to the direction only if there are additional capillary features that connect the substantially horizontal capillary features such that there is a connected flow circuit in the vertical direction.

[0137] In an alternate embodiment, the two-phase feed mixture may be fed directly to the process gaseous flow path. The liquid present in the feed stream will diffuse to the flowing liquid retained within the first set of capillary features (or liquid removal structure or capture structure).

[0138] The method of distributing the two-phase flow may be selected through analysis of the relative mass fraction of gas to liquid in the feed stream. Feed streams that are primarily gaseous in nature (>60% by volume) may be manifolded and distributed as a gas. The design of the manifolding system may be such that the mixture flows in a regime that is not segregated, slugging, or stratified, but rather flows as a fine mist or droplets of liquid in a gas. The more homogeneous mixture may distribute as a gaseous stream where flow follows the lowest pressure drop path. Distribution features, including those disclosed in U.S. application Ser. No. 10/695,400, filed Oct. 27, 2003, which is incorporated herein by reference, may be useful in distributing the gas-like flow stream.

[0139] If the two-phase feed stream is primarily a liquid (for example, greater than about 60% by volume liquid), then the flow distribution methodology may entrain fine gas bubbles within the liquid feed carrier flow stream. The more homogeneous mixture may be distributed again by controlling the pressure drop in each flow circuit or to each feed introduction point adjacent to the liquid removal structure (or first set of capillary features) in the process flow stream.

[0140] The two-phase mixture may be either homogenized to avoid segregation, stratification, slugging within the flow distribution network and prior to the introduction of feed to either the process gaseous or liquid flow path, or the two-phase feed mixture may be phase separated before or after entering the microchannel distillation unit. It is not recommended to distribute a slugging or chaotically stratified two-phase mixture along a flow network that feeds multiple parallel process microchannels.

[0141] As shown in **FIG. 25**, a homogeneous inlet feed F may be introduced through an inlet micro-manifold. This technique may be used to distribute or deliver feed to a plurality of parallel process microchannels. The homogeneous feed may be single phase, or an homogenized two-phase feed, where one phase is substantially uniformly distributed within the second phase to an appropriate extent such that the flow mixture follows steady-state predictions of pressure drop along the inlet micro-manifold. A spatially homogeneous mixture may be either mixed throughout the feed micro-manifold, as in the case of gaseous bubbles dispersed in a liquid stream or fine liquid droplets or mist in a gaseous stream. A temporarily homogeneous feed mixture may by used. A temporarily homogeneous mixture may be defined as a spatially stratified two-phase flow stream that does not substantially fluctuate with time. In the latter case, the two-phase feed stream that flows in an annular flow regime, where liquid flows along the wall and gas along the micro-manifold center, may be considered a temporary-homogeneous feed stream. Local temporary variations in flow patterns of a two-phase stream may give rise to flow maldistribution, as in the case of a slug that forms and dissipates as it flows along the micro-manifold.

[0142] The microchannel condenser **120** illustrated in **FIG. 1** or microchannel condenser **240** illustrated in **FIGS. 2 and 3** may have the construction illustrated in **FIGS. 32-34**. Referring to **FIGS. 32-34**, microchannel condenser **800** comprises process microchannel **802**, liquid channels **804** and **806**, heat exchange channels **808** and **810**, and outlet **812**. Liquid channel **804** includes wicking region **814** and outlet **816**, and liquid channel **806** includes wicking region **818** and outlet **820**. Process microchannel **802** is positioned between liquid channels **804** and **806**. Heat exchange channels **808** are adjacent to liquid channel **804**. Heat exchange channels **810** are adjacent to liquid channel **806**. Process microchannel **802** includes inlet **822** for permitting vapor to flow into the process microchannel **802**, and outlets **824** and **826** for permitting condensed vapor to flow from microchannel **802** into wicking regions **814** and **818**, respectively. In operation, vapor **828** flows through inlet **822** into process microchannel **802** in the direction indicated by arrow **830** and condenses to form condensed vapor **832** which may be referred to as the distillate product D. Heat exchange fluid flows through heat exchange channels **808** and **810** in a direction that is crosscurrent relative to the flow of vapor in the process microchannel **802**. Part or all of the condensed vapor may flow through outlet **812**, as indicated by arrow **834**. The remaining condensed vapor may flow through outlets **824** and **826** into wicking regions **814** and **818**, respectively. The distillate product flowing in the wicking regions **814** and **818** flows in the direction indicated by arrows **836** and **838** through outlets **816** and **820**, respectively.

[0143] The microchannel reboiler **130** illustrated in **FIG. 1** or microchannel reboiler **270** illustrated in **FIGS. 2 and 3** may have the construction illustrated in **FIGS. 35-37**. Referring to **FIGS. 35-37**, microchannel reboiler **850** comprises process microchannel **852**, liquid channel **854**, and heat exchange channels **856** and **858**. Liquid channel **854** includes wicking region **860**. Process microchannel **852** is positioned between liquid channel **854** and heat exchange channels **856**. Heat exchange channels **858** are adjacent to liquid channel **854**. Process microchannel **852** includes outlets **862** and **864**, and inlet **866**. In operation, liquid **868** flows through wicking region **860** to inlet **866**, and through inlet **866** into process microchannel **852**, as indicated by arrow **868**. Heat exchange fluid flows through heat exchange channels **856** and **858** in a direction that is crosscurrent relative to the flow of liquid through the wicking region **860**. Part or all of the liquid **868**, which is in the form of bottoms product B, may flow through outlet **862**, as indicated by arrow **870**. The remainder of the bottoms product B may be vaporized. The vapor **872** flows through process microchannel **852** in the direction indicated by arrow **874** and out of process microchannel **852** through outlet **864**.

[0144] An alternate embodiment of the microchannel reboiler **130** illustrated in **FIGS. 38-40** or microchannel reboiler **270** illustrated in **FIGS. 2 and 3** and the microchannel reboiler **690** illustrated in **FIG. 19** is disclosed in **FIGS. 38-40**. Referring to **FIGS. 38-40**, microchannel reboiler **900** comprises process microchannel **910**, liquid channel **920**, and heat exchange channels **930** and **940**. Liquid channel **920** includes wicking region **925**. Process microchannel **910** is positioned between liquid channel **920** and heat exchange channels **930**. Heat exchange channels **940** are adjacent to liquid channel **920**. Process microchannel **910** includes outlets **912** and **914**, and inlet **916**. In