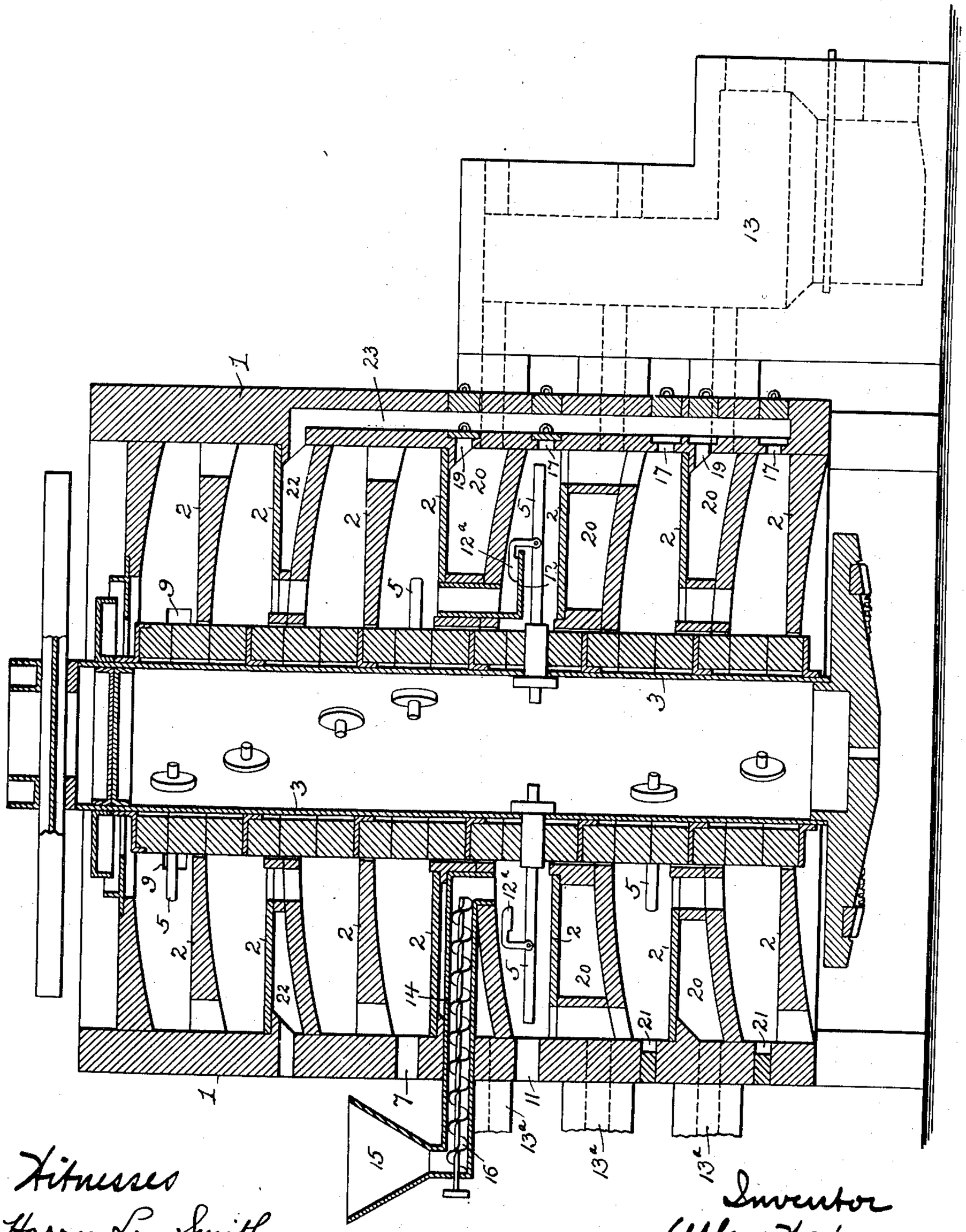
U. WEDGE.

TREATING SULFIDS OR SULFATES.

APPLICATION FILED JAN. 20, 1910.

976,525.

Patented Nov. 22, 1910.



Witnesses

Harry L. Smith

Hamilton D. Turner

Inventor

Utley Hedge

by his attorneys

Smith & Frazier

UNITED STATES PATENT OFFICE.

UTLEY WEDGE, OF ARDMORE, PENNSYLVANIA, ASSIGNOR TO THE FURNACE PATENT COMPANY, OF PHILADELPHIA, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

TREATING SULFIDS OR SULFATES.

