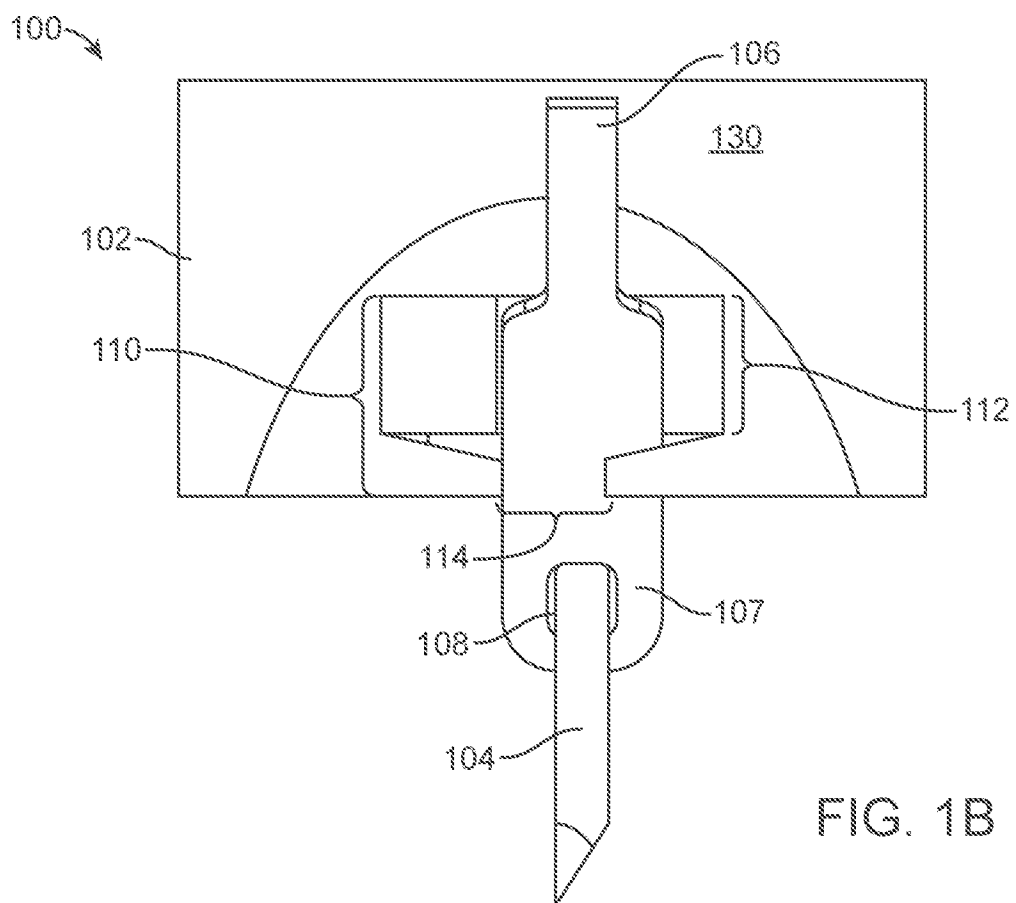
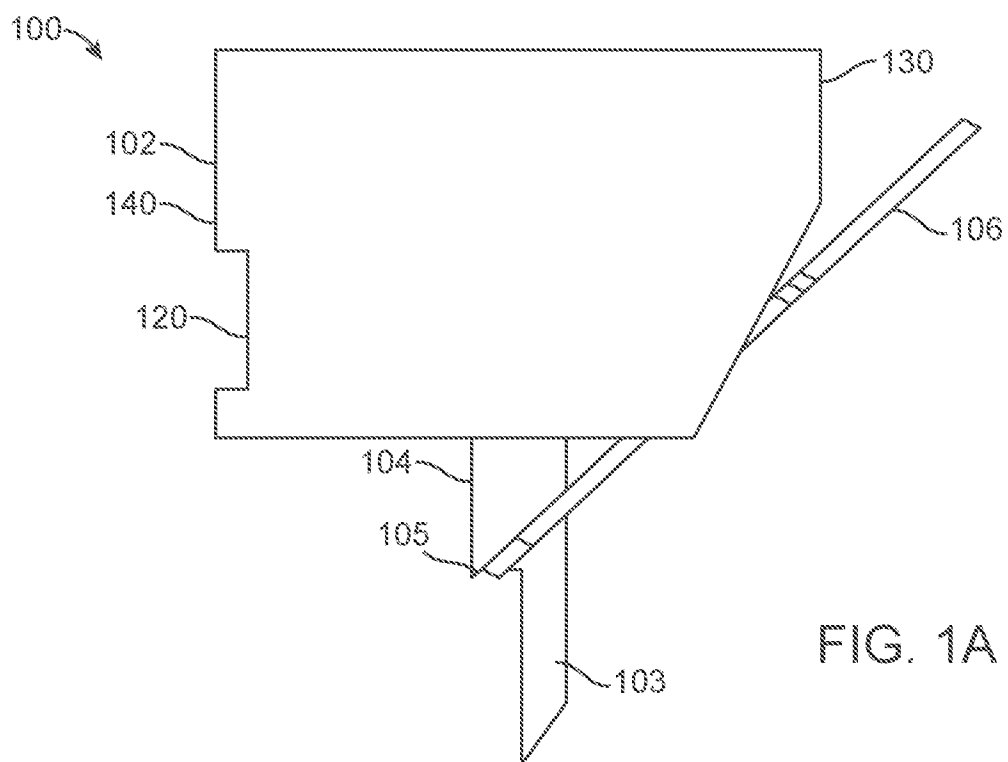
