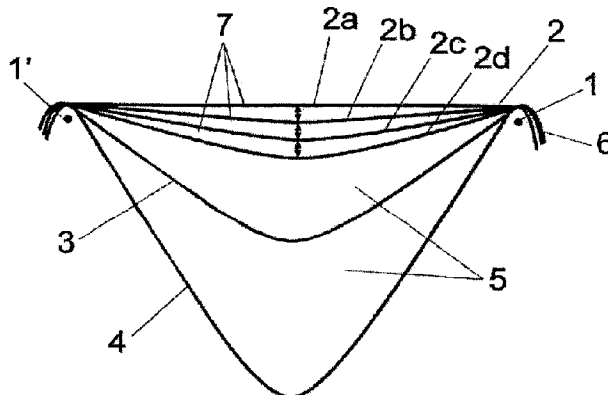




(86) Date de dépôt PCT/PCT Filing Date: 2016/02/10
(87) Date publication PCT/PCT Publication Date: 2016/08/18
(45) Date de délivrance/Issue Date: 2023/03/21
(85) Entrée phase nationale/National Entry: 2017/07/27
(86) N° demande PCT/PCT Application No.: ES 2016/000019
(87) N° publication PCT/PCT Publication No.: 2016/128593
(30) Priorité/Priority: 2015/02/10 (ES P201500105)

(51) Cl.Int./Int.Cl. *A01G 31/02* (2006.01)
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(54) Titre : INSTALLATION DE CULTURE HYDROPONIQUE
(54) Title: FACILITY FOR HYDROPONIC CULTIVATION



(57) **Abrégé/Abstract:**

The facility is of the type that has a pair of side bars (1,1) acting as inclined supports for an upper sheet (2) with openings (8) for inserting the plants, a closed lower sheet (4) acting as a collector, and at least one intermediate sheet (3) with openings determining a cascade trajectory for the water with the nutrients. The invention consists in providing a multi-layer upper sheet (2) comprising preferably four layers (2a, 2b, 2e and 2d), which together define narrow channels (7) for selective use, such that at the time of insertion, the root of each plant is placed in a channel (7) different from that used by the adjacent plants. Furthermore, according to the invention, the openings (8) for the insertion of the plants form two marginal and longitudinal lines. In this way, the roots of the adjacent plants can be completely isolated during the first growth phase thereof, preventing interference therebetween and allowing plants with different growth rates and even different types of plants to be arranged on the facility, generating, in turn, continuous production and an improved yield from the facility.

(12) SOLICITUD INTERNACIONAL PUBLICADA EN VIRTUD DEL TRATADO DE COOPERACIÓN EN MATERIA DE PATENTES (PCT)

(19) Organización Mundial de la
Propiedad Intelectual
Oficina internacional(43) Fecha de publicación internacional
18 de agosto de 2016 (18.08.2016)

WIPO | PCT

(10) Número de Publicación Internacional
WO 2016/128593 A1(51) Clasificación Internacional de Patentes:
A01G 31/02 (2006.01)(21) Número de la solicitud internacional:
PCT/ES2016/000019(22) Fecha de presentación internacional:
10 de febrero de 2016 (10.02.2016)

(25) Idioma de presentación: español

(26) Idioma de publicación: español

(30) Datos relativos a la prioridad:
P201500105
10 de febrero de 2015 (10.02.2015) ES(71) Solicitante: NEW GROWING SYSTEMS, S.L. [ES/ES];
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Canadillar, 10, 04640 Pulpi, Almería (ES).(74) Mandatario: GONZALEZ PALMERO, Fe; Sagasta, 4,
28004 Madrid (ES).(81) Estados designados (a menos que se indique otra cosa,
para toda clase de protección nacional admisible): 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, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE,
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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) Estados designados (a menos que se indique otra cosa,
para toda clase de protección regional admisible):
ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW,
SD, SL, ST, SZ, TZ, UG, ZM, ZW), euroasiática (AM, AZ,
BY, KG, KZ, RU, TJ, TM), europea (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,
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CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

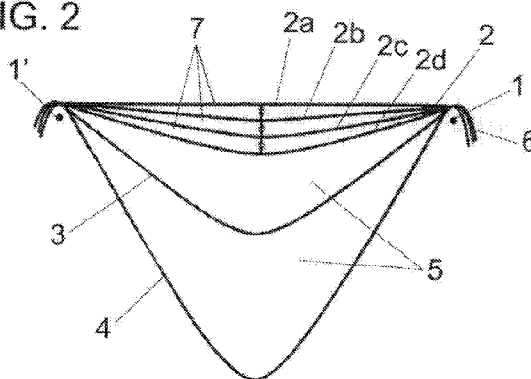
Publicada:

— con informe de búsqueda internacional (Art. 21(3))

(54) Title: FACILITY FOR HYDROPONIC CULTURE

(54) Título : INSTALACIÓN PARA CULTIVO HIDROPÓNICO

FIG. 2



(57) Abstract: The facility is of the type that has a pair of side bars (1,1) acting as inclined supports for an upper sheet (2) with openings (8) for inserting the plants, a closed lower sheet (4) acting as a collector, and at least one intermediate sheet (3) with openings determining a cascade trajectory for the water with the nutrients. The invention consists in providing a multi-layer upper sheet (2) comprising preferably four layers (2a, 2b, 2c and 2d), which together define narrow channels (7) for selective use, such that at the time of insertion, the root of each plant is placed in a channel (7) different from that used by the adjacent plants. Furthermore, according to the invention, the openings (8) for the insertion of the plants form two marginal and longitudinal lines. In this way, the roots of the adjacent plants can be completely isolated during the first growth phase thereof, preventing interference therebetween and allowing plants with different growth rates and even different types of plants to be arranged on the facility, generating, in turn, continuous production and an improved yield from the facility.

(57) Resumen:

[Continúa en la página siguiente]

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Del tipo de las que cuentan con una pareja de varillas laterales (1,1) en funciones de soporte con pendiente para una lámina superior (2) con orificios (8) para implantación de las plañias, una lámina inferior (4) cerrada en funciones de colector, y una o mas láminas intermedias (3), con orificios que determinan una trayectoria en cascada para el agua con los nutrientes, la invención consiste en disponer una lámina superior (2) multicapa en la que participan preferentemente cuatro capas (2a, 2b, 2e y 2d), que definen entre ellas estrechas canalizaciones (7) de uso selectivo, de manera que en el momento de la implantación la raíz de cada planta queda situada en una canalización (7) distinta de la utilizada por las plantas adyacentes. Además se ha previsto que los orificios (8) para implantación de las plantas, formen dos alineaciones marginales y longitudinales. De esta manera se consigue mantener totalmente aisladas las raíces de las plantas adyacentes durante la primera fase de crecimiento de las mismas, evitando interferencias entre ellas y permitiendo la ubicación sobre la instalación de plantas con distintos niveles de crecimiento e incluso plantas de diferente naturaleza, lo que propicia a su vez una producción continuada con un mayor rendimiento de la instalación.

FACILITY FOR HYDROPONIC CULTIVATION

DESCRIPTION

5 OBJECT OF THE INVENTION

The present invention refers to a facility for hydroponic cultivation, that is, for growing plants without soil, using inert supports to allow the plant to take root and to provide nutrients by means of a closed circuit of liquid fertiliser, to which the nutrients that must be replaced after being absorbed by the plants are
10 periodically added.

The object of the invention is to significantly improve the yield of the facility thanks to the capacity of planting on said facility plants with different rates of growth, which reach their optimal growth or state of fruit production in staggered phases in time, with the aim of achieving a continuous production.

15 The invention is therefore in the field of agriculture, more specifically in the production of fruits and vegetables. It can also be used for outdoor cultivation.

BACKGROUND OF THE INVENTION

As it is commonly known, hydroponic cultivation consists of an artificial
20 procedure of cultivation without soil, which is carried out on a support structure where a plant with small roots is placed, which is provided with liquid fertiliser with a formulation suitable for the nutritional needs of the specific type of plant grown, so that with the appropriate light, which may also be artificial, the suitable concentration and proportion of nutrients dissolved in water provide the optimal
25 growth conditions for the plant, and in consequence, the yield of the plants is far better than that of traditional systems.

At the same time, it also has a series of other advantages such as higher plantation density, perfect protection of the roots and the plant as a whole against the action of pathogen agents, etc.

The applicant is the owner of the Spanish Invention Patent with application number ES 2 125 803, which describes a procedure of hydroponic cultivation and the complementary device for putting it into practice.