976,525. Specification of Letters Patent. **Patented Nov. 22, 1910.**

Application filed January 20, 1910. Serial No. 539,135.

To all whom it may concern:

Be it known that I, UTLEY WEDGE, a citizen of the United States, residing in Ardmore, Pennsylvania, have invented certain Improvements in Treating Sulfids or Sulfates, of which the following is a specification.

The object of my invention is to facilitate the elimination of sulfur in roasting sulfids or sulfates, such as those of zinc or nickel, an object which I attain in the manner hereinafter set forth, reference being had to the accompanying drawing, which represents, partly in side elevation and partly in vertical section, a furnace adapted for carrying out my invention.

In the roasting of sulfids or ores containing the same, the elimination of the sulfur remaining after the sulfid has passed through the preliminary stages of the roasting process requires the employment of an objectionably high temperature and even in such case the sulfur is not completely eliminated and objectionable amounts of sulfur are likely to be left in the calcined or roasted material, owing to the formation of basic sulfates which are difficult to roast. In order to overcome this difficulty, I combine with the material, after it has passed through the first stages of its treatment, in the roasting furnace, a reagent which will reduce the basic sulfates, the elimination of the remaining sulfur contents down to the point desired being then readily effected without the employment of an objectionably high temperature during the latter part of the treatment.

In the drawing, I have shown a furnace for carrying out my invention, this furnace being of the general type heretofore patented by me but having certain additions whereby it is adapted for the carrying out of my present invention.

In the drawing, 1 represents the outer wall of the furnace, 2 a series of superposed hearths and 3 a central hollow shaft carrying radial arms 5, which project into the working chambers of the furnace and are intended to carry stirring and feeding blades or rabbles of any appropriate character (not shown) these feeding blades or rabbles serving to mix the material lying upon the hearths of the furnace and to convey the same over said hearths from the inner to the outer or from the outer to the inner portions of the same, the material being discharged from one hearth to another through openings 6 located alternately at the outer and inner portions of the hearths.

Preferably, the roof of the furnace serves as a heating floor for the green ore or concentrate and the shaft 3 is provided with any suitable feeding device whereby the ore is deposited upon the uppermost hearth of the furnace through a trapped or luted passage or passages, in order to prevent the escape of gas from the uppermost working chamber into the room or apartment in which the furnace is situated.

The furnace is divided into two sections, the upper section comprising, in the present instance, the four upper hearths and having an air inlet 7 and gas outlet 9 and the lower section comprising the three lower hearths. The passages for the material from the lower hearth of the upper section to the upper hearth of the lower section may be sealed against the flow of gas therethrough, each passage having below it a shelf 12 upon which the material flowing through the passage 6 is supported so as to back up into the said passage and close the same against gas flow, the material being removed from the shelf 12, at intervals, by means of scrapers 12^a attached to the stirrer arms 5 in the upper working chamber of the lower section of the furnace, a fresh supply of material then flowing onto the shelf from the passage 6 to be removed in its turn, and so on, indefinitely.

Between the arch of the uppermost working chamber of the lower section of the furnace and the hearth of the lowermost working chamber of the upper section of the furnace, I provide means for feeding into said upper working chamber of the lower section of the furnace the desired supply of the reducing agent for admixture with the material which is being treated in said lower section. In the present instance, this feeding device comprises a tube 14 having, at its outer end, a feed hopper 15, and communicating, at its inner end, with said upper working chamber of the lower section of the furnace, the tube containing a screw conveyer 16 or being provided with other means whereby material may be fed through the same.

The preferable reducing agent is carbonaceous material such as coke breeze, pulverized coal, charcoal, pulverized coke from pe-

troleum, or other form of carbonaceous matter or hydrocarbon.

The major portion of the sulfur is eliminated from the sulfid by the treatment of the latter in the upper section of the furnace and when the metal combined with its remaining sulfur and other impurities is fed into the upper chamber of the lower section of the furnace, the carbonaceous matter fed into the latter is intimately mixed with said compound and reduces any sulfate contained therein so as to permit of the elimination of the remaining sulfur contents by the application of a temperature approximating 1,200° F., as compared with a temperature of about 1,600° to 1,800° F., commonly required in the lower portion of the furnace as ordinarily operated.

When the products of combustion of the carbonaceous matter in the lower section of the furnace are prevented from gaining access to the upper section of the furnace by reason of the sealed communications between the two sections, a separate gas outlet is provided for the lower section of the furnace at 11, through which will escape both the products of combustion of said carbonaceous matter and such quantities of sulfur as may be eliminated from the compound in the lower portion of the furnace, the metallic oxid being delivered from the lower chamber of the furnace in the usual way.

