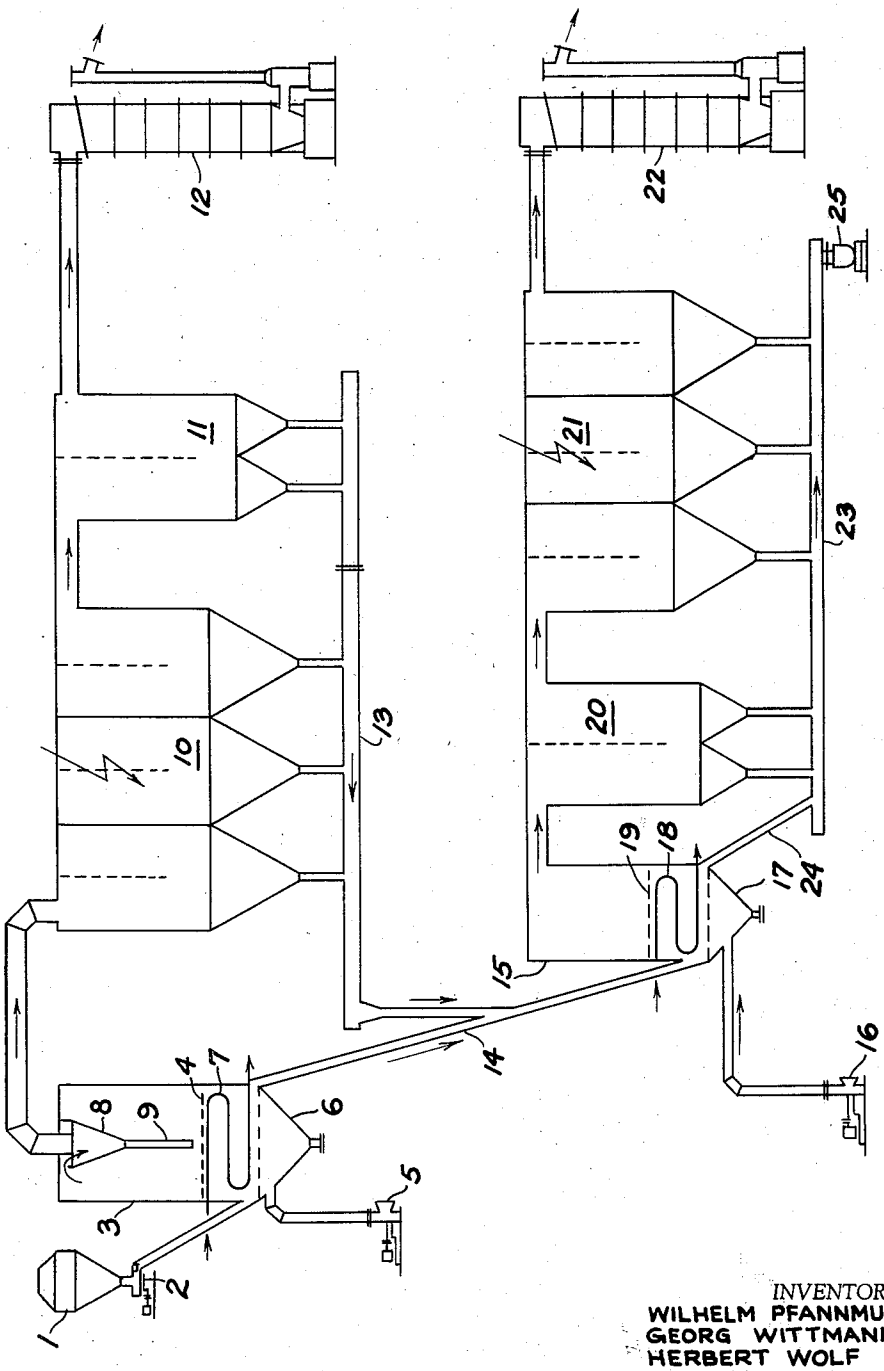
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PRODUCTION OF GASES CONTAINING SULFUR DIOXIDE

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PRODUCTION OF GASES CONTAINING SULFUR DIOXIDE

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This invention relates to a process for the production of gases containing sulfur dioxide from materials containing roastable sulfur in addition to at least one of the elements arsenic and antimony with the recovery of roasted residues practically free from arsenic and antimony by stepwise roasting said materials in fluidized layers, wherein the oxygen necessary for roasting is supplied separately to the individual fluidized layers and the roaster gas formed in the first of said layers is withdrawn separately from the roaster gas formed in the following one or more layers.

