CLAIMS

1. A steam pyrolysis process comprising:

providing a steam pyrolysis unit including a convection section upstream of a pyrolysis section;

charging a feed to a flash vessel for separation into a light fraction as a steam pyrolysis feed and a heavy fraction, the flash vessel having a vapor-liquid separation device at its inlet, the vapor-liquid separation device including

a pre-rotational element for conversion of linear velocity of the incoming feed into a rotational velocity, the pre-rotational element having

an entry portion having an inlet for receiving the feed and a curvilinear conduit spanning from the inlet to an outlet, and

a transition portion at the outlet of the curvilinear conduit,

a controlled cyclonic section having

an inlet adjoined to the transition portion of the pre-rotational element through convergence of the curvilinear conduit and the cyclonic section, and

a riser section at an upper end of the cyclonic member through which the light fraction passes,

wherein a bottom portion of the flash vessel serves as a collection and settling zone for the heavy fraction prior to passage of all or a portion of said heavy fraction;

passing the light fraction to the convection section of the steam pyrolysis unit for heating; and

passing the heated light fraction to the pyrolysis section for thermal cracking to produce a mixed product stream.

2. A steam pyrolysis system comprising:

a steam pyrolysis unit including a convection section upstream of a pyrolysis section; and

a flash vessel upstream of the convection section of the steam pyrolysis unit, the flash vessel including a vapor-liquid separation device at its inlet, the vapor-liquid separation device including

a pre-rotational element for conversion of linear velocity of an incoming feed into a rotational velocity, the pre-rotational element having

an entry portion having an inlet for receiving the feed and a curvilinear conduit spanning from the inlet to an outlet, and

a transition portion at the outlet of the curvilinear conduit,

a controlled cyclonic section having

an inlet adjoined to the transition portion of the pre-rotational element through convergence of the curvilinear conduit and the cyclonic section, and

a riser section at an upper end of the cyclonic member through which a light fraction passes,

wherein a bottom portion of the flash vessel serves as a collection and settling zone for a heavy fraction prior to passage of all or a portion of said heavy fraction.

3. A steam pyrolysis process comprising:

a. charging a feed to a flash vessel for separation into a light fraction as a steam pyrolysis feed and a heavy fraction, the flash vessel having a vapor-liquid separation device at its inlet, the vapor-liquid separation device including

a pre-rotational element having

an entry portion having an inlet for receiving the feed and a curvilinear conduit spanning from the inlet to an outlet, and

a transition portion at the outlet of the curvilinear conduit,

a controlled cyclonic section having

an inlet adjoined to the transition portion of the pre-rotational element through convergence of the curvilinear conduit and the cyclonic section, and

a riser section at an upper end of the cyclonic member through which the light fraction passes,

wherein a bottom portion of the flash vessel serves as a collection and settling zone for the heavy fraction prior to passage of all or a portion of said heavy fraction;

b. charging the light fraction to a convection section of a steam pyrolysis unit to produce a heated light fraction;

c. separating the heated light fraction in a vapor-liquid separator into a vapor phase and a liquid phase, the vapor-liquid separator including

a pre-rotational element having

an entry portion having an inlet for receiving the heated light fraction and a curvilinear conduit spanning from the inlet to an outlet, and

a transition portion at the outlet of the curvilinear conduit,

a controlled cyclonic section having

an inlet adjoined to the transition portion of the pre-rotational element through convergence of the curvilinear conduit and the cyclonic section, and

a riser section at an upper end of the cyclonic member through which the vapor phase passes, and

a liquid collector/settling section through which liquid phase passes,

and

d. thermally cracking the vapor phase in a pyrolysis section of a steam pyrolysis unit to produce a mixed product stream.

4. The process as in claim 1, wherein

a diameter of a conduit flowing to the inlet has a value D1,

the pre-rotational element comprises the inlet having a cross section area S1 for receiving the flowing mixture and the outlet having a cross section area S2, wherein the ratio between S2 and S1 is $0.7 \leq S2/S1 \leq 1.4$, and

the curvilinear conduit having a radius of curvature R1 in the range of $2 \leq R1/D1 \leq 6$ and opening angle αR1 between S1 and S2 that is in the range of $150° \leq \alpha R1 \leq 250°$.

5. The process as in claim 3, wherein

a diameter of a conduit flowing to the inlet has a value D1,

the pre-rotational element of the vapor-liquid separation device, the vapor-liquid separator or both the vapor-liquid separation device and the vapor-liquid separator comprises the inlet having a cross section area S1 for receiving the flowing mixture and the outlet having a cross section area S2, wherein the ratio between S2 and S1 is $0.7 \leq S2/S1 \leq 1.4$, and

the curvilinear conduit having a radius of curvature R1 in the range of $2 \leq R1/D1 \leq 6$ and opening angle αR1 between S1 and S2 that is in the range of $150° \leq \alpha R1 \leq 250°$.

6. The system as in claim 2, wherein

a diameter of a conduit flowing to the inlet has a value D1,

the pre-rotational element comprises the inlet having a cross section area S1 for receiving the flowing mixture and the outlet having a cross section area S2, wherein the ratio between S2 and S1 is $0.7 \leq S2/S1 \leq 1.4$, and

the curvilinear conduit having a radius of curvature R1 in the range of $2 \leq R1/D1 \leq 6$ and opening angle αR1 between S1 and S2 that is in the range of $150° \leq \alpha R1 \leq 250°$.