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Polysius et al.

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[54] **APPARATUS FOR PREHEATING FINE GRANULAR MATERIAL**

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[51] **Int. Cl.** **F27b 15/00,** F26b 17/00

[58] **Field of Search** ....263/32 R, 21 A; 34/57 R

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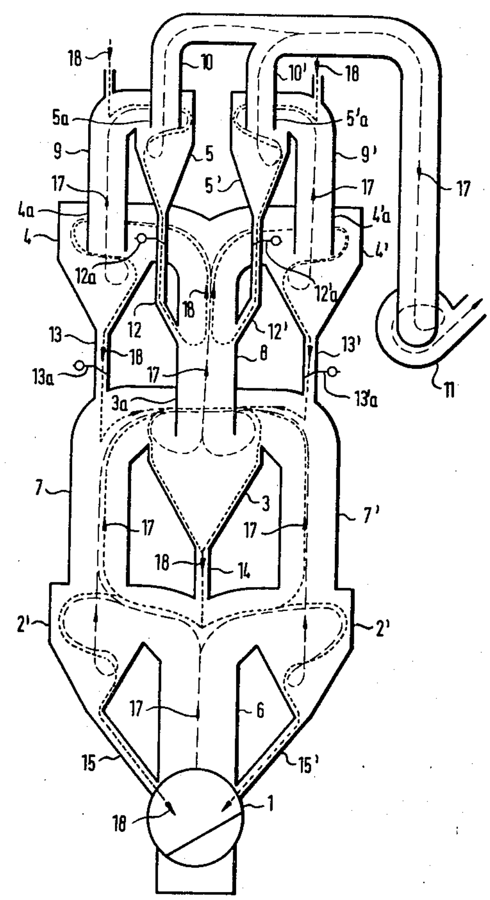
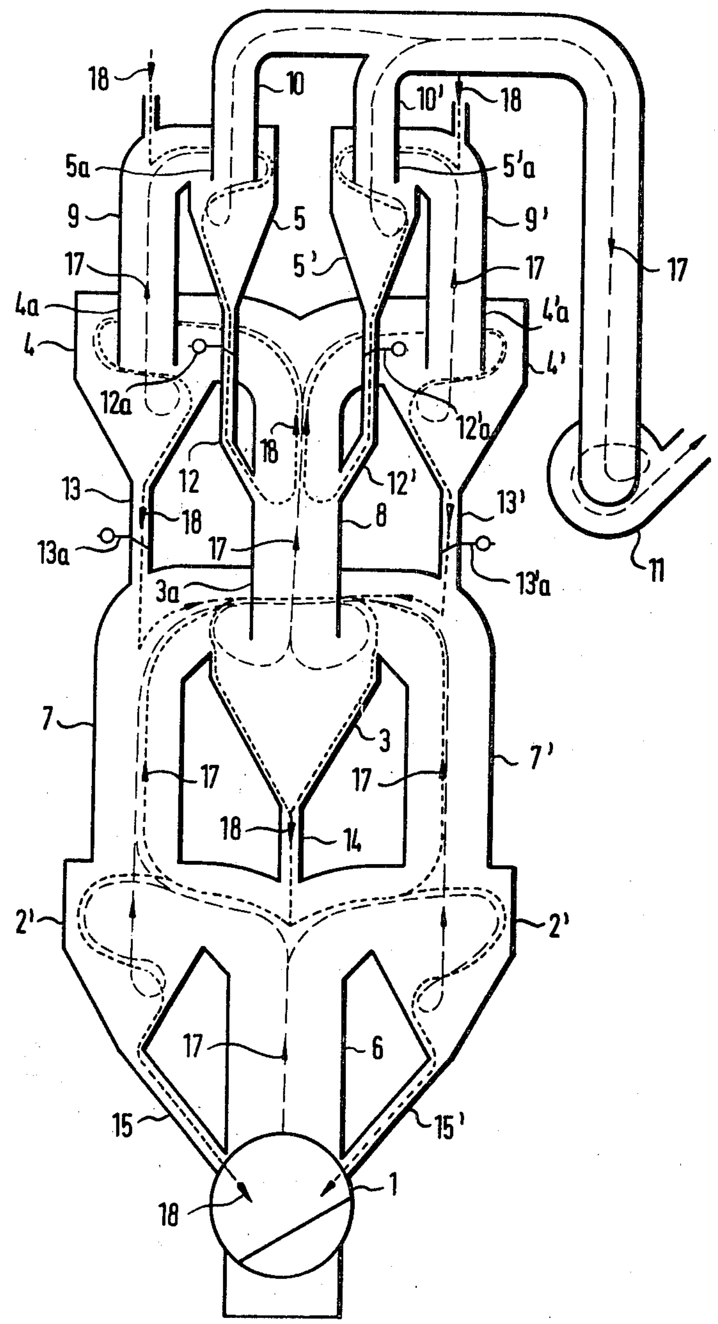
[57] **ABSTRACT**

A plurality of eddy chambers of the cyclone separator type are arranged in superimposed levels through which the material passes downward in series and through which the hot gases travel upward in series. Each eddy chamber in at least the uppermost level is provided with a dip pipe, and each eddy chamber in at least the lowermost level is constructed without any dip pipe.

