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Declarations under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

— *of inventorship (Rule 4.17(iv))*

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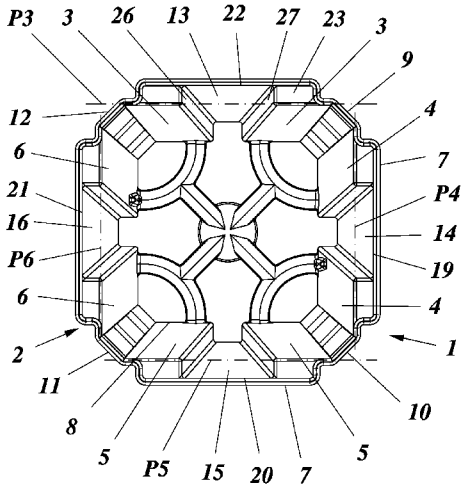
(54) **Title**: A CELL AND A TRAY FOR PLANT PROPAGATION

FIG. 6



(57) **Abstract**: A cell (1) for a seedling tray has a tubular body (2) with cell sides (3-6) forming an open upper end (7) and an at least partly open lower end (8) and cell corner portions (9-12) between each of said cell sides, whereby inwardly facing channels (13-16) extend along said cell sides from the upper end and to the lower end of the cell and are provided at least mainly outside a main plane (P3-P6) of the respective cell side. Trays for such cells are also provided.

A cell and a tray for plant propagation

TECHNICAL FIELD

The present disclosure generally concerns the propagation of plants in individual compartments in a plant tray.

BACKGROUND

For the growing of seedlings and cuttings forest nurseries employ different types of trays that generally consist of rows of cells gathered in a frame. The trays may either be manufactured in one piece, i.e. with the cells being formed integral with each other as well as with a tray frame, or may consist of a frame with openings in which separate, loose cells may be received and supported to complete the tray. The use of frames having separate cells especially creates an advantageous possibility of providing a flexible system wherein frames may be used in combination with different cell types within the system. Within both of the above indicated major categories the choice of the specific type of tray design may be determined for instance by the species to be grown, the climate conditions, etc.

For some time now it has been common to design frames and cells to promote effective and environmental friendly air pruning of the propagated plants. Some existing frame and cell systems have specifically set out to optimize the conditions for general aeration and air pruning of the plants by providing adequate ventilation around upper cell ends in a frame and by additionally providing appropriate slits in the cell side walls. Inwardly projecting guide structures have also been added to cell configurations to assist guiding plant roots in the cells.

In spite of successful efforts that have been made within this field, there is still a desire to further improve the results. The existing systems, whether having trays with separate or with integrated cells, make use of cells with a restricted cultivation area. This may cause root development problems. One general desire would be to have plant propagation cells enabling the development of a larger and stronger root ball while still providing adequate ventilation and maintaining appropriate root guiding. Providing a larger, stronger root ball would in turn promote positive root development.

SUMMARY

A general object is to provide a solution to the described problem.

A specific object is to provide an improved cell for a plant propagation tray, having a generally tubular body with cell sides forming an open upper end and an at least partly open lower end and cell corner portions between each of the cell sides.

Another object is to suggest a plant propagation tray for receiving separate improved cells.

A further object is to suggest a plant propagation tray with improved cells integrated therein.

These and other objects are met by embodiments as defined by the accompanying claims.

In a first aspect the present technology generally relates to a cell for a plant propagation tray, comprising a generally tubular body with cell sides forming at least partly open upper and lower ends of the cell and cell corner portions between each of the cell sides. In a basic configuration inwardly facing channels extend along the cell sides generally from an area of the upper end and to an area of the lower end of the cell and are provided at least mainly outside a main plane of the respective cell side.

In another aspect the technology relates to a plant propagation tray having a frame with plant receiving openings. In a basic configuration a cell of the present technology is received in each tray opening, with support tabs of the cells being supported on tray frame support lugs.

In a further aspect the technology relates to a plant propagation tray for receiving plants. In a basic configuration fixed cells of the present technology are integrated in a distributed pattern in the plant propagation tray.

These basic configurations present the advantages of:

- effectively increasing the cell volume; thereby
- increasing the water uptake area of the cell; and
- allowing for effective ventilation; while
- allowing cells to be received in existing tray structures of standard dimensions.

Preferred further developments of the basic technology as well as embodiments thereof are specified in the dependent subclaims.

Advantages that are offered in addition to those described above will be readily appreciated upon reading the below detailed description of embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention and its further objects and advantages will be best understood by reference to the following description taken together with the accompanying drawings, in which:

Fig. 1 is a top plan view of a prior art plant propagation tray;

Fig. 2 is a top perspective view of another prior art plant propagation tray;

Fig. 3 is a bottom perspective view of a first embodiment of a separate plant propagation cell of the present invention;

Fig. 4 is a top perspective view of the plant propagation cell embodiment of Fig. 3;

Fig. 5 is a side view of the plant propagation cell embodiment of Figs. 3 and 4;

Fig. 6 is a top view of the plant propagation cell embodiment of Figs. 3 and 4;

Fig. 7 is a bottom view of the plant propagation cell embodiment of Figs. 3 and 4;

Fig. 8 is a bottom perspective view of a second embodiment of a separate plant propagation cell of the present invention;

Fig. 9 is a top perspective view of the plant propagation cell embodiment of Fig. 8;

Fig. 10 is a partial illustration of separate plant propagation cells of the invention supported in a plant propagation tray; and

Fig. 11 is a partial illustration of fixed plant propagation cells of the invention integrated in a plant propagation tray.

DETAILED DESCRIPTION

The present technology will now be explained with reference to exemplifying embodiments of plant propagation cells as well as plant propagation trays for receiving or incorporating such cells. The embodiments relate to an application of the present technology primarily to the propagation of plants in forest nurseries. However, the present technology is equally well suited for application to other environments and for other types of plant trays. It is therefore emphasized that the illustrations are for the sole purpose of describing preferred embodiments and are not intended to limit the invention to details or to any specific field of application thereof. The plant propagation trays that are schematically illustrated in Figs. 1, 2, 10 and 11 are only given as examples of an environment where the present technology may be applied. Thus, the illustrations are for the sole purpose of describing preferred embodiments of the present technology and are not intended to limit the technology to details or to any specific field of application. It shall be realized that the disclosure covers the incorporation of features related to other applications and any combination of features disclosed herein.

In use, cells of the general type discussed herein are intended for receiving a substrate and a seedling or cutting (not illustrated on the drawings) therein. In Fig. 1 is illustrated a tray 330 of a known configuration having a base frame 331 with uniformly distributed openings 332. The openings 332 are provided for receiving a respective cell or insert 301 being supported with support knobs 321 thereof on corresponding support lugs 333 of the tray base frame 331. In Fig. 2 is illustrated an alternative tray 430 likewise consisting of a frame 431. In this case cells 401 are integrated in a distributed pattern in the tray 430 frame 431, forming its openings 432.

