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ORE BURNER

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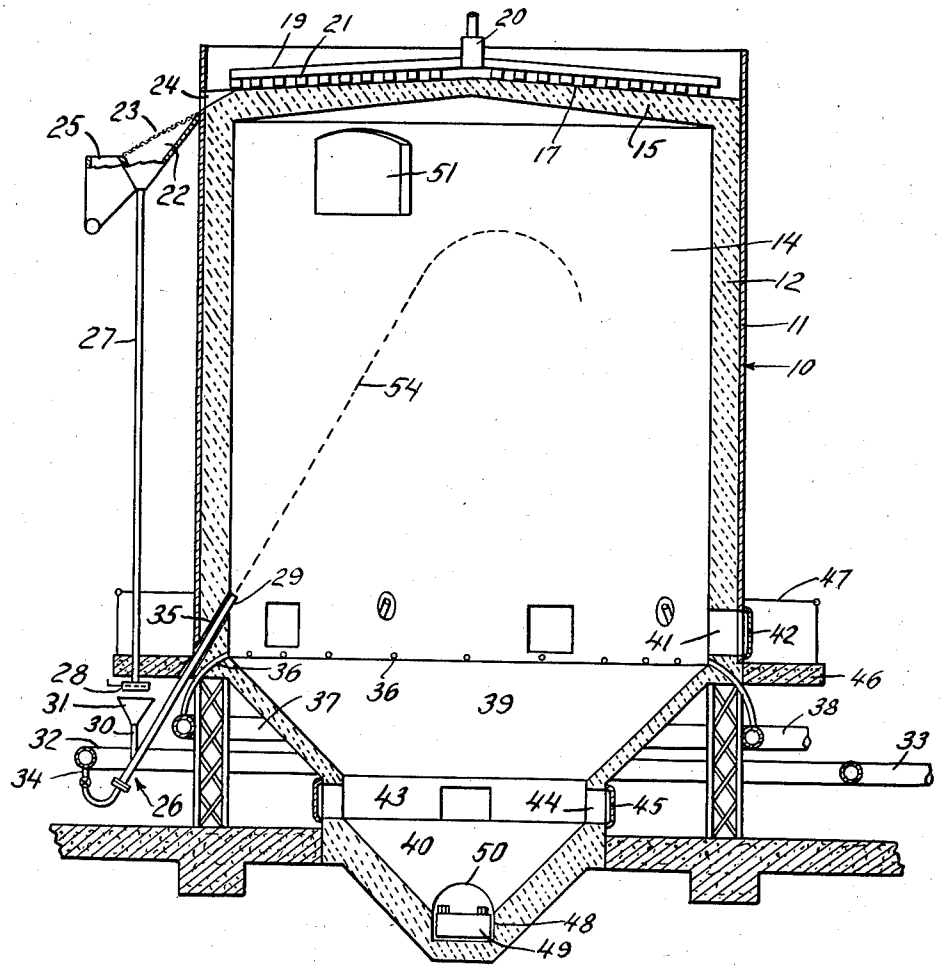

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ORE BURNER

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This invention is directed to an apparatus for roasting metal sulfides, and more particularly for roasting finely divided sulfides to desulfurize the same and to produce sulfur dioxide for use in the manufacture of sulfuric acid, or for any other purposes desired. The invention is particularly related to roasters having a hoppered or tapered hearth for collection and discharge of cinder.

In operating roasters of the character described there is occasionally a tendency for the cinder on the hearth to cohere or cake, particularly when such a roaster is operating at high capacity. Further, under some operating conditions there is a tendency for the cinder to build up on the sloping sides of the hearth and it thus becomes necessary from time to time to loosen by a bar the cinder from the hearth. However, the hearth of such a burner may be too large to permit the operator to reach conveniently with a bar all parts of the hearth through the cinder outlet or through a work hole. According to the present invention the bottom is so constructed that the entire hearth can be reached readily.

Other and further objects and advantages of the invention may be fully understood from a consideration of the following description taken in connection with the accompanying drawing, which is a vertical section of a preferred form of roaster showing the improved hearth.

