

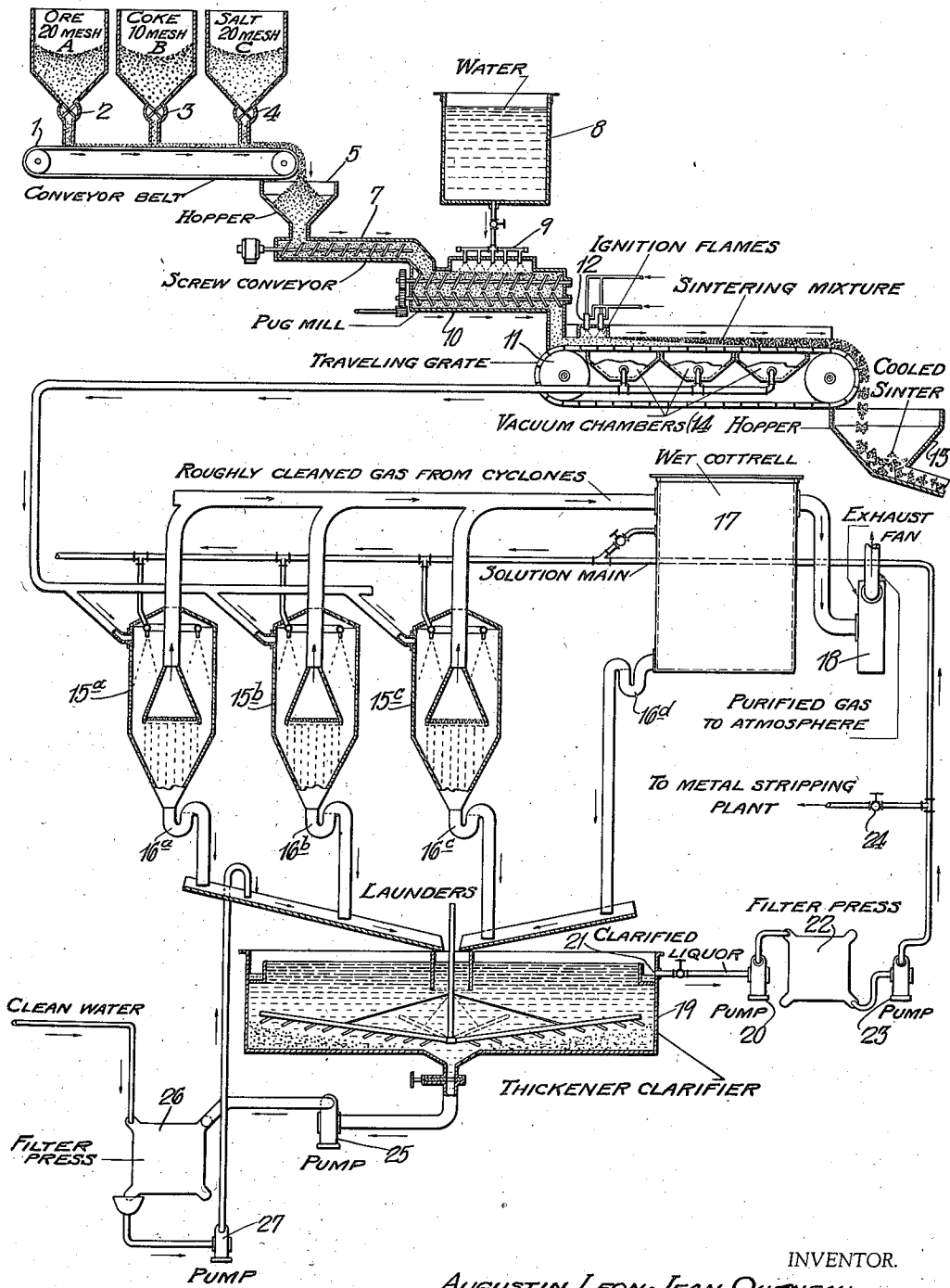
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METHOD AND APPARATUS FOR RECOVERING VAPORIZED METAL COMPOUNDS

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METHOD AND APPARATUS FOR RECOVER-
ING VAPORIZED METAL COMPOUNDS

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5 Claims. (Cl. 75—113)

This invention relates to methods of treating ores, residues and the like to recover therefrom the valuable constituents thereof. More particularly this invention is an improvement of the inventions described and claimed in my Patent No. 1,999,209 issued April 30, 1935 and my application Serial No. 756,660, filed December 8, 1934 for an improvement thereon.

