

ABSTRACT

“GLASS CORE SUBSTRATE FOR INTEGRATED CIRCUIT DEVICES AND METHODS OF MAKING THE SAME”

Disclosed are embodiments of a glass core substrate for an integrated circuit (IC) device. The glass core substrate includes a glass core and build-up structures on opposing sides of the glass core. Electrically conductive terminals may be formed on both sides of the glass core substrate. An IC die may be coupled with the terminals on one side of the substrate, whereas the terminals on the opposing side may be coupled with a next-level component, such as a circuit board. The glass core may comprise a single piece of glass in which conductors have been formed, or the glass core may comprise two or more glass sections that have been joined together, each section having conductors. The conductors extend through the glass core, and one or more of the conductors may be electrically coupled with the build-up structures disposed over the glass core. Other embodiments are described and claimed.

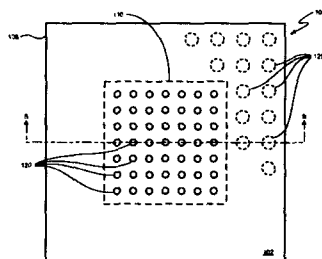


FIG. 1A

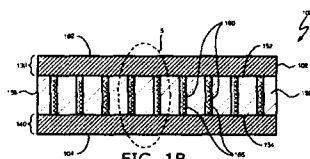


FIG. 1B

CLAIMS

What is claimed is:

1. A substrate comprising:
a core comprised of glass, the glass core having a first surface and an opposing second surface;
a number of conductors extending through the glass core from the first surface to the second surface;
at least one dielectric layer and at least one metal layer disposed at the first surface of the glass core, wherein the at least one metal layer at the first surface is electrically coupled with at least one of the conductors;
at least one dielectric layer and a least one metal layer disposed at the second surface of the glass core, wherein the at least one metal layer at the second surface is electrically coupled with at least one of the conductors.
2. The substrate of claim 1, wherein the glass core comprises a single piece of glass.
3. The substrate of claim 1, wherein the glass core comprises two or more sections of glass joined together.
4. The substrate of claim 1, wherein each of the conductors comprises a hole formed in the glass core and an electrically conductive material disposed in the hole.
5. The substrate of claim 4, further comprising a wetting layer disposed on a wall of the hole.
6. The substrate of claim 4, wherein the electrically conductive material comprises a metal.
7. The substrate of claim 4, wherein a wall of the hole is tapered at an angle relative to a centerline of the hole.

8. The substrate of claim 1, wherein each of the conductors comprises a metal wire embedded in the glass core.

9. The substrate of claim 1, wherein the at least one metal layer disposed at the first surface of the glass core is disposed directly adjacent the first surface, and wherein the at least one metal layer disposed at the second surface of the glass core is disposed directly adjacent the second surface.

10. The substrate of claim 1, further comprising:
a first set of terminals disposed on at the first side of the glass core, the first set of terminals to mate with a corresponding array of terminals on an integrated circuit (IC) die; and
a second set of terminals disposed at the second side of the glass core, the second set of terminals to mate with a corresponding array of terminals on a next-level component.

11. A method comprising;
forming a number of holes in a glass plate, the glass plate having a first surface and an opposing second surface substantially parallel with the first surface, each hole extending from the first surface to the second surface, wherein the holes are formed by a process selected from a group comprising imprinting, sand blasting, and casting;
disposing an electrically conductive material in each of the holes to form a conductor in each hole;
disposing at least one dielectric layer and at least one metal layer at the first surface of the glass plate and electrically coupling the at least one metal layer at the first surface with at least one of the conductors; and
disposing at least one dielectric layer and a least one metal layer at the second surface of the glass core and electrically coupling the at least one metal layer at the second surface with at least one of the conductors.

12. The method of claim 11, further comprising disposing a wetting layer on a wall of each hole prior to disposing the electrically conductive material.

13. The method of claim 12, wherein the electrically conductive material comprises a metal.

14. The method of claim 11, wherein a wall of each hole is tapered at an angle relative to a centerline of the hole.

15. The method of claim 11, wherein the at least one metal layer disposed at the first surface of the glass plate is disposed directly adjacent the first surface, and wherein the at least one metal layer disposed at the second surface of the glass plate is disposed directly adjacent the second surface.

16. The method of claim 11, further comprising:
disposing a first set of terminals at the first side of the glass plate, the first set of terminals to mate with a corresponding array of terminals on an integrated circuit (IC) die;
and
disposing a second set of terminals at the second side of the glass plate, the second set of terminals to mate with a corresponding array of terminals on a next-level component.

17. A method comprising
providing a glass body having a number of embedded conductive wires; and
cutting slices from the glass body, each slice having a first surface and an opposing second surface substantially parallel with the first surface, wherein a portion of each embedded wire remains in each of the slices and extends from the first surface to the second surface of the slice, each embedded wire portion providing one of a corresponding number of a conductors;
wherein one or more of the slices provides a glass core for a substrate.

18. The method of claim 17, wherein a single one of the slices provides the glass core.

19. The method of claim 17, further comprising joining two or more of the

slices together to provide the glass core.

20. The method of claim 19, wherein the glass body includes alignment elements, the method further comprising aligning the two or more slices using the alignment elements while joining the two or more slices together.

21. The method of claim 19, wherein the two or more slices are joined by a fusing process.

22. The method of claim 17, further comprising:
disposing at least one dielectric layer and at least one metal layer at the first surface of the glass core and electrically coupling the at least one metal layer at the first surface with at least one of the conductors; and
disposing at least one dielectric layer and at least one metal layer at the second surface of the glass core and electrically coupling the at least one metal layer at the second surface with at least one of the conductors.

23. The method of claim 17, further comprising:
disposing a first set of terminals at the first side of the glass core, the first set of terminals to mate with a corresponding array of terminals on an integrated circuit (IC) die;
disposing a second set of terminals at the second side of the glass core, the second set of terminals to mate with a corresponding array of terminals on a next-level component.

24. The method of claim 17, wherein each slice is cut from the glass body by a process selected from a group comprising laser cutting and mechanical sawing.

25. The method of claim 17, wherein the glass body having embedded wires is formed by an extrusion process.

26. The method of claim 25, wherein alignment elements are provided on the glass body during the extrusion process.

Dated this the 12th day of April 2012.

28



(ASHISH K. SHARMA)
of SUBRAMANIAM, NATARAJ & ASSOCIATES
Attorneys for the Applicants

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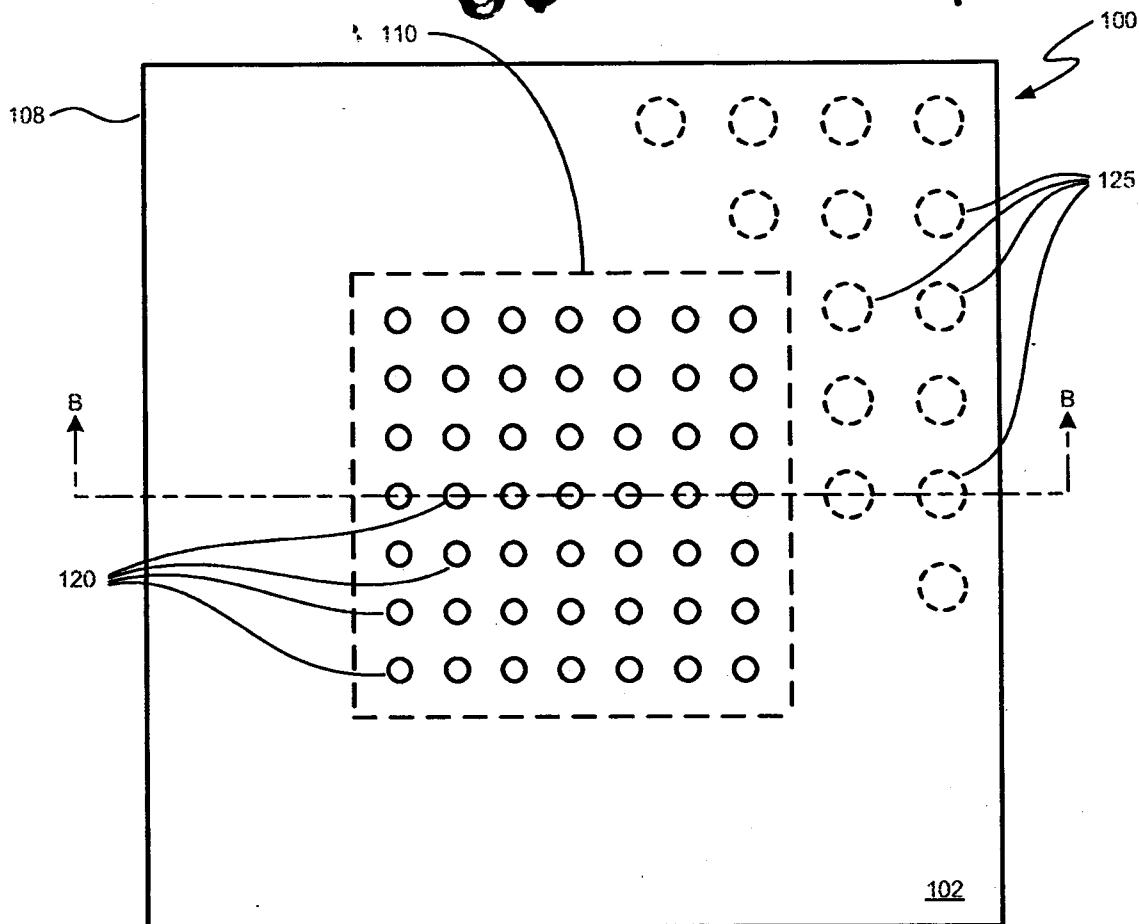


