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(54) **MICROFLUIDIC DEVICE FOR CELL SEPARATION AND USES THEREOF**

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(57) **ABSTRACT**

**Related U.S. Application Data**

(60) Continuation of application No. 11/726,231, filed on Mar. 21, 2007, now Pat. No. 8,986,966, which is a division of application No. 10/529,453, filed on Dec. 19, 2005, now Pat. No. 8,895,298, filed as application No. PCT/US2003/030965 on Sep. 29, 2003.

(60) Provisional application No. 60/414,065, filed on Sep. 27, 2002, provisional application No. 60/414,102, filed on Sep. 27, 2002, provisional application No. 60/414,258, filed on Sep. 27, 2002.

**Publication Classification**

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*G01N 1/40* (2006.01)

The invention features methods for separating cells from a sample (e.g., separating fetal red blood cells from maternal blood). The method begins with the introduction of a sample including cells into one or more microfluidic channels. In one embodiment, the device includes at least two processing steps. For example, a mixture of cells is introduced into a microfluidic channel that selectively allows the passage of a desired type of cell, and the population of cells enriched in the desired type is then introduced into a second microfluidic channel that allows the passage of the desired cell to produce a population of cells further enriched in the desired type. The selection of cells is based on a property of the cells in the mixture, for example, size, shape, deformability, surface characteristics (e.g., cell surface receptors or antigens and membrane permeability), or intracellular properties (e.g., expression of a particular enzyme).