With specific reference to Figs. 3-7 the separate type propagation tray cells 1 are formed as a generally tubular body 2, having a basically square cross-section (see Fig. 6). The body 2 is formed by four sides 3, 4, 5 and 6 that are each separated by a flattened corner or corner portion 9, 10, 11 and 12 and that each extend from an entirely open upper end 7 to a partially open lower end 8. The sides 3-6 as well as the corners 9-12 of the cell body 2 taper from the open upper end 7 towards the partially open lower end 8 to enable easy stacking of the cells and also to facilitate removal of a seedling and substrate, not illustrated, from the cell for transplanting purposes. As was mentioned, the lower end 8 of the cell 1 is here partially open, having a generally cross-shaped bottom structure formed by corner apertures 28 and central apertures 29 (see Fig. 7).

However, depending upon the substrate and partly upon the manner in which a plant is to be removed from the cell the bottom may have a different design and may even be entirely open.

In this type of separate cell 1 configuration outwardly directed cell supporting and positioning knobs 23 are provided at distributed locations around the upper end 7 of the cells 1 to support the cells at their open top, while still allowing free access for air to the interior of an associated tray 30 illustrated schematically and partially in Fig. 10. The depicted tray 30 of Fig. 10 corresponds to that of Fig. 1 so that the cells 1 are supported in tray openings 32 of a tray frame 31 with their support knobs 23 engaging and being supported by corresponding support lugs 33 of the frame 31. Such a design provides excellent support for and stabilization of the cells in such a tray structure accommodating the cells. The tray structure may be of any other conventional type provided with corresponding openings or apertures for the insertion of the cells.

Drying out problems and related stress and bacterial infection problems may be experienced with species being sensitive to drying out. In order to avoid such problems there may also be provided a previously known dam 18 at the cell edge or rim at the upper end 7 of the cell 1. This dam 18 is preferably in the shape of a damming barrier wall that will assist in increasing the collection and retaining of applied irrigation water and fertilizer in the cell 1.

As described so far the cell or insert 1 is of a known design for use with a conventional type of plant propagation tray 30. However, in accordance with the present invention said basic design has been further developed and improved, as will now be described in detail.

With specific reference again to Figs 3-7 and 10 the first, basic configuration of a cell 1 of the invention is intended for use in the above briefly described plant propagation tray 30 of a generally conventional, existing type. In such an embodiment the cell 1 is a separate part intended to be received in the respective opening 32 of the plant propagation tray 30 frame 31, as is partially shown in Fig. 10. With cells 1 being received in the openings 32 the above mentioned tray support knobs 23 are supported on corresponding support lugs 33 of the tray frame 31 as described. The cell 1 has the briefly described generally tubular body 2 with cell sides 3-6 forming the upper end 7 and the lower end 8 of the cell and the cell corner portions 9-12 between each of said cell sides 3-6.

The now suggested plant propagation cell 1 further has inwardly facing or open channels 13-16 that extend along the respective cell sides 3-6 generally from an area of the upper end 7 and to an area of the lower end 8 of the cell 1. The channels 13-16 project generally outwardly from the cell sides 3-6 and are thus provided with a bottom wall 19-22 thereof outside a main plane P3-P6 (see Fig. 6) of the respective cell sides 3-6. The tray support knobs 23 are likewise provided outside the main plane P3-P6 of the respective cell side 3-6. They are provided on each side of the respective channel 13-16, between said channels and the adjacent cell corner portions 9-12. The channels 13-16 are designed having a generally box-like cross section with side edges 26, 27 (only those of the channel 13 are denoted in Fig. 6). These side edges 26, 27 of the channels 13-16 are provided generally perpendicular to both the bottom wall 19-22 of the respective channels and to the adjacent cell 1 sides 3-6. Being provided centrally on each side 3-6 of the cell 1 and with their side edges 26, 27 sharply meeting the associated channel bottom wall 19-22, the channels 13-16 do not only add extra volume to the cell. With this design they rather also provide protection against horizontally growing roots causing "root spiraling".

The inwardly facing channels 13-16 extend along the full extension of the respective cell sides 3-6, from the upper end 7 to the lower end 8 of the cell 1. As mentioned above they are preferably provided in a longitudinally central area of the cell sides 3-6. The channels 13-16 thus divide the respective cell sides approximately in half, into two separate generally flat side wall parts 3-3, 4-4, 5-5 and 6-6, respectively, provided on either side of the respective channel 13-16. With the disclosed configuration the inwardly facing channels 13-16 are open-ended at said upper 7 and lower 8 ends of the cell 1. Also, the described dam 18 extends around the entire outer circumference of the upper cell end 7, including along the outer bottom wall 19-22 of each channel 13-16.

As was mentioned above it is common that the cell 1 sides 3-6 taper from a wide upper cell end 7 towards a narrower lower cell end 8. In the suggested cell 1 the channels 13-16 will in such cases likewise taper towards the lower cell end 8. Moreover the cell corner portions 9-12 are in this embodiment provided with at least one open corner slit 24, 25. In the illustrations two slits 24, 25 are provided at different height along the respective corner portion 9-12.

The described cell configuration with outwardly projecting channels or outer "boxes" makes it possible to make the cell larger than before while still fitting in an existing tray frame. Actually, the useable cross section area of the cell is increased all along its height. This results in a larger cell volume compared to that of conventional cells fitting in a given type of tray with "single cell frame" and equipped with "cell supporting/positioning knobs". Such cells are preferably used for cultivating plants with vertical ventilation around the cells and through the actual plants. Both features are of importance for the quality and vitality of the cultivated plants. In addition to the increased cell volume the described configuration with the full length open channels simultaneously contributes to maintaining a considerable open area securing good ventilation characteristics. In other words, the supported cells do not close the entire top surface when positioned in the frame. The described cell design does also promote positive root development by preventing vertically growing roots in the channels or boxes from twisting. Instead, the roots are guided towards the cell corners where the slits may be provided.

In Figs. 8 and 9 is briefly illustrated an alternative second embodiment of a separate plant propagation cell 101 according to the invention. This alternative cell 101 is identical to the first basic cell embodiment of Figs. 3-7 except that the cell corner portions 109-112 are continuous. In other words, there are not provided any slits in the corner portions 109-112. Such an embodiment may be appropriate for some specific conditions and/or plant types.