For the production of roaster gases which are required for the production of sulfuric acid or for the production of bisulfite liquor, by the combustion of sulfidic materials, in particular ores containing roastable sulfur, as pyrites, the fluidized layer method is being increasingly used; it offers technical advantages and reduced costs for the roasting as compared with the hitherto conventional roasting in rotary tube ovens, shelf ovens and the like.

It is found that the working up of the cinders obtained by roasting ores containing nonferrous metals, for example pyrites or copper pyrites, according to the fluidized layer method, for the purpose of recovering the nonferrous metals, if desired after chloridizing or sulfating roasting of the roasted ores, renders possible yields equally as good as are obtained by working up roasted ores from the older roasting systems. On the contrary when roasting sulfidic ores containing arsenic and/or antimony by the fluidized layer method, a large part of the arsenic or antimony remains bound in the roasted ore and is not removed to the desired extent even by the subsequent chloridizing or sulfating roasting and leaching from the so-called purple ore. In the smelting of the purple ore which is practically free from nonferrous metal but which still contains arsenic or antimony, it is therefore necessary to incorporate with the purple ore, iron ore free from arsenic or antimony. For this reason it is of special economic interest to carry out the fluidized layer method for the roasting of sulfidic ores, in particular pyrites, which contain arsenic or antimony, in such a way, by special measures, that roasted ores which are practically free from arsenic and antimony are obtained.

It is already known that by roasting of arsenopyrites by the fluidized layer method it is possible to obtain a roasted ore which is suitable for leaching with cyanides for the purpose of recovering gold, provided the roasting is carried out in a single fluidized layer in such a manner that the oxygen content of the gas introduced into the fluidized layer is not sufficient to oxidize the iron in the arsenopyrites to ferric oxide but on the other hand is sufficient to convert the whole of the sulfur into sulfur dioxide, the arsenic into arsenic trioxide and the iron into ferroso-ferric oxide according to the equation:

$$6FeAsS+14.5O_2=2Fe_3O_4+3As_2O_3+6SO_2$$

The maintenance of this condition is scarcely realizable in technical operation because even with small variations in the amount or composition of the arsenopyrites supplied results either in too little oxygen being available for the thorough roasting, whereby incompletely roasted ore passes into the roasted ore, or in too much oxygen being present, whereby the oxidation proceeds to ferric oxide and the volatility of the arsenic is consequently prevented.

A fluidized layer roasting method is also known in which arsenopyrites containing gold and with a content of 13 to 22% of iron, 14 to 19% of sulfur and 2 to 15% of arsenic is thoroughly roasted in two stages in such a way that the roaster gases obtained in the after-roasting stage is used for roasting the arsenopyrites in the preliminary-roasting stage. For this purpose such an amount of gas containing free oxygen is supplied to the after-roasting stage that in said stage all oxidizable substances are oxidized and moreover about 50% of the theoretical oxygen requirement remains for the preliminary roasting stage. Between the after-roasting stage and the preliminary roasting stage there is provided on the gas side a cyclone which is for the purpose of separating the dust carried out from the after-roasting stage. In the preliminary roasting stage, up to 94% of the arsenic introduced is driven off as vapor at 550° C. The residence time of the arsenopyrites in the two fluidized layers necessary for the complete roasting amounts to 18 hours. Apart from the fact that the coupled gas supply is attended by a series of technical difficulties, it is not possible by this process to obtain, for example from pyrites with sulfur contents of more than 30% and arsenic contents up to 2%, any roasted ores which are substantially freed from arsenic.

According to a similar proposal, pyrites, for the purpose of producing roaster gases free from sulfur trioxide, have been roasted in a fluidized layer in such a way that there are obtained a gas containing sulfur and sulfur dioxide and a roasted ore having at least 2 percent by weight of sulfidic sulfur which is finally roasted in a second fluidized layer. The roaster gas thereby formed is led back into the first fluidized layer.

It has also been proposed to drive out from pyrites the polysulfidic sulfur as such by means of hot roaster gases free from oxygen at about 400° C. and not to burn them until they reach the gas space, while the solid reaction product consisting practically of ferrous sulfide is subjected to a subsequent roasting in a second stage. Also in this method of operation there is no removal of arsenic.