FIG. 1A

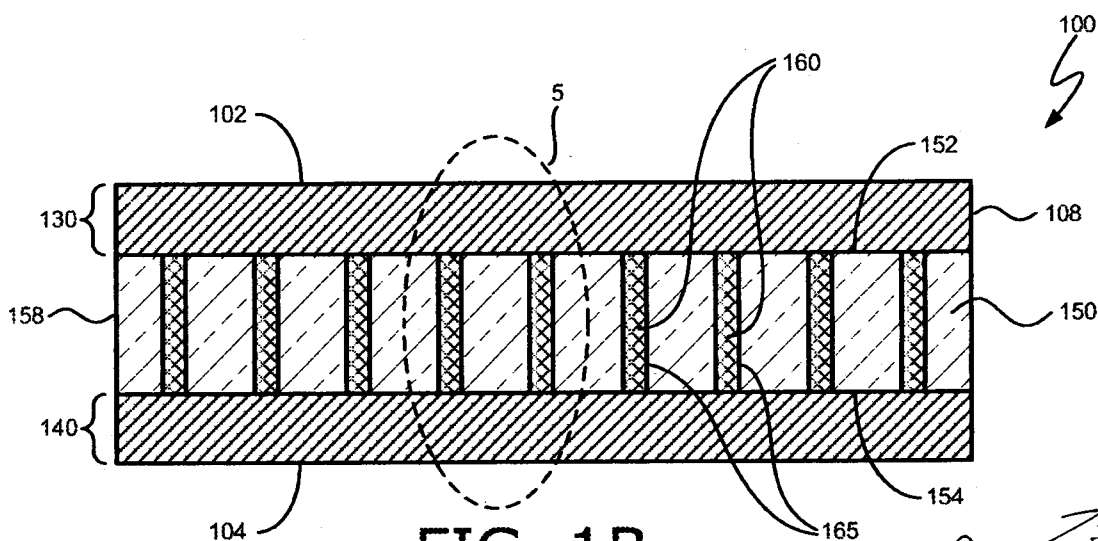
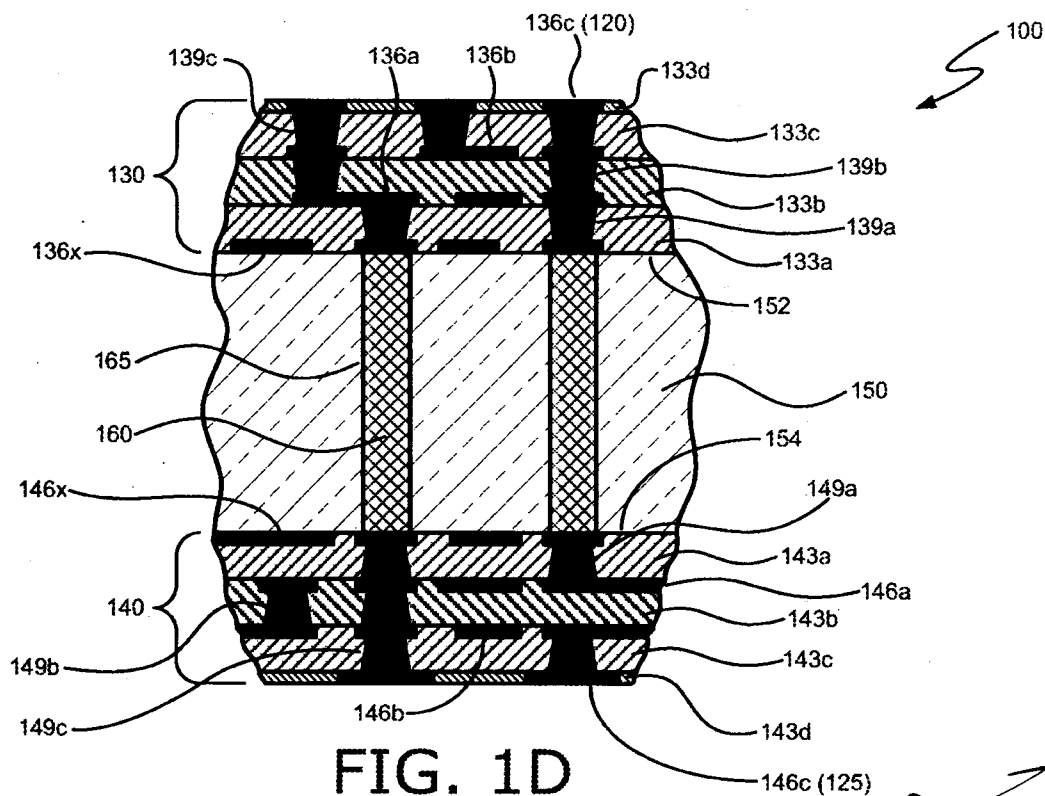
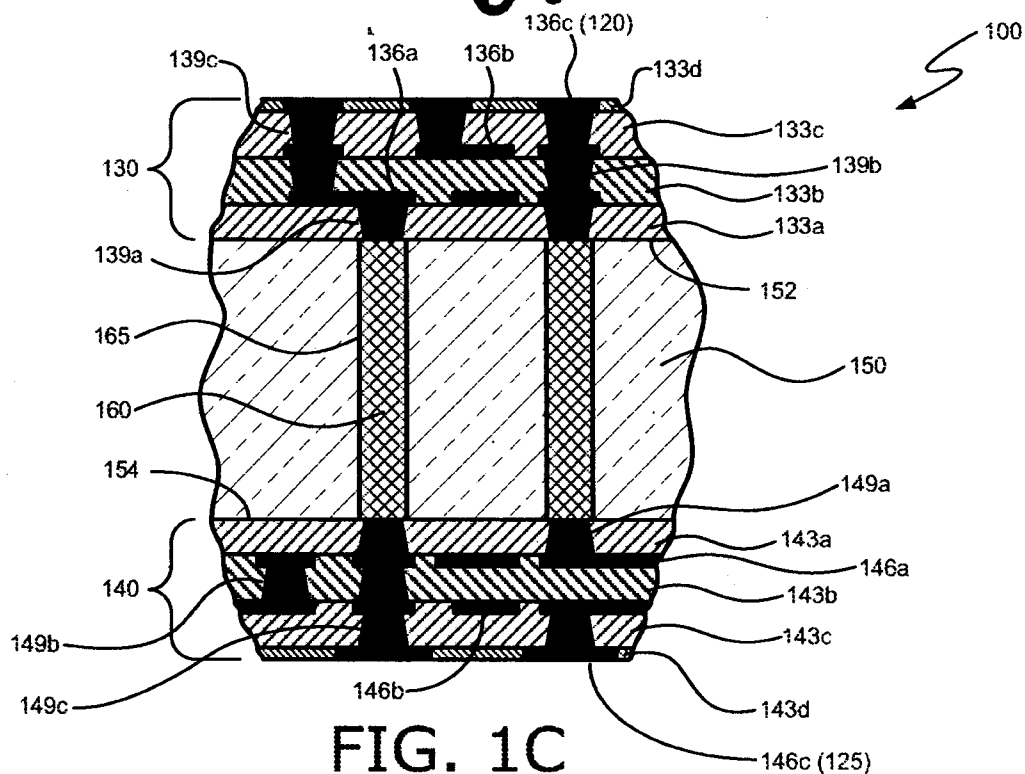