Through the entire specification the expression "cell" is intended to cover not only the separate cells that are illustrated in Figs. 3-10 and that are intended to be individually received in a respective opening 32 of a tray 30 frame 31 of the general type illustrated in Fig. 10. It likewise covers an alternative embodiment where fixed cells of the described configuration form integral parts of a seedling tray, as in the conventional tray illustrated in Fig. 2. This alternative embodiment of the present technology is schematically illustrated in connection with the partly illustrated plant propagation tray 230 of Fig. 11. In this case the complete plant propagation cell 201 is an integrated part of a plant propagation tray frame 231. The plant propagation tray 230 includes the tray frame 231 wherein the fixed cells 201 having the suggested channels of the invention are integrated. The fixed cells 201 are provided in a distributed pattern (only partially shown) in the plant propagation tray 230, forming the tray openings 232 in the tray base frame 231. The fixed cells 201 may also in this case be provided with a surrounding dam 218 extending around the entire outer circumference of the cells 201.

In alternative, but not specifically illustrated embodiments of the invention variations of the different illustrated parts of the inventive units may be employed without departing from the scope of the invention. An example of this is varying the number of and specific positioning of the provided corner slits. Likewise, the configuration of the cell bottom may be varied for specific circumstances and/or applications of the invention. It shall also be emphasized that although the invention has been described and illustrated with specific reference to the propagation of seedlings and cuttings in forest nurseries, the invention is in no way restricted to such applications. The basic principles of the invention may be applied to other areas within the general field of plant propagation.

The present technology has been described in connection with embodiments that are to be regarded as illustrative examples thereof. It will be understood by those skilled in the art that the present technology is not limited to the disclosed embodiments but is intended to cover various modifications and equivalent arrangements. The present technology likewise covers any feasible combination of features described and illustrated herein. The scope of the present technology is defined by the appended claims.

PATENT CLAIMS

1. A cell (1; 101; 201) for a plant propagation tray (30; 230; 330; 430), comprising a generally tubular body (2) having cell sides (3-6) forming an open upper end (7) and an at least partly open lower end (8) of the cell, and cell corner portions (9-12) between each of said cell sides, **characterized by** inwardly facing channels (13-16) extending along said cell sides generally from an area of the upper end and to an area of the lower end of the cell and being provided generally outside a main plane (P3-P6) of the respective cell sides.

2. A cell (1; 101; 201) according to claim 1, **characterized in** that the inwardly facing channels (13-16) are extended along the full extension of the respective cell sides (3-6) in a longitudinally central area thereof, dividing the respective cell sides approximately in half, into two separate side wall parts (3-3, 4-4, 5-5 and 6-6).

3. A cell (1; 101; 201) according to claim 1 or 2, **characterized in** that the inwardly facing channels (13-16) are open-ended at said upper (7) and lower (8) ends of the cell.

4. A cell (1; 101; 201) according to any of claims 1-3, **characterized by** a dam (18; 218) extending around the entire outer circumference of the upper cell end (7), including along an outer bottom wall (19-22) of each channel (13-16).

5. A cell (1; 101; 201) according to any of claims 1-4, wherein the cell sides (3-6) taper from a wide upper cell end (7) towards a narrow lower cell end (8), **characterized in** that the channels (13-16) likewise taper towards the lower cell end (8).

6. A cell (1; 201) according to any of claims 1-5, **characterized in** that the cell corner portions (9-12) have at least one open corner slit (24, 25).

7. A cell (101) according to any of claims 1-5, **characterized in** that the cell corner portions (9-12) are continuous.

8. A cell (1; 101) according to any of claims 1-7 being a separate part for being received in an opening (32) in a frame (31) of a plant propagation tray (30), **characterized in** that tray support knobs (23) are provided outside the main plane (P3-P6) of the respective cell side (3-

6), on each side of the respective channel (13-16), between said channels and the adjacent cell corner portions (9-12).

9. A cell (201) according to any of claims 1-7, **characterized in** that the complete cell (201) is an integrated part of a plant propagation tray frame (230).

10. A plant propagation tray (30) having a frame (31) with openings (32) for receiving plants, **characterized in** that a cell (1; 101) according to claim 8 is received in each of said openings, with the tray support knobs (23) being supported on corresponding support lugs (33) of the tray frame (31).

11. A plant propagation tray (230) for receiving plants, **characterized in** that fixed cells (201) according to any of claims 1-7 are integrated in a distributed pattern in the plant propagation tray.

