ABSTRACT OF THE DISCLOSURE

A boiler made up of identical transverse segments consisting of a plurality of intersecting horizontal and vertical water passages forming an open network asymmetrical across the vertical centerline thereof. Each segment is reversed with respect to the next adjacent segments to provide irregular flow paths through the passages formed by the open network.

This invention relates generally to boiler structures and more particularly to a novel segmental or sectional boiler constructed from identical segments.

Among other factors, the heating capacity of a boiler is proportional to the heat transfer area presented to the flue gases. Heat transfer may also be increased by providing a tortuous path for the flue gases to provide a more effective wiping action due to the deviation from a straight line path required of the gas in following a tortuous path.

Prior art segmental boilers of the general type to which this invention pertains are generally constructed of identical segments or sections connected in a symmetrical, aligned fashion so that a constant area for heat transfer in each of the segments is presented to the flue gas flowing therethrough. The overall configuration of prior art boilers presents a straight-through flowpath for flue gases so that a tortuous flowpath is not inherent without the provision of additional structures. Such prior art structures are exemplified by such patents as U. S. 2,125,795 to Maguire, issued Aug. 2, 1938; U.S. 2,469,293 to Ashby, issued May 3, 1949; and U.S. 2,621,328 to Mueller, issued July 19, 1966.

It is an object of this invention to provide a novel segmental boiler structure having identical segments which may be assembled in such a manner that greater heat transfer area is presented to boiler gases passing therethrough than heretofore available in prior art structures.

It is another object of this invention to furnish an asymmetrical segment structure for segmental boilers which, by assembly thereof in alternatively reversed fashion, provides a tortuous gas flow path through the assembled structure thereof and presents an increased heat transfer surface to the boiler gas flowing therethrough.

It is yet another object of this invention to furnish a novel structure for segmental boilers in which the segments thereof may readily be replaced with a minimum of expense by providing a structure incorporating identical segments.

It is a further object of this invention to provide a novel segment for segmental boiler structures which, through assembly of identical segments in accordance with the invention, presents a maximum effective heat transfer surface and maximum effective variation in gas flow path therethrough.

These and other objects of the invention will become more apparent to those skilled in the art by reference to the following detailed description when viewed in light of the accompanying drawings, wherein like elements throughout the figures thereof are indicated by like numerals and wherein:

FIGURE 1 is an elevational view of a segment adapted for use in a segmental boiler in accordance with the invention;

FIGURE 2 is a sectional view of the segment of FIGURE 1 taken along the lines 2—2 thereof;

FIGURE 3 is a sectional view of the segment of FIGURE 1 taken along the lines 3—3 thereof;

FIGURE 4 is a sectional view of a plurality of segments of the type shown in FIGURE 1 in an assembled condition as taken at a point corresponding to lines 4—4 in that figure; and

FIGURE 5 is a perspective view, partly broken away, of an assembled segmental boiler in accordance with the invention.

Referring now to FIGURE 1 of the drawings, a segment, in accordance with the invention shown generally at 10, comprises a pair of upstanding hollow legs 12 and 14 supporting an open network formed from upper, intermediate and lower horizontally disposed water passages 16, 18 and 20, respectively, intersected by and communicating with a plurality of intermediate vertical water passages 22 and left and right vertical water passages 24 and 26, respectively. Flanged intersegmental water transmitting orifices or headers 28 and 30 are formed proximate the lower portion of each of the legs 12 and 14 and the upper horizontal water passage 16 on each transverse surface thereof.

The aforesaid structure is preferably fabricated from cast iron or the like in a manner well known in the art. The water passage network set forth above defines a plurality of flue passages 32 therethrough. The surfaces of the water passages forming the upper and side peripheries of the flue passages 32, as well as the lower surface of the lower horizontal water passage 20 are provided with heat transfer surface increasing fins or vanes 34 extending therefrom into the flue passages.

The intermediate and lower horizontal water passages 18 and 20 are provided, on the transverse surfaces thereof, with flanges or sealing lands 36 and 38 parallel therewith and extending normally from the surfaces thereof.

The intermediate vertical water tubes 22 are similarly provided with normally extending flanges or sealing lands 40 on the transverse surfaces thereof, the lands 40 being symmetrically displaced relative to the vertical centerline of the segment 10 as indicated by line A—B in FIGURE 1. A continuous peripheral flange or sealing land 42 extends along the outer edge of the legs 12, 14, the right and left vertical tubes 24 and 26 and along the upper edge of the upper horizontal water tube 16. The transverse surfaces of each of the aforesaid lands and the lands around the water and steam communicating orifices 28 and 30, are coplanar for purposes to be described in greater detail below.

Referring now specifically to FIGURES 1—3, it will be noted that the horizontal water passages 16, 18, and 20 to the left side of the segment 10 of the centerline A—B are of greater diameter than the corresponding horizontal water passages on the right side of the segment. It will also be noted that the upper surfaces of the horizontal water passages 16, 18, and 20 are disposed at equal height so that the flue passages 32 on the right side of the segment 10 as shown in FIGURE 1, in effect, are of greater height than the corresponding flue passages on the left side of the segment. By reference again primarily to FIGURE 1, it will also be seen that the intermediate vertical water passages 22 are of substantially equal diameter; however, it should be noted that, although the vertical lands 40 are equally spaced centrally on each side of the centerline A—Z, the vertical centerline of each of the intermediate vertical water passages 22 is displaced to the right of the lands so that the water passages, and therefore the flue passages 32, are asymmetrically disposed with respect to the centerline
A-B. The left vertical water passage 24 is of larger diameter than the right vertical water passage 26 so that the vertical sides of the openings appurtenant thereto are asymmetrically disposed with respect to the centerline A-B in a fashion similar to that of the vertical sides of the intermediate water passages 22.