In the said patent and copending application above identified I have disclosed and claimed an improved method of sintering and blast chloridizing oxidized zinc ores, in which the said ore is admixed with carbon, a chloridizing agent and water in suitable proportions and is subjected to blast sintering at temperatures above about 1000° C. As a resultant substantially all associated metal and metalloid impurities in the ore except the zinc is chloridized and vaporized therefrom. The remaining zinc content of the ore is substantially pure and adapted for subsequent reduction by pyrometallurgical methods to high grade zinc or to conversion into other high grade zinc products.

The present invention is an improvement of the method described and claimed in said above identified patent and application and relates to and its object is to provide a method and means for recovering the vaporized products, the said means also effectively improving the functioning of the chloridizing and blast sintering operation. Another object is to provide a method and means for recovering the cadmium content of the vaporized products substantially free from associated metallic impurities. Other objects and advantages will be apparent as the invention is more fully disclosed.

In connection with the following description of the present invention reference should be made to the accompanying drawing wherein in a single figure the apparatus involved in the present invention is schematically illustrated.

Referring to the drawing, I have reproduced in the upper half of the figure the apparatus disclosed in my above identified application, together with appropriate identification indicia. Briefly stated, the ore, carbon (coke) and chloridizing agent (salt, NaCl) are each stored separately in bins A, B, and C respectively. As indicated these materials are preferably of 20, 10, and 20 mesh respectively.

These materials are fed through valves 2, 3, and 4 respectively upon traveling conveyor belt 1, in the relative proportions desired for the practice of the blast chloridizing operation.

Conveyor belt 1 feeds these materials into hop-

per 5 which in turn delivers the materials to screw conveyor 7. Screw conveyor 7 feeds the material at a determined rate into pug mill 10. The material in pug mill 10 is mixed with a determined percentage of water from tank 8 through nozzles 9. In pug mill 10 the mixture of ore, coke and salt is rendered intimate and sufficient water is incorporated therewith to render the mixture suitable for blast sintering.

From pug mill 10 the mixture of materials and water is fed onto the traveling grate of sintering machine 11 in a bed of desired thickness and the surface of the bed is ignited by burners 12. The ignited area is carried by means of an air blast drawn through the bed, downwardly towards the traveling grate as the bed travels from left to right. The darkened areas in the bed indicate the progress of such ignited area. As the bed reaches the end of the sintering machine 11 it is completely sintered and falls from the grate into hopper 13.

During the blast sintering operation the chloridizing agent (salt) is vaporized and it and the oxygen of the air blast react with the associated metal and metalloid impurities in the ore forming volatile compounds thereof, which are drawn off in vacuum chambers 14 disposed below the traveling grate of sintering machine 11.

Heretofore in the art it has been customary to employ an exhaust fan to create the necessary vacuum in chambers 14 and to expel the vaporized material entering chambers 14 through the fan into apparatus suitable to separate said material from the air before passing the air to the atmosphere. The material thus vaporized is hygroscopic in nature, and with the large amounts of water vapor carried by the evacuated gases forms a highly corrosive substance which rapidly destroys the fan blades and associated apparatus. Moreover, there is a relatively large amount of finely divided solid material carried along with the gases which serve to abrade the said fan blades and associated apparatus and thus accentuate the corrosion of the same. In addition the temperature of the gases and of the vaporized materials is relatively high thereby requiring the expenditure of more power in exhausting the same.

These difficulties have led me to devise a method and means to eliminate the vaporized materials from the exhaust gases and to lower the temperature of the said gases before entering the fan, the said method providing means to segregate from the said vaporized materials the cadmium content thereof.

