CLAIMS

What is claimed is:

1. A tray for use in a mass transfer column to facilitate interaction between fluids when they are flowing within the mass transfer column, said tray comprising:

a tray deck having an upper surface;

an inlet area on the tray deck for receiving a downward flow of liquid onto the upper surface of the tray deck;

a plurality of apertures distributed across an area of the tray deck and extending through the tray deck to permit upward passage of fluid through the tray deck for interaction with the liquid after it leaves the inlet area and flows across and above the area of the tray deck on which the apertures are distributed;

an outlet positioned on the tray deck at the same end of the tray deck as said inlet area for allowing removal of liquid from the upper surface of the tray deck after it has flowed from the inlet area and interacted with the fluid passing upwardly through the apertures in said area;

a plurality of spaced-apart baffle walls extending upwardly from the upper surface of the tray deck and positioned to narrow a width of a flow path of the liquid when it flows from the inlet area to the outlet and to force the liquid to reverse its direction of flow at least three times and thereby lengthen the flow path; and

a downcomer extending downwardly from the outlet to receive liquid when it enters the outlet and then convey it downwardly to a discharge outlet located at a lower end of the downcomer, wherein said downcomer includes an inclined or horizontal portion that causes the discharge outlet to be positioned beneath and in vertical alignment with the inlet area on the tray deck.

2. The tray of claim 1, wherein said plurality of spaced-apart baffle walls comprises three of said baffles walls.

3. The tray of claim 2, wherein said flow path is a serpentine flow path.

4. The tray of claim 3, including valves formed in part by said apertures.

5. The tray of claim 4, wherein said valves include a valve cover that is able to float up and down in response to a force exerted by an upward flow of fluid through the apertures.

6. The tray of claim 1, wherein said downcomer is formed by pipe segments.

7. The tray of claim 6, wherein said downcomer extends through one or more of said plurality of spaced-apart baffle walls.

8. A mass transfer column comprising a shell, an open internal region within said shell, and a plurality of trays of claim 1 positioned in vertically spaced-apart relationship within and extending across a cross section of the open internal region, wherein the inlet areas of the tray decks are in vertical alignment, the outlets on the tray decks are also in vertical alignment, and the flow path is a serpentine flow path that is in the same direction on each of the trays.

9. The mass transfer column of claim 8, wherein said plurality of spaced-apart baffle walls comprises three of said baffles walls.

10. The mass transfer column of claim 9, wherein each of said baffle walls has an end that abuts against one side of the shell and an opposite end that is spaced a preselected distance from an opposite side of the shell.

11. The mass transfer column of claim 9, including valves in said tray decks of said trays that are formed in part by said apertures.

12. The mass transfer column of claim 11, wherein said valves include a valve cover that is able to float up and down in response to a force exerted by an upward flow of fluid through the apertures.

13. The mass transfer column of claim 8, wherein said downcomer is formed by pipe segments.

14. The mass transfer column of claim 13, wherein the baffle walls extend upwardly to an undersurface of an adjacent overlying tray deck.

15. A method of interacting fluids on and above an upper surface of tray deck of trays of claim 1 positioned in vertically spaced-apart relationship within a mass transfer column and extending across a cross section of an open internal region formed by a shell of the mass transfer column, the method comprising the steps of:

delivering a liquid onto the inlet area of a tray deck on each of the trays and allowing it to flow along and above the upper surface of the tray deck along a serpentine flow path in which the liquid reverses its direction of flow at least three times, the serpentine flow path being defined in part by the plurality of baffle walls that extend upwardly from the upper surface of each of the tray decks, said liquid flowing at a rate of less than 0.0052 m^2/s of flow path width along and above the upper surface of the tray deck along said serpentine flow path;

causing a vapor to ascend through a plurality of apertures in the tray deck to interact with the liquid as it flows along its serpentine flow path;

removing the liquid from the tray deck at the end of its serpentine flow path by directing it through an outlet in the tray deck and into a downcomer; and

then discharging the liquid from the downcomer onto the inlet area of an adjacent underlying one of the trays.

16. The method of claim 15, wherein said liquid flows at a rate of less than 0.0021 m^2/s of flow path width along and above the upper surface of the tray deck along said flow path.

17. The method of claim 15, including flowing the liquid in a same direction along the serpentine flow path on adjacent ones of the trays.

18. The method of claim 17, including flowing the liquid around three of said baffle walls on the upper surface of each tray deck.

19. The method of claim 15, including maintaining a spacing between adjacent ones of the tray decks by extending the baffle walls upwardly to an undersurface of an adjacent overlying tray deck and attaching the baffle walls to the adjacent overlying tray deck.

20. The method of claim 19, wherein said liquid flows at a rate of less than 0.0021 m^2/s of flow path width along and above the upper surface of the tray deck along said flow path.