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2,983,263

CERAMIC SUPPORTING CONSTRUCTION FOR HEAT TRANSFER COMPONENTS

Filed May 24, 1957

2 Sheets-Sheet 1

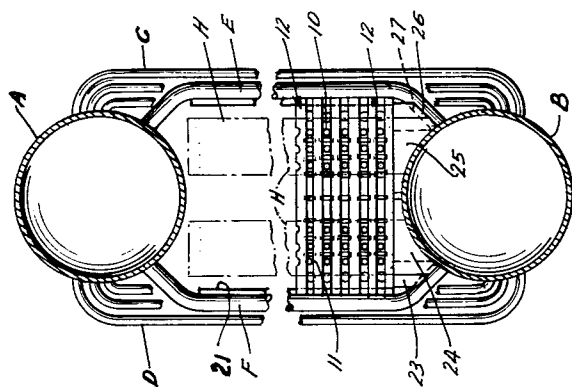


FIG. 2

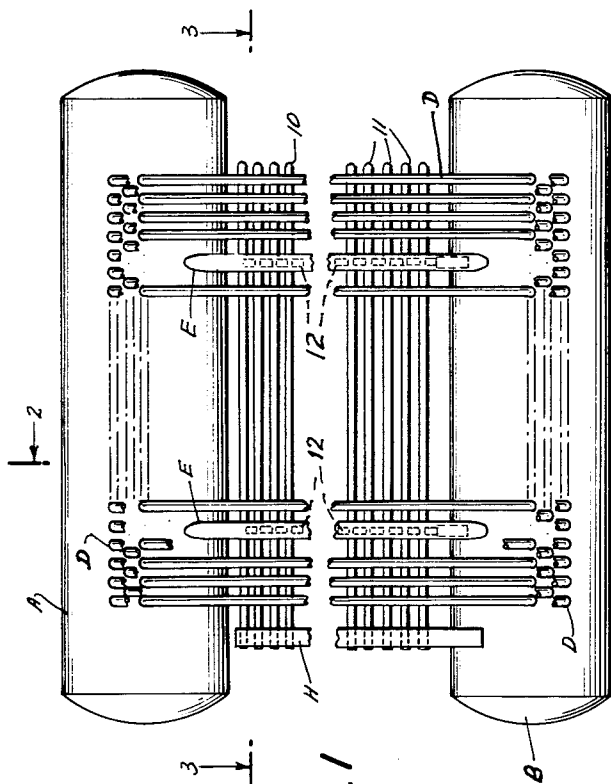


FIG. 1

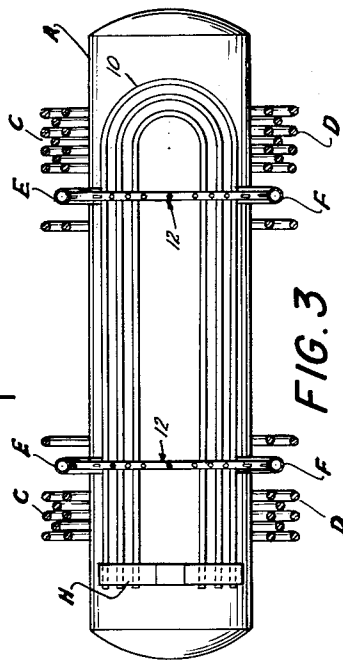


FIG. 3

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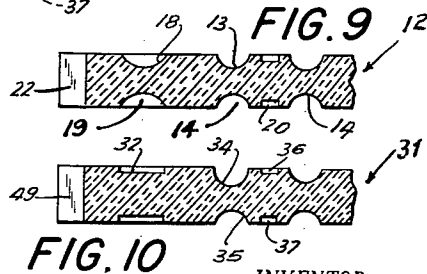
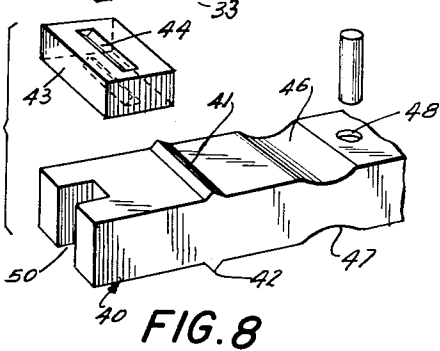
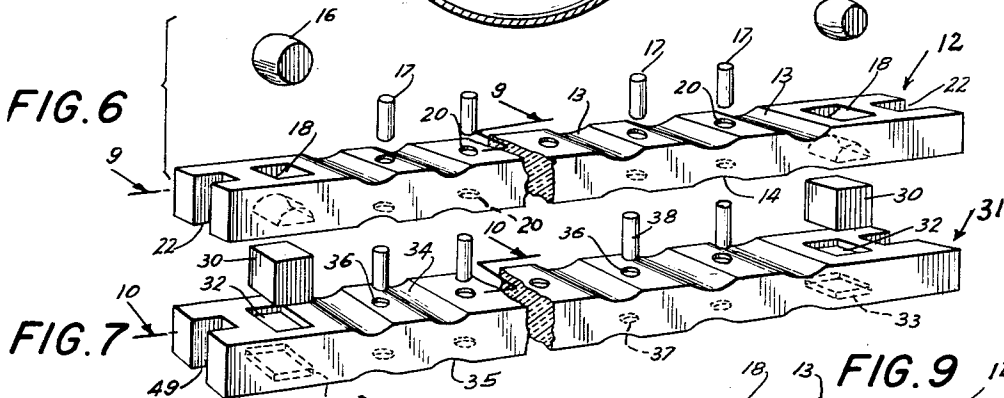
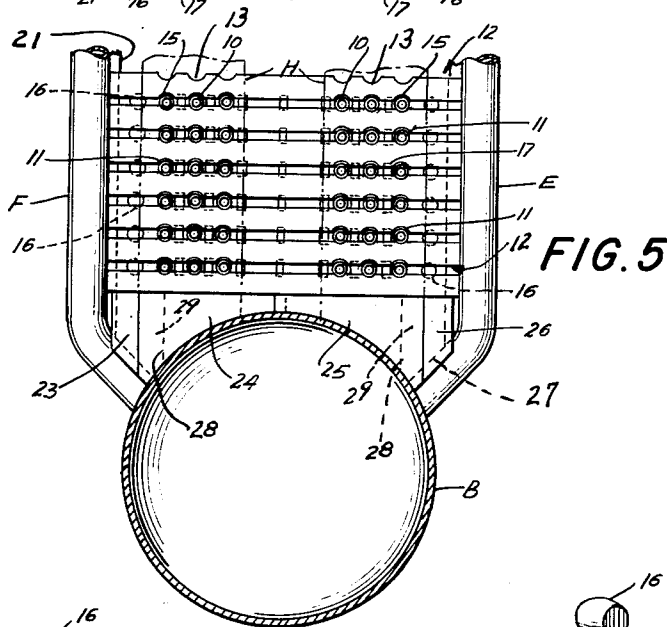
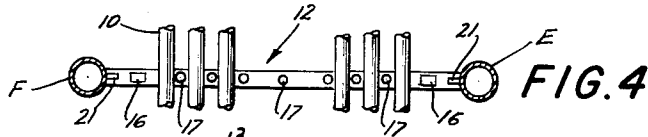
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CERAMIC SUPPORTING CONSTRUCTION FOR HEAT TRANSFER COMPONENTS

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4 Claims. (Cl. 122—510)

This invention relates to supporting means for steam boiler components, petroleum heaters, catalytic petroleum cracking units and the like. More particularly, the invention relates to ceramic elements for supporting heat transfers components of the aforesaid apparatus subject to high temperatures and corrosive conditions.