5 More specifically, in a facility with this procedure, a series of suspended channels is placed on parallel filiform supports, specifically these channels comprise an upper sheet with orifices to plant the respective plants, a lower sheet without orifices that acts as collector, and intermediate sheets that comprise a series of upper orifices, but these are offset longitudinally depending on the plants to be cultivated. The aforementioned channels are connected to a pipe feeding them water and nutrients as well as controlling their growth and temperature, with micro-pipes or
10 similar protruding from the level of the upper sheet of the pipe for each irrigation unit, that is, for each plant, so that they are watered individually. The liquid cascades down through the channels by means of the staggered orifices until it reaches the lower channel, directing in turn the roots of the plants along the same path taken by
15 the nutrients.

A facility of this type is suitable for a monoculture of a determined type of plants, that is, for a plurality of plants identical to each other, but it is not ideal for growing plants with different growth rates or of different species, since their roots quickly become in contact with each other, which results in interactions that harm
20 some of them in relation to others.

DESCRIPTION OF THE INVENTION

According to one aspect of the present invention, an object is to provide a hydroponic cultivation facility with a structure comprising a pair of parallel
25 longitudinal threads, bars or a rigid channel, with a certain inclination, which comprise the physical support for an upper sheet with orifices for planting the respective plants, a closed lower sheet, and one or more intermediate sheets forming a series of dihedral channels connected cascading down by means of orifices established for said effect, wherein the upper sheet is a multi-layered sheet

comprising a plurality of layers slightly separated between them, so that they define independent channels of a small height used selectively to plant the roots of plants, for which purpose, facing the orifices for planting the plants on the upper layer, wherein the remaining layers comprise die cuts or fragile fold lines that can be torn
5 off by using the roots of the plant itself as a perforating element, so that said roots reach the channel chosen by the user, which is different than that of the adjacent plants; and wherein an orifice is placed at the end of the channels corresponding to each plant and at the lowest point of said channels in the direction of the inclination, with said orifices affecting simultaneously the three upper layers and connecting the
10 aforementioned channels of the upper sheet with the channels defined by the intermediate sheets and the closed lower sheet, in order to allow the water carrying nutrients to cascade down parallel to the trajectory of the roots of the plants.

According to another aspect of the present invention, an object is to provide a facility for hydroponic cultivation of plants, the facility comprising:

15 a pair of spaced apart supports which together comprise a physical support for an upper sheet;

the upper sheet including first orifices configured for planting the plants at the upper sheet orifices;

a closed lower sheet spaced from and below the upper sheet;

20 at least one intermediate sheet between the upper sheet and the lower sheet;

each intermediate sheet forming a series of dihedral channels connected for cascading down of a liquid via second orifices formed in the one or more intermediate sheets for providing the cascading;

25 the upper sheet comprises a multi-layered sheet comprising a plurality of layers separated and positioned such that each pair of layers defines between the pair of layers an independent channel of a height selected for planting of roots of the plants;

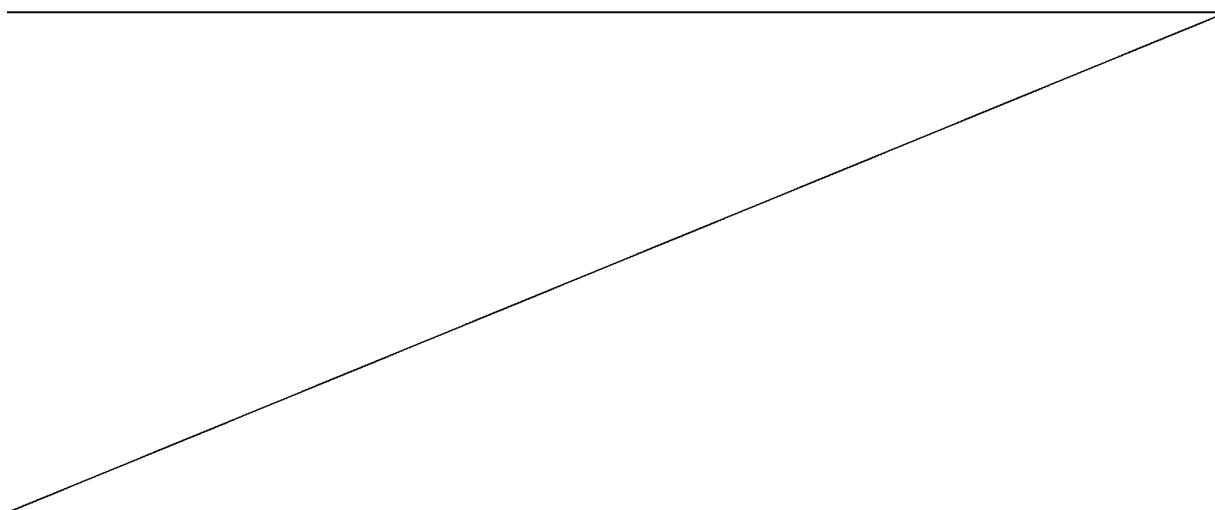
each remaining layer of the plurality of layers of the multi-layered sheet comprises die cuts or fragile fold lines positioned below the first orifices; and

each die cut or fragile fold line positioned to face an orifice of the first orifices, and configured to be torn off, so that the roots of each plant reach the
5 respective channel, the respective channel chosen by a user, and different from a channel containing the roots of others of the plants.