- - - -

FIG. 1
PRIOR ART

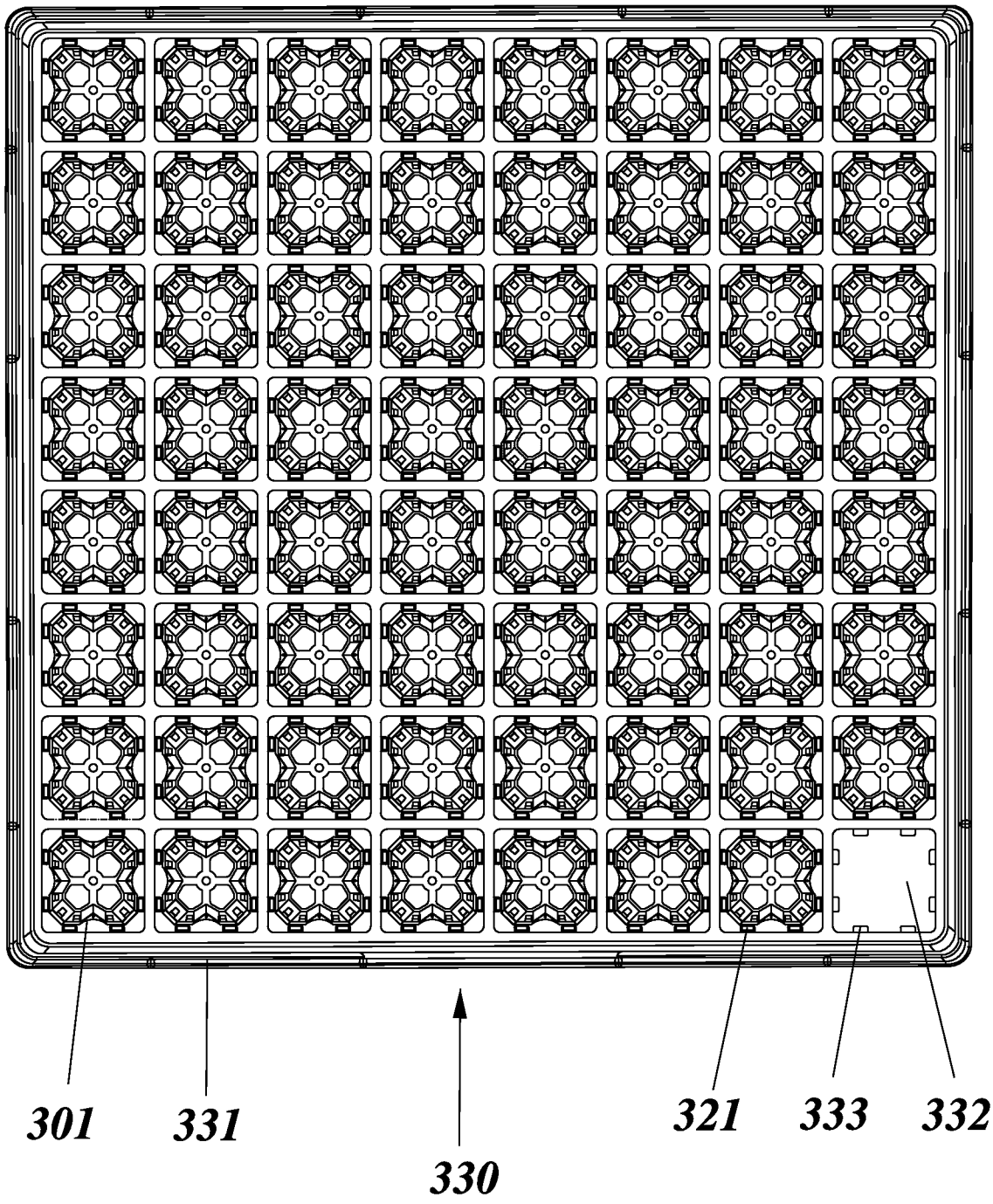


FIG. 2
PRIOR ART

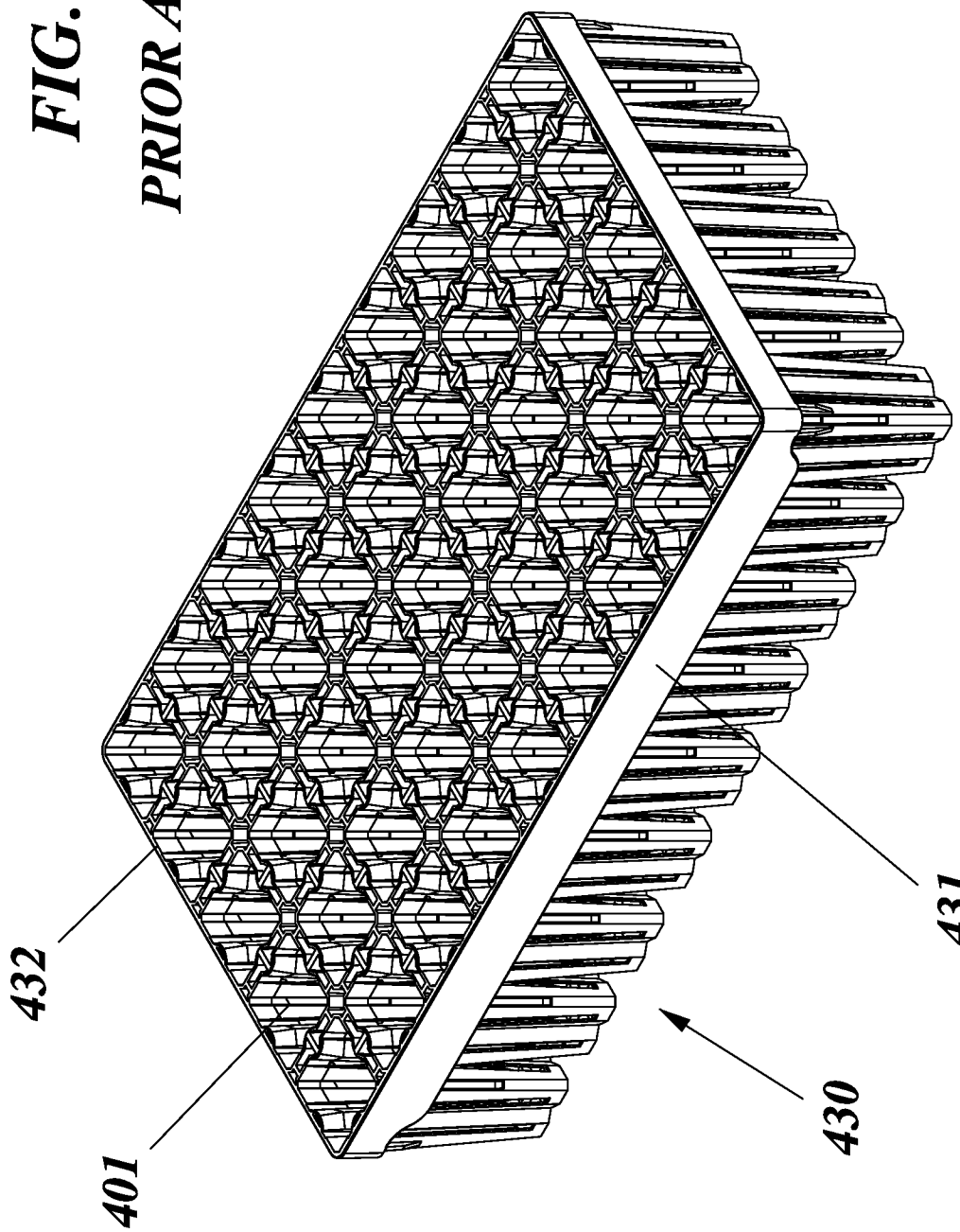


FIG. 4

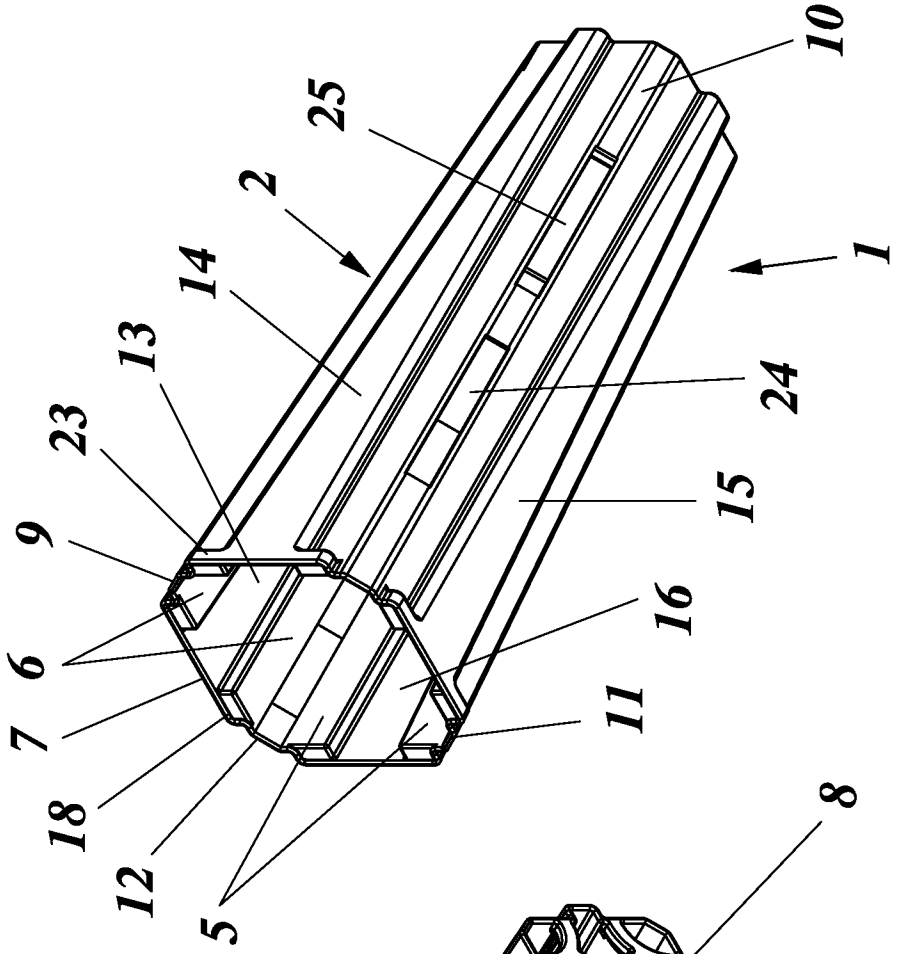


