United States Patent

[11] 3,603,568

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[21] Appl. No. 864,762
[22] Filed Oct. 8, 1969
[45] Patented Sept. 7, 1971
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[32] Priority Nov. 6, 1968
[33] Germany
[31] P 18 07 292.9

[54] APPARATUS FOR HEAT TREATMENT OF FINE MATERIAL

3 Claims, 1 Drawing Fig.

[52] U.S. Cl. ..... 263/21 R

[51] Int. Cl. F27b 15/00

[50] Field of Search 263/21

[56] References Cited

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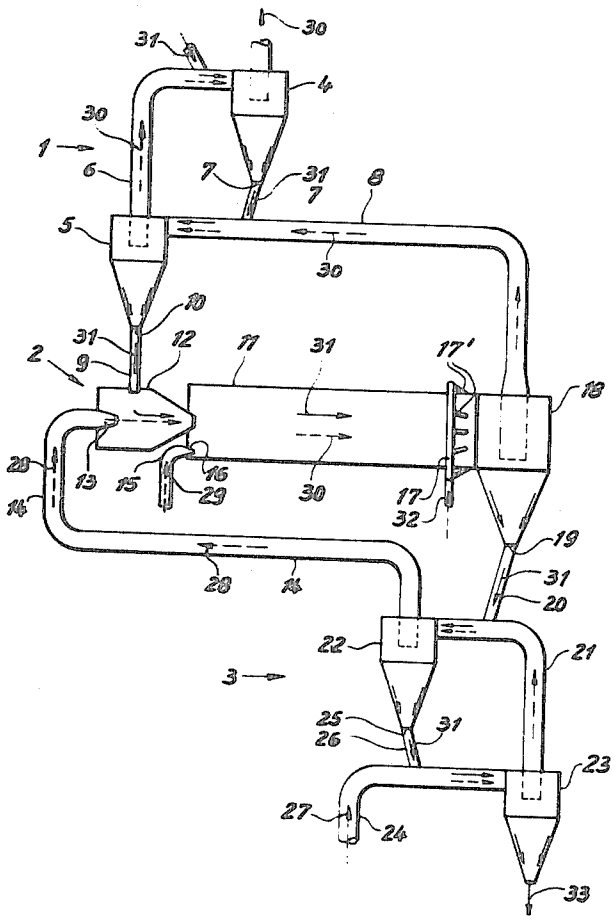
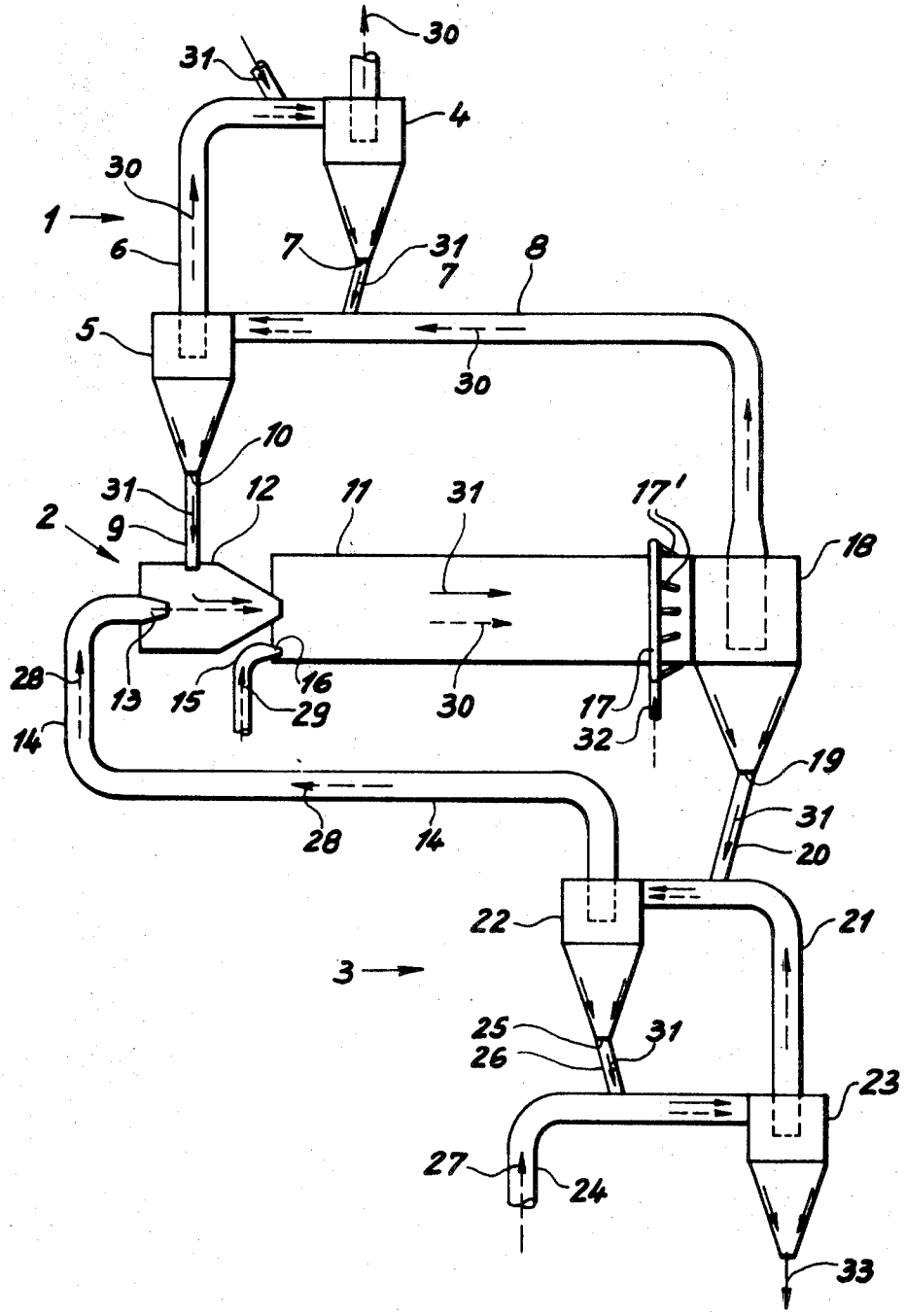
ABSTRACT: The apparatus comprises preheating, firing and cooling apparatus. Hot gases and fine material are passes concurrently through a firing chamber, and a separator is directly connected to the firing chamber.

