

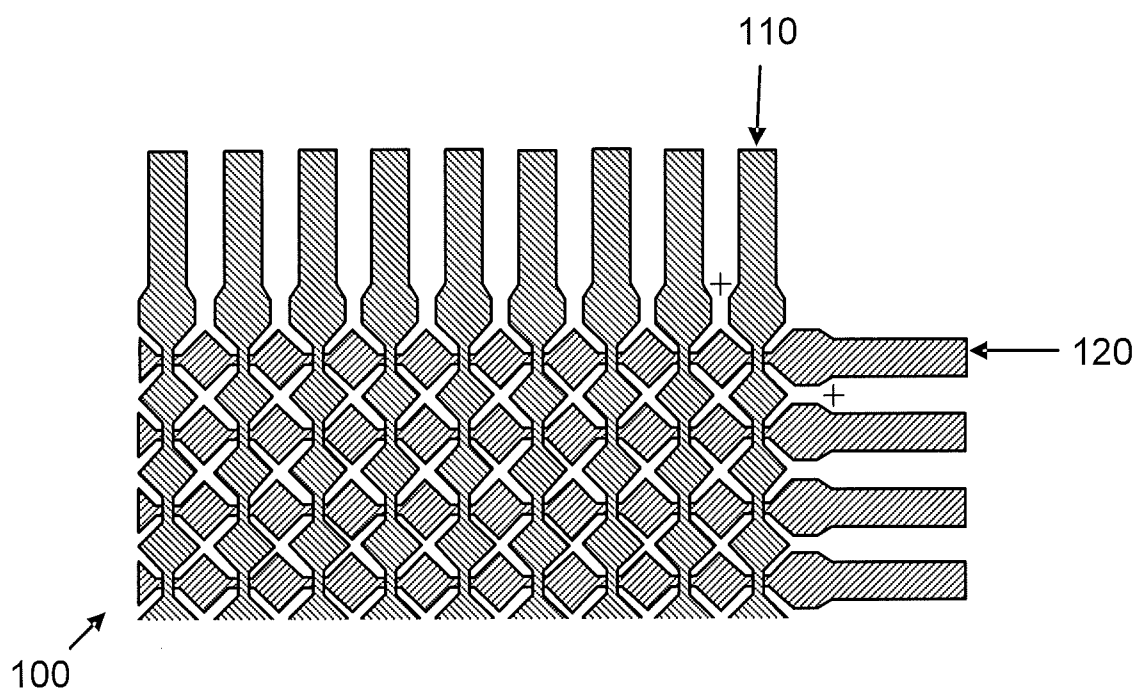


FIG. 1

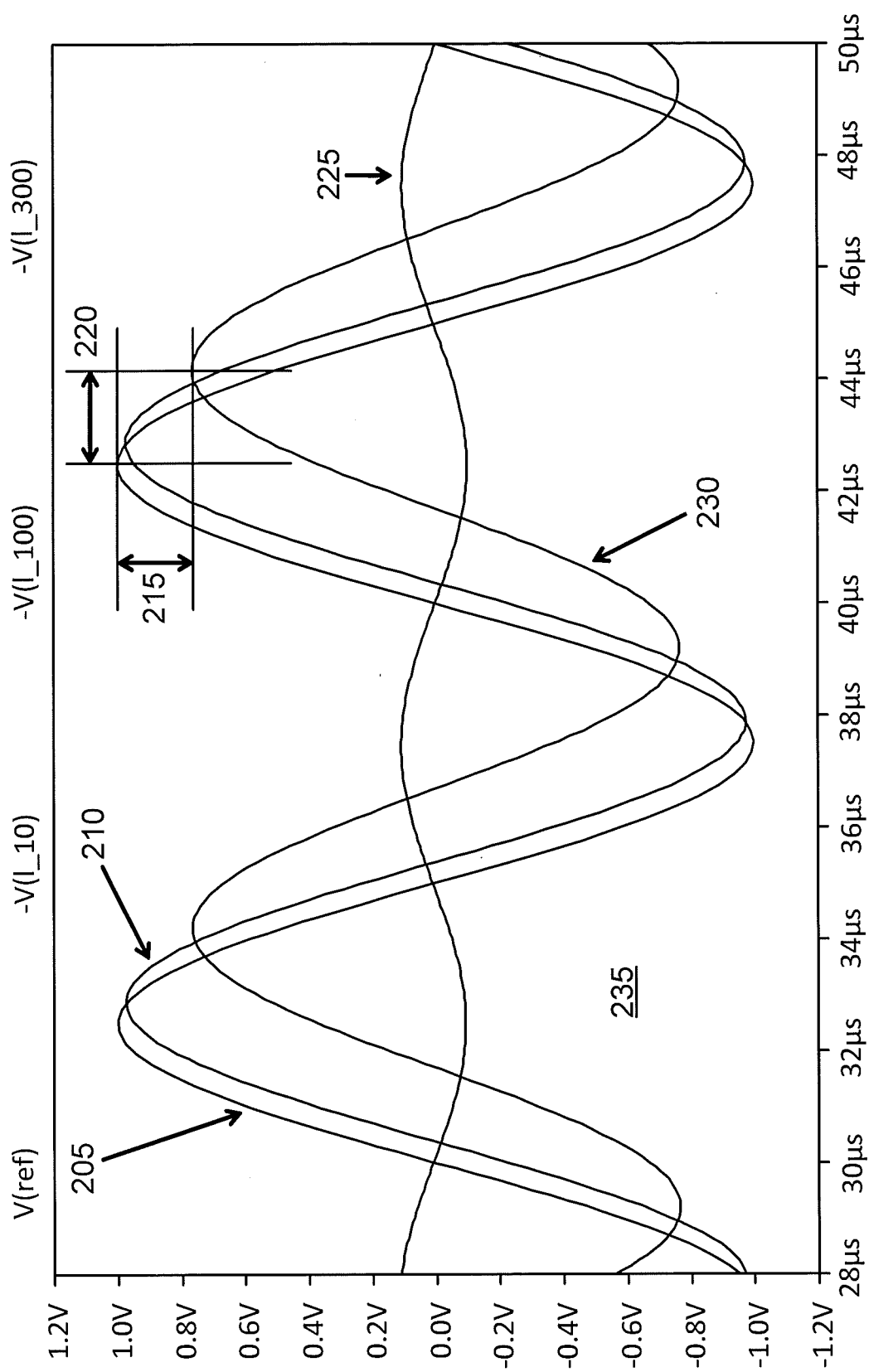


FIG. 2

200

