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METHOD OF MANUFACTURING SUBLIMED WHITE LEAD.

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920,332.

Patented May 4, 1909.

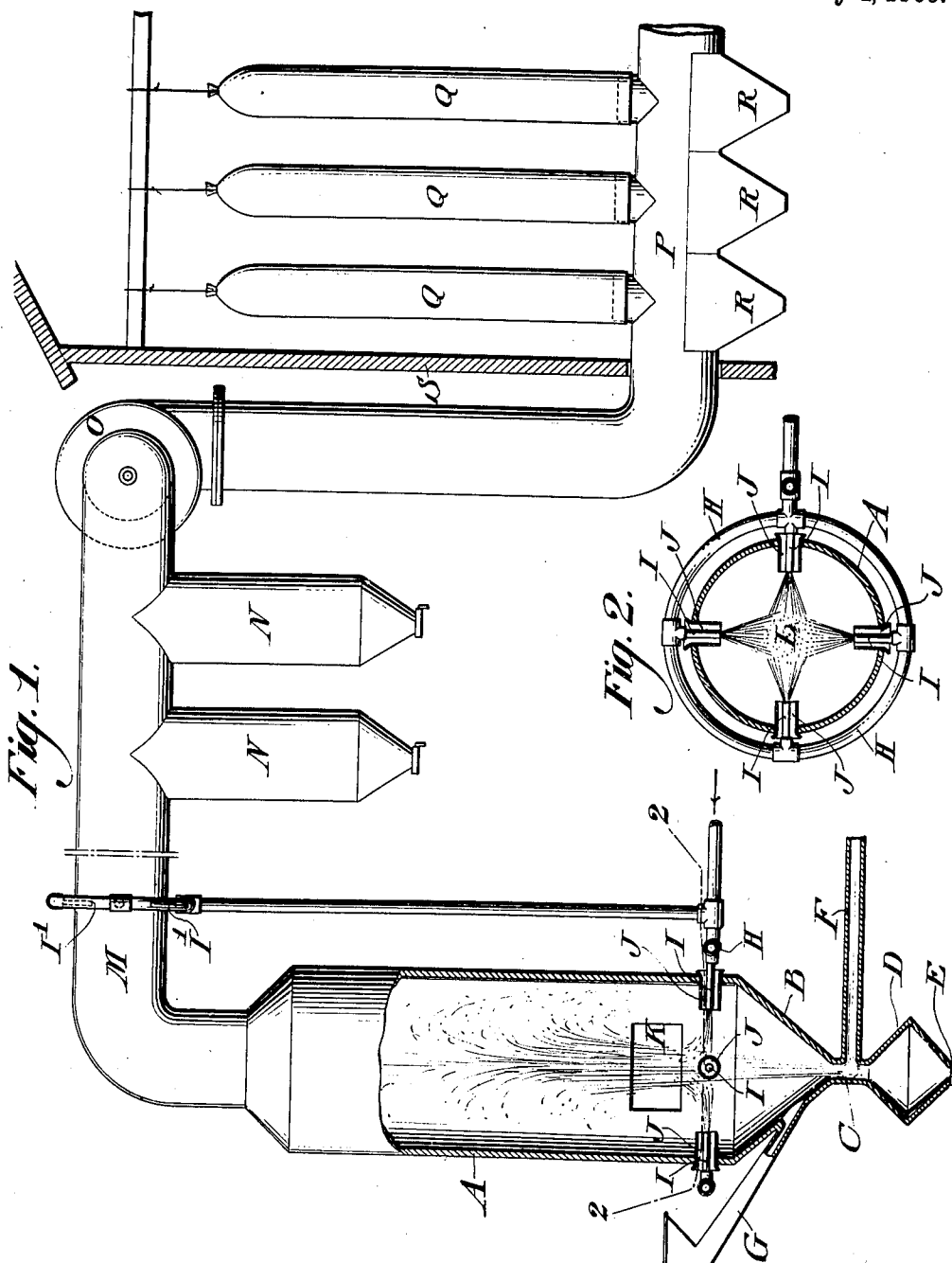


Fig. 1.

Fig. 2.

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METHOD OF MANUFACTURING SUBLIMED WHITE LEAD.

No. 920,332.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, LOUIS S. HUGHES, a citizen of the United States of America, residing in Joplin, in the county of Jasper, in the State of Missouri, have invented a certain new and useful Improvement in Methods of Manufacturing Sublimed White Lead, of which the following is a true and exact description, reference being had to the accompanying drawings, which form a part thereof.

My invention relates to the manufacture of the white pigment known as sublimed white lead and consisting chiefly of lead sulfate from ores or compounds consisting largely of lead sulfid.

The objects of my invention are to obtain the maximum production of sublimed white lead from the ore treated at low cost and with a minimum admixture with harmful impurities.

