Nov. 18, 1958 E. LEROI 2,860,964

METHOD OF ROASTING SULPHUR ORES IN SUSPENSION

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Fig. 1

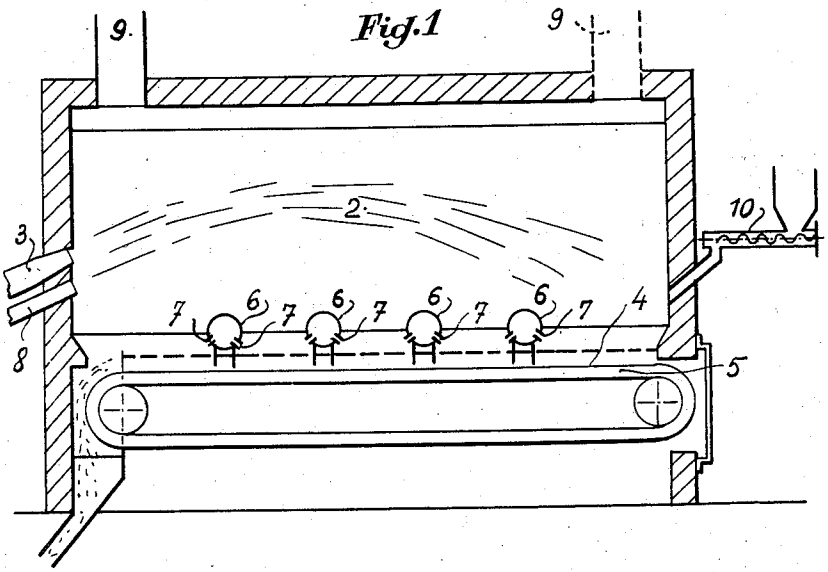


Fig. 5

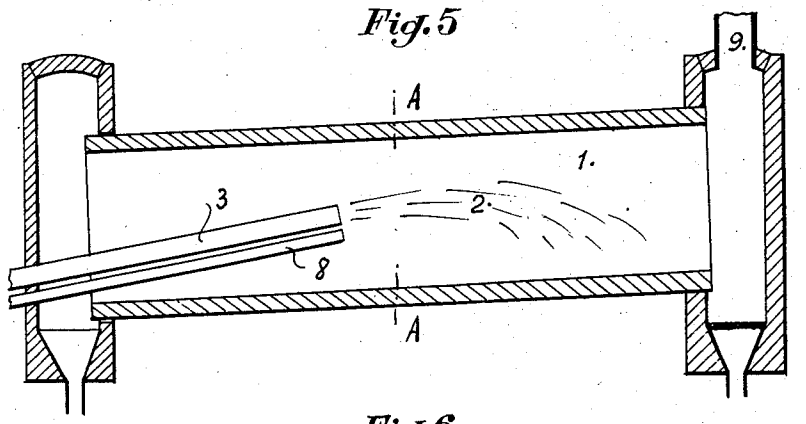
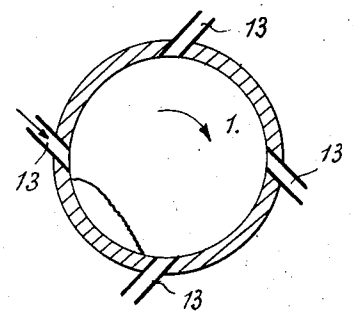


