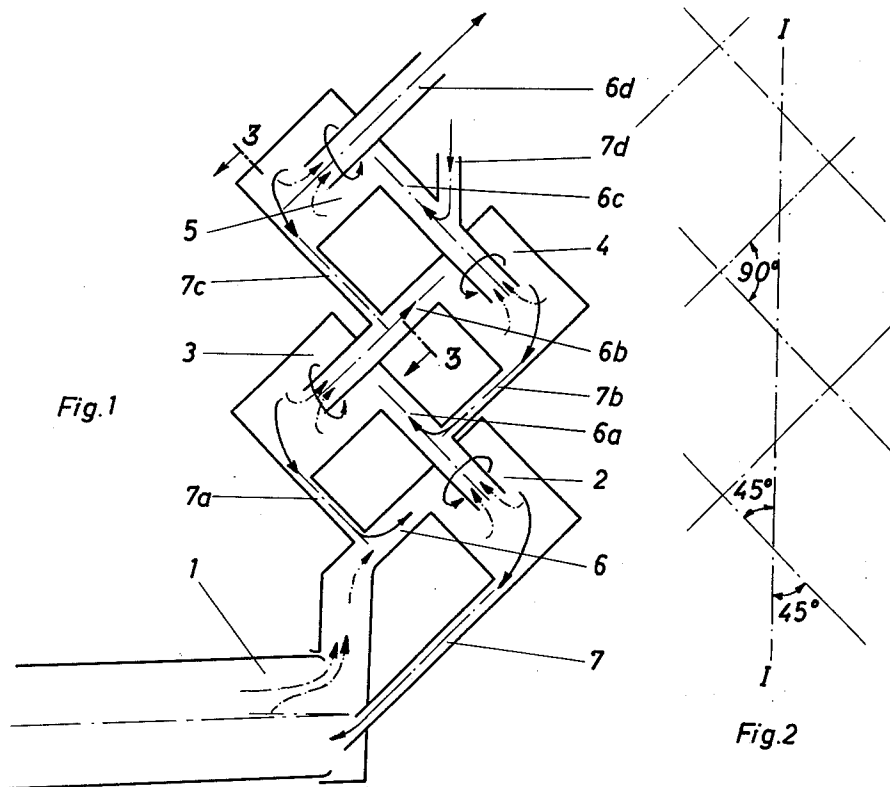
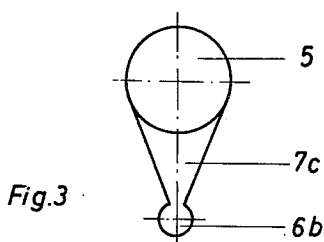
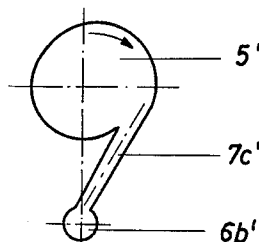


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 APPARATUS FOR HEATING CEMENT POWDER OR
 SIMILAR FINE-GRANULAR MATERIALS
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APPARATUS FOR HEATING CEMENT POWDER OR SIMILAR FINE-GRANULAR MATERIALS

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4 Claims. (Cl. 263—32)

The present invention relates to an apparatus for heating cement powder or similar fine-granular materials.

Known devices of this type comprise several cyclones which are connected with each other by means of pipes in such manner that the exhaust gases of a rotary kiln are sucked successively through the individual cyclones, by means of a blower while the dust exhaust pipes of each cyclone, with the exception of the last one, open into the exhaust gas pipe leading to the next cyclone. The cyclones may be arranged, one above the other, in two rows, the cyclones of each row being offset relative to each other in a manner that each cyclone of one row is exactly aligned with the gap left between two cyclones of the adjacent row. Since the axes of the cyclones are disposed vertically above each other, the entire unit requires a considerable overall height, if it is taken into consideration, that for use of a given temperature drop of the exhaust gases, four and more cyclones have to be placed above each other, whereby always the dust-like material passes into the pipe bent leading to the next cyclone of the adjacent row. For a conventional plant an overall height of approximately 130 feet results which, of course, necessitates a great and expensive steel or concrete structure to receive the individual cyclones.