While many processes have heretofore been described and patented for the manufacture of sublimed white lead most of them have proved commercially impracticable for various reasons and the only process which, so far as I know, is in practical operation is carried on in substantial accordance with the specification of Patent 492,832 to Petrus, involving the use of a low cupola furnace using coke for fuel, the greater part of the charge of the furnace consisting of gray slag, fumes and dust from an open hearth furnace in which galena is first treated, a minor part of the charge consisting of pulverized galena blown, or otherwise charged, into or over the fires in the furnace; the product of the furnace being in part sublimed white lead and in part metallic lead. Various attempts have been made for the direct production of sublimed white lead from galena by burning it in admixture with air in various forms of apparatus and conditions of combustion, but, so far as I am aware, no plant of this kind has been tried or suggested which is in fact capable of successful commercial use. I have discovered that lead sulfid ores such as galena can have their lead contents directly converted into sublimed white lead, mainly consisting of lead sulfate, under practical operative conditions and so as to give a satisfactory commercial product by dividing the ore into comparatively fine particles, mixing it with an excess of air, igniting the mixture of air and ore and maintaining the combus-

tion thereof at a temperature below that at which fusion of the ore particles will take place, separation of the unburned particles being effected by subsidence and a separation of produced lead sulfate or sublimed white lead being effected in the usual way, as by means of screens, and this discovery or invention, as applied in practice, constitutes the main feature of my invention.

It is highly important in the practice of my invention that the combustion of the mixed ore and air should take place under conditions which will prevent the reduction of the ore which will always occur to a greater or less extent when reducing agents and conditions are present; and it is also highly important for the best economical and practical results that the combustion of the ore should take place in an atmosphere as energetically oxidizing as possible, that is to say, one contaminated as little as possible by inert products of combustion. It is also important in the treatment of most ores, that is to say, those containing iron sulfid in addition to the lead sulfid, that the temperature of the furnace and of the burning ore therein should be maintained below the point at which the iron sulfid would ignite because the oxid of iron produced by its combustion would be of such specific gravity and fineness of division that it would pass from the furnace with the fumes of lead sulfate and injuriously contaminate and discolor such sulfate. This contamination I prevent, not only by keeping the temperature of the burning ore below that at which the iron sulfid would naturally ignite and burn, but also by avoiding too fine a comminution of the ore, my practice being to pulverize the ore to such a degree that it would pass through a screen of approximately sixty mesh, with which material and the temperatures I find it convenient to employ the particles of iron sulfid so large that they are not ignited and burned but separated unaltered from the lead sulfate fume by subsidence.

A further description of my invention will be best made in connection with the drawings of an apparatus adapted for its practice and shown in the drawings forming part of this specification, in which—

Figure 1 is a diagrammatic sectional elevation of such an apparatus, and Fig. 2, a cross-sectional view on the line 2—2 of Fig. 1.

A, is the furnace or flue in which the combustion of the ore takes place; it is formed with a conical or hopper bottom indicated at B, opening into a conduit C, which terminates in a chamber D, having a gate E, which can be opened at times to remove the accumulated unburned particles or residue of the process.

F, is an air blast pipe entering the conduit C; G, is an ore chute through which pulverized ore is fed to the furnace.

H is a gas pipe from which extend a number of gas burners I, which project through the walls of the furnace A, and are surrounded by air pipes J, also extending into the furnace and through which air is forced or drawn to mix with the gas and form in the center of the furnace a sheet of flame which should be essentially non-reducing in its character, the air being supplied in excess of that necessary for complete combustion. It is highly desirable that the flames should not come in contact with the walls of the furnace, but should form, as shown in Fig. 2, a flame area or zone in the furnace immediately above the conduit C, through which the air is projected upward in admixture with the finely divided ore fed into the furnace. The fumes and products of combustion escape from the top of the furnace through the flues M, in which are situated hoppers, as indicated at N, N, adapted to receive any heavy impurities which may settle by subsidence, the fumes and gases being drawn through the flue by an exhaust fan O, and forced into the flue P, to the upper part of which are attached screen bags, as indicated at Q, Q, and to the lower part of which are attached hoppers, such as indicated at R, for receiving the sublimed white lead, the gaseous products of combustion escaping through the screen bags.

The furnace chamber A, as I have constructed and practically applied it, is made of sheet iron entirely without lining or packing of refractory material, nor have I found it necessary to apply water jackets to any part of it. This construction of the furnace chamber not only maintains the walls of the furnace at so low a temperature that the ore will not fuse and stick to it, but also lowers the temperature of the burning ore below the point at which the ore will fuse and below the point at which combined particles of iron sulfid will ignite and burn. The essential feature of construction is that the furnace should be of such a character or provided with such means as to provide for the maintenance of combustion therein at temperatures below that at which fusion of the ore and combustion of the iron sulfid would take place. This of course could be secured in many ways, but I have found the simple construction illustrated to be sufficient and effective.