4 Claims, 1 Drawing Figure




18
10
10'
18
5a
5'a
9
5
9'
5'
17
17
17
4a
4'a
4
4'
12a
12'a
18
12
12'
13
18
13'
8
17
13a
13'a
11
3a
7
3
7'
17
17
18
14
2'
2'
17
6
15
15'
18
1

APPARATUS FOR PREHEATING FINE GRANULAR MATERIAL

BACKGROUND OF THE INVENTION

The invention relates to an apparatus for the preheating of fine granular material by means of hot gases, consisting of a plurality of eddy chambers of the cyclone type arranged at several superimposed levels, wherein the hot gas stream which is distributed to the eddy chambers of the first, lowermost stage is reunited in a central eddy chamber of the second stage, before it is again distributed to the eddy chambers of the third stage, while the divided stream of material coming from the eddy chambers of the third stage is united in the central eddy chamber of the second stage, before it is again distributed to the eddy chambers of the first stage.

In the known preheaters of this type the eddy chambers are in the form of cyclone separators which are provided as usual with dip pipes. In practice it is found, however, that particularly in the high temperature zone of the preheater, i.e. in the lowermost stage, the dip pipes of the cyclone separators are subjected to extraordinarily severe thermal and mechanical deterioration. In many cases, the dip pipes of the lowermost cyclone separators are already burned out after a relatively short period of operation, and this has necessitated difficult repairs heretofore, which often bring about lengthy shutdowns of the entire installation.

SUMMARY OF THE INVENTION

The object of the invention accordingly is to construct an apparatus of the type which has been described in such a manner that the difficulty which has been mentioned is eliminated.

In accordance with the invention, this object is achieved by providing the cyclone-type eddy chambers with dip pipes in at least one stage, and by constructing the eddy chambers without dip pipes in at least one stage lying in a zone of higher gas temperature.

When the dip pipes are eliminated, particularly in the lowermost stages of the preheater which are subjected to the highest gas temperature, an undesirable and hazardous source of trouble is thereby eliminated. As shown by tests, the omission of the dip pipes impairs only insignificantly the separating capacity in the cyclone separators in question. Moreover, in the lower stages of the preheater a somewhat prolonged dwell time of the material in the hot gas stream is even very desirable for an intensive exchange of heat in most cases. The retention of the dip pipes in the less intensively heated stages of the preheater, particularly in the uppermost stage of the preheater, guarantees on the other hand the complete separation of the material from the gas stream leaving the preheater.

Accordingly, in the practice of the invention there is achieved a substantial improvement in reliability of operation and freedom from shutdowns of the installation, with simultaneous preservation of a good rate of heat transfer and a complete separation of dust from the gas stream leaving the preheater.

In accordance with a practical embodiment of the invention, in at least one stage the material discharge ducts of the eddy chambers are provided with shutoff devices, and in at least one of the stages which lie in a zone of higher gas temperature the material discharge ducts of the eddy chambers are constructed without shutoff devices.

Like the dip pipes, the shutoff devices which are ordinarily provided in the material discharge ducts are subject to a substantial mechanical and thermal deterioration. This undesirable source of trouble is likewise eliminated by omission of the shutoff devices in the hottest stages of the preheater. The retention of these shutoff devices in at least one cooler stage of the preheater, preferably in the uppermost stage, guarantees on the other hand, in conjunction with the retention of the dip pipes in these stages, the good separating capacity which is necessary for a complete separation of dust from the gas stream.

The open cross section of the material discharge ducts which are constructed without shutoff devices is advantageously made at least great enough so that a maximum of 80 percent, preferably a maximum of 50 percent of the cross section is occupied by material, and at the most great enough so that in total a maximum of 10 percent, preferably a maximum of 5 percent of the entire gas stream passes through the material discharge ducts of this stage.

BRIEF DESCRIPTION OF THE DRAWING

The drawing is a schematic longitudinal section of a preferred form of apparatus embodying the invention

DESCRIPTION OF THE PREFERRED EMBODIMENT

The illustrated apparatus serves for the preheating of fine granular material, which is finally supplied to a rotary kiln **1**. The preheater comprises several eddy chambers arranged in superimposed levels, which are constructed like cyclone separators, and are referred to hereinafter as cyclone separators for the sake of simplicity. The lowermost stage of the preheater consists of the cyclone separators **2, 2'**, the second stage consists of one central cyclone separator **3**, the third stage consists of two cyclone separators **4, 4'** and the fourth stage consists of two cyclone separators **5, 5'**.