FIG. 1B

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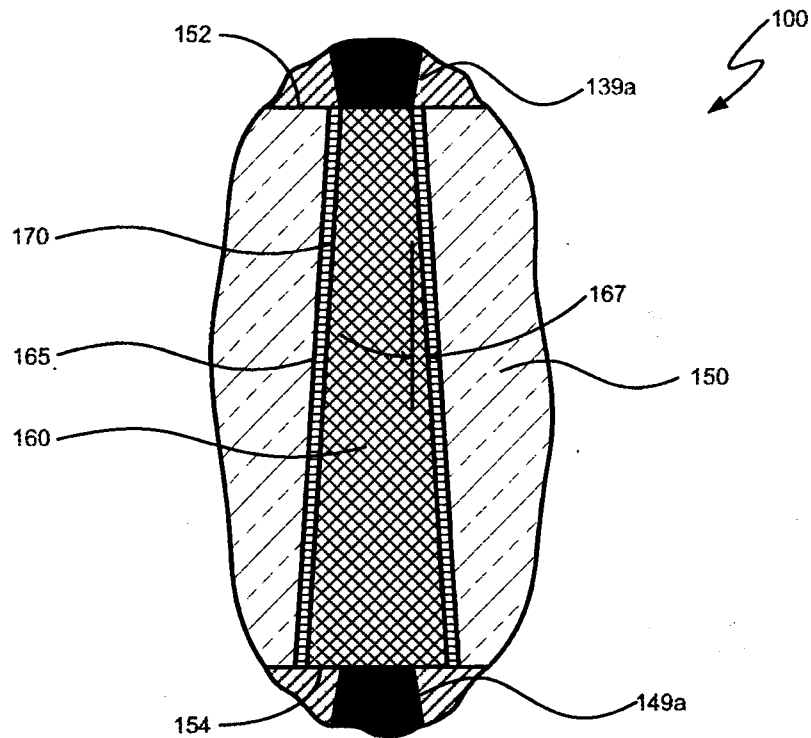
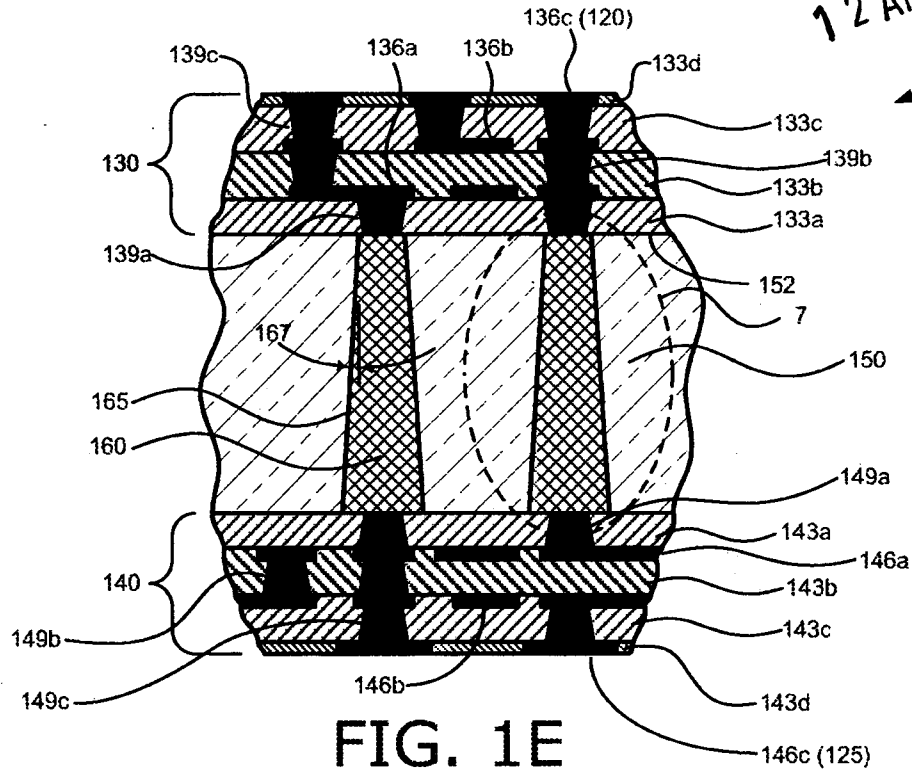
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(ASHISH K. SHARMA)
Of SUBRAMANIAM, NATARAJ & ASSOCIATES
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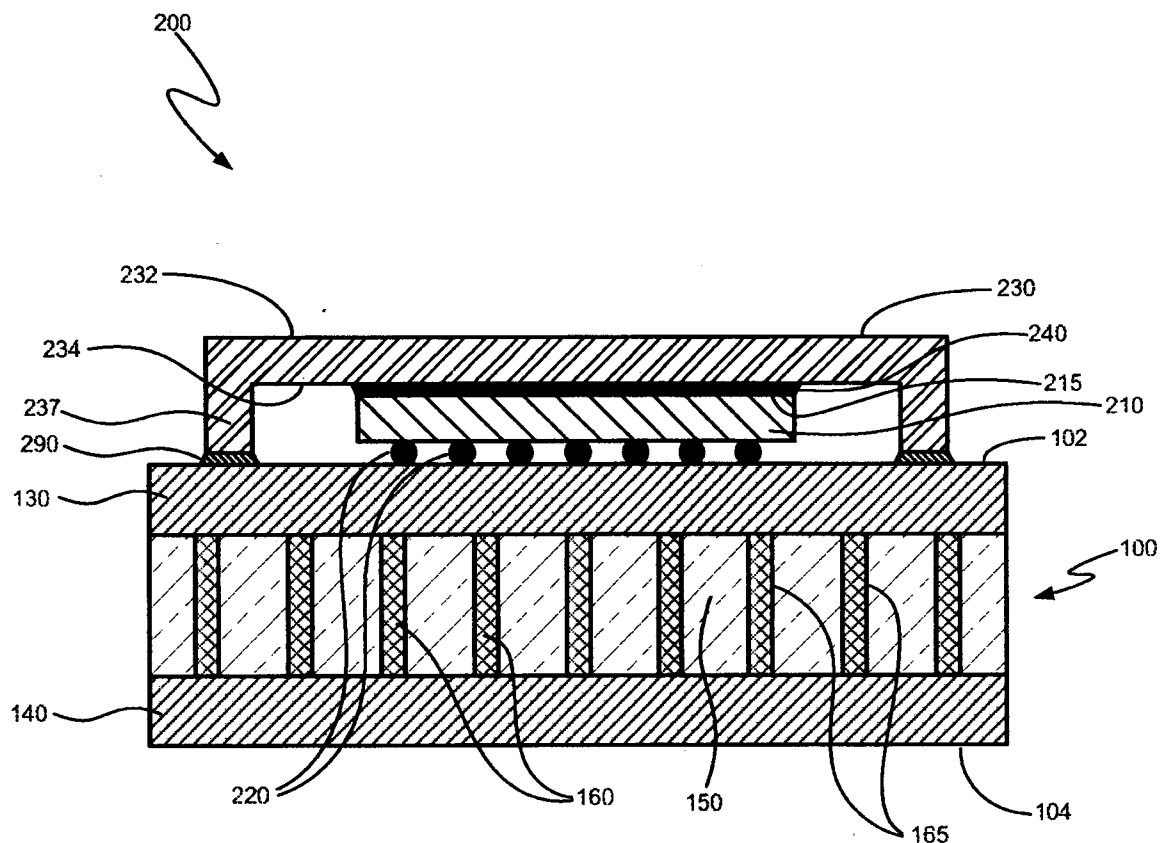
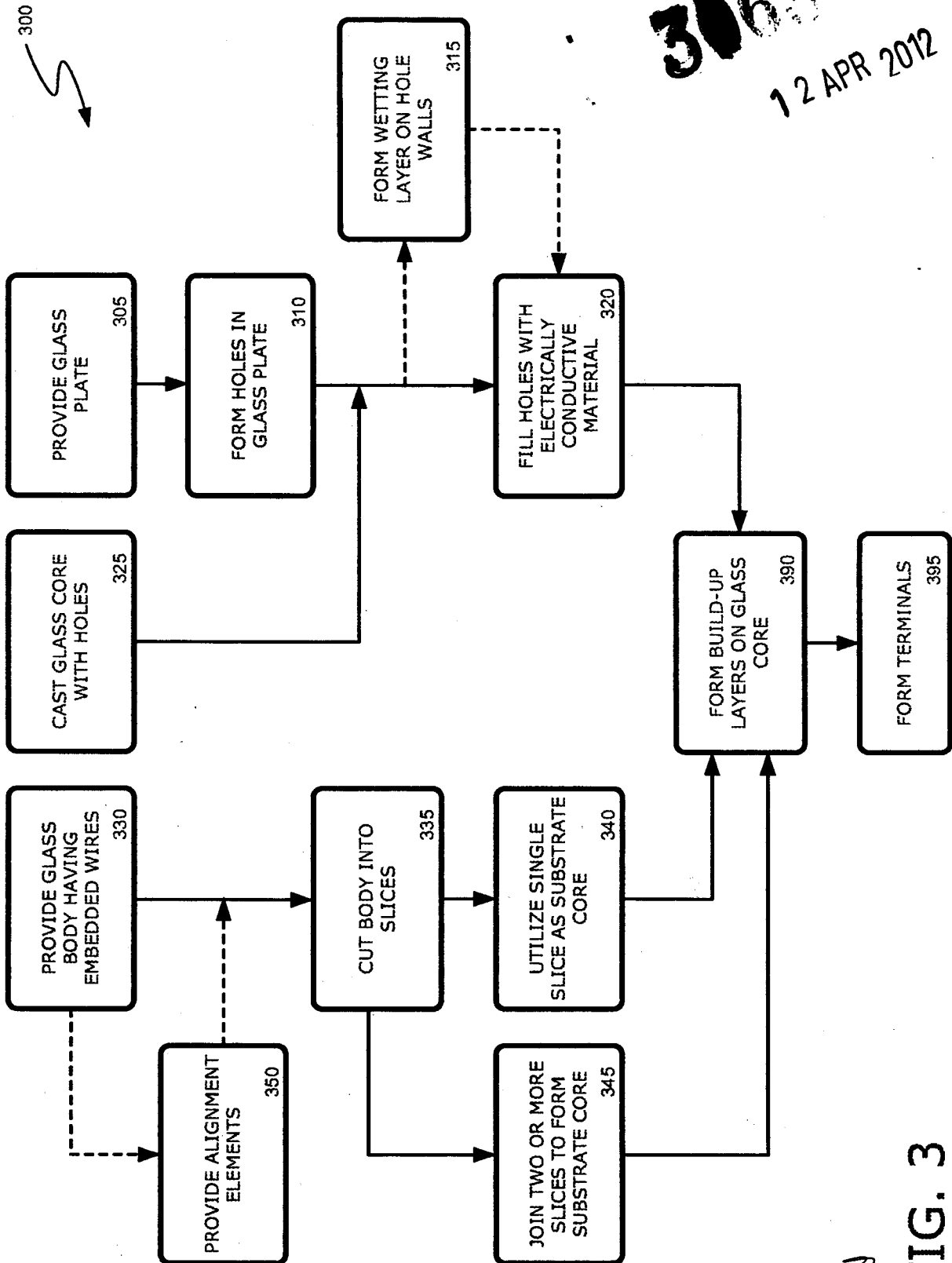