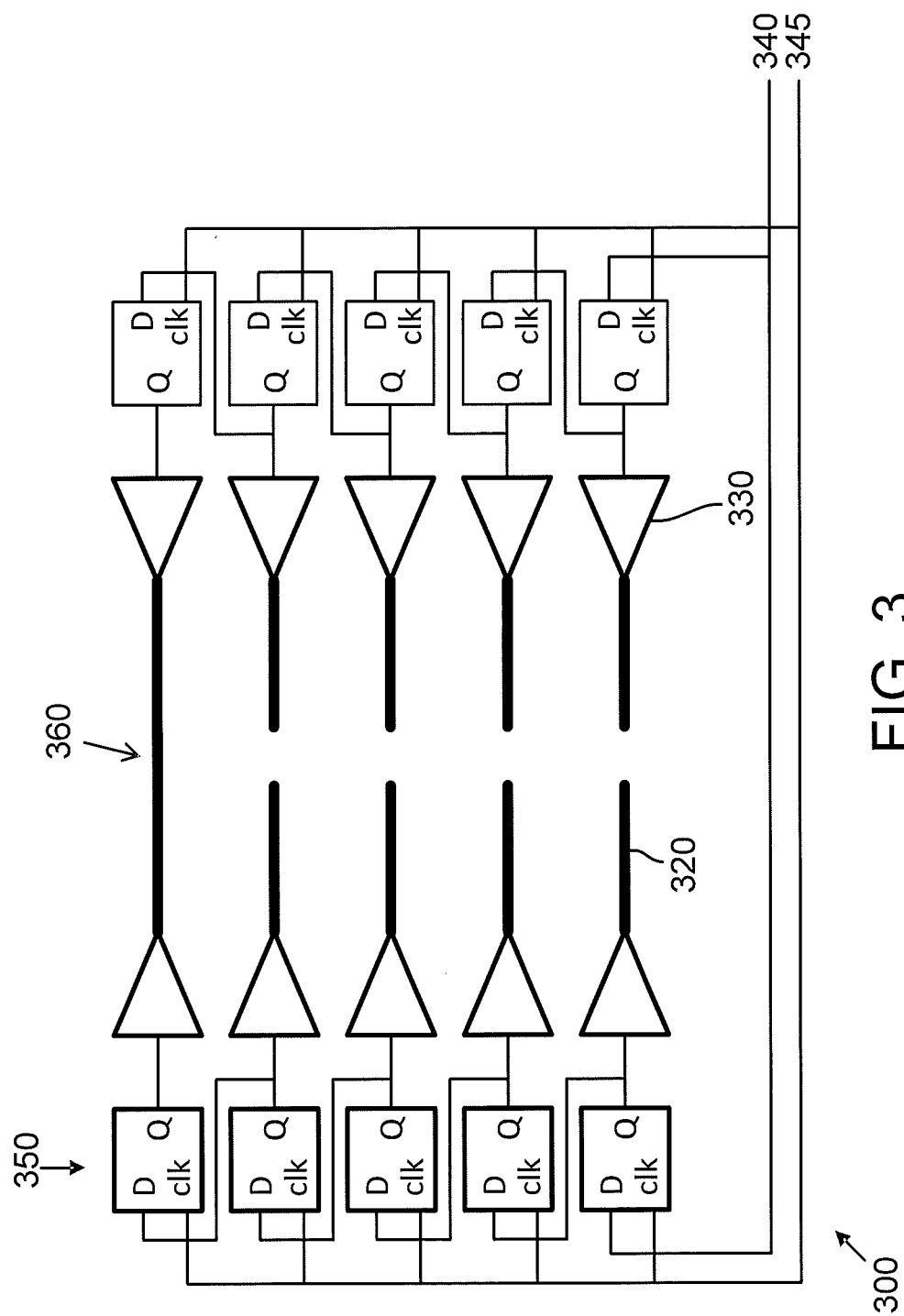


FIG. 3

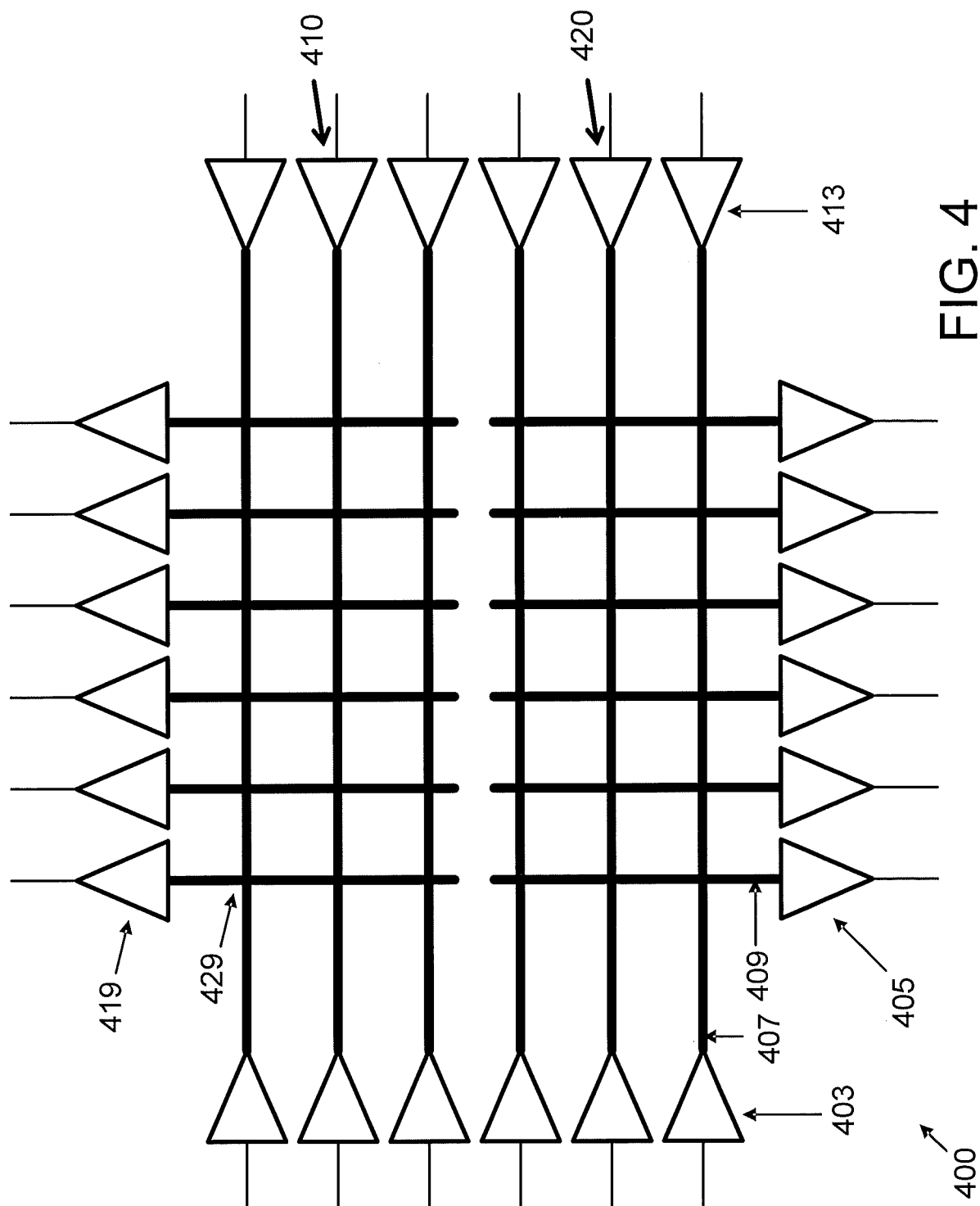


FIG. 4

