



(51) International Patent Classification:

A01G 9/02 (2006.01) A01G 27/00 (2006.01)
A01G 27/02 (2006.01)

(21) International Application Number:

PCT/SG2016/050483

(22) International Filing Date:

30 September 2016 (30.09.2016)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

10201508138P 30 September 2015 (30.09.2015) SG

(71) Applicant: AEROSPRING GARDENS PTE. LTD.
[SG/SG]; 7 Pandan Valley, #09-502 Poinciana Tower,
Singapore 597631 (SG).

(72) Inventor: LINNEBERG, Thorben; 7 Pandan Valley,
#09-502 Poinciana Tower, Singapore 597631 (SG).

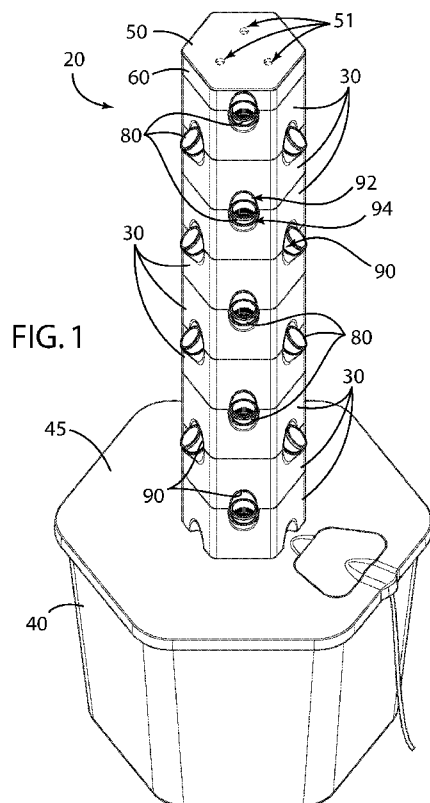
(74) Agent: BIRD & BIRD ATMD LLP; 2 Shenton Way,
#18-01 Sgx Centre 1, Singapore 068804 (SG).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

[Continued on next page]

(54) Title: AEROPONIC COLUMN



(57) Abstract: An aeroponic column comprises a base, a planter section attached to the base, wherein the planter section defines a hollow interior, a channel and plant holder openings adapted to receive a plant holder, a nutrient distributor attached over the planter section with fluid openings adapted to allow fluid to flow down the planter sections, and a conduit assembly operatively connected between the base and the nutrient distributor, and adapted to carry fluid from the base to the nutrient distributor. The conduit assembly comprises a conduit formed separate from the planter section, the conduit extends through the channel of the planter section, and the conduit has a male threaded first end and a female threaded second end.



Published:

— *with international search report (Art. 21(3))*

AEROPONIC COLUMN

This patent application claims priority benefit of Singapore patent application 10201508138P, filed on September 30, 2015.

FIELD OF THE INVENTION

[0001] This invention relates to aeroponic columns for growing plants, and more particular to improved aeroponic columns of simple, robust construction and modifiability.

BACKGROUND OF THE INVENTION

[0002] Aeroponic devices are used for plant cultivation, often in the form of generally vertical columns where horizontal space is limited, as can be the case in an urban environment or a residential setting, for example. Known aeroponic devices have a rotatable modular planting column wherein each module includes a unitary fluid conduit, and the column is mounted in a vertical orientation to circulate a nutrient rich fluid for growing plants in a medium, often a soil-less growth medium. Such vertical columns generally include a lower reservoir for holding nutrient rich fluid to be feed to plants, a planting column for holding the plants, and a watering system running through the column which pumps the fluid upward to the top of the column where it is directed back down to the column interior for watering the plants. See for example US Patent 7,055,282 to Bryan, III.

1 [0003] However known aeroponic and hydroponic columns have several problems.
2 They can be relatively difficult to assemble and disassemble, and can have relatively
3 complex structure. Also, known columns may need extra structural reinforcements
4 to hold elements together properly, resist torsional stresses and to reduce the
5 likelihood of leaking, and this makes assembly much more complex. It would be
6 desirable to provide an aeroponic column which is of a simple and strong modular
7 construction, which is easy to assemble and disassemble, and which is aesthetically
8 attractive.

9 10 SUMMARY OF THE INVENTION

11
12 [0004] In accordance with a first aspect, there is provided an aeroponic column
13 comprising a base, a planter section attached to the base, wherein the planter
14 section defines a hollow interior, a channel and plant holder openings adapted to
15 receive a plant holder, a nutrient distributor attached over the planter section with
16 fluid openings adapted to allow fluid to flow down the planter sections, and a conduit
17 assembly operatively connected between the base and the nutrient distributor, and
18 adapted to carry fluid from the base to the nutrient distributor. The conduit assembly
19 comprises a conduit formed separate from the planter section, the conduit extends
20 through the channel of the planter section, and the conduit has a male threaded first
21 end and a female threaded second end.

22
23 [0005] From the foregoing disclosure and the following more detailed description of
24 various embodiments it will be apparent to those skilled in the art that the present
25 invention provides a significant advance in the technology of aeroponic columns.

1 Particularly significant in this regard is the potential the invention affords for providing
2 a high quality aeroponic column which is of modular construction and is aesthetically
3 attractive. Additional features and advantages of various embodiments will be better
4 understood in view of the detailed description provided below.

5
6 BRIEF DESCRIPTION OF THE DRAWINGS

7
8 [0006] Fig. 1 is an isometric view of an aeroponic column in accordance with one
9 embodiment, showing the column formed with a series of planter sections.

10
11 [0007] Fig. 2 is a cross section view through the aeroponic column of Fig. 1 taken
12 through line 2-2 in Fig. 3.

13
14 [0008] Fig. 3 is a top view showing a six-sided column.

15
16 [0009] Fig. 4 is a close up of the connection between two conduits in a conduit
17 assembly of the aeroponic column of Fig. 1.

18
19 [0010] Fig. 5 is an exploded isometric view showing some of elements of the
20 aeroponic column of Fig. 1.

21
22 [0011] Fig. 6 shows tongue and groove nesting of the planter sections.

23
24 [0012] Fig. 7 is an isolated isometric underside view of one of the planter sections of
25 the aeroponic column of Fig. 1.

1

2 [0013] Fig. 8 is a top side isolated isometric view of the aeroponic column of Fig. 1,
3 showing the conduit assembly extending through the planter sections.

4

5 [0014] Fig. 9 is an isolated isometric view of a plant holder of the aeroponic column
6 of Fig. 1.

7

8 [0015] Fig. 10 is an isolated isometric view of the nutrient distributor of the aeroponic
9 column of Fig. 1.

10

11 [0016] Fig. 11 is an isolated view of the base optionally used for storage of the
12 connector column and nutrient distributor.

13

14 [0017] Figs. 12-13 show views of an optional automatic nutrient controller.

15

16 [0018] It should be understood that the appended drawings are not necessarily to
17 scale, presenting a somewhat simplified representation of various features illustrative
18 of the basic principles of the invention. The specific design features of the aeroponic
19 column as disclosed here, including, for example, the specific number of planter
20 sections, will be determined in part by the particular intended application and use
21 environment. Certain features of the illustrated embodiments have been enlarged or
22 distorted relative to others to help provide clear understanding. In particular, thin
23 features may be thickened, for example, for clarity of illustration. Also, where two
24 halves combine to form a part, it will be readily understood by those skilled in the art,
25 given the benefit of this disclosure, that each half need not be mathematically

1 precisely equal. All references to direction and position, unless otherwise indicated,
2 refer to the orientation illustrated in the drawings.

3 4 DETAILED DESCRIPTION OF CERTAIN EMBODIMENTS

5
6 [0019] It will be apparent to those skilled in the art, that is, to those who have
7 knowledge or experience in this area of technology, that many uses and design
8 variations are possible for the aeroponic column disclosed here. The following
9 detailed discussion of various alternate features and embodiments will illustrate the
10 general principles of the invention with reference to an aeroponic column for use in a
11 residential setting. Other embodiments suitable for other applications will be
12 apparent to those skilled in the art given the benefit of this disclosure.