It has been the practice to support such components by means of metallic constructions disposed beneath the same and affixed at their ends to other parts of the apparatus. Due to the high temperatures of the combustion gases employed in heating the aforesaid apparatus and the heat transfer media therein, the use in metallic constructions for supporting such components have been found unsatisfactory. In addition to the problem of the metallic supporting constructions being subjected to high temperature conditions, the fuels consumed contain high vanadium sulphur content. This produces combustion gases which are highly corrosive and which corrodes and erodes the metallic supporting constructions. Due to this condition, the metallic constructions supporting such components must be frequently replaced necessitating the discontinuance of use of the apparatus for repair and materially increasing the maintenance cost of the apparatus.

In order to overcome this condition and to eliminate objectionable metallic constructions, the present invention provides ceramic supporting elements which are arranged to allow for individual movement of such components and which reduces thermal shock so as to eliminate mechanical stresses developing within the ceramic elements.

Another object of the invention is to provide a ceramic supporting element which is recessed on opposite sides thereof to receive portions of adjacent vertically disposed components and with ceramic spacing elements disposed between the supporting elements.

Still another object of the invention is to provide transverse ceramic supporting elements having means at the ends thereof adapted to engage means on the apparatus for retaining the elements in position.

Still another object of the invention is to provide saddle means for supporting a stack of the vertically disposed ceramic supporting elements.

With the foregoing and other objects in view, reference is now made to the following specification and accompanying drawings in which the preferred embodiment of the invention is illustrated.

In the drawings:

Fig. 1 is a view in elevation of a water tube boiler provided with a heat exchanger of the superheater type and with means constructed in accordance with the invention for supporting the tubes of the heat exchanger.

Fig. 2 is a vertical sectional view taken approximately on line 2—2 of Fig. 1 with parts broken away.

Fig. 3 is a horizontal sectional view taken approximately on line 3—3 of Fig. 1.

Fig. 4 is an enlarged fragmentary sectional view of a

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row of tubes of the heat exchanger and the supporting means therefor.

Fig. 5 is an enlarged fragmentary view similar to Fig. 2 showing the lower portion of the boiler and heat exchanger only.

Fig. 6 is a perspective view of one of the ceramic supports for the tubes of the heat exchanger and with spacing elements in juxtaposition thereto.

Fig. 7 is a similar view of a modified form of a ceramic element and with a modified form of spacing element shown in juxtaposition thereto.

Fig. 8 is a fragmentary perspective view of still another form of ceramic element for supporting the tubes of the heat exchanger and with a modified form of spacing element shown in juxtaposition thereto.

Fig. 9 is a vertical sectional view taken approximately on line 9—9 of Fig. 6.

Fig. 10 is a fragmentary vertical sectional view taken approximately on line 10—10 of Fig. 7.

The invention is shown in its application to a heat exchanger of the superheater type arranged within a water tube boiler. This type of heat exchanger includes a plurality of tubes 10 arranged in vertically spaced rows 11 and with the tubes in each row disposed in laterally spaced relation. The rows 11 may be of any desired number and are connected to a header H in any desired manner. The header is connected with the steam drum of the boiler for the flow of steam through the superheater tubes for drying and superheating the steam. The tubes extend longitudinally of the steam and mud drums A and B of the boiler and transversely of the water tubes C and D which are connected at their ends to the steam and mud drums A and B.

The invention provides means for supporting the superheater tubes 10 by ceramic elements, one of which extends beneath each row of tubes. The ceramic element 12 illustrated in perspective view in Fig. 6 of the drawings is formed with concave recesses 13 and 14 in the upper and lower faces thereof. The recesses correspond in number to the number of tubes in each row and the recesses are of a depth to receive a peripheral portion of the tubes. Thus, each ceramic element 12 is disposed between an upper and a lower row of tubes with the tubes in the upper and lower rows engaging in the recesses 13 and 14 respectively. A clearance 15 is provided between the upper surfaces of the tubes and the faces of the recesses 14 so as to prevent the weight of the ceramic element being imposed upon the tubes. Adjacent ceramic elements are maintained in vertically spaced relation by means of spacing elements such as the barrel and cylindrical shaped members 16 and 17. The spacing elements 16 are located adjacent the ends of the ceramic elements and fit into concave depressions 18 and 19 in the confronting faces of adjacent ceramic elements, while the spacing elements 17 are located between adjacent tubes in each row and fit into circular recesses 20 in the confronting faces of adjacent ceramic elements. It will be understood that the longitudinal axes of the spacing elements 16 extend transversely of the ceramic elements, while the longitudinal axes of the spacing elements 17 extend vertically between adjacent ceramic elements.