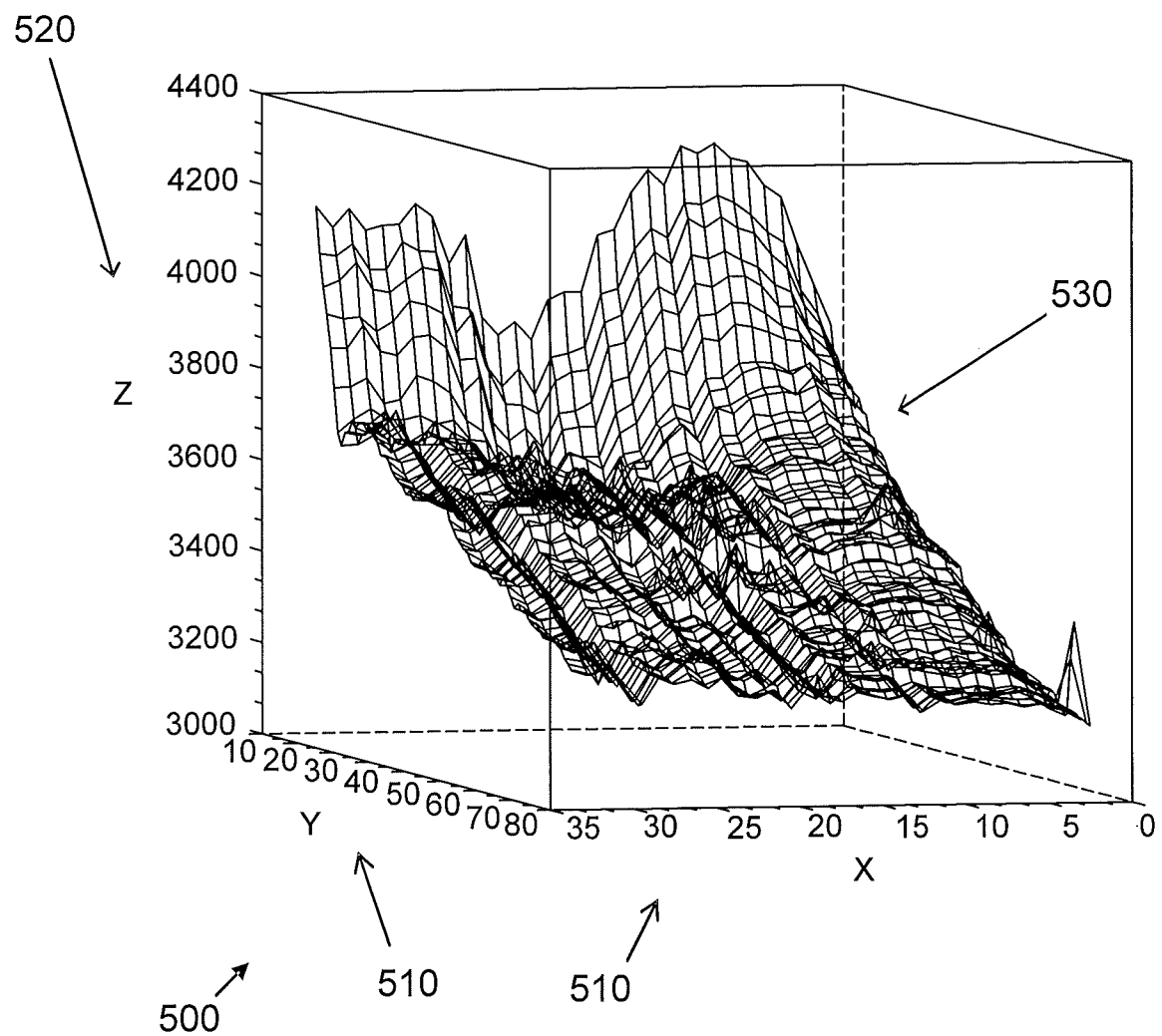


FIG. 5

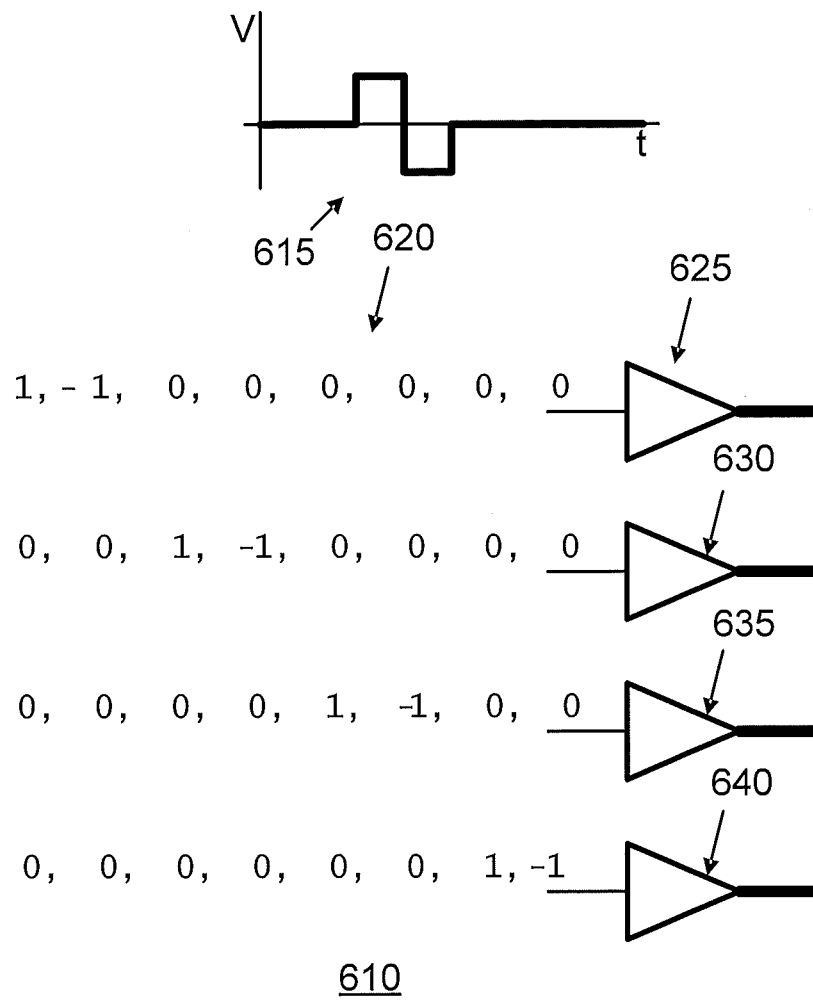


FIG. 6A

