

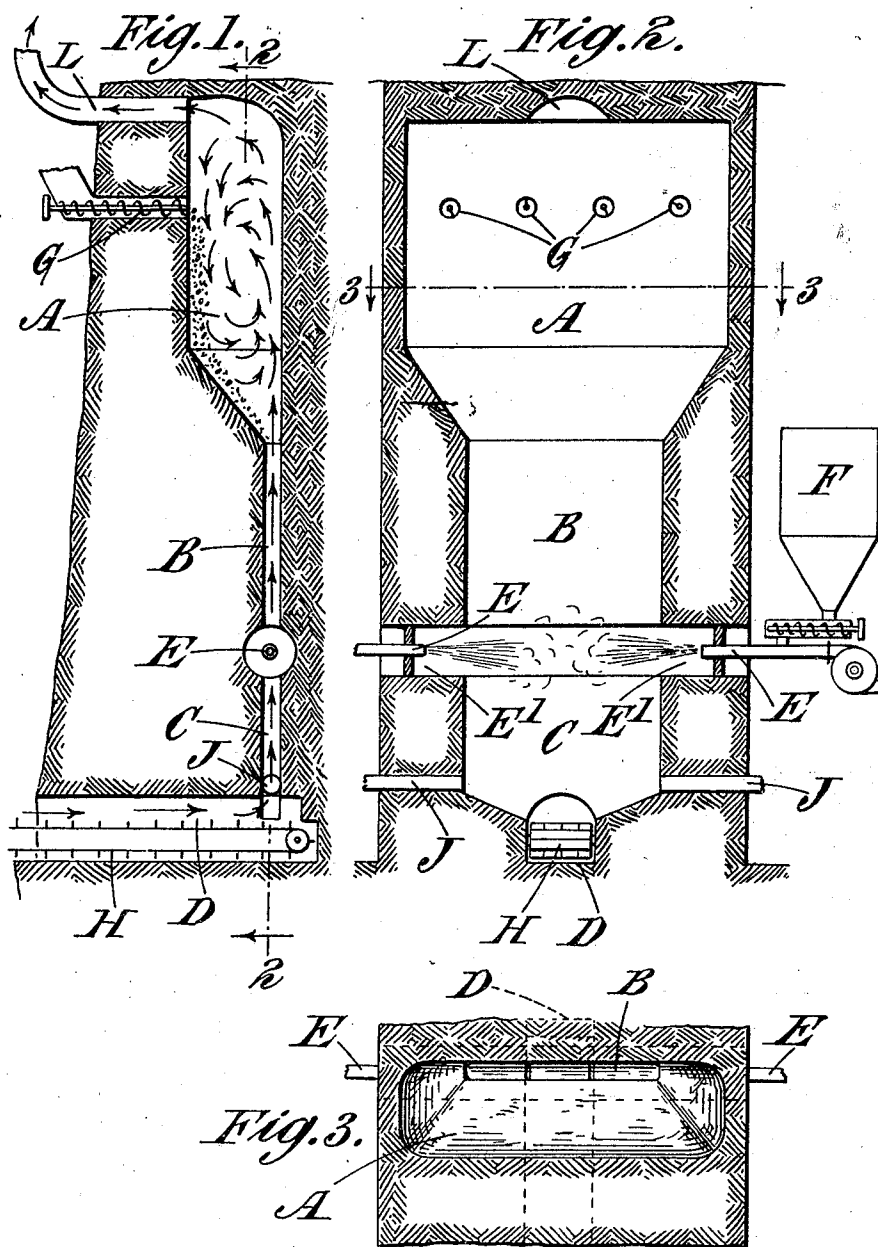
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KILN FOR MANUFACTURING LIME OR THE LIKE

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KILN FOR MANUFACTURING LIME OR THE LIKE

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This invention relates to kilns particularly adapted for use in the manufacture of lime, gypsum, calcareous and/or aluminiferous cements, the calcination of ores and kilns therefor.

The object of the invention is to improve kilns of the shaft type into the upper end of which raw materials in powdered form are introduced and permitted to fall against an ascending stream of hot gases.

According to this invention the average speed of the gases in the clinkering or sintering zone is maintained at least four times greater than that of the gases in the preliminary heating or decarbonating zone. In this way the fine particles do not leave the preliminary heating zone until a sufficient number of them fuse together or coalesce and can thus overcome the higher speed of the gases in the sintering zone and so fall through this zone and pass into the cooling shaft or chamber formed below it.

As a result, the fine particles form a baffle and so prevent internal radiation losses in the upper or decarbonating zone and sintering rapidly takes place in the lower zone of the kiln after these particles are properly calcined and preheated.

