[0059] **FIG. 37** is a schematic illustration of the microchannel reboiler illustrated in **FIG. 35** taken along line II-II in **FIG. 35**.

[0060] **FIG. 38** is a schematic illustration of an alternate embodiment of a microchannel reboiler that can be used with the inventive process.

[0061] **FIG. 39** is a schematic illustration of the microchannel reboiler illustrated in **FIG. 38** taken along line I-I in **FIG. 38**.

[0062] **FIG. 40** is a schematic illustration of the microchannel reboiler illustrated in **FIG. 38** taken along line II-II in **FIG. 38**

[0063] **FIG. 41** is a schematic illustration showing a process using the inventive microchannel distillation units for separating water, butanes or butylenes, propanes or propylenes, and ethane or ethylene, from raw natural gas.

[0064] **FIG. 42** is a flow sheet illustrating a process for distilling a fluid mixture in accordance with the inventive process.

[0065] **FIG. 43** is a schematic illustration of microchannel distillation unit that can be used in accordance with the inventive process.

[0066] **FIG. 44** is a schematic illustration of a mesh arrangement that can be used in a microchannel distillation unit with the inventive process.

[0067] **FIG. 45** is a schematic illustration of an alternate embodiment of a microchannel distillation unit that can be used in accordance with the inventive process.

[0068] **FIG. 46** is schematic illustration of another alternate embodiment of a microchannel distillation unit that can be used in accordance with the inventive process.

[0069] **FIG. 47** is a schematic illustration of surface features (or grooves and protrusions) that can be used in the microchannel distillation unit illustrated in **FIG. 46**.

[0070] **FIGS. 48 and 49** are schematic illustrations of alternate embodiments of the surface features that can be used in the microchannel distillation unit illustrated in **FIG. 46**. In each of these figures the surface features for positioning in the vapor region of the microchannel distillation unit illustrated in **FIG. 46** are shown on the left, and the surface features for use in the liquid region are shown on the right. Next to each of these figures are schematic illustrations showing the surface features as they overlap and complement one another.

[0071] **FIGS. 50 and 51** are schematic illustrations of alternate embodiments of the surface features that can be used in the microchannel distillation unit illustrated in FIG. **46**. Each of these figures show the complementing nature of the surface features.

[0072] **FIGS. 53-55** are schematic illustrations of microchannel distillation units that employ surface features on their sidewalls for enhancing the mixing of the vapor and liquid phases.

[0073] **FIG. 56** is a schematic illustration of a wall of a microchannel that employs dual depth surface features that promote capillary retention and mixing.

DETAILED DESCRIPTION

[0074] The term "microchannel" refers to a channel having at least one internal dimension of height orwidth of up to about 10 millimeters (mm), and in one embodiment up to about 5 mm, and in one embodiment up to about 2 mm, and in one embodiment up to about 1 mm. In one embodiment, the height or width is in the range of about 0.01 to about 10 mm, and in one embodiment about 0.05 to about 5 mm, and in one embodiment about 0.05 to about 2 mm, and in one embodiment about 0.05 to about 1.5 mm, and in one embodiment about 0.05 to about 1 mm, and in one embodiment about 0.05 to about 0.75 mm, and in one embodiment about 0.05 to about 0.5 mm. Both height and width are perpendicular to the direction of flow through the microchannel.

[0075] The term "adjacent" when referring to the position of one channel relative to the position of another channel means directly adjacent. In one embodiment, a wall or walls may separate the two channels, in part or in whole. This wall may vary in thickness. In one embodiment, a process microchannel and a liquid channel may be in fluid contact with one another. For example, a process microchannel may have an opening exposed to the wicking region of a liquid channel. However, "adjacent" channels are not separated by an intervening channel that would interfere with heat transfer between the channels.

[0076] The terms "upstream" and "downstream" refer to positions within the process microchannels used in the inventive process that are relative to the direction of flow of the vapor phase through the process microchannels towards the distillate end of the microchannel distillation unit. For example, a position within the process microchannels not yet reached by a portion of the vapor phase flowing toward that position would be downstream of that portion of the vapor phase. A position within the process microchannels already passed by a portion of the vapor phase flowing away from that position would be upstream of that portion of the vapor phase. The terms "upstream" and "downstream" do not necessarily refer to a vertical position since the process microchannels used in the inventive process may be oriented horizontally, vertically or at an inclined angle.

[0077] The term "capture structure" refers to a structure positioned within a channel that captures liquid.

[0078] The term "capillary features" are features associated with a microchannel that are used to hold liquid substances. They are either recessed within a wall of a microchannel or protrude from a wall of the microchannel into the flow path that is adjacent to the microchannel wall. The features may create a spacing that is less than about 1 mm, and in one embodiment less than about 250 microns, and in one embodiment less than about 100 microns. The features may have at least one dimension that is smaller than any dimension of the microchannel in which they are situated.

[0079] The term "wick" or "liquid removal structure" refers to medium for drawing off liquid by capillary action.

[0080] The term "wicking region" refers to a space occupied by a wick and/or a wicking surface (e.g., a grooved surface).

[0081] The term "pore throat" refers to a wick which is as denser or denser than a wick and is located at a liquid outlet to prevent vapor or gas breakthrough into the liquid.