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(54) **METHODS AND APPARATUS  
INCORPORATING A SURFACE  
PENETRATION DEVICE**

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(57) **ABSTRACT**

A surface penetration device, methods of use and methods of manufacture thereof are provided. The device includes a substrate supporting a tapered elongate structure extending from and supported by the substrate upper surface. The elongate structure includes a distal portion, a proximal portion supported at the substrate upper surface, a lumen, and a plurality of lumen openings. A cross section of the lumen is asymmetrical and includes a first defining dimension that is larger than a second defining dimension. The lumen extends from the lumen openings and through the elongate structures. The lumen openings are positioned proximal to the elongate structure's distal portion. In one embodiment an array of a plurality of the elongate structures are provided. In another embodiment, the elongate structures are microneedles.