

DESCRIPTION

Title of Invention

REACTION CHAMBER

Technical Field

5 [0001] The present invention relates to a reaction chamber of a fluidized bed reactor.

Background Art

[0002] Conventionally, as a technique of such field, a reaction chamber that is described in the below-described Patent Document 1 has been
10 known. In this reaction chamber, there are arranged multiple waterwall tubes extending vertically, these waterwall tubes are connected together by flat plate-like fins, and thereby walls defining this reaction chamber are formed. An upper part of these walls is in a substantially vertical posture, and an intermediate part of the walls is
15 bent downwards as well as outwards at an angle to the vertical plane. Furthermore, a lower part of the walls continuing below the bend part is applied with a refractory lining on the inside, and an inner surface of this refractory lining is disposed so as to be positioned in the same vertical plane as that of the fins at the wall upper part. Owing to this
20 construction, it is suggested that when reactant particles in the reaction chamber fall down along the walls, they are made to fall continuously without the occurrence of changes of direction, and thus erosion of the walls caused by the collision of the reactant particles is suppressed.

Citation List

25 **Patent Literature**

[0003] Translated Japanese Publication of Patent Application No. 4-

503243

Summary of Invention**Technical Problem**

[0004] In this construction, however, an upper end of the refractory lining is shaped to become thin by degrees upwards along the bend of the walls. At such thin upper end portion of the refractory lining, it is difficult to embed an anchor for preventing detachment. As a result, there is a possibility that by the friction and collision of reactant particles, which are fluidized along the walls in the reaction chamber, against the upper end of the refractory lining, the thin upper end portion of the refractory lining comes off and is damaged. When the refractory lining is damaged, the reactant particles that are fluidized in the vicinity of the walls are likely to pile at the damaged portion, and as a result, the waterwall tubes may be brought in contact with the reactant particles to be damaged.

[0005] It is therefore an object of the present invention to provide a reaction chamber capable of suppressing the detachment of a refractory lining.

Solution to Problem

[0006] The present invention is a reaction chamber in a fluidized bed reactor having a grid at the bottom of the reaction chamber and walls defining the reaction chamber horizontally, the walls having:

a substantially vertical upper waterwall section in the upper part of the reaction chamber, the tubes in a waterwall being combined with fins or flat plates to form the waterwall;

a refractory lined lower wall section in the lower part of the

reaction chamber; and

an intermediate waterwall section between the upper waterwall section and the refractory lined lower wall section, characterized in that:

a waterwall in the intermediate waterwall section is bent
5 downwards as well as outwards at an angle to the vertical plane; and

an upper end face of the refractory lining is a horizontal surface.

[0007] In this reaction chamber, even in the case in which reactant particles falling down along an upper waterwall part are collided against the upper end face of the refractory lining, due to that the upper end face
10 of this refractory lining is formed to be a horizontal surface, the collision of the above-mentioned reactant particles is less likely to act as the force of causing this refractory lining to come off. In addition, in case where the upper end face of the refractory lining is to be a horizontal surface, the refractory lining at the upper end portion can be
15 thick enough, and this sufficient thickness at the upper end portion can make it less likely for the refractory lining to come off due to the friction and collision of the reactant particles.

[0008] Furthermore, the refractory lining preferably includes a sloping surface that is formed so as to be positioned on the inside of the upper
20 end face and to come down inwardly. Owing to this construction, in the case in which reactant particles falling down along the upper waterwall part are collided against the sloping surface, they are splashed back in the direction of being apart from the walls toward the inside of the reaction chamber. Therefore, the reactant particles after having
25 been splashed back are less likely to be contacted to the walls again, and as a result, the damage of the refractory lining and the waterwall tubes

can be suppressed.

[0009] Furthermore, the upper end face of the refractory lining is preferably positioned outside the virtually vertical plane along the fins in the upper waterwall part. In this case, the above-mentioned upper end face is to be positioned on the backside of the upper waterwall part viewed from an internal part of the reaction chamber, so that the reactant particles falling down along the upper waterwall part are less likely to collide against the upper end face of the refractory lining. Accordingly, it is possible to further suppress the detachment of the refractory lining.