FIG. 2

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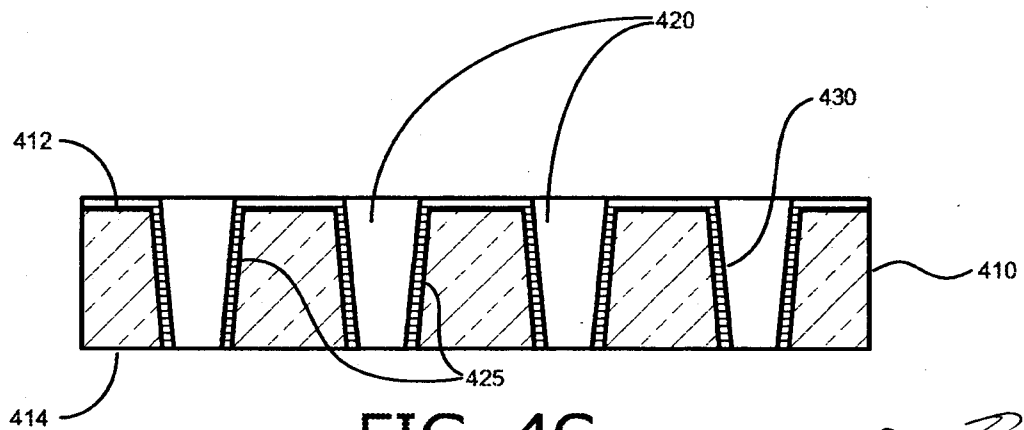
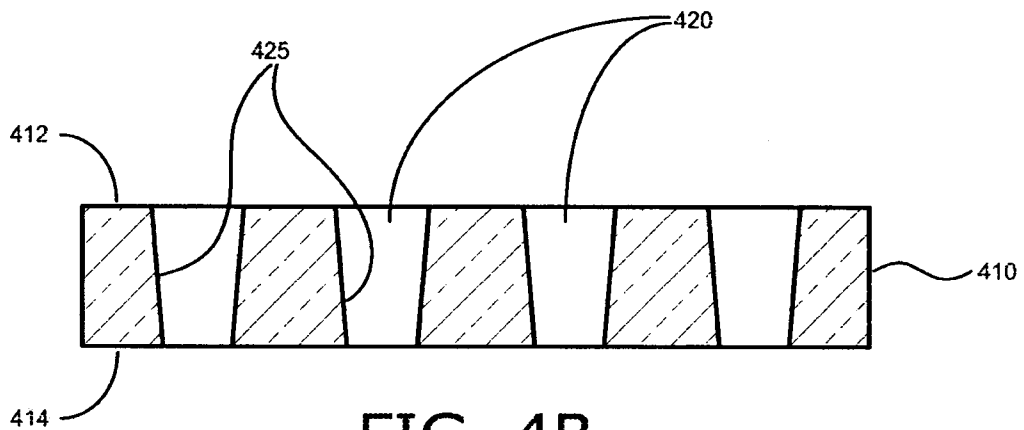
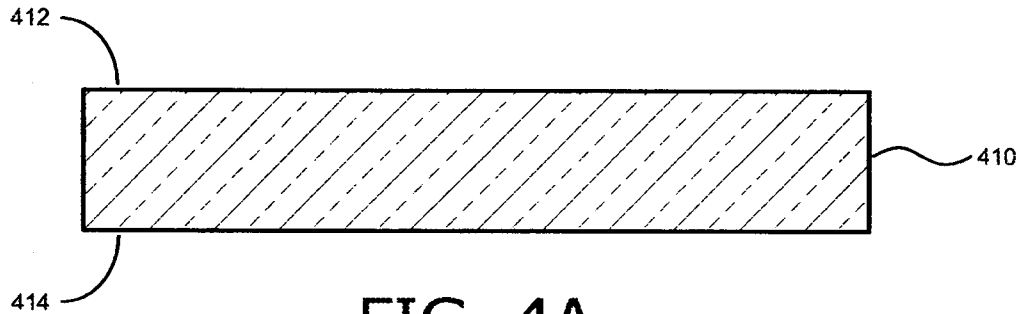


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FIG. 3

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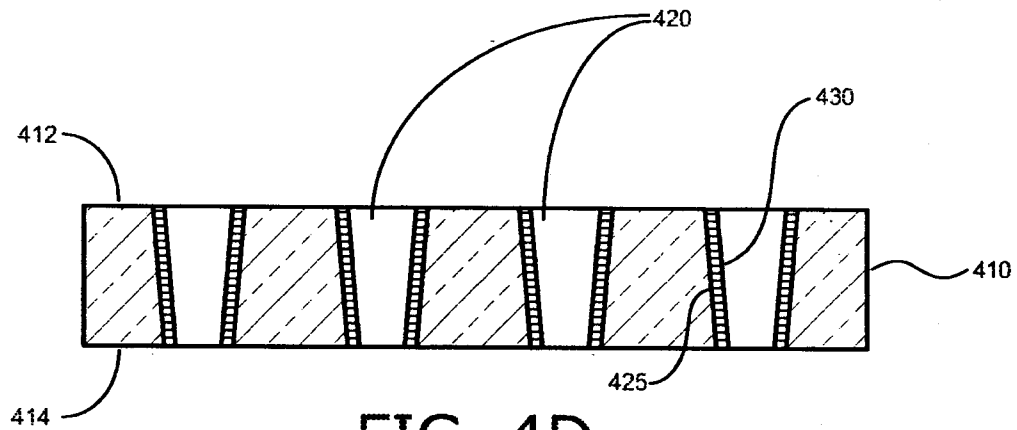


