ABSTRACT

TITLE ' A RIGID AND RELIABLE DEVICE TO SUPPORT TUBE BUNDLES WITH LOWER INTER-SPACING IN A BUNDLE CHAMBER OF FLUIDIZED BED COMBUSTIONS BOILERS'

The invention relates to a rigid and reliable device to support tube bundles with lower inter-spacing a bundle chamber of fluidized bed combustion boilers, the tube bundle comprising at least one vertical tube (1) having a central hole formed on the vertical tube (1); and at least two multi loop horizontal coil assemblies, the support device configured as a sold forged block (3) having semi-circular profiles at both ends (4) of the block (3), the vertical tube (1) is shrink-fit with the forged block (3) through the central hole to form a sub-assembly (1, 3), the sub-assembly is inserted in between the at least two multi loop horizontal coil assemblies (2) with the coil elements pushed into said semi-circular profiles; wherein the end blocks (4) are welded with the forged block (3) upon insertably locating the coil elements (2) such that the horizontal tube elements (2) remain free from welding to allow a force longitudinal movement of the vertical tube (1) when susceptible to thermal expansion during boiler operation and wherein the vertical tube (1) is a steam-cooled hanger tube.

{ FIGURE 4 }

WE CLAIM :

1. A rigid and reliable device to support tube bundles with lower inter-spacing a bundle chamber of fluidized bed combustion boilers, the tube bundle comprising at least one vertical tube (1) having a central hole formed on the vertical tube (1); and at least two multi loop horizontal coil assemblies, the support device configured as a sold forged block (3) having semi-circular profiles at both ends (4) of the block (3), the vertical tube (1) is shrink-fit with the forged block (3) through the central hole to form a sub-assembly (1, 3), the sub-assembly is inserted in between the at least two multi loop horizontal coil assemblies (2) with the coil elements pushed into said semi-circular profiles;

   wherein the end blocks (4) are welded with the forged block (3) upon insertably locating the coil elements (2) such that the horizontal tube elements (2) remain free from welding to allow a force longitudinal movement of the vertical tube (1) when susceptible to thermal expansion during boiler operation and wherein the vertical tube (1) is a steam-cooled hanger tube.

2. The device as claimed in claim 1, wherein a plurality pairs of horizontal coil assemblies (1) are assembled to one each vertical tubes (1).

3. The device as claimed in claim 1, wherein the number of hanger tubes per row of support is half the number of horizontal coil assemblies.

