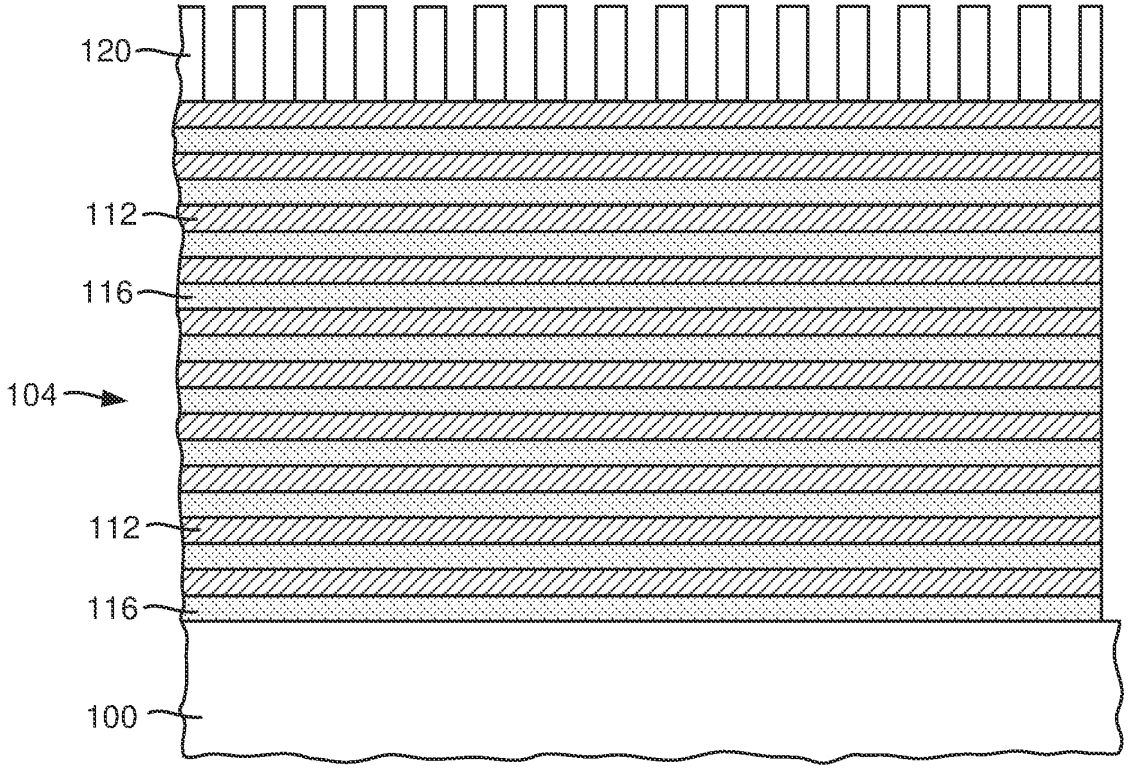


FIGURE 1A

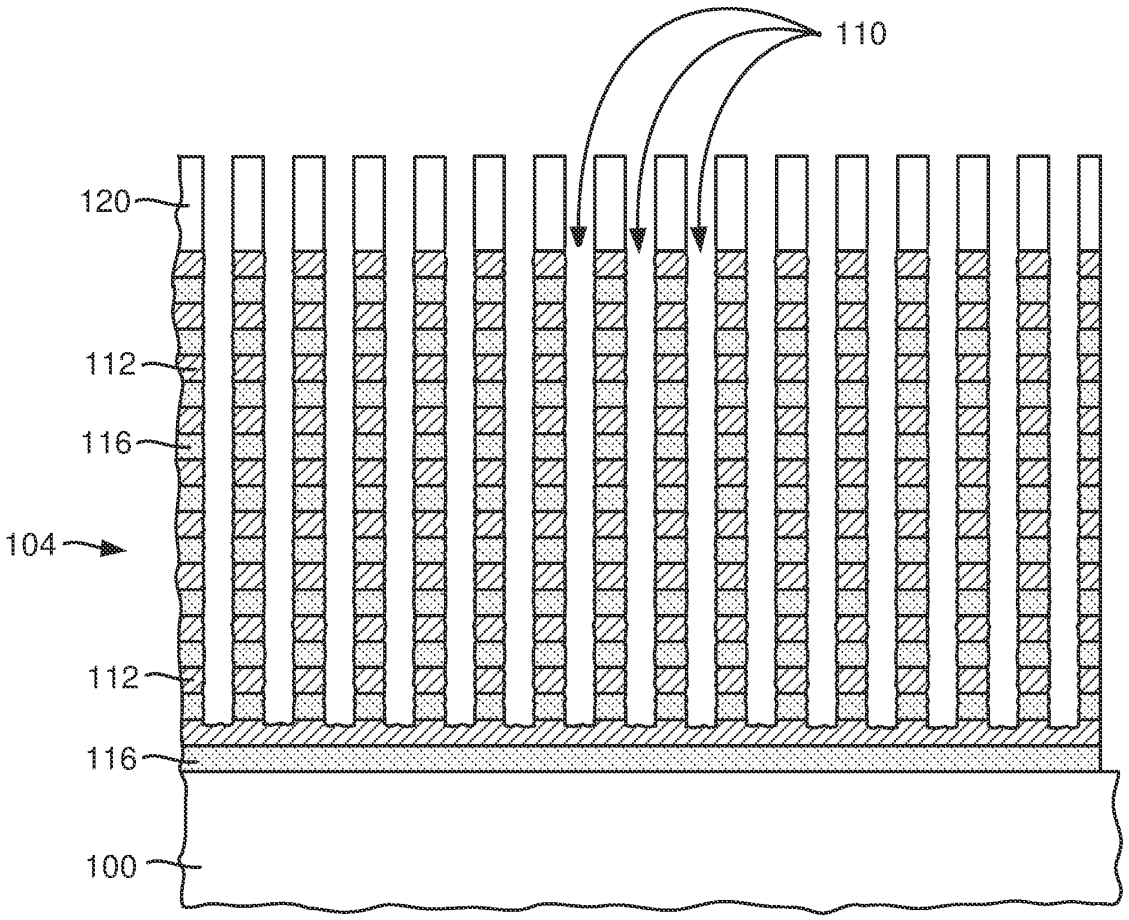


FIGURE 1B

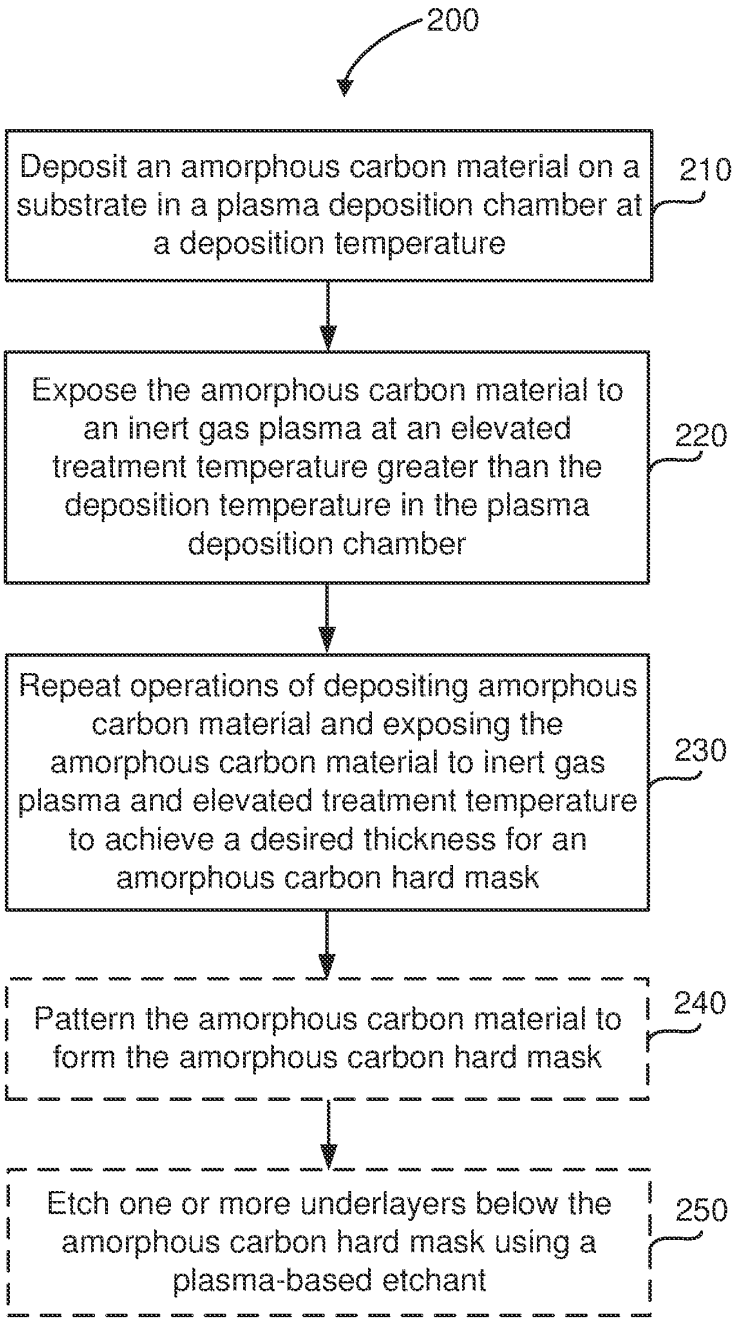

200
Deposit an amorphous carbon material on a substrate in a plasma deposition chamber at a deposition temperature
210
Expose the amorphous carbon material to an inert gas plasma at an elevated treatment temperature greater than the deposition temperature in the plasma deposition chamber
220
Repeat operations of depositing amorphous carbon material and exposing the amorphous carbon material to inert gas plasma and elevated treatment temperature to achieve a desired thickness for an amorphous carbon hard mask
230
Pattern the amorphous carbon material to form the amorphous carbon hard mask
240
Etch one or more underlayers below the amorphous carbon hard mask using a plasma-based etchant
250