FIG. 4D

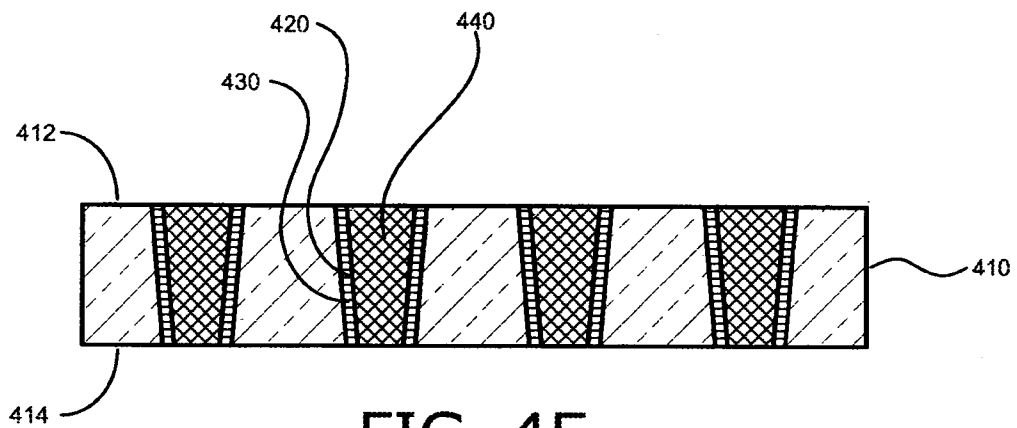


FIG. 4E

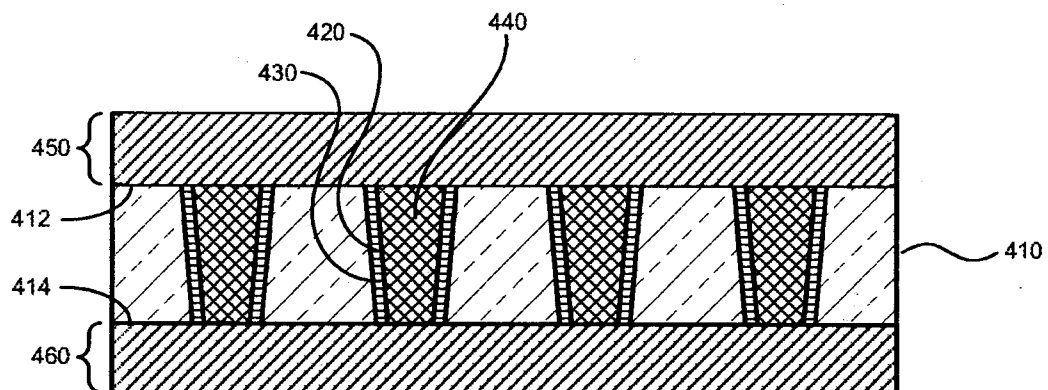
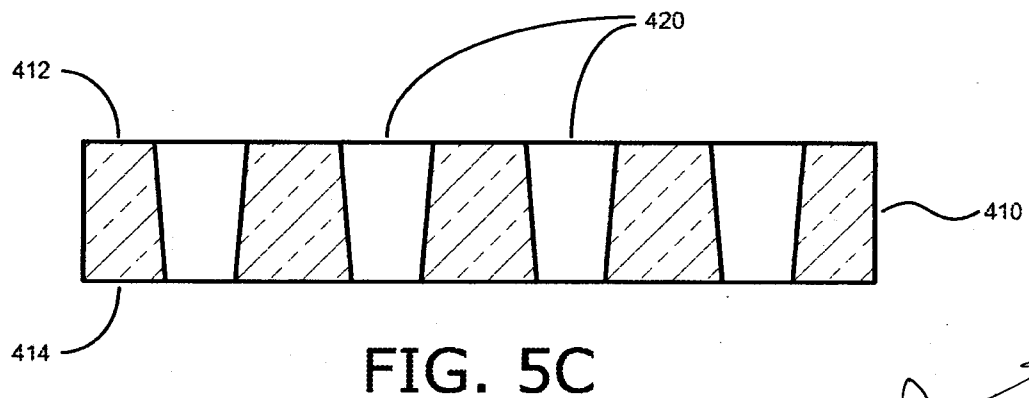
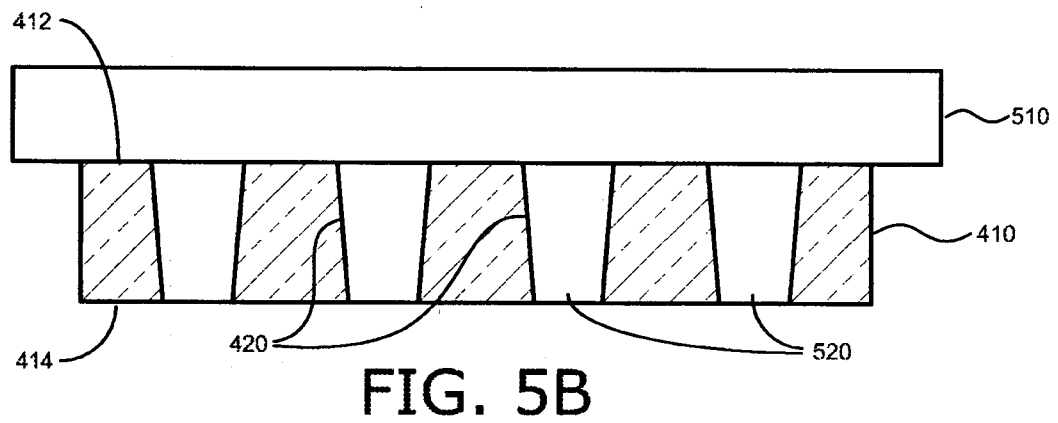
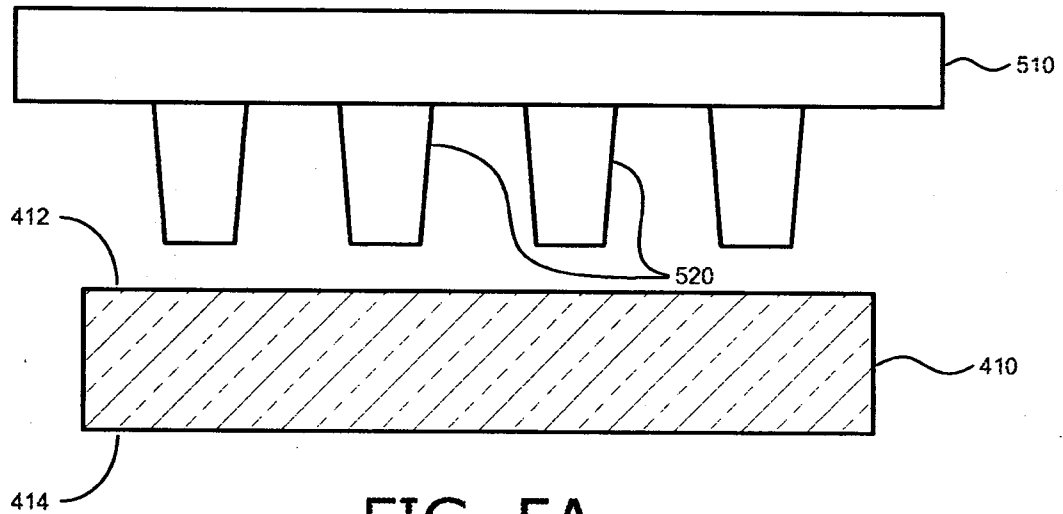