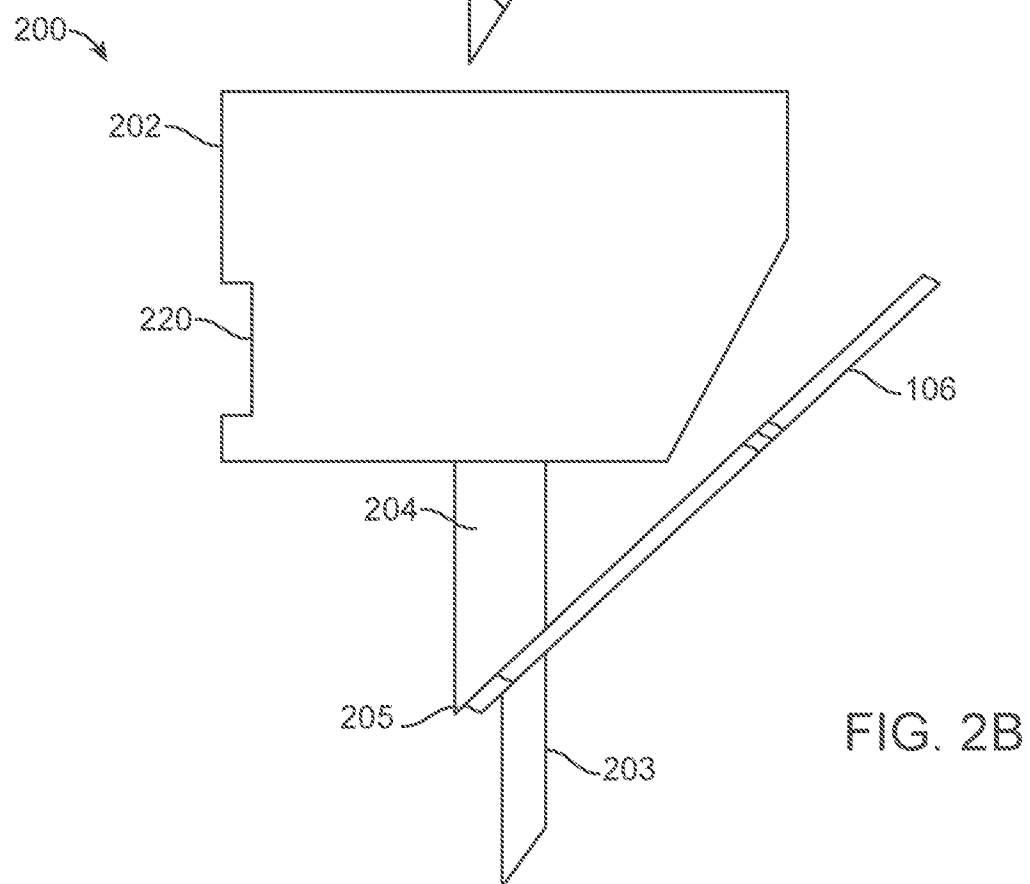
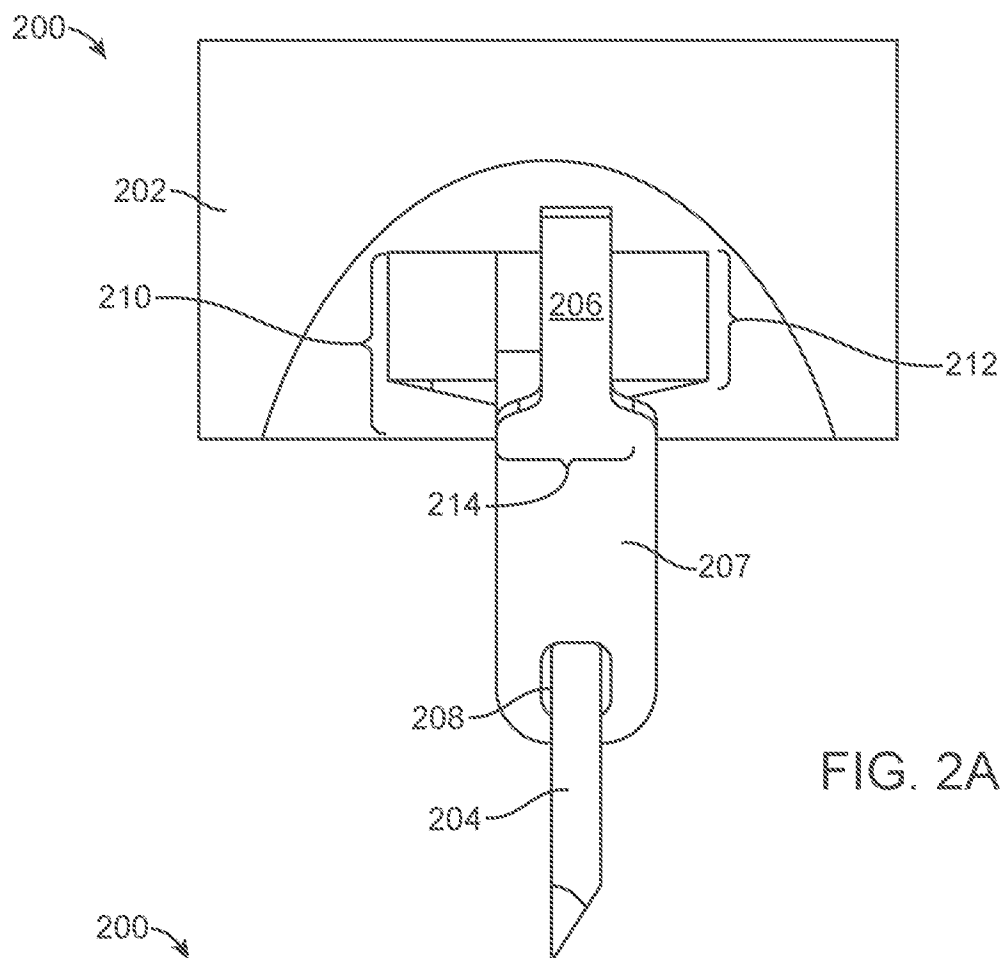