I accomplish this in the following manner:

The exhaust gases from vacuum chambers 14 of sintering machine 11 are passed first into one or more wet cyclones 15 (a, b, c) wherein the gases are roughly cleaned and freed from fumes, dust particles, moisture and the like in a manner heretofore practiced in the art. Cyclones 15 (a, b, and c) are comprised of corrosion resistant materials at least interiorly, and are each provided with syphon water seals 16 (a, b, c) to continuously remove the separated materials therefrom.

From cyclones 15 (a, b, c) the gases pass into a wet Cottrell precipitator device 17 wherein the remaining vaporized and volatilized materials and acidic gases are removed therefrom. The thus cleaned gases which have in passing through cyclones 15 (a, b, and c) and Cottrell 17 been cooled to approximate atmospheric temperatures then pass through fan 18 to the atmosphere. Alternatively absorption towers may be used in place of precipitator device 17.

The solution employed in gas cleaning means 15 and 17 may comprise water or other suitable solvents. It may be desirable, for example, to provide a solution having a solvent or an acid or alkali neutralizing reaction towards the thus separated constituents of the gas stream.

By thus placing the fan 18 at the tail end of the gas cleaning means 15 and 17 I effectively reduce the volume of gas to be handled thereby and by removing from the gases the vaporized materials (solid and gaseous) before reaching the fan 18, the operating life of the fan 18 is immeasurably prolonged.

Cyclones 15 (a, b, and c) and wet Cottrell precipitator 17 separate out from the evacuated gases all of the vaporized constituents from the sintering mixture which are contained in the said gases. In the main these constituents are cadmium, lead and silver compounds together with a relatively small amount of zinc and gaseous sulphur oxide and hydrochloric acid compounds. The metallic constituents are present as chlorides, oxides and sulphates. Some of these compounds are water soluble. The lead is generally present as lead sulphate, insoluble in water and as lead chloride slightly soluble in water.

When these materials are separated in the cyclones 15 (a, b, c) and wet Cottrell separator 17 the water employed in these devices dissolves the soluble salts: cadmium chloride, zinc chloride, etc. I therefore feed the sludge discharged through syphon water seals 16 (a, b, c, and d) into a thickener clarifier device 19 and provide pump means 20 to withdraw the clarified liquor passing over the weir 21 of the clarifier and to feed the same to a filter press 22 and from thence to a pump 23 which returns the clarified liquor to the cyclones 15 (a, b, and c) and Cottrell precipitator 17 thus completing a closed circuit whereby the cadmium chloride content of the solution may be increased to a desired maximum.

I provide means 24 to continuously bleed from this return circuit a sufficient desired amount of the clarified cadmium chloride containing liquor for distribution to a metal stripping plant.

I also provide continuous means 25 to continuously withdraw from the clarifier 19 the sludge falling to the bottom thereof and to pass the same to a filter press 26 wherein the cadmium chloride containing solution is extracted and returned by pump 27 to the circuit substantially as indicated. Clean water is continuously supplied to the circuit to replace that withdrawn by

means 24 and is utilized in filter press 26 to wash the filter sludge material therein. The wash water is carried by means 27 to the circuit substantially as indicated.

As a specific embodiment of the present invention, and to indicate the operation of the same, it is usual in forming the sintering mixture to incorporate therewith about 12 to 13% of water which approximates from 250 to 270 pounds of water per ton of ore treated. The whole of this water during the sintering operation is converted into water vapor and passes into the gases evacuated by exhaust fan 18. The temperature of these gases is relatively high as the temperature of the sintering mixture is maintained above about 1000° C. and approximately about 1400° C.

As described in my copending application above identified it is preferable to comprise the oxidized zinc ore which is being sintered of ore carrying relatively large amounts of zinc and relatively small amounts of cadmium, lead and other associated metallic impurities. For effective continuous operation it is preferable to standardize the ore composition. In the standardized ore composition indicated in my said copending application the cadmium and lead content approximate up to .50% and 1.50% respectively. For the purposes of the present invention the lead content may be disregarded as most if not all of the lead will appear in the exhaust gases in the form of insoluble lead sulphate. The cadmium content, however, appears mainly as water soluble chloride or sulphate compounds as does also the small amount of zinc that is carried away from the ore charge in the gases. The cadmium content of the charge on the zinc sintering machine is in most instances well below .50%. It is seldom that zinc in excess of .50% will be vaporized. Thus the total amount of cadmium and zinc in the exhaust gases will approximate about 20 pounds per ton of sintering mixture and figuring these metals as combined with chlorine the total weight of zinc and cadmium chloride will approximate 37 pounds.