The ceramic elements 12 are maintained in vertical alignment and in stacked formation by rectangular shaped projections 21 welded or otherwise affixed to the confronting faces of supporting water tubes E and F and which slideably engage vertically disposed slots 22 in the ends of the said elements. Thus, the weight of each ceramic element together with the weight of all of the tubes supported thereby are imposed upon the adjacent lower ceramic element and the weight of all of the rows of tubes and all of the upper ceramic elements are imposed upon the lowermost ceramic element, which latter ceramic ele-

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ment is supported by foundation tiles 23, 24, 25 and 26 carried by the lower ends of the supporting tubes E and F and the mud drum B. The endmost tiles 23 and 26 are similar in formation and are formed with concave recesses 27 respectively so as to straddle the upper circumferential portion of the tubes E and F adjacent their connections with the mud drum B. The tiles 24 and 25 are also of similar formation and are arcuately curved to correspond to the curvature of the mud drum so as to fit the upper portion thereof between the outer tiles 23 and 26. The tiles are formed with vertically disposed interlocking recesses and tongues 28 and 29 to retain the several tiles in position beneath the lowermost ceramic element.

Instead of the cylindrical spacing elements 16, rectangular shaped spacing elements 30 may be employed with ceramic element 31 shown in the perspective view in Fig. 7 of the drawings. The ceramic element 31 is formed with rectangular shaped depressions 32 and 33 in its upper and lower faces adjacent the opposite ends thereof in which the spacing elements 30 fittingly engage between adjacent ceramic elements 31. The ceramic element 31 is otherwise similar to the ceramic element 12 and includes a plurality of upper and lower concave recesses 34 and 35 corresponding in number to the number of tubes in each row of the heat exchanger. The ceramic element 31 is also formed with a plurality of circular depressions 36 and 37 in the upper and lower faces thereof for receiving cylindrical spacing elements 38 similar in formation to the spacing elements 17.

Ceramic elements 40, as illustrated in Fig. 8 of the drawings, may also be employed in place of the ceramic elements 12 and 31. The ceramic element 40 is provided with upper and lower triangular shaped projections 41 and 42 in the upper and lower faces thereof adjacent each end thereof. Rectangular shaped spacing elements 43 are employed in association with ceramic elements 40, the spacing elements 43 having triangular shaped depressions 44 in the upper and lower faces thereof for receiving the projections 41 and 42 of adjacent ceramic elements. This ceramic element is similarly provided with a plurality of upper and lower concave recesses 46 and 47 in the upper and lower faces thereof and which correspond in number with the number of tubes in each row of the heat exchanger. This type of ceramic element is also provided with circular recesses 48 in the upper and lower faces thereof which are located between adjacent recesses 46 and 47 in the upper and lower faces thereof for receiving cylindrical spacing elements similar to the spacing elements 17 and 38. The ceramic elements 31 and 40 are also formed with recesses 49 and 50 respectively similar to the recesses 22 in the ends of the ceramic element 12 for receiving the rectangular shaped projections 21 carried by the supporting tubes E and F for retaining the ceramic elements in stacked formation.

