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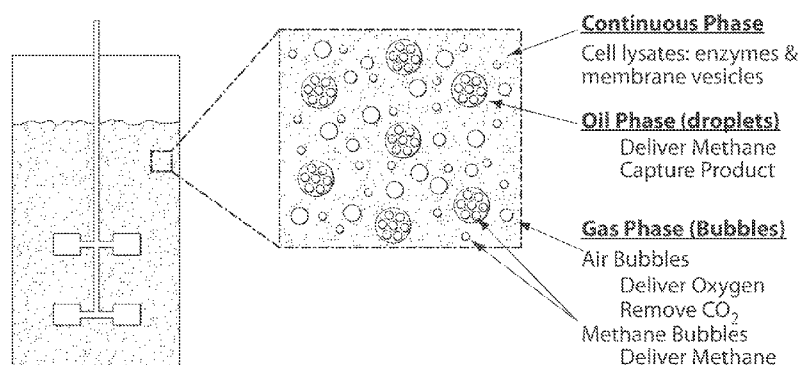


Fig. 1

(57) Abstract: The present disclosure relates, in some aspects, to cell-free methods and systems for large-scale conversion of methane to isobutanol, comprising combining, in a bioreactor at elevated pressure, methane, oxygen, and cell lysates containing methane monooxygenase, methanol dehydrogenase, and enzymes that catalyze the conversion of formaldehyde to isobutanol, to form a cell-free reaction mixture, and incubating under suitable conditions the cell-free reaction to convert methane to isobutanol.