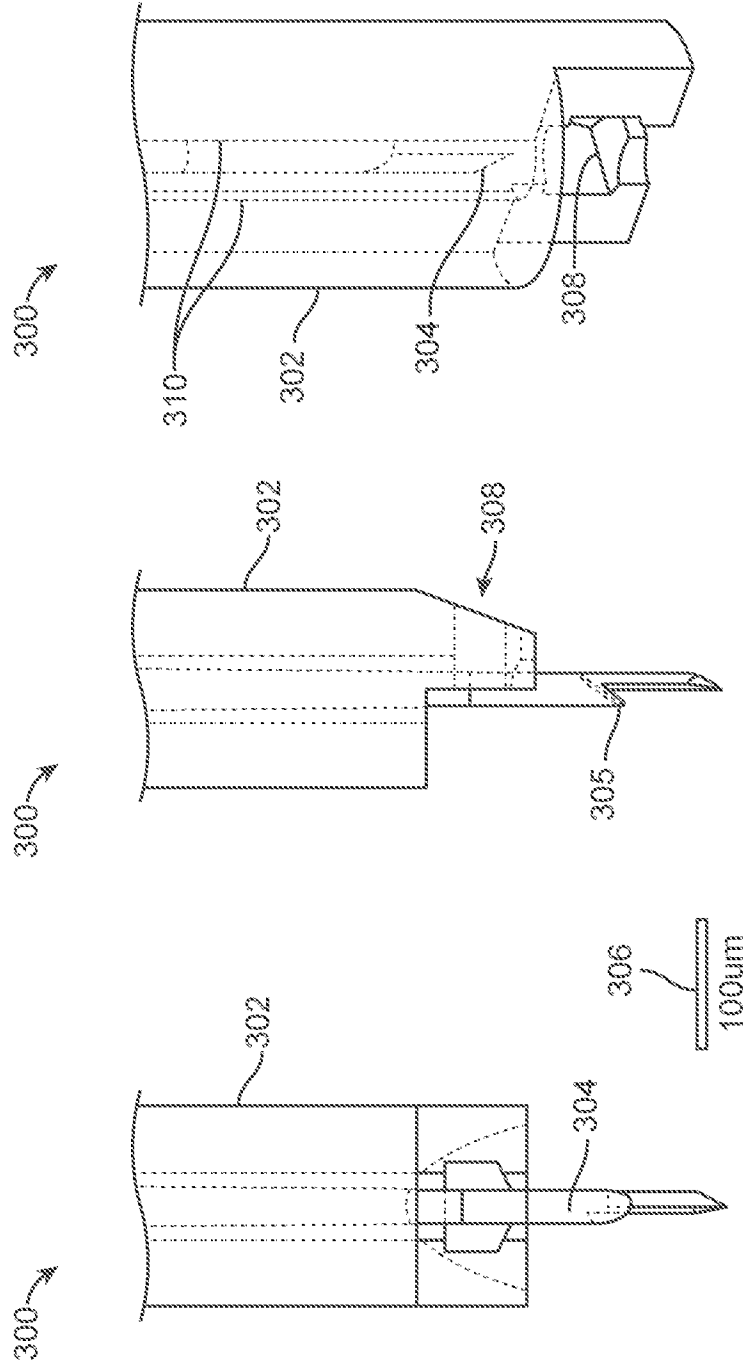


FIG. 3A

FIG. 3B

FIG. 3C

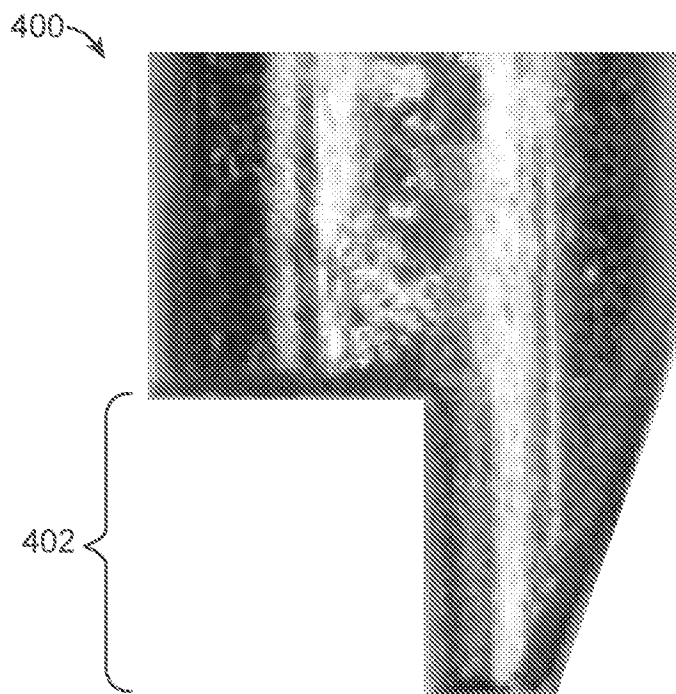


FIG. 4A

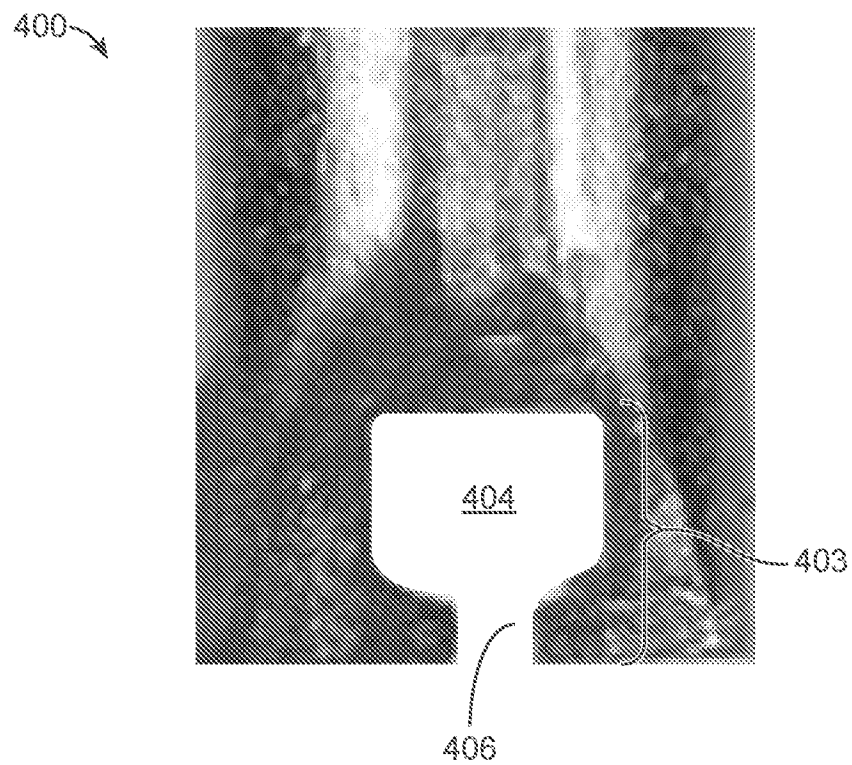


FIG. 4B

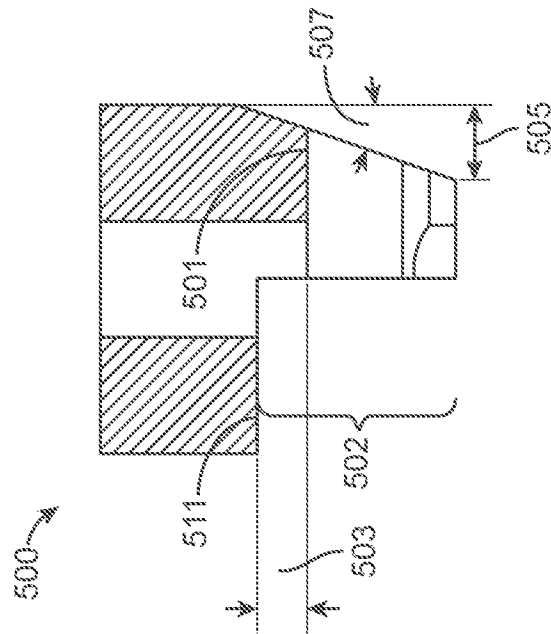