The tiles 23, 24 and 25 similarly support a stack of the ceramic elements 31 or a stack of the ceramic elements 40 so as to transmit the weight of the stack together with the tubes of the heat exchanger to the mud drum B and to the lower portions of the supporting tubes E and F. The supporting tubes E and F are relatively larger than the remainder of the boiler tubes D and C. One set of tubes E and F are located approximately one-third the distance from each end of the steam and mud drum A and B. Thus, one stack of ceramic elements is arranged between each pair of supporting tubes E and F so as to support the heat exchanger 10 adjacent the ends thereof.

While the preferred form of the invention has been shown and described herein, it is to be understood that the same is not so limited but shall cover and include any and all modifications thereof which fall within the purview of the invention.

What is claimed is:

1. A support for a superheater arranged within a heat

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exchanger, said superheater consisting of a plurality of vertically spaced rows of superheater pipes arranged with a plurality of said pipes disposed in laterally spaced relation in each row and positioned between side parts of said heat exchanger and above a bottom part thereof, said support including a plurality of ceramic supporting elements arranged in stack formation with one of said ceramic supporting elements disposed beneath and supporting each row of said superheater pipes, said supporting elements having means slidably engaging said side parts thereby retaining said supporting elements in said stack in vertical alignment, ceramic spacing elements arranged in engagement with and between adjacent ceramic supporting elements at a plurality of points spaced lengthwise along the supporting elements and between adjacent laterally spaced pipes to transmit to each supporting element substantially the entire weight of the superposed ceramic supporting and spacing elements and superheater pipes at points disposed between said laterally spaced pipes thereby more evenly to distribute the weight of said superposed elements and pipes along the length of the supporting elements and to space adjacent ceramic supporting elements apart at the locations of the superheater pipes disposed therebetween a distance greater than the diameter of said superheater pipes to provide clearance between the upper ceramic supporting element and the pipes to prevent the weight thereof being imposed upon the superheater pipes, each of said ceramic supporting elements having laterally spaced recesses in the upper and lower faces thereof whereby the superheater pipes in each of said rows extend into the recesses in the under face of the ceramic supporting element thereabove and extend into the recesses in the upper face of the ceramic supporting element therebelow, and means supported on said bottom part of said heat exchanger and underlying and supporting substantially the entire weight of said stack of ceramic elements and said superheater pipes.

2. A support for a superheater arranged within a heat exchanger, said superheater consisting of a plurality of vertically spaced rows of superheater pipes arranged with a plurality of said pipes disposed in laterally spaced relation in each row and positioned between side parts of said heat exchanger and above a bottom part thereof, said support including a plurality of ceramic supporting elements arranged in stack formation with one of said ceramic supporting elements disposed between and supporting each row of said superheater pipes, said supporting elements having means slidably engaging said side parts thereby retaining said supporting elements in said stack in vertical alignment, ceramic spacing elements arranged in engagement with and between adjacent ceramic supporting elements at a plurality of points spaced lengthwise along the supporting elements and between adjacent laterally spaced pipes to transmit to each supporting element substantially the entire weight of the superposed ceramic supporting and spacing elements and superheater pipes at points disposed between said laterally spaced pipes thereby more evenly to distribute the weight of said superposed elements and pipes along the length of the supporting elements and to space adjacent ceramic supporting elements apart at the locations of the superheater pipes disposed therebetween a distance greater than the diameter of said superheater pipes to provide clearance between the upper ceramic supporting element and the pipes to prevent the weight thereof being imposed upon the superheater pipes, and means supported on said bottom part of said heat exchanger and underlying and supporting the entire weight of said stack of ceramic elements and said superheater pipes.

3. A support as claimed in claim 2, certain of said ceramic spacing elements being barrel-shaped.

4. A heat resistant ceramic element consisting of a solid ceramic body of elongated formation having a plurality of laterally spaced shallow transversely extending recesses in the upper and lower faces thereof, said

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ceramic element having recesses in the upper and lower faces thereof adjacent their ends and between adjacent transversely extending recesses adapted for receiving spacing elements therein, and said ceramic element having vertically disposed recesses in the ends thereof adapted to receive guide means for retaining said ceramic element in vertical position.

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