By preference, the lower section of the furnace is of the muffle type, the heating chambers 20 being supplied with products of combustion from a fire place 13 at one side of the furnace and escaping therefrom through flues 13ª at the opposite side.

The quantity of carbonaceous matter required for the decomposition of the basic sulfates is so small that its introduction still permits of the utilization of all of the sulfur gases leaving the furnace for the purpose of manufacturing sulfurous and sulfuric acids, so that when the hearths of the lower section of the furnace are muffle fired, as shown in the drawing, the sulfurous gas escaping from said lower section may, if desired, be allowed to pass through the ore treating chambers of the upper section of the furnace and in any event they may be allowed so to pass in case it is not desired to utilize said sulfurous gases.

Air for oxidizing purposes should be admitted to one or more of the treating chambers of the lower section of the furnace, as for instance, through suitably stoppered openings 21 in the walls of the furnace. I, however, prefer to use, for this purpose, preheated air and to effect the preheating of this air by passing it through one or more heating chambers interposed between the treating chambers of the upper section of the furnace, one of said air heating chambers being illustrated at 22 in the drawing and serving not only to provide for the desired preheating of the air but at the same time to abstract surplus heat from the treating chambers in the upper portion of the furnace and thereby maintain a relatively low temperature therein, and prevent the overheating of the ore.

The heating chamber 22 communicates with a flue 23 (or any number of such flues) located in the walls of the furnace said flue (or each of said flues) communicating through suitable stoppered or dampered openings 17 with such of the treating chambers of the lower section of the furnace as may be desired. Preferably, also, the flue 23 communicates, through properly stoppered or dampered openings 19, with one or more of the heating chambers 20 so as to admit supplies of heated air thereto for the purpose of facilitating or improving the combustion of the heating gases therein.

I claim:

1. In the process of desulfurizing, by roasting, ores containing sulfids or sulfates, the mode herein described of facilitating the removal of the sulfur during the later stage of the process, said mode consisting in adding to the metal-bearing material a reagent whereby any sulfates which may be present will be reduced and the elimination of the sulfur effected without the application of an objectionably high degree of heat.

2. In the process of desulfurizing, by roasting, ores containing sulfids or sulfates, the mode herein described of facilitating the removal of the sulfur during the later stage of the process, said mode consisting in heating the metal-bearing material during this stage of the process without direct access of the heating gases thereto, and adding to said metal-bearing material a reagent whereby any sulfates which may be present will be reduced and the elimination of the sulfur effected without the application of an objectionably high degree of heat.

3. In the process of desulfurizing, by roasting, ores containing sulfids or sulfates, the mode herein described of facilitating the removal of the sulfur during the later stage of the process, said mode consisting in adding to the metal-bearing material a reagent whereby any sulfates which may be present will be reduced and the elimination of the sulfur effected without the application of an objectionably high degree of heat, and also introducing preheated air for oxidizing purposes.

4. In the process of desulfurizing, by roasting, ores containing sulfids or sulfates, the mode herein described which consists in maintaining a relatively low temperature during the early stage of the process by the abstraction of heat for air-heating purposes, adding to the metal-bearing material, during the later stage of the process, a reagent

whereby any sulfates which may be present will be reduced and the elimination of the sulfur effected, and, at the same time, using, in said later stage of the process, for oxidizing purposes, the air preheated in the earlier stage of the process.

5. In the process of desulfurizing, by roasting, ores containing sulfids or sulfates, the mode herein described of facilitating the removal of the sulfur during the later stage of the process, said mode consisting in heating the metal-bearing material during the later stage of the process without direct access of the heating gases thereto, adding to said material during said later stage of the process, a reagent whereby any sulfates which may be present will be reduced and the elimination of the sulfur effected, and also introducing preheated air for oxidizing purposes in the later stage of the process.

6. In the process of desulfurizing, by roasting, ores containing sulfids or sulfates, the mode herein described of facilitating the removal of the sulfur during the later stage of the process, said mode consisting in heating the metal-bearing material during the later stage of the process without direct access of the heating gases thereto, adding to said material during said later stage of the process, a reagent whereby any sulfates which may be present will be reduced and the elimination of the sulfur effected, and also introducing preheated air for oxidizing purposes and for facilitating the combustion of the heating gases in the later stage of the process.

