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## (54) Title: PYROLYSIS REACTOR MATERIALS AND METHODS

Figure 1(a)

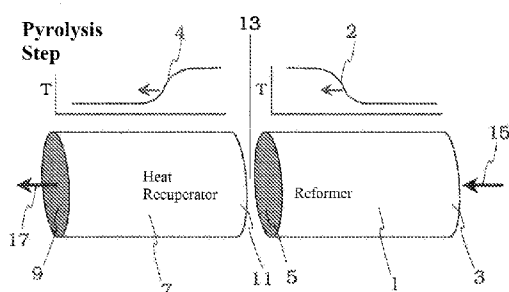
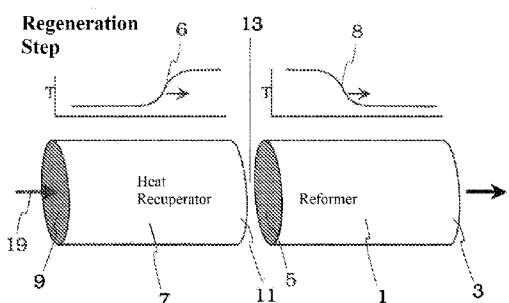


Figure 1(b)



(57) Abstract: In one aspect, the invention includes a reactor apparatus for pyrolyzing a hydrocarbon feedstock, the apparatus including: a reactor component comprising a refractory material in oxide form, the refractory material having a melting point of at least 20600C and which remains in oxide form when exposed to a gas having an oxygen partial pressure of 10<sup>-15</sup> bar, a carbon partial pressure above the carbon partial pressure of the zirconium carbide and zirconium oxide phase transition at the same temperature, and at temperatures below the temperature of the zirconium triple point at the oxygen partial pressure of 10<sup>-15</sup> bar; and ii) when exposed to a gas having an oxygen partial pressure of 10<sup>-15</sup> bar and at temperatures above the zirconium triple point at the oxygen partial pressure of 10<sup>-15</sup> bar. In some embodiments, the reactor comprises a regenerative pyrolysis reactor apparatus and in other embodiments it includes a reverse flow regenerative reactor apparatus. In other aspects, this invention includes a method for pyrolyzing a hydrocarbon feedstock using a pyrolysis reactor system comprising the step of providing in a heated region of a pyrolysis reactor system for pyrolyzing a hydrocarbon feedstock, apparatus comprising the above refractory material.



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