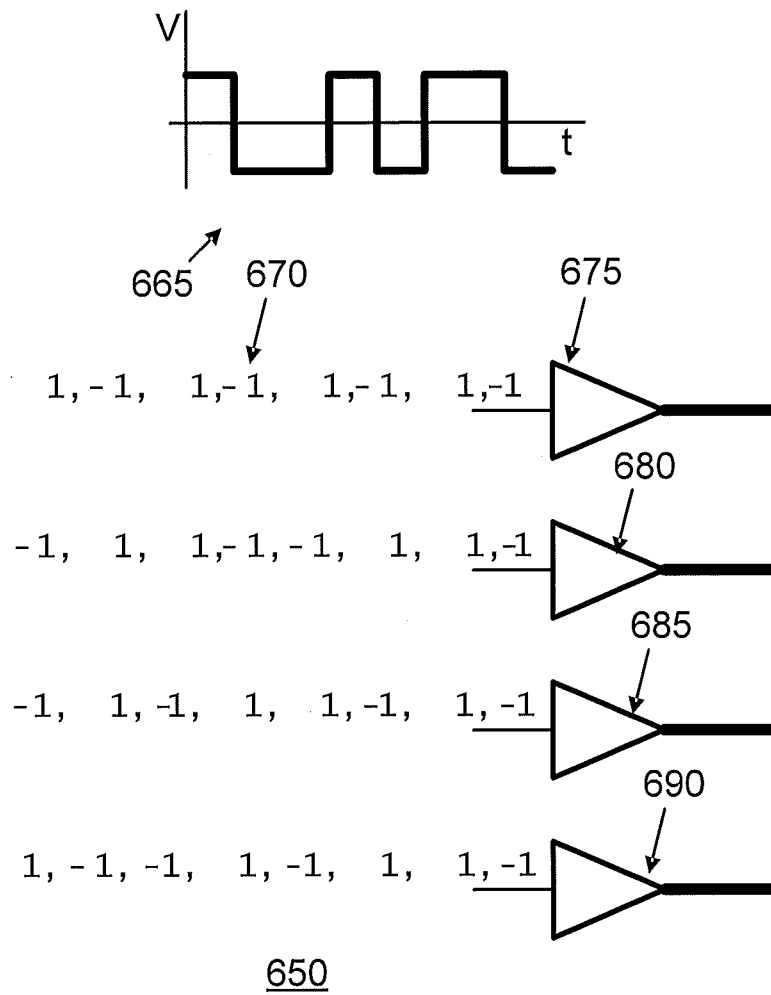


FIG. 6B

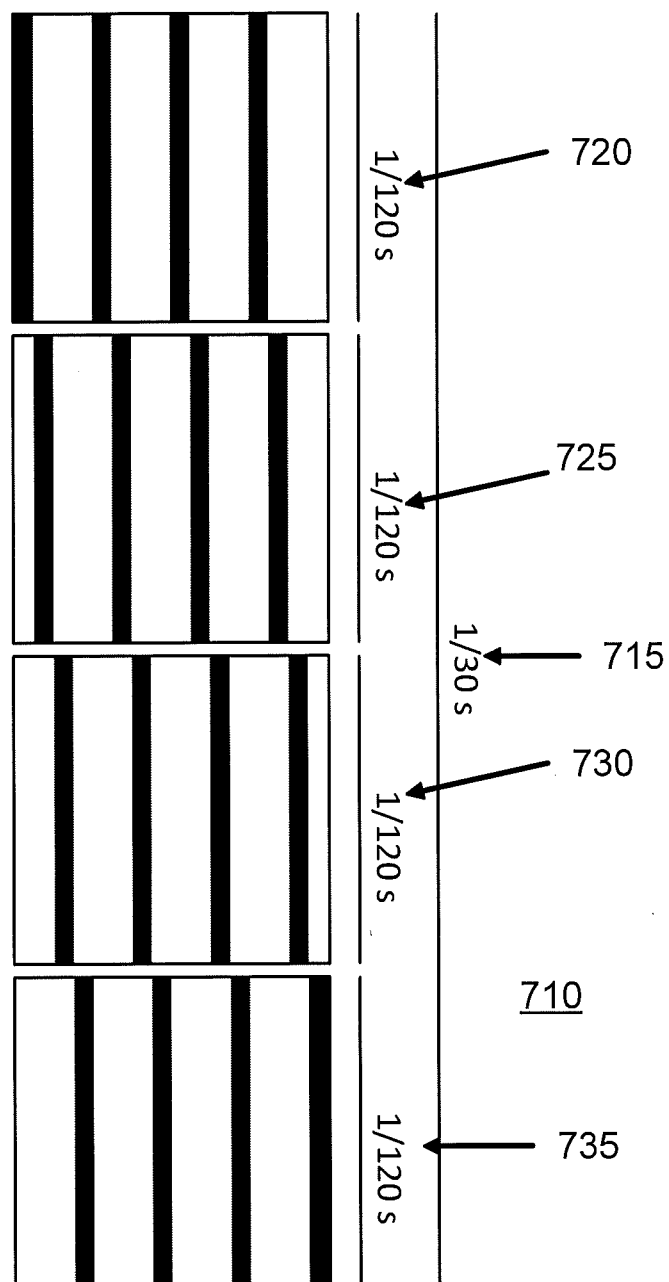


FIG. 7A

