July 5, 1966 F. A. LEE 3,259,112

REMOVABLE TUBE SUPPORT

Filed Sept. 2, 1964

Fig. 1.

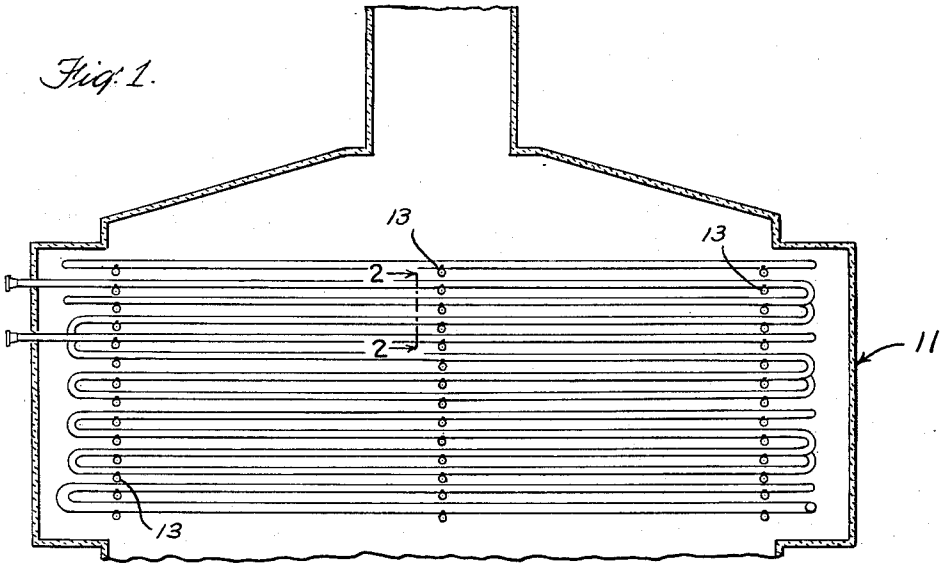


Fig. 2.

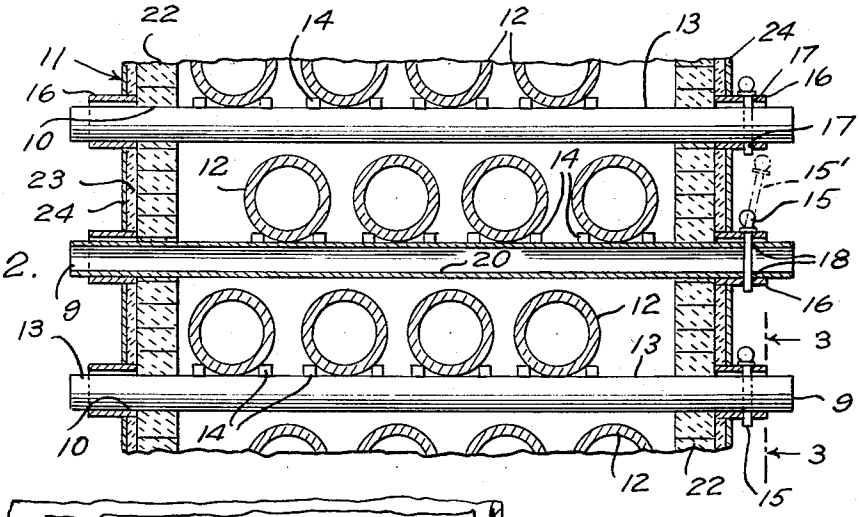
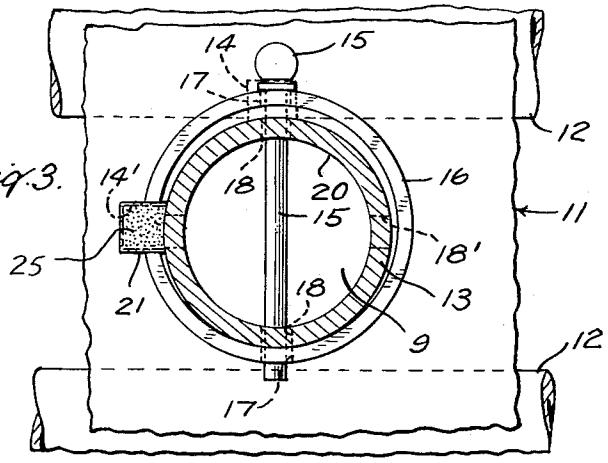


Fig. 3.



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REMOVABLE TUBE SUPPORT

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This invention reates to removable supports for horizontal tubes. In particular, it relates to removable supports for horizontal tubes in a convection section of a fired heater.

The present method for supporting horizontal tubes within a fired heater convection section is to vertically mount large stainless steel 2520 chrome nickel or other high strength heat and corrosive resistant tube sheets from the external shell of the fired heater. The sheets are formed with tube size holes which are capable of receiving the tubes therein. The heater tubes are placed through the holes of two or more sheets spaced along the heater for support and alignment.