7. In the process of desulfurizing, by roasting, ores containing sulfids or sulfates, the mode herein described which consists in maintaining a relatively low temperature during the early stage of the process by the abstraction of heat for air-heating purposes, heating the metal-bearing material during the later stage of the process without direct access of the heating gases thereto, adding to said material a reagent whereby any sulfates which may be present will be reduced and the elimination of the sulfur effected, and also introducing the air preheated in the earlier stage of the process for oxidizing purposes in the later stage of the process.

8. In the process of desulfurizing, by roasting, ores containing sulfids or sulfates, the mode herein described which consists in maintaining a relatively low temperature during the early stage of the process by the abstraction of heat for air-heating purposes, heating the metal-bearing material during the later stage of the process without direct access of the heating gases thereto, adding to said material a reagent whereby any sulfates which may be present will be reduced and the elimination of the sulfur effected, and also introducing the air preheated in the earlier stage of the process for oxidizing purposes and for facilitating the combustion of the heating gases in the later stage of the process.

9. In the process of desulfurizing, by roasting, ores containing sulfids or sulfates, the mode herein described of facilitating the removal of the sulfur during the later stage of the process, said mode consisting in adding to the metal-bearing material a reagent whereby any sulfates which may be present will be reduced and the elimination of the sulfur effected without the application of an objectionably high degree of heat, and discharging the gases developed during the later stage of the process independently of those developed during the earlier stage of the process.

10. In the process of desulfurizing, by roasting, ores containing sulfids or sulfates, the mode herein described of facilitating the removal of the sulfur during the later stage of the process, said mode consisting in heating the metal-bearing material during the later stage of the process without direct access of the heating gases thereto, adding to said metal-bearing material a reagent whereby any sulfates which may be present will be reduced and the elimination of the sulfur effected without the application of an objectionably high degree of heat, and discharging the gases developed during the later stage of the process independently of those developed during the earlier stage of the process.

11. In the process of desulfurizing, by roasting, ores containing sulfids or sulfates, the mode herein described of facilitating the removal of the sulfur during the later stage of the process, said mode consisting in adding to the metal-bearing material during the later stage of the process a reagent whereby any sulfates which may be present will be reduced and the elimination of the sulfur effected without the application of an objectionably high degree of heat and also introducing, during the later stage of the process, preheated air for oxidizing purposes, and discharging the gases developed during the later stage of the process independently of those developed during the earlier stage of the process.

12. In the process of desulfurizing, by roasting, ores containing sulfids or sulfates, the mode herein described of facilitating the removal of the sulfur during the later stage of the process, said mode consisting in heating the metal-bearing material during the later stage of the process without direct access of the heating gases thereto, adding to said metal-bearing material during the later stage of the process a reagent whereby any sulfates which may be present will be reduced and the elimination of the sulfur effected, also introducing preheated air for oxidizing purposes, and discharging the

gases developed during the later stage of the process independently of those developed during the earlier stage of the process.

13. In the process of desulfurizing, by roasting, ores containing sulfids or sulfates, the mode herein described, which consists in maintaining a relatively low temperature during the early stage of the process by the abstraction of heat for air heating purposes, adding to the metal-bearing material during the later stage of the process a reagent whereby any sulfates which may be present will be reduced and the elimination of the sulfur effected, using in the later stage of the process, for oxidizing purposes, the air preheated in the earlier stage of the process, and discharging the gases developed during the later stage of the process independently of those developed during the earlier stage of the process.

14. In the process of desulfurizing, by roasting, ores containing sulfids or sulfates, the mode herein described, which consists in maintaining a relatively low temperature during the early stage of the process by the abstraction of heat for air heating purposes, heating the metal-bearing material during the later stage of the process without direct access of the heating gases thereto, adding to said material a reagent whereby any sulfates which may be present will be reduced and the elimination of the sulfur effected, introducing the air preheated in the earlier stage of the process for oxidizing purposes, and discharging the gases developed during the later stage of the process independently of those developed during the earlier stage of the process.

15. In the process of desulfurizing, by roasting, ores containing sulfids or sulfates, the mode herein described, which consists in maintaining a relatively low temperature during the early stage of the process by the abstraction of heat for air heating purposes, heating the metal-bearing material during the later stage of the process without direct access of the heating gases thereto, adding to said material a reagent whereby any sulfates which may be present will be reduced and the elimination of the sulfur effected, introducing the air preheated in the earlier stage of the process for oxidizing purposes and for facilitating the combustion of the heating gases in the later stage of the process, and discharging the gases developed during the later stage of the process independently of those developed during the earlier stage of the process.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

UTLEY WEDGE.

Witnesses:
KATE A. BEADLE,
HAMILTON D. TURNER.