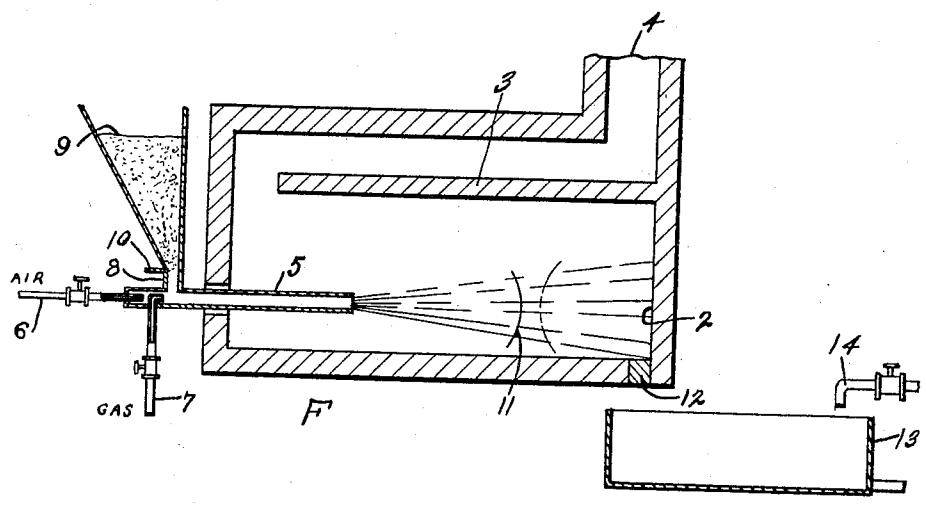
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METHOD AND APPARATUS FOR TREATMENT OF CHROMITE ORES

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METHOD AND APPARATUS FOR TREATMENT OF CHROMITE ORES

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This invention relates to the treatment of ores and more particularly treatment of such materials in pulverized state with heat and suitable reaction conditions; and it is among the objects of the invention to provide a process and apparatus affording direct and simple procedure, and capable of continuous-type operation. Other objects and advantages will appear as the description proceeds.

To the accomplishment of the foregoing and related ends, the invention, then, consists of the features hereinafter fully described, and particularly pointed out in the claims. the following description and the annexed drawing setting forth certain embodiments of the invention, these being illustrative however of but a few of the various ways in which the principle of the invention may be employed.

In said annexed drawing:—

The sole figures shows in vertical section a form of apparatus contemplated.

In accordance with the invention, a combustion zone is provided into which materials to be heated are introduced, and conditions favorable for reaction between finely divided solid substances are had, the substances being heated and preferably projected onto a receiving surface in the furnace, the combustion being had by burners supplied under pressure and usually the materials to be treated are swept into the combustion zone along with the fuel thereof.

In such blast-type of burners while in some cases powdered or liquid fuel may be employed, preferably a gaseous fuel is most generally to be desired. The air supply for such fuel may then be arranged, pressure for the blast being had in convenient manner, as by utilization of air supply under suitable tank pressure, or in the case of gaseous fuel as much of the pressure component as desired may be had therethrough. With the fuel and air mixture thus projected through the burner into the combustion zone in blast-like form, the relative proportioning of the air in the supply may be readily adjusted to neutral conditions, or to oxidizing or reducing conditions in the combustion zone, as may be desired in detail in any given instance. The material to be treated is ground to a very finely divided condition, and preferably is controllably fed to the blast stream going through the burner. The finer the material is, the better; for instance the particles may be such as to pass a 200 mesh screen, or finer up to available practical limits. Such material presented to the heated zone is quickly raised in temperature to the desired reaction temperature, and under neutral, or reducing or oxidizing conditions as particularly desired. The extent of the flame zone in any given instance may be determined by the proportioning of the burner design, and the enclosure in which the equipment is placed.

It is desirable also that for most materials in treatment there be arranged a receiving surface or wall whereon reaction products may build up in a manner capable of being scraped therefrom continuously or at suitable intervals. Such receiving surface may be in the form of a wall of refractory material, or a plate of high temperature resisting metal; and for the facilitation of removal of the deposited material, suitable scraping means may be arranged to detach the incrustation and direct it to a further point of collection. Movable receiving surfaces, in the form of rotary tables or endless belt-like structures may in many instances be effective in this relation.

Among the materials which may be advantageously treated in accordance with this procedure are for example ores of zirconium, chromium, titanium, tungsten, etc. And agents reactive therewith may be provided in admixture, the pulverized mass then being available for feeding to the combustion zone.