In practice gas and air entering through the burner pipes I and J are ignited, forming the central zone L of non-reducing flame, the function of this flame zone being essentially that of an igniter of the highly combustible intimate mixture of air and ore. The air blast is turned on through the pipe F, and projected vertically upward from the bottom of the conical bottom of the furnace toward the flame zone and the ore is fed into the furnace in pulverized form through the ore chute G, or in any convenient way. I have successfully fed it above the flame zone as well as below it. Precaution must be taken that the air supplied to the furnace should be materially in excess of that necessary for the full combustion of the lead sulfid in the ore as the intimately mixed ore and air ignited in the flame zone burn with great freedom and with the ebullition of very considerable heat in the upper parts of the furnace, the heat generated by the combustion of the ore being more than sufficient to insure the fusion of the ore and the ignition of the iron sulfid which may be in admixture with it if means were not taken for lowering the temperature which is done, as I have already stated, by conducting away a large portion of the heat generated preferably and most simply by the use of the unjacketed, unprotected sheet iron furnace exposed to the air on all sides.

The energy of the air blast aided by the suction of the fan should be regulated so that the effective current in the upper part of the furnace shall be insufficient to carry the larger particles of unburned ore into the flue leading from the furnace, the effect of which is that such larger particles have a tendency to fall downward and are again and again caught and carried upward by the ascending air blast until all lead sulfid contained therein is burned out. The similar larger particles of iron sulfid move up and down in the furnace chamber without being substantially affected, and such particles of impurities as may escape into the flue are separated from the gases and lead fume by subsidence and are caught in properly situated chambers or hoppers such as those indicated at N, so that practically nothing reaches the flue P except the fumes of sublimed white lead and the gaseous products of combustion.

In the operation of my apparatus and process, as the unburned constituents of the ore accumulate in the furnace I from time to time stop the operation thereof permitting the unburned particles to fall through the hopper bottom of the furnace and the conduit C, into the receiving chamber D, from which they are removed through the gate E. The particles are unfused, dry and ash like in character and can be removed from

the furnace and the furnace again put in operation in a very short interval of time and without materially affecting the practically continuous operation of the furnace.

5 As I have already described, the chief function of the flame zone formed in the lower part of the furnace is the ignition of highly combustible masses of pulverized ore and air. The provision of this or some other
10 igniter is of course absolutely necessary at the beginning of the operation and it is advisable to maintain this flame zone during the operation of the furnace although doubtless after the ore and air mixture is once
15 thoroughly ignited it would in itself afford a perfect igniter for the fresh ore and air, but by maintaining the igniting zone in the lower part of the furnace I insure complete
20 ignition at all points above that zone and the flame zone is of such inconsiderable extent that it does not harmfully contaminate the mixture of ore and air with inert products of combustion. It is obviously desirable
25 that the flame zone should be not only of such a character as to be essentially non-reducing but also of such a character as to produce the minimum amount of inert products of combustion.

It may at times be advisable or even necessary to supply an additional flame or heat zone to insure the complete combustion of the lead sulfid. I have indicated in Fig. 1
30 burner pipes I', J', entering the flue M, and forming a heat zone through which the fumes and gases passing from the furnace A pass, but my belief, founded on experience,
35 is that practically complete combustion of the lead sulfid can under proper precautions be secured in a single furnace such as A.

40 The apparatus shown in the drawings and hereinabove described embodies features of novelty and will be covered in an additional application, my present application being
45 confined entirely to the method or process of treating the ore and the drawings being simply for the purpose of illustrating an apparatus well adapted for the purpose of the process but in no wise essential thereto since
50 the invention can be carried out in various forms of apparatus.

Having now described my invention, what I claim as new and desire to secure by Letters Patent is,

1. The process of treating ores or compounds containing lead sulfid for the production of sublimed white lead, a product
55 consisting chiefly of lead sulfate, without the production of metal, slag, or other fused or liquid product, which consists in finely dividing the ore or compound, mixing it with
60 air, igniting the mixture of air and ore particles, maintaining its combustion at temperatures below those at which the ore particles will fuse, separating the unburned particles
65 of ore from the gases and lead sulfate fume

by subsidence and separating the lead sulfate from the gases.

2. The process of treating ores or compounds containing lead sulfid for the production of sublimed white lead, a product
70 consisting chiefly of lead sulfate, without the production of metal, slag, or other fused or liquid products, which consists in finely dividing the ore or compound, mixing it
75 with air in excess of that necessary for the combustion of the lead sulfid, igniting the mixture of air and ore particles, maintaining its combustion at temperatures below those
80 at which the ore particles will fuse, separating the unburned particles of ore from the gases and lead sulfate fume by subsidence and separating the lead sulfate from the
85 gases.

