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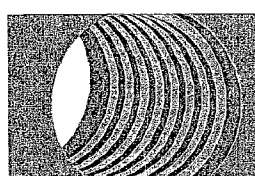
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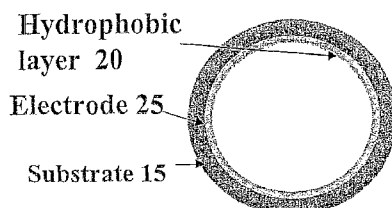
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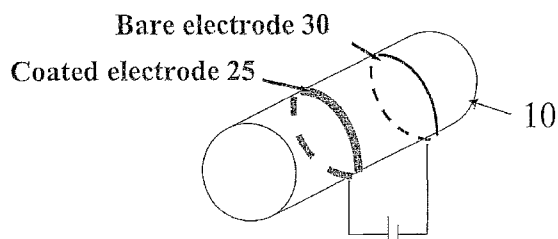
(54) Title: SYSTEMS AND METHODS FOR PUMPING CONTINUOUS LIQUID COLUMNS USING HYDROPHOBICITY CONTROL FEATURES IN A MICROCHANNEL



a: Inside wall of the pump channel 10



b: Cross section at the hydrophobic-electrode ring



c: Typical arrangement of electrodes

(57) Abstract: A micropump includes a microchannel (10) formed in a substrate (15). The microchannel includes a plurality of electrode ring layers (25, 30) within the microchannel. Alternating electrode layers are covered with a fluoropolymer or other hydrophobic substance (20) that changes to hydrophilic in response to an applied voltage signal. Electrodes covered by fluoropolymer material (25) define hydrophobic regions interspersed between hydrophilic regions defined by exposed electrode ring layers (30). When a propagating fluid within the microchannel nears a hydrophobic region, a meniscus formed by the fluid is prevented from propagating due to the hydrophobic properties of the microchannel surface in that region. Application of a voltage to the hydrophobic region changes it to become hydrophilic, thereby allowing the meniscus, and the

column of fluid behind it, to propagate past that region due to capillary forces. Upon encountering the next hydrophobic region, the meniscus is again prevented from propagating. Selective application of voltage signals to the electrodes in consecutive hydrophobic regions allows for a controlled rate of flow of fluid columns as determined by the dimensions of the microchannel (e.g., diameter of a microchannel having circular cross-section) and properties of the propagating fluid (e.g., viscosity).

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