Advantageous Effects of Invention

[0010] According to the reaction chamber of the present invention, it is possible to suppress the detachment of the refractory lining.

Brief Description of Drawings

[0011] Fig. 1 is a cross sectional view illustrating a first exemplary embodiment of a reaction chamber according to the present invention.

Fig. 2 is an elevation view illustrating the shape viewed from the inside of the reaction chamber in the vicinity of an upper end portion of a refractory lining of this reaction chamber illustrated in Fig. 1.

Fig. 3 is a cross sectional view illustrating the shape viewed from the side in the vicinity of the upper end portion of the refractory lining illustrated in Fig. 2.

Fig. 4 is a cross sectional view illustrating the shape viewed from the side in the vicinity of the upper end portion of a refractory lining in a second exemplary embodiment of a reaction chamber according to the present invention.

Description of Embodiments

[0012] Hereinafter, exemplary embodiments of a reaction chamber according to the present invention will be described in detail referring to the drawings.

5 [0013]

(Embodiment 1)

As illustrated in Figs. 1 to 3, a combustion chamber (reaction chamber) 1 of a fluidized bed reactor is provided with a grid plate 3 that is horizontally disposed at the bottom and a side wall 5 that horizontally
10 defines this combustion chamber 1. The side wall 5 is provided with multiple waterwall tubes 51 that vertically extend to cause water to flow, and multiple flat plate-like (platy) fins 53 that connect adjacent waterwall tubes 51 together. Furthermore, the side wall 5 is constructed of multiple waterwall tubes 51 and multiple fins 53 being
15 alternately arranged and connected. In addition, the side wall 5 is provided with a refractory lining 55 that is applied on the inner wall side so as to cover the above-mentioned waterwall tubes 51 and fins 53 at the lower part.

[0014] Into this combustion chamber 1, air is introduced through a
20 nozzle 4 from an air chamber 7 beneath this combustion chamber 1, and reactant particles in the combustion chamber 1 are fluidized by this air. If other gas than air is used to fluidize the reactant particles in the combustion chamber, gas for fluidization is introduced through other inlets (not shown). Moreover, in some cases, fuel for combustion,
25 additives, and other particulate material or secondary gas are supplied into the combustion chamber 1 through other inlets (not shown).

[0015] The side wall 5 includes an upper waterwall part 5a that is formed of the waterwall tubes 51 and the fins 53, has a substantially vertical posture, and horizontally defines an upper part 1a of the combustion chamber 1. Furthermore, the side wall 5 includes a lower wall part 5c that is provided with the above-mentioned refractory lining 55, and horizontally defines a lower part 1c of the combustion chamber 1. In addition, the side wall 5 includes an intermediate waterwall part 5b that is situated between the upper waterwall part 5a and the lower wall part 5c, and horizontally defines an intermediate part 1b of the combustion chamber 1. The ratio of the height of the lower wall part 5c with respect to the vertical height of the total side wall 5 is usually in the range of 1: 10 to 1: 3.

[0016] As illustrated in Figs. 2 and 3, the side wall 5, at a bend position 13 of the intermediate waterwall part 5b, is bent at an angle α downwards as well as outwards. Incidentally, in the state of being illustrated in Fig. 3, the left side of the side wall 5 is an internal part of the combustion chamber 1, and the right side of the side wall 5 is the outside of the combustion chamber 1. This angle α can be set to be 5 degrees to 30 degrees, and in many cases, setting of the angle α at 10 degrees to 20 degrees enables to obtain such sufficient effects of bending as described below. Further, in a position of bent again 15 between the intermediate waterwall part 5b and the lower wall part 5c, the side wall 5 is bent at an angle α in a direction opposite to the direction of bending at the bend position 13 so as to vertically extend downwards again. Thus, at least an upper portion of the lower wall part 5c extends in a substantially vertical direction.

