United States Patent [19]

Vishnevsky et al.

[11] **3,724,176**

[45] **Apr. 3, 1973**

[54] **DEVICE FOR HEAT TREATMENT OF FINELY DISPERSED MATERIAL**

[76] Inventors: **Konstantin Pavlovich Vishnevsky**, Ulianovskaya ulitsa, 19, kv. 24; **Sergei Alexandrovich Belyanov**, Vilonovskaya ulitsa, 13, kv. 32, both of Kuibyshev, U.S.S.R.

[22] Filed: **May 19, 1971**

[21] Appl. No.: **144,912**

[52] **U.S. Cl.** **55/269**, 55/343, 55/349

[51] **Int. Cl.** **B01d 51/06**

[58] **Field of Search**.....55/267, 269, 345, 349, 343, 55/419, 449, 459

[56] **References Cited**

UNITED STATES PATENTS

2,392,872	1/1946	Wolfe	55/345 X
2,663,561	12/1953	Muller	55/267 X
2,797,076	6/1957	Muller	55/267 X
2,841,385	7/1958	Muller	55/267 X
3,212,764	10/1965	Muller et al.	55/267 X

FOREIGN PATENTS OR APPLICATIONS

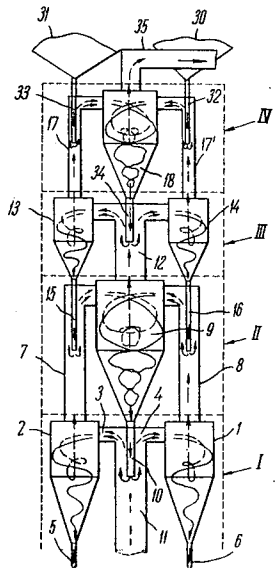
982,719	2/1965	Great Britain	55/343

Primary Examiner—Tim R. Miles
Assistant Examiner—William Cuchlinski, Jr.
Attorney—Holman & Stern

[57] **ABSTRACT**

A device for heat treatment of finely dispersed material in which there are several stages of duplex and single cyclone-heat-exchangers with the last cyclone in the line serving as a precipitator and being of a multistage construction.

1 Claim, 2 Drawing Figures



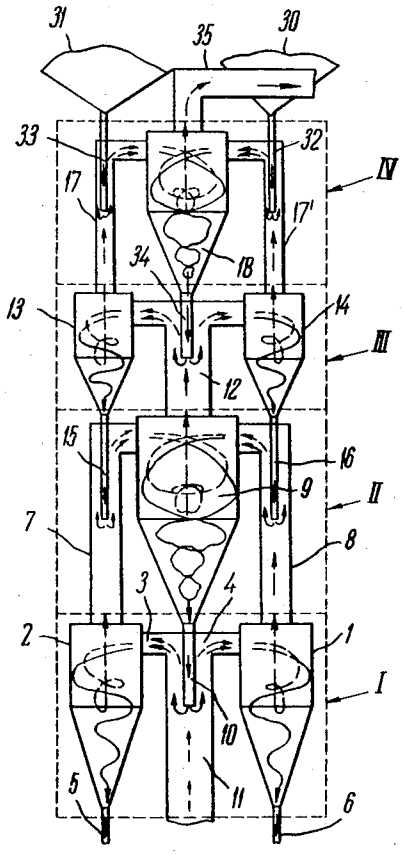

31
35
30
33
32
IV
17
17'
34
18
13
14
III
12
15
16
9
II
7
8
3
4
2
1
I
10
5
11
6

FIG. 1

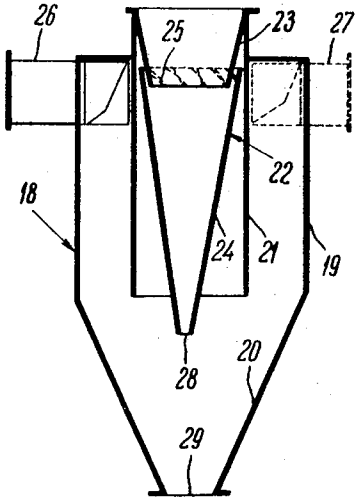

26
25
23
27
22
18
24
21
19
28
20
29

FIG. 2

DEVICE FOR HEAT TREATMENT OF FINELY DISPERSED MATERIAL

The present invention relates to devices for the production of construction materials, and more specifically to devices for the heat treatment of finely dispersed materials, particularly cement.

Known in Prior Art are the devices for heat treatment of finely dispersed materials, for example these manufactured by "Vedag" Co. (Federal Republic of Germany), consisting of a number of stages of single and duplex cyclone-heat-exchangers installed in a consecutive alternating order and interconnected by dust and gas ducts.

In the known devices, the last in the line of cyclones along the flow of gases fails to trap the dust effectively so that the finely dispersed material is not completely precipitated. This causes pollution of the atmosphere and interferes with the sanitary requirements for the operation of the plants.

In addition, in these devices, the hot gases at first enter a single cyclone, then the duplex cyclones which fails to ensure an effective separation of the partly heat-treated finely dispersed material and its delivery into the furnace. The single cyclone located immediately after the furnace is necessarily of a larger diameter in view of the increase in the volume of gases at a high temperature, as compared with the diameters of the subsequent cyclones which reduces the efficiency of the device.

An object of the present invention is to provide a device for the heat treatment of finely dispersed material with such an arrangement of cyclones which ensures efficient separation of the finely dispersed material in the last and first stages at a minimum expenditure of power for overcoming the hydraulic resistance of the entire system.