FIG. 5A

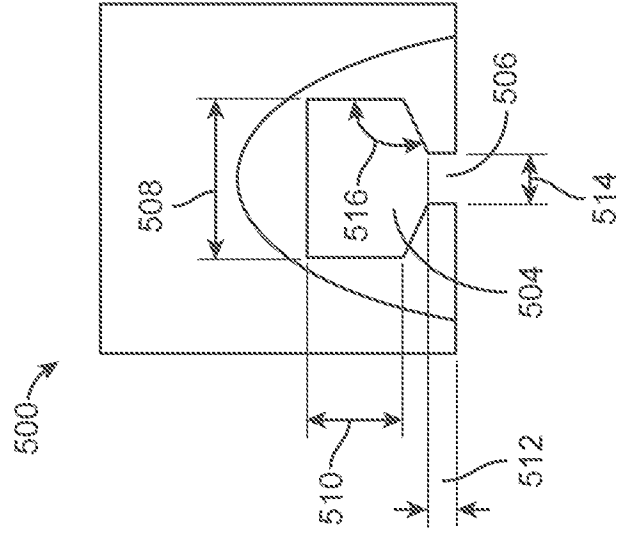


FIG. 5B

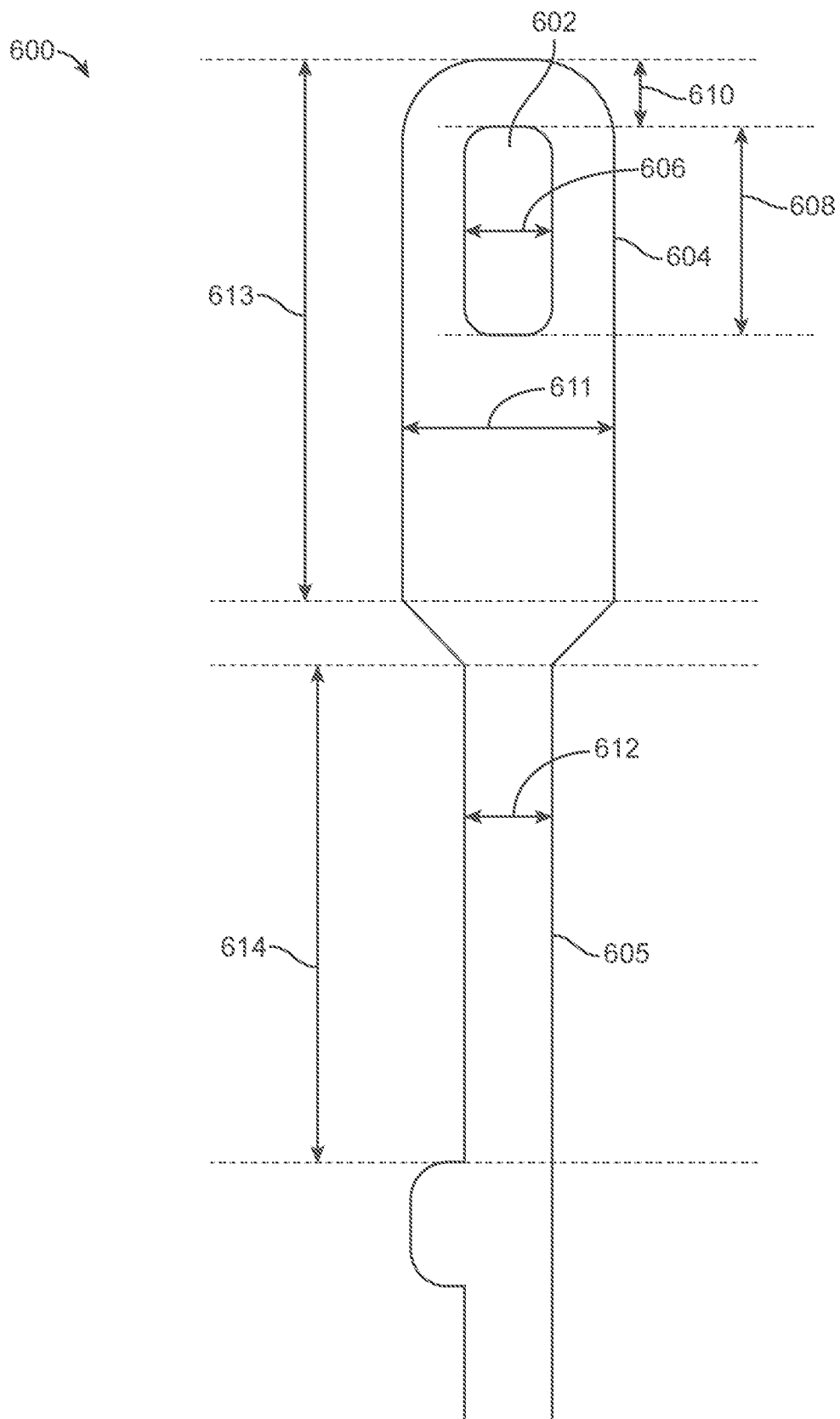


FIG. 6

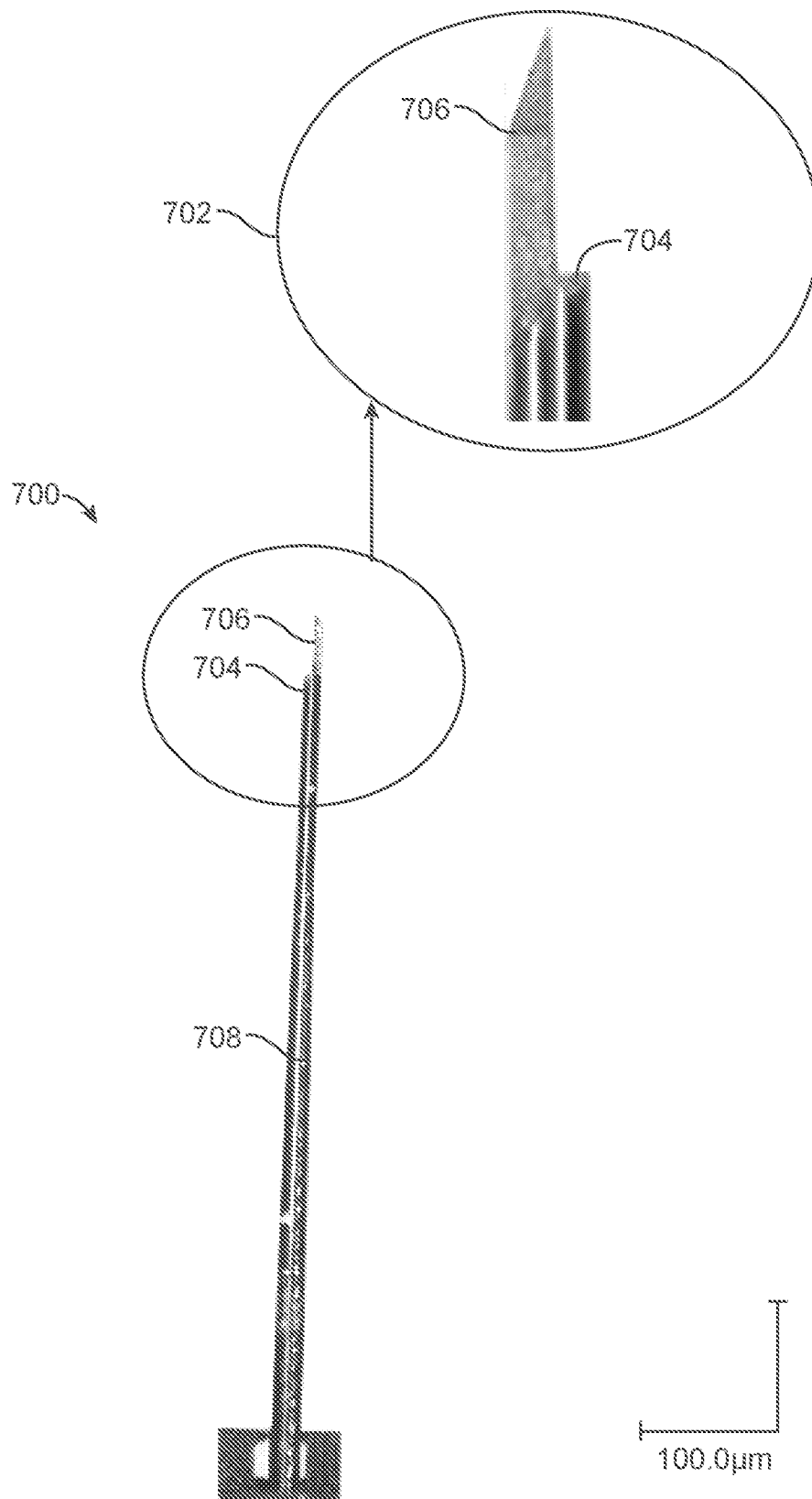
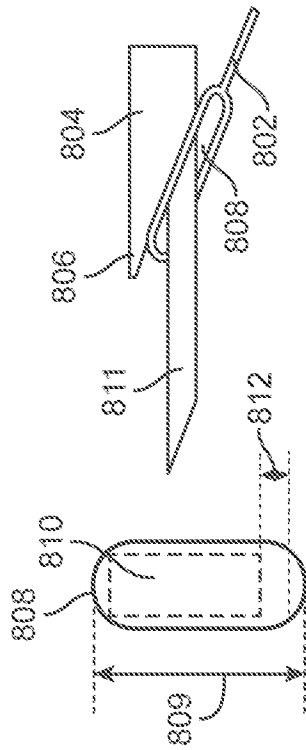