[0017] At the lower wall part 5c, an upper end face 21 of the refractory lining 55 is formed to be a horizontal surface. Furthermore, at the upper end portion of the refractory lining 55, there is formed a sloping surface 23 that continues obliquely below the upper end face 21. This sloping surface 23 is extended obliquely at about 45 degrees so as to come down toward the inside of the combustion chamber 1 from a ridge line 21a at the end of the upper end face 21. In addition, the refractory lining 55 includes an inner wall surface 25 extending downwards in parallel to the waterwall tubes 51 and the fins 53 from the lower end of the above-mentioned sloping surface 23.

[0018] Letting a virtually vertical plane along the fins 53 in the upper waterwall part 5a a vertical plane A as illustrated in the figure, the upper end face 21 is positioned outside the vertical plane A (i.e., at the back viewed from an internal part of the combustion chamber 1). That is, the ridge line 21a at the end of the upper end face 21 is positioned outside the vertical plane A. In addition, letting a virtually vertical plane of being contacted from the inside of the reactor 1 with respect to the outer circumferential surface of each waterwall tube 51 in the lower wall part 5c a vertical plane B as illustrated in the figure, the ridge line 21a of the upper end face 21 is positioned inside the vertical plane B (i.e., in the front viewed from an internal part of the combustion chamber 1). By securing some distance between these ridge line 21a and vertical plane B, the portion of sticking to the waterwall tubes 51 at the upper end portion of the refractory lining 55 can be thick enough.

[0019] According to such combustion chamber 1 as described above, due to that the upper end face 21 of the refractory lining 55 is formed to

be a horizontal surface, even in the case in which reactant particles falling down along the upper waterwall part 5a are collided against the upper end face 21 of the refractory lining 55, this collision force is less likely to act as the force of causing this refractory lining 55 to come off.

5 [0020] Moreover, due to that the upper end face 21 of the refractory lining 55 is formed to be a horizontal surface, the refractory lining 55 at the upper end portion can be thick enough, and this sufficient thickness at the upper end portion can make it less likely for detachment thereof due to the friction and collision of reactant particles to occur. In
10 addition, by securing the sufficient thickness at the upper end portion of the refractory lining 55, it becomes possible to provide an anchor on the surface of the waterwall tubes 51 and the fins 53 to enforce the strength of being fixed at the upper end portion of the refractory lining 55. Further, due to that the sloping surface 23 is formed as a chamfer at a
15 corner portion between the upper end face 21 and the inner wall surface 25, damage at the upper end corner portion of the refractory lining 55 can be suppressed. Furthermore, even in the case where reactant particles falling down along the upper waterwall part 5a are collided against the sloping surface 23, it is splashed back in the direction of
20 being apart from the side wall 5 toward the inside of the combustion chamber 1. Therefore, the reactant particles having been splashed back are less likely to be contacted with the side wall 5 again, and as a result, the damage of the refractory lining 55 and the waterwall tubes 51 can be suppressed.

25 [0021] Further, due to that the side wall 5 is bent downwards as well as outwards in the bend position 13, and the upper end face 21 is

positioned outside the vertical plane A, reactant particles falling down along the fins 53 of the upper waterwall part 5a (that is, along the vertical plane A) is less likely to collide against the upper end face 21. Thus, the detachment of the refractory lining 55 can be suppressed further. From the viewpoint of having such effects, the distance in a height direction from the bend position 13 to the upper end face 21 is preferably made to be small, and the horizontal distance from the vertical plane A to the ridge line 21a is preferably made to be large. Furthermore, to actualize such construction, the upper end face 21 of the refractory lining 55 is preferably provided at the height of the position of bent again 15.

[0022] Incidentally, regarding the case of forming the refractory lining 55 by being vertically joined, it is preferably constructed so that no joint face of relatively small strength is placed in the proximity of the upper end face 21 from the viewpoint of suppressing the detachment of the upper end portion of the refractory lining 55.

