(No Model.)

4 Sheets—Sheet 1.

A. C. BRADLEY.

PROCESS OF MANUFACTURING THE OXIDES OF READILY OXIDIZABLE METALS FOR PAINTS, &c.

No. 382,133. Patented May 1, 1888.

Fig. 1.

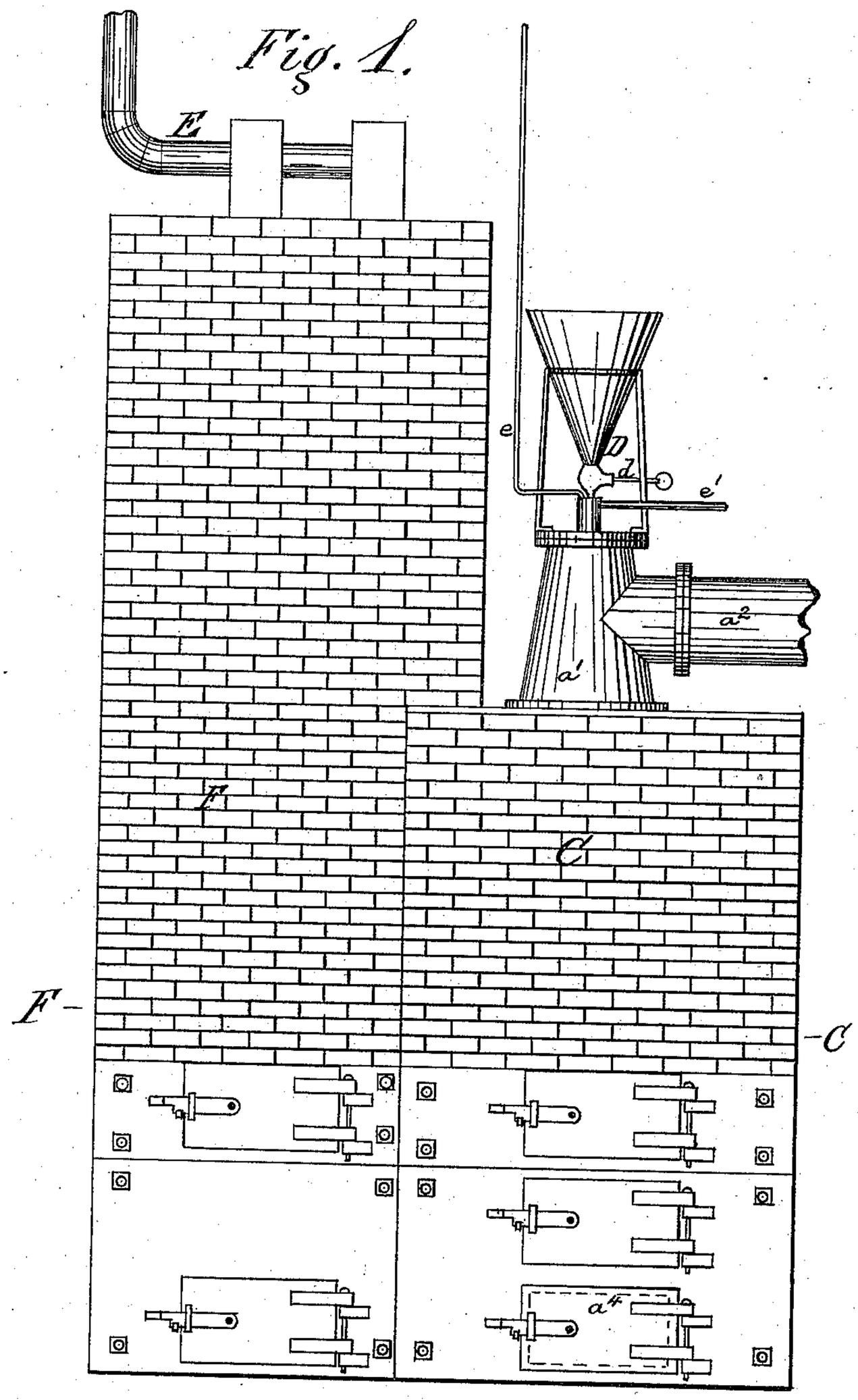

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Fig. 2.