Other possible aspect(s), object(s), embodiment(s), variant(s) and/or advantage(s) of the present invention, all being preferred and/or optional, are briefly summarized hereinbelow.

10 For example, the facility proposed by the present patent specification makes it possible to simultaneously grow plants with different growth rates or of different species, without causing negative interactions between them. As explained above, this makes it possible to substantially increase the yield of the facility, in addition to achieving continuous production or cultivation.

15 More specifically, in order to do so the facility described retains basically all the characteristics of the Patent cited above, in regard to the existence in said patent of a pair of threads, lateral bars or a rigid channel, which determine the



means for supporting several sheets constituting respective overlapping channels of an indefinite length, forming dihedrals of different angles, which due to their angles configure overlapping channels with a common mouth, wherein the upper sheet comprises orifices that correspond with the place where the plants are placed, the lower sheet is closed, while the intermediate sheet or sheets are provided with orifices also matching the distance between the plants and that are offset with those of the upper sheet in order to achieve a cascade effect, based on a certain longitudinal inclination given to the entire facility, more specifically to the threads, bars or the rigid channel supporting the sheets.

Obviously this "cascade" effect refers to the trajectory of the liquid fertiliser supplied by a pipe running along the length of the facility, which is collected by the lower sheet or channel after coating the roots in order to be recycled.

Therefore, from this basic configuration and according to the invention, the upper sheet adopts a multi-layer structure, for example, structured in four layers separated at a noticeable distance, although separated at a much smaller distance than the different sheets of the facility, with the upper layer of this sheet comprising orifices separated at convenient distances according to the expected separation between plants, while the rest of the layers of this upper sheet comprise die cuts or fold lines that face the aforementioned orifices and that can be easily torn off, so that when the plant is placed in the facility using the plant itself as a perforating element, one or more of the aforementioned die cuts, or none, may be torn off in order to place the roots of the plant at the level selected for each plant, physically isolating them from the rest of the plants.

According to another characteristic of the invention, the design of the aforementioned orifices of the upper sheet and the complementary die cuts form two marginal lines in the context of the sheet, which makes the most of the space of available.

A water inlet with multiple outlets is placed alongside every orifice and complementary die cuts of the upper sheet, one outlet for each layer, opening at each point the relevant outlet for the space provided for the corresponding plant to take root in.

In each segment of the upper sheet corresponding a plant, where said plant is placed in the highest level according to the inclination of the facility, there is an orifice in the opposite end of the segment, that is, the lowest level, that only affects the lower layers, that is, it does not effect the upper layer, and water falls
5 through this orifice to the second sheet, cascading down until it reaches the lower sheet, and this orifice is also used by the corresponding plant when the roots thereof reach a predetermined length in order to allow the roots thereof to reach down to the lower sheets, in the same way as in the Patent cited above.

10 DESCRIPTION OF THE DRAWINGS

To complete the invention described and in order to give a better understanding of the characteristics of the invention, according to a preferred embodiment thereof, this description is accompanied by a set of drawings in which the figures described below have been represented, for purely illustrative
15 purposes and should not be construed as limiting:

Figure 1 shows a partial perspective view of a facility for hydroponic cultivation designed according to the object of the present invention.

Figure 2 shows a crosswise section of the assembly represented in figure
1.

20 Figure 3 shows a representation similar to the one shown in figure 1 but featuring the three options for planting the roots of the plant in the different respective levels at the heart of the multi-layer sheet at the moment of planting them.

Figure 4, finally, shows a longitudinal scheme of a segment of the facility.
25

PREFERRED EMBODIMENT OF THE INVENTION

In light of the drawings described above, and more specifically of figures 1 and 2, we can see that the facility proposed in the invention is constituted by a pair of parallel and longitudinal threads or bars (1, 1'), which constitute the
30 physical support of the multiple channels that comprise a multi-layered upper sheet (2), at least one intermediate sheet (3), and a lower sheet (4), made of

different widths in order to create respective channels (5) configured noticeably in the shape of dihedrals, secured to the bars (1, 1') by means of marginal folds (6) represented in a scheme of the drawings.