A variant of this process, which is no less unsuitable for the solution of the present problem, consists in expelling the polysulfidic sulfur of the pyrites in a distillation zone while partly oxidizing the same and burning it outside this zone to sulfur dioxide, then supplying the sulfur dioxide together with the solid distillation residue consisting substantially of ferrous sulfide to a roasting zone in which the said residue is oxidized to iron oxide up to a small residual amount.

By the abovementioned supply of the roaster gas produced in one stage into a second stage, arsenic trioxide is entrained into this stage by the roaster gas and oxidized by the oxygen present therein in excess to arsenic pentoxide which is bound by the ferric oxide formed in this stage.

When supplying the roaster gas from the after-roasting stage to the preliminary roasting stage it is also impossible, in spite of intermediate removal of dust from the gas by a cyclone, to avoid dust particles consisting of ferric oxide from passing into the preliminary roasting stage where they prevent a practically complete expulsion of the arsenic.

The supply of the roaster gas formed in one stage into the next stage moreover is attended by technical disadvantages because such a gas supply necessitates a high gas throughput through the fluidized layer and this brings

with it an additional undesirable comminution of the material being roasted, an increased removal of dust from the layer, an increased gas resistance and a fall in the height of the fluidized layer.

We have now found that gases containing sulfur dioxide can be prepared by stepwise roasting of materials containing roastable sulfur as well as arsenic and/or antimony, in particular pyrites, with oxygen or gases containing free oxygen in fluidized layers with the recovery of roasted residues practically free from arsenic and antimony, by supply the oxygen necessary for roasting to the individual fluidized layers for the preliminary roasting and the after-roasting separately as fresh gas, independently of each other, and withdrawing the roaster gas formed in the first fluidized layer separately from the roaster gas formed in the subsequent one or more layers.

To the first fluidized layer serving for the preliminary roasting it is preferable to supply such an amount of oxygen or free oxygen-containing gas, in particular air, that there is obtained roaster gas with about 16 to 20.5% of sulfur dioxide and a solid roasted intermediate product consisting mainly of ferrous sulfide and ferrosoferric oxide of which the content of sulfidic sulfur still amounts to at least 3% and preferably at least 15%. For the after-roasting in the one or more subsequent fluidized layers there may if desired be used an excess of oxygen beyond the amount theoretically necessary, in order to effect practically complete conversion of the sulfide sulfur into sulfur dioxide. By the after-roasting, a sulfur dioxide concentration in the roaster gas of about 8 to 13% can be reached.

The preliminary roasting in the first fluidized layer is carried only to such an extent that the roasted intermediate product contains a small portion of ferrosoferric oxide besides the ferrous sulfide; in this way it is ensured that the whole of the polysulfidic sulfur of the pyrites is converted into sulfur dioxide and no elementary sulfur can occur in the roaster gas and cause trouble in the later gas purification. Moreover it is advantageous to keep the amount of ferrosoferric oxide in the roasted intermediate product inversely proportional to the height of the first fluidized layer. In this way the formation of ferric oxide particles, which considerably impair the volatilization of the arsenic and antimony, is prevented with certainty because in a higher fluidized layer the contact time between gas and solid is correspondingly longer.

The preliminary roasting of pyrites can also be so controlled that a preliminariiy roasted material is obtained which, besides gangue, consists only of ferrous sulfide or of ferrous sulfide and iron disulfide, without elementary sulfur occurring in the roaster gas obtained. For this purpose, when using air as the free oxygen-containing gas, the air and pyrites are supplied to the first fluidized layer in such a ratio that a roaster gas with a content of about 20% by volume of sulfur dioxide is obtained and a preliminarily roasted product is obtained which consists, besides gangue, only of ferrous sulfide or of ferrous sulfide and iron disulfide. It is preferable so to correlate the ratio of free oxygen-containing gas supplied to the pyrites that the content of sulfidic sulfur in the preliminarily roasted material amounts to about 30% or more.

When roasting materials containing arsenic and roastable sulfur, the temperature in the individual fluidized layers is kept at about 600° to 850° C., advantageously about 750° to 800° C. For the roasting of materials containing roastable sulfur and antimony or antimony and arsenic, the temperature in the individual fluidized layers is kept at about 550° to 880° C., and preferably between 750° and 800° C. in the first fluidized layer and between 750° and 880° C. in the following one or more fluidized layers.

At the said temperature of 750° to 800° C. in the first fluidized layer, there takes place also, when roasting materials containing lead, a volatilization of lead which amounts to about 30 to 60% of the lead content of the material being roasted.