13
14 [0020] Turning now to the drawings, Fig. 1 is an isometric view of an aeroponic
15 column 20 in accordance with an embodiment formed having a base 40 with a lid 45,
16 defining a reservoir for water and other plant nutrients, at least one planter section
17 30. In the embodiment shown in the drawings, there are nine planter sections
18 stacked sequentially one on top of the other, and each is formed with a polygonal
19 cross section. Preferably the planter sections are all made the same size. Planter
20 sections will have at least three side walls, and can be four, five, six, seven, eight,
21 etc. Here, the planter sections have a hexagonal cross section and are sometimes
22 referred to as hex bodies. The hexagonal cross section also provides stiffness to the
23 column, to help resist dislocation of plant holders 80 (discussed in greater detail
24 below) from the stackable planter sections. The stackable planter sections also

1 allow for ease in disassembly, allowing for rapid movement to a new location, if
2 desired.

3
4 [0021] A nutrient distributor or shower head 60, and a top or lid 50 is positioned
5 above the planter sections 30. On warm days water can evaporate from the hollow
6 interior, cooling the plants, and warm air may rise up. Optionally the lid may be
7 provided with openings to allow hot air to escape from the hollow interior of the
8 column. Water and nutrients are typically stored in the base. Fluid is pumped up
9 through a conduit assembly from the base through the planter sections to the
10 nutrient distributor, where it is controllably released to rain or drip down through the
11 column, eventually reaching plant holders 80 and thereby watering plants. As
12 discussed in greater detail below, a plant holder opening 90 is provided adapted to
13 releasably receive a corresponding plant holder 80. The upper half 92 of the plant
14 holder opening cooperates with a lower half 94 of the plant holder opening to form
15 the plant holder opening 90. Advantageously many plants can be grown
16 simultaneously on a very small footprint simply by adding more plant holders on the
17 column.

18
19 [0022] The conduit assembly is shown in the cross section view of Fig. 2 taken
20 through the line 2-2 in Fig. 3. Advantageously the conduit assembly is formed
21 separate from the planter sections. Here, the conduit assembly is formed as a series
22 of conduits 70 running through a hollow interior 75 extending through the nutrient
23 distributor 60 and planter sections 30 to operatively connect the nutrient reservoir to
24 the nutrient distributor. That is, the conduits carry fluid, including water and nutrients
25 pumped up from the nutrient reservoir to the nutrient distributor. The top conduit is

1 operatively connected to the nutrient distributor, and may be provided with a valve,
2 screw or other release mechanism such as tightening nut 62 operatively connected
3 to the conduit assembly to allow for control of the amount of nutrients distributed to
4 the plants growing in the column. The bottom conduit is operatively connected to the
5 nutrient reservoir in a manner similar to the connection between conduits positioned
6 in each planter section. The conduits advantageously have a dual function, nutrient
7 transport and securing the column together. Forming the conduit assembly as
8 separate pieces helps avoid problems with trying to do too many things at once with
9 the same elements.

10
11 [0023] The base 40 can serve as a fluid reservoir 42. A pump 41 can be provided
12 positioned in the base which pumps fluid through a hose 43 to the conduit assembly.
13 The lid 45 may be provided over the fluid reservoir, optionally with a service port as
14 shown. Cord 44 routed out through an opening in the reservoir lid 45 connects the
15 pump to a power source.

16
17 [0024] In the cross section view of Fig. 2, two of the plant holders 80 are visible at
18 each level, meaning each combination of a pair of adjacent planter sections 30 (or
19 the nutrient distributor 60 and the top planter section) shows two plant holders. In
20 the embodiment shown in the Figs., the plant holders 80, positioned in
21 corresponding plant holder openings, are spaced circumferentially evenly around the
22 conduit assembly and are about 120 degrees apart such that one plant holder is
23 shown in cross section and the other is shown at an angle.

1 [0025] The conduit assembly cooperates with the planter sections to help support the
2 column, advantageously removing the need for separate reinforcing bars to be
3 inserted in the column. The series of conduits 70 may be threadably connected.
4 For example, a first end 71 of a conduit positioned in one planter section is
5 threadably connectable to the second end 72 of an adjacent conduit in another
6 adjacent planter section. Optionally as shown in Fig. 4, for ease of assembly the
7 female threaded end 72 each conduit 70 may be wider than a central channel 38
8 (which the conduits extend through) at a bottom 36 of the planter section 30, such
9 that the conduit can be balanced or sit on the bottom while an adjacent conduit is
10 threaded together to build out the conduit assembly. Fig. 4 also shows a close up of
11 a tongue 31 and groove 32 connection allowing a pair of adjacent planter sections 30
12 to releasably and robustly stack together as well as the bottom 36 with a plurality of
13 small openings 39 adapted to allow fluid to pass from planter section to planter
14 section. The tongue and groove design allows for ease of assembly and ease of
15 modification; the overall height of the column may be varied in a straightforward
16 manner by adding or removing a planter section (and corresponding conduit).

17

18 [0026] Fig. 5 shows an isometric view of a plurality of planter sections positioned
19 between the base and the nutrient distributor, each having a first wall 91 defining an
20 upper plant holder opening 92, and a second wall 93 defining a lower plant holder
21 opening 94. Nutrient distributor 60 is also provided with a wall defining an upper
22 plant holder opening 92. Each conduit 70 can have a length 73 substantially the
23 same as a depth 77 of each planter section 30. (The reduction in length of the
24 column assembly is compensated for by reduction in height of the stacked planter
25 sections due to nesting of the tongue and the groove.) The bottom planter section

1 may be affixed to the lid 45, such as by screwing the parts together, for example.

2 Both the upper plant holder opening 92 and the lower plant holder opening 94 may
3 define semi-cylindrical openings, and combined define a cylindrical plant holder
4 opening 90. As shown the cylindrical opening is angled to allow the plant holder to
5 nest by gravity, but advantageously is still easily removable.

6
7 [0027] Fig. 6 shows a pair of adjacent planter sections 30 stacked together by
8 insertion of the tongue 31 extending along a top wall of one of the planter section
9 side walls 91 into the groove 32 of an adjacent bottom wall of side wall 93. This
10 assembly technique helps increase the strength of the column, allows for simple
11 stacking and unstacking of stackable bodies to whatever height column is desired,
12 as well as helps prevent water from seeping out of an interior of the stackable
13 bodies. The tongue and groove arrangement can be reversed. The tongue and
14 groove do not extend into the plant holder opening 90. Since at least three walls are
15 provided, instead of a circumferential element, the tongue and groove and side walls
16 91, 93 cooperate to resist rotation and potential dislocation of the planter sections of
17 the aeroponic column. Each planter section can have an even number of side walls,
18 91 and 93, and the top of the walls forms alternating first halves of corresponding
19 plant holder openings 90, and the bottom of the walls forms alternating second
20 halves of corresponding plant holder openings 90. The plant holder opening 90 is
21 shown cylindrical and circular in cross section. This cross section, coupled with the
22 use of a corresponding circular cross section plant holder 80 makes for easy
23 insertion and removal of plant holders as desired.

1 [0028] Fig. 7 shows an underside of one of the planter sections 30. The tongue 31 is
2 adapted to meet with the groove 32 on an adjacent planter section. In a further effort
3 to help control the flow of water, the planter section is provided with a splash guard
4 33 and a drip line 34. The drip line helps 33 to keep water from reaching the areas
5 where the planter sections are assembled together. The splash guard 34 helps keep
6 the nutrient solution from splashing and forming large droplets over time on the
7 wrong side of the drip line. Channel 38 is adapted to receive the conduits. Bottom
8 36 is shown with openings 39 allowing fluid to pass to reach other plants. The
9 flanges meet near the center of the hollow interior 75 and form a ring around the
10 channel 38, helping to fix the location of the conduit assembly. The column needs a
11 way to both carry fluid up to the shower head/nutrient distributor 60 and be
12 structurally robust enough to withstand loading, including torsional stresses. The
13 strength and rigidity of the column is advantageously enhanced by making the
14 planter sections with a polygonal cross section and stacking them, thereby resisting
15 torsional stresses. As shown in Figs. 7 and 8, the planter sections 30 also have
16 support flanges 37 which extend from the bottom to the center ring, thereby
17 surrounding the central channel containing the conduits 70, greatly enhancing
18 structural strength. In the embodiment shown here, four flanges 37 are used. The
19 flanges cooperate to define the channel 38 which receives the conduits, thereby
20 reinforcing the conduits all along the length of the column.

