Claims

1. Cracking furnace system for converting a hydrocarbon feedstock into cracked gas comprising a convection section, a radiant section and a cooling section,

wherein the convection section includes a plurality of convection banks, including a first high temperature coil, configured to receive and preheat a hydrocarbon feedstock-diluent mixture,

wherein the radiant section includes a firebox comprising at least one radiant coil configured to heat up the feedstock to a temperature allowing a pyrolysis reaction,

wherein the cooling section includes at least one transfer line exchanger,

wherein the convection section is configured for mixing said hydrocarbon feedstock with a diluent in the form of a superheated steam to provide a hydrocarbon feedstock-diluent mixture, in the convection section upstream of the first high temperature coil,

wherein the system is configured to further preheat the feedstock-diluent mixture after exit of feedstock from the first high temperature coil by the transfer line exchanger before entry into the radiant section,

wherein the convection section includes a second high temperature coil configured to further preheat the feedstock-diluent mixture after exit from the transfer line exchanger and before entry into the radiant section.

2. Cracking furnace system according to claim 1, wherein the second high temperature coil is located in a bottom part of the convection section.

3. Cracking furnace system according to claim 1 or 2, wherein the cracking furnace system comprises a provision, configured to add additional

superheated diluent steam, to the hydrocarbon feedstock-diluent steam

mixture, which provision is configured to introduce the additional superheated diluent steam into the hydrocarbon feedstock-diluent steam mixture between the outlet for hydrocarbon feed-diluent steam mixture from said first high temperature coil and the inlet for hydrocarbon feed-diluent steam mixture into said transferline exchanger.

4. Cracking furnace system according to any of the preceding claims, further comprising a steam drum configured to generate saturated high pressure steam.

5. Cracking furnace system according to claim 4, further comprising a secondary transfer line exchanger which is located downstream from a primary transfer line exchanger and which is connected to the steam drum, and which is configured to at least partly vaporized boiler water coming from the steam drum.

6. Cracking furnace system according to claim 3, 4 or 5, wherein the convection section includes at least one high pressure steam superheater configured to superheat high pressure steam coming from the steam drum.

7. Cracking furnace system according to claim 3, 4, 5 or 6, wherein the convection section includes at least one dilution steam super heater configured to superheat dilution steam to add to the feedstock or the feedstock-diluent mixture

8. Cracking furnace system according to any of the preceding claims, wherein the plurality of convection banks further includes a feed preheater configured to preheat the hydrocarbon feedstock prior to a provision, configured to mix the preheated feedstock with part or all of the diluent, which provision is situated between said feed preheater and said first high temperature coil.

9. Cracking furnace system according to any of the preceding claims, wherein the plurality of convection banks includes a further provision configured to mix further diluent into the feedstock-diluent mixture which

further provision is located downstream of the first high temperature coil and upstream of the transfer line exchanger.

10. Method for cracking hydrocarbon feedstock in a cracking furnace system, for example in a cracking furnace system according to any of the preceding claims, the method comprising mixing a hydrocarbon feedstock with a diluent in the form of a superheated steam thereby providing a hydrocarbon feedstock-diluent mixture in a convection section of the cracking furnace system upstream of a first high temperature coil, and subjecting the hydrocarbon feedstock-diluent mixture to a first feedstock preheating step, a second feedstock preheating step, and a third preheating step before entry of the hydrocarbon feedstock-diluent mixture into a radiant section of the cracking furnace system, in which radiant section the hydrocarbon feedstock is cracked,

wherein the first feedstock preheating step includes preheating the hydrocarbon feedstock-diluent mixture by hot flue gasses of a cracking furnace system using the first high temperature coil,

wherein the second feedstock-diluent mixture preheating step includes further preheating of the feedstock-diluent mixture by waste heat of cracked gas of the cracking furnace system using a transfer line exchanger after exit from the first high temperature coil and before entry into the radiant section,

wherein the third feedstock-diluent mixture preheating step includes further preheating of the feedstock by hot flue gasses of the cracking furnace system using a second high temperature coil after exit from the transfer line exchanger and before entry into the radiant section.

11. Method according to claim 10, wherein after said first preheating step, further dilution steam is added to the feedstock-diluent mixture, before subjecting the feedstock-diluent mixture to said further preheating of the

feedstock-diluent mixture by waste heat of cracked gas of the cracking furnace system using a transfer line exchanger.

12. Method according to claim 10 or 11, wherein high pressure steam is generated by waste heat of cracked gas of the cracking furnace system, using a secondary transfer line exchanger located downstream of the transfer line exchanger.

13. Method according any of the claims 10-12, wherein the hydrocarbon feedstock-diluent mixture is superheated in the convection section.

14. Method according to any of the claims 10-13, wherein the feedstock is subjected to preheating prior to mixing the feedstock with diluent.

15. Method according to claim 14, wherein the feedstock is preheated prior to the mixing with the diluent to temperature whereby upon mixing with diluent a feedstock-diluent mixture, to be fed into the first high temperature coil, is obtained having a temperature exceeding the water dew point.

16. Method according to any of the claims 10-15, wherein the feedstock-diluent mixture enters the first high temperature coil at a temperature above the dew point of water.

17. Method according to claim 16, wherein the feedstock-diluent mixture enters the first high temperature coil at a temperature of 30-70 ^{0}0 above the dew point of water, e.g. about 50 ^{0}0 above the dew point of water.

18. Method according to any of the claims 10-17, wherein the feedstock-diluent mixture is preheated in the first high temperature coil and the feedstock-diluent mixture already has a temperature exceeding the feedstock's hydrocarbon dew point at the start of the second feedstock-diluent preheating step.

19. Method according to any of the claims 10-18, wherein the method is carried out in cracking furnace system, further comprising a steam drum configured to generate saturated high pressure steam, the system preferably further comprising a secondary transfer line exchanger which is located

downstream from a primary transfer line exchanger and which is connected to the steam drum, and which is configured to at least partly vaporized boiler water coming from the steam drum.

20. Method according to claim 19, wherein the convection section includes at least one high pressure steam superheater configured to superheat high pressure steam coming from the steam drum.

21. Method according to any of the claims 10-20, wherein the convection section includes at least one dilution steam super heater configured to superheat dilution steam to add to the feedstock or the feedstock-diluent mixture.