CLAIMS

What is claimed is:

1. A reactor comprising:

a furnace;

a crucible positioned for heating by the furnace, the crucible defining an interior volume and having a reactant inlet;

a downtube disposed at least partially within the interior crucible, the downtube including a conduit having an inlet at a first end, an outlet at a second end and at least one opening formed in the conduit between the first end and the second end, the outlet and at least one opening configured to provide a recirculation path for any liquid material contained within the crucible;

wherein the reactant inlet is positioned below the second end of the conduit, and wherein the reactor further comprises a porous disc structure positioned between the reactant inlet and the second end of the conduit.

2. The reactor of claim 1, wherein the at least one opening is tapered at one end thereof.

3. The reactor of claim 2, wherein the at least one opening includes a plurality of openings within the conduit between the first and second ends.

4. The reactor of claim 1, wherein the downtube extends substantially along a longitudinal axis of the crucible.

5. The reactor of claim 4, wherein a cross-sectional area of the downtube, as taken substantially perpendicular to the longitudinal axis, is approximately half of a cross-sectional area of the crucible, as taken substantially perpendicular to the longitudinal axis.

6. The reactor of claim 5, wherein the downtube further comprises a plurality of guide members coupled with the conduit, the plurality of guide members being sized and positioned to maintain the conduit substantially along the longitudinal axis.

7. The reactor of claim 6, further comprising a spool structure coupled with the crucible, the spool structure having at least one outlet and at least one inlet.

8. The reactor of claim 7, wherein an inlet of conduit is in fluid communication with the at least one inlet of the spool structure.

9. The reactor of claim 6, further comprising a flow diversion structure positioned adjacent the second end of the conduit.

10. The reactor of claim 9, wherein the flow diversion structure exhibits a substantially spherical geometry.

11. The reactor of claim 10, wherein the flow diversion structure is spaced apart from the second end of the conduit and wherein each of the plurality of guide members are coupled between the conduit and the flow diversion structure.

~~12. The reactor of claim 9, wherein the crucible further includes a reactant inlet positioned below the second end of the conduit.~~

~~13. The reactor of claim 12, further comprising a porous disc structure positioned between the reactant inlet and the second end of the conduit.~~

12~~14~~. The reactor of claim ~~13~~ 1, further comprising a splash guard coupled with the conduit and positioned between the at least one opening and the first end of the conduit.

13~~15~~. The reactor of claim ~~14~~ 12, wherein the crucible and the downtube are formed from a stainless steel material.

14~~16~~. The reactor of claim 1, wherein the furnace includes a plurality of selectively controllable heating zones.

15~~17~~. A gas processing system comprising:

a supply of oxidizing material;

a supply of hydrocarbon material; and

a reactor comprising:

a furnace;

a crucible positioned for heating by the furnace, the crucible defining an interior volume and having a catalyst material therein , the crucible including an inlet;

a downtube disposed at least partially within the interior crucible along an axis, the downtube including a conduit having a first end, a second end and at least one opening between the first end and the second end, the first end being in fluid

communication with the supply of hydrocarbon material, the second end providing an outlet into the interior volume of the crucible, and the second end and the at least one opening defining a recirculation path for the catalyst material within the crucible;

wherein the inlet is located below the outlet of the conduit, the reactor further comprising a porous disc structure positioned between the inlet and the conduit.

16~~18~~. The system of claim ~~17~~ 15, wherein the catalyst material includes a salt.

17~~19~~. The system of claim ~~17~~ 15, wherein the catalyst material includes sodium carbonate.

18~~20~~. The system of claim ~~19~~ 17, wherein the supply of hydrocarbon material includes residual bitumen.

19~~21~~. The system of claim ~~20~~ 18, wherein ~~the crucible further comprises an inlet located below the outlet of the conduit,~~ the inlet ~~being~~ is in fluid communication with a source of oxidizing material.

20~~22~~. The system of claim ~~21~~ 19, wherein the oxidizing material includes water.

~~23. The system of claim 22, further comprising a porous disc structure positioned between the inlet and the conduit.~~

21~~24~~. The system of claim ~~23~~ 15, further comprising a flow diversion structure disposed adjacent the second end of the conduit between the porous disc structure and the conduit.

22~~25~~. A downtube for use in the interior volume of a crucible of a reactor, the downtube comprising:

a conduit having a first end and a second end and extending along an axis;

a flow diversion structure adjacent the second end of the conduit and coupled to the conduit;

at least one opening formed in the conduit between the first end and the second end; and

a plurality of guide members coupled with the conduit and extending radially outward from the conduit;

a splash guard coupled with the conduit and positioned between the at least one opening and the first end of the conduit.

23~~26~~. The downtube of claim ~~25~~ 22, wherein the at least one opening includes at least a portion exhibiting a tapered geometry.

24~~27~~. The downtube of claim ~~25~~ 22, wherein the flow diversion structure exhibits a substantially spherical geometry.

~~28. The downtube of claim 27, further comprising a splash guard coupled with the conduit and positioned between the at least one opening and the first end of the conduit.~~

25~~29~~. A method of controlling a reaction within a reactor, the method comprising:

providing a salt bath within a crucible;

introducing a hydrocarbon material into the salt bath through an outlet of a conduit, the conduit being disposed at least partially within the crucible;

positioning a porous disc structure between an inlet of the crucible and the outlet of the conduit;

introducing an oxidizing material into the salt bath ~~at a bottom portion~~ through the inlet of the crucible and through the porous disc; and

providing a recirculation path through the conduit for the salt bath.

2630. The method according to claim ~~29~~ 25, further comprising defining the conduit to have a first end, a second end, and wherein providing a recirculation path includes providing at least one opening in the conduit between the first end and the second end.

2731. The method according to claim ~~30~~ 26, further comprising flowing a portion of the salt bath through at least one opening in the and back through the conduit.

2832. The method according to claim ~~31~~ 27, wherein flowing a portion of the salt bath through the at least one opening further includes raising the liquid level of the salt bath to an elevation of the at least one opening.

2933. The method according to claim ~~32~~ 28, wherein raising the liquid level of the salt bath includes introducing the oxidizing material into the salt bath as a plurality of gas bubbles.

3034. The method according to claim ~~33~~ 29, wherein providing a salt bath within a crucible includes providing a salt bath containing sodium carbonate.

31~~35~~. The method according to claim ~~34~~ 30, wherein introducing an oxidizing material into the salt bath includes introducing steam into the salt bath, and wherein introducing a hydrocarbon material into the salt bath includes injecting a residual bitumen into the salt bath under pressure.