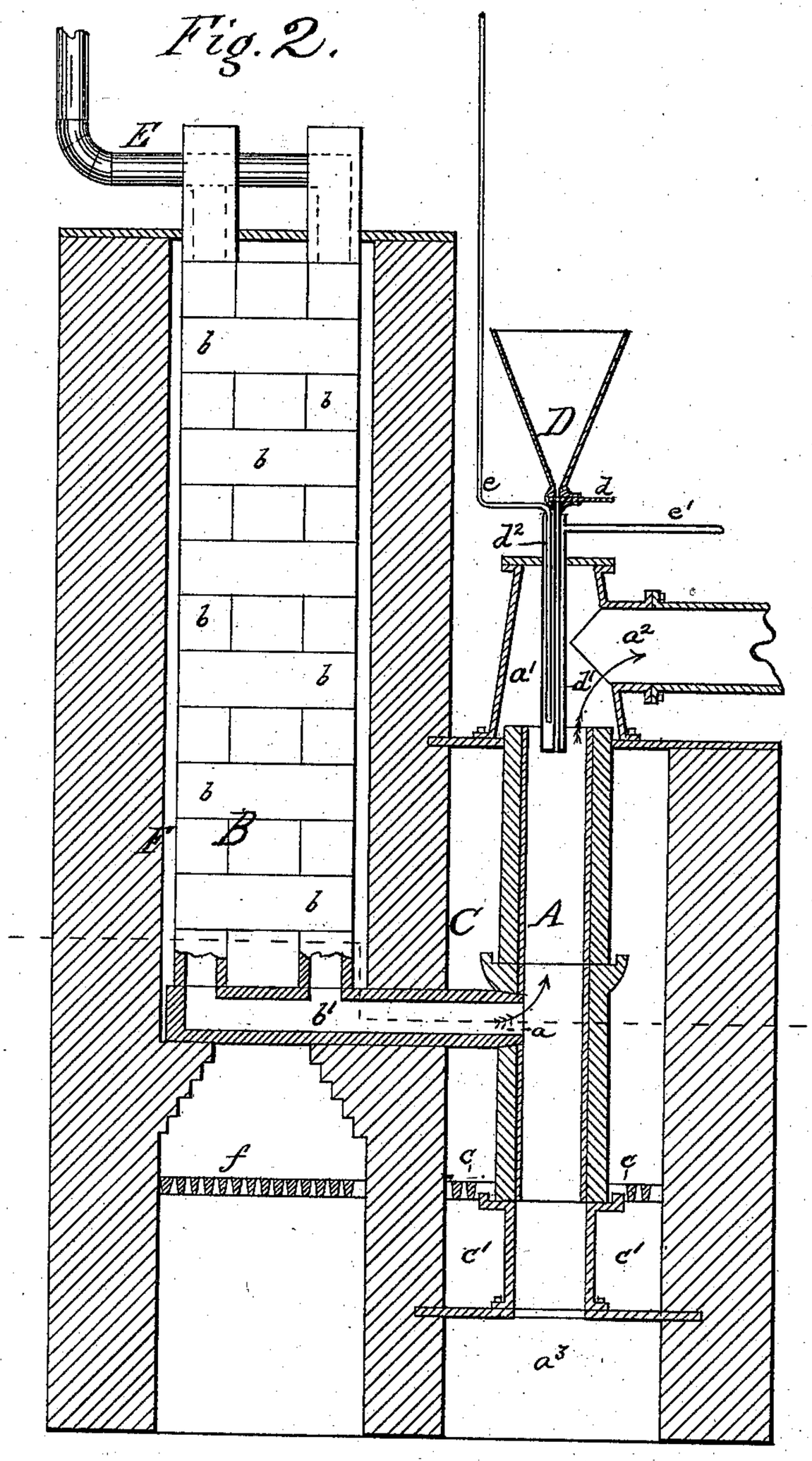

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Fig. 3.