FIG. 3

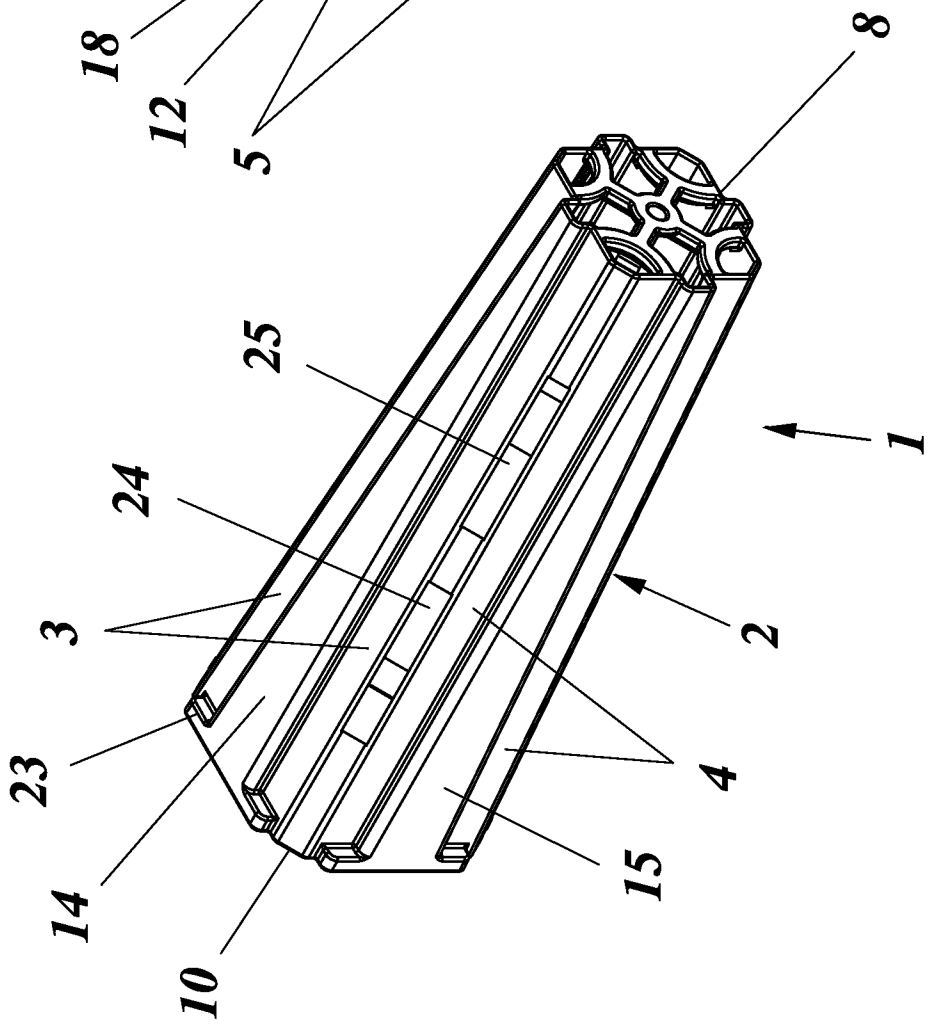


FIG. 5

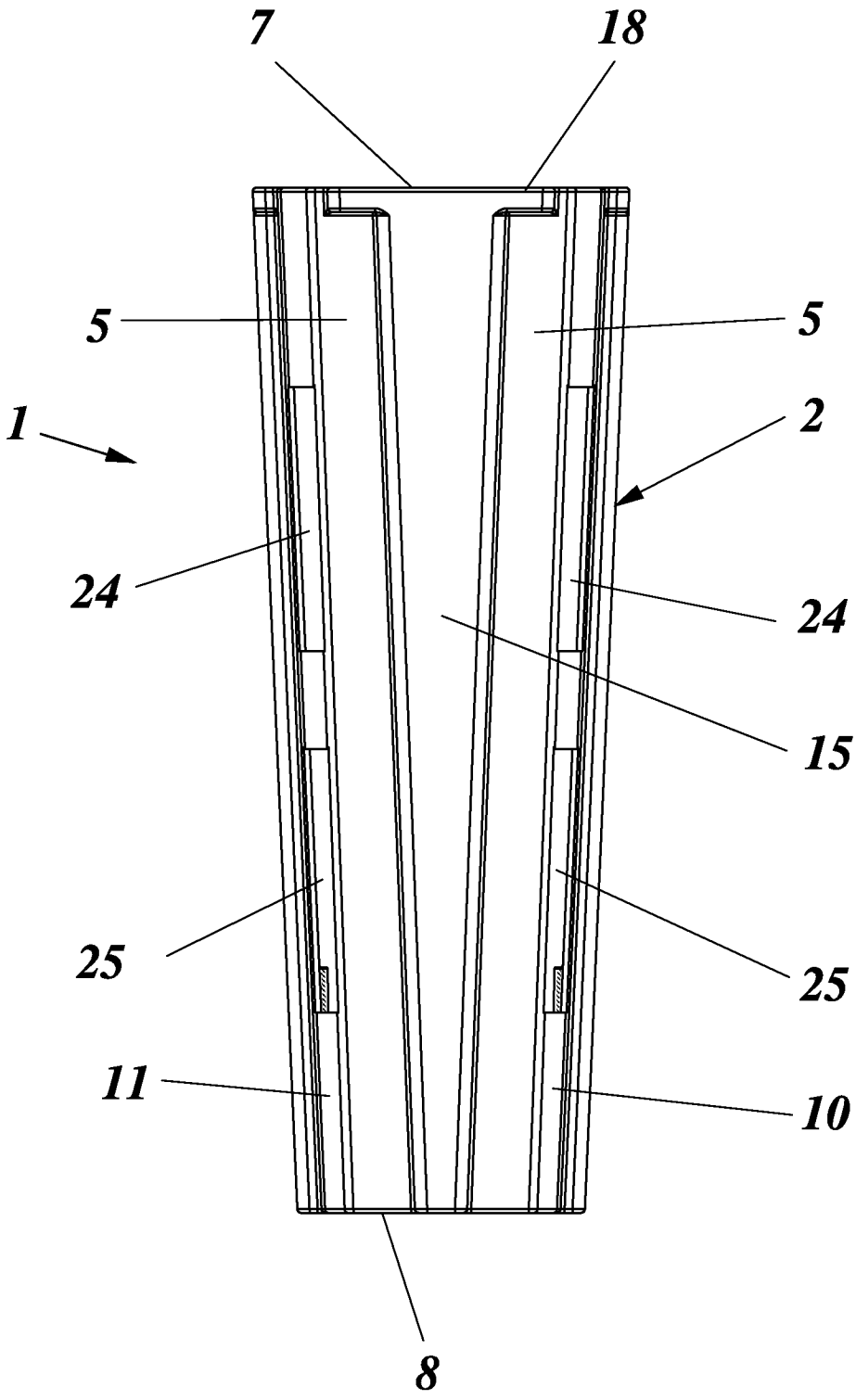


FIG. 6

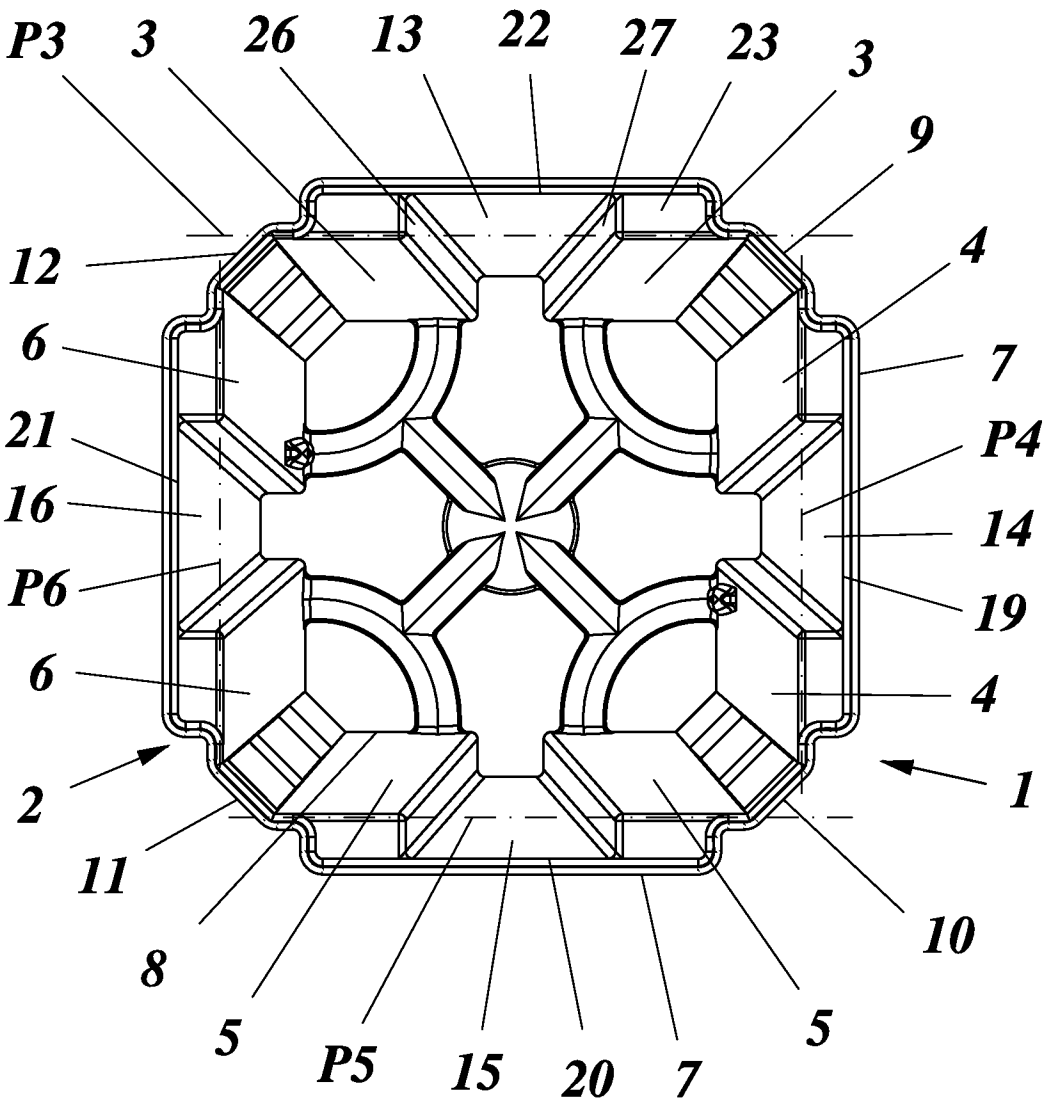

P3