Dated this 6TH day of FEBRUARY 2014

(P.D.GUPTA)
OF L.S.DAVAR & CO
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BHARAT HEAVY ELECTRICALS LIMITED

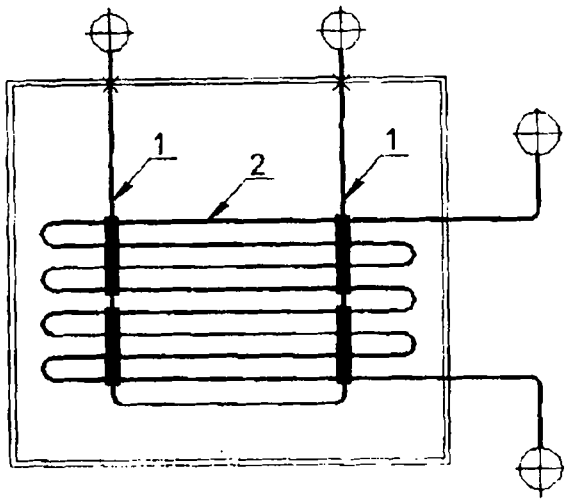

FIGURE - 1

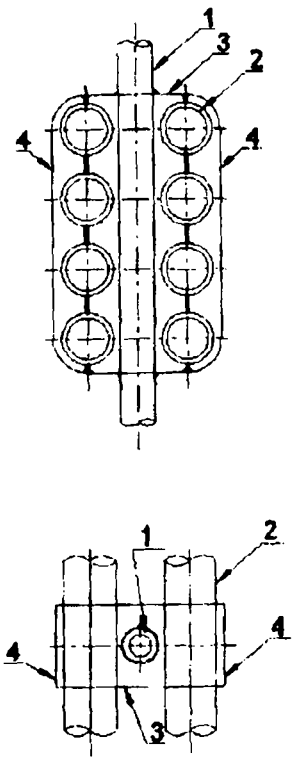

FIGURE - 2

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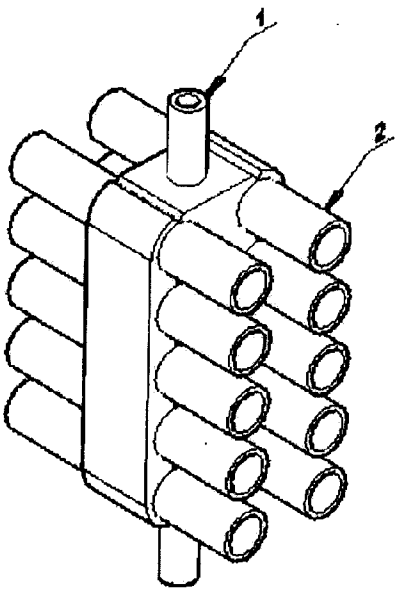

FIGURE – 3

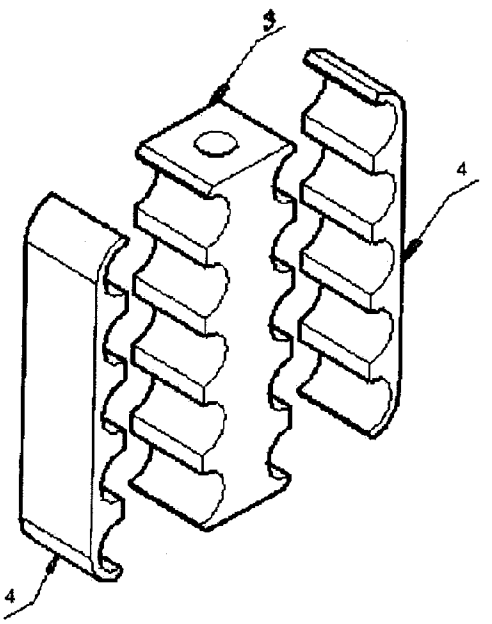

FIGURE - 4

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FIELD OF THE INVENTION

The present invention relates to a rigid and reliable support device tube bundles with lower inter-spacing in a bundle chamber of fluidized bed combustion boilers.

BACKGROUND OF THE INVENTION

In a fluidized bed combustion boiler, the heat transfer surfaces such as Superheater, Reheater and Evaporator bundles are kept immersed inside the inert bed material to recover the heat of the solid particles available in the bed of the boiler. The bundles are kept inside a bundle chamber and inlet and outlet headers of the bundles are kept outside the chamber being connected through tubes penetrating the walls of the bundle chamber. The bundles are either suspended from top or supported from bottom based on the coil penetration location with respect to walls of the bundle chamber. There are a number of tube rows or parallel flow paths with defined spacing in between the tube elements. In specific cases, the distance between the tube elements of each column is very less which requires different types of support . Just below the tube bundle, air nozzles are provided on the grate for proper fluidization of the bed material.

According to the prior art, the supports for the horizontal heat transfer surfaces are provided in the second pass of the conventional boilers, which interalia face only flue gas flow as the external medium. But, in case of a fluidized bed, combustion boiler the tube bundles are in a physical contact with the agitating solid particles since they are immersed in the fluidized bed. Hence, known support for conventional boilers may not be adequate for a fluidized bed environment due to dynamics of fluidization. In some cases, when the distance between the tube elements of each column is very less, different type of support is needed. Further, the tube bundles need to be supported inside the bundle chamber considering the self weight of the bundle, tube thermal expansion and the dynamic forces due to fluidization. The supports shall be sufficiently rigid enough to take care of the above forces. Considering the harsh operating regime inside the fluidized bundle chamber, it is necessary to develop support devices to support the tube bundles inside the fluidized bed having less spacing between the tube elements.

US 5943985 teaches a welded bracket for supporting SH and RG coils inside a fluidized bed, in which one tube firmly engages with the other vertical tube. The bracket is welded on both the tubes to prevent relative movement between the tubes. The tubes can not move with respect to each other. The tubes have angular surface contact with the bracket for intimate thermal contact with the tubes.