21

22 [0029] Nutrient-containing fluid can flow with gravity from the nutrient distributor 60
23 down to through the planter sections 30 via openings 39 to allow for access to each
24 plant on each planter section in a relatively uniform manner. The conduits 70
25 carrying the nutrients are advantageously threaded and are essentially the same

length as a depth of each planter section, allowing for modular assembly of aeroponic columns of varying heights, as desired. Fig. 8 also shows how the planter sections can be stacked, with the conduits 70 running through the middle of the hollow interior 75, in channel 38, out of sight, with only the aesthetically attractive show surface of the planter sections 30 (with the plant holders 80 for the plants) visible to the viewer standing adjacent the column.

[0030] Fig. 9 shows an isolated isometric view of one of the plant holders 80. Rock wool and/or a sponge or foam can be used to hold a seed and be positioned inside the plant holder. Openings 82 on the side and bottom openings 83 can be provided to allow roots to grow and water to enter and exit. Each plant holder opening 90 has a width, and preferably each corresponding plant holder 80 has a bottom width less than the width of the plant holder opening, and a top width greater than the width of the plant holder opening. As shown, the plant holder advantageously has a frusto-conical shape such that it is wider at the top and narrower at the lower end or bottom of the plant holder. Also a lip 81 may be provided to which when inserted into the column rests on one of the planter section, making it much easier to remove the plant holder when a change is desired. The plant holder may have a circular cross section as shown so as to be easily insertable and removable from cylindrical the plant holder openings.

[0031] Fig. 10 is an isolated isometric view of the nutrient distributor 60. Structurally the nutrient distributor is similar to the planter sections, in the sense that it has the same polygonal cross section, has plant holder opening upper portion 92 which, when assembled, cooperates with a plant holder opening lower portion 94 of an

1 adjacent planter section to define a plant holder opening. Also, the nutrient
2 distributor may be stacked on top of the planter sections in the same way the planter
3 sections are stacked on top of each other. However, the depth of the nutrient
4 distributor need not be the same, and the geometry of a floor need only provide a
5 central opening 38 for the top conduit, and smaller openings 62 to allow fluid to pass
6 down to the planter sections below.

7
8 [0032] Fig. 11 shows how the base 40 can serve as a storage vessel for the nutrient
9 distributor 60 and planter sections/hex bodies 30 when the aeroponic column 20 is
10 not in use. As shown, multiple planter sections/stackable bodies 30 may be stowed
11 in the base and a lid may be placed on the base, helping with disassembly and
12 reassembly at another time and/or location.

13
14 [0033] Figs. 12-13 show an optional automatic nutrient controller 46 operatively
15 connected to a control box 47 and power source which can be added with the pump,
16 attached to the column as a separate module or, as shown here, be positioned
17 inside the lowest planter section immediately adjacent the nutrient reservoir. Also,
18 storage containers for several different types of nutrients can be provided in the
19 lowest planter section. Such storage containers can comprise, for example, pH
20 solutions 86 for making the fluid in the fluid reservoir more acidic or more basic, or
21 mineral solutions 84, 85 for adjusting the amounts of important nutrients in the fluid,
22 depending on the needs of the particular plants to grow. The nutrient reservoir in the
23 base 40 is shown receiving at least one sensor, here with two sensors 87, 88
24 operatively connected to the controller/logic box 46. One of the sensors 87 can be
25 used to determine pH of the fluid in the reservoir, the other of the sensor 88 can be

1 used to measure mineral levels, for example. Data about the pH and/or mineral
2 levels is sent to the controller 56. If the pH and/or mineral levels of the fluid in the
3 reservoir is not at a desired level, a signal can be sent to a valve assembly 48 to
4 open a valve corresponding to the correct corresponding storage container.

5
6 [0034] The nutrient controller can be programmed to automatically release nutrients
7 not only in response to data from the sensors, but also at a predetermined rate or at
8 a given time from each storage container and release these nutrients in response to
9 instructions from a user. The logic controller 46 may be operatively connected to a
10 smart phone, pc, laptop etc., for customization of the fluid for particular plants. Also
11 default nutrient release schedules for particular plants may be provided to the user
12 and programmed into the nutrient controller.

13
14 [0035] From the foregoing disclosure and detailed description of certain
15 embodiments, it will be apparent that various modifications, additions and other
16 alternative embodiments are possible without departing from the true scope of the
17 invention. The embodiments discussed were chosen and described to provide the
18 best illustration of the principles of the invention and its practical application to
19 thereby enable one of ordinary skill in the art to use the invention in various
20 embodiments and with various modifications as are suited to the particular use
21 contemplated. All such modifications and variations are within the scope of the
22 invention as determined by the appended claims when interpreted in accordance
23 with the breadth to which they are fairly, legally, and equitably entitled.

CLAIMS

What is claimed is:

1. An aeroponic column comprising, in combination:
 - a base;
 - a planter section attached to the base, wherein the planter section defines a hollow interior, a channel and plant holder openings adapted to receive a plant holder;
 - a nutrient distributor attached over the planter section with fluid openings adapted to allow fluid to flow down the planter sections; and
 - a conduit assembly operatively connected between the base and the nutrient distributor, and adapted to carry fluid from the base to the nutrient distributor;
 - wherein the conduit assembly comprises a conduit formed separate from the planter section, the conduit extends through the channel of the planter section, and the conduit has a male threaded first end and a female threaded second end.
2. The aeroponic column of claim 1 further comprising a plurality of planter sections positioned between the base and the nutrient distributor, each having a conduit, wherein the first end of a conduit positioned in one planter section is threadably connectable to the second end of an adjacent conduit in another adjacent planter section.
3. The aeroponic column of claim 2 wherein each planter section has at least three walls and a bottom, and the bottom has openings adapted to allow fluid to pass.

1

2 4. The aeroponic column of claim 3 wherein the channel extends through the
3 bottom, and further comprises a support flange extending from each wall to another
4 support flange, wherein the flanges cooperate to define the channel.

5

6 5. The aeroponic column of claim 1 further comprising a plurality of planter
7 sections positioned between the base and the nutrient distributor, each having a first
8 wall defining an upper plant holder opening, and a second wall defining a lower plant
9 holder opening.

10

11 6. The aeroponic column of claim 5 wherein the upper plant holder of one
12 planter section cooperates with the lower plant holder of another adjacent planter
13 section to define a plant holder opening adapted to receive a plant holder.

14

15 7. The aeroponic column of claim 6 wherein the plant holder opening has a
16 circular cross section.

17

18 8. The aeroponic column of claim 5 wherein the planter section has a tongue
19 extending from an upper edge of the walls, and the tongue is adapted to engage a
20 corresponding groove on an underside of an adjacent planter section.

21

22 9. The aeroponic column of claim 5 wherein the first wall of a planter section is
23 immediately adjacent the second wall of the planter section.

24

1 10. The aeroponic column of claim 5 wherein each planter section has an even
2 number of walls, the top of the walls forms alternating first halves of corresponding
3 plant holder openings, and a lower side of the walls forms alternating second halves
4 of corresponding plant holder openings.

5
6 11. The aeroponic column of claim 1 further comprising
7 a plurality of planter sections positioned between the base and the nutrient
8 distributor, wherein plant holder openings are formed from a pair of adjacent planter
9 sections;

10 each plant holder opening has a width; and

11 each corresponding plant holder has a bottom width less than the width of the
12 plant holder opening, and a top width greater than the width of the plant holder
13 opening.

14
15 12. The aeroponic column of claim 2 wherein each conduit has a length
16 substantially the same as a depth of each planter section.