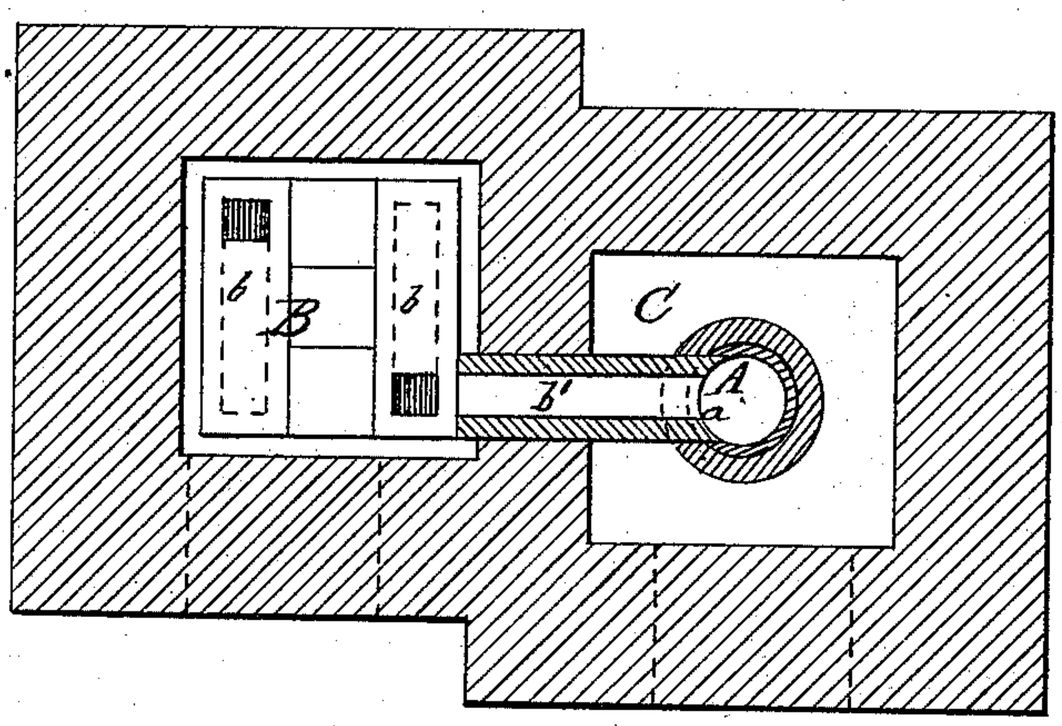
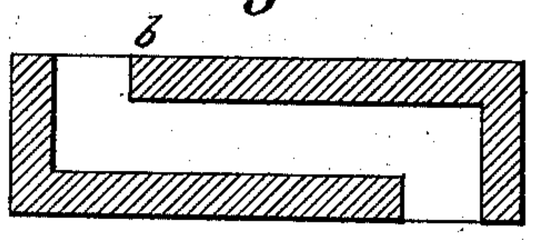


Fig. 4.



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PROCESS OF MANUFACTURING THE OXIDES OF READILY OXIDIZABLE METALS FOR PAINTS, &c.

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Fig. 5.