The heating gases are preferably maintained at the required relative speeds by forming the cross-sectional area of the decarbonating zone at least four times greater than that of the sintering zone.

Further, to prevent internal radiation losses and to facilitate the heating of the kiln and the roofing of the upper chamber, both the sintering and decarbonating portions are conveniently formed of elongated elliptical or of narrow and substantially rectangular shape in cross-section, thus bringing the longer opposite walls close to one another.

Moreover to ensure thorough preheating of the raw powdered materials in the decarbonating zone or chamber and to reduce the length of this portion of the kiln, the gases are made to follow a rotary or circulatory path in the decarbonating chamber. This result is secured by introducing the hot gases from the clinkering zone eccentrically or asymmetrically into the decarbonating chamber, so as

to flow over one of its longer walls, and by introducing the cold raw material through one or more openings in the opposite wall. The hot gases thus impinge eccentrically upon the slower and cooler gases in the decarbonating or pre-heating chamber, causing the gases on the colder, or inlet side to sink and helping to carry down the fine particles just introduced, instead of allowing them to be swept upwards and through the exhaust flue by the rising gases.

The raw materials may be introduced in wet form, as a spray, or in dry granular or pulverized form by a blower, worm feed or other known means, the particle sizes being so predetermined that on the one hand fine dust is not carried away by the hot gases and on the other hand the raw material does not at once fall into the sintering zone or shaft.

One form of kiln for carrying out the present invention is diagrammatically illustrated in the accompanying drawings, in which

Figure 1 is a vertical section through a quarry face showing a shaft kiln,

Figure 2 is a vertical section on the line 2—2 of Figure 1, and

Figure 3 is a cross-section on the line 3—3 of Figure 2.

The kiln diagrammatically illustrated is excavated in the ground and comprises an upper preheating and decarbonating chamber portion A, a lower narrower portion constituting the clinkering or sintering zone or shaft B, and a cooling shaft or chamber C which communicates with the ground level through an adit D.

The burners E which supply hot gases to the kiln communicate through lateral apertures E¹ with the lower end of the clinkering shaft B and are supplied with liquid, powdered or gaseous fuel in any known manner, in the particular example illustrated a hopper F for powdered fuel being diagrammatically illustrated on one side only.

The preliminary heating or decarbonating chamber is of at least four times the cross-sectional area of the sintering shaft, and in the particular example diagrammatically shown, the decarbonating chamber A is of

approximately ten times the cross-sectional area of the sintering shaft B. Both the shaft B and the decarbonating chamber A are of substantially rectangular cross-section and so shaped that the longer opposite walls are as close together as practical conditions will permit. This facilitates the lateral introduction of the burners at the lower end of the shaft B, and further enables the hot gases to be projected into the preheating chamber in the form of a narrow sheet or ribbon having a large heating surface which meets with considerable resistance on encountering the descending particles. As a result the heating gases can be quickly brought to rest thus reducing the height of the kiln and its consequent cost of construction. Further, the narrow substantially rectangular cross-section of the upper portion of the kiln facilitates the formation of a roof which, in the case of large kilns, would present difficulties were the kiln of circular cross-section.

The raw materials are introduced laterally into the upper portion of the chamber A through a suitable number of openings G, being introduced by means of a fan or blower or by worn conveyers as diagrammatically illustrated in the drawing.

A suitable conveyer H is also furnished in the working adit D through which the hot clinker can be withdrawn from the cooling shaft C, the air to support combustion being introduced to the burners through the mass of hot clinker in the cooling shaft through one or more suitable supply pipes as indicated at J.

It will be seen from Figures 1 and 3 that the decarbonating or preheating chamber portion A of the shaft is arranged asymmetrically with relation to the sintering shaft B, and further that the lateral openings G through which the powdered material is introduced into the kiln are formed in the wall furthest from and opposite to that with which the sintering shaft is in alignment.

As a result, the hot gases from the shaft B impinge eccentrically upon the slower and cooler gases in the preheating chamber causing the gases on the material inlet or opposite side wall to sink and thus assisting to carry down the fine particles of raw material which have just been introduced instead of allowing these particles to be swept away by the exhaust fan or its equivalent (not shown) through the shaft L.

It will therefore be seen that the gases in the upper or decarbonating chamber A of the kiln are caused to follow a rotary or circulatory path, thus permitting reduction of the vertical height of the kiln and further ensuring proper calcination and admixture of the various powdered materials before these particles coalesce or fuse together sufficiently to overcome the tendency of the hot gases to resist their fall. As soon as the particles are

thus of sufficient size and weight they fall against the hot and more rapidly moving gases in the sintering shaft B and being thus properly sintered pass into the cooling shaft C whence they are removed by the conveyer H after they have given up their heat to the incoming air which supports combustion.