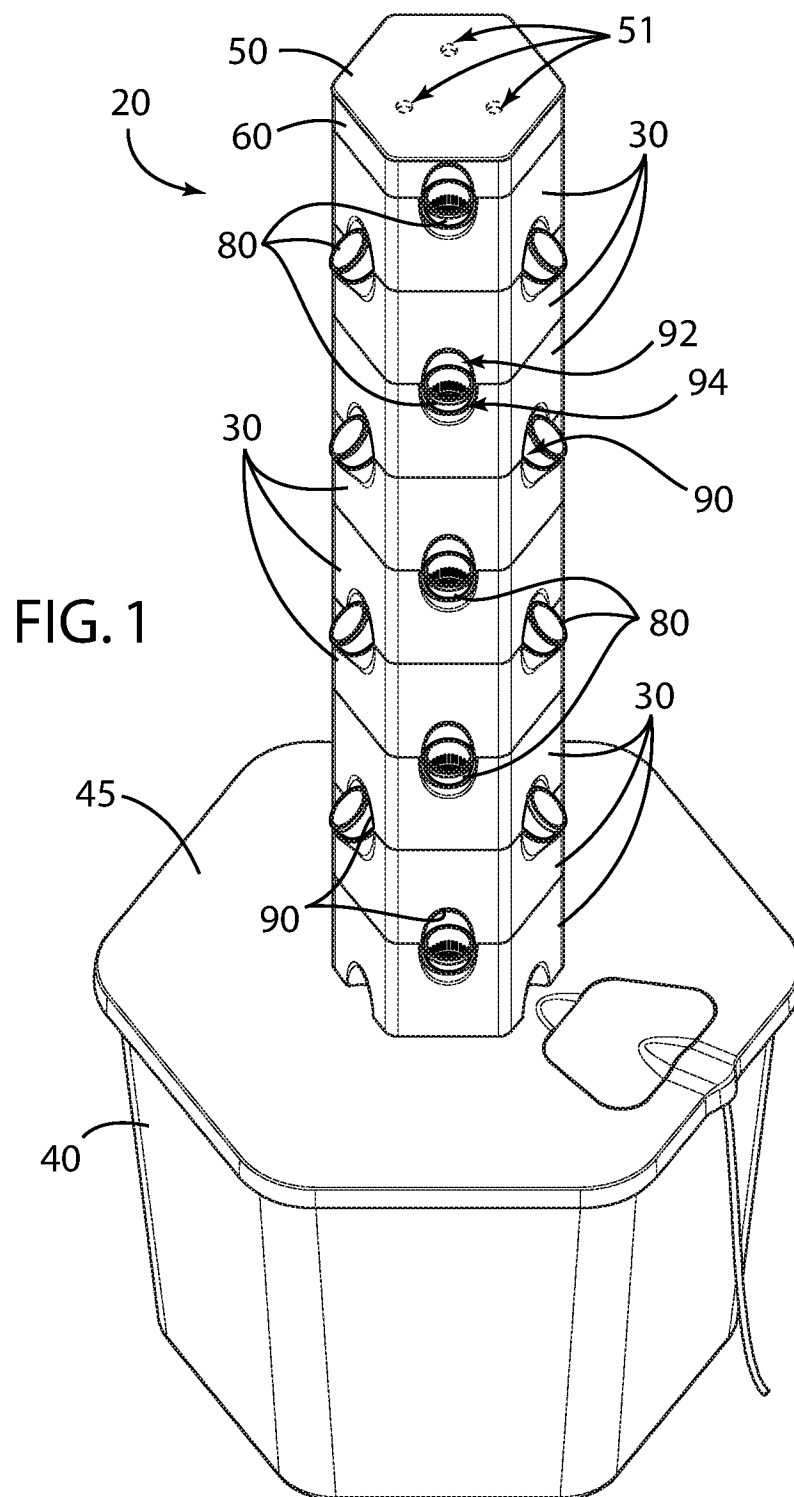
17
18 13. The aeroponic column of claim 1 wherein the planter section has a polygonal
19 cross section.

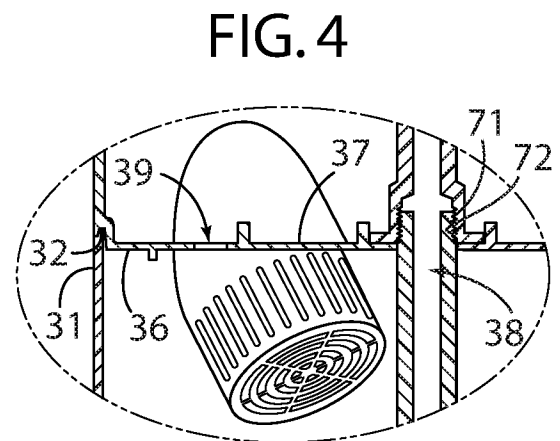
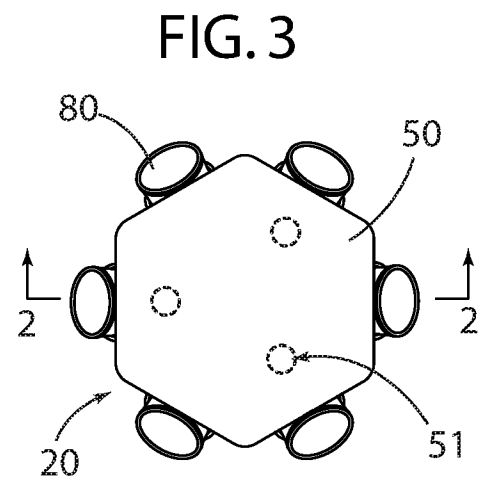
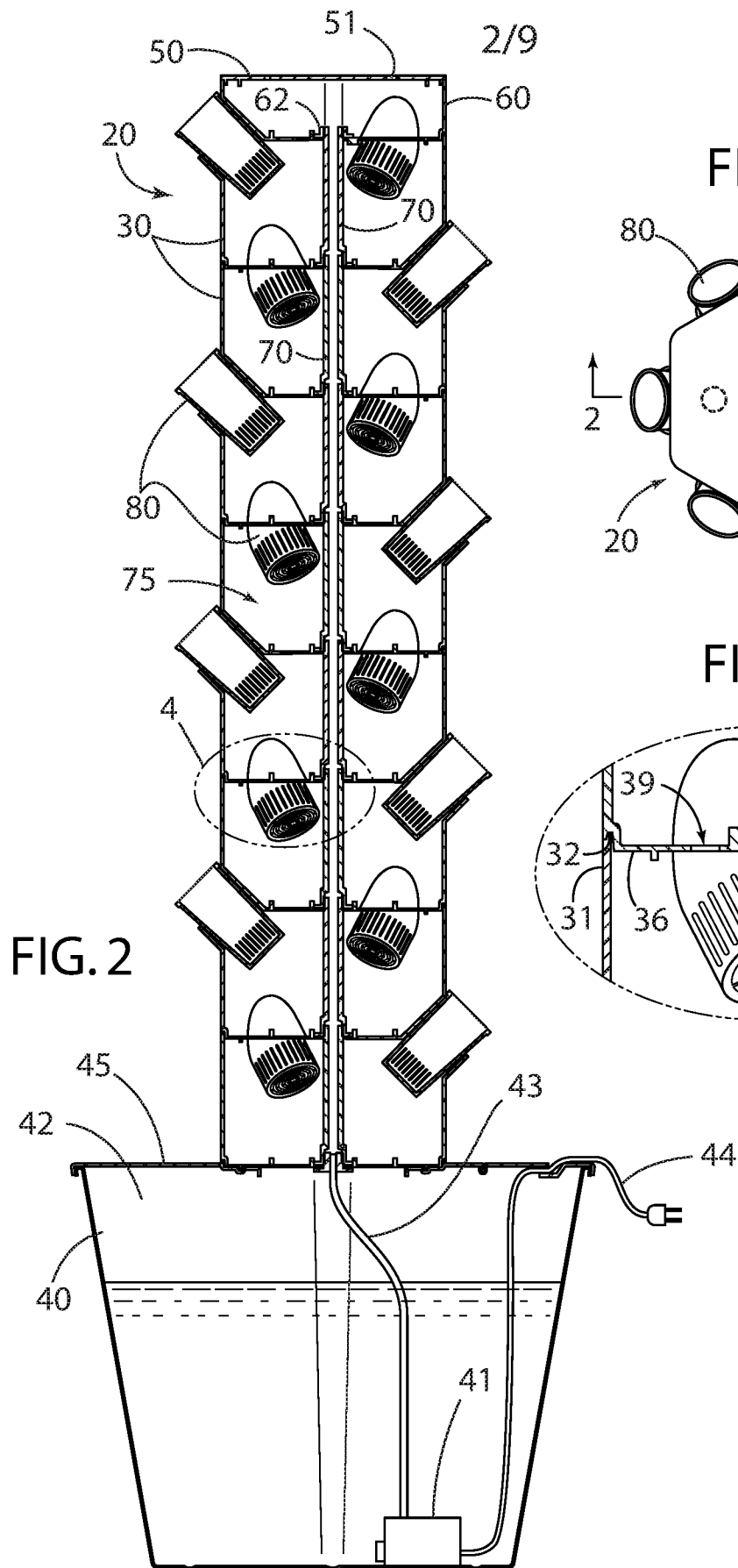
20
21 14. The aeroponic column of claim 1 wherein each planter section has a bottom
22 and the channel extends through the bottom, and the second end of the conduit is
23 wider than the channel at the bottom.