FIG. 7


$$ID_h-loop \geq ID_h-ir + Margin + (2 * \text{leftover radius height})$$

108

Inscribed rectangle, projection of
needle tip width when loop seated at
sewing angle

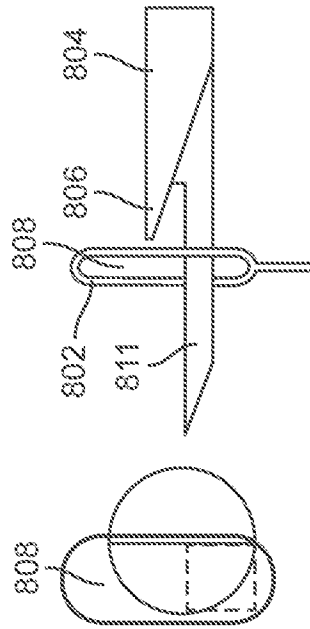
608-100

Loop height, including radii

Ward, 812

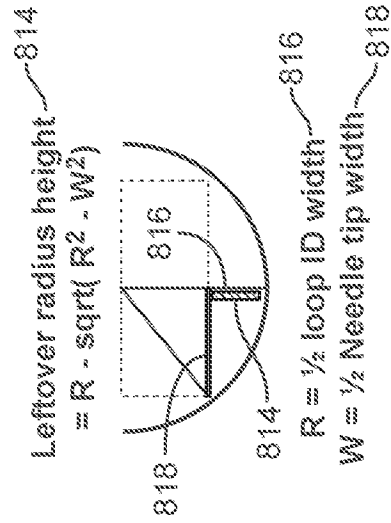
Margin before needle tip would wedge inside loop when loop is seated

480



Distance past Needle ID =
ID_h-loop - (1 * leftover radius height)
- Needle OD



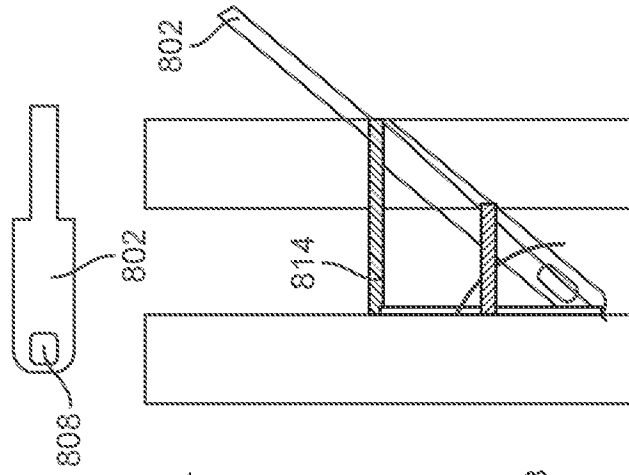


Leftover radius height $\sim 8^{14}$
 $= R - \text{sqrt}(R^2 - W^2)$

1818

$$W = \frac{1}{2} \text{ needle tip width}$$

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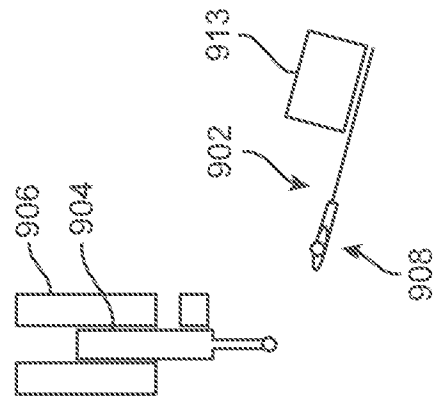


