CLAIMS

1. A device (318) for filtering and settling entrained particles from a gas feed stream, the device comprising:

a cylindrical v-wire filter element (324) to filter the entrained particles, wherein the v-wire filter element comprises a solid metal ring (325) and a body, wherein the solid metal ring is mounted on a top portion of the body to form a hollow internal passagewayof the v-wire filter element, wherein the body comprises slits, wherein a first portion of gas stream flows radially through the slits to form a filtered gas stream, and wherein the hollow internal passageway receives the filtered gas stream;

a cap (326) located above the v-wire filter element comprising an outer surface, an under surface, and a downward rim attached to a perimeter of the under surface (340), wherein a bottom edge of the rim is aligned with a bottom edge of the solid metal ring; and

an open annulus area (338) located between and in fluid communication with an open top portion of the v-wire filter element and the under surface of the cap, wherein a second portion of gas feed stream flows upward along a length of the v-wire filterelement, into the open annulus area and downward into the hollow internal passageway.

2. The device of Claim 1, wherein the v-wire filter element comprises a v-wire screen.

3. The device of Claim 2, wherein the v-wire screen consists of surface wires welded together.

4. The device of Claim 1, wherein diameter of the solid metal ring corresponds with the diameter of the filter element.

5. A gas-phase settling (GPS) tray (114) installed within a catalytic reactor (100) having at least one catalyst bed, the GPS tray comprising:

a plurality of devices (118) for trapping entrained particles from an inlet gas feed stream by particle filtration and settling, wherein each device comprises:

a cylindrical v-wire filter element (324) to filter the entrained particles, wherein the v-wire filter element comprises a solid metal ring (325) and a body, wherein the solid metal ring is mounted on a top portion of the body to form a hollow internal passageway of the v-wire filter element, wherein the body comprises slits, wherein a first portion of gas stream flows radially through the slits to form a filtered gas stream, and wherein the hollow internal passageway receives the filtered gas stream;

a cap (326) located above the v-wire filter element comprising an outer surface, an under surface, and a downward rim attached to a perimeter of the under surface (340), wherein a bottom edge of the rim is aligned with a bottom edge of the solid metal ring; and

an open annulus area (338) located between and in fluid communication with an open top portion of the v-wire filter element and the under surface of the cap, wherein a second portion of gas feed stream flows upward along a length of the v-wire filter element, into the open annulus area and downward into the hollow internal passageway; and

a planar surface (116) comprising a plurality of panels, wherein each panel comprises an opening (230), and wherein the hollow internal passage of each device is located above and aligned with the opening of the panel.

6. The GPS tray of Claim 5, wherein a total open slit area of the v-wire filter element is greater than or equal to a total open annulus area.

7. The GPS tray of Claim 6, wherein the total open slit area of the v-wire filter element is at least twice the size of the open annulus area.

8. The GPS tray of Claim 5, wherein the catalytic reactor comprises a reaction chamber located below a skirt (120), wherein the skirt is located below the GPS tray.

9. The GPS tray of Claim 5, wherein the GPS tray is installed above a top catalyst bed of the at least one catalyst bed of the catalytic reactor.

10. A method for removing entrained particles from an inlet gas feed stream flowing into a catalytic reactor (100), the method comprising:

(a) flowing the inlet gas feed stream into a top inlet of the catalytic reactor (100); and

(b) subjecting the inlet gas feed stream to a gas-phase settling (GPS) tray (114) installed within the catalytic reactor, the GPS tray comprising:

a plurality of devices (118) for trapping entrained particles from an inlet gas feed stream by particle filtration and settling, wherein each device comprises:

a cylindrical v-wire filter element (324) to filter the entrained particles, wherein the v-wire filter element comprises a solid metal ring (325) and a body, wherein the solid metal ring is mounted on a top portion of the body to form a hollow internal passageway of the v-wire filter element, wherein the body comprises slits, wherein a first portion of gas stream flows radially through the slits to form a filtered gas stream, and wherein the hollow internal passageway receives the filtered gas stream;

a cap (326) located above the v-wire filter element comprising an outer surface, an under surface, and a downward rim attached to a perimeter of the under surface (340), wherein a bottom edge of the rim is aligned with a bottom edge of the solid metal ring; and

an open annulus area (338) located between and in fluid communication with an open top portion of the v-wire filter element and the under surface of the cap, wherein a second portion of gas feed stream flows upward along a length of the v-wire filter element, into the open annulus area and downward into the hollow internal passageway; and

a planar surface (116) comprising a plurality of panels, wherein each panel comprises an opening (230), and wherein the hollow internal passage of each device is located above and aligned with an opening of the panel.

11. The method of Claim 10, wherein the maximum allowable pressure-drop over the tray is 0.03 psi (2 millibar (mbar)).

12. The method of Claim 10, wherein the filtered gas stream flowing through the hollowinternal passage comprises a maximum velocity of 1 meter/second (m/s).

13. The method of Claim 10, wherein subjecting the inlet gas stream to the GPS tray comprises filtering the entrained particles with a diameter of 100 microns (μm) and above from the first portion of the gas stream through the v-wire filter element.