1 15. The aeroponic column of claim 1 further comprising an automatic nutrient
2 controller operatively connected to at least one sensor adapted to extend into a fluid
3 reservoir in the base, and at least one storage container operatively connected to the
4 automatic nutrient controller, wherein the automatic nutrient controller is adapted to
5 release nutrients in response to data from the at least one sensor.

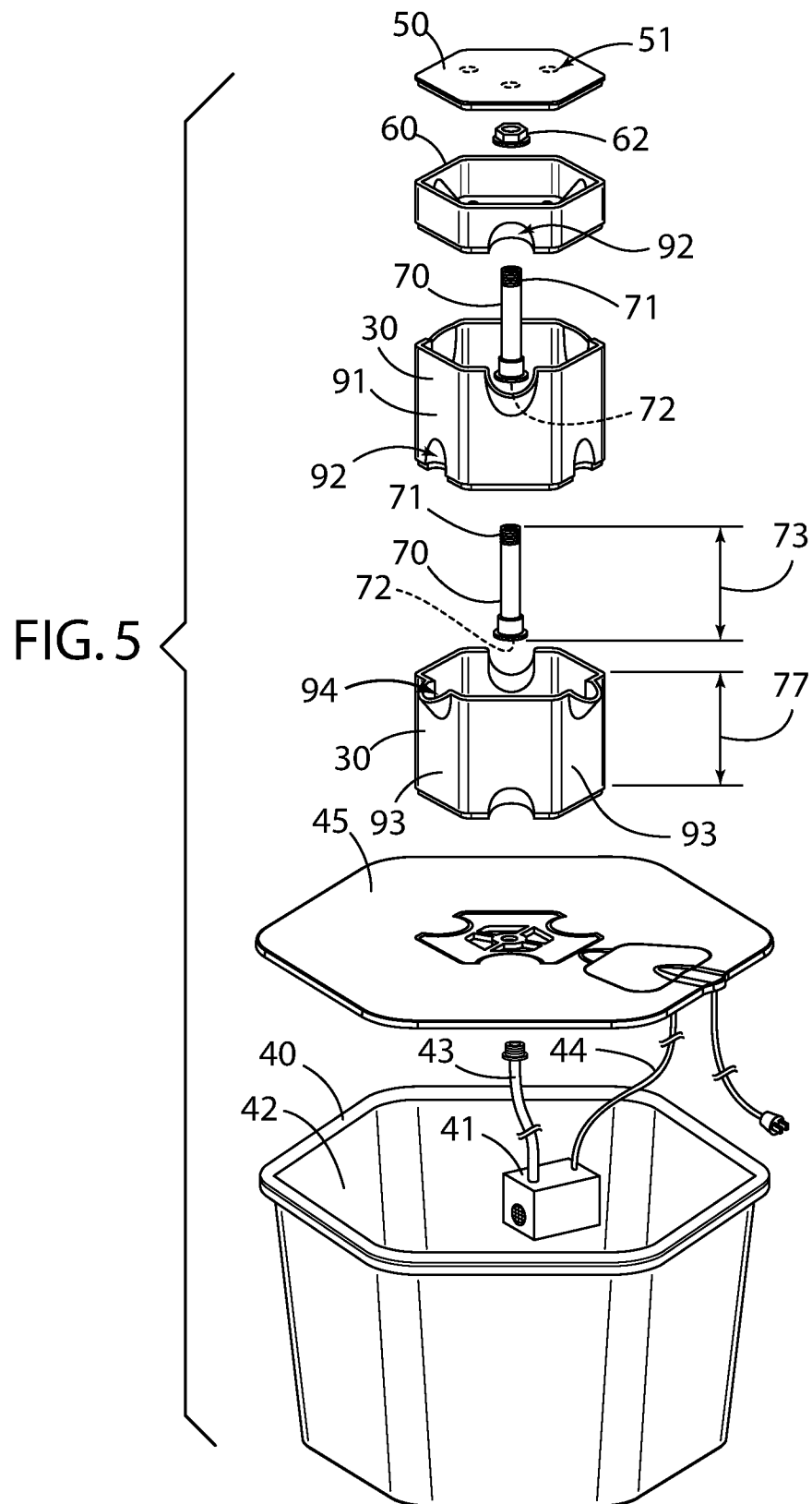
6

1/9

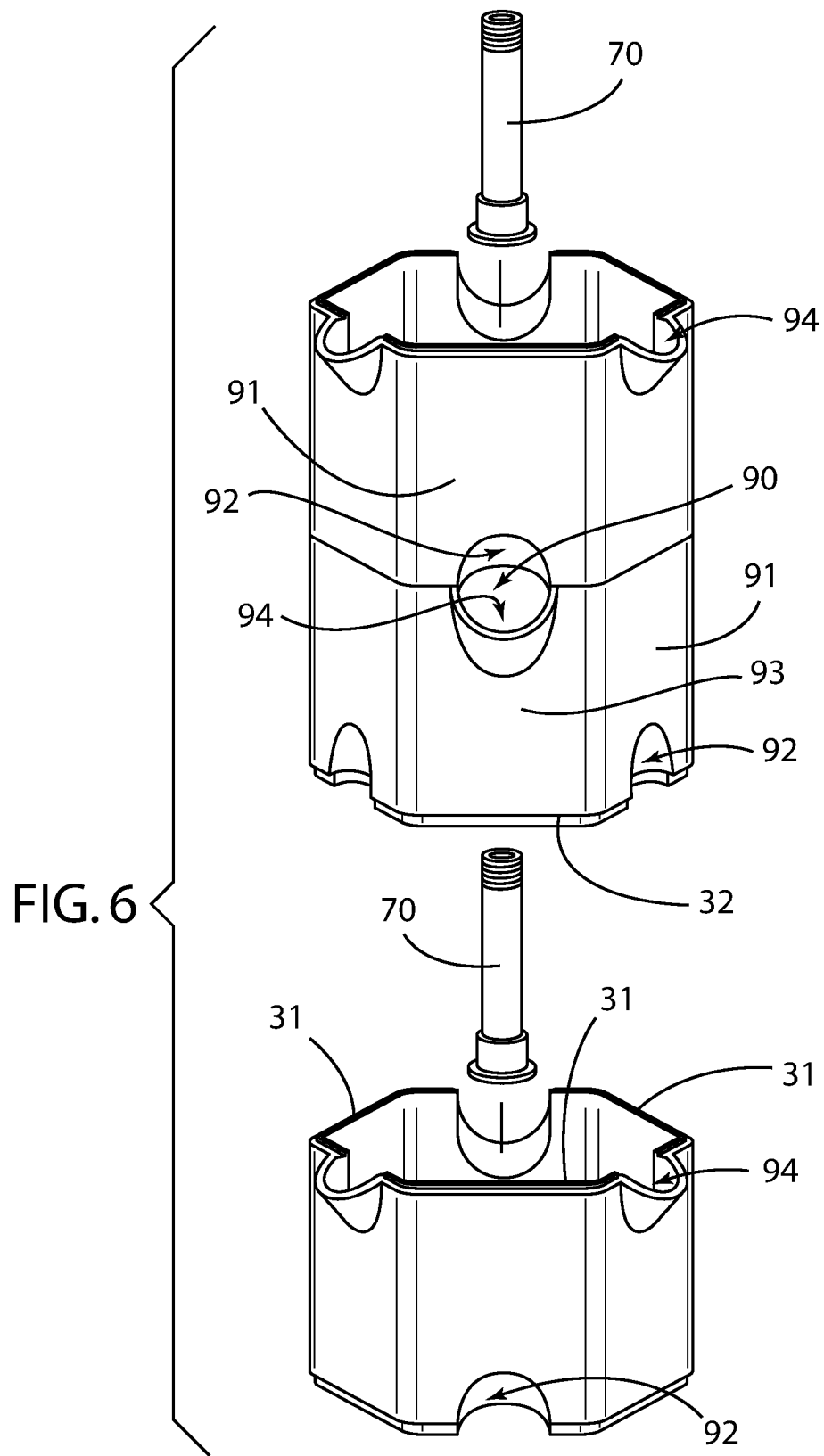


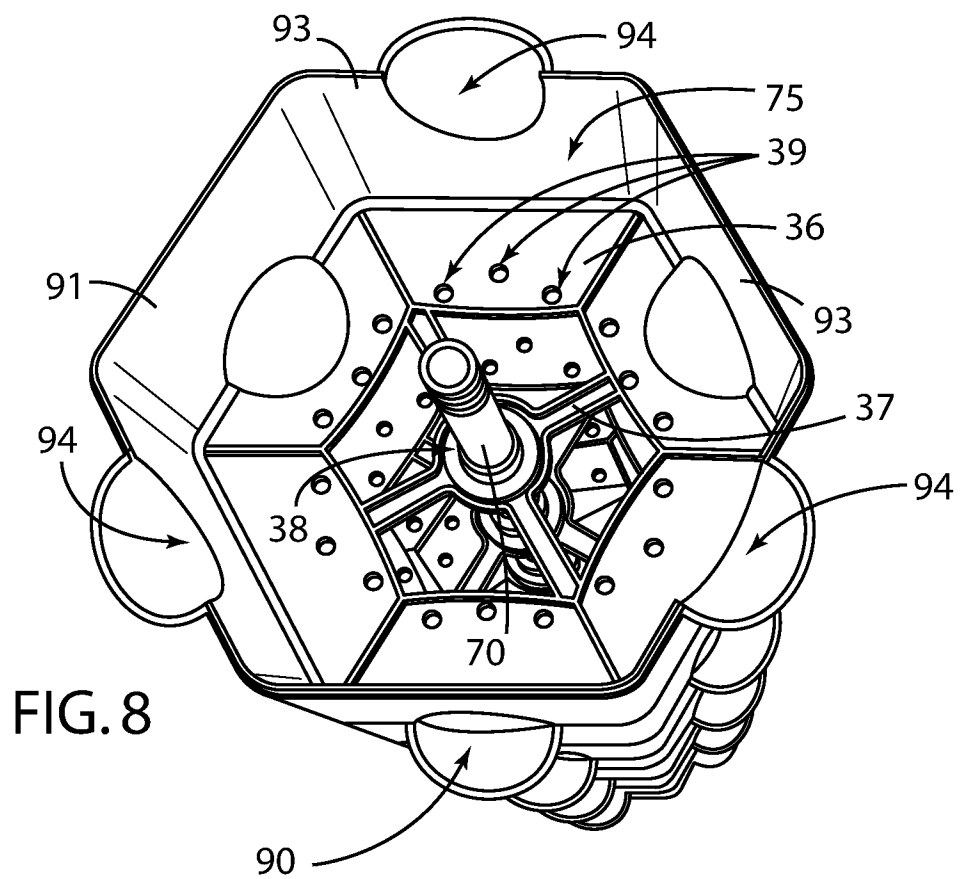
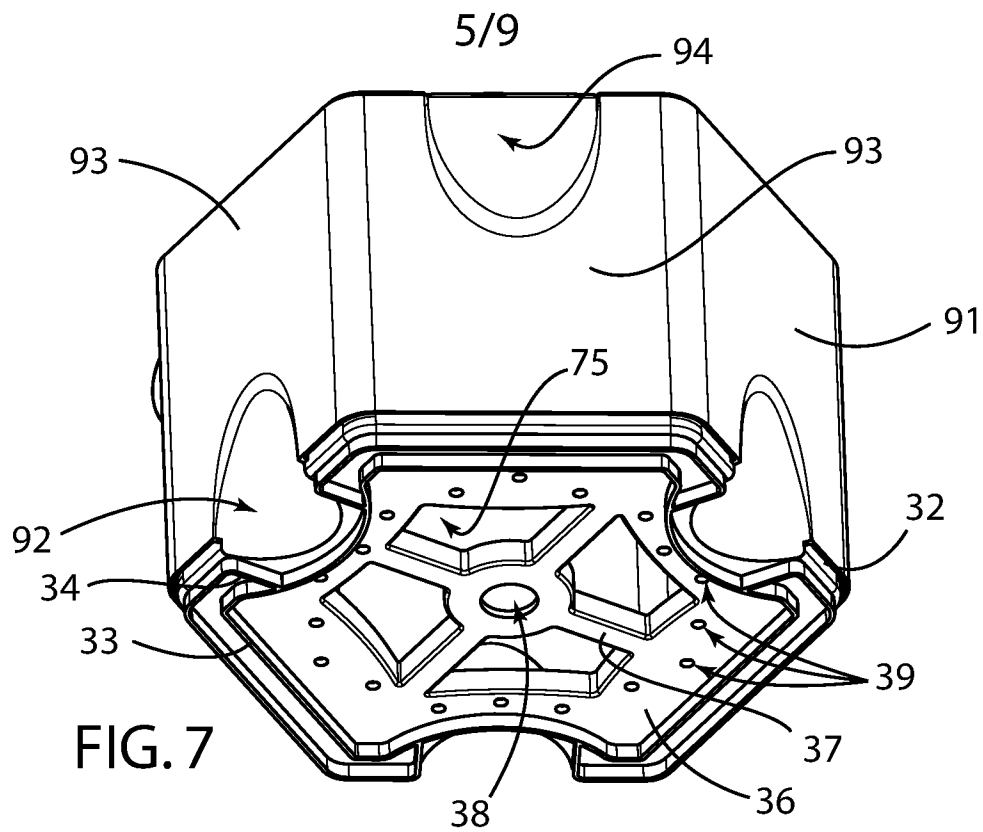