FIG. 9A

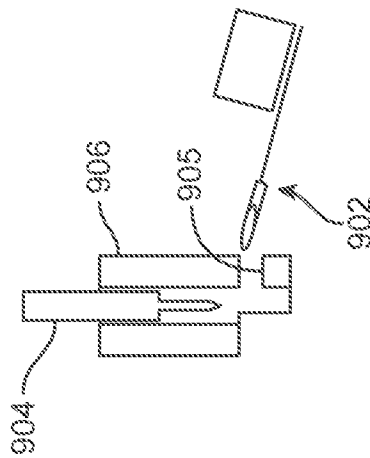


FIG. 9B

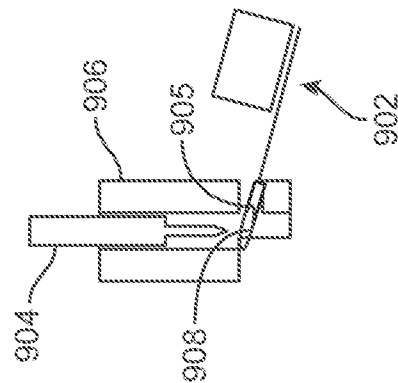


FIG. 9C

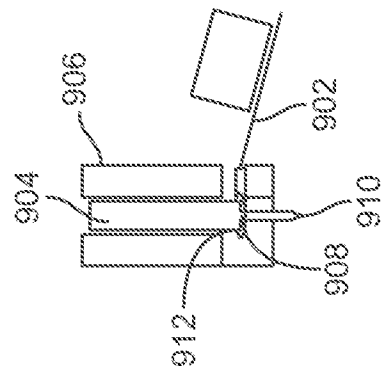


FIG. 9D

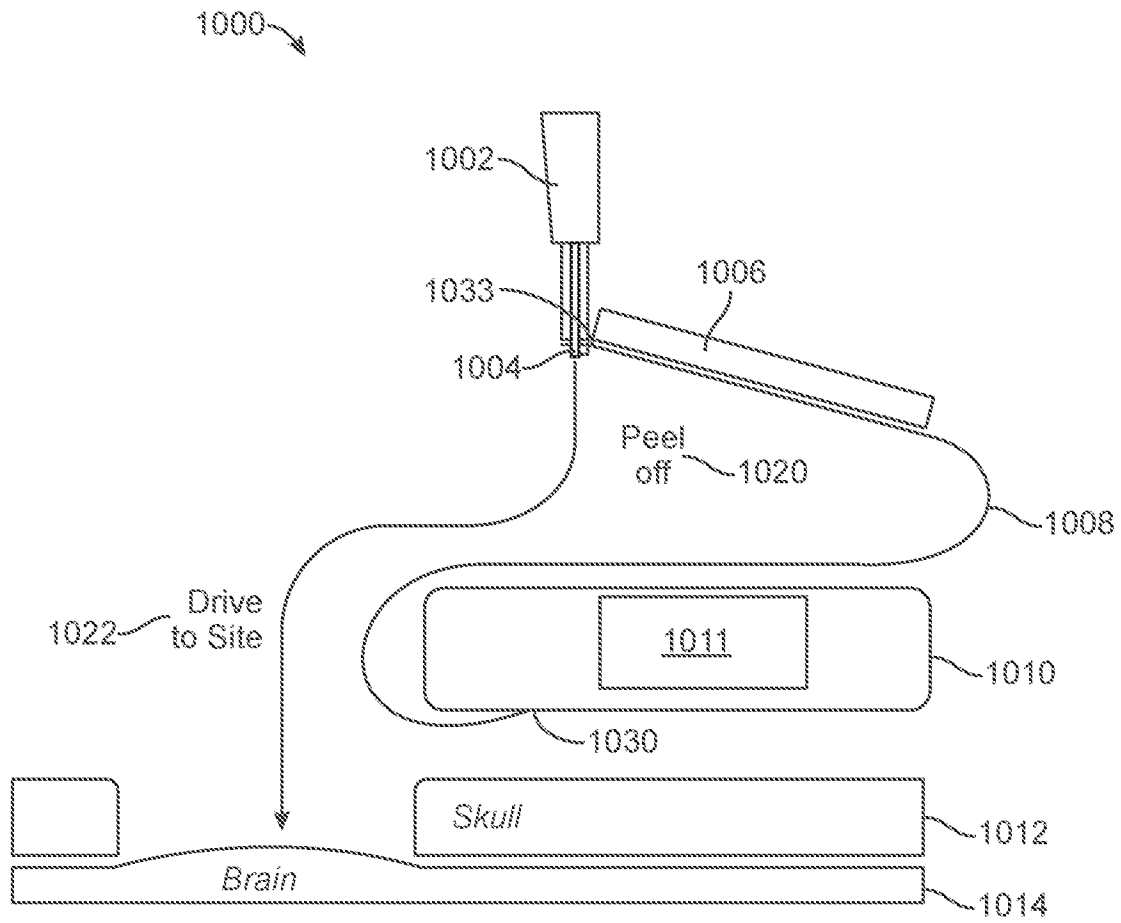