Fig. 6



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Fig. 2

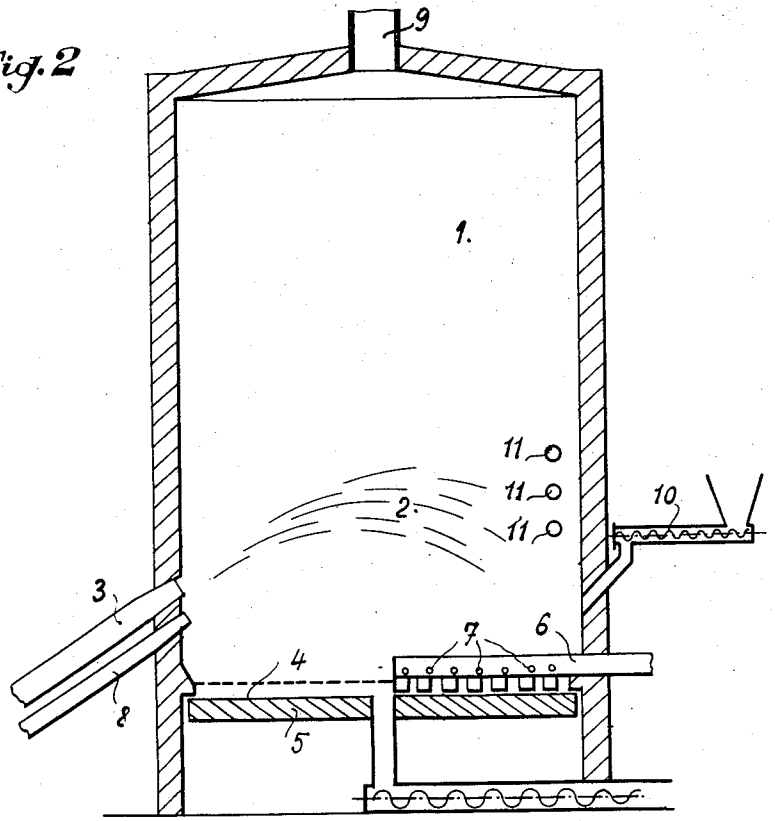
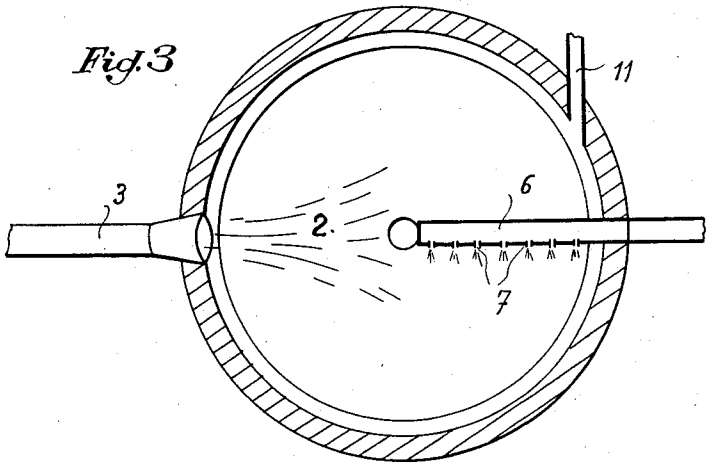


Fig. 3



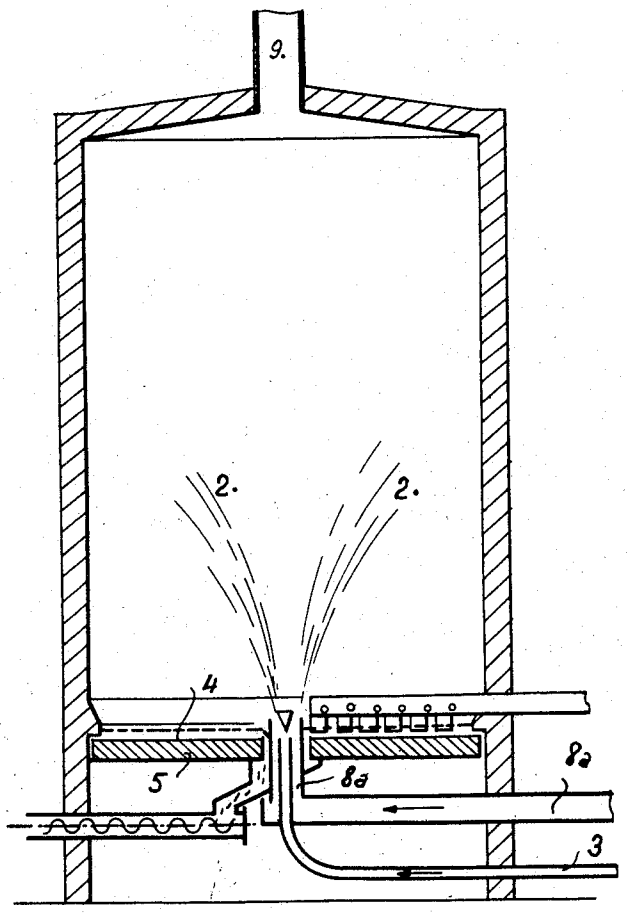
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Fig. 4



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METHOD OF ROASTING SULPHUR ORES IN SUSPENSION

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Claims priority, application France October 5, 1953

3 Claims. (Cl. 75—9)

It has been proposed a long time ago to roast sulphur ores in powder form by passing them in suspension in a current of air or of gas into a heated chamber.