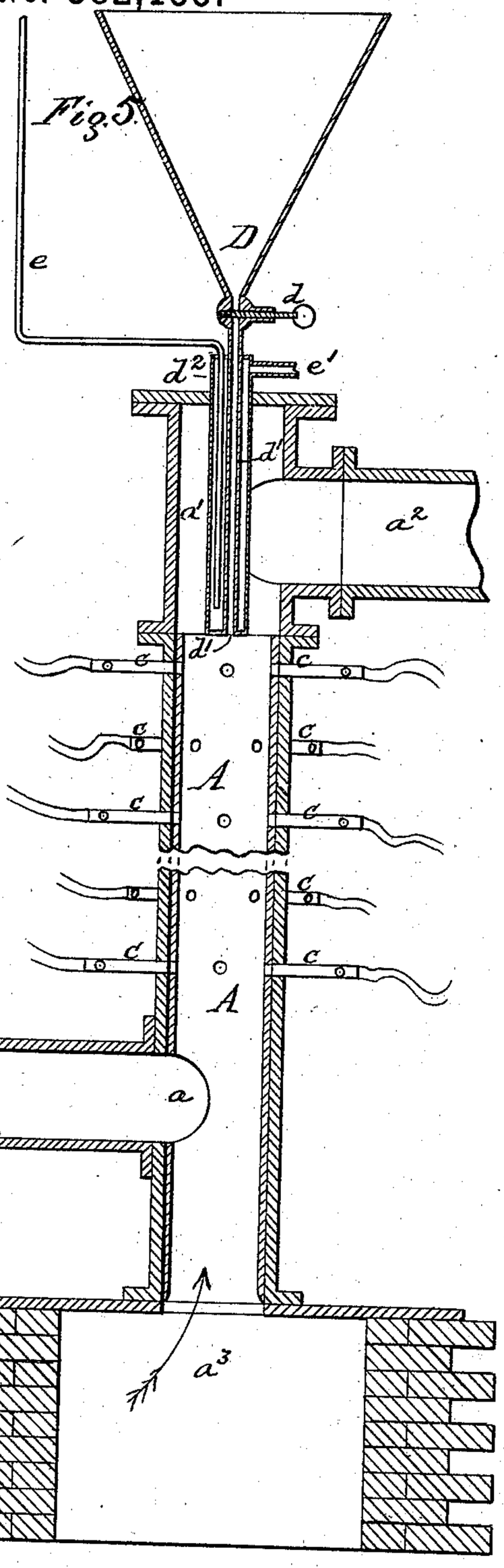
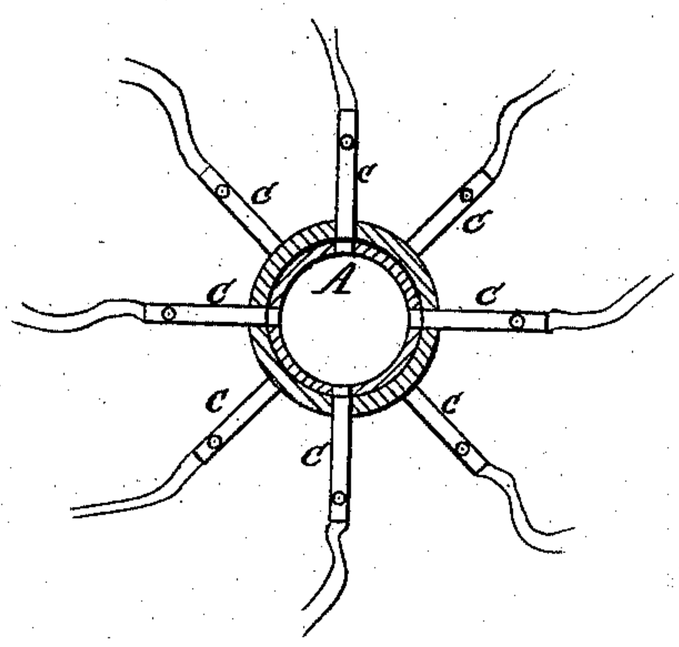


Fig. 6.



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UNITED STATES PATENT OFFICE.

ARTHUR CROSSMAN BRADLEY, OF BROOKLYN, NEW YORK.

PROCESS OF MANUFACTURING THE OXIDES OF READILY-OXIDIZABLE METALS FOR PAINTS, &c.