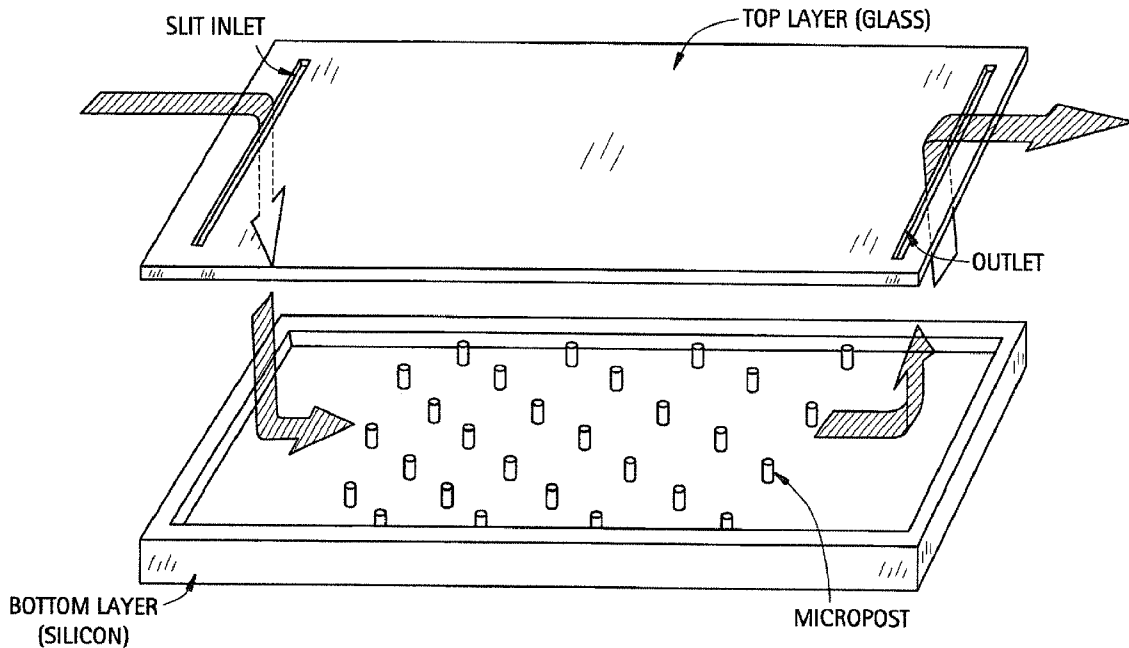


FIG. 1