Referring to the drawing, the shaft roaster shown comprises a cylindrical shaft 10, comprising a steel shell or casing 11 and a furnace lining 12 placed therein, constructed of suitable refractory material such as firebrick and defining a roasting chamber 14 of circular horizontal section. The upper part of the roasting chamber is closed by a crown 15, the top side of which forms a drying or preheating hearth 17.

The shell 11 projects upwardly beyond the crown 15. The surface of hearth 17 slopes downwardly toward the shell of the burner. Lying above the hearth are rabble arms 19, carried and driven by a hub 20 supported by a framework, not shown, and having downwardly projecting plows 21 pitched to work sulfides, fed to the center of the hearth 17, gradually toward the circumference of the drying hearth.

Attached to shell 11 by suitable brackets not shown are hoppers 22 covered by sloping screens 23. Cut through the shell 11 and also in the upper edge of lining 12 are downwardly sloping passages or conduits 24 through which fines are passed from drying hearth 17 into hoppers 22. Oversized material discharged by screens 23 is collected by receptacles 25 and conveyed by means not shown to a crusher, or used in a bed roaster or otherwise disposed of. It will be understood that the number of conduits 24 and hoppers 22 used in conjunction with the roaster correspond with the number of ore injectors 26 employed. On rotation of rabble arms 19 the sulfide fines are gradually fed through openings 24 into hoppers 22 which discharge fines into injector feed pipes 27 having at their lower ends any suitable means such as slide valves 28 for controlling flow of fines out of the lower ends of pipes 27.

Each ore injector 26, shown more or less diagrammatically in the drawing, comprises principally an elongated pipe section or nozzle 29 constituting a fines inlet conduit. A pipe 30, carrying on the upper end a funnel 31, is arranged to feed fines into the lower end of nozzle 29. Air or other gas used to inject the fines into the burner is supplied from a bustle pipe 32 surrounding the lower end of the burner. Bustle 32 may be connected to a blower or other source of air through pipe 33. Adjacent injector 26, pipe 32 is provided with an air outlet nipple 34 connected by a control valve to a flexible hose connection which is attached at the other end to nozzle 29. Each injector 26 may be supported by a suitable bracket, not shown, so that the upper end of the nozzle 29 extends through an opening 35 in the shaft 10 into the roasting chamber 14. The burner may be provided with any suitable number of injectors. In the embodiment illustrated, five injectors 26 are employed.

Spaced about the lower end of the shaft 10 are air inlet pipes 36 through which air to support the combustion is introduced. The lower ends of the pipes 36 are connected to the bustle pipe 37 surrounding the lower end of the burner. Air is admitted to the pipe 37 and thence to the roasting chamber 14 from pipe 38.

The hearth of the burner comprises a plurality of superposed frusto-conical sections 39, 40 of suitable refractory material. The upper section 39 is attached to the lower edge of the shaft 10. Spaced about the lower end of the shaft 10 and therethrough are openings 41 closed by doors 42. The sections 39 and 40 are connected by a cylindrical wall 43 through which wall are spaced openings 44 closed by doors 45. By operating with a bar through the openings 41 and 44, cinders which have collected on sections 39 and 40 may be loosened. Slightly below the openings 41 a platform 46 is provided, about which is a guard rail 47, and upon which an operator may

stand while loosening cinders from hearth 39. To remove cinders from the lower end of section 40 there is provided at the lower end thereof a pit 48 in which is a conveyor 49, which, in the embodiment shown, is of the drag-chain type, by which the cinders are removed through the opening 50.

A gas main 51, for withdrawing the gaseous products of combustion from the burner, opens into the combustion chamber 14 at a point just below crown 15.

The invention is applicable to the roasting of finely divided metal sulfides such as iron pyrites, pyrrhotite, zinc sulfide or arsenopyrite, but for convenience the operation of the process may be described in connection with the roasting of iron pyrites.

