(No Model.) 2 Sheets—Sheet 1.

F. L. BARTLETT.

PROCESS OF MANUFACTURING PIGMENTS.

No. 406,869. Patented July 16, 1889.

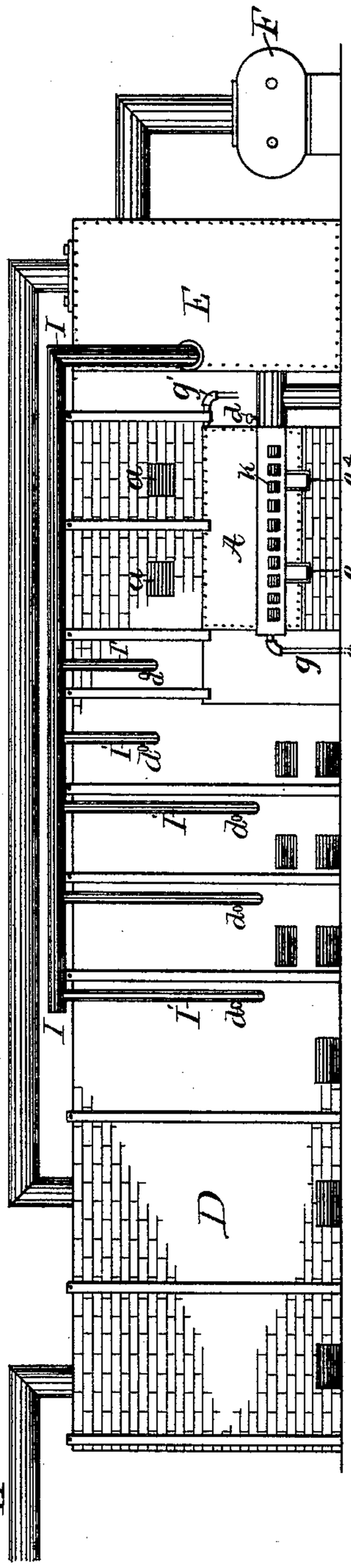
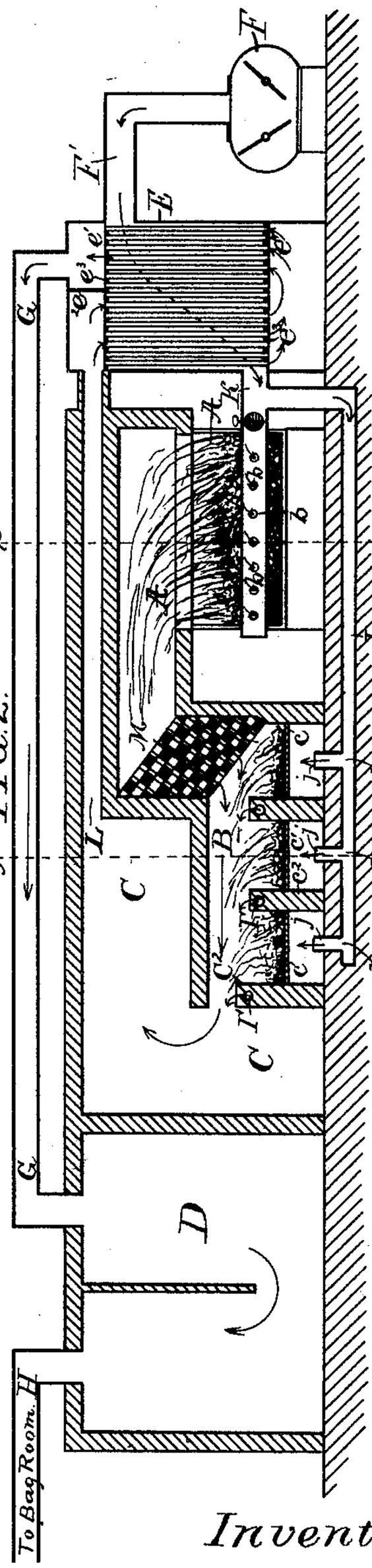
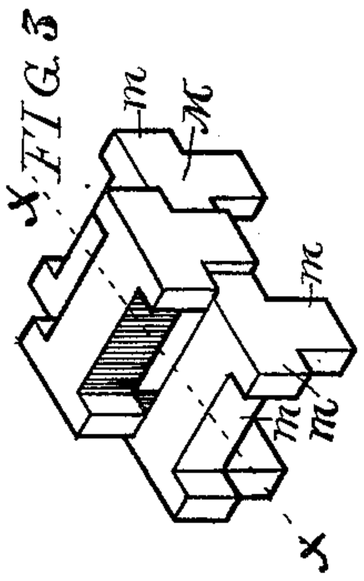


FIG. 1.