SPECIFICATION forming part of Letters Patent No. 382,133, dated May 1, 1888.

Application filed February 21, 1887. Serial No. 228,290. (No model.)

To all whom it may concern:

Be it known that I, ARTHUR CROSSMAN BRADLEY, of Brooklyn, in the county of Kings and State of New York, have made an invention of a new and useful Process of Manufacturing the Oxides of Readily-Oxidizable Metals for Paints, and for other Purposes; and I do hereby declare that the following, in connection with the accompanying drawings, is a full, clear, and exact description and specification of the same.

The processes that have hitherto been employed to manufacture the metallic oxides used as paints have been, so far as my knowledge extends, in the case of the oxide of lead, known as "litharge," to expose a mass of the molten metal in an open-hearth reverberatory furnace to the products of combustion of fuel mixed with more or less air, accompanied with the stirring of the metal to expose fresh surfaces to the action of such products, or to expose the lead in a hot revolving retort to air, which is drawn through the retort, which is turned during the operation to expose fresh surfaces of the lead to the action of the air. In the case of the white oxide of zinc the process has been to volatilize the metal either from a molten mass of it, or from a mass of its ores, sometimes mixed with fuel, and permit the metallic vapor to burn in air. The process of manufacture by the first process is tedious and requires the expenditure of much labor to stir the molten metal and to free the oxide from the metal as it is formed. The second is also tedious, and requires the expenditure of power to turn the retort and the lead within it. The product, also, in the first case is soiled with the earthy matter from the fuel. On the other hand, the processes of manufacturing the oxide of zinc are either attended with the mixture of earthy matter from the fuel with the product, (which injures its value,) or are slow, and require a large expenditure of fuel to volatilize the metal from a mass of it.

The object of the present invention is to enable metallic oxides of such metals as can be treated by my invention to be produced with far greater rapidity than by the previous processes of heating the lead in a large mass or in a divided state in a revolving retort, and without a preliminary vaporizing of the metal and with a large saving of labor.

The invention is recited in the claims at the close of this specification.

In order that it may be fully understood, I will proceed to describe the mode in which I have practiced my invention with success, and the new apparatus which I have successfully used for the purpose, it being understood that my process is not restricted to the use of the apparatus which I am about to describe, or to the means of performing some of the operations which I am about to describe.

Figure 1 of the accompanying drawings represents a front view of an oxidizing-furnace which I have used with success. Fig. 2 represents a vertical central section of the furnace, with some parts in elevation. Fig. 3 represents a horizontal section of the furnace, following the zigzag lines *x x* of Fig. 2. Fig. 4 represents a section of one of the hollow fire-brick blocks of which the hot-air heating-pipe is built up. Figure 5 represents a vertical central section of a modified construction of oxidizing-furnace. Fig. 6 is a horizontal sectional view of the same.

The said furnace, Figs. 1 to 4, inclusive, consists substantially of two parts—viz., an oxidizing-chamber, A, and an air-heating apparatus, B, both heated by means of burning fuel. The oxidizing-chamber A has the form of a pipe, which is sustained in a furnace, C, at the lower end of which there is a grate, *c*, upon which the fuel is burned. This chamber is provided above the grate with an opening or nozzle, *a*, by which it is connected with the heating apparatus B for heating air, and the said chamber is fitted at its upper end or head, *a'*, with an escape-pipe, a^2, by which the chamber is connected with a dust-collector. At the upper end of the oxidizing-chamber there is a charger, D, by means of which the metal to be oxidized is fed to the inclosed oxidizing-chamber, and the neck of this charger is preferably fitted with a sliding gate or valve, *d*, by means of which the supply of metal can be regulated. The neck *d'* of the charger is preferably extended into the oxidizing-chamber sufficiently to have the lower end of the neck below the orifice of the escape-pipe a^2; and as it is desirable to prevent the metal, when previously comminuted, from melting in the neck of the charger, the extension of the neck into the said chamber is surrounded by a water-

jacket, d^2, through which a current of water is caused to pass, the water being supplied by means of a water-supply pipe, *e*, and the warm water being permitted to escape through an escape water-pipe, *e'*.