It is to be appreciated that the drawings are of a purely diagrammatic nature and that in some cases the kiln may be built up against the quarry face. Moreover the general lay out of the kiln, the way in which the raw and sintered materials are respectively introduced and removed and the auxiliary apparatus employed, will naturally vary widely in accordance with special circumstances without departing from this invention.

Further, the relative length of the preliminary heating and decarbonating zones and the size of the cooling zone will again be varied to suit the material under treatment and the product sought to be obtained, the relative cross-sectional area of the sintering zone and the preliminary heating zone being in all cases such that the speed of the gases in the sintering zone is at least four times as great as that of the gases in the upper or preliminary heating zone.

What I claim as my invention and desire to secure by Letters Patent is:—

1. A shaft kiln for heat treating lime, cement and the like in powdered form comprising a preheating chamber of elongated cross-section having its wider side walls relatively close together, a sintering shaft of relatively smaller cross-section disposed below the preheating chamber and communicating asymmetrically therewith through the bottom, and means for introducing heated fluid into the lower portion of the sintering shaft, said chamber having an inlet for powdered raw material and a gas outlet both located at the upper end of the preheating chamber at the side remote from the upper end of the sintering shaft.

2. A shaft kiln for heat treating lime, cement and the like comprising a preheating chamber of elongated cross-section having its wider opposite sides relatively close together, a sintering shaft of relatively smaller cross-section disposed below the preheating chamber and communicating asymmetrically therewith through the bottom in such a way that the whole of the said sintering shaft lies to one side of the vertical axis of the preheating chamber, means for maintaining an ascending stream of hot gases in the sintering shaft, a passage so connecting the upper end of the sintering shaft and the preheating chamber that the hot gases from the sintering shaft enter the preheating chamber close to one of the longer side walls of said chamber, said chamber having an inlet through which powdered raw materials are delivered into

the upper end of the preheating chamber so as to fall along that side of the axis of the preheating chamber remote from the sintering shaft, and a gas outlet likewise located at the upper end of the preheating chamber at the side remote from the upper end of the sintering shaft.

3. A shaft kiln for heat treating lime, cement and the like in powdered form comprising a preheating chamber of elongated cross-section having its wider side walls relatively close together, a sintering shaft having a cross-sectional area not exceeding one-fourth that of the preheating chamber, the said sintering shaft being disposed below the preheating chamber and communicating asymmetrically therewith through the bottom, and means for introducing heated fluid into the lower portion of the sintering shaft, said chamber having an inlet for powdered raw material and a gas outlet both located at the upper end of that side wall of the preheating chamber which is opposite to the wall in alignment with the sintering shaft.

4. A shaft kiln for heat treating lime, cement and the like in powdered form comprising a preheating chamber of elongated cross-section having its wider side walls relatively close together, a sintering shaft having a cross-sectional area not exceeding one-fourth that of the preheating chamber, the said sintering shaft being disposed below the preheating chamber and communicating asymmetrically therewith through the bottom, means for introducing heated fluid into the lower portion of the sintering shaft, an inlet for powdered raw material and a gas outlet both located at the upper end of the preheating chamber and at that side wall thereof opposite to the wall in alignment with the sintering shaft, a cooling shaft forming an extension of the sintering shaft into which the sintered material is discharged, and means for introducing air to support combustion through the kiln shaft and thereby preheating the said air as set forth.

5. A shaft kiln for heat treating lime, cement and the like in powdered form comprising a preheating chamber of elongated cross-section having its wider side walls relatively close together, a sintering shaft of elongated cross-section having a cross-sectional area not exceeding one-fourth that of the preheating chamber, the said sintering shaft being disposed below the preheating chamber and communicating asymmetrically therewith through the bottom, and means for introducing heated fluid into the lower portion of the sintering shaft, said chamber having an inlet for powdered raw material and a gas outlet both located at the upper end of that side wall of the preheating chamber which is opposite to the wall in alignment with the sintering shaft.

6. A shaft kiln for heat treating lime, ce-

ment and the like in powdered form comprising a preheating chamber of elongated cross-section having its wider side walls relatively close together, a sintering shaft of relatively smaller cross-section disposed below the preheating chamber and communicating asymmetrically therewith through the bottom and having its upper end adjacent one of the longer side walls of said preheating chamber, and means for introducing heated fluid into the lower portion of the sintering shaft, said chamber having an inlet for powdered raw material and a gas outlet both located at the upper end of the side wall of the preheating chamber opposite to that to which the upper end of the sintering shaft is adjacent.

In testimony whereof I have signed my name to this specification.

GEOFFREY MARTIN.

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