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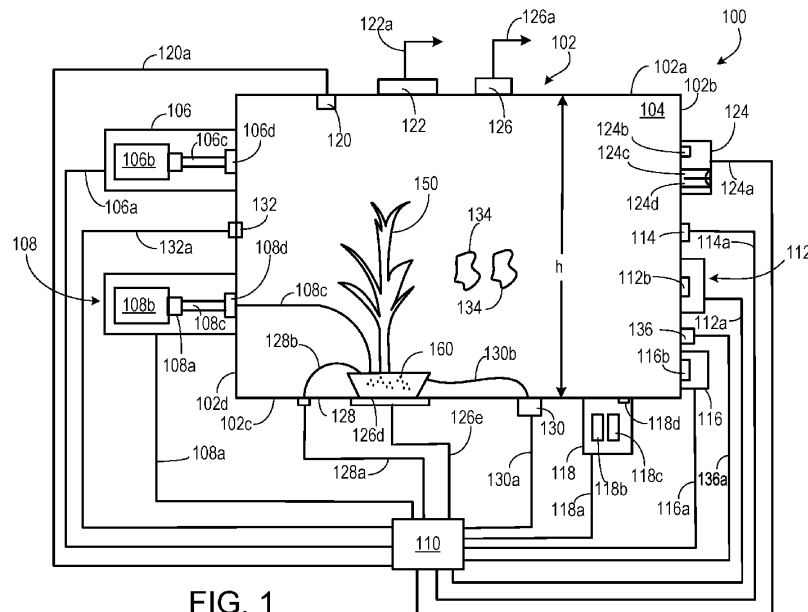


FIG. 1

(57) Abstract: Systems for plant culture include a chamber featuring one or more walls enclosing a spatial volume internal to the chamber, where the one or more walls include a surface for supporting a plant within the enclosed spatial volume, a gas delivery apparatus with at least one gas source, a nutrient delivery apparatus with a reservoir, a sampling apparatus connected to a port formed in the one or more walls, and a controller configured so that during operation of the system, the controller activates the nutrient delivery apparatus to deliver an aqueous growth medium to the plant, and activates the gas delivery apparatus to deliver into the enclosed spatial volume a mixture of isotopically-substituted gases. Also provided are methods of use of the system for measuring nitrogen in a plant and for identifying microbes capable of providing fixed nitrogen to a plant.

[Continued on next page]

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