This object is achieved by providing a device for the heat treatment of the finely dispersed material, comprising several stages of duplex and single cyclone-heat-exchangers, installed in a consecutive alternating order and interconnected by dust and gas ducts in which, according to the invention, the first and third stages of the cyclone-heat-exchanger along the gas flow consist of duplex cyclones while the second and fourth stages consist of single cyclones, with the last one thereof, serving for the precipitation of the finely dispersed material, being of a multistage construction.

Such an arrangement of the device ensures effective separation of the finely dispersed material in the last cyclone along the gas flow due to its multistage construction and in the first cyclones due to their duplex construction.

Now the invention will be described by way of example with reference to the accompanying drawings, in which:

FIG. 1 is a schematic view of the device according to the invention; and

FIG. 2 is a view in longitudinal section of the multistage cyclone precipitator used in the present device.

The device for heat treatment of the finely dispersed material consists of four stages I,II,III,IV (FIG. 1). Stage I consists of two parallel cyclones 1 and 2 intended to heat the finely dispersed material with furnace gases.

The furnace gases from a gas duct II enter the cyclones 1 and 2 through pipes 3 and 4 and the finely dispersed material heated in the cyclones is discharged through dust ducts 5 and 6.

Gas outlet pipes 7 and 8 of the cyclones 1 and 2 respectively are connected with stage II of the device which is constituted by a single cyclone 9. A dust duct 10 for the discharge of the dispersed material is lowered into the gas duct 11 and a gas discharge pipe 12 from the cyclone 9 branches off and communicates with two cyclones 13 and 14 defining stage III.

Dust ducts 15 and 16 of the cyclones 13 and 14 for the discharge of the finely dispersed material are lowered into the gas outlet pipes 7 and 8 while gas discharge pipes 17 and 17′ of the cyclones 13 and 14 are connected with stage IV constituted by a multistage cyclone 18 which serves for the precipitation of the finely dispersed material.

The multistage cyclone 18 (FIG. 2) includes a cylindrical casing 19 provided with a hopper-shaped bottom 20 and a gas discharge pipe 21 spaced inwardly of the casing 19. Inside the pipe 21 is an additional cyclone 22 designed to trap the finely dispersed material which has not been separated in the cylindrical casing 19.

The additional cyclone 22 consists of two truncated cones 23 and 24, with the cone 23 being inserted into the cone 24 and interconnected by slanting guide vanes 25, serving to swirl the gas.

The gas enters the multistage cyclone-precipitator 18 through tangential pipes 26 and 27 and leaves through the truncated cone 23. A lower hole 28 of the additional cyclone 22 and a lower hole 29 of the bottom 20 of the casing 19 are used for the discharge of the finely dispersed material.

Bunkers 30 and 31 (FIG. 1) supply the finely dispersed material for heat treatment; and are connected by dust ducts 32 and 33 with the gas ducts 17 and 17′ respectively.

The device operates as follows:

The finely dispersed material is fed from the bunkers 30 and 31 (FIG. 1) through the dust ducts 32 and 33 into the gas ducts 17 and 17′ where it is entrained by the hot gases and carried into the multistage cyclone-precipitator in stage IV (FIG. 2). In this cyclone 98 to 99 percent of the finely dispersed material is separated from the gases and flow through a dust duct 34 (FIG. 1) into the gas duct 12 of stage III. Here, in the gas duct 12, a heat exchange takes place between the finely dispersed mixture and the hot gases. Next, the finely dispersed mixture enters the cyclones 13 and 14 of stage III. Passing through all the four stage of the cyclones, the finely dispersed mixture is heated, partly decarbonized and flows through the dust ducts 5 and 6 into the furnace (not shown) for calcination.

From the furnace, the hot gases flow through the gas duct 11 into the cyclones 1 and 2 of stage I, carrying the finely dispersed mixture fed in through the dust duct 10 and reject part of the heat to it.

In the cyclones of stage I, the gases are separated from the finely dispersed mixture, flow through the gas ducts 7 and 8, carrying the finely dispersed mixture fed through the dust ducts 15 and 16, and enter the cyclone 9 of stage II in which the process is repeated again.

Having passed through all the four stages, the gases heat the raw material, become cooled, and flow through gas duct 35 for cleaning.

The consecutive separation of the dust-and-gas flow in stages I and III and its mixing in stages II and IV of the device produce a stabilizing effect on the thermal and aerodynamic work in the gas duct branches.

The tests of the present device have proven its high efficiency and economy. The average hydraulic resistance of the device is 20–25 percent lower than it is in the known devices and the use of the device reduces the amount of dust discharged into the atmosphere by 15–17 percent.

What is claimed is:

1. A device for the heat treatment of finely dispersed material comprising: a first stage consisting of two cyclone-heat-exchangers, dust ducts and gas ducts providing communication between said heat-exchangers, a second stage constituted by a single cyclone heat-exchanger, second dust ducts and gas ducts connecting the single cyclone heat-exchanger with the heat exchangers of the first stage; a third stage consisting of two cyclone-heat-exchangers, third gas ducts and dust ducts providing communication between the heat-exchangers of the third stage and the heat-exchanger of the second stage; a fourth stage defined by a single cyclone-heat-exchanger, said heat-exchanger of the fourth stage being of a multistage construction and serving as a precipitator, and fourth dust ducts and gas ducts connecting the heat-exchanger of the fourth stage with the heat-exchangers of the third stage.

* * * * *