3/9



4/9





6/9

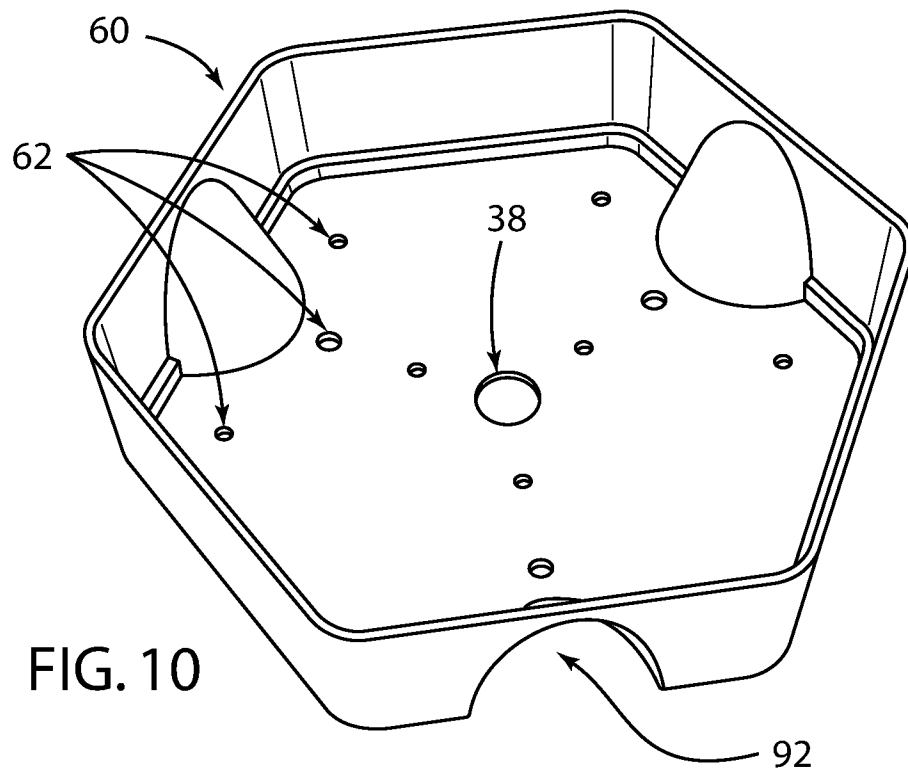
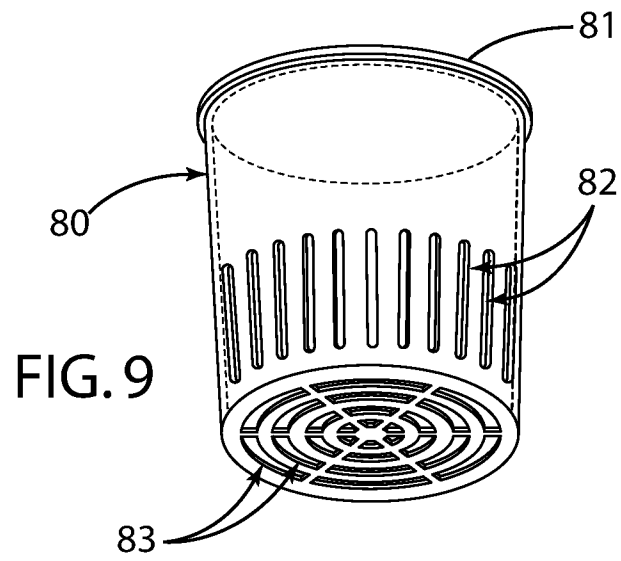