US 4270599 discloses a support structure for supporting tube bundles in a fluidized bed heat exchanger. A grid plate is supported in the housing for receiving bed particulates material. A perforated support pier projects out from the grid plate and supports the tube bundles and passes the air over the tubes. A ladder type support structure is provided between adjacent tube sections to support the tube sections relative to each other.

US 3530838 describes a support system for low and high temperature superheaters. Low temperature superheater coils are directly welded to the vertical hanger tubes whereas high temperature SH is indirectly supported from these vertical hanger tubes. Horizontal elements rests on a support tube either independently of in groups. Steam from drum passes through the horizontal support tubes and acts as additional SH heat transfer surfaces.

US 4619315 describes a hot support bracket for supporting heat exchanger tubes inside a fluidized bed furnace. It comprises a plurality of plates having openings or cut outs at one edge for housing the tubes. Adjacent plates are connected for stability. The vertical support plate rests on a wear channel on which the load of the tubes are transferred and having provision for sliding.

US 3265044 teaches an arrangement for supporting a horizontal heat transfer serpentine tube on a vertical tube with slidable arrangement. It is free to expand without overstressing the support tube. One part of the support is welded to the vertical tube whereas another part with groove is welded to the horizontal tube. The sliding joints are free from jamming due to ash accumulation.

OBJECTS OF THE INVENTION

It is therefore an object of the invention to propose a rigid and reliable device to support tube bundles with lower inter-spacing in a bundle chamber of fluidized bed combustion boilers.

Another object of the invention is to propose a rigid and reliable device to support tube bundles with lower inter-spacing in a bundle chamber of fluidized bed combustion boilers which is capable to sustain harsh operating temperature inside the bed including the thermal expansion forces and the dynamic forces of fluidization.

SUMMARY OF THE INVENTION

Accordingly, there is provided a rigid and reliable device to support tube bundles with lower inter-spacing in a bundle chamber of fluidized bed combustion boilers. The fluidized bed material generally consists of inert particles and crushed coal particles. The plurality of tubes are arranged as rows and columns with definite spacing in between the tubes. Sometimes, the distance between the tube elements of each column is very less which requires different type of support. The tube elements are subjected to internal steam pressure, temperature and other dynamic forces of fluidization. Considering this operating environment, a cooled and rigid support device formed of a solid forged block with steam cooled hanger tubes is provided to support the tube bundle. The tube bundles are formed of multi loop horizontal coils.

BRIEF DESCRIPTION OF THE ACCOMPANYING DRAWINGS

Figure 1 – shows an overview of a tube bundle forming heat transfer surface in a fluidized bed combustion boiler.

Figure 2 – show the plan and elevational views of the tube bundle when supported inside the combustion chamber.

Figure 3 – shows an assembled view of the support device of the invention.

Figure 4 – shows an exploded view of the support device of the invention.

DETAILED DESCRIPTION OF THE INVENTION

The attached drawing may be referred for better understanding of the invention.

A vertical steam cooled hanger tube (1) is interposed between two horizontal coil (2) assemblies. The two horizontal coils are connected to the hanger tube through a solid forged block (3) which also accommodates the hanger tube and the coil assemblies. The forged block (3) is inserted into the vertical hanger tubes (1) by shrink fit and held in position by welding with the hanger tube. A central hold for inserting the block into the hanger tube is made to close tolerances so that the shrink fit can be implemented between the forged block and the hanger tube. The assembled forged blocks along with the vertical

hanger tube is inserted in between the two horizontal coil (2) assemblies. The horizontal coil elements are pushed into a semi-circular profile available on both sides of the forged block. The two profiled end blocks (4) are assembled from both ends to kept the horizontal coil elements in position. The end blocks (4) are welded with the block (3) after inserting the coils (2) into a position. It is ensured that there is no welding over the horizontal tube element (2) so that the tube can freely move along its length inside the block due to thermal expansion. Similarly, each pair of the remaining horizontal coils are assembled to the vertical hanger tubes. The number of hanger tubes per row of support is half the number of horizontal coil assemblies since there is one hanger tube for each pair of coil assemblies. The vertical hanger tubes (1) are suspended from the roof casing of the bundle chamber. There are two rows of hanger tuber support for the tube bundle to make it a simply supported configuration.