The success of this operation is, in general, ensured by grinding the ore to a very fine state, the total oxidation of the grains being easier and more rapid as their size becomes smaller. But, on the other hand, the proportions of the grains carried away by the gases of combustion becomes higher as the ore is in a more finely ground state, and the costs of grinding increase with the fineness.

Now the applicants have found—and this is the object of the present invention—that it is possible to reduce considerably the required conditions in respect of fineness of grinding by utilising a mixed process in accordance with which the ore is roasted partly in suspension and partly on a sole-plate of the furnace.

In order to carry this method into effect, the ore is projected into the furnace, in suspension in a gas, in the form of a layer having a thickness as small as possible in order that the ore may be brought very rapidly to its burning temperature. The furnace is closed at its lower portion by a horizontal or roughly horizontal surface, upon which the grains of ore fall, whether they are completely roasted or not, and on which the desulphurisation is completed, either by causing a current of air or gas containing free oxygen to pass through the layer of ore, or by subjecting this layer to the action of raking members in order to complete the de-sulphurisation. This raking may be carried out in known manner, either by means of members which move with respect to a fixed sole-plate, or by means of members which are fixed with respect to a moving sole-plate, or finally by employing a combination of these two means.

The oxygen required for the combustion may be partly introduced with the gas carrying the ore; the major portion is blown-in over the layer of ore or through this latter so as to activate the elimination of the last traces of sulphur. The distribution of the air over the base of the furnace has the effect of reducing the speed of fall of the grains of ore, and in addition, the latter as they fall come in contact with an atmosphere more and more rich in oxygen. The air of combustion is heated as much as possible before it is passed into the furnace.

The internal temperature of the furnace is the higher as the gases emitted are poorer in oxygen. Since an increase in temperature may have the effect of forming a crust inside the furnace or may produce an undesirable agglomeration of the roasted product, this increase in temperature is limited by an injection of inert gases or, preferably, by re-introducing into the furnace the gases of combustion which have been previously cooled, as is the current practice in heating with liquid fuels.

It will, of course, be understood that the heat contained in the gases leaving the furnace will be recovered, preferably in the form of steam in a boiler of suitable type. The type of furnace used may be of any kind whatever, but furnaces of parallopiped and cylindrical

shapes would appear however, to lend themselves best to the carrying out of the process.

The attached drawings show, by way of example, and not in any limiting sense, a furnace for carrying out the method in accordance with the invention and also various alternative forms of its construction.

Fig. 1 is a diagrammatic view in longitudinal axial cross-section of a horizontal rectangular furnace.

Fig. 2 is a diagrammatic view in longitudinal axial cross-section of a vertical cylindrical furnace.

Fig. 3 is a view in horizontal cross-section corresponding to Fig. 2.

Fig. 4 shows an alternative form of construction of the furnace shown in Figs. 2 and 3.

Fig. 5 is a diagrammatic view in axial longitudinal cross-section of an approximately horizontal rotary furnace.

Fig. 6 is a view in transverse cross-section following the line A—A of Fig. 5.

In the furnace shown in Fig. 1, the ore is introduced at one end of the furnace 1 in the form of a stream of particles 2 by means of one or a number of nozzles 3 of suitable shape. The combustion of the finest particles takes place immediately, that of the larger grains is slower, but as is shown in the figure, it is the larger grains which have the longest trajectory and therefore the longest time exposed to the atmosphere of the furnace and on the sole-plate 5.

The sole-plate is constructed in the form of a travelling band as shown, either in the form of independent moving containers or with any other equivalent arrangement. This moving sole-plate is protected against the radiation of the furnace either by a refractory lining and/or a heat insulating coating 4, or by a suitable cooling arrangement.

The raking devices 6 are fixed and serve at the same time for the injection of air at 7 at the level of the sole-plate. This air also serves to cool the said raking devices.

The gas which is provided to limit the temperature inside the furnace is injected into the furnace through one or a number of nozzles 8 close to the point of injection of the ore and preferably beneath the latter. The gas outlet 9 is arranged at one of the extremities of the furnace and preferably close to the point of entry of the ore so as to extend the path of the flame.

