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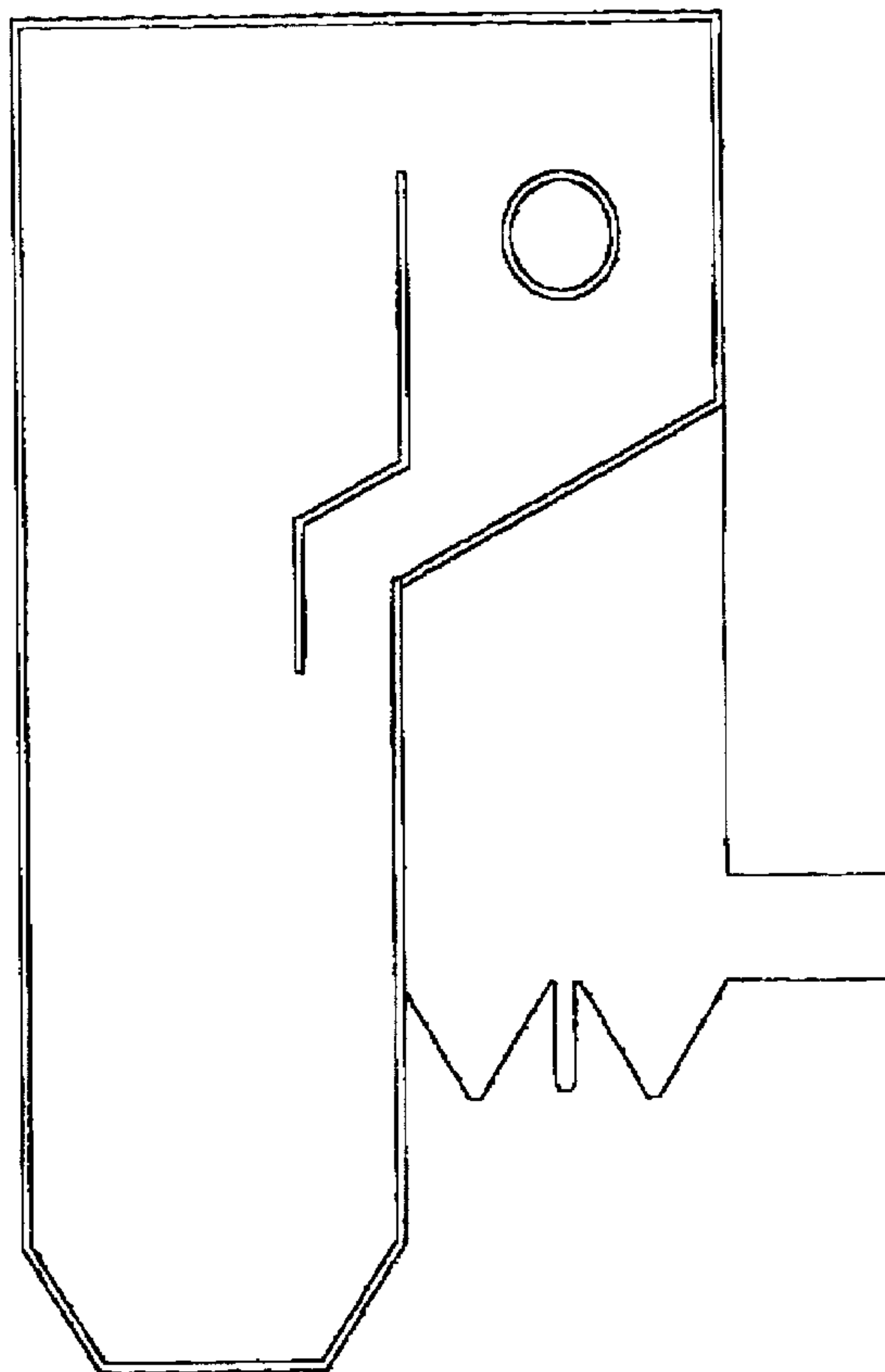
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(54) Titre : AMELIORATIONS CONCERNANT LES SEPARATEURS GAZ-SOLIDES POUR UTILISATION DANS LES CHAUDIDRES OU AUTRES FLUX GAS-SOLIDES

(54) Title: IMPROVEMENTS IN OR RELATING TO NOVEL GAS-SOLID SEPARATORS FOR USE IN BOILERS OR OTHER GAS-SOLID STREAMS



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Improvements in or relating to Novel gas-solid separators for use in Boilers or other gas-solid streams

The present invention relates to gas-solid separators of novel designs, which reduces substantially heat loss through walls, act as heating surfaces of boiler or heat exchangers, and are economical due to low fabrication and maintenance costs. More particularly, this invention pertains to novel horizontal, box-type gas-solid separators which may conveniently be used in conventional fossil fuel flame fired boilers for operating it as circulating fluidized bed boilers, or in purpose built circulating fluidized bed boilers. The novel gas-solid separators of this invention could preferably be square or rectangular.

BACKGROUND OF THE INVENTION

Heretofore gas-solid separators, used for separating gases or heated gases from gas-solid suspension in a circulating fluidized bed, were normally vertical axis circular in shape, refractory lined, with a single horizontal axis inlet and a vertical outlet for gases denuded of suspended solids. Gases entering the circular gas-solid separator (vertical or horizontal) underwent a vortex movement and thereafter the stripped gases were led out through an opening, usually provided at the central region of said gas-solid separator. Such circular gas-solid separators were lined with refractory bricks or slabs of considerable thickness that necessitated use of enhanced quantity of refractory materials. Hot gases entering the gas-solid separators were exposed to the refractory surfaces, which absorbed heat resulting in uneven heating and consequent deterioration of the surfaces including cracking and/or spalling.