X FIG. 2.



X FIG. 3

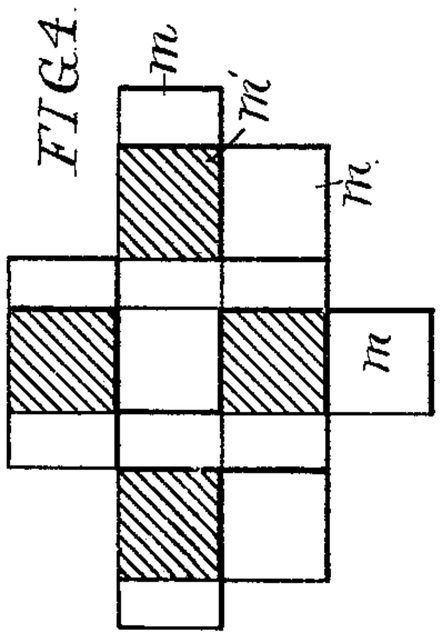


FIG 4.

Witnesses

Severance

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Inventor

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by S. W. Bates

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(No Model.) 2 Sheets—Sheet 2.

F. L. BARTLETT.

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FIG. 5

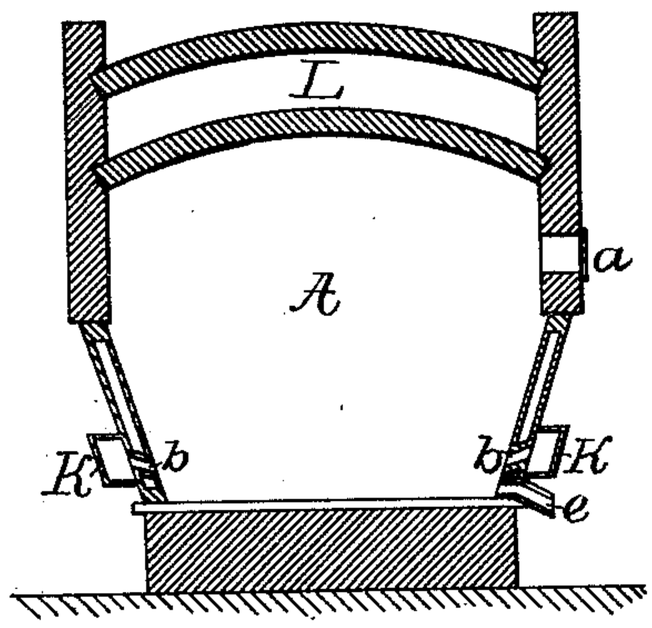
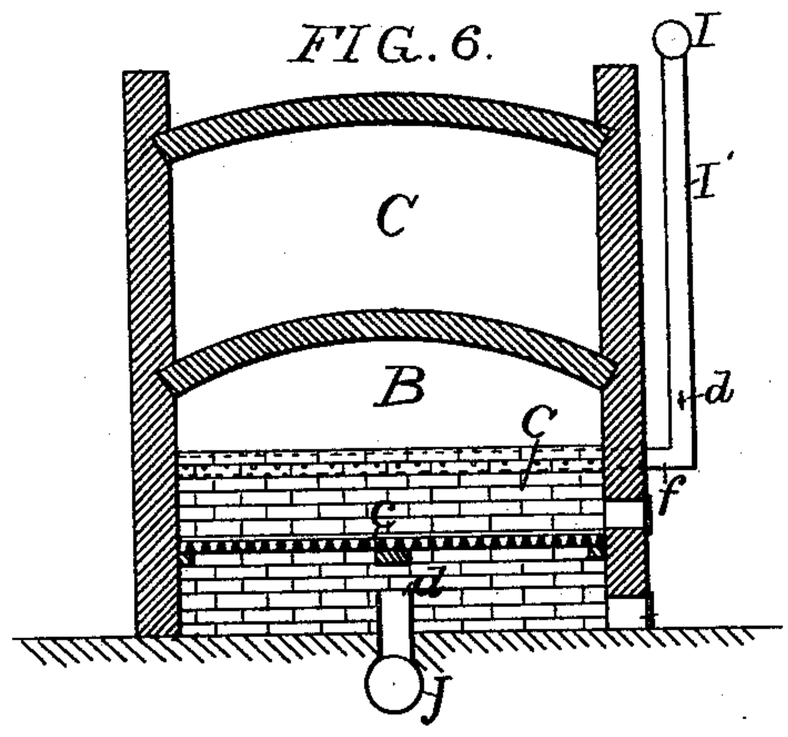


FIG. 6.



