CLAIMS:

We claim:

1. A heat exchange apparatus comprising:

a) a furnace body forming an interior cavity, said furnace body including:

a first surface and a second surface defining at least a portion of said furnace body, wherein said first surface is positioned exterior with respect to said interior cavity and with respect to said second surface, and said second surface is positioned between said interior cavity and said first surface;

b) a first conduit for conveying a fluid to said furnace body;

c) a second conduit in fluid communication with said first conduit wherein said second conduit is positioned at least partially within said interior cavity of said furnace body; and

d) a joint between said first conduit and said second conduit, wherein (i) said joint moves between a first location and a second location based on the temperature within the interior cavity, ~~wherein at least one of~~ (ii) the first location ~~and the second location~~ is intermediate said first surface and said second surface~~.~~, and (iii) said second location is within said interior cavity of said furnace body.

~~2. The heat exchange apparatus of claim 1, wherein:~~

~~said first conduit comprises austenitic stainless steel; and~~

~~said second conduit comprises a metallic or ceramic material that does not catalyze formation of coke;~~

~~wherein said joint is positioned intermediate said first surface and said second surface when said second conduit is at a tube metal temperature of at least 1100°C.~~

~~3.~~2. The heat exchange apparatus of claim 1, wherein the first surface is a first wall and the second surface is a second wall, and further comprising a refractory material intermediate said first wall and said second wall.

~~4.~~3. The heat exchange apparatus of claim 1, wherein said second conduit is formed from a material comprising at least one of an alumina former, a ceramic, and combinations thereof.

~~5.~~4. The heat exchange apparatus of claim 1, wherein said joint includes a weld between said first conduit and said second conduit.

~~6. The heat exchange apparatus of claim 1, wherein said joint is within said interior cavity of said body when said second conduit is at a tube metal temperature of 20°C.~~

~~7.~~5. The heat exchange apparatus of claim 1, wherein said second conduit comprises an oxide layer on an inner surface of said second conduit, wherein said oxide layer comprises less than 5 wt% of nickel, iron, or mixtures thereof.

~~8.~~6. The heat exchange apparatus of claim 1, wherein said second conduit comprises a metallic material ~~comprises~~ comprising an oxide layer on an inner surface of said second conduit, wherein said oxide layer comprises less than 1 wt% of nickel and said oxide layer comprises less than 2 wt% of iron.

~~9.~~7. The heat exchange apparatus of claim ~~8~~ 6, wherein said inner surface of said second conduit comprises at least one of aluminum oxide, silicon oxide, zirconium oxide, yttrium oxide, and cesium oxide.

~~10.~~8. The heat exchange apparatus of claim 1, wherein when said second conduit is at a tube metal temperature of at least 700°C, said joint is intermediate said first surface and said second surface.

~~11. The heat exchanger apparatus of claim 1, wherein said first location is intermediate said first surface and said second surface and said second location is within said interior cavity of said body.~~

~~12.~~9. A hydrocarbon cracking unit comprising:

a) a furnace having an interior cavity formed by a furnace casing and firebox wall, wherein said furnace casing is exterior with respect to said interior cavity, said firebox wall is positioned between said furnace casing and interior cavity;

b) a first conduit for conveying fluid to said furnace, said first conduit comprising austenitic stainless steel;

c) a second conduit in fluid communication with said first conduit, said second conduit comprising an inner surface, said second conduit being positioned at least partially within said interior cavity; and

d) a joint between said first conduit and said second conduit, wherein (i) said joint moves between a first location and a second location based on the temperature within the interior cavity, ~~wherein at least one of~~ (ii) said first

location ~~and said second location~~ is intermediate said furnace casing and said firebox wall~~.~~, and (iii) said second location is within said interior cavity.

~~13.~~10. The cracking unit of claim ~~12~~ 9, further comprising a radiant heat source within said interior cavity, and said tube metal temperature of said second conduit is at least 1000°C when said joint is intermediate said furnace casing and said firebox wall.

~~14.~~11. The cracking unit of claim ~~12~~ 9, wherein said second conduit comprises a radiant tube for cracking a hydrocarbon feedstock mixed with steam.

~~15.~~12. The cracking unit of claim ~~12~~ 9, further comprising a convection section in thermal communication with said first conduit.

~~16.~~13. The cracking unit of claim ~~12~~ 9, further comprising a refractory material intermediate said furnace casing and said firebox wall.

~~17.~~14. The cracking unit of claim ~~12~~ 9, wherein said second conduit has an internal diameter that provides a furnace residence time of less than 0.20 seconds.

~~18.~~15. The cracking unit of claim ~~12~~ 9, wherein said second conduit is made of a material comprising at least one of an alumina former, a ceramic, and combinations thereof.

~~19.~~16. The cracking unit of claim ~~12~~ 9, wherein said joint includes a weld between said first conduit and said second conduit.

~~20.~~17. The cracking unit of claim ~~19~~ 16, wherein said joint is within said interior cavity of said furnace when said second conduit is at a tube metal temperature of 20°C.

~~21.~~18. The cracking unit of claim ~~19~~ 16, wherein said second conduit comprises an oxide layer on an inner surface of said second conduit, wherein said oxide layer comprises less than 5 wt% of nickel, iron, or mixtures thereof.

~~22.~~19. The cracking unit of claim ~~21~~ 18, wherein said inner surface of said second conduit comprises at least one of aluminum oxide, silicon oxide, zirconium oxide, yttrium oxide, and cesium oxide.