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APPARATUS FOR HEAT TREATMENT OF FINE MATERIAL

BACKGROUND OF THE INVENTION

The invention relates to an apparatus for heat treatment of finely divided material, particularly raw material for the manufacture of cement, including a preheating apparatus, a firing apparatus and a cooling apparatus.

Apparatus is known in which a rotary kiln is provided as the firing apparatus. This apparatus, with moving parts, has disadvantages in that it is subject to substantial wear, requires extensive maintenance in order to prevent breakdowns and entails great initial cost as well as very considerable space requirements.

Other installations are known which in general consist of a vertical shaft through which the material travels downward and the gas travels upward. In the middle part of the shaft there is provided a firing zone furnished with a burner, from which the upward-flowing products of combustion heat the material, while the fired material in the lower part of the shaft is cooled by the upward-flowing secondary air. Since in installations of this type the material must travel in countercurrent to the gases in a downward direction, in the case of powdery or finely divided material it is impossible to use high gas velocities and accordingly impossible to attain high output capacities.

SUMMARY OF THE INVENTION

Accordingly, the object of the invention is to construct an apparatus of the class which has been described in such a manner that the firing apparatus, having no moving parts, on the one hand is relatively inexpensive to construct, and on the other hand permits the attainment of high output capacities.

This object is attained, in accordance with the invention, in that the firing apparatus is constructed in the form of a firing chamber which is fixed and through which the fine material and the hot gases flow in the same direction, and to which a separator is directly connected.

Since the firing chamber of the apparatus according to the invention is fixed, the abrasion and breakdowns due to moving parts are eliminated. The cost of construction and thus the cost of installation are substantially reduced in comparison to the known apparatus hereinbefore described. The concurrent flow of material and hot gases in the firing chamber makes possible the use of high rates of flow and thus the attainment of great output capacities.

In accordance with an advantageous embodiment of the invention, at least one cooling air supply passage discharges into the end of the firing chamber adjacent to the separator, and the separator and/or the firing chamber are provided with a porous inner wall for the introduction of cooling air. These arrangements assure that the hot fine material which has been fired will be partly cooled whereby formation of deposits on the inner wall of the separator will be safely prevented. Introduction of cooling air into the firing chamber protects against formation of deposits in the location where such protection is particularly needed. The cooling air introduced into the firing chamber can form at the same time a part of the air required for combustion.