5 The upper sheet (2) is multi-layered, so that it is comprised of four layers (2a, 2b, 2c and 2d), with these layers also being made of different widths so that significantly smaller channels (7) are defined between them, specifically smaller in height in comparison to the channels (5) defined between the different sheets (2, 3, 4).

10 The upper layer (2a) of the upper sheet (2) comprises two marginal lines of orifices (8) conveniently separated according to the planned separation between plants (9), and the die cuts (8') are located under these orifices (8) and they affect the other three layers (2b, 2c and 2d) of the sheet (2), with said die cuts being initially closed and they are easily torn off when the plants are planted so that the roots of each of the plants can be placed on any of the three levels (7) defined by
15 the aforementioned layers (2b, 2c and 2d), as shown in figure 4, depending on the choice of the farmer, and on a different level than the adjacent plants. The roots of the plant themselves act as a puncher to tear off the die cut or die cuts needed in order to gain access to the planned level.

20 A multiple water inlet (11) is placed alongside every orifice (8), which is individualised for each plant, with three independent outlets (12), each of them facing each of the spaces or channels (7) defined by the different layers of the sheet (2).

The roots are then placed on the same level of the multi-layered sheet (2) as the water carrying nutrients, and they are completely independent from the
25 roots of the rest of the plants during the initial stage of growth, which is long enough so that no interference takes place between plants, so each plant, following the direction of the inclination (13), finally reaches an orifice (14), which simultaneously affects the three lower layers (2b, 2c and 2d) of the sheet (2), from where the water carrying nutrients and the roots descend to the intermediate
30 sheet (3), and from said sheet, with the possibility of there being another layer of intermediate sheets (3'), they descend to the closed lower sheet (4) that acts a

collector, all of which takes place through the orifices (15) of said sheets (3, 3'), which determine the circulation of the water with nutrients cascading down, and an identical trajectory for the roots.

CLAIMS:

1. A hydroponic cultivation facility with a structure comprising a pair of parallel longitudinal threads, bars or a rigid channel (1,1'), with a certain inclination, which comprise the physical support for an upper sheet (2) with orifices for planting the respective plants (9), a closed lower sheet (4), and one or more intermediate sheets (3,3') forming a series of dihedral channels (5) connected cascading down by means of orifices established for said effect, wherein the upper sheet (2) is a multi-layered sheet comprising a plurality of layers (2a, 2b, 2c, 2d) slightly separated between them, so that they define independent channels (7) of a small height used selectively to plant the roots of plants, for which purpose, facing the orifices (8) for planting the plants on the upper layer (2a), wherein the remaining layers (2b, 2c, 2d) comprise die cuts (8') or fragile fold lines that can be torn off by using the roots of the plant itself as a perforating element, so that said roots reach the channel (7) chosen by the user, which is different than that of the adjacent plants; and wherein an orifice (14) is placed at the end of the channels (7) corresponding to each plant (9) and at the lowest point of said channels in the direction (13) of the inclination, with said orifices affecting simultaneously the three upper layers (2b, 2c and 2d) and connecting the aforementioned channels (7) of the upper sheet (2) with the channels (5) defined by the intermediate sheets (3, 3') and the closed lower sheet (4), in order to allow the water carrying nutrients to cascade down parallel to the trajectory of the roots of the plants.

2. Hydroponic cultivation facility according to claim 1, wherein the orifices (8) for planting the plants (9) and the complementary die cuts (8') thereof form two longitudinal, marginal lines on the upper sheet (2).

3. Hydroponic cultivation facility according to claim 1 or 2, wherein a multiple water inlet (11) is placed over the upper sheet and in correspondence with each

plant, which comprises water outlets for selectively watering each of the channels (7) constituted by the layers (2b, 2c and 2d) of the upper sheet (2).

4. A facility for hydroponic cultivation of plants, the facility comprising:

5 a pair of spaced apart supports which together comprise a physical support for an upper sheet;

the upper sheet including first orifices configured for planting the plants at the upper sheet orifices;

a closed lower sheet spaced from and below the upper sheet;

10 at least one intermediate sheet between the upper sheet and the lower sheet;

each intermediate sheet forming a series of dihedral channels connected for cascading down of a liquid via second orifices formed in the one or more intermediate sheets for providing the cascading;

15 the upper sheet comprises a multi-layered sheet comprising a plurality of layers separated and positioned such that each pair of layers defines between the pair of layers an independent channel of a height selected for planting of roots of the plants;

20 each remaining layer of the plurality of layers of the multi-layered sheet comprises die cuts or fragile fold lines positioned below the first orifices; and

each die cut or fragile fold line positioned to face an orifice of the first orifices, and configured to be torn off, so that the roots of each plant reach the respective channel, the respective channel chosen by a user, and different from a channel containing the roots of others of the plants.