~~23.~~20. The cracking unit of claim ~~12~~ 9, wherein when said second conduit is at a tube metal temperature of at least 1100°C when said joint is intermediate said furnace casing and said firebox wall.

~~24.~~21. The cracking unit of claim ~~12~~ 9, wherein said second conduit comprises at least one of a single pass coil, a U-shaped coil, a serpentine coil, and a multiple pass coil.

~~25.~~22. The cracking unit of claim ~~12~~ 9, wherein said second conduit comprises a non-circular internal profile.

~~26. The cracking unit of claim 12, wherein said position of said joint location is configured to move based on thermal changes between (i) a first position intermediate said furnace casing and firebox wall and (ii) a second position within said interior cavity of said furnace.~~

~~27. A method for preparing a heat exchange unit comprising:~~

~~a) providing a body having an interior cavity within said body, said body further comprising a first surface and a second surface, said second surface defining said interior cavity within said body, said first surface positioned exterior with respect to said second surface and with respect to said interior cavity, and said second surface positioned between said interior cavity and said first surface;~~

~~b) providing a first conduit, at least a portion of said first conduit being exterior with respect to said first surface;~~

~~c) providing a second conduit, positioning said second conduit in fluid communication with said first conduit, and said second conduit positioned at least partially within said interior cavity of said body; and~~

~~d) positioning a joint between said first conduit and said second conduit and said joint moves between a first location and a second location based on the temperature within the interior cavity, wherein at least one of said first location and said second location being between (i) intermediate said first surface and said second surface and (ii) within said interior cavity of said body, wherein said location is at least partially dependent on the temperature within said interior cavity.~~

~~28. The method of claim 27, wherein said heat exchange unit is a steam cracking furnace.~~

~~29. The method of claim 27, wherein said first conduit comprises austenitic stainless steel and said second conduit comprises a metallic or ceramic interior surface that does not catalyze formation of coke.~~

~~30. The method claim 27, wherein said joint between said first conduit and said second conduit is intermediate said first surface and said second surface when said second conduit is at a tube metal temperature of at least 700°C.~~

~~31. A method for cracking hydrocarbon in a steam cracking unit comprising:~~

~~a) providing a steam cracking furnace body comprising an interior cavity within said body, said body further comprising a first surface and a second surface, said second surface defining said interior cavity within said body, said first surface positioned exterior with respect to said second surface and with respect to said interior cavity, and said second surface positioned between said interior cavity and said first surface;~~

~~b) providing a first conduit comprising austenitic stainless steel, at least a portion of said first conduit being exterior with respect to said first surface;~~

~~c) providing a second conduit comprising a metallic or ceramic material that does not catalyze formation of coke, positioning said second conduit in fluid communication with said first conduit, and said second conduit positioned at least partially within said interior cavity of said body;~~

~~d) positioning a joint between said first conduit and said second conduit at one of a first location or a second location, wherein at least one of said first location and second location is intermediate said first surface and said second surface, wherein said first location and said second location is at least partially dependent on the temperature within said interior cavity;~~

~~e) heating said second conduit to a tube metal temperature of at least 700°C; and~~

~~f) feeding a hydrocarbon feedstock along a fluid path through said first conduit, through said joint, and through said second conduit.~~

~~32. The method of claim 31, further comprising feeding a mixture of hydrocarbon and steam through said second conduit at a rate sufficient to provide a cracking residence time of less than 0.2 seconds.~~

~~33. The method of claim 31, comprising fusing said first conduit with said second conduit at said joint.~~

23. A heat exchange apparatus comprising:

a) a furnace body forming an interior cavity, said furnace body including:

a first surface and a second surface defining at least a portion of said furnace body, wherein said first surface is positioned exterior with respect to said interior cavity and with respect to said second surface, and said second surface is positioned between said interior cavity and said first surface;

b) a first conduit for conveying a fluid to said furnace body, wherein said first conduit comprises austenitic stainless steel;

c) a second conduit in fluid communication with said first conduit wherein (i) said second conduit is positioned at least partially within said interior cavity of said furnace body and (ii) said second conduit comprises a metallic or ceramic material that does not catalyze formation of coke; and

d) a joint between said first conduit and said second conduit, wherein (i) said joint moves between a first location and a second location based on the temperature within the interior cavity, (ii) at least one of the first location and the second location is intermediate said first surface and said second surface, and (iii) said joint is positioned intermediate said first surface and said second surface when said second conduit is at a tube metal temperature of at least 1100°C.

24. A heat exchange apparatus comprising:

a) a furnace body forming an interior cavity, said furnace body including:

a first surface and a second surface defining at least a portion of said furnace body, wherein said first surface is positioned exterior with respect to said interior cavity and with respect to said second surface, and said second surface is positioned between said interior cavity and said first surface;

b) a first conduit for conveying a fluid to said furnace body;

c) a second conduit in fluid communication with said first conduit wherein said second conduit is positioned at least partially within said interior cavity of said furnace body; and

d) a joint between said first conduit and said second conduit, wherein (i) said joint moves between a first location and a second location based on the temperature within the interior cavity, (ii) at least one of the first location and the second location is intermediate said first surface and said second surface, and (iii) said joint is within said interior cavity of said furnace body when said second conduit is at a tube metal temperature of 20°C.