BRIEF DESCRIPTION OF THE DRAWING

The drawing is a schematic view of an apparatus embodying the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The illustrated apparatus comprises in general a two-stage preheater 1, a generally horizontal firing apparatus 2 arranged thereunder, and a similar two-stage cooler 3, which is connected to the firing apparatus. The preheater 1 is composed of two cyclone separators 4 and 5, arranged one above the other, wherein the discharge duct 6 of the cyclone separator 5 is connected to the inlet of the cyclone separator 4, and the tailings outlet 7 of the cyclone separator 4 is connected to the gas supply duct 8 of the cyclone separator 5. The tailings outlet 10 of the cyclone separator 5 is connected by a passage 9 to a mixing chamber 12, which is located ahead of a tube-shaped firing chamber 11. Also projecting into this mixing chamber is the end of a primary air supply duct 14, which is formed as an injection nozzle 13. The mixing chamber 12 and also a burner nozzle 16 connected with a gas supply pipe 15 discharge into the rear end of the firing chamber 11. In the vicinity of its other end, the firing chamber 11 is surrounded by an annular duct 17, from which several branch ducts 17' lead into the firing chamber. Directly connected to this end of the firing chamber 11 is a cyclone separator 18, whose central discharge pipe is connected with the gas supply pipe 8 of the cyclone separator 5. The material outlet 19 of this cyclone separator is connected by means of a passage 20 to a duct 21 which connects the inlet of the cyclone separator 22 with the central discharge pipe of a cyclone separator 23 which with the separator 22 constitutes a cooler 3. The central discharge pipe of the cyclone separator 22 discharges into the primary air supply duct 14. The material discharge pipe 26 leading from the tailings outlet 25 of the cyclone separator 22 discharges into the air duct 24 which leads into the cyclone separator 23.

The operation of the apparatus is as follows: fresh air (arrow 27) enters the apparatus through the duct 24 as cooling air, and travels through the cyclone separator 23, the duct 21, the cyclone separator 22 and the primary air supply duct 14 to the firing apparatus 2, as primary air (28) which has been preheated in the cooler 3. The injector nozzle 13 blows the primary air into the mixing chamber 12. From there it travels into the firing chamber 11 and serves for combustion of the fuel introduced through the burner nozzle 16, for example gas (arrow 29). The hot gases (arrow 30) then flow to the cyclone separator 18. From this cyclone separator the hot gases (arrow 30) flow through the gas supply duct 8 to the lower cyclone separator 5 of the preheater 1. It travels through the duct 6 and the cyclone separator 4 and is finally (if desired after dust removal) discharged into the atmosphere.

Fine material (arrow 31) is introduced into the gas supply pipe 6 in the zone preceding the inlet of the upper cyclone separator 4 of the preheater 1. It travels with the hot gases (arrow 30) into the cyclone separator 4, is there separated, and then travels through the outlet 7 into the duct 8. The hot gases flowing therein (arrow 30) carry the fine material (arrow 31) into the lower cyclone separator 5 of the preheater. The fine material which in this manner has been preheated and if desired simultaneously partially deacidified flows through the outlet 10 and the fine material supply pipe 9 into the mixing chamber 12 of the firing apparatus 2. The primary air (arrow 28) injected into the mixing chamber through the injection nozzle 13 carries the fine material (arrow 31) into the firing chamber 11, where it is fired in the flame from the burner nozzle 16. The fine material is held in suspension by the hot gases (arrow 30) and travels concurrently therewith into the directly connected cyclone separator 18. Before being discharged from the firing chamber 11, the fine material is subjected to the action of cooling air (arrow 32) which is injected from the annular duct 17 and its branch ducts 17' into the periphery of the firing chamber. The purpose of this arrangement is a partial cooling of the fully fired fine material, in order to prevent the formation of a deposit on the interior of the cyclone separator 18.

The fine material (arrow 31) separated in the cyclone separator 18 travels through the outlet 19 and the passage 20 to the cooler 3. The cooling air flowing into the duct 21 carries the fine material into the cyclone separator 22. In the latter it is separated and travels through the outlet 25 and the passage 26, as well as through the duct 24 with the fresh air (arrow 27) into the lower cyclone separator 23 of the cooler 3. Here it is removed as final product 33.

As it will be evident from the description of the embodiment, the details of the multistage preheater 1 and of the

multistage cooler 3 are without particular significance for the present invention. Within the scope of the invention, a preheater and a cooler constructed in a different manner may be substituted instead of those which are illustrated.

I claim:

1. Apparatus for heat treatment of fine material, comprising an air preheater and a fine material preheater, wherein the improvement comprises a tubular firing chamber having an axial inlet at one end which connects the firing chamber to a premixing chamber, means for introducing the preheated fine material and preheated air into the premixing chamber, to cause them to mix and then flow axially into the tubular firing chamber through the axial inlet, and a separating chamber, for precipitating the fired fine material, which is directly connected to the other end of the tubular firing chamber.

2. Apparatus according to claim 1, wherein at least one cooling air supply passage discharges into the end of the firing chamber adjacent to the separating chamber.

3. Apparatus according to claim 1, wherein the firing chamber is substantially horizontal.