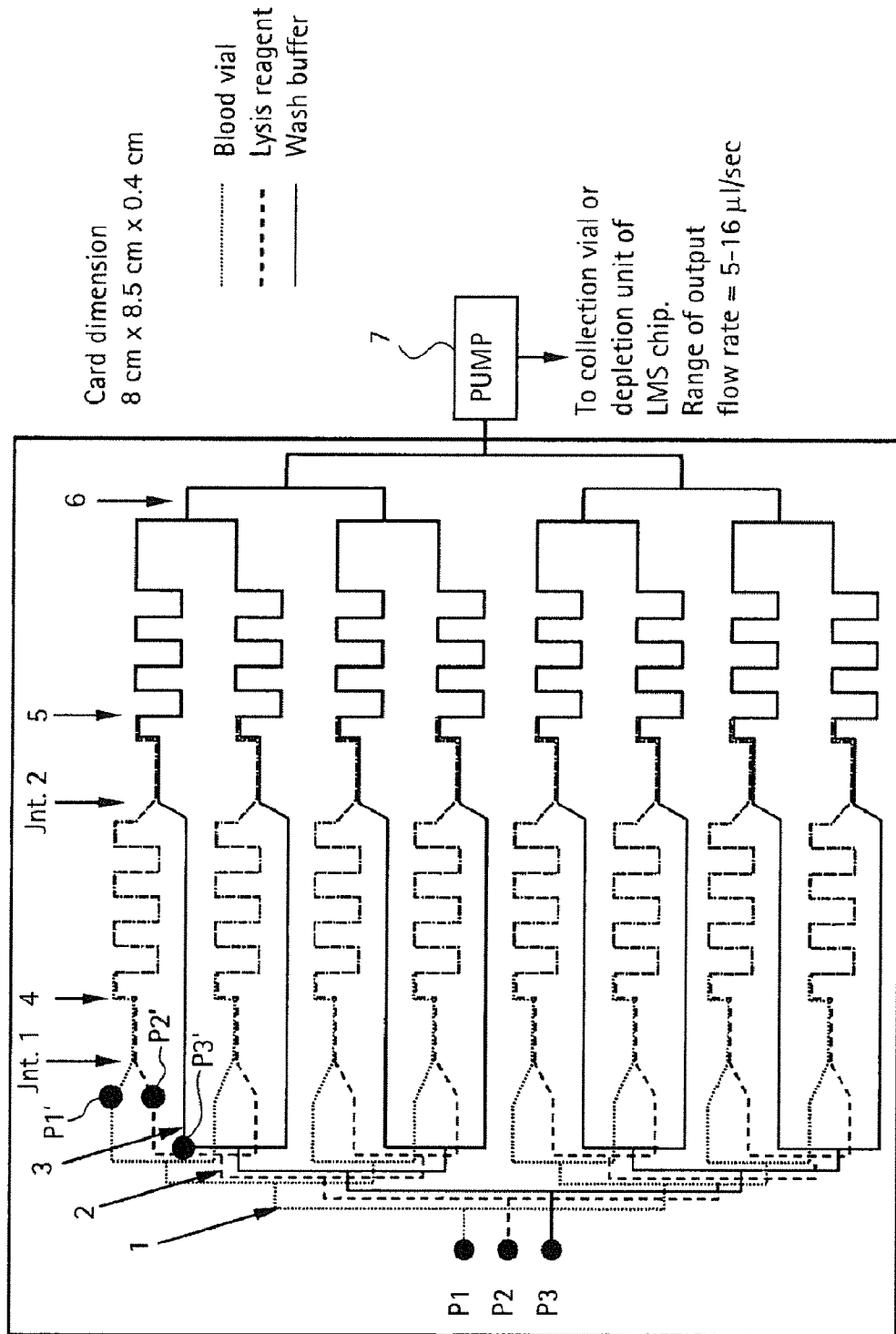
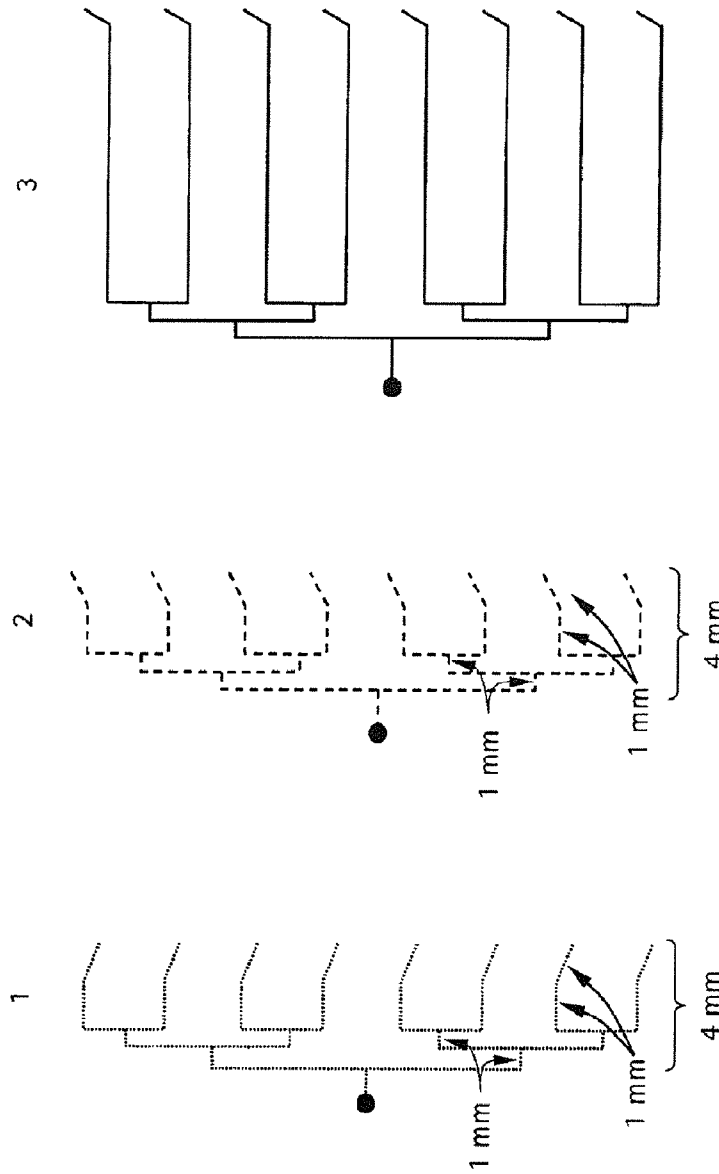