These cyclone separators are connected by means of their gas and material ducts as follows: the gas duct **6** coming from the rotary kiln **1** is divided and leads to both of the cyclone separators **2**, and **2'**. Their gas discharge ducts **7, 7'** both discharge into the central cyclone separator **3**, and preferably are tangential in the same sense of rotation. The gas discharge duct **8** of the cyclone separator **3** is divided and leads to the cyclone separators **4** and **4'**, which are connected by means of their gas discharge pipes **9, 9'** with the cyclone separators **5, 5'**. The gas discharge ducts **10, 10'** of the latter cyclone separators are connected to a common blower **11**.

The material discharge ducts **12, 12'** of the cyclone separators **5, 5'** discharge into the gas duct **8**. The material discharge ducts **13, 13'** of the cyclone separators **4, 4'** are connected to the gas ducts **7, 7'**, while the material discharge **14** of the cyclone separator **3** discharges into the upper end of the gas duct **6**. The material discharge ducts **15, 15'** of the two lowermost cyclone separators are directly connected with the rotary kiln **1** or with its inlet housing.

While the material discharge ducts **12, 12'** and **13, 13+** of the two uppermost stages of the preheater are provided with shutoff devices **12*a*, 12'*a*, 13*a*, 13'*a***, for example in the form of balanced dampers, such devices are lacking in the material discharge ducts **14, 15** and **15'** of the two lower preheater stages. Both cyclone separators **2, 2'** of the lowermost preheater stages furthermore are constructed without dip pipes, while all of the other cyclone separators **3, 4, 4', 5, 5'** are provided with the usual dip pipes **3*a*, 4*a*, 4'*a*, 5*a***, and **5'*a***.

The path of flow of the hot gases coming from the rotary kiln **1** is indicated by arrows **17**; the hot gas stream is distributed first to the two cyclone separators **2, 2'**, is then reunited in the central cyclone separator **3**, is distributed anew to the cyclone separators **4, 4'** then passes through the cyclone separators **5, 5'** and is finally withdrawn through the blower **11**.

The countercurrent path of the material being preheated is marked by the arrows **18**: the material entering the gas ducts **9, 9'** is separated in the cyclone separators **5, 5'**, then travels into the gas duct **8**, is led to the cyclone separators **4, 4'**, travels after separation in these cyclone separators into the gas ducts **7, 7'**, is brought together anew in the central cyclone separator **3** and is once more distributed, after entering the gas duct **6**, to the two cyclone separators **2, 2'**, before it travels, highly preheated, into the rotary kiln **1**.

We claim:

1. Apparatus for preheating fine granular material by means of hot gases, comprising a plurality of eddy chambers of the cyclone separator type, arranged in superimposed levels

through which the material passes downward in series and through which the hot gases travel upward in series, each eddy chamber of the cyclone separator type having a lateral gas inlet which is located adjacent to the top of the eddy chamber and which is directed to cause the entering gas to eddy in cyclone fashion so as to separate solids from the gas by centrifugal force, and each eddy chamber also having a lower portion that tapers downward to a bottom outlet for discharging separated solids, wherein the improvement comprises a central vertical gas outlet duct at the top of each eddy chamber, the lower end of such outlet duct of each eddy chamber in at least the uppermost level being extended downward into the eddy chamber in order to improve the separation of solids, and the lower end of the gas outlet duct of each eddy chamber in at least the lowermost level terminating flush with the top of the eddy chamber in order to protect the duct from thermal deterioration.

2. Apparatus according to claim 1 wherein the eddy chambers are arranged in at least three superimposed levels, the lower end of the central vertical gas outlet duct of each eddy chamber above the lowermost level being extended downward into the eddy chamber.

3. Apparatus according to claim 1 wherein the eddy chambers are arranged in at least three superimposed levels, the first and third levels from the bottom each comprising two eddy chambers, and the second level from the bottom comprising only one eddy chamber having two gas inlet ducts, which lead from the two eddy chambers of the first level and into each of which discharges a material supply duct leading from one of the eddy chambers of the third level.

4. Apparatus according to claim 3 wherein a fourth level from the bottom comprises two eddy chambers each of which has a gas inlet duct leading from one of the eddy chambers of the third level, the latter eddy chambers being connected to a gas inlet duct, which leads from the eddy chamber of the second level and into which discharge two material supply ducts leading from the eddy chambers of the fourth level, each of such material supply ducts being provided with a shutoff device.

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