Witnesses

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UNITED STATES PATENT OFFICE.

FRANK L. BARTLETT, OF PORTLAND, MAINE.

PROCESS OF MANUFACTURING PIGMENTS.

SPECIFICATION forming part of Letters Patent No. 406,869, dated July 16, 1889.

Original application filed September 15, 1887, Serial No. 249,775. Divided and this application filed March 8, 1889. Serial No. 302,517. (No model.)

To all whom it may concern:

Be it known that I, FRANK L. BARTLETT, residing at Portland, in the county of Cumberland and State of Maine, have invented certain new and useful Improvements in Process of Manufacturing Pigments; and I do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to the manufacture of paint-pigments direct from the ores of lead, zinc, sulphur, or antimony, or mixtures of these. Hitherto such pigments have been made by the following well-known methods, namely:

Zinc oxide has been made from the carbonate and oxide ores of zinc by mixing the ore in a finely-pulverized state with equal weights of anthracite coal, and blowing in air in the well-known Wetherill hearths. Sulphide of zinc has also been converted into the oxide by this method after first roasting the ore to drive off the sulphur. Certain impurities interfere with the successful working of this process, only pure high-grade ores being adapted to it, and no attempt was made to save the non-volatile metals—as copper, gold, and silver—when they happened to be present. The loss was also very large, as from eight to twelve per cent. of the metal was always left in the slag.

Sulphate-of-lead pigment was made by the Lewis-Bartlett process by oxidizing the ore in hearth-furnaces into a crude pigment and then refining it in a blast-furnace into a white pigment. In this process only pure galena was used, and no attempt was made to save gold or other precious metals if present. Some attempt has also been made in ordinary blast-furnace smelting to save such fumes as come over from smelting ores; but the fumes thus saved were of dark color and fit only for resmelting into the metals.

The class of ores to which my present invention is applied particularly is known as "complex ores." These ores are mixtures of zinc, copper, lead, silver, gold, antimony, and arsenic, either all together or two or more of them held in combination with sulphur, and termed "sulphurets." The presence of zinc in these ores is considered by smelters as objectionable, since it causes loss of the precious metals in smelting. Moreover, such ores have to be carefully roasted to expel the sulphur before they can be smelted by the usual processes. In the present method of smelting there is not only loss of the precious metals when zinc is present, but the zinc itself is lost in the process.

My process is based upon the following facts or discoveries, believed to be hitherto unknown, namely: First, when complex sulphuret ores are smelted in the raw or natural state, without previous roasting, and with suitable fuel and fluxing material, in a strong blast of air, the volatile elements—zinc, lead, and antimony—can be driven off in an atmosphere of sulphurous oxide—as oxides, sulphates, and oxysulphurets, or mixtures of these—to form valuable white pigment, while the silver, gold, and copper suffer slight loss, and can be saved by drawing them through suitable openings in the bottom of the furnace; and, second, if fumes of zinc, lead, or antimony, when in a highly-heated state, are passed through closed passages externally cooled, the product is instantly rendered white and increased in body.

The object of my invention is to devise a process by which complex and low-grade ores may be transformed in a single operation into pure white marketable pigment, while the precious metals which may be contained in the ores are saved with but trifling loss.

In the accompanying drawings I illustrate the apparatus by which my invention is preferably carried into effect.

In the drawings, Figure 1 represents a side elevation of the furnace. Fig. 2 is a central longitudinal section through the same. Fig. 3 is a perspective view of a special tile used in the regenerating apparatus. Fig. 4 is a section through $x\ x$ of Fig. 3. Fig. 5 is a section through $x\ x$ of Fig. 2. Fig. 6 is a section through Y Y of Fig. 2.

A represents a blast-furnace having water-jacketed sides and ends. Although I prefer to use a furnace of this description, an ordinary brick or stone furnace may be used. The furnace is comparatively shallow, and has a length which is considerably in excess

of its width, and in its side it has numerous tuyeres or air-blast holes *b b*, all pointing sharply downward. At the bottom of the furnace are tap-holes *e e*[4]. An air-pipe K connects with the tuyeres *b*, and extends along the side of the furnace, which is also provided with feeding doors or openings *a* at its top.