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FIG. 7

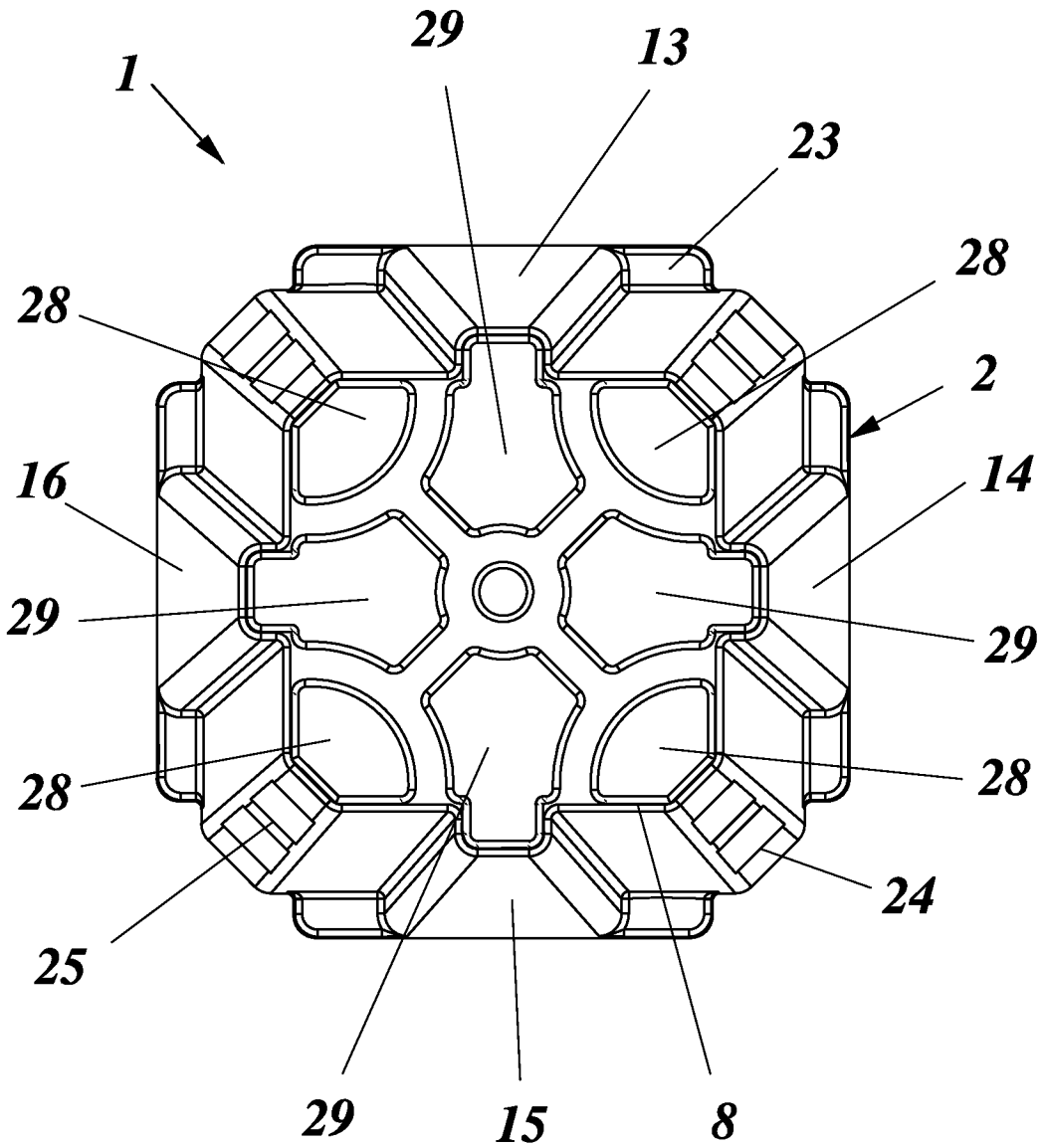

FIG. 9

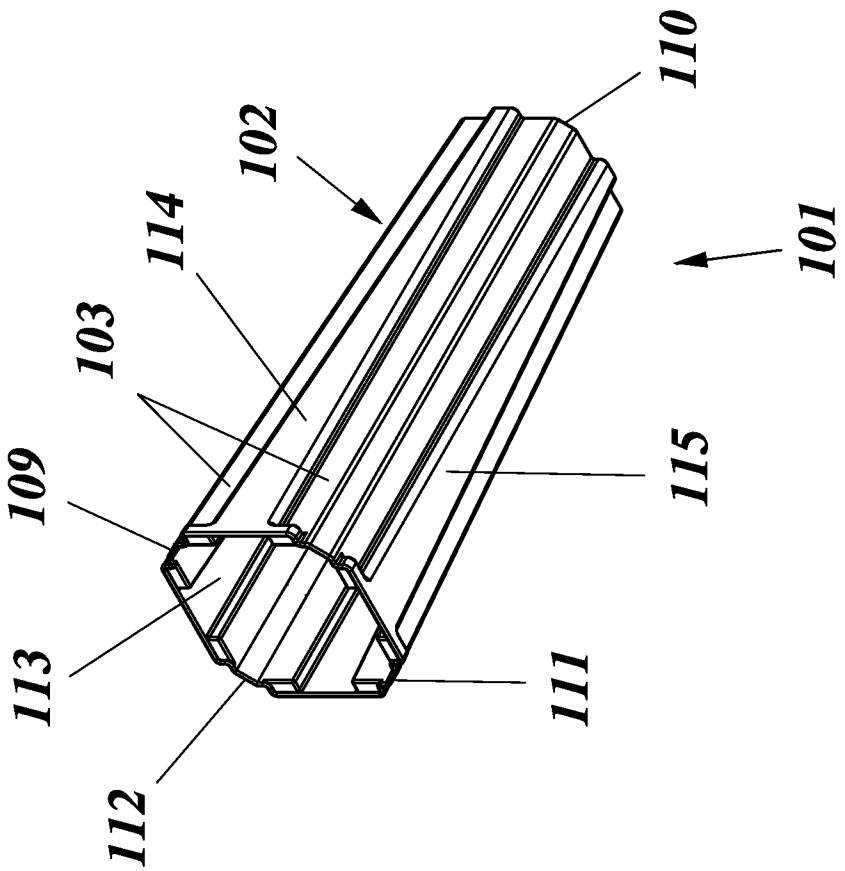