3. The process of treating ores or compounds containing lead sulfid and iron sulfid
85 for the production of sublimed white lead, a product consisting chiefly of lead sulfate, without the production of metal, slag, or other fused or liquid products, and without
90 oxidizing the iron sulfid, which consists in finely dividing the ore or compound, mixing it with air in excess of that necessary for the combustion of the lead sulfid, igniting
95 the mixture of air and ore particles, maintaining its combustion at temperatures below those at which the ore particles will fuse or the iron sulfid oxidize, separating the unburned
100 particles of ore from the gases and lead sulfate fume by subsidence and separating the lead sulfate from the gases.

4. The process of treating ores or compounds containing lead sulfid for the production of sublimed white lead consisting
105 chiefly of lead sulfate without the production of metal, slag, or other fused or liquid products which consists in finely dividing the compound, passing the finely divided ore in intimate mixture with air in excess of
110 that necessary for the complete combustion of the lead sulfid through an igniting zone of non-reducing flame to ignite the lead sulfid, maintaining combustion of the ore at
115 temperatures which will prevent fusion thereof, separating unburned particles of the ore from the gases and lead sulfate fume by subsidence and finally separating the lead
120 sulfate from the gases.

5. The process of treating ores or compounds containing lead sulfid for the production of sublimed white lead consisting chiefly
125 of lead sulfate, without the production of metal, slag, or other fused or liquid product which consists in finely dividing the compound, passing the finely divided ore in intimate mixture with air in excess of that necessary
130 for the complete combustion of the lead sulfid through an igniting zone of non-reducing flame to ignite the lead sulfid, maintaining combustion of the ore at temperatures which will prevent fusion thereof,

4
 5 separating unburned particles of the ore from the gases and lead sulfate fume by subsidence, returning such unburned particles in admixture with air to the igniting zone until all lead sulfid is oxidized and finally separating the lead sulfate from the gases.

6. The process of treating ores or compounds containing lead sulfid for the production of sublimed white lead, a product consisting chiefly of lead sulfate without the production of metal, slag, or other fused or liquid product, which consists in finely dividing the ore or compound, mixing it with air in excess of that necessary for the combustion of the lead sulfid, forcing the mixed air and ore into a furnace having a zone of non-reducing flame of small volume and adapted to ignite the mixture without in itself imparting material heat to the furnace or materially diluting the mixture with inert products of combustion, maintaining the combustion of the mixed ore and air at temperatures below that at which the ore particles fuse, separating the unburned ore particles from the lead sulfate and gases by subsidence and finally separating the lead sulfid from the gases.

7. The process of treating ores or compounds containing lead sulfid and iron sulfid for the production of sublimed white lead, a product consisting chiefly of lead sulfate, without the production of metal, slag, or other fused or liquid product and without oxidizing the iron sulfid which consists in finely dividing the ore or compound without producing any material amount of pulverulent iron sulfid, mixing it with air in excess of that necessary for the combustion of the lead sulfid, igniting the mixture of air and ore particles, maintaining its combustion at temperatures below those at which the ore particles will fuse or the iron sulfid oxidize, separating the unburned particles of ore from the gases and lead sulfate fume by

subsidence and separating the lead sulfate from the gases. 45

8. The process of treating ores or compounds containing lead sulfid for the production of sublimed white lead, a product consisting chiefly of lead sulfate, without the production of metal, slag, or other fused or liquid products which consists in finely dividing the ore or compound, mixing it with air, igniting the mixture of air and ore particles, maintaining its combustion at temperatures below those at which the ore particles will fuse by carrying off the heat in the combustion chamber by conduction, separating the unburned particles of ore from the gases and lead sulfate fume by subsidence and separating the lead sulfate from the gases. 50 55 60

9. The process of treating ores or compounds containing lead sulfid for the production of sublimed white lead, a product consisting chiefly of lead sulfate, without the production of metal, slag, or other fused or liquid products, which consists in finely dividing the ore or compound, mixing it with air in excess of that necessary for the combustion of the lead sulfid, forcing the mixed air and ore into a furnace having a zone of non-reducing flame of small volume and adapted to ignite the mixture without in itself imparting material heat to the furnace or materially diluting the mixture with inert products of combustion, maintaining the combustion of the mixed ore and air at temperatures below those at which the ore particles fuse by carrying off the heat of the furnace by conduction, separating the unburned ore particles from the lead sulfate and gases by subsidence and finally separating the lead sulfate from the gases. 65 70 75 80

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Witnesses:

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 JERE. CHARLOW.