The air-heating apparatus may be of the same construction as the pipe hot-blast ovens used in the manufacture of pig-iron; but the air-heating apparatus which I have used with success consists of convoluted pipes *b*, formed of hollow fire-brick blocks that form two worm-like passages, which are analogous to the two threads of a double-threaded screw, and which communicate at their lower ends by means of the connecting-pipe *b'* with the nozzle *a* of the oxidizing-chamber. The upper ends of the air-passages are connected by means of a pipe, E, (a part only of which is shown in the drawings,) with an air-forcing machine, that which I have used with success being an ordinary Baker blower, and as the construction of air-forcing machines is well known in metallurgy I do not deem it necessary to describe one in detail. The convoluted pipe or pipes are sustained in a furnace, F, at the lower end of which there is a grate, *f*, on which fuel is burned to heat the pipes and the current of air which is forced through it by the air-forcing machine, so that the air is highly heated when it enters the oxidizing-chamber.

The lower end of the oxidizing-chamber is extended downward through the grate *c* and through the ash-pit *c'* of the furnace, and forms a receptacle, a^3, to receive any unoxidized metal, which may be removed at intervals through an opening or doorway provided for the purpose, said doorway being fitted with a door, a^4.

The escape-pipe a^2 of the oxidizing-chamber is connected with a dust-collector, which may be of any suitable construction, such as is used for collecting dust in the useful arts. Thus the said dust-collector may be a large chamber fitted with partitions, forming a tortuous passage similar to the dust-collectors used in collecting flour-dust, or with a series of wire-cloth partitions; or the dust-collector may consist of a series of pipes with bag attachments similar to those used for collecting the oxide of zinc; or it may consist of a large chamber having such a bag collecting apparatus connected with it, so that the said chamber may collect the first portions of the oxide and the bag collectors may collect the residue; but when bag collectors are used the current proceeding from the oxidizing-chamber must be cooled sufficiently before it reaches the bags, by being caused to pass through long pipes or otherwise, to prevent the bags from being burned by the heat. In all cases the dust-collecting apparatus should be fitted with openings or doorways closed by doors, to enable the dust to be readily removed. As the construction of dust-collectors is well understood in metallurgy, I do not deem it necessary to describe them in detail.

In order that my process may be practiced it is essential that the metal to be treated shall be in a comminuted condition before it is oxidized, by which I mean that the metal to be oxidized shall be reduced to the condition of sand or minute globules, as distinguished from the metal in mass on the one hand and from metal in the condition of vapor on the other. I prefer that the metal shall be comminuted before it is fed into the oxidizing-furnace; and the mode of comminuting the metal which I prefer is to permit a stream of the molten metal to fall upon a rapidly-revolving disk, the practical effect of which is to throw off the metal by centrifugal action in a powdery or sand-like condition; and as this mode of comminuting metal is well known in metallurgy it is unnecessary to describe it in detail.