Connected with the furnace A and forming part thereof is the regenerating or oxidizing furnace B, the opening or flue between the two being filled by the smoke consumer or regenerator M, which is preferably constructed of the tiles shown in Fig. 3, laid in such a way that the gas in passing through it follows a zigzag passage and comes in frequent contact with the surfaces of the tiles. Each of these tiles consists of a central bar *m'*, at each end of which are offsets or projections *m*, extending laterally in three directions at right angles to each other and to the central bar. The tiles can thus be built up to form a mass of brick-work traversed by indirect passages, wherein the gas is brought in frequent contact with the surfaces of the tiles.

The furnace B is provided with bridge-walls C^2 C^2, between which are grates *c c*. Opening underneath the grates *c c* are various branches *j j* from the air-supply pipe J. An air-pipe I, situated at the top of the furnace, is provided with branches I', some of which open into the space or flue between the furnaces B and A, and some enter the bridge-walls C^2 of the furnace B, which are there supplied with perforations, by which the air from the pipe is discharged into the furnace B.

The regenerating-furnace B connects with an ante-chamber C, from which a passage L leads over the furnace A to the top of the cooling-chamber E. The cooling-chamber E consists of a closed chamber having two horizontal flue-sheets e^3, one near its top and one near its bottom, these flue-sheets being connected by vertical tubes *e'*, which open into the spaces above and below said flue-sheets. A partition e^2 divides the space above the upper flue-sheet into two parts, and into one of these spaces opens the passage L, above described, and from the other leads the pipe G. The pipe K connects with the space surrounding the tubes just above the lower flue-sheet, while a pipe F' enters the same space near its top. The pipe F' connects with the pressure-blower F. The pipe G, which leads from the top of the cooler E, passes to a settling-chamber D, from which the pipe H leads to the bag-room or dust-collecting apparatus. *g' g* are the inlet and outlet water-pipes of the water-jacket of the furnace A. Dampers *d d* control the air-blast in the pipes I' I', *j j*, and K.

In carrying out my process I may make use of any simple ores which are capable of producing a pigment; but I prefer to use the complex or sulphuret ores, for the reason that they are low-grade ores of comparatively small value for smelting purposes, and when worked by my process they produce the best pigment. As will be hereinafter pointed out, the apparatus can be run so as to produce the pure oxide pigments or the mixtures of oxides and sulphates, sulphurets, &c., before spoken of; but since the latter product is the most valuable and the most cheaply made, for the reason that it utilizes a large proportion of sulphur, I prefer to operate it with that end in view, and, in fact, it is for the manufucture of this product that the apparatus is chiefly designed.

When sulphuret ores are to be treated, the process is as follows, namely: The ores, crushed to the size of a pea, are mixed with about twenty-five to thirty per cent., by weight, of coke, charcoal, or other fuel, together with a suitable amount of fluxing material when the nature of the ore requires it. If the zinc or lead ores to be treated are not sulphurets, or, if they do not contain at least ten per cent. of sulphur, crude sulphur or sulphuret of iron is added to bring it up to this proportion. The mixture is charged into the blast-furnace in a shallow layer. (In practice I do not put in over eighteen inches of ore, &c.) This furnace is supplied with a hot-air blast through the tuyeres *b* from the pressure-blower F, the current of air passing through the cooling-chambers E, where it circulates outside the flues *e'*, and is heated by the hot gases which are passing through these tubes, as hereinafter shown. It is designed to maintain an even temperature in the furnace by charging the two ends alternately through the doors *a a*, thus always maintaining a bright glowing fire in one end. The combustion of the fuel liberates the sulphur, which, igniting. assists combustion, and is converted into sulphurous oxide gas. The non-volatile metals—such as gold, silver, and copper—will fuse and settle to the bottom of the furnace in the form of "mattes," and as they accumulate they are drawn off through the tap-hole *e*. The earthy impurities—such as silica, alumina, &c.—unite with the lime and iron and form slag, which is drawn off through the tap-hole e^4, which is slightly higher in elevation than the tap-hole *e*. The zinc, lead, and antimony are reduced and volatilized and pass off in an atmosphere composed of the other products of combustion—such as sulphurous oxide, carbonic oxide, carbonic-acid gas, and free nitrogen—as oxides, sulphates, and oxysulphurets of the metals. These fumes and products of combustion, carrying along with them a certain amount of unconsumed carbon and raw ores and other impurities, first meet the air-supply which is blown in over the furnace and pass through the smoke-consumer M, where they come in contact with the incandescent tiles and where such impurities are wholly or partially oxidized. In passing through the smoke-consumer M the fumes also become diffused, and in this state they enter the furnace B and