FIGURE 2

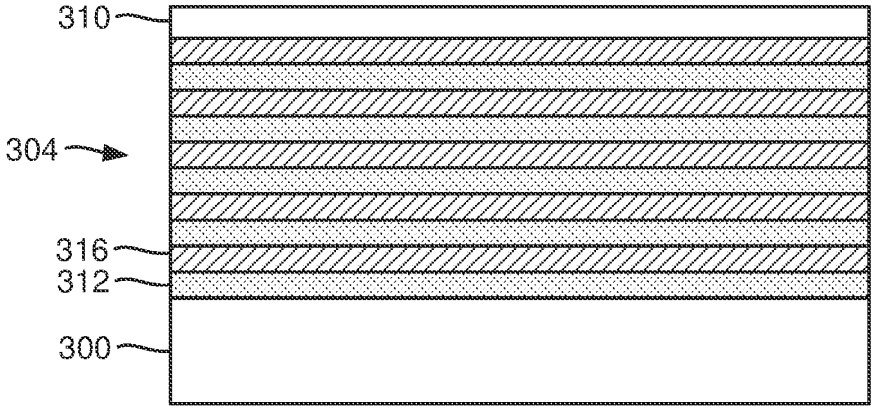


FIGURE 3A

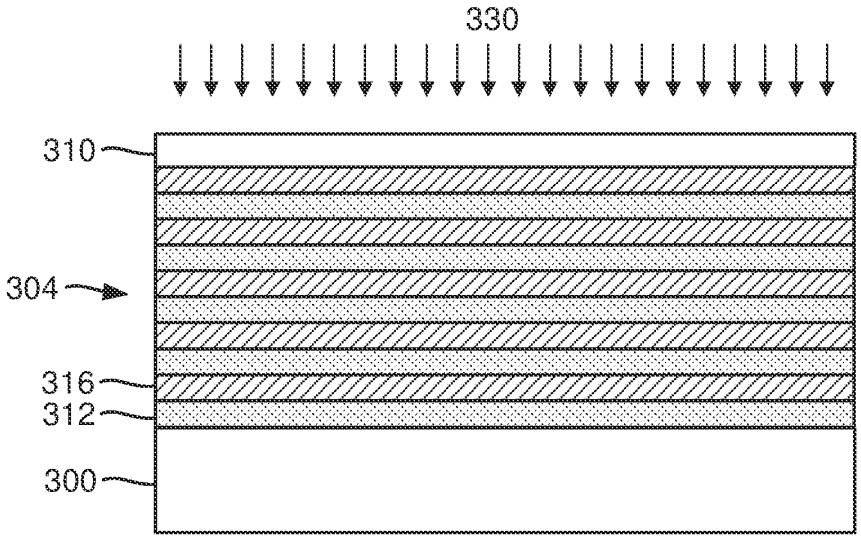


FIGURE 3B

