CLAIMS

What is claimed is:

1. A polymer synthesis system comprising:

(i) polymerization reactor having an inlet proximate to a first end and an outlet proximate to an opposed second end, said reactor including a rotatable shaft positioned axially within said reactor and including at least two shearing paddles extending radially outward from said rotatable shaft; and

(ii) a deliquifying-quench extruder having an inlet proximate to a first end and an outlet proximate to an opposed second end, said extruder including a shaft assembly positioned axially within said extruder and including multiple helical flight configurations, said extruder including multiple processing zones defined by the multiple flight configurations, said processing zones including an extraction-compaction zone, a sealing zone downstream of the extraction-compaction zone, a vent-cooling zone downstream of the sealing zone, a quenching zone downstream of the vent-cooling zone, and a conveying zone downstream of the quenching zone, where the deliquifying-quench extruder is downstream of said polymerization reactor, and where said deliquifying-quench extruder is in fluid communication with said polymerization reactor via the outlet of the reactor and the inlet of the extruder.

2. The system as claimed in claim 1, where said reactor includes a sidewall, and further includes hooks extending radially inward toward said shaft.

3. The system as claimed in either claim 1 or 2, where said shaft assembly with the extraction-compaction zone provides a channel having a channel depth, and where the channel depth decreases from a first end to a second end of said shaft assembly.

4. The system as claimed in any one of claims 1 to 3, where said shaft assembly within the sealing zone includes a dam, and where said shaft assembly within the sealing zone further includes a helical flight downstream of said dam, wherein said helical flight is reversed.

5. The system as claimed in any one of claims 1 to 4, where said shaft assembly within the vent-cooling zone is configured to provide for greater conveying capacity relative to the sealing zone.

6. The system as claimed in any one of claims 1 to 5, where said deliquifying-quench extruder is positioned at angle relative to the horizontal to thereby promote flow of liquid materials toward the inlet of the deliquifying-quench extruder.

7. A polymer synthesis system comprising:

(i) a first vessel adapted to knead and/or granulate the contents thereof; and

(ii) a second vessel adapted to process the contents thereof by sequentially (i) compacting the contents thereof while allowing for the bidirectional flow of physically-distinct constituents; (ii) subjecting the contents thereof to reduced pressures and/or increased temperatures to thereby volatilize lower-boiling constituents within the second vessel and separate them from the other constituents; (iii) mixing the contents thereof while introducing a quenching agent; (iv) conveying the contents thereof out of the second vessel, where the first vessel is in fluid communication with the second vessel, and where the second vessel is downstream of the first vessel.

8. The system as claimed in claim 7, where said first vessel is adapted to transfer the contents thereof to said second vessel by way of pulsatile flow.

9. The system as claimed in claim 7, where said second vessel is an extruder including a shaft assembly that includes a compacting segment that includes a core shaft and a screw segment, with the screw segment providing a channel having a channel depth, where the channel depth decreases from a first end of the compacting segment to a second end of the compacting segment to thereby provide for compacting the contents thereof.

10. The system as claimed in claim 7, where said second vessel is an extruder including a shaft assembly that includes a compacting segment that includes a core

shaft and a screw segment, where the screw segment includes with the screw segment providing a flight clearance that allows for the bidirectional flow of physically-distinct constituents.