The regulation of the temperature in the individual fluidized layers can be effected by members installed within the layers which withdraw the heat which is not required for maintaining the roasting reaction and for covering the losses by radiation. This heat, and also the sensible heat of the products of the roasting, in particular of the roaster gas, can be utilized in known manner, preferably for the production of hot water or steam. The roaster gas leaving the first fluidizde layer, which is practically free from oxygen, can be cooled in a tubular vaporizer of a steam boiler to about 450° to 500° C. before it is supplied to a gas purification plant, for example an electrical gas purification plant. The dust separated by such purification can be introduced together with the roasted intermediate product from the first fluidized layer into the next fluidized layer.

The complete separation of the dust from the gas leaving the first fluidized layer can be facilitated by a cyclone, preferably operated hot. The portion of the dust entrained from the first fluidized layer with the roaster gas, which is precipitated in such a separator arranged before the electrical gas purification, can be wholly or partly returned continuously or discontinuously to the first fluidized layer.

The roaster gases from the individual fluidized layers are purified and further worked up separately from each other or united after their purification and worked up together.

In order to work up the roaster gas obtained in the preliminary roasting stage to sulfur trioxide it is necessary, after the usual purification, to mix it with oxygen or air before or during the contact reaction, in such proportions that the oxygen requirement for the conversion of the sulfur dioxide to sulfur trioxide is met and moreover the reaction is favorably influenced. An addition of oxygen or air is also necessary for the conversion of the roaster gas obtained from the after-roasting of the preliminarily roasted material into sulfur trioxide, after the usual purification.

The process can either be carried out in separate fluidized layer furnaces, or in a single fluidized layer furnace which is subdivided in known manner into individual layer chambers. In some cases it is preferable to subdivide the first fluidized layer in order to avoid any individual grain passing through the fluidized layer too quickly by reason of the statistical distribution of the residence time with the result that its content of arsenic and/or antimony cannot be completely volatilized during the said time. This precaution is only necessary however when it is a question of a fluidized layer through which less than 10 metric tons of pyrites per day are passed, whereas with larger units the effect of the statistical distribution of the residence time is no longer in evidence.

The following examples will further illustrate this invention but the invention is not restricted to these examples.

Example 1

In a two-stage fluidized layer roasting furnace there are continuously supplied to the first fluidized layer per square metre of grate surface and per hour 1600 kilograms of pyrites with a maximum grain size of 6 millimetres and a content of 45.9% of S, 40.5% of Fe, 1.1% of Cu and 0.55% of As. At the same time 1500 normal cubic metres of air per hour per square metre of grate surface are led upwardly into the fluidized layer, the height of the latter thereby being kept at 60 centimetres. A temperature of 780° C. is maintained in the fluidized layer by cooling surfaces. The hot intermediate roasted product of a weight of 860 kilograms and the dust en-

trained from the first fluidized layer with the roaster gases and having a weight of 350 kilograms are together supplied continuously to the second fluidized layer. Leaving the first fluidized layer are 1490 normal cubic metres of roaster gas with 18.9% by volume of SO_2. Free oxygen can no longer be detected in this roaster gas.

Into the second fluidized layer there are introduced, per square metre of grate surface per hour, 2000 normal cubic metres of air and the 1210 kilograms of intermediate roasted product and dust, containing 26.5% of sulfur as well as 53.1% of Fe, 1.44% of Cu and 0.03% of As, obtained hourly from the first fluidized layer are continuously thoroughly roasted. The temperature is kept at 800° C. by indirect cooling. 1800 normal cubic metres of roaster gas with 11.8% by volume of SO_2 and 1.2% by volume of free oxygen are formed. 460 kilograms of dust are entrained with the roaster gas from the second fluidized layer and 680 kilograms of roasted ore are directly withdrawn from the fluidized layer. The dust is separated from the roaster gas and united with the 680 kilograms of roasted ore. After mixing the roasted ore and dust contain 56.5% of Fe, 1.53% of Cu, 0.8% of S and 0.03% of As. The average residence time of the pyrites in the two fluidized layers together amounts to about 1 hour.

Example 2

To a two-stage fluidized layer furnace there are supplied per hour to the first fluidized layer which has a grate surface of 1 square metre, 1800 kilograms of pyrites with a maximum grain size of 6 millimetres and the composition: 46.2% of sulfur, 40.8% of iron, 0.9% of copper and 0.14% of antimony.