pass over the regenerating or oxidizing fires, which are kept up of light coke in one or more of the divisions of the furnace B. These fires are supplied with air from the pipe J, and air is also blown in through the perforated pipes I′ contained in the bridge-walls C^2, mixing intimately with the fumes as they pass through the furnace. The effect of the regenerating-fire, the smoke-consumer M, and the air upon the fumes is to reduce any portions of raw ore passing over from the furnace A and to regenerate the heat, which must be kept up to a high degree to insure the success of the process.

Sufficient air is admitted to decompose any unburned raw ore that may be driven over from the furnace A, as described. No excess of air is allowed to enter, since it would have a tendency to completely oxidize the metals, forming oxides, which are not so desirable as a product as the oxysulphurets. The dampers *d* enable the operator to completely control the air-blast, so that the fumes can be run in a full atmosphere of sulphurous oxide or in a mixture of that and atmospheric air, as desired. It is desirable to keep the gas in which the fumes are suspended strongly sulphurous, so that the sulphates and sulphurets will form as freely as possible. The now partially-refined fumes pass over into the ante-chamber C, where the heavy impurities are deposited, thence through the pipe L to the cooler E, where they pass downward through the flues *e′*, which are cooled by the cold air from the blower passing around them to the bottom of the cooler and thence upward and out through the pipe G.

I have found that the highly-heated fumes passing through contracted passages which are externally cooled are suddenly rendered white and freed from the dark-colored impurities which cling to them. This effect I understand to be due partly to the mechanical action of the gas passing through the small tubes or contracted passages and the agitation incident thereto, whereby the flakes of pigment into which it is first formed are broken up and the impurities released, and partly to the sudden change of temperature, which contributes to this result. This explanation may or may not be correct, and I do not base my claim on it, but on the fact as pointed out. It will be observed that, since the hot gas passes inside the tubes and the cold air from the pressure-blower passes on the outside of such tubes, the gas is cooled at the same time the air is heated, both of which results are desirable. The fumes after leaving the cooler E pass through the pipe G to the settling-chamber D, where the speed of the current is so reduced that all the remaining impurities settle, the refined pigment being drawn by an exhaust-fan or other suitable means to a bag-room or dust-collector.

It is evident that the apparatus herein described may be varied as to its details to a very considerable extent without departing from the spirit of my invention.

I do not wish to confine myself to the exact regenerating apparatus here shown, as any suitable means can be used for this purpose. After the furnaces are well started and the brick-work thoroughly heated through, I find that it is not always necessary to keep the fires in the regenerating-furnace in operation, the incandescent tiles and the air-blast being sufficient to accomplish the desired result without the aid of the coke fires.

In another application (Serial No. 249,775, filed September 15, 1887) relating to the same subject-matter I claim some of the features herein described and shown.

I claim—

1. The herein-described process of manufacturing pigment, which consists in mixing the ores of lead, zinc, or antimony with carbon, subjecting the mixture to an air-blast in a suitable furnace, then successively supplying air to the fumes thus produced, bringing them into contact with incandescent fire-clay or other refractory material, subjecting them to the action of an oxidizing-flame, then suddenly cooling them, substantially as shown.

2. The herein-described process of manufacturing pigment, which consists of mixing the ores of lead, antimony, or zinc with carbon, subjecting the mixture to an air-blast in a suitable furnace, then successively supplying air to the fumes thus produced, bringing them into contact with incandescent fire-clay or other refractory material, subjecting them to the action of an oxidizing-flame, and finally collecting them, substantially as shown.

3. The herein-described process of manufacturing pigment, which consists in mixing the ores of lead, zinc, or antimony with carbon, subjecting the mixture to an air-blast in a suitable furnace, then successively supplying air to the fumes thus produced, bringing them into contact with incandescent fire-clay or other refractory material, subjecting them to the action of an oxidizing-flame, withdrawing said oxidizing-flame after the apparatus becomes heated through, then suddenly cooling them when in a highly-heated state, and finally collecting them, substantially as shown.

In testimony that I claim the foregoing as my own I have affixed my signature in presence of two witnesses.

FRANK L. BARTLETT.

Witnesses:
S. W. BATES,
C. SEVERANCE.