FIG. 10

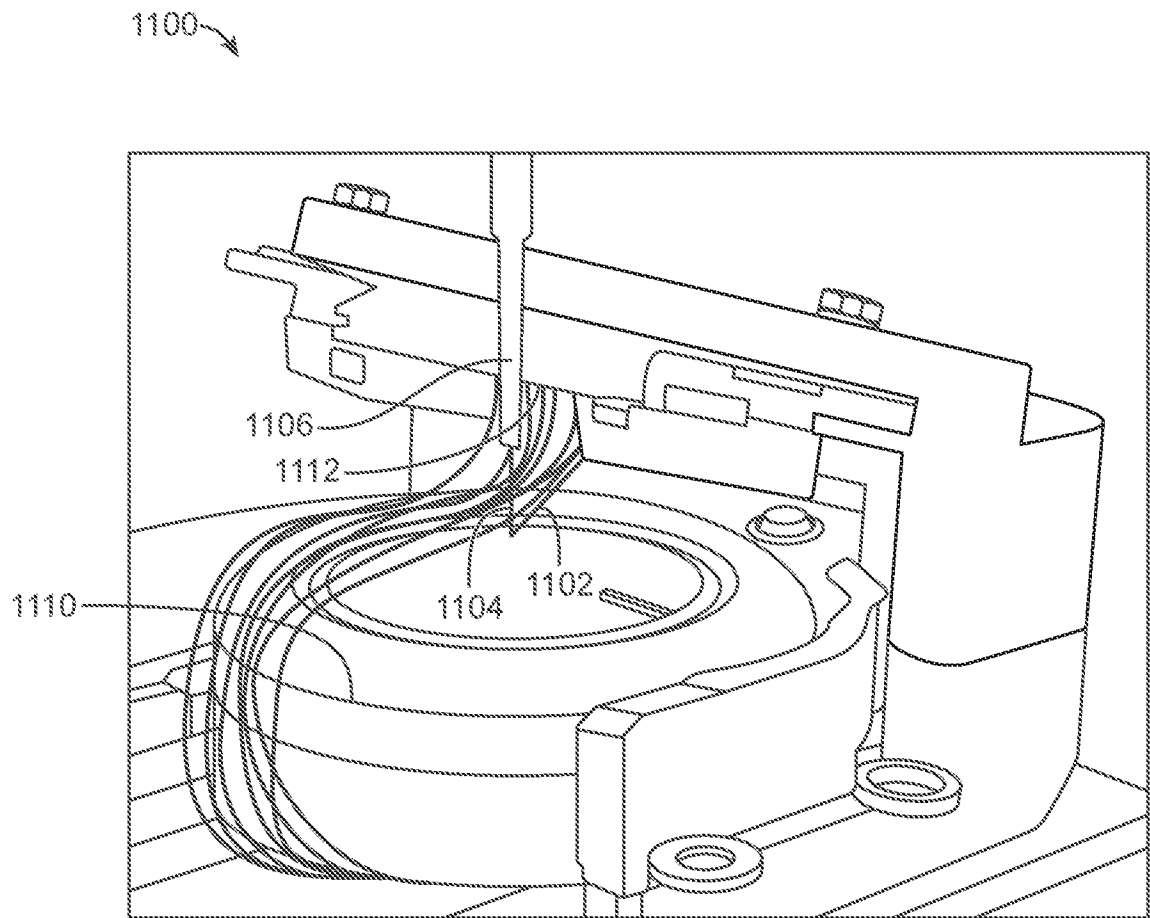


FIG. 11

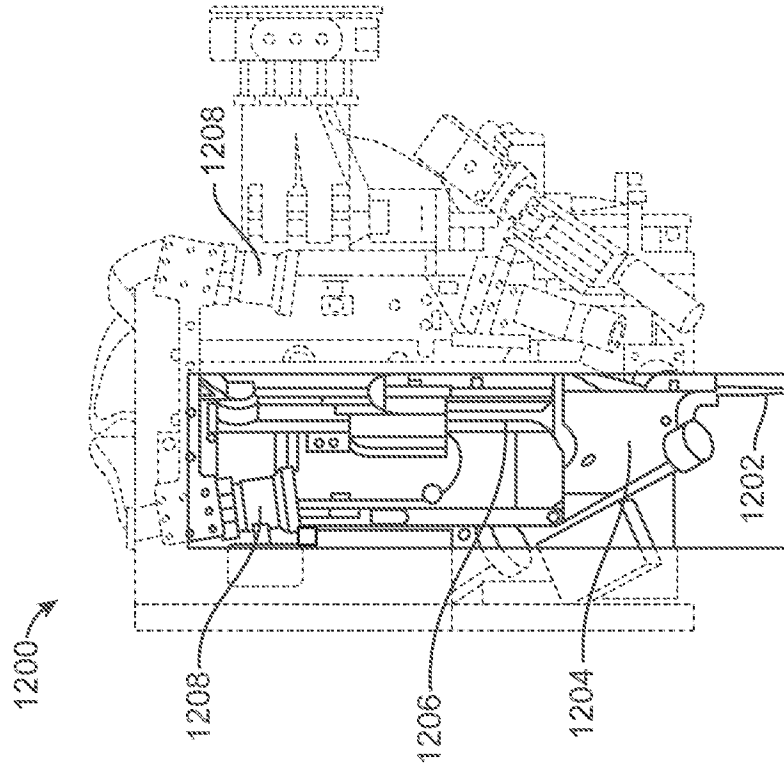


FIG. 12A

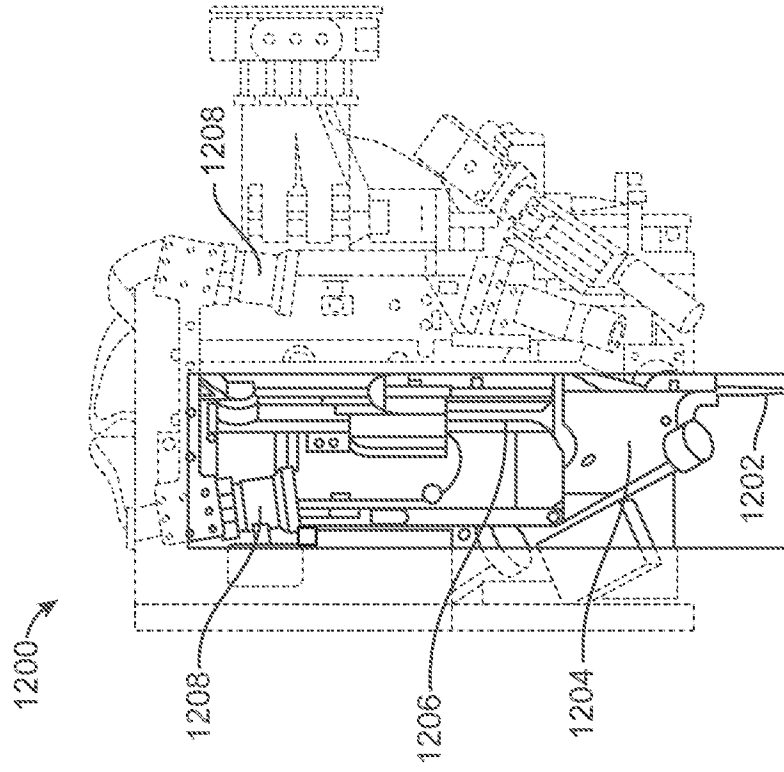


FIG. 12B

