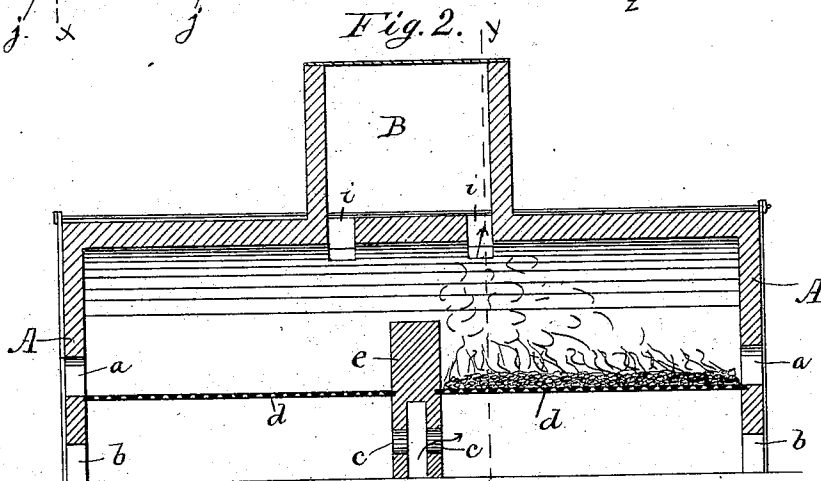
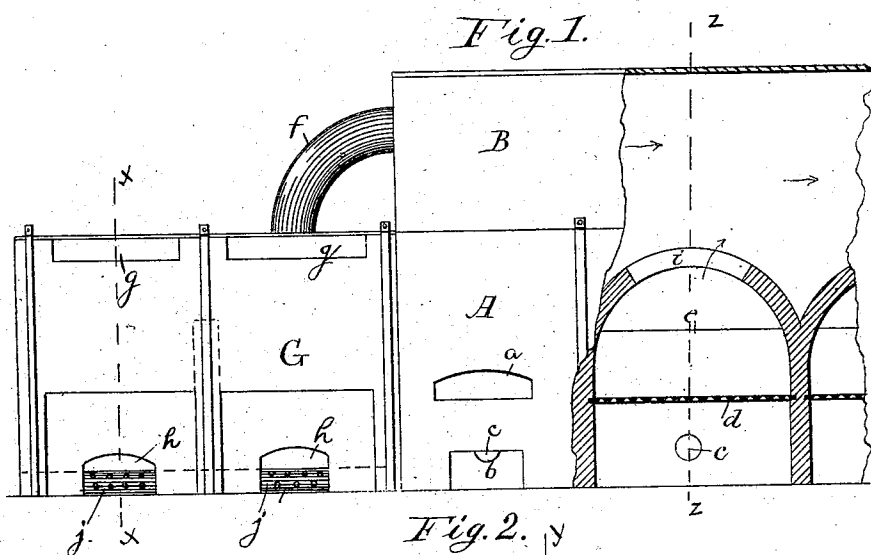


(No Model.)

F. L. BARTLETT.
PROCESS OF TREATING ORES.

No. 512,531.

Patented Jan. 9, 1894.



Witnesses:
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UNITED STATES PATENT OFFICE.

FRANK L. BARTLETT, OF CAÑON CITY, COLORADO.

PROCESS OF TREATING ORES.

SPECIFICATION forming part of Letters Patent No. 512,531, dated January 9, 1894.

Application filed January 11, 1893. Serial No. 457,981. (No specimens.)

To all whom it may concern:

Be it known that I, FRANK L. BARTLETT, a citizen of the United States, residing at Cañon City, in the county of Fremont and State of Colorado, have invented certain new and useful Improvements in Processes of Treating Ores; 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.

My invention has relation to the preparation of certain finely divided ores for the process of smelting in blast or other furnaces. It is well known that fine ores, or granular ores, are exceedingly difficult to smelt in blast furnaces owing to their tendency to pack in the furnace or to blow out with the blast. Many devices have been tried for working these ores, such as making bricks or balls of the ore, or by cementing the grains together with chemicals. Besides being expensive, the bricked or balled ore falls to pieces when heat is applied and the results have not been satisfactory. In order to smelt such ores they now have to be used in small quantities at a time or else previous to smelting they have to be roasted very slowly and at great expense and partly clinkered or cemented by raising the heat at the latter end of the operation. I have discovered a cheap process whereby such ores may be cemented quickly and cheaply by waste fuel, in such a manner that the ore becomes combustible and may be burned to get rid of the sulphur, may be partially fused and cemented with a certain amount of fuel contained or entangled in the mass so that the ore may be smelted direct without additional fuel. Any finely divided ore may be used, such as concentrates of gold, silver, copper, zinc and lead, or flue dust and iron and copper mattes. Natural granular ores may also be used or the ore may be crushed to pea and dust size, and then operated on. I have discovered that such material, especially that containing the sulphides of iron, copper, zinc and lead if mixed with any slack or waste coal, and submitted to an air blast either on perforated grates or on closed hearths, may be quickly cemented or clinkered and that such material, or clinker, can be made to retain a large portion of the

fuel in an available form and that in this spongy or cemented condition the clinker is combustible and may be desulphurized by self sustained combustion carried on either in heaps in the open air or in stalls or kilns.

If it is not desired to desulphurize the ore but to prepare it for subsequent smelting the combustion may be checked by withdrawing the charge from the furnace before the combustion is completed and while a large part of the unconsumed fuel is retained within the mass. This mass of ore and fuel may then be smelted in a blast or other furnace without the addition of other fuel.

I have illustrated in the accompanying drawings a set of furnaces well adapted to carry out my process.