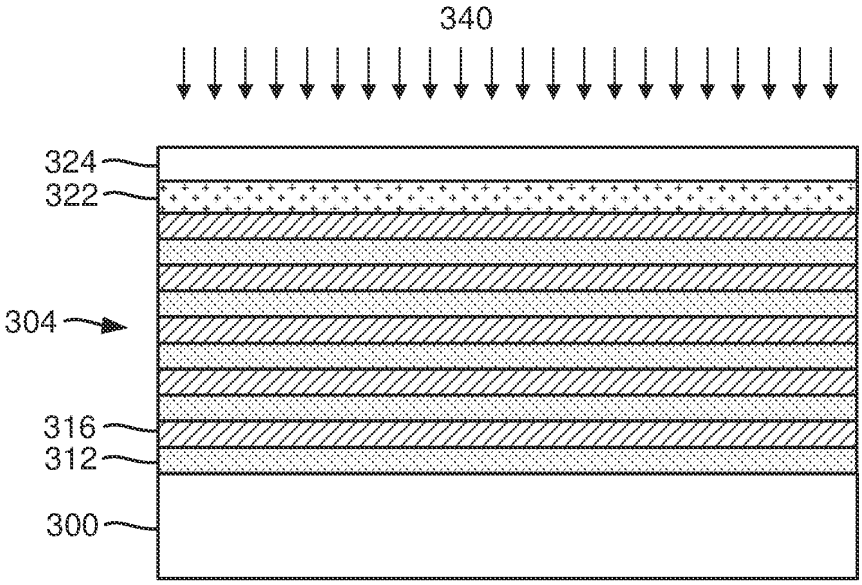


FIGURE 3C

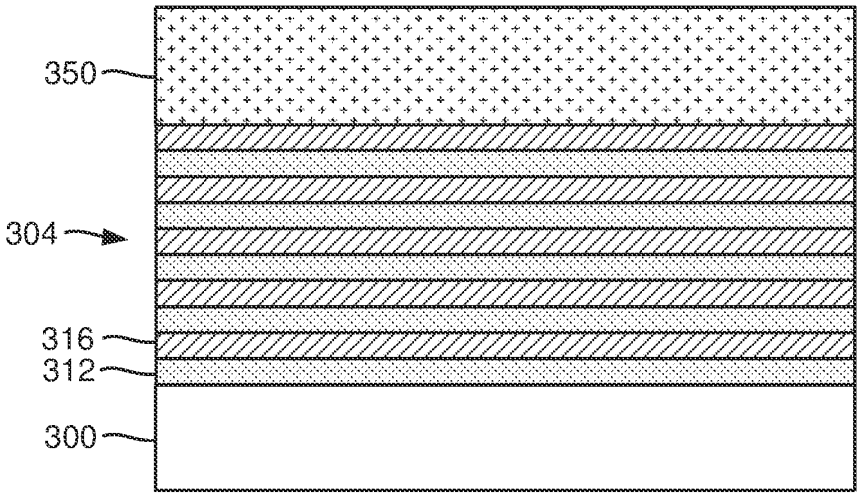


FIGURE 3D

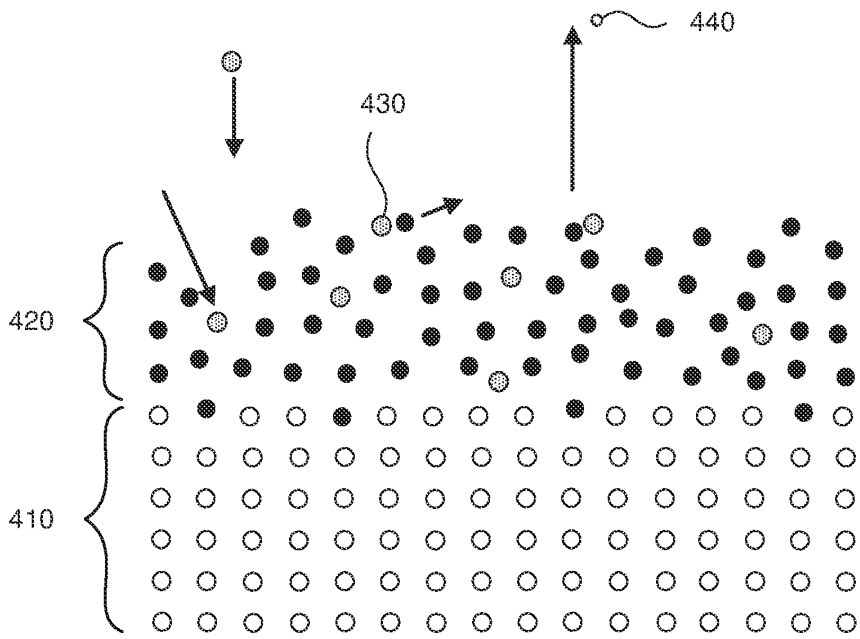