At the same time 2050 normal cubic metres of air are led per hour upwardly through the grate into this fluidized layer. The temperature of the layer is kept at 770° C. by cooling. The intermediate roasted product, obtained in the layer in an amount of 880 kilograms and 470 kilograms of dust which are entrained from the layer by the roaster gases are together supplied to a second fluidized layer. By the roasting in the first layer there are formed per hour 2000 normal cubic metres of roaster gas with a content of 18.2% by volume of sulfur dioxide. This roaster gas is free from uncombined oxygen, elementary sulfur and sulfur trioxide.

The 1350 kilograms of intermediate roasted product and dust with 21.9% of sulfur, 54.4% of iron, 1.2% of copper and 0.02% of antimony obtained per hour in the first fluidized layer is thoroughly roasted in the second fluidized layer into which 1980 normal cubic metres of air are introduced per square metre of grate surface per hour. The temperature of the second fluidized layer is kept at 810° C. by indirect cooling. 1830 normal cubic metres of roaster gas with 10.6% by volume of sulfur dioxide and 3.5% by volume of free oxygen are obtained per hour which entrain 515 kilograms of dust, while 780 kilograms of roasted ore are directly withdrawn from the fluidized layer. The dust separated from the roaster gas and the 780 kilograms of roasted ore are united and after mixing contain 56.7% of iron, 1.25% of copper, 0.74% of sulfur and 0.02% of antimony.

Example 3

1850 kilograms of pyrites containing 45.1% of sulfur, 39.8% of iron, 0.70% of copper, 0.10% of antimony and 0.52% of arsenic are continuously supplied per hour to a fluidized layer 0.65 metre in height, at 780° C. and having a grate surface of 1 square metre. 2200 normal cubic metres of air per hour are introduced into the fluidized layer from the bottom. The excess heat is withdrawn from the fluidized layer by cooling and a constant temperature of 780° C. is maintained in the layer. The intermediate roasted product and the entrained dust, which together have a weight of 1380 kilograms, are cooled by a cooling device to 80° C. upon leaving the fluidized layer or the dust removal chamber. Leaving the fluidized layer hourly are 2065 normal cubic metres of roaster gas with 18.0% by volume of sulfur dioxide but not containing free oxygen, sulfur in elementary form or sulfur trioxide.

The roasted product formed in this fluidized layer contains 21.0% of sulfur, 53.2% of iron, 0.94% of copper, 0.017% of antimony and 0.038% of arsenic.

The 1380 kilograms of intermediate roasted product directly withdrawn from the layer and dust separated from the gas space obtained in the said fluidized layer per hour are continuously supplied to a second fluidized layer 0.70 metre in height and kept at 810° C. into which 2000 normal cubic metres of air per hour are introduced upwardly through a grate 1 square metre in area. The temperature of 810° C. is maintained in the layer by cooling. Leaving the layer each hour are 1820 normal cubic metres of roaster gas with a content of 10.5% by volume of sulfur dioxide. The roasted ore directly withdrawn from the fluidized layer and the dust separated from the roaster gases, which together have a weight of 1330 kilograms, contain 0.74% of sulfur, 55.2% of iron, 0.97% of copper, 0.014% of antimony and 0.029% of arsenic.

Example 4

Into the first fluidized layer of a stepwise roasting there are introduced per hour 3.20 metric tons of pyrites with a content of 47% of sulfur and 0.52% of arsenic and having a maximum grain size of 6 millimetres and 2500 normal cubic metres of air per square metre of the grate surface.

The height of the fluidized layer is 0.65 metre. A temperature of 690° C. is maintained in the layer by cooling devices. 2.44 metric tons of preliminarily roasted material and fly dust separated from the roaster gases are obtained per hour. The sulfur content of this product is 30.8%, and the arsenic content is 0.03%. 2490 normal cubic metres per hour of roaster gas with a content of 20.5% by volume of sulfur dioxide are obtained from the layer.

Example 5

Into the first fluidized layer of a stepwise roasting there are continuously introduced per hour per square metre of the grate surface 3.40 metric tons of pyrites with a content of 46.5% of sulfur, 0.58% of arsenic and 0.096% of antimony and having a maximum grain size of 6 millimetres and 2500 normal cubic metres of air.