I prefer to heat the oxidizing-chamber A to a temperature somewhat higher than that at which the metal to be treated will burn in air; but the heat should not be high enough to melt the oxide-dust, and the hot-air apparatus should be heated hot enough to heat the current of air which is forced through it to a temperature at which the metal in a comminuted condition will burn in its passage through the oxidizing-chamber. When, then, the air-forcing apparatus is in operation, a current of highly-heated air is forced through the oxidizing-chamber. The comminuted metal to be oxidized, which may be lead, is placed into the charger D, and is permitted (by opening the gate *d*) to flow into the oxidizing-chamber. The comminuted metal falls through the said chamber in a shower, so that the air therein has free access to its particles, which are acted upon simultaneously by heat and the current of air. Consequently the metal burns or oxidizes rapidly, and is converted mainly into a pulverulent oxide. As the current of hot air in which the metal is burned is inclosed or confined by the walls of the oxidizing-chamber, the pulverulent oxide produced cannot escape from the current, but is carried off by the current and is deposited in the dust-collector, whence it may be removed through the doorways or openings provided for the purpose. If a bag dust-collector be used, its bags must be made of cloth porous to air, so that the air will filter through the cloth of the bags, leaving the oxide within them to be withdrawn at intervals, as is customary with this class of dust-collectors. Such larger particles of the comminuted metal as are not fully oxidized drop into the receiver a^3 at the lower end of the oxidizing-chamber, and may be removed at intervals through the doorway provided as above described. Instead of connecting the upper orifice, a^2, of the oxidizing-chamber with the dust-collector, and the lower orifice, *a*, with the air-heating apparatus, the upper orifice, a^2, may be connected with the air-heating apparatus, and the lower orifice, *a*, or the upper portion of the receiver a^3, may be connected with the dust-collector, and in such case the current of air will be downward through the oxidizing-chamber.

When the metal that is treated is lead, the oxide produced as above described is litharge, and it is produced in such a finely-divided condition that it is particularly fitted for a pigment. Moreover, as the oxidation is effected in a chamber from which the earthy products of the combustion of mineral fuel are excluded, the oxide is not soiled by admixture with earthy matter.

The oxidizing-chamber should be formed of a material that will withstand the heat, the part which is in the furnace having been constructed by me of fire-brick material; and it should, if necessary, be lined or coated on its interior with some material that will not melt readily when acted upon by the metallic oxide. When lead is the metal that is oxidized, I have found that it is expedient to line the inside of the part of the oxidizing-chamber which is within the furnace-body with bone-ashes, which may be moistened and rammed in around a wooden former or core, which is subsequently withdrawn.

As before stated, the apparatus used for practicing my said process may be varied. Thus, for example, if natural gas or other heating-gas can be had at a lower cost for the purpose than coal, the oxidizing-furnace above described may be heated with gas, instead of with coal, by using gas-burners of the usual construction instead of grates; or the gas may be burned in the oxidizing-chamber. A section of an oxidizing-furnace heated on the latter plan by natural gas is represented at Fig. 5. In this case the oxidizing-chamber A is fitted with burners *c*, through which natural gas is introduced, these gas-burners being of the construction of the well-known Bunsen burner, so that the gas is mixed with air. The action of the Bunsen burners introduces an excess of air and creates a strong draft upward through the oxidizing-chamber, and whatever additional air may be required to thoroughly oxidize the metal is admitted through one or more orifices beneath the gas-burners, a forced current being introduced if a current strong enough to make the operation practically successful is not obtained by draft. The gas-burners must be of sufficient capacity to heat the oxidizing-chamber and the current of air passing through the same to the requisite temperature for the rapid oxidation of the metal. The pulverulent oxide produced in the gas-furnace is carried out of the chamber with the current of air, and is collected in the dust-collector, as previously described with reference to the oxidizing-furnace first described in this specification. This modification of my process and the apparatus shown for carrying the same into effect are not herein specifically claimed, as they form the basis of another application filed August 12, 1887, Serial No. 246,746.

I claim as my invention—

1. The process, substantially as before set forth, of manufacturing an oxide of a metal, which consists in exposing the metal in a comminuted condition to the action of an inclosed current of air heated to a temperature sufficient to burn the metal without contact with any other substance.

2. The process, substantially as before set forth, of manufacturing the oxide of a metal, which consists, first, in exposing the metal in a finely-comminuted condition and in a descending shower to an inclosed current of air heated to a temperature sufficient to burn the metal, and, second, in collecting the dust oxide from said current.

In witness whereof I have hereto set my hand this 17th day of February, A. D. 1887.

ARTHUR CROSSMAN BRADLEY.

Witnesses:
WALTER STABLER,
JAS. E. WARNER.