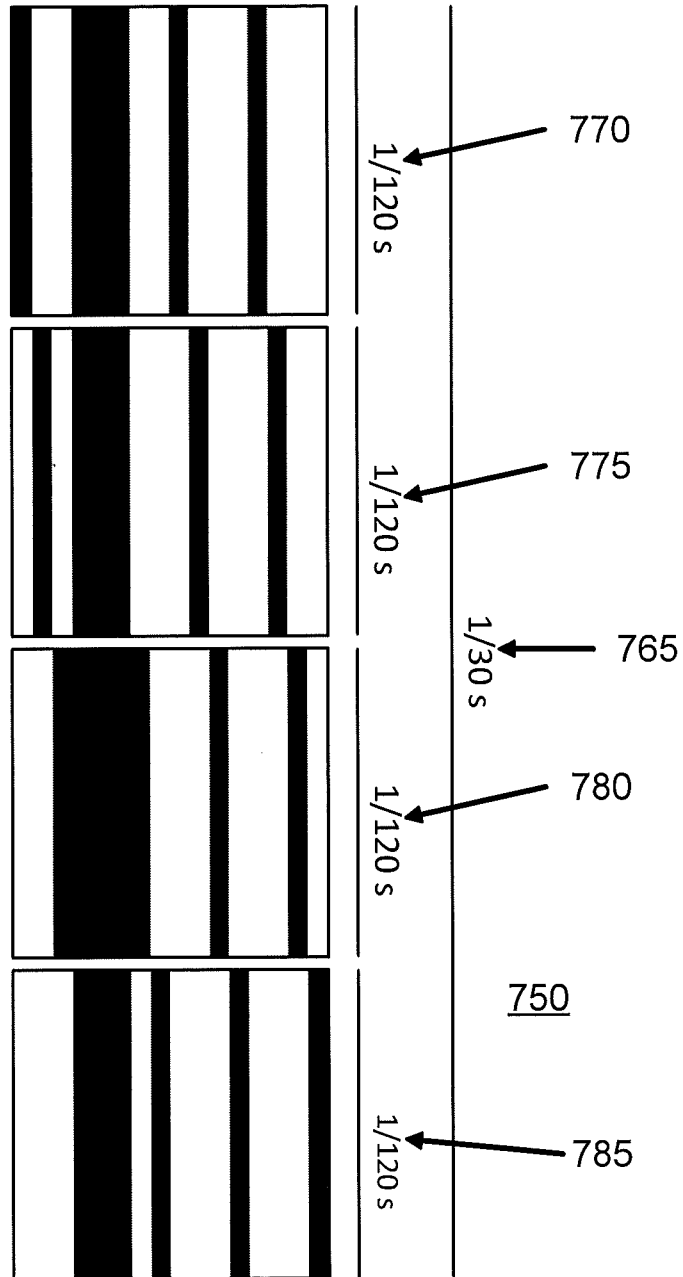
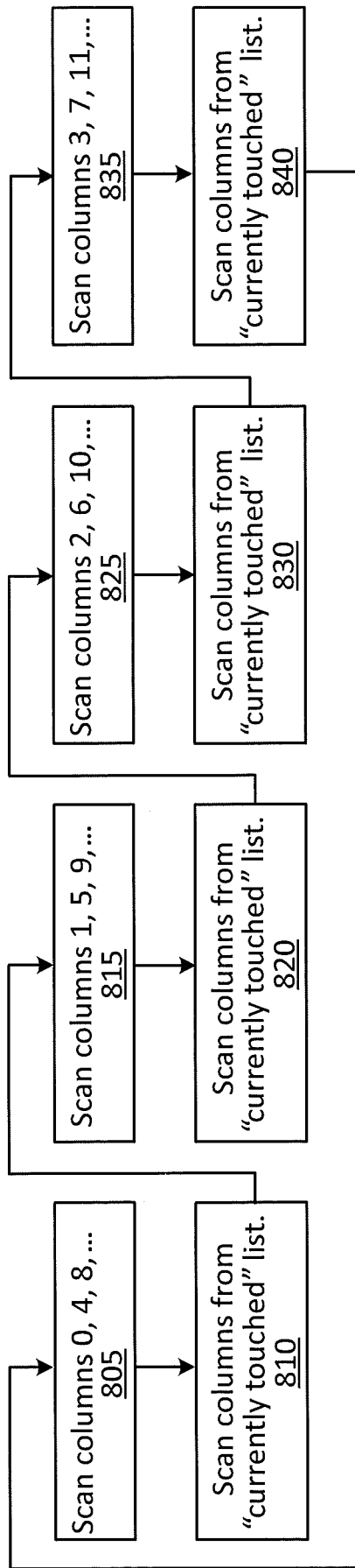
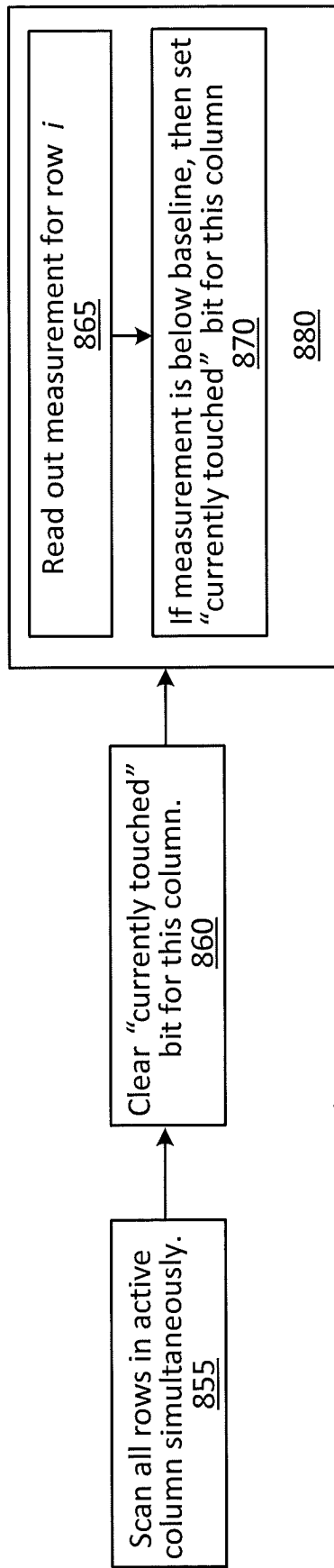