Gas-solid separators of different shapes were tried to eliminate the aforesaid difficulties, for instance, of a rectangular shape with an vertical slit horizontal axis inlet located at one peripheral end, and a vertical axis circular outlet located in the middle region either above or below the entry section thereof. Yet another design tried was that of a conical body with a gas inlet at the side and outlet at the top. It is difficult to integrate these within the compact confines of a boiler while retaining a reasonable gas inlet velocity.

PRESENT INVENTION

The present invention aims at surmounting the disadvantages and difficulties envisaged by the gas-solid separators used previously.

The principal object of the present invention is to provide a novel gas-solid separator that ensures efficient separation of particulate solids suspended in the gases leaving a circulating fluidized bed (CFB) furnace or riser.

A further object of this invention is to provide novel, horizontal box-type gas-solid separators easily adaptable with rectangular configuration of boilers.

A further object of this invention is to provide novel, horizontal box-type gas-solid separators which also serves as heat transfer surface of the boiler and a multiple number of gas-solid separators can be conveniently stacked in parallel.

A still further object of this invention is to provide novel, horizontal square gas-solid separators which are not only cost effective, but are also capable of reducing start-up time of the boilers in which such gas-solid separators are used.

Yet another object of the present invention is to provide circulating fluidized bed boilers deploying novel gas-solid separators as aforesaid.

Another object of one embodiment of the present invention is to reduce erosion of the target region of the separators

The gas-solid separators of this invention are provided with a horizontal slit shaped (width exceeding the height) inlet into a box for solid-laden gases, and are usually equipped with a plurality of outlets for gases. The slit, which covers the entire width of the box, is located either above or below the axis of the exit pipe. The path of incoming gas-solid mixture being tangent to an imaginary cylinder along the horizontal axis of the exit, it goes round in spiral path before exiting the box through the circular opening on the vertical side wall of the box located either one or both sides of the box. The spiral motion of the particle laden gases strips off the suspended particles and the denuded gas flow out through the outlets.

The gas-solid separator walls may be made of heat absorbing panels to absorb heat from the hot flue gas and transfer that to the heated medium in the panel. Thus the walls require considerably less quantity of refractory materials for cladding. This has two-fold advantages, namely (i) cost reduction due to use of less quantity of refractory material, and (ii) enhanced heat-exchange ensuring uniform heating and short start-up time.

Furthermore, the novel gas-solid separator design eliminates erosion problems associated with circular, refractory-lined cyclones type separators, particularly since a layer of particulate matters deposited on the square gas-solid separator walls act as an additional refractory-cum-protective substrate in respect of the in-flowing gases impinging thereon.

As an alternative embodiment of the present invention there may be provided box-type gas-solid separators with a single outlet.

As an alternative embodiment of the present invention a notch is built in the wall just opposite to the entrance of the gas-solid mixture. A number of horizontal shelves are located in this notch to trap solids impacting as they enter the separator. These solids protect the target region from erosion.

The gas-solid separators of the present invention will now be more particularly described and illustrated by means of drawings accompanying this specification in which:

Fig.1 shows the arrangement of the horizontal square gas-solid separators in the circulating fluidized bed boilers;

Fig. 2 gives a sectional view of arrangement of multiple gas-solid separators stacked in a confined space with erosion protector. Fig. 2(a), 2 (b) and 2 (c) stand for horizontal square gas-solid separators viewed along sections C-C View, B-B view, and view A-A, respectively.

**Fig.3 gives a sectional view of the horizontal box-type, square gas-solid separator with single exit and without erosion protector. Fig 3(b) shows a section along D-D on Fig. 3(a).**

**In the aforementioned figures, (3) denotes exit pipe, (1) is the port through which gas enters the gas-solid separator, (2) indicates separation box, (5) stands for hopper, (4) designates the notch in target area to reduce erosion, (6) is the gas corridor and (7) is the opening or chute through which particulate solids are allowed to travel downwards. The novel horizontal box-type gas-solid separators of the present invention show a number of advantages that are, inter alia, as follows:**

**The geometric shape of the equipment allows it to be blended well with the rectangular configuration of boilers:**

**They can easily be fabricated/made of boiler panels:**

- I. Low refractory requirement for making such gas-solid separators leads to**
  - a) cost savings**
  - b) reduction in starting-up time and**
  - c) lower maintenance cost:**

**Shelves in the target area effectively eliminates erosion problems usually associated with circular, refractory-lined gas-solid separators and Water-wall covered with thin refractory layer reduces heat loss through wall and simultaneously cuts down start-up time.**

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CLAIMS:

1. Gas-solid separators being horizontal and box-type and easily adaptable within boilers of rectangular configuration.
2. Gas-solid separators being horizontal and box-type comprising heat transfer surfaces, wherein the separators are adapted to be conveniently stacked in parallel.
3. Gas-solid separators adapted for reducing erosion of a target region of the separators.

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**GRI**  
Consulting Engineers Inc.

**HORIZONTAL CYCLONE**  
DETAIL

DATE: 04-18-00  
BY: [Signature]

Fig 1