FIG. 4F

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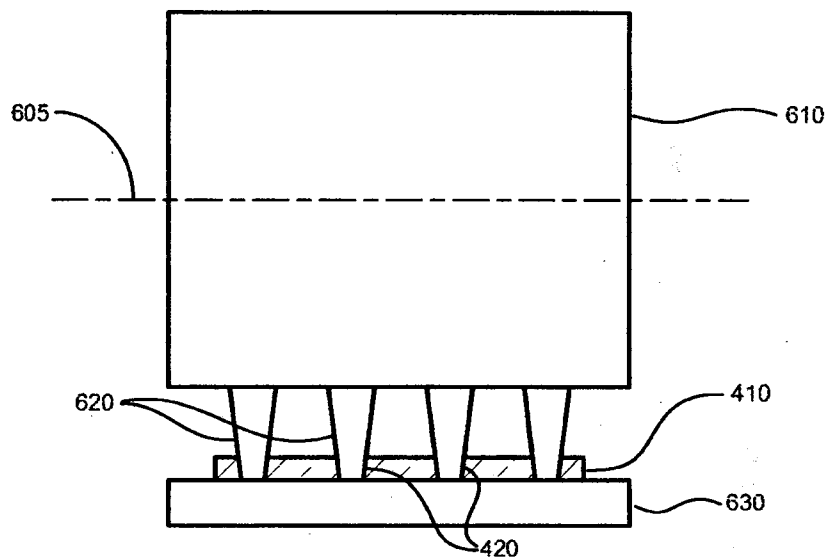
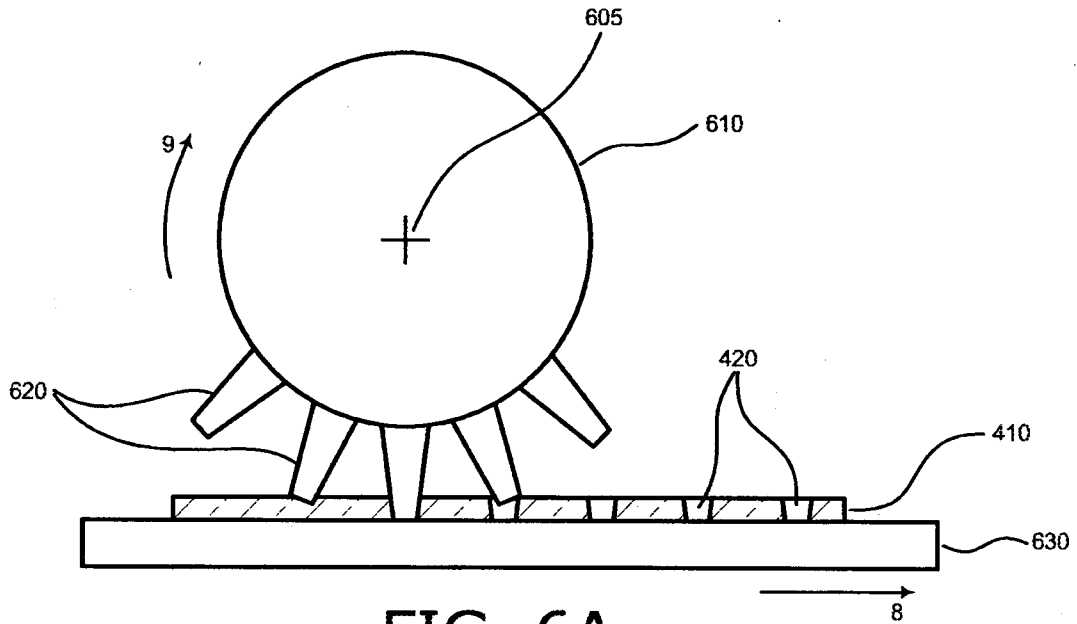
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(ASHISH K. SHARMA)
Of SUBRAMANIAM, NATARAJ & ASSOCIATES
ATTORNEYS FOR THE APPLICANTS

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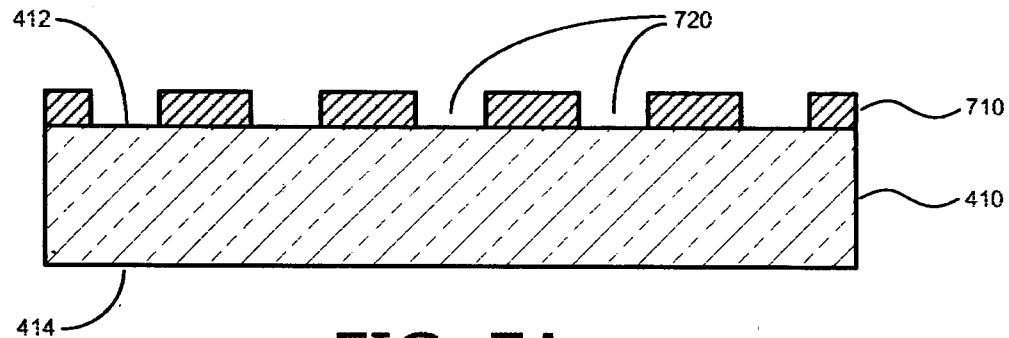


FIG. 7A

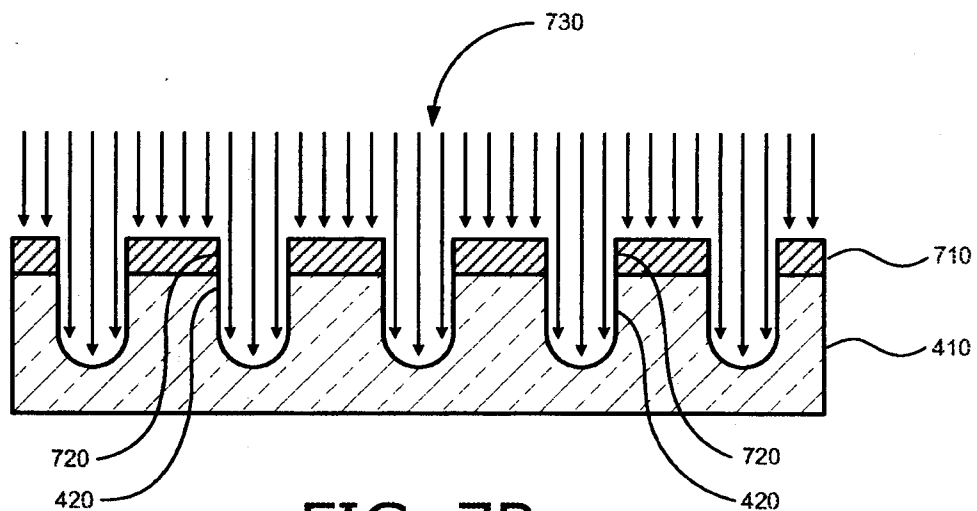


FIG. 7B

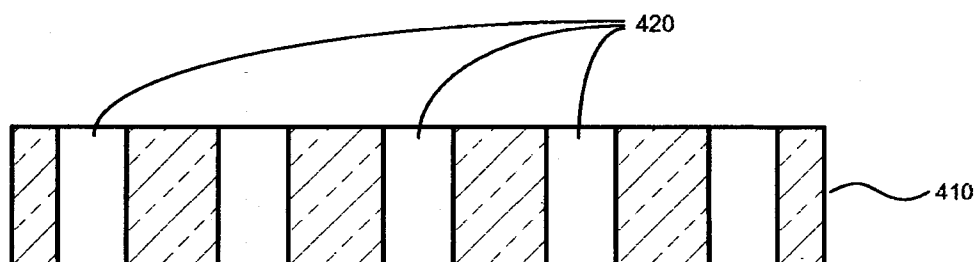


FIG. 7C

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(ASHISH K. SHARMA)
Of SUBRAMANIAM, NATARAJ & ASSOCIATES
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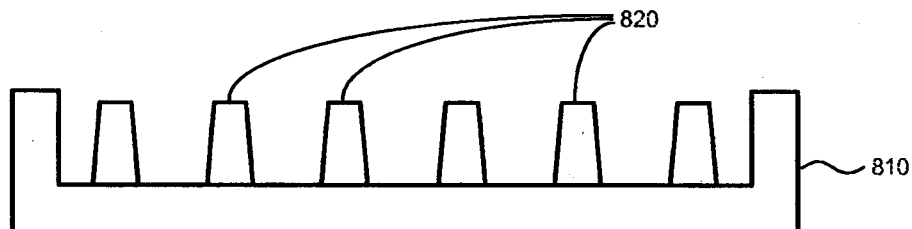