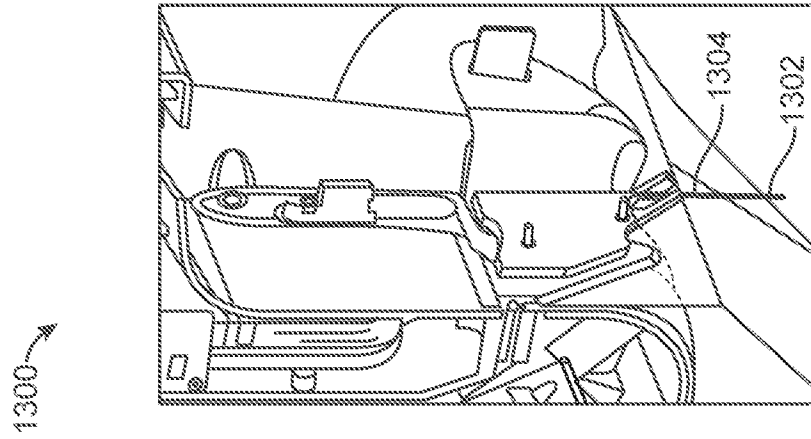


FIG. 13B

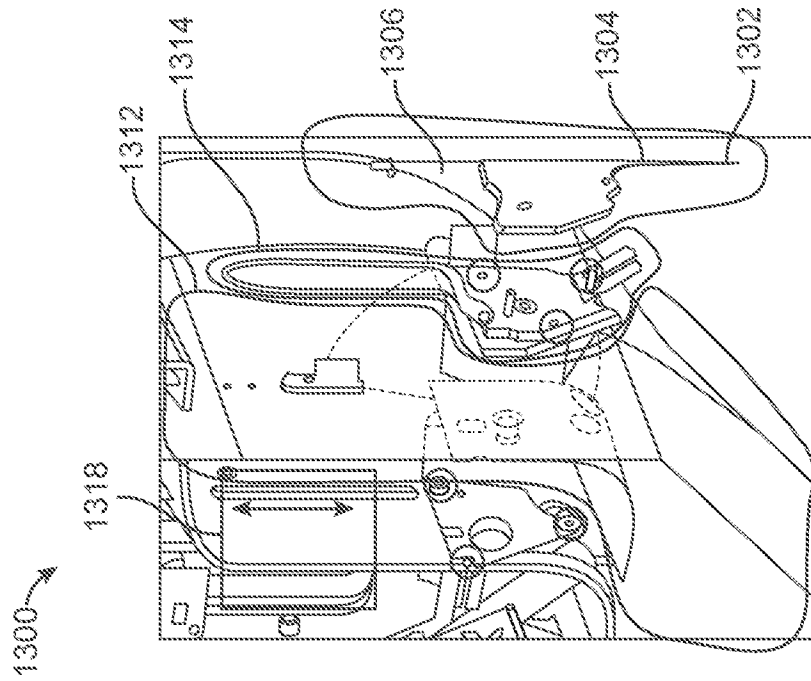


FIG. 13A

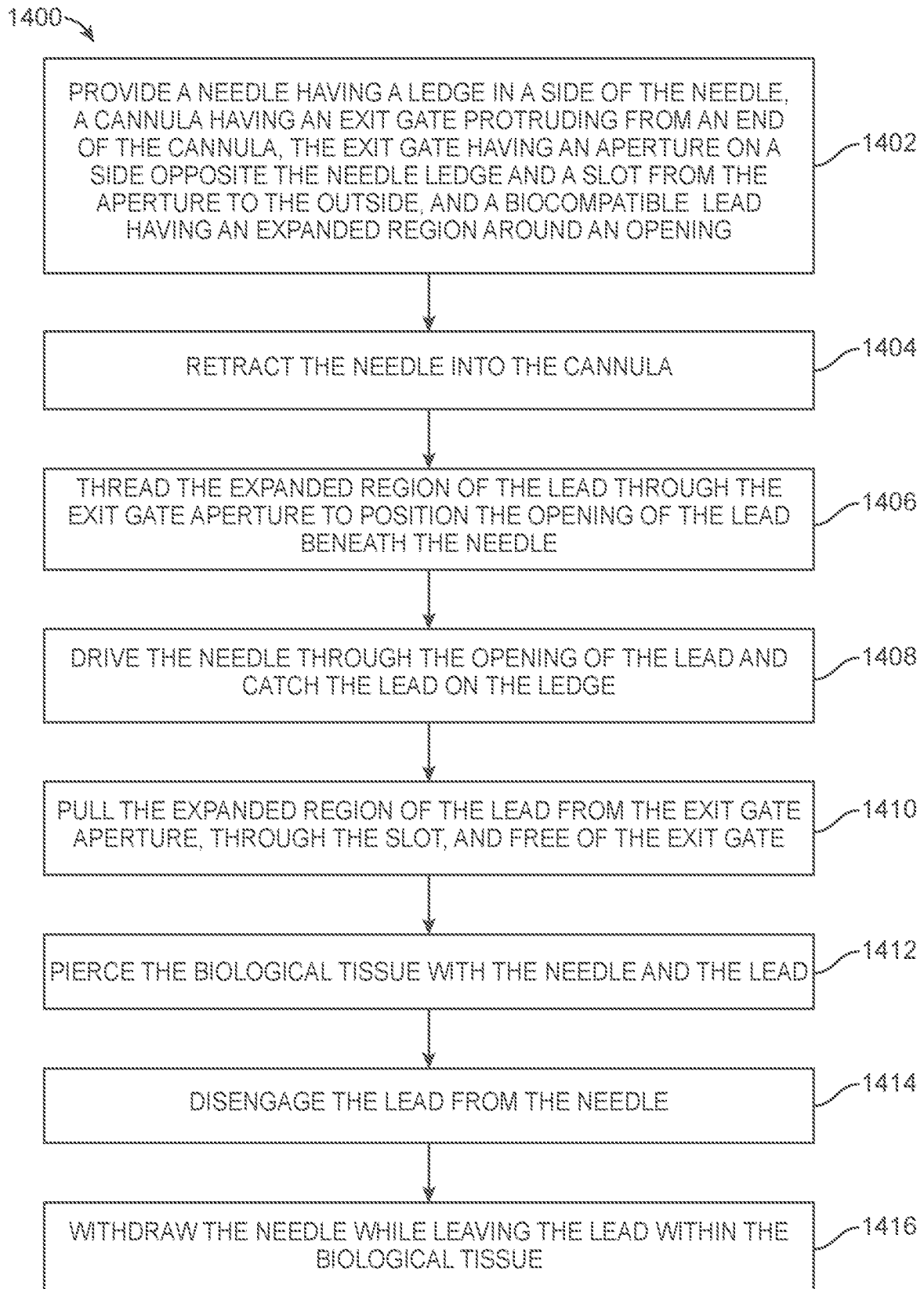


FIG. 14

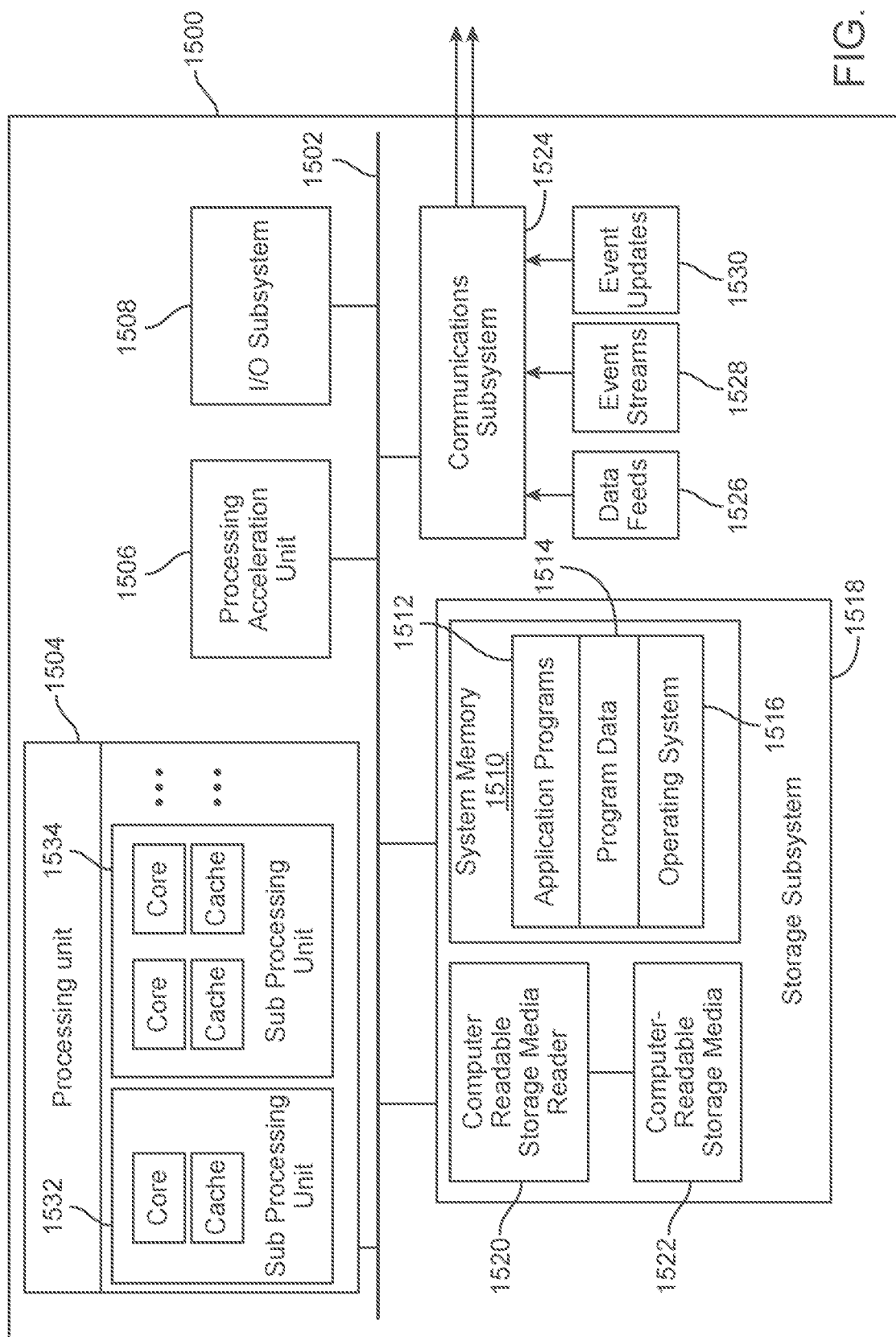


FIG. 15