As can be seen from the above description, this invention provides a segment for segmental boilers which can be formed in the usual manner from cast iron and which, when assembled with identical segments, forms an integral water passage system of the boiler.

Referring now to FIGURE 4, the segment 10 is shown in planform section joined, on either side thereof, by segments 10a and 10b. Components of the segments 10a and 10b corresponding to those of the segment 10 are indicated by like numerals with the appropriate suffix added thereto. As can be seen by reference to the FIGURE, the segments 10a and 10b are identical to the segment 10 but are assembled in reversed order thereto so that the vertical water passage 26, for example, is in adjacent relationship to the vertical water passages 24a and 24b and vice versa. Since the vertical lands 40 are spaced in symmetrical relationship with respect to the centerline of the segments, the flanges 40a and 40b abut in sealing relationship as shown.

Referring now to FIGURE 5 an additional plurality of segments is shown assembled and installed in a boiler. The boiler is provided with a fire grate 46 and as is common in the art, hot gases from burning fuel located on the grate rise to heat water circulated through the water passage network of the boiler. In the water passage structure of this invention, the assembled segments form, through the flue passages 32 and the abutting lands, flow paths or channels for the rising flue gases from the fire box. As indicated by arrows, the gases flow rearwardly between the legs 12 and 14 of the respective segments 10 and, at the rear wall of the boiler turn forward and flow through the channels formed by the lowermost flue passages 32. Upon reaching the forward wall of the boiler the gases are turned upwardly and rearwardly and flow through the channel formed by the uppermost flue passages 32 and thence to the rear of the boiler to be exhausted from an appropriate stack (not shown).

The boiler may be of any type common in the art. In the embodiment shown the boiler is provided with fire doors 49 and 50, respectively, fire grate shakers 52 and flue passage access doors 54 in the front face thereof.

As best can be seen by reference to FIGURES 4 and 5, the above-described segments, although identical in form, are assembled in such a manner that maximum heat transfer area, as well as tortuous flow paths, are presented to boiler gases transmitted through the flue passages by reverse assembly of segments. Since the heated boiler gases generally flow proximate the upper surface of the passages formed by the assembled water tubes, as best can be seen in FIGURE 5 of the drawings, only the lower surfaces of the horizontal water passages 16, 18 and 20 are disposed in a staggered fashion to present a tortuous path to the gases flowing thereby. It should be obvious that the upper surfaces of the above-described horizontal water passages may also be staggered, if so desired, without exceeding the scope of the invention.

From the foregoing description, one skilled in the art can easily ascertain the essential characteristics of this invention and, without departing from the spirit and scope thereof, can make various changes and modifications of the invention to adapt it to various usages and conditions. Consequently, such changes and modifications are properly, equitably, and intended to be, within the full range of equivalence of the following claims.

What is claimed is:

1. A boiler having a plurality of identical transverse segments forming the water passage structure therefor, each of said segments comprising a plurality of intersecting substantially horizontal and vertical water passages forming an open network defining flue passages therebetween, each of said segments being divided into first and second halves about the vertical centerline thereof, said water passages being formed to be asymmetrical across said vertical centerline, each of said segments being reversed with respect to the segment next adjacent thereto so that the first side of one of said segments is aligned with the second side of the segments adjacent thereto to thereby provide an irregular flowpath of increased heat transfer area through said flue passages.

2. A boiler in accordance with claim 1 wherein said vertical water passages are intersected by vertical reference planes equidistantly spaced on either side of the centerline of said network, said vertical water passages being disposed so that the centerlines thereof are spaced from said vertical reference lines.

3. A boiler in accordance with claim 1 wherein the horizontal water passages of the first half of said network are of different diameter than the horizontal water passages of the second half of said network and disposed in such a manner that the corresponding upper surfaces thereof are substantially equidistant from a horizontal reference line.

4. A boiler in accordance with claim 2 wherein the horizontal water passages of the first half of said network are of different diameter than the horizontal water passages of the second half of said network and disposed in such a manner that the corresponding upper surfaces thereof are substantially equidistant from a horizontal reference line.

5. A boiler in accordance with claim 1 wherein sealing lands are disposed along each water passage, the sealing lands on said vertical water passages being symmetrically and equidistantly spaced from each side of the vertical centerline of each segment to provide sealing engagement with corresponding lands of the segments adjacent thereto and aggregate said flue passages formed thereby along the vertical sides thereof.

6. A boiler in accordance with claim 1 wherein said segments further comprise upstanding legs at each edge of said segment for support thereof, and a continuous sealing land around the outer periphery of the transverse surfaces of said segment to provide sealing engagement with the corresponding lands of the segments adjacent thereto and contain flue gases within the water passage network formed thereby.

7. A boiler in accordance with claim 6 wherein said legs are hollow and communicative with said water passages, lower intersegmental communicating connectors on the transverse surface of each of said legs to sealingly abut corresponding connectors on the legs of said adjacent segments and provide intercommunication therebetween, and an upper intersegmental communicating connector on the transverse surfaces of the uppermost of said horizontal water passages to sealingly abut corresponding connectors on the horizontal water passages of said adjacent segment.

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