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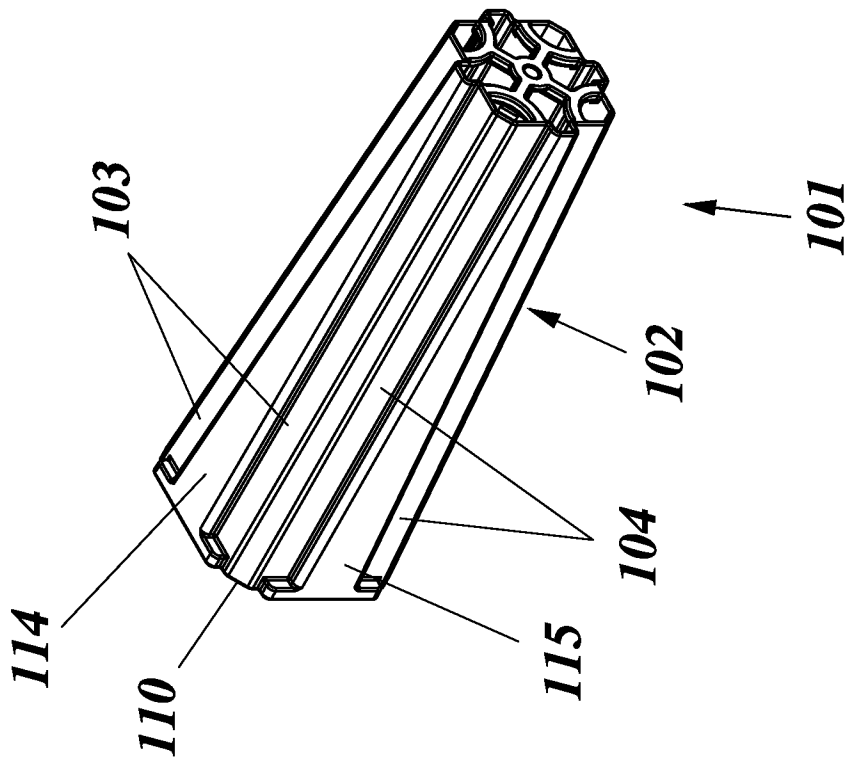
FIG. 8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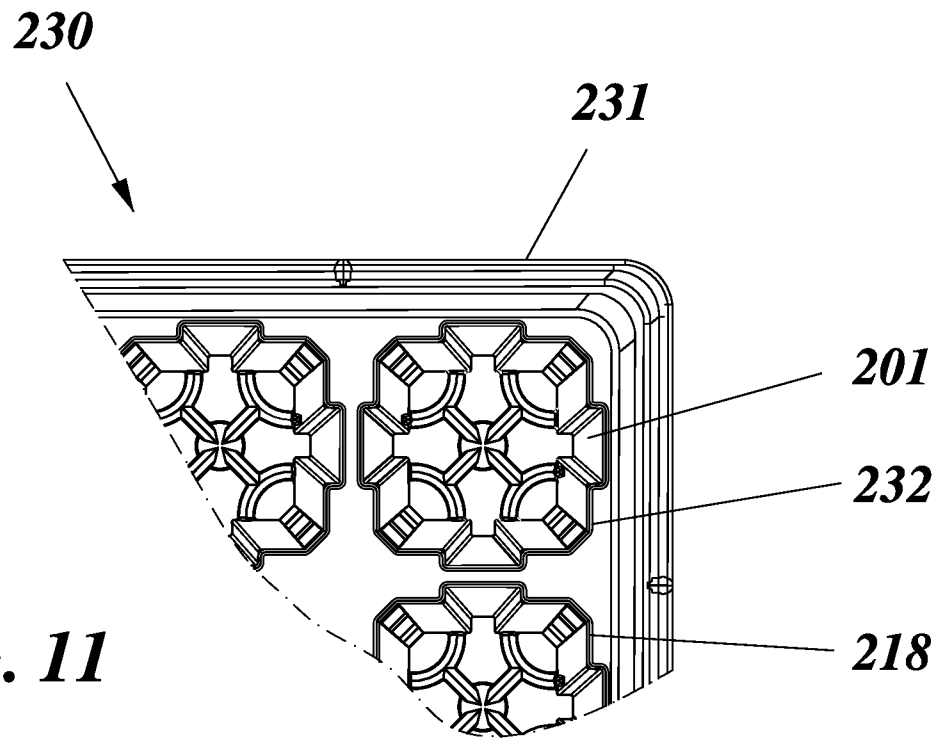