Hence it may be seen that if all of the water present in the ore charge (250 to 270 pounds) was to be condensed the 37 pounds of zinc and cadmium chlorides would readily dissolve therein and given a concentration of about 14 to 15% it is apparent therefore that the total amount of solution to be maintained in the circuit for the sprays supplying water to the cyclones 15 (a, b, c) and wet Cottrell 17 should be closely controlled in amount and that no more additional water should be introduced into the circuit as by wash water in filter press 26 than is absolutely necessary to replace that drawn off at 24 for the metal stripping plant.

In continuous operation the closed circuit shown is maintained, without bleeding at 24, until the cadmium chloride content of the solution approximates a desired maximum for efficient separation in the metal stripping plant.

It is apparent from the above description of the present invention that many modifications and adaptations can be made therein without departing from the nature and scope thereof, and such modifications and adaptations are contemplated as may fall within the scope of the accompanying claims:

What I claim is:

1. The method of treating gases evolved in the chloridizing and blast sintering of oxidized zinc ores which comprises drawing said gases from the

sintering machine into a wet cyclone device, thence into a wet precipitator device, thence through an exhaust fan device to the atmosphere.

2. The method of treating gases evolved in the chloridizing and blast sintering of oxidized zinc ores which comprises drawing said gases from the sintering machine into a wet cyclone device, thence into a wet precipitator device, thence through an exhaust fan device to the atmosphere, clarifying the solution obtained from said cyclone device and said precipitator device and returning the clarified liquor to the said devices.

3. The method of treating gases evolved in the chloridizing and blast sintering of oxidized zinc ores which comprises drawing said gases from the sintering machine into a wet cyclone device, thence into a wet precipitator device, thence through an exhaust fan device to the atmosphere, clarifying the solution obtained from said cyclone device and said precipitator device and returning the clarified liquor to the said devices and withdrawing a portion of the clarified solution for treatment to recover the values contained therein, replacing in the circuit sufficient water to maintain the volume of said solution substantially constant.

4. In combination a sintering machine including a traveling grate, vacuum chambers and means to continuously pass said grate over said chambers, means to evacuate said chambers and means interposed between said chambers and said evacuating means to pass the evacuated gases from said chambers through at least one wet cyclone device adapted to separate from said gases any solid materials carried by said gases and to condense therefrom the bulk of the water vapor content thereof, and thence to pass said gases through a wet precipitator device adapted to separate therefrom substantially all remaining gases and vapors except the normal constituents

of air, means to continuously withdraw from the said cyclone device and the said precipitator device the said separated products, means to clarify the solution thus separated, means to filter the said clarified solution and to return the thus filtered solution to the said cyclone and precipitator device, means to separate the insoluble materials from the clarified solution, means to filter and wash the same and means to return the solution thereby obtained to the said circuit.

5. In combination a sintering machine including a traveling grate, vacuum chambers and means to continuously pass said grate over said chambers, means to evacuate said chambers and means interposed between said chambers and said evacuating means to pass the evacuated gases from said chambers through at least one wet cyclone device adapted to separate from said gases any solid materials carried by said gases and to condense therefrom the bulk of the water vapor content thereof, and thence to pass said gases through a wet precipitator device adapted to separate therefrom substantially all remaining gases and vapors except the normal constituents of air, means to continuously withdraw from the said cyclone device and the said precipitator device the said separated products, means to clarify the solution thus separated, means to filter the said clarified solution and to return the thus filtered solution to the said cyclone and precipitator device, means to separate the insoluble materials from the clarified solution, means to filter and wash the same and means to return the solution thereby obtained to the said circuit and means to withdraw from the filtered solution returning to the said devices portions thereof for the separation therefrom of the dissolved values contained therein.

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