In the drawings Figure 1. is a side view with a portion in section on the line Y Y of Fig. 2. Fig. 2. is a section on the line Z Z of Fig. 1, and Fig. 3. is a section on line X X of Fig. 1.

The furnaces A A as here shown are arranged in the form of a double bank back to back the two sets being separated by a bridge wall "e." Each furnace is provided with a perforated grate "d" of ordinary construction. "a" is the charging door, "b" the ash door, and "c" the air blast opening beneath each grate connected with a blower or other source of supply. Extending above the furnaces is a flue "B" and there is an opening "i" at the top of each furnace through which the gases pass into the flue. The flue "B" is connected with any suitable exhaust apparatus for the purpose of creating a draft.

At the end of the furnaces "A," I construct two kilns "G" having charge openings "gg" at the top and lower doors "h" for withdrawing the burned charge.

A pipe "f" carries off the products of combustion and discharges into the end of the flue "B."

A perforated air pipe "j" extends along the bottom of the kiln and is connected with the blower or air supply.

In operating my furnace an air blast of four to ten ounces is used and the furnaces "A" are first heated by an ordinary coal fire until the hearth and walls are sufficiently heated to ignite coal quickly. The operation then begins by spreading over the grate a thin

layer of slack coal preferably of the coking class, then a layer of the ore to be treated, then another layer of coal and ore until it has a depth of three to five inches. The heavy blast ignites the gas of the heated coal and the sulphur of the ore, resulting in partially oxidizing the ore and coking the coal. In a few moments the mass is sufficiently heated to partially fuse, cementing the particles together forming a cake. This cake is then broken up by a bar and pulled out of the furnace to cool, fresh ore and coal are spread over the hearth and the operation repeated making the process continuous and rapid. The caked ore is firmly cemented together in a spongy form having distributed evenly through it the coked coal. At the same time a small proportion of the sulphur is removed, also zinc and arsenic to some extent. No silver, gold or copper is lost by the operation and but a trifling amount of lead. Some latitude however exists according to the object to be attained. For instance, if it be desired to retain the sulphur, zinc, and lead, the blast is increased and the operation quickened so that the process will be completed before the sulphur has time to burn or the zinc to vaporize. Or, on the other hand, if it be desirable to remove a portion of the sulphur and zinc the blast is lowered and the operation made slower. I have discovered that fine ores treated this way can be made to hold coke in sufficient quantity to be self smelting in the blast furnace and that ore so treated is more easily and quickly smelted than the untreated ore. Moreover ore so treated desulphurizes to a large extent in the blast furnace, zinc is more fully eliminated, and the loss by blowing out of the furnace is largely reduced. Moreover the coke obtained at a nominal cost as slack coal is a waste product of little value when compared with coke as ordinarily produced. If it is desirable to fully desulphurize the ore, then the cemented spongy mass as drawn from the furnace "A" is immediately (while hot) thrown into the kiln "C" where it ignites and burns slowly, consuming all its sulphur and coal contained in the mass until it is thoroughly desulphurized, the operation in the kiln "G" being perpetual, the clinker being charged in at the top opening "g" and as fast as desulphurized drawn out at the bottom opening "h." The perforated pipe "j" at the bottom furnishes a small amount of air to help sustain combustion if necessary, and the flue "f" draws off the products of combustion. When much sulphur is present the cemented material can be burned in heaps in the open air, but the desulphurization is not so complete as when burned in the kiln described.

The ores which work best are those which contain considerable sulphide of iron or those commonly known as "sulphurets." Ores of different kinds may be mixed to form the proper charge for the furnace, but it is in all cases desirable that the ore contain at least

ten per cent. of sulphide of iron, copper, or lead. For treating flue dust sulphide ores may be mixed with it, or if it contains lead in considerable proportion, no sulphide ore is necessary. The fume arising from the combustion of the ore may be drawn off and saved, but this is not usually of much value, especially when the process is conducted with rapidity.

The quantity of coal used in the process can be varied to suit the character of the ore. If desirable a large quantity of fuel can be used with perfect results. No benefit arises however from the introduction of much fuel if the cemented ore is to be subsequently roasted to get rid of the sulphur, but it would be desirable if it is desired to smelt the ore.

I claim—

1. The herein described process of cementing finely divided ore, flue dust, matte &c. preparatory to smelting, which consists of mixing it with slack coal and subjecting it to the action of a quick air blast in a suitable furnace whereby the coal is partially burned and the mineral elements melted to form a spongy coherent mass, without reduction of the metals substantially as described.

2. The herein described process of preparing finely divided ore, flue dust, matte, &c. for subsequent smelting which consists of mixing it with finely divided coking coal and subjecting the mixture to the action of heat and a quick air blast in a suitable furnace until the coal is coked and the mineral elements fused to cement the mass together without reduction of the metals, substantially as described.

3. The herein described process of treating finely divided ore, flue dust &c. which consists of mixing it with finely divided coking coal and subjecting the mixture to the action of heat and a quick air blast in a suitable furnace until the coal is coked and the mineral elements fused to cement the mass together and subsequently smelting the ore without the addition of other fuel, without reduction of the metals substantially as described.

4. The herein described process of desulphurizing ores &c. which consists of reducing them to a finely divided state mixing them with slack coal and subjecting the mixture to the action of a quick air blast in a suitable furnace until the coal is partially burned and the mineral elements are fused to form a spongy coherent mass, withdrawing the charge and subsequently completing the combustion of carbonaceous matter and sulphur without reduction of the metals, substantially as described.

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

FRANK L. BARTLETT.

Witnesses:

S. W. BATES,
CHAS. P. WILLIAMS.