[0023]

(Embodiment 2)

Now, as illustrated in Fig. 4, a refractory lining 155 in a combustion chamber 101 is formed to be a horizontal surface at an upper end face 121. Further, an inner wall surface 125 of the refractory lining 155 is extended downwards vertically from a ridge line 121a at the end of the upper end face 121. No chamfer part is formed between the upper end face 121 and the inner wall surface 125. Incidentally, in this combustion chamber 101, like reference numerals and symbols refer to the same or equivalent parts as those of the above-

described combustion chamber 1, and duplicated descriptions will be omitted.

[0024] Also in such combustion chamber 101, due to that the upper end face 121 of the refractory lining 155 is to be a horizontal surface, in the case in which reactant particles falling down along the upper waterwall part 5a is collided against the upper end face 121 of the refractory lining 155, the force of this collision is less likely to act as the force of causing this refractory lining 155 to come off.

[0025] In addition, due to that the upper end face 121 of the refractory lining 155 is to be a horizontal surface, the refractory lining 155 at the upper end portion can be thick enough, and this sufficient thickness thereof at the upper end portion can make it less likely for detachment due to the friction and collision of reactant particles to occur. In addition, by securing the sufficient thickness at the upper end portion of the refractory lining 155, it also becomes possible to provide an anchor on the surface of the waterwall tubes 51 and the fins 53 to enforce the strength of being fixed at the upper end portion of the refractory lining 155, further enabling to make it less likely for the refractory lining 155 at the upper end portion to come off as well.

[0026] The present invention is not limited to the above-described embodiments. For example, in the first embodiment, it is preferable that the ridge line 21a of the upper end face 21 is provided in a position outside the vertical plane B. In this case, the upper end face 21 of the refractory lining is constructed of multiple intermittent horizontal surfaces that are situated in each part sandwiched between adjacent waterwall tubes 51. In addition, in the above-described Embodiment 1

and Embodiment 2, as illustrated in Figs. 3 and 4, although the inner wall surfaces 25 and 125 of the refractory linings 55 and 155 are positioned inside the vertical plane A, it is preferable that the inner wall surfaces 25 and 125 are positioned on the vertical plane A. In this case, reactant particles falling down along the fins 53 at the upper waterwall part 5a (that is, along the vertical plane A) can continue to fall down along the inner wall surfaces 25 and 125 of the refractory linings 55 and 155 without changes of direction, so that reactant particles to collide against the upper end faces 21 and 121 come to decrease further.

Reference Signs List

[0027] 1, 101: combustion chamber (reaction chamber), 1a: upper part of the combustion chamber, 1c: lower part of the combustion chamber, 3: grid plate (grid), 5: side wall, 5a: upper waterwall part, 5b: intermediate waterwall part, 5c: lower wall part, 21, 121: upper end face, 23: sloping surface, 51: waterwall tube, 53: fin (flat plate), 55, 155: refractory lining, A: virtually vertical plane

CLAIMS

1. A reaction chamber in a fluidized bed reactor having a grid at the bottom of the reaction chamber and walls defining the reaction chamber horizontally, the walls having:

5 a substantially vertical upper waterwall section in the upper part of the reaction chamber, the tubes in a waterwall being combined with fins or flat plates to form the waterwall;

 a refractory lined lower wall section in the lower part of the reaction chamber; and

10 an intermediate waterwall section between the upper waterwall section and the refractory lined lower wall section,

 wherein a waterwall in the intermediate waterwall section is bent downwards as well as outwards at an angle to the vertical plane; and

 an upper end face of the refractory lining is a horizontal surface.

15 2. A reaction chamber according to claim 1, wherein the refractory lining has a sloping surface that is formed so as to be positioned on the inside of the upper end face, and to come down inwardly.

20 3. A reaction chamber according to claim 1 or 2, wherein the upper end face of the refractory lining is positioned outside a virtually vertical plane along the fins in the upper waterwall section.