FIG. 8A

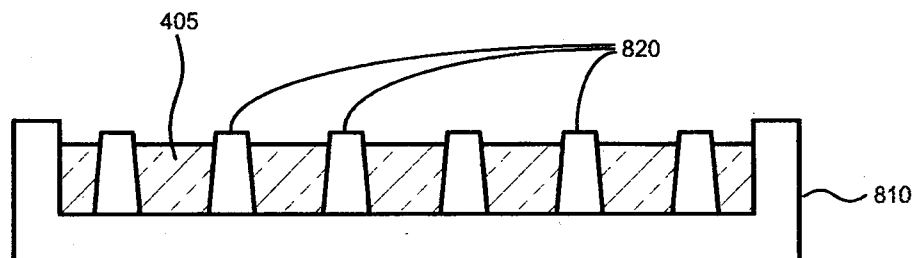


FIG. 8B

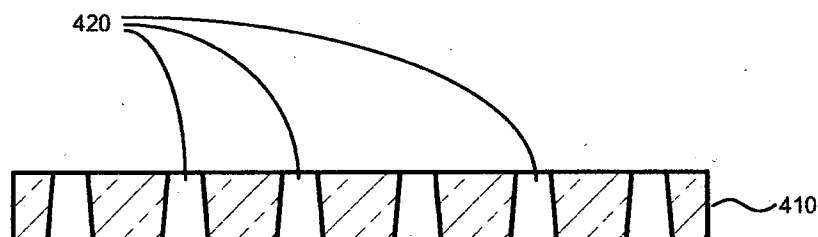


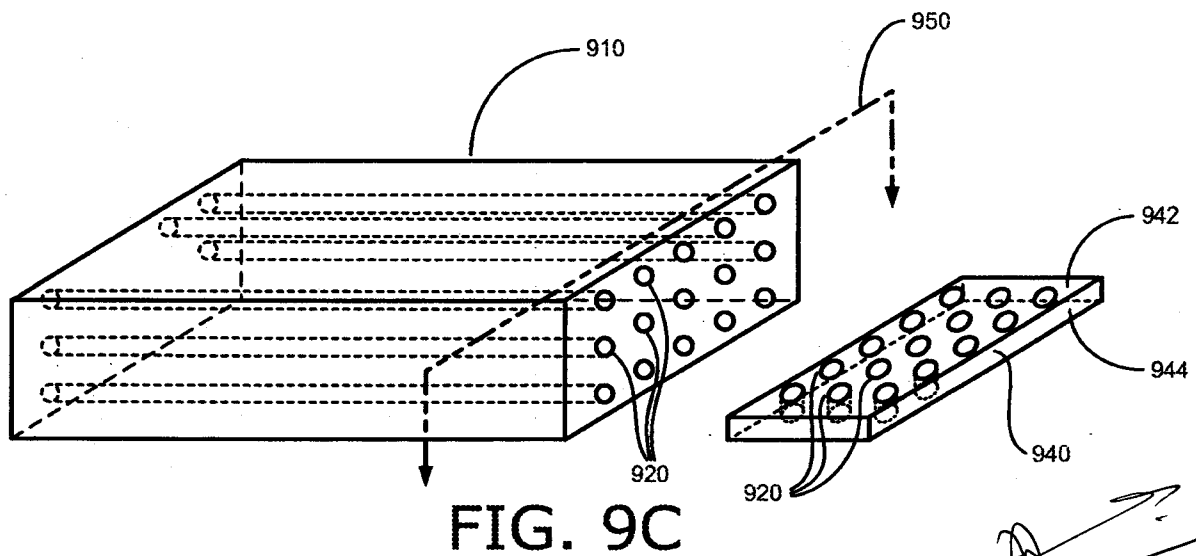
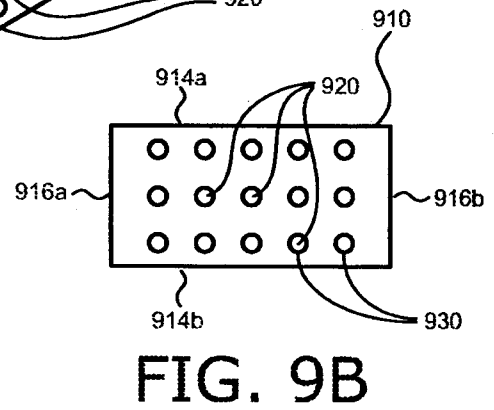
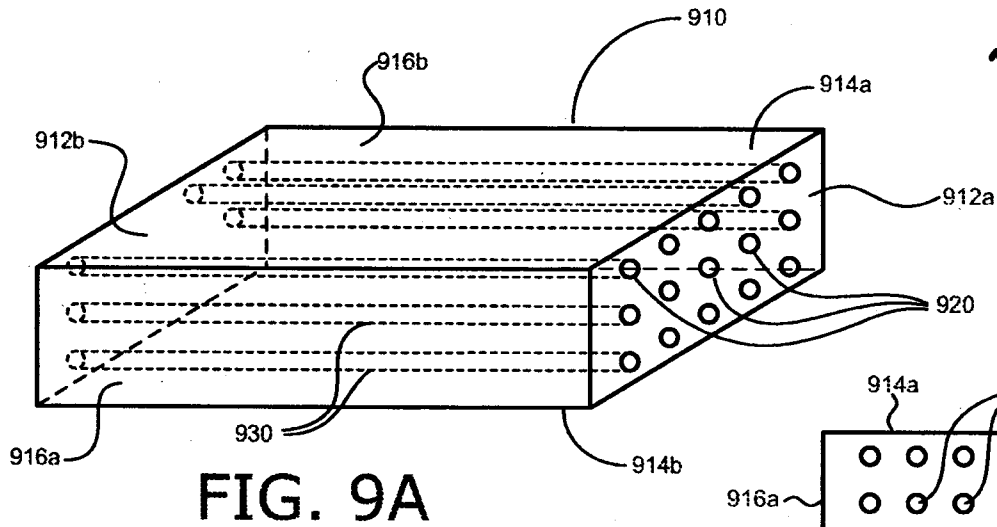
FIG. 8C

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(ASHISH K. SHARMA)
Of SUBRAMANIAM, NATARAJ & ASSOCIATES
ATTORNEYS FOR THE APPLICANTS

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Of SUBRAMANIAM, NATARAJ & ASSOCIATES
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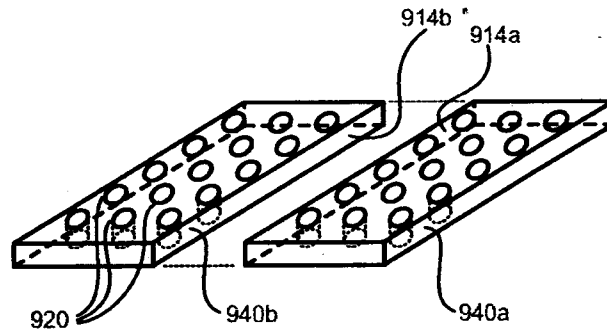