FIG. 11

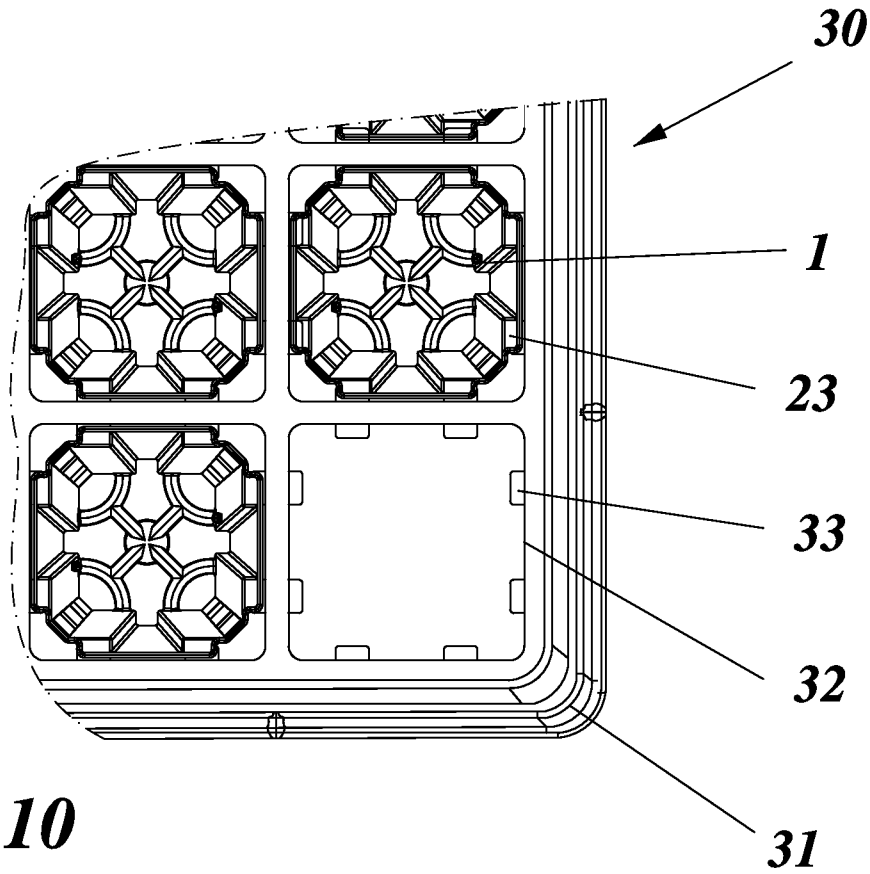

FIG. 10

INTERNATIONAL SEARCH REPORT

International application No.
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A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: A01G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE, DK, FI, NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, PAJ, WPI data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	AU 2004201547 A1 (TRANSPLANT SYSTEMS LTD), 13 January 2005 (2005-01-13); page 7, line 24 - page 8, line 2; page 14, line 13 - page 15, line 5; figures 1-7; claims 1, 2	1-7, 9, 11
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X	US 6266921 B1 (KESKILOHKO ALTTI), 31 July 2001 (2001-07-31); column 1, line 25 - line 37; column 3, line 35 - column 4, line 22; figures	1-6
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X	WO 9823143 A1 (FENN CHRISTOPHER ANTHONY), 4 June 1998 (1998-06-04); page 7, line 18 - page 8, line 13; figures 1,2,5	1-5, 7
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☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
18-09-2012	18-09-2012

Name and mailing address of the ISA/SE	Authorized officer
Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. + 46 8 666 02 86	Erik Dahlblom Telephone No. + 46 8 782 25 00

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

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PCT/SE2012/050103

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4510712 A (WHITCOMB CARL E), 16 April 1985 (1985-04-16); column 4, line 53 - column 5, line 24; figures 3,11,12	1-7, 9, 11
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A	US 6029399 A (MERCER WAYNE A), 29 February 2000 (2000-02-29); abstract; column 2, line 21 - line 31; figures 1A,1B	1-11
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International application No.
PCT/SE2012/050103

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International Patent Classification (IPC)

A01G 9/10 (2006.01)
A01G 9/02 (2006.01)

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AU	2004201547	A1	13/01/2005	NONE			
US	6266921	B1	31/07/2001	AU	4241199	A	24/02/2000
				AU	763871	B2	31/07/2003
				CA	2279010	A1	31/01/2000
				FI	109867	B1	31/10/2002
				FI	981684	A	01/02/2000
				NZ	336935	A	27/10/2000
				SE	9902689	L	01/02/2000
				SE	518241	C2	10/09/2002
WO	9823143	A1	04/06/1998	NONE			
US	4510712	A	16/04/1985	NONE			
US	6029399	A	29/02/2000	NONE			