Before roasting is begun, roasting chamber 14 is preheated to temperatures above the ignition point of the particular ore to be roasted, as by the use of oil burners inserted through openings 41. When the desired temperature is obtained in the roasting chamber, rabble arms 19 may be rotated at a rate of, say, one revolution in two minutes. During rotation of rabble arms 19, the sulfide fines delivered to the center of hearth 17 are gradually worked across the hearth 17 and into the several passages 24, each of which communicates with a hopper 22. The dry or dry and partly preheated fines run onto sloping screens 23, which remove lumps, and thence into hoppers 22 and feed pipes 27.

Valves 28 in pipes 27 are adjusted so that a substantially steady stream of fines runs into the lower ends of nozzles 29 through funnels 31 and pipes 30. Air, steam, or other gas, not adversely affecting oxidation of the sulfide, may be employed to charge the fines into the combustion chamber. For this purpose it is preferred to employ air which may be admitted to the lower ends of nozzles 29 at pressures of, for example, about 5 pounds per square inch. The dotted line 54 indicates the approximate path of travel of an ore particle of average size introduced through the injector on the left side of the roaster.

The major portion of the total quantity of air, or other oxidizing gas, necessary to support the oxidation reaction either may be forced into the roasting chamber through the pipes 36, 37 and 38 or it may be drawn in through said pipes by exhausting gases from the chamber through the gas main 51. When air is employed for injecting the fines through nozzles 29 not more than about 10% of the total air required for the oxidation need be introduced through the injectors 26, although larger amounts may be used if desired.

Following ignition, the fines rise to approximately the top of the roasting chamber, the temperature of the particles increasing because of rapidly progressing roasting. Although the air introduced is initially at about normal temperatures, the roasting operation is such that the temperature of the roasting atmosphere increases at a relatively uniform rate until the temperature of the gases in the top of the roasting chamber, on entering gas main 51, may be about 1800–2000° F. Gas main 51 may be connected to the inlet side of a blower so that the burner may operate under a slight negative pressure.

Due to the introduction of air at the lower end of the roasting chamber there is at the lower end a zone of substantially pure air through which the fines pass, which produces an iron oxide cinder. This cinder, which then deposits upon the sections 39 and 40, is generally finely divided and free-flowing, so that it runs into the pit 48, whence it is removed by conveyor 49. As above indicated, however, there is occasionally a tendency for the cinder to cake or at least lose its free-flowing character. At intervals, therefore, an operator may loosen the cinder on the sections 39 and 40 with a bar by operating through the openings 41, 44.

While a cinder collecting hearth having but two sections has been described, it is obvious that any number of sections may be employed depending upon the size of the roasting chamber.

I claim:

1. An ore roaster of the suspension type comprising a shaft in which the ore is adapted to be roasted while in gaseous suspension, and a cinder collecting hearth at the lower end of said shaft, said hearth comprising a plurality of inwardly inclined sections in stepped relation, the upper edge of each section but the topmost being adjacent the lower edge of the section next thereabove, the upper edge of the topmost section being adjacent the lower edge of said shaft, said ore roaster being provided with an opening at the upper edge of each section arranged to permit insertion of a bar to loosen cinder from the section there beneath.

2. An ore roaster of the suspension type comprising a combustion chamber in which the ore is adapted to be roasted while in gaseous suspension, the lower end of said roaster comprising a downwardly and centrally converging cinder collecting hearth, said hearth being formed of a plurality of hollow frustoconical sections in stepped relation to convey cinder on any section to the lower end of the lowermost section, said sections being spaced apart between adjacent ends of adjacent sections, an opening adjacent the upper edges of said sections for the insertion of a bar by which cinder may be loosened from said hearth, and means at the lower end of the lowermost section to withdraw cinder therefrom.

3. An ore roaster comprising a shaft forming a combustion chamber in which ore is adapted to be roasted while in gaseous suspension, means including an injector passing through a side wall of said shaft for forming a dispersion of ore in the upper end of said combustion chamber, and a cinder collecting hearth at the lower end of said shaft, said hearth comprising a plurality of inwardly inclined sections in stepped relation, each section being provided with an opening at the upper edge thereof and said stepped relation so spacing said sections vertically that access may be had through each opening to operate a bar on the section next therebelow.

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