As suitable apparatus in such connection, there may be employed a furnace chamber F of refractory material and having a wall 2 toward which the flame jet is directed, a baffle wall 3 overhead being arranged to prevent direct outlet of products to the flue 4. A blast burner 5 comprising a suitable tube or nozzle is directed into the combustion chamber, and an air supply, as a compressed air pipe 6, and a fuel supply as a gas line 7, enter the mixing chamber of the burner. In

the line of sweep of the gaseous mixture, there is further arranged an inlet 8 for the pulverized material to be treated, the feed thereof from the hopper 9 being controlled as desired by a suitable gate or control valve 10. A plate 11 may in some cases be desired in the path of the flame, and by sloping it with a concave or convex surface, the flame distribution may be correspondingly modified. The flue 4 may lead to a stack, or more usually through a series of settling compartments before entry to the stack, in order to insure separation of any suspended particles which might be carried along. At the lower portion, an outlet adjacent to the surface 2, and normally closed by a suitable closure 12 permits material deposited upon the wall to be raked down into a receptacle 13. This latter may also if desired function as a leaching vat, water being supplied thereto through a suitable water line 14.

In the treatment of chromite for example, a mixture of chromite ore and sodium carbonate is prepared in proportions of about two parts of chromite by weight and one part of sodium carbonate, these being preferably ground together, and this material is then supplied to the heated zone, the burner having been previously operated to an extent to bring up the chamber temperature to desired point. As the chromite is swept along into the combustion zone, it is quickly in its finely divided condition raised to the reaction point, and at a temperature of around 2000° F. there ensues a reaction, sodium chromate being formed, and this together with the iron oxide and silicates of aluminum and magnesium in the ore is carried along and deposited upon the wall 2, forming an incrustation of porous rather friable character. This deposit is scraped from the receiving surface, and is subjected to leaching with water, at elevated temperature. The sodium chromate dissolves out, and the solution may be finally drawn off from the residue of iron oxide and silicate, and may be separated by crystallization, with further purification as may be desired.

In similar manner, appropriate ores may be treated with a direct yield of such products as sodium titanate, tungstate, etc.

As will be seen, under such conditions of very finely powdered and intimately mixed reaction materials, carried directly into the flame and high temperature zone, reaction between non-volatile solids is particularly favored, and even if in some cases it be incomplete on reaching the receiving surface, it is terminated under the effective temperature conditions there obtained; and the deposition of the particles of material on such heated receiving surface is effected in a manner providing homogeneity and a mechanical condition such as to require little subsequent grinding in order to effectively leach out its water soluble constituents.

In some instances the most favorable temperature conditions may be further insured by provision of external heating means for the chamber in addition to the blast flame, and this, as well as the various features of mechanical means for the removal of the deposit, such as movable belts, rotating disks or the like may be arranged in their detail, as desired.

Other modes of applying the principle of the invention may be employed, change being made as regards the details disclosed, provided the steps or means stated in any of the following claims, or the equivalent of such, be employed.

I therefore particularly point out and distinctly claim as my invention:—

1. A process of conducting chemical reactions, which comprises carrying and heating pulverized chromite ore and a material reactive therewith, by a flame jet.

2. A process of conducting chemical reactions, which comprises carrying and heating pulverized chromite ore and a material reactant therewith by gaseous flame, and collecting the products in solid form.

3. A process of conducting chemical reactions, which comprises carrying and heating pulverized chromite ore and a material reactive therewith, by a flame jet, and leaching the reaction products with water.

4. A process of conducting chemical reactions, which comprises throwing pulverized chromite ore and a material reactive therewith through a flame zone onto a hot collecting surface.

5. A process of conducting chemical reactions, which comprises bearing pulverized chromite ore and a material reactive therewith by a gaseous flame onto a heated surface.

6. A process of conducting chemical reactions, which comprises carrying and heating pulverized chromite ore and an alkali metal compound, by a flame jet.

7. A process of conducting chemical reactions, which comprises carrying and heating chromite ore and an alkali metal compound, by a gaseous flame, collecting the reaction products, and leaching with water.

8. A process of conducting chemical reactions, which comprises bearing chromite ore and an alkali metal compound by a gaseous flame onto a heated surface, removing the reaction products, and leaching with water.

9. A process of conducting chemical reactions, which comprises carrying and heating pulverized chromite ore and a sodium compound, by a flame jet.

10. A process of conducting chemical reactions, which comprises bearing chromite ore and a sodium compound by a gaseous flame onto a heated surface, removing the reaction products, and leaching with water.

11. A process of conducting chemical reactions, which comprises bearing pulverized chromite ore and sodium carbonate by a gaseous flame onto a heated surface, removing the reaction products, and leaching with water.

12. A process of conducting chemical reaction, which comprises projecting a stream of finely divided chromite and an agent reacting therewith through a flame zone, and collecting the products in solid form as an adherent layer on an upstanding surface.

13. Apparatus for conducting chemical reactions, which comprises a furnace chamber, blast-nozzle means for projecting a stream of finely divided solid material therein, a target surface in the path of such stream and exposed to heat, upon which such projected material may adhere and build up, and a raking-down opening aligned under said target.

14. Apparatus for conducting chemical reactions, which comprises a furnace chamber, blast-nozzle means for projecting a stream of finely divided solid material therein, a target surface in the path of such stream and exposed to heat, upon which such projected material may adhere and build up, a raking-down opening aligned under said target, and a leaching vat under said opening.

Signed by me, this 1st day of September, 1928.

WILLIAM A. HARSHAW.