The sulphated or badly roasted dust which could be separated from the gas before it leaves the furnace is re-introduced on the sole-plate by means of a screw 10 or any other equivalent air-tight apparatus so that the last traces of sulphur may be removed from it.

By way of a second example, the method may be put into operation in a cylindrical furnace with a vertical axis such as that shown in Figs. 2 and 3. Since certain of the elements disclosed in Figures 2 and 3 correspond to elements described above with respect to Figure 1, the same reference numerals will be applied thereto.

The ore may be introduced at a point on the periphery by means of one or a number of nozzles 3 in the form of a spread-out stream of particles 2. Re-cycled gas and/or air is admitted through tubular members 11 in the vicinity of the opposite wall of the furnace so as to avoid the agglomeration of the ore on this wall. These gases, together with the air introduced at 7 through the raking devices 6 will be introduced obliquely so as to impart a rotary movement to the atmosphere of the furnace and thus to make it uniform.

The ore may also be introduced in the form of two oppositely-directed layers which have their origin in diametrically-opposite points of the furnace so as to prevent agglomerations on the walls.

The form of construction shown diagrammatically in Fig. 4 will, however, be preferable, in which the intro-

duction of the ore is approximately axial and directed upwards from the base, while that of the gas which limits the temperature of the furnace is injected concentrically with it at 8*a*. The other reference numerals appearing in Figure 4 refer to the same elements as described above with respect to Figure 1.

In both cases, the sole-plate will, of course, have a circular shape, the roasted ore being extracted close to the center so as to reserve the longest trajectory to the coarser particles. The diameter of the sole-plate may be equal to that of the furnace or may differ from it by any particular desired amount.

By way of a further example, the method may be put into effect in a rotary cylindrical furnace having an axis which is horizontal or slightly inclined to the horizontal, of the type shown diagrammatically in Fig. 5. The stream of ore particles **2** is introduced through a nozzle **3** parallel to the axis or slightly inclined at an angle to the axis, and passing into the furnace through one of its extremities. The particles of ore fall back on to the lower portion of the furnace and are taken along by the rotary movement of the latter. The gas which is applied to control the temperature of the furnace will preferably be introduced through a nozzle **8** under the nozzle **3** with a slightly rising direction. This arrangement has the effect of increasing the length of the trajectory of the grains of ore inside the furnace.

The air is introduced through oblique nozzles **13**. A device, not shown, is provided to open these nozzles in order only to admit the injection of fresh air on to the surface of the ore while the latter is in movement at the lower part of the furnace.

What I claim is:

1. A process for oxidizing sulphide ores, including the steps: injecting a stream consisting of a mixture of coarse and fine sulphide ore particles together with air upwardly into a combustion chamber and allowing said mixture to fall freely within said chamber; simultaneously injecting a stream of non-oxidizable temperature controlling gas into said combustion chamber in the same direction as, and in close proximity to, said first mentioned stream; receiving the partially oxidized particles upon a moving surface in the lower portion of said chamber and progressively removing said partially oxidized particles from said chamber; simultaneously injecting air streams into said partially oxidized material on said moving surface to further oxidize said particles, said last mentioned air streams passing upwardly through said combustion chamber to contact and oxidize particles falling downwardly therein.

2. A process according to claim 1 wherein said stream of ore particles is directed upwardly in and transversely across said chamber, and the coarser of said particles in said stream of ore particles move in a direction opposite to the direction of movement of particles on said moving surface and away therefrom and are thereafter in contact with said moving surface for a greater length of time than the finer of said particles.

3. A process for oxidizing sulphide ores, including the steps: injecting a stream consisting of a mixture of coarse and fine sulphide ore particles together with air upwardly through an opening in the center of a sole plate into a combustion chamber; simultaneously injecting a stream of non-oxidizable temperature controlling gas into said combustion chamber in the same direction as, and substantially coaxial with, said first mentioned stream; deflecting said streams as they are injected into said combustion chamber toward the side walls of said combustion chamber and allowing the particles of said mixture to fall freely within said chamber; receiving the partially oxidized particles upon the sole plate with the coarser particles being closer to the periphery of said sole plate on the average than are the finer particles; moving the particles toward the center of the sole plate and simultaneously injecting air streams into said partially oxidized particles to further oxidize said particles, said air streams passing upwardly through said combustion chamber to contact and oxidize particles falling downwardly therein; and removing the oxidized particles through the center of said sole plate.

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