It is another drawback of known devices that for the feeding of the exhaust gases and the dust-like material, respectively, from one cyclone to the following one, elbow pipes have to be used which are very often a source of disturbance in the operation. It has been experienced that the dust-like material is deposited on and adheres to the elbow walls so that the cross-sectional area of the passage is decreased. Therefore, many openings had to be provided to allow for frequent cleaning of the pipes. In order to provide a great number of such openings, it has been proposed to use elbow pipes having rectangular cross-section which, of course, raise further the cost of the plant. In addition, the cleaning of the pipes also requires a considerable number of trained workers.

It is, therefore, one object of the present invention to provide an apparatus, for heating cement powder or similar fine-granular material which eliminates the above described deficiencies by arranging the cyclones in such manner that their axes are inclined. The cyclones are placed one above the other and in substantially two vertical rows offset in such arrangement, that they can be connected with each other by straight pipes.

It is another object of the present invention to provide an apparatus for heating cement powder or similar fine-granular material, wherein, conveniently, the center lines of all of the cyclones are inclined at a 45 degree angle, so that the center line of a cyclone of one of the two rows forms a right angle with the center line of the next lower cyclone of the adjacent or other of the two rows. The center lines of all of the cyclones form thus a zigzag line. This inclined arrangement has the advantage that the cyclones can be arranged very close to each other and that only short, straight pipes are required to connect the cyclones with each other, thus eliminating any elbow pipes.

It is a further object of the present invention to provide an apparatus for heating cement powder or similar fine-granular material, wherein the dust exhaust pipes and the exhaust gas pipes of each cyclone are arranged in

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planes which are approximately in parallel with each other. The gas pipe of cyclone is exactly in the center line of the next lower cyclone, while the dust exhaust pipe opens at almost right angles into the exhaust gas pipe which connects the cyclone with the next one.

It is yet another object of the present invention to provide an apparatus for heating cement powder or similar fine-granular material, wherein, depending upon operating conditions, the different pipes may open into the associated cyclone in radial or tangential direction and the dust exhaust pipe may form a chute, level with the bottom of the cyclone.

It is still a further object of the present invention to provide an apparatus for heating cement powder or similar fine-granular material, wherein the diameter of the next higher cyclone may be smaller than that of the next lower one, since the temperature of the exhaust gas decreases from one cyclone disposed in one row to the other in the other row and to maintain a constant velocity of flow, the cyclones being smaller in diameter the farther they are away from the rotary kiln.

With these and other objects in view, which will become apparent in the following detail description, the present invention will be clearly understood in connection with the accompanying drawing, in which

FIGURE 1 is a diagrammatic, sectional elevation of a complete plant, designed in accordance with the present invention;

FIG. 2 shows schematically the axes of the respective cyclones;

FIG. 3 is a section taken along the lines 3—3 of the uppermost cyclone of FIG. 1; and

FIG. 4 is a similar section as shown in FIG. 3 of another embodiment of a cyclone.

Referring now to the drawing, and in particular to FIG. 1, the apparatus is arranged in such manner that the cyclone unit is disposed adjacent the conventional rotary kiln 1, and comprises the cyclones 2, 3, 4, and 5. It is to be understood that, depending upon the operating conditions, a greater number of cyclones may be arranged, one above the other in two rows, to form a single series. The cyclones 3 and 5 form one row and the cyclones 2 and 4 form the other row. The center lines of the cyclones form thus a zigzag line, as shown in FIG. 2, since they move between the two rows, and are disposed at an angle of 45 degrees, with the vertical line forming the other angle side, i.e., the center lines of the cyclones form approximately right angles relative to each other.