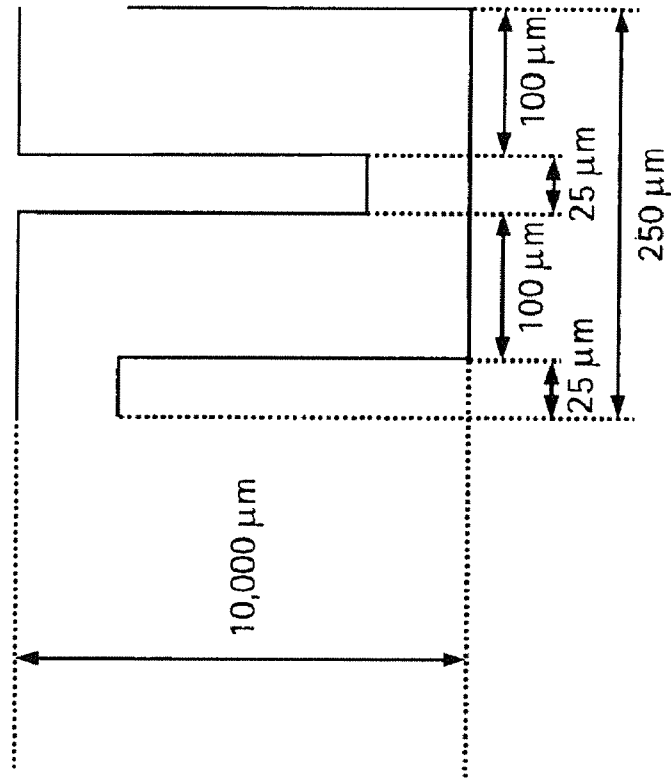
FIG. 2



Channel width = 100 microns, Channel depth = 100 microns

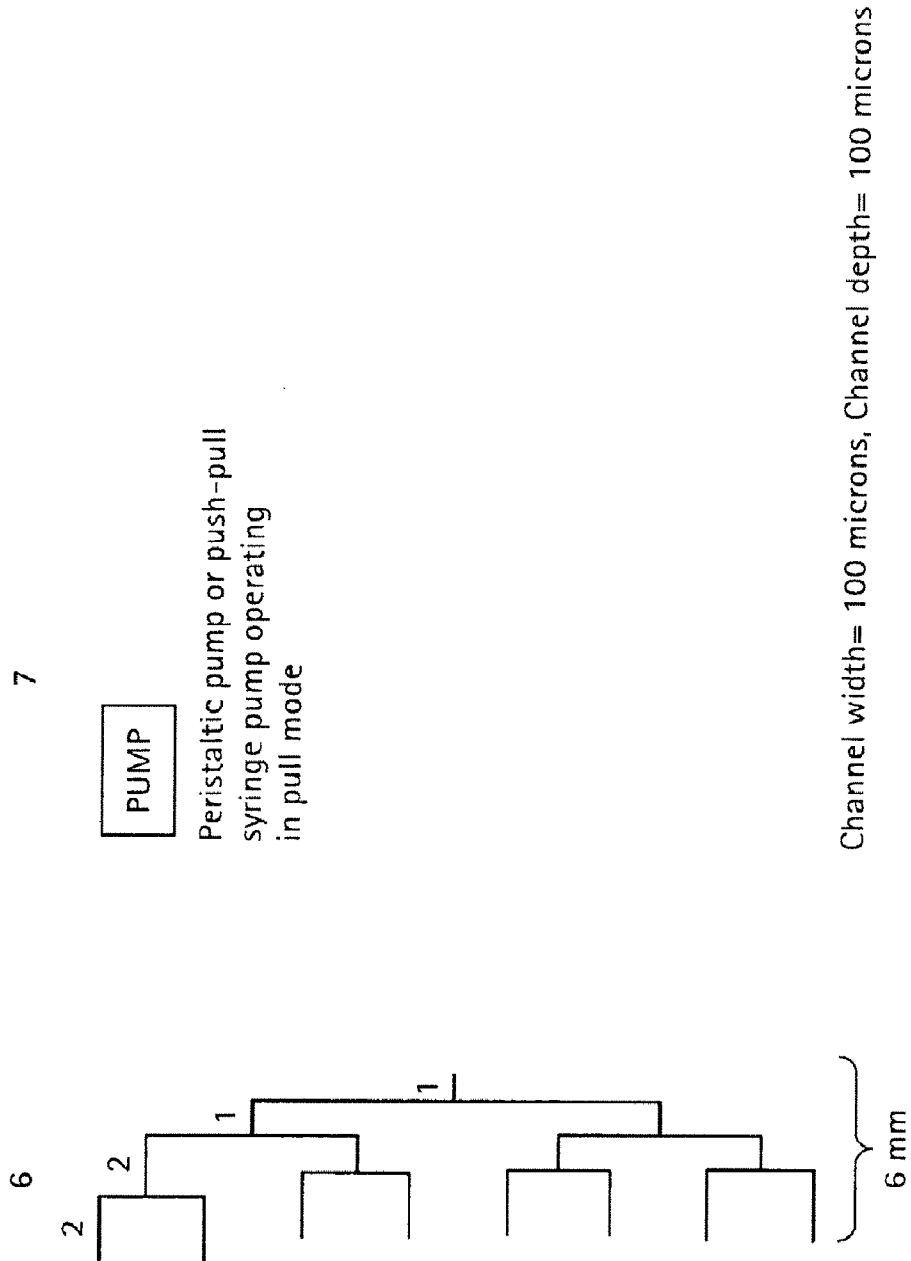
FIG. 3

One embodiment of dilution/reaction chambers



Unit Effective length = 20,050 μm  
Unit Linear length = 250 μm  
Unit Fluid volume = 0.2005 μl (0.1 x 0.1 x 20.05)  
# of Units in 33 mm linear length = 132  
Total chamber volume = 26.46 μl (0.2005 x 132)  
Fluid Residence Time = 42 seconds @ output flow rate of 5 μl/sec for 8 networks operating in parallel

FIG. 4



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