FIG. 10A

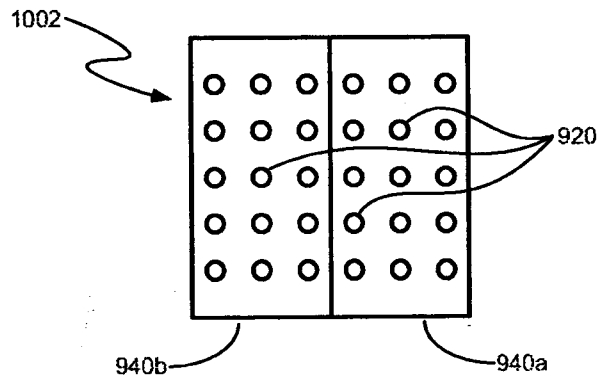


FIG. 10B

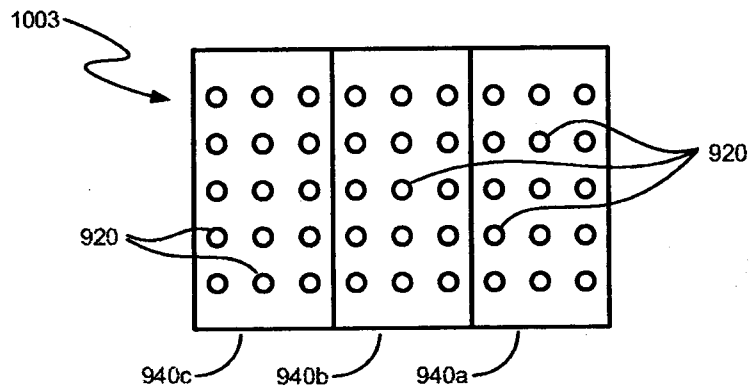


FIG. 10C

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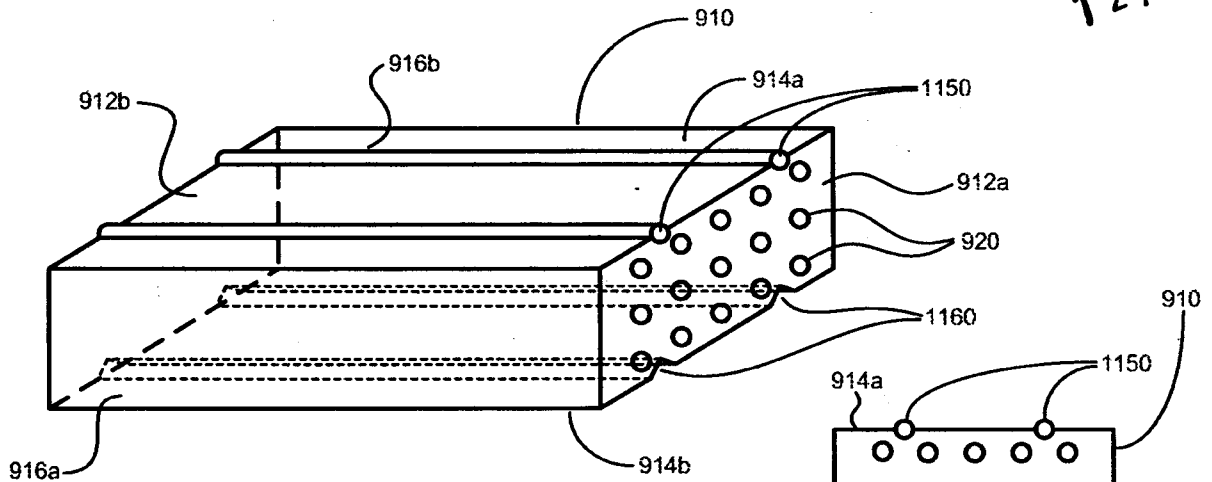


FIG. 11A

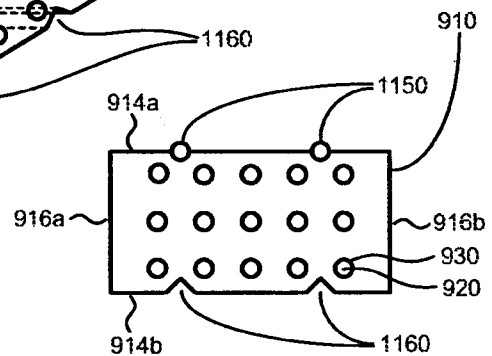


FIG. 11B

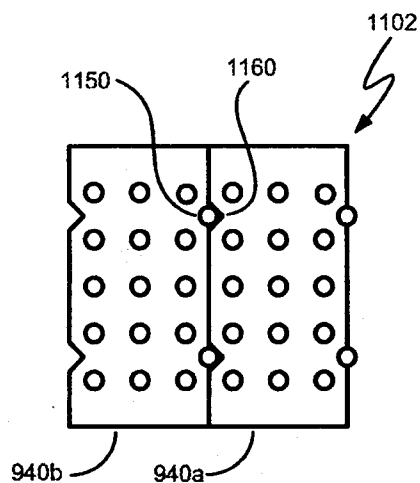


FIG. 11C

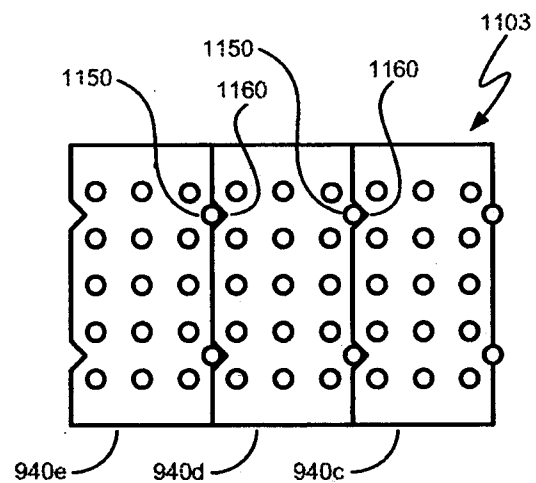


FIG. 11D

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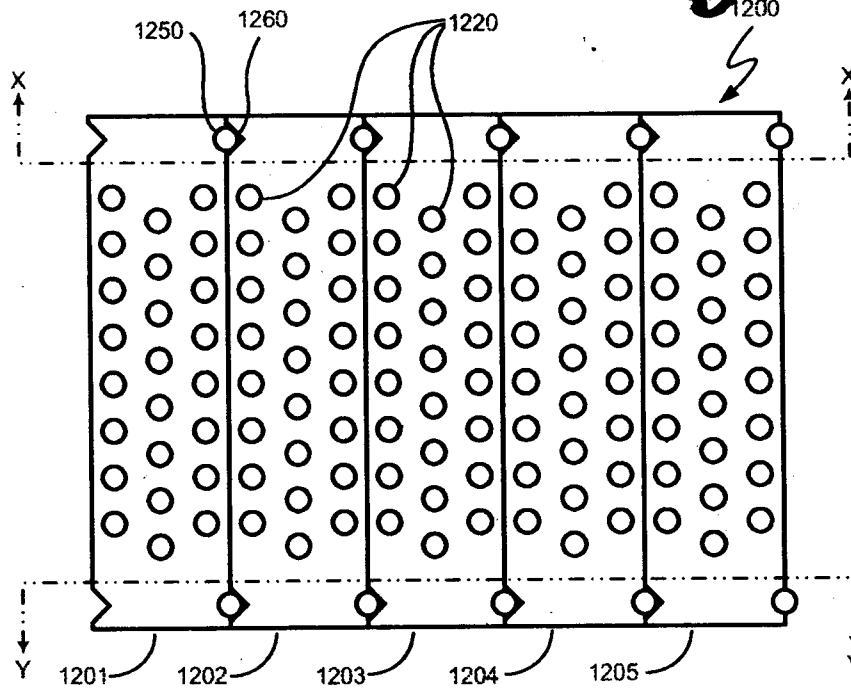


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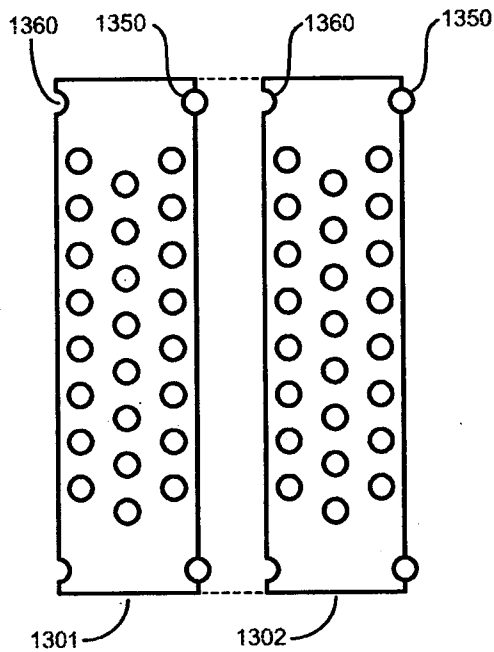


FIG. 13

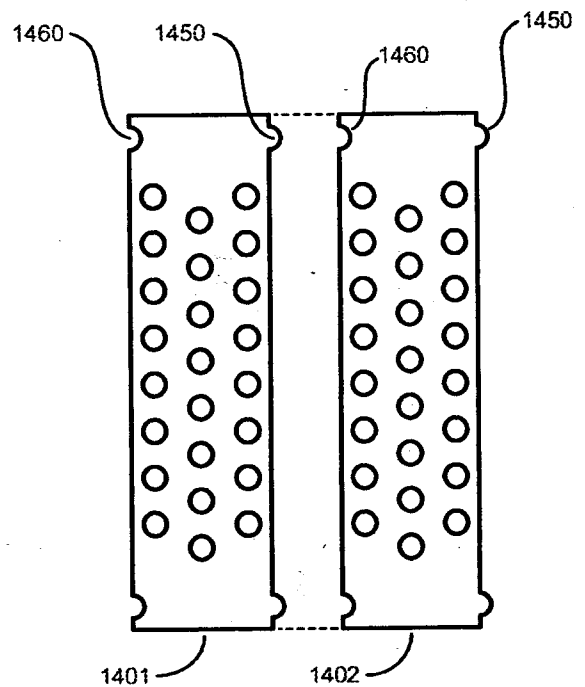


FIG. 14

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