The height of the fluidized layer is kept at 0.70 metre. A temperature of 750° C. is maintained in the layer by cooling devices. 2.67 metric tons per hour of preliminarily roasted material, including the fly dust separated from the roaster gases, are obtained. The sulfur content of this preliminarily roasted material amounts to 31.1%, the arsenic content to 0.03% and the antimony content to 0.016%. 2500 normal cubic metres per hour of roaster gas with a content of 20.5% by volume of sulfur dioxide are obtained from the layer.

The single figure of the drawings is a schematic elevational view illustrating the manner of carrying out the process of the invention in suitable apparatus. In the drawings, a material containing iron, roastable sulfur and arsenic or antimony, such as a sulfidic iron ore, is supplied from a bunker 1 by means of a feed regulator 2 to a preliminary roaster 3. The roaster contains a fluidized bed undergoing roasting and having an upper level or surface indicated at 4. Air or other oxygen-containing gas is supplied by a blower 5 to a wind chamber 6 located beneath the fluidized bed. The temperature of the bed is regulated by withdrawing heat through a heat exchange member 7 located in the bed.

The roaster gas produced in the preliminary or first stage roaster 3 is conducted through a cyclone separator 8 in the roaster. Fine particles of roasted material are separated in the cyclone and returned to the fluidized bed by a conduit or leg 9 at the bottom of the cyclone.

The gas leaving the cyclone is conducted to an electrostatic gas purification installation **10** and thence to a steam-producing installation **11**. The gas is then conducted to a gas cooler **12** and from there to further processing. The dust separated in the installations **10** and **11** is collected in a conduit **13** connected at the lower ends of the installations, and it is conducted to the next roasting stage. The dust is combined with roasted material withdrawn from the preliminary roaster **3** through a conduit **14**, and together they constitute the feed to the second stage roaster **15**.

The incompletely roasted intermediate solid material, which contains a minimum of about 3% by weight of sulfidic sulfur while being substantially free of arsenic and antimony, is completely roasted in the second stage or final roaster **15**. Alternatively, the roasting may be completed in stages or steps in a plurality of roasters, not illustrated.

Air is supplied separately and independently to the second stage roaster **15** by means of a blower **16**. The roaster includes a wind chamber **17** and heat exchange apparatus **18** as in the first stage roaster, and a fluidized bed of solid material undergoing roasting and having an upper level **19** is likewise maintained in the roaster. The roaster gas produced exits at the top of the second stage roaster and is conducted through a steam-producing installation **20**, an electrostatic gas purifier **21**, and a gas cooler **22**, and then to further processing. The dust separated in the steam producer **20** and the purifier **21** is collected in a conduit **23** together with the roasted solid residue or cinder withdrawn by gravity from the fluidized bed through a conduit **24**. The roasted residue is conducted from the process by conveying apparatus **25**.

In the process, the roaster gas produced in the first stage roaster **3**, which contains volatilized arsenic and/or antimony, is maintained out of contact with solid material undergoing further roasting with the production of ferric oxide, being withdrawn from the roasting process to accomplish this condition. The solid material undergoing further roasting in the second stage roaster **15** and which contains ferric oxide is prevented from entering the first stage roaster **3**, being withdrawn from the process for that purpose. The roaster gas produced in the second stage, which contains a quantity of dust containing ferric oxide, is likewise withdrawn from the roasting process, and not conveyed to the first stage. Each stage is separately supplied with air for the roasting and independently regulated.

We claim:

1. In a fluidized bed process for roasting a sulfidic iron ore containing at least one of the elements arsenic and antimony with a free oxygen-containing gas to produce sulfur dioxide, the improvement for producing completely roasted solid residue substantially free of said elements which comprises conducting the roasting in a plurality of separate fluidized bed roasting stages, preliminarily roasting said ore in a first said stage to produce sulfur dioxide and volatilize said elements, limiting said preliminary roasting to the production of intermediate roasted solid material containing a minimum of about 3% by weight of sulfiidic sulfur while being substantially free of said elements, completely roasting said intermediate material in at least one additional said stage to produce said roasted residue containing ferric oxide, supplying said oxygen-containing gas to said first stage and to said additional stage with the supply to each stage separate from and independent of the other, after each said stage separately withdrawing the roaster gas produced in each stage from the roasting process, and withdrawing said completely roasted residue containing ferric oxide from the roasting process, whereby exhaust gases are not commingled and not contacted with other stages and roasted residue is prevented from entering said first stage, to prevent reaction and binding of said elements with ferric oxide.