The tube sheets being in the convection section of the heater are subjected to corrosive attack by vanadium pentoxide, a product of combustion found in fired heaters burning fuel oil. The high operating temperature ranges in fired heaters, 1200° F. and above, also subject the tube sheets to deterioration. Together high temperatures and vanadium pentoxide result in frequent tube sheet failure necessitating replacement of the sheets.

The replacement of defective tube sheets is not a simple task. It entails the removal of all the fired heater tubes passing through the holes in the tube sheets. It requires the opening of the convection section in order to obtain access to the sheets. It requires tedious manipulation in congested convection sections of fired heaters wherein ample working space does not exist. It requires the heater to be shut down during long replacement periods. In total, replacement of tube sheets to date has been an expensive and undesirable operation.

Consequently, it is an object of the present invention to provide a readily removable tube support for horizontal tubes in a convection section of a fired heater.

It is also an object of the present invention to provide a tube support which may be conveniently cooled so as to minimize heat damage.

It is a further object of the present invention to provide a sectionalized tube support that is readily removable solely at sections where deterioration has occurred.

Accordingly, the present invention comprises a heater shell defining a convection section of a fired heater comprising at least one aperture means having opposed openings within the shell through which an elongated hollow open ended rigid support member is disposed. The support member engages horizontal fired heater tubes located in the convection section for supporting the same, and in turn is slidably engaged and supported by the shell aperture means. A locking means is provided for retaining the support member in fixed engagement with the aperture means. Lugs are disposed on the support member which are adapted to position the horizontal tube in alignment. The openings defined by the aperture means are designed to permit longitudinal withdrawal of the support member from outside the heater shell.

The simplicity and ease of removal of the supports provides a great savings in replacement time and labor. Shut down time is kept to a minimum. The tube supports may be replaced while the heater is operational. Replacement is accomplished without touching the heater tubes and without opening the convection section of the heater. Support sections where deterioration has occurred may be removed at will without the necessity of removing other sections.

These and other advantages of the present invention will become apparent from a detailed description of a preferred embodiment of the invention and drawings, of which:

FIGURE 1 is a longitudinal, vertical section of a fired heater convection section having rows of horizontal tubes and sectionalized supports of the preferred embodiment of the present invention;

FIGURE 2 is a vertical transverse section taken along line 2—2 of FIG. 1;

FIGURE 3 is a section taken along line 3—3 of FIG. 2.

Referring now to FIG. 1 for a vertical section of a fired heater convection section, **11** represents the external shell of the convection section. Horizontal heater tube rows **12** carry process fluid. The heater tube rows **12** rest on support tubes **13** disposed thereunder. Although not limited thereto, the support tubes **13** are vertically aligned with a support tube underlying each horizontal heater tube row **12**. Three vertical arrays of support tubes **13** are shown to support the heater tube rows **12**.

FIG. 2 is an enlarged section of FIG. 1 wherein the support tubes **13** are shown mounted from horizontally disposed circular holes **10** in external shell **11**. External shell **11** consists of refractory bricks **22**, insulation **23**, and metal lining **24**. The support tubes **13** are inserted underneath each horizontal row of tubes **12** for support of the tubes resting thereon.

Support tubes **13** have open-ends **9** and extend beyond the metal lining **24** of the external shell **11**. The open-ended tubes **13** are thereby provided with access for cool ambient air, or external atmosphere, including any suitable surrounding medium for cooling purposes. Air is pulled into the inside **20** of the support tubes **13** as a result of the temperature gradient and circulates naturally therein. In this manner, the temperatures of the support tubes may be maintained below the metal tolerance of the support tubes so as to decrease the rate of temperature attack on the support tubes.

The support tubes **13** are locked in a fixed position by locking pin **15** (shown enlarged in FIG. 3) which is inserted through lock holes **17** and **18**, respectively, in cylindrical support sleeves **16** and tube **13**. The guide lugs **14** are welded on support tubes **13** in such a position so as to engage heater tubes **12** therebetween when the support tubes **13** are locked by insertion of pin **15**. The guide lugs maintain the heater tubes **12** in position and prevent heater tube shifting.

When a support tube is to be replaced, locking pin **15** is lifted up and removed as shown at **15'**. Support tube **13** is then rotated from the outside of the external wall **11** so that the guide lugs **14** disengage the tubes **12**. A notch opening **21** is provided in external shell **11** and support sleeve **16**, aligned with each other so that the guide lugs may slide therethrough when properly aligned with the notch opening. The notch opening is normally packed with insulating cement shown at **25** in FIG. 3 which prevents the fired heater gases from escaping through the notch opening **21** during operation of the heater. However, the insulating cement is easily knocked out by the lugs during replacement of a tube. For replacement, tube **13** is rotated until the guide lugs **14** are horizontally

aligned adjacent notch **21** as may be seen from FIG. 3 where rotated guide lug **14'** is shown adjacent notch **21**. The support tube **13** may then be pulled out from outside of the furnace through the sleeve **16** and external shell **11** and a new support tube **13** inserted.

The heater tubes **12** sag slightly when a support is removed. A smaller diameter tube may be inserted as a wedge to raise the tubes **12** back into position before a new tube support tube **13** is inserted; or, a new support tube **13** may be simultaneously inserted from one end as a deteriorated tube support **13** is being removed from the other end.