The lowermost cyclone 2 is connected to the rotary kiln 1 by means of an exhaust gas pipe 6 and a dust exhaust pipe 7 in the manner shown. The dust exhaust pipe 7 forms a chute which transfers the dust-like material from the cyclone 2 to the rotary kiln 1. The hot exhaust gases enter the cyclone 2 at its upper end through an exhaust gas pipe 6.

The cyclone 3 is arranged higher than the cyclone 2, yet in the adjacent row its dust exhaust pipe 7a opens into the exhaust gas pipe 6, and its exhaust gas pipe 6a, in the center line of the cyclone 2, extends into the cyclone 2 and leads straight to the upper end of the cyclone 3. In the same way, the other cyclones 4 and 5 disposed alternately in the respective rows and are arranged and connected with each other by short, straight dust exhaust pipes and exhaust gas pipes, the dust exhaust pipe 7b and 7c opening into the exhaust gas pipe 6a and 6b which connect the lower cyclones.

The exhaust gas pipe 6d, extending from the cyclone 5, leads to a blower (not shown) or to a filter, while the pipe 7d, opening into the exhaust gas pipe 6c, is connected to the feeding station for the dust-like material.

Referring now to FIG. 3, the dust exhaust pipe 7c may

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radially widen and open into the bottom of the cyclone 5. FIG. 4 shows, however, that it is also possible to have the dust exhaust pipe 7c' open into the cyclone 5' in tangential direction, so that the separated material is thrown into the chute, as indicated by the arrow.

The dust-like material, supplied into the pipe 7d, flows through each of the cyclones 5, 4, 3, and 2 in the direction of the arrows indicated by thick lines, and enters the rotary kiln 1 through the chute 7. Contrary to this arrangement, the exhaust gas leaving the rotary kiln 1 flows through the cyclones 2, 3, 4, and 5 in the direction of the arrows, indicated by dotted lines, and eventually enters the blower or the filter through the pipe 6d.

As can be readily seen from the drawing, the cyclones are arranged close to each other. The connecting pipes are short and straight so that any elbow pipes which might form a source of trouble are eliminated from the pipe lines. Furthermore, a low over-all height of the complete unit is achieved.

Preferably, the cyclones are arranged in the form of a spiral or helix.

While I have disclosed two embodiments of the present invention, it is to be understood that these embodiments are given by example only and not in a limiting sense, the scope of the present invention being determined by the objects and the claims.

I claim:

1. An apparatus for heating cement powder or similar fine-granular material by hot kiln gases comprising two substantially vertical rows of a plurality of cyclones disposed in a single series, each of the latter having an exhaust gas pipe and a dust exhaust pipe, said dust exhaust pipe of each of said cyclones leading into said exhaust gas pipe of the previous of said cyclones in said series with the exception of the lowermost of said cyclones, said

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cyclones jointly with said exhaust gas pipes forming a single series defining a continuous and upwardly directed gas flow path, the longitudinal axis of each of said cyclones being disposed at an angle of 45° to the vertical, the longitudinal axes of each pair of adjacent cyclones forming an angle of 90°, the exhaust gas pipes connecting each pair of adjacent cyclones consisting of straight conduits, and an imaginary projection of said dust exhaust pipes except the lowermost of said dust exhaust pipes intersects its adjacent dust exhaust pipe to form an angle of about 90°.

2. The apparatus, as set forth in claim 1, wherein each of said cyclones has a plane bottom disposed perpendicularly to the longitudinal axis of said cyclones, and said dust exhaust pipes extending from and in the plane of the corresponding bottom of said cyclones.

3. The apparatus, as set forth in claim 2, wherein said dust exhaust pipes form a chute the diameter of which is reduced axially at least in one direction starting with the diameter of the corresponding cyclone.

4. The apparatus, as set forth in claim 2, wherein said dust exhaust pipes terminate tangentially into the side wall of the corresponding of said cyclones.

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