2. The process defined in claim 1 wherein said preliminary roasting is limited to the production of intermediate roasted solid material containing a minimum of about 15% by weight of sulfidic sulfur.

3. In a fluidized bed process for roasting iron pyrites containing at least one of the elements arsenic and antimony with a free oxygen-containing gas to produce sulfur dioxide, the improvement for producing completely roasted solid residue substantially free of said elements which comprises conducting the roasting in a plurality of separate fluidized bed roasting stages, preliminarily roasting said pyrites in a first said stage to produce sulfur dioxide and volatilize said elements, limiting said preliminary roasting to the production of intermediate roasted solid material containing a minimum of about 3% by weight of sulfidic sulfur while being substantially free of said elements, completely roasting said intermediate material in at least one additional said stage to produce said roasted residue containing ferric oxide, supplying said oxygen-containing gas to said first stage and to said additional stage with the supply to each stage separate from and independent of the other, after each said stage separately withdrawing the roaster gas produced in each stage from the roasting process, and withdrawing said completely roasted residue containing ferric oxide from the roasting process, whereby exhaust gases are not commingled and not contacted with other stages and roasted residue is prevented from entering said first stage, to prevent reaction and binding of said elements with ferric oxide.

4. The process defined in claim 3 wherein said preliminary roasting is conducted to produce intermediate roasted solid material containing a proportion of sulfidic sulfur in the range of about 3% to 31% by weight.

5. The process defined in claim 4 wherein said range is about 15% to 31% by weight.

6. The process defined in claim 3 wherein said intermediate roasted solid material consists essentially of ferrous sulfide and a small proportion of ferrosoferric oxide.

7. The process defined in claim 3 wherein said oxygen-containing gas is air, and a quantity of air is supplied to said first stage such that the roaster gas produced therein contains in the range of about 16% to 20.5% by volume of sulfur dioxide.

8. The process defined in claim 3 wherein the temperature in said roasting stages is maintained in the range of about 550° C. to 880° C.

9. The process defined in claim 3 wherein the temperature in said first stage is maintained in the range of about 750° C. to 800° C.

10. In a fluidized bed process for roasting iron pyrites containing arsensic with air to produce sulfur dioxide, the improvement for producing completely roasted solid residue substantially free of arsenic which comprises conducting the roasting in a plurality of separate fluidized bed roasting stages, preliminarily roasting said pyrites in a first said stage to produce sulfur dioxide and volatilize said arsensic, conducting said preliminary roasting to produce intermediate roasted solid material containing a proportion of sulfidic sulfur in the range of about 3% to 31% by weight while being substantially free of said arensic, and roaster gas containing in the range of about 16% to 20.5% by volume of sulfur dioxide, completely roasting said intermediate material in at least one additional said stage to produce said roasted residue containing ferric oxide, maintaining the temperature in said roasting stages in the range of about 600° C. to 850° C., supplying said air to said first stage and to said additional stage with the supply to each stage separate from and independent of the other, after each said stage separately withdrawing the roaster gas produced in each stage from the roasting process, and withdrawing said completely roasted residue containing ferric oxide from the roasting process, whereby exhaust gases are not commingled and not contacted with other stages and roasted residue is

prevented from entering said first stage, to prevent reaction and binding of said arsenic with ferric oxide.

11. In a fluidized bed process for roasting iron pyrites containing antimony with air to produce sulfur dioxide, the improvement for producing completely roasted solid residue substantially free of antimony which comprises conducting the roasting in a plurality of separate fluidized bed roasting stages, preliminarily roasting said pyrites in a first said stage to produce sulfur dioxide and volatilize said antimony, conducting said preliminary roasting to produce intermediate roasted solid material containing a proportion of sulfidic sulfur in the range of about 3% to 31% by weight while being substantially free of said antimony, and roaster gas containing in the range of about 16% to 20.5% by colume of sulfur dioxide, completely roasting said intermediate material in at least one additional said stage to produce said roasted residue containing ferric oxide, maintaining the temperature in said roasting stages in the range of about 550° C. to 880° C., supplying said air to said first stage and to said additional stage with the supply to each stage separate from and independent of the other, after each said stage separately withdrawing the roaster gas produced in each stage from the roasting process, and withdrawing said completely roasted residue containing ferric oxide from the roasting process, whereby exhaust gases are not commingled and not contacted with other stages and roasted residue is prevented from entering said first stage, to prevent reaction and binding of said antimony with ferric oxide.

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