FIGURE 4

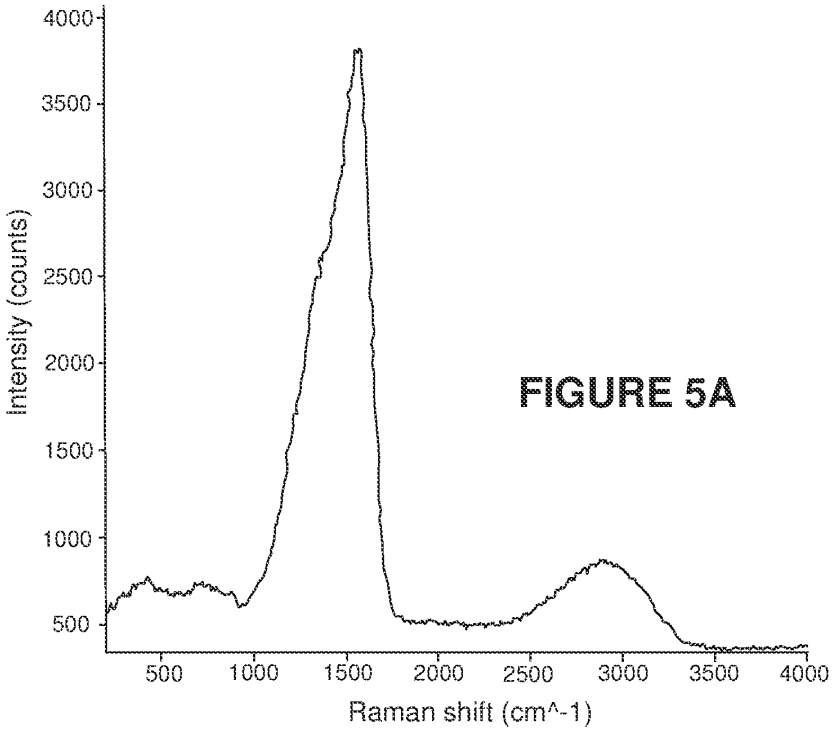


FIGURE 5A

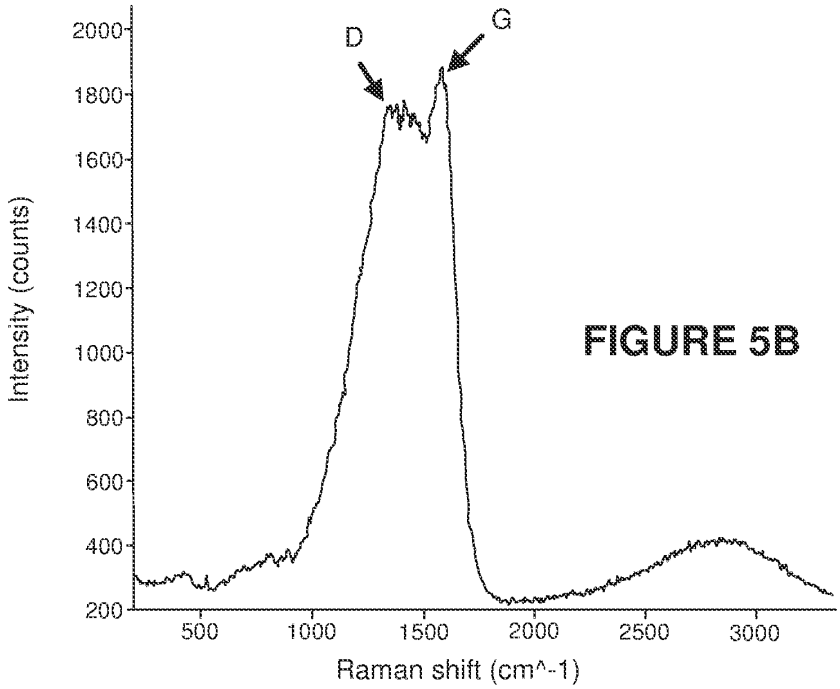


FIGURE 5B

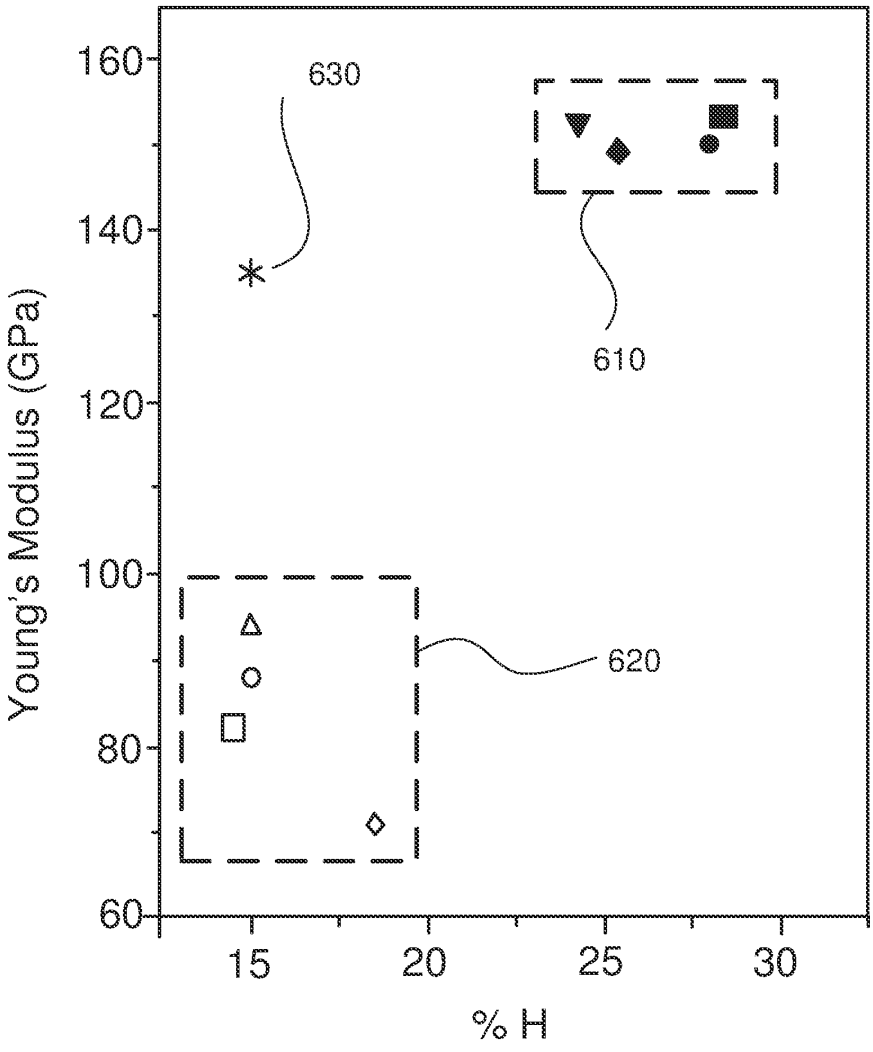