FIG. 7B



810 **FIG. 8A**



850

FIG. 8B

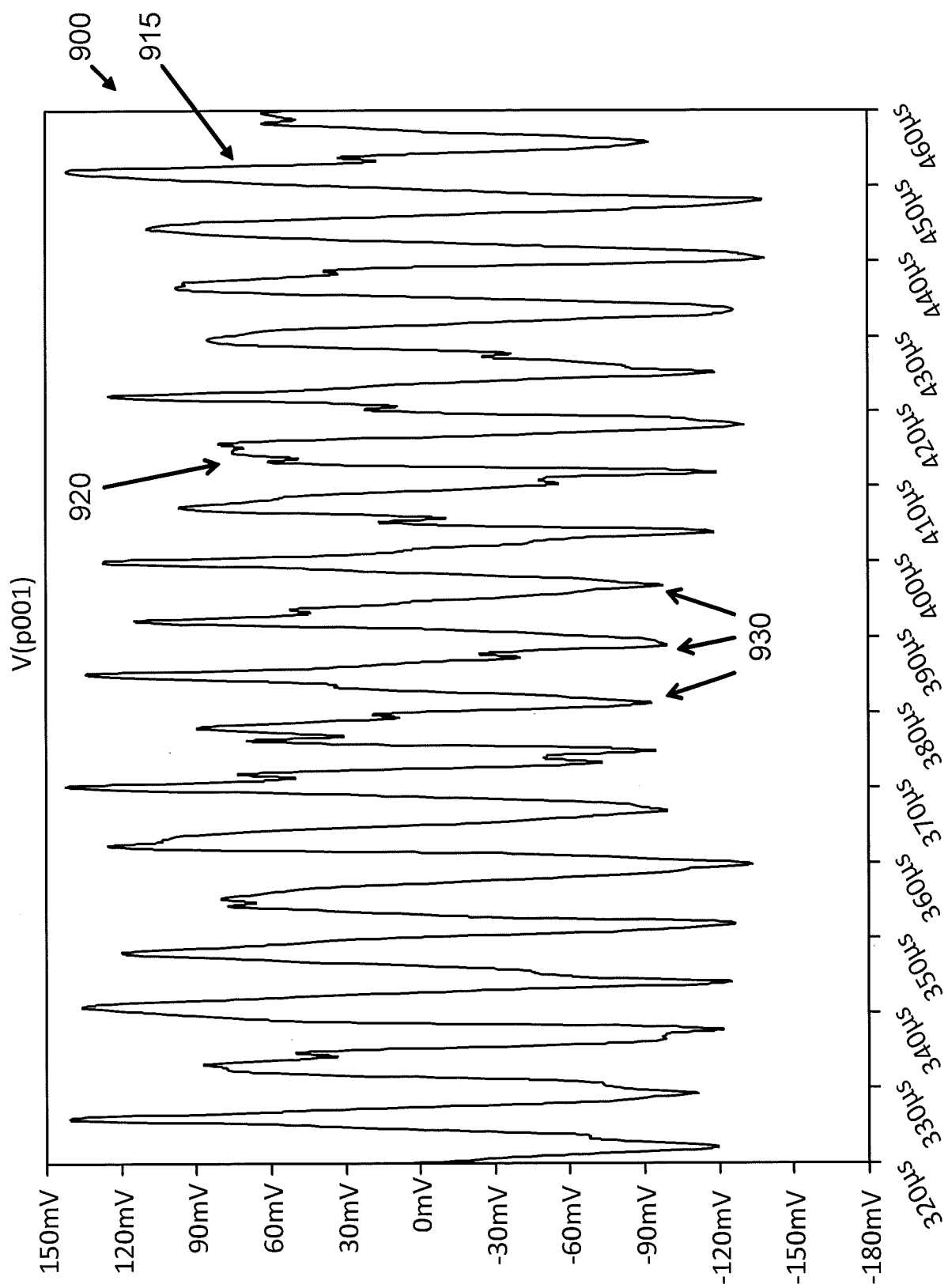


FIG. 9

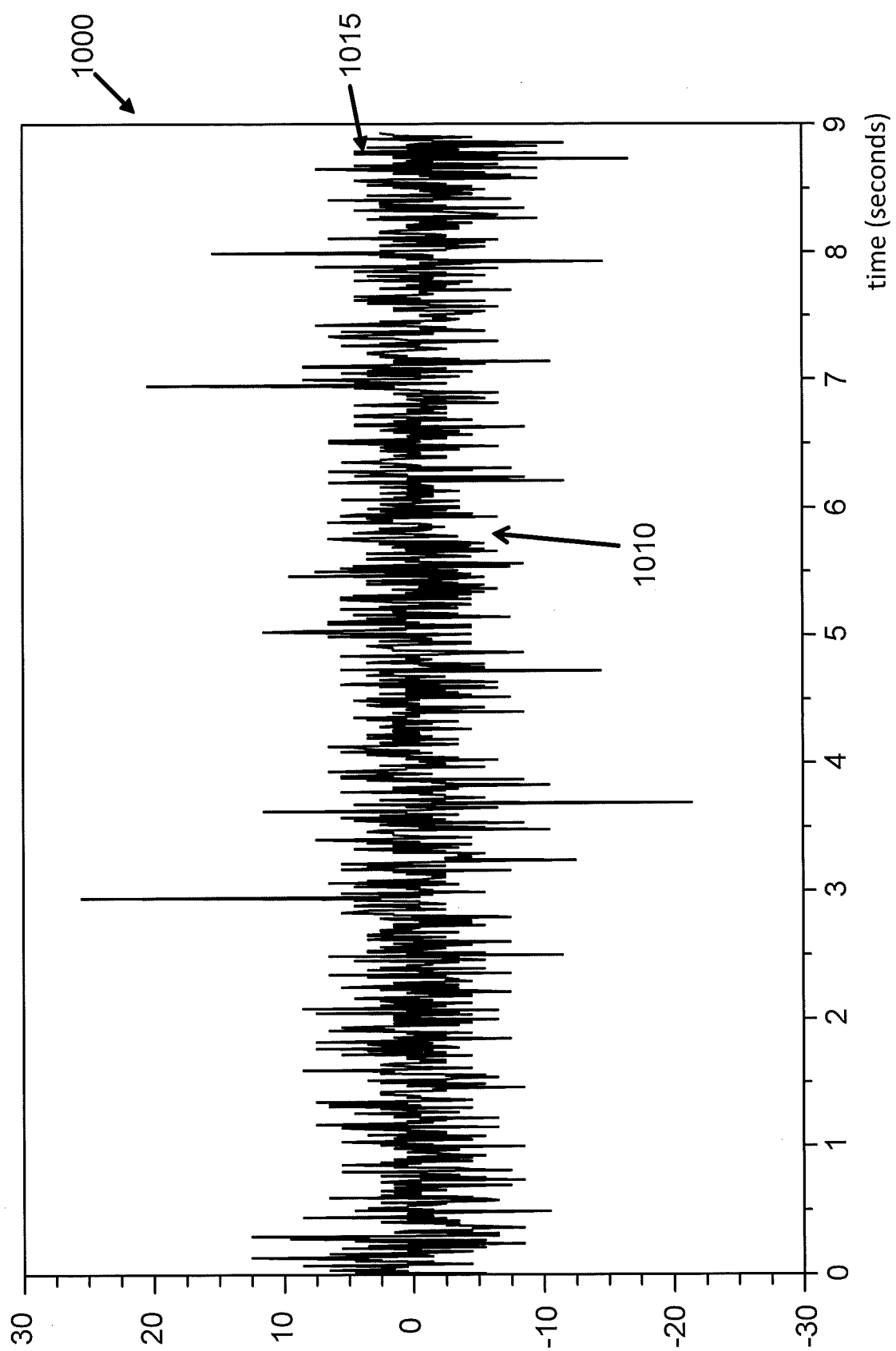


FIG. 10

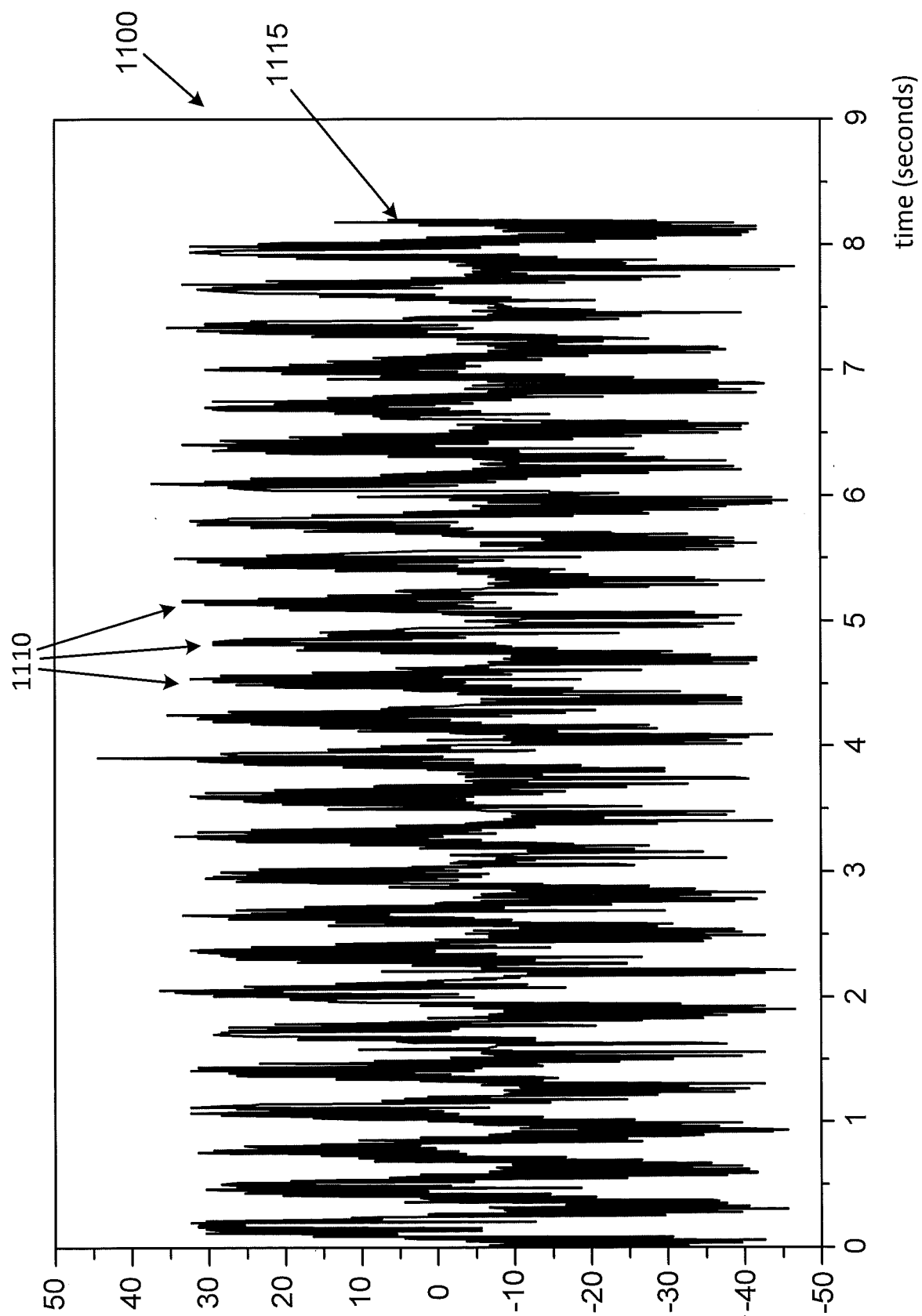


FIG. 11

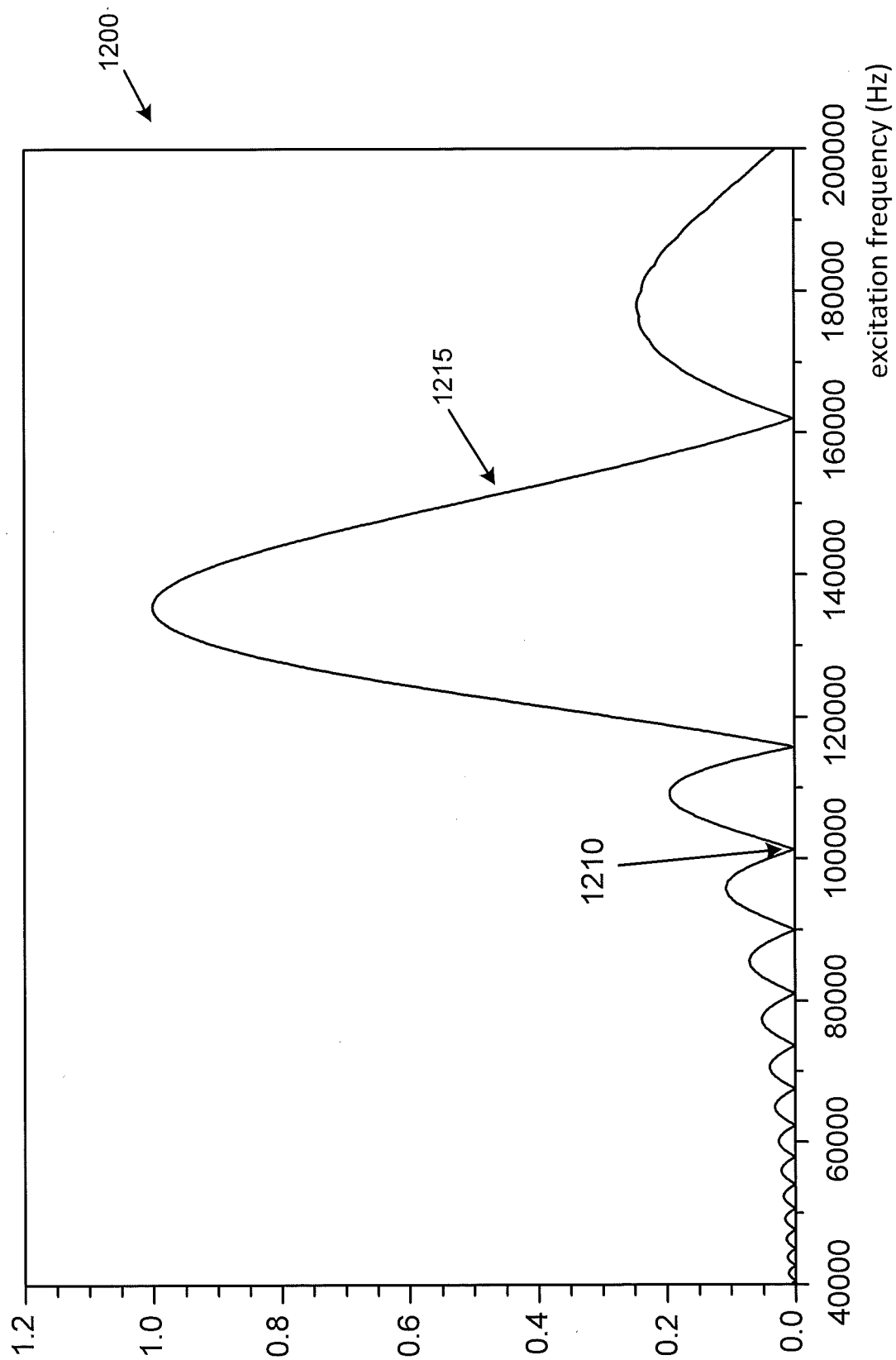


FIG. 12

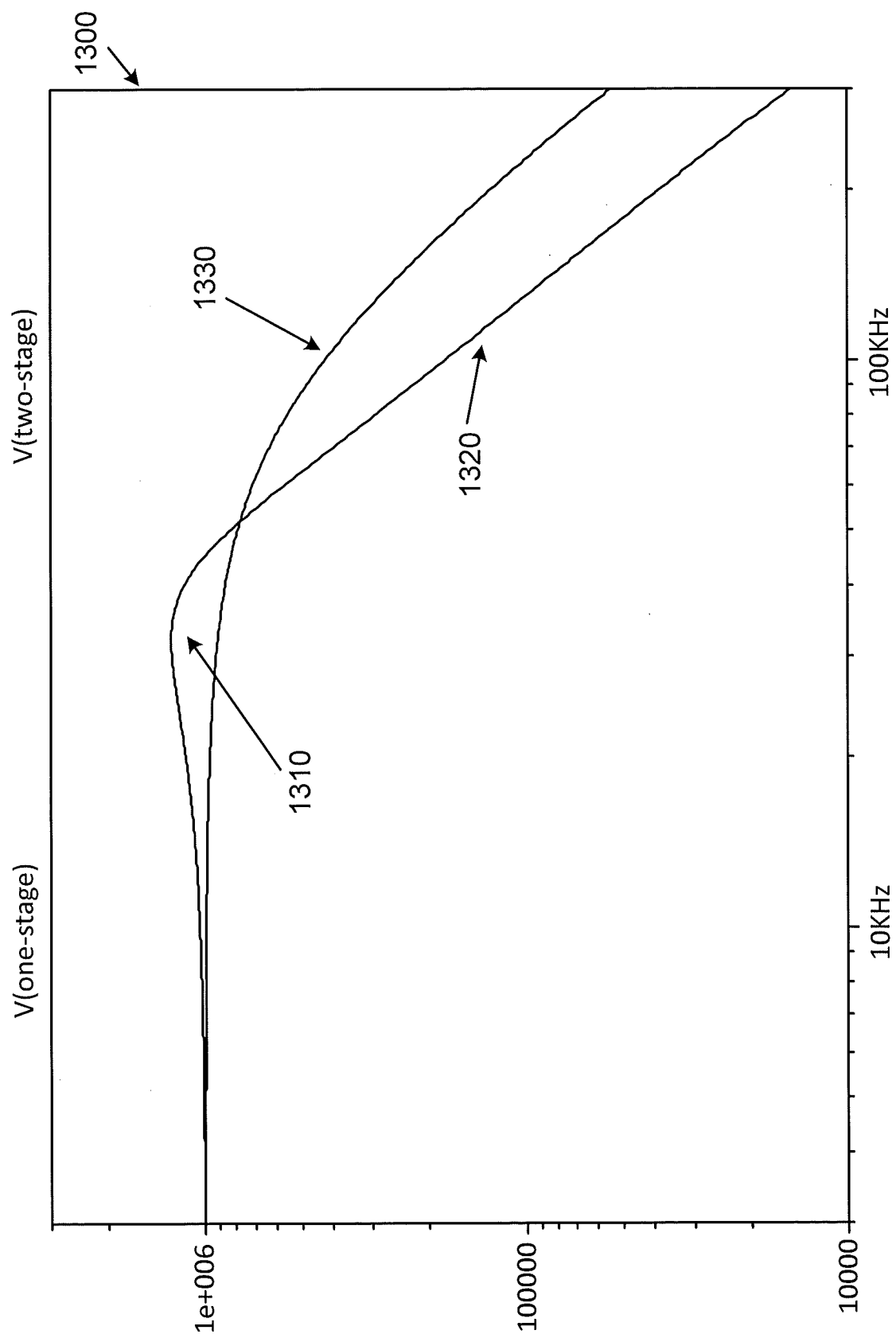


FIG. 13

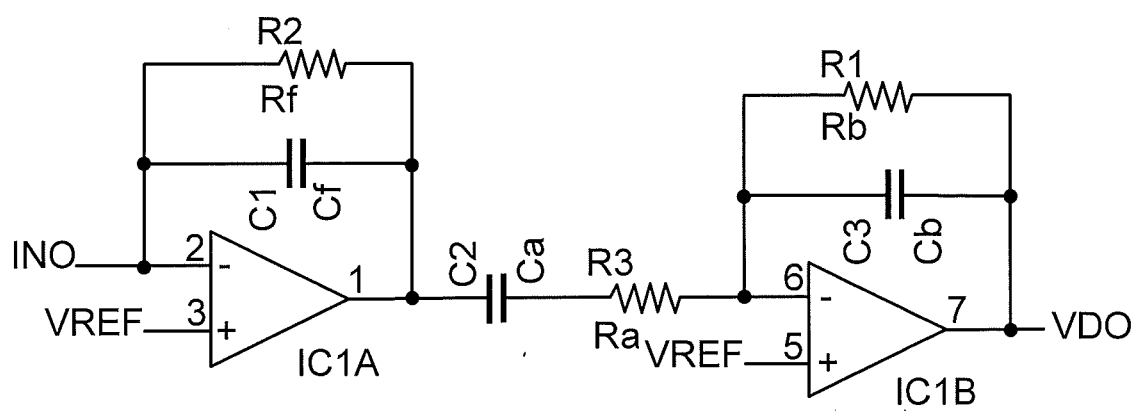


FIG. 14A

1400

Given:

Desired total gain G , in units of capacitance

Total capacitance C_{in} at input of amplifier (due to capacitance of ITO lines in the sensor)

Excitation frequency f (or center frequency, for a broadband excitation signal, e.g. a pseudo-noise sequence)

Expected total system noise I_n (coupled from LCD, etc.), in units of current, referred to analog front end input.

Choose C_f comparable to total input

capacitance C_{in}

1420

Choose R_f around the same impedance

magnitude as C_f at frequency of interest, i.e.,

$$R_f = 1/(2 * \pi * f * C_f)$$

1425

Choose the ratio R_b/R_a equal to the desired gain divided by the first - stage gain, i.e.,

$$C_f/G$$

1430

Design the first stage with total voltage noise V_n (integrated over the system bandwidth)

such that

$$I_n / (2 * \pi * f * G) \gg (R_b/R_a) * V_n$$

1435

Choose C_a for about 500:1 attenuation at 60 Hz, so

$$C_a = 1/((R_a * 500) * (60 \text{ Hz}) * 2 * \pi)$$

1440

Choose C_b for about 10:1 attenuation at $10 * f$, so

$$C_b = 1/((R_b / 10) * (10 * f) * 2 * \pi)$$

1445

FIG. 14B

1400