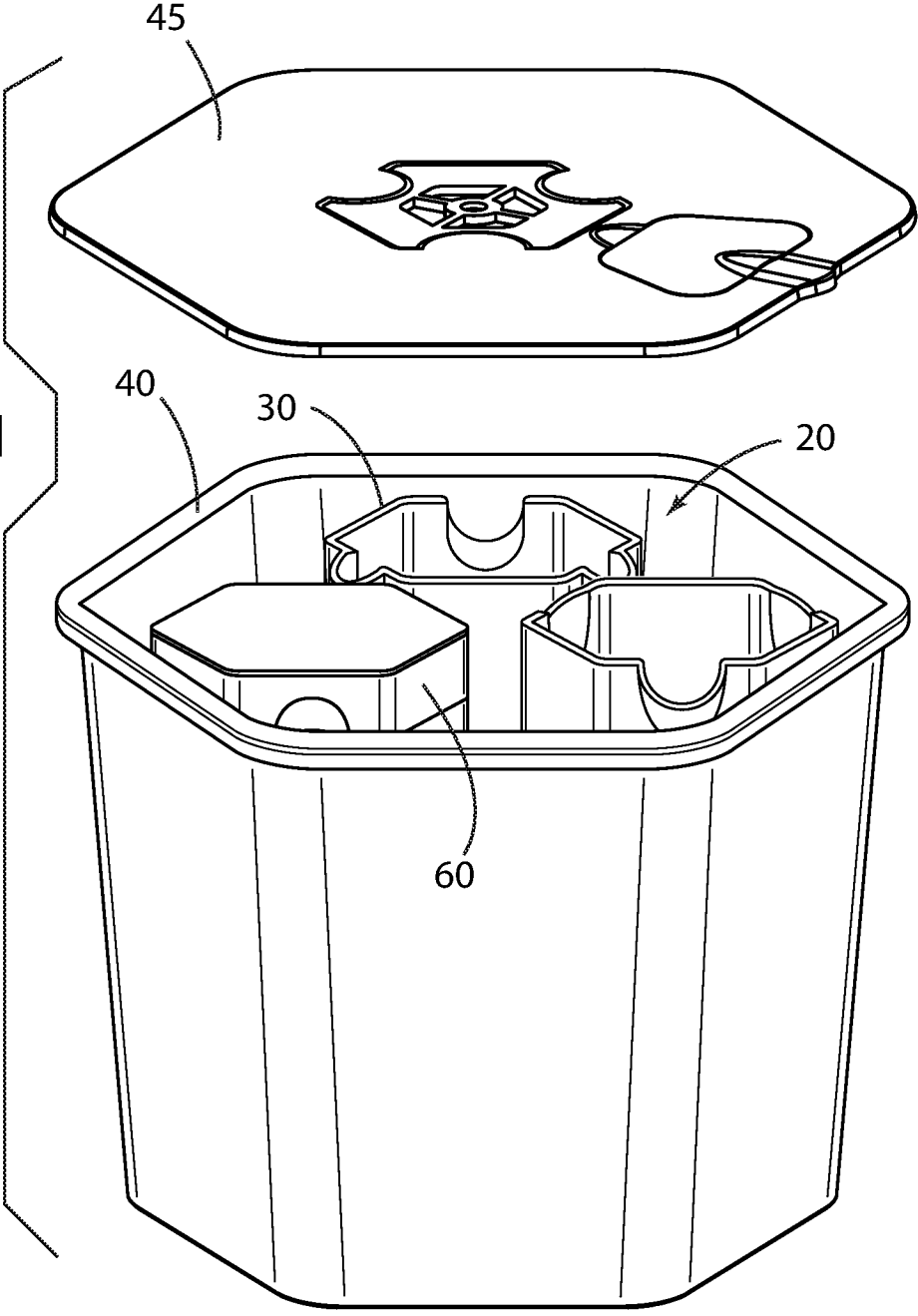
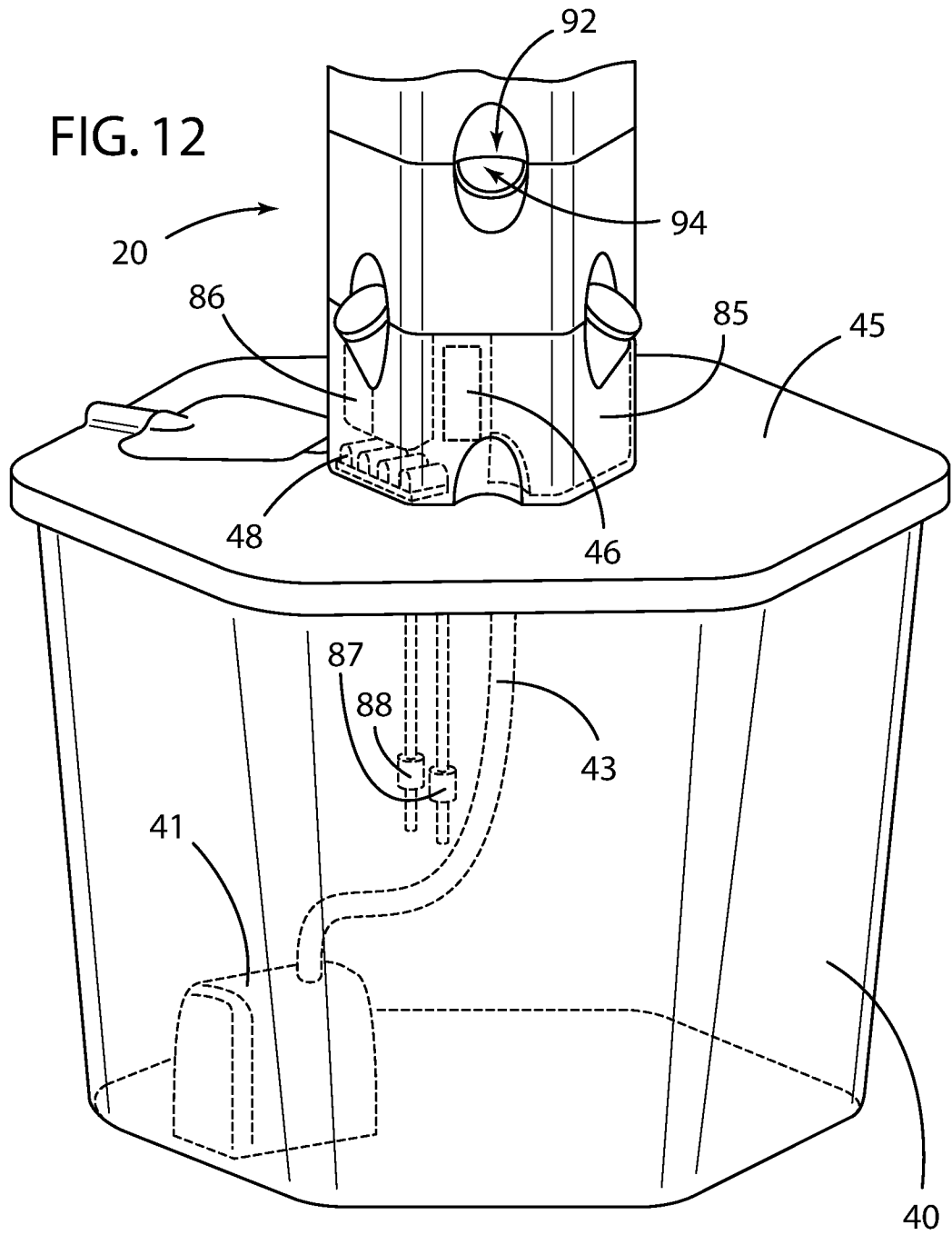
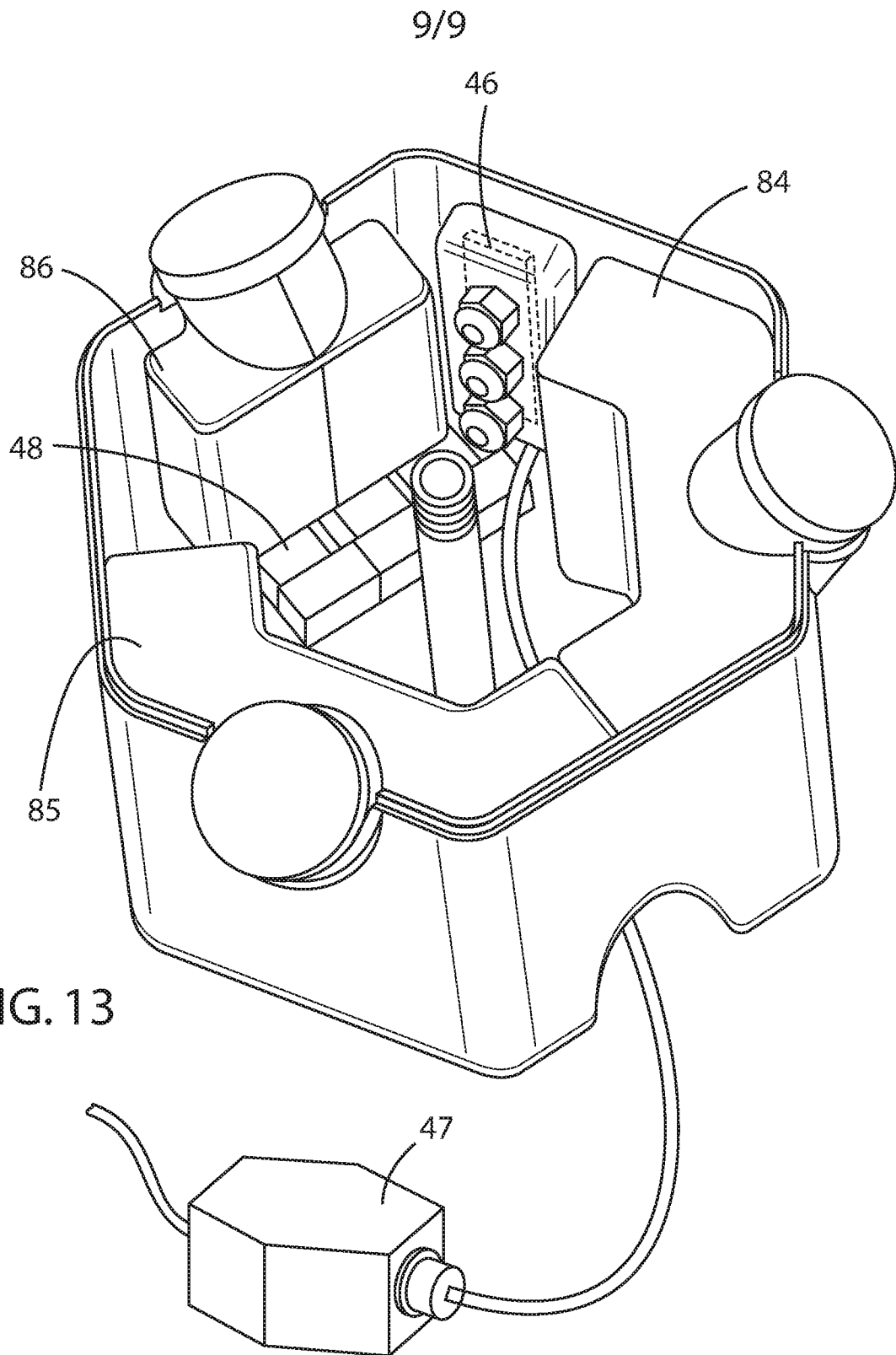