160
140
120
100
80
60
Young's Modulus (GPa)
15
20
25
30
% H
630
610
620

FIGURE 6

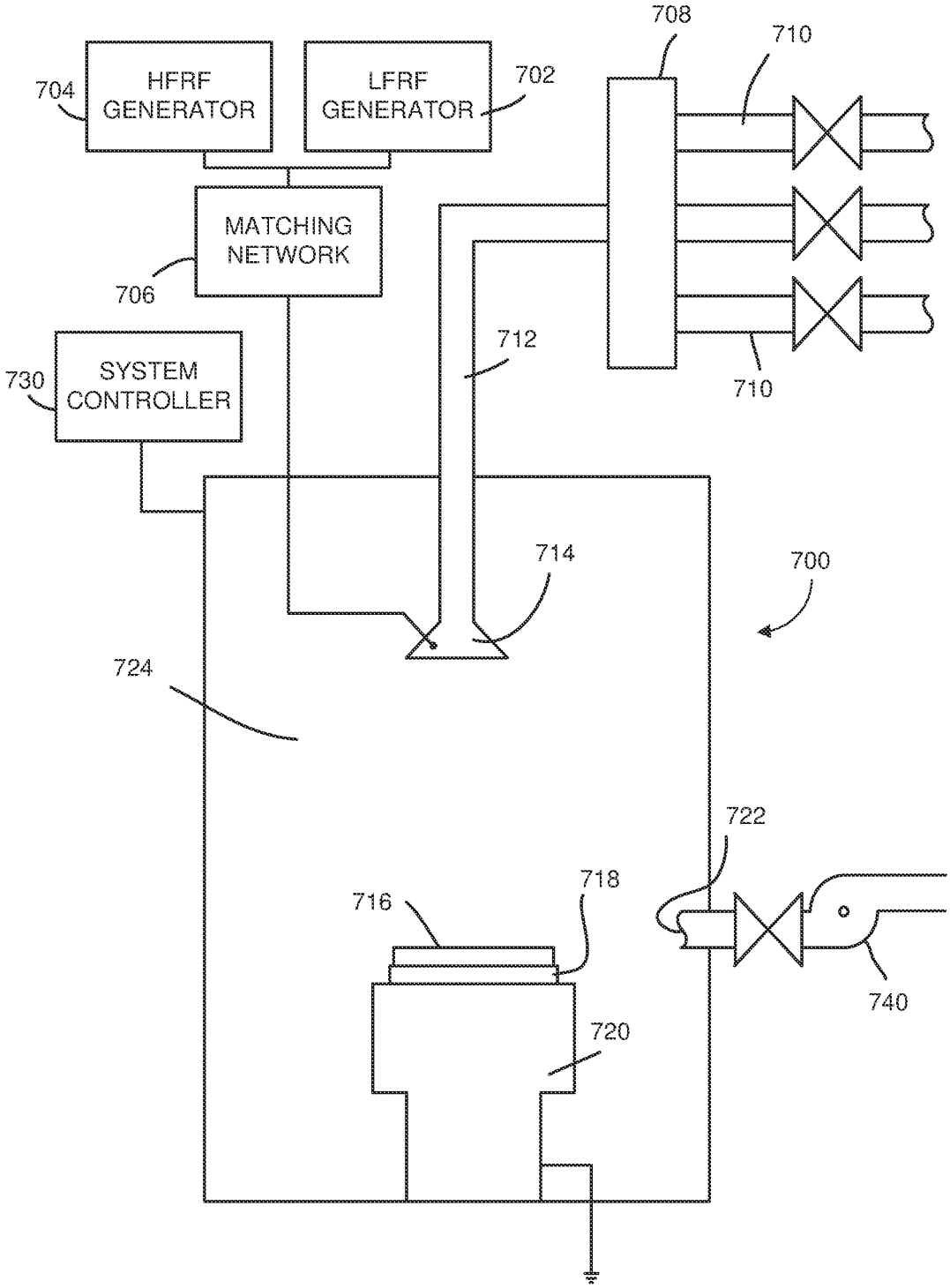

708
710
HFRF GENERATOR
704
LFRF GENERATOR
702
MATCHING NETWORK
706
712
SYSTEM CONTROLLER
730
710
714
700
724
722
718
716
720
740