Support members other than pipes may be used without departing from the scope of the present invention. Other modifications and changes in the structure and details of the present invention may be made in accordance with the scope of the present invention as set forth by the appended claims.

What is claimed is:

1. A removable support arrangement comprising:
an external heater shell defining a convection section;
aperture means defining opposed openings through the shell and communicating with the external atmosphere;
horizontal tubes disposed in said convection section;
at least one hollow open ended rigid tube disposed in touching engagement underneath one of the horizontal tubes in the convection section for supporting the horizontal tube;
said rigid tube being slidably engaged and supported by said aperture means and disposed in the opposed openings, the rigid tube being in communication with the external atmosphere;
locking means arranged to retain said rigid tube in fixed engagement with said aperture means; and
the aperture means being arranged to permit longitudinal withdrawal of the rigid tube therethrough.

2. A removable support arrangement, comprising
an external heater shell defining a convection section;
aperture means defining opposed openings through the shell and communicating with the external atmosphere;
horizontal heater tubes disposed in the convection section;
at least one elongated hollow open ended rigid member disposed in touching engagement underneath one of the horizontal heater tubes in the convection section for supporting the tube;
said member being slidably engaged and supported by said aperture means and disposed in the opposed openings, the rigid member being in communication with the external atmosphere;
locking means arranged to retain said member in fixed engagement with said aperture means;
lugs on said member adapted to position the horizontal heater tube; and
the aperture means being arranged to permit longitudinal withdrawal of the member therethrough.

3. A removable support arrangement, comprising
a heater shell defining a convection section, the heater shell comprising an interior refractory side of the shell facing the convection section and an external metal lining side of the shell facing outwards from the heater;
horizontal heater tubes disposed in said convection section defining horizontal rows of parallel heater tubes;
a plurality of aperture means defining opposed openings within the shell, said opposed openings defining a plurality of parallel horizontal aperture lines intersecting the convection section in a direction perpendicular to the heater tubes, said parallel horizontal lines defining a plurality of parallel vertical aperture planes intersecting the convection section in a direction perpendicular to the horizontal heater tubes;
a plurality of vertical arrays comprising a plurality of hollow open ended rigid support tubes forming planes coincident with the aperture planes;
the support tubes being slidably engaged and supported by said aperture means so that the support tubes form lines coincident with the aperture lines, and so that each support tube is horizontally disposed in touching engagement underneath one of the horizontal rows of tubes in the convection section for supporting the row of tubes, each of said array having one support tube for each row of tubes;
the opposed openings defined by said aperture means circular in cross section and sufficiently large so that each support tube is rotatably engaged by the aperture means;
a plurality of open-ended cylindrical casing sleeves axially connected to the aperture means extending from the external metal lining side of the shell wall about the circular opposed openings so that the sleeves protrude outward from the heater;
the support tubes having at least one support tube lock hole near one end of the support tubes;
a plurality of guide lugs disposed in spaced relationship along the surface of each support tube adapted to position the horizontal tubes for engaging in alignment the horizontal heater tubes therebetween;
said aperture means and at least one casing sleeve axially connected thereto defining an aligned notch opening;
said aligned notch opening packed with insulating material so as to close the notch opening from fluid communication with the interior of the convection section;
said aligned notch opening sufficiently large to permit withdrawal of the guide lugs therethrough when the insulating material is removed;
said notch opening oriented relative the vertical so that the lugs are disengaged from the heater tubes when the lugs are rotated so as to be aligned adjacent the notch opening;
the casing sleeves formed with at least one lock hole in at least one of the sleeves that are connected to each aperture means;
a locking pin for aligned insertion into the casing lock hole in the casing sleeve and in the support tube lock hole in the support tube when said casing lock hole and support tube lock hole are aligned for locking said support tube in fixed position relative the sleeve, said holes being approximately the same in cross-section as the cross-section of the locking pin, the support tube lock hole disposed in the support tube at a position so that when the tube lock hole and the casing lock hole are aligned the guide lugs engage the heater tubes in alignment.

4. A removable support arrangement, comprising
a heater shell defining a convection section;
aperture means defining opposed openings within the shell;
horizontal heater tubes disposed in said convection section;
at least one elongated hollow open ended rigid support tube disposed in touching engagement underneath one of the horizontal heater tubes in the convection section for supporting the tube;
said support tube being slidably engaged and supported by said aperture means;
locking means arranged to retain said support tube in fixed engagement with said aperture means;
lugs on said support tube adapted to position the horizontal heater tube, said lugs being at spaced intervals aligned along the upper surface of the support tube;
the aperture means being arranged to permit longitudinal withdrawal of the support tube therethrough;
the opposed openings defined by said aperture means

being circular in cross-section and sufficiently large so that the support tube is rotatably engaged by the aperture means;

the aperture means defining a notch opening sufficiently large to permit withdrawal of the lugs therethrough and oriented relative the vertical so that the lugs are disengaged from the horizontal heater tubes when aligned with the notch opening.

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