25

5. Facility for hydroponic cultivation according to claim 4, wherein the upper sheet includes two marginal areas, a first marginal area extending along a longitudinal direction of the upper sheet at a first lateral area, and a second marginal area extending along a longitudinal direction of the upper sheet at a second lateral

area of the upper sheet, and wherein the first orifices and the die cuts or fragile fold lines are located along the two marginal areas on the upper sheet.

5 6. Facility for hydroponic cultivation according to claim 5, wherein the marginal areas comprise longitudinal lines.

7. Facility for hydroponic cultivation, according to any one of claims 4 to 6, further comprising:

10 a multiple water inlet placed over the upper sheet and in correspondence with the first orifice;

wherein the plurality of layers of the multi-layered sheet define at least two channels; and

15 the multiple water inlet comprises water outlets, each water outlet positioned and configured for watering a respective channel of the at least two channels, the respective channel selected by the user for cooperating with a respective water outlet of channels.

20 8. Facility for hydroponic cultivation according to any one of claims 4 to 7, wherein the second orifices are placed at the ends of the channels corresponding to each plant and at the lowest point of the channels in one direction, the first orifices affecting the three upper layers and connecting the channels of the upper sheet with the channels defined by the intermediate sheets and with the closed lower sheet; and

25 wherein the channels defined by the intermediate sheets are configured to convey the water carrying nutrients such that the water carrying nutrients cascades down parallel to a trajectory of the roots of the plants.

9. Facility for hydroponic cultivation according to any one of claims 4 to 8, wherein each support comprises a longitudinal support.

10. Facility for hydroponic cultivation according to claim 9, wherein each support comprises a pair of parallel, spaced apart and longitudinal threads, bars or a rigid channel with an inclination.

5

11. Facility for hydroponic cultivation according to any one of claims 4 to 10, wherein the die cuts or the fragile fold lines are configured to be torn off by using the roots of the plant itself as a perforating element.

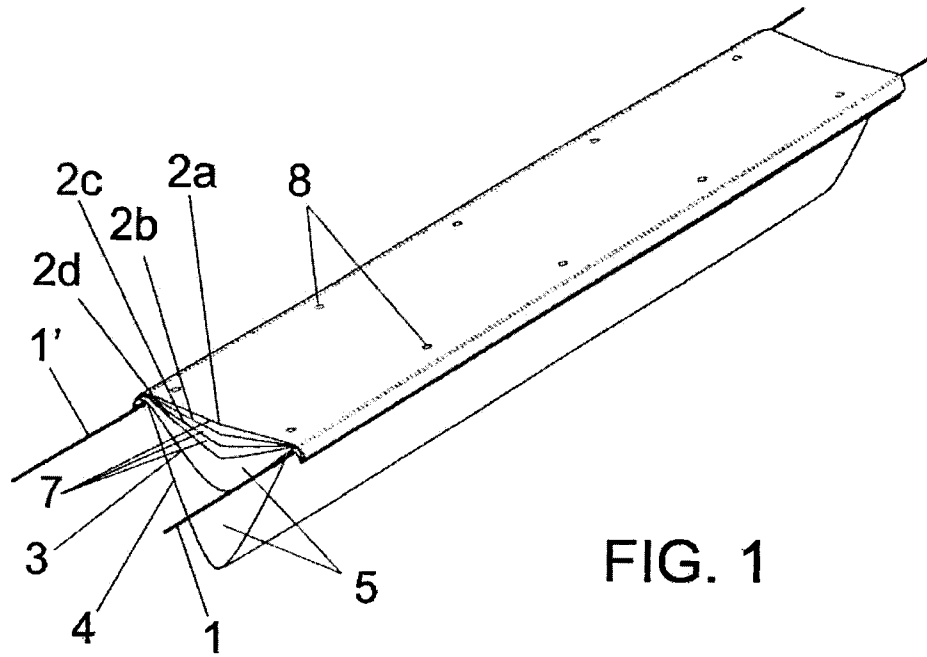


FIG. 1