FIGURE 7

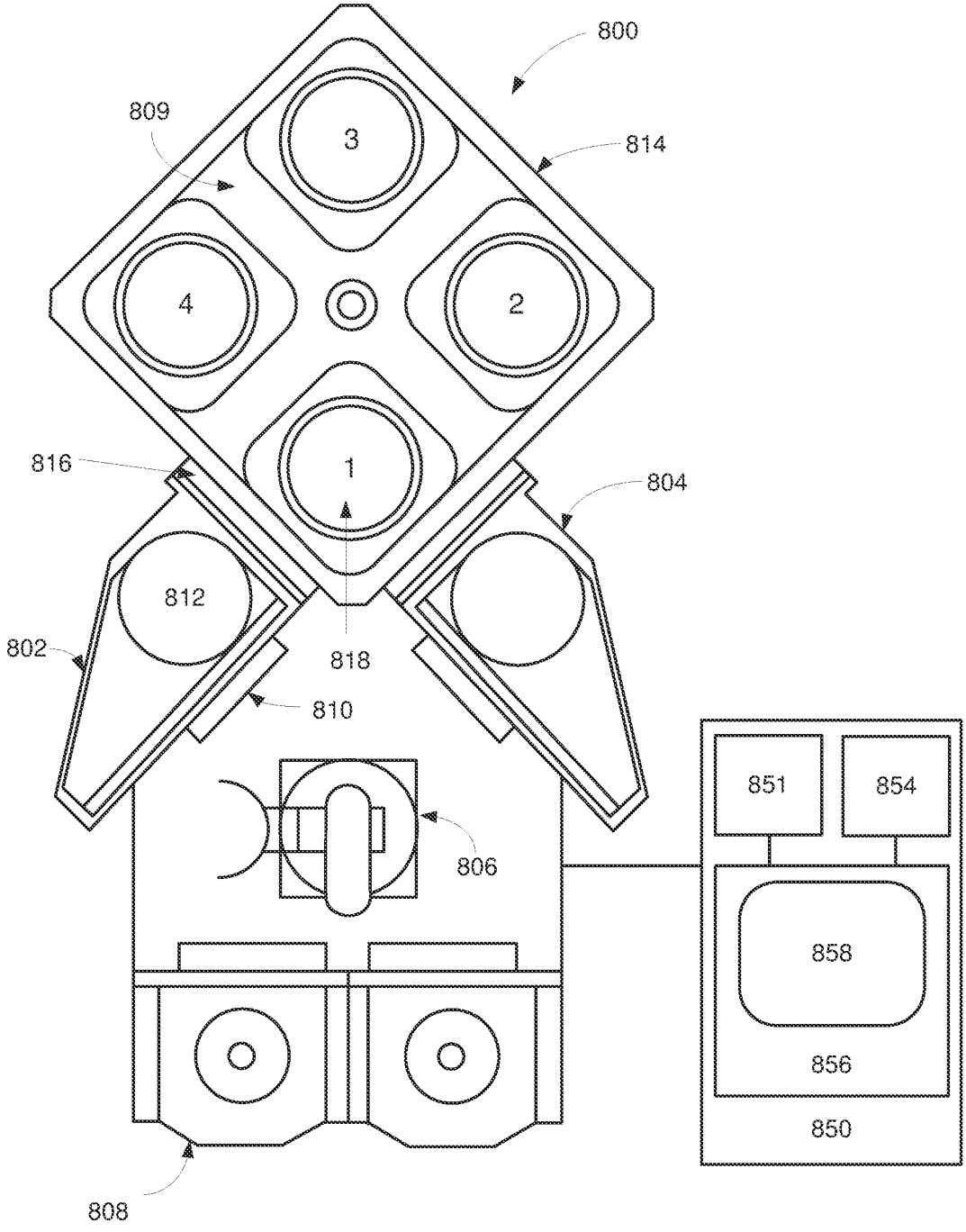

800
809
814
3
4
2
1
816
804
812
802
818
810
851
854
806
858
856
850
808

FIGURE 8