



(12) **United States Patent**  
**Wegeng et al.**

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(54) **MICROCHANNEL APPARATUS  
COMPRISING PLURAL MICROCHANNELS  
AND METHODS OF CONDUCTING UNIT  
OPERATIONS**

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422/211; 261/152; 261/75

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See application file for complete search history.

(57) **ABSTRACT**

Microchannel apparatus comprising a header and plural flow  
microchannels is described in which orifices connect the  
header and the flow microchannels. The orifices constrict  
flow. The ratio of the cross-sectional area of each of the  
orifices to the cross-sectional area of the flow microchannels  
connected to the orifices is between 0.0005 and 0.1. Also  
described is microchannel apparatus for conducting unit  
operations in which a device comprises two arrays of micro-  
channels, and a unit operation is conducted on a fluid as it  
passes through the first set of microchannels and into a header  
where a second unit operation is performed, and then the fluid  
stream passes into the second array of microchannels where  
the first unit operation is again performed. Methods of con-  
ducting unit operations in the apparatuses are also described.

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**(1 of 28 Drawing Sheet(s) Filed in Color)**