FIG. 11



8/9





A. CLASSIFICATION OF SUBJECT MATTER**A01G 9/02(2006.01)i, A01G 27/02(2006.01)i, A01G 27/00(2006.01)i**

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)

A01G 9/02; A01G 31/00; A01G 31/06; A01G 31/02; A01G 27/02; A01G 27/00

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

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

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

eKOMPASS(KIPO internal) & Keywords: aeroponic column, conduit, distributor

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2006-0032128 A1 (BRYAN III, MORRIS) 16 February 2006	1, 2, 11, 12, 14
Y	See abstract; paragraphs [0012]-[0013], [0035]-[0048]; figs.1-9.	3-10, 13, 15
Y	Website: JIMTHECARVER' s blog, 'Aeroponic strawberry tower' , 2012 < http://gardentenders.com/projects/992 > See figure in page 1.	3-10, 13
Y	JP 01-215224 A (MATSUSHITA ELECTRIC IND. CO., LTD.) 29 August 1989 see page 214, Example section; Figs. 1-5	15
A	JP 03-019629A (YANMAR DIESEL ENGINE CO., LTD.) 28 January 1991 See the whole document.	1-15
A	JP 2013-504327 A (SIMMONS, ROBERT) 07 February 2013 See the whole document.	1-15
A	KR 10-2013-0059044 A (UNIVISION INDUSTRY CO., LTD. et al.) 05 June 2013 See the whole document.	1-15
A	KR 10-2014-0018572 A (KIM, YOUNG SAM) 13 February 2014 See the whole document.	1-15



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

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"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

19 January 2017 (19.01.2017)

Date of mailing of the international search report

20 January 2017 (20.01.2017)

Name and mailing address of the ISA/KR

International Application Division

Korean Intellectual Property Office

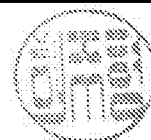
189 Cheongsa-ro, Seo-gu, Daejeon, 35208, Republic of Korea

Facsimile No. +82-42-481-8578

Authorized officer

HEO, Joo Hyung

Telephone No. +82-42-481-8150



INTERNATIONAL SEARCH REPORT

International application No.

PCT/SG2016/050483

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2014-0000162 A1 (BLANK, TIMOTHY A.) 02 January 2014 See the whole document.	1-15
A	Website: LA URBAN FARMS' s home page, 'About the tower garden' , April 2015 < http://web.archive.org/web/20150604053251/http://laurbanfarms.com/aeroponics ></http:> See the whole document.	1-15
A	US 2012-0279126 A1 (SIMMONS, ROBERT S.) 08 November 2012 See the whole document.	1-15

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/SG2016/050483

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2006-0032128 A1	16/02/2006	CA 2488178 A1 US 7055282 B2	11/02/2006 06/06/2006
JP 01-215224 A	29/08/1989	None	
JP 03-019629 A	28/01/1991	JP 2596831 B2	02/04/1997
JP 2013-504327 A	07/02/2013	CN 102638969 A EP 2475241 A1 US 2011-0061296 A1 US 2011-0061297 A1 US 8225549 B2 US 8250809 B2 WO 2011-031939 A1	15/08/2012 18/07/2012 17/03/2011 17/03/2011 24/07/2012 28/08/2012 17/03/2011
KR 10-2013-0059044 A	05/06/2013	KR 10-1325537 B1	07/11/2013
KR 10-2014-0018572 A	13/02/2014	KR 10-1384684 B1	14/04/2014
US 2014-0000162 A1	02/01/2014	None	
US 2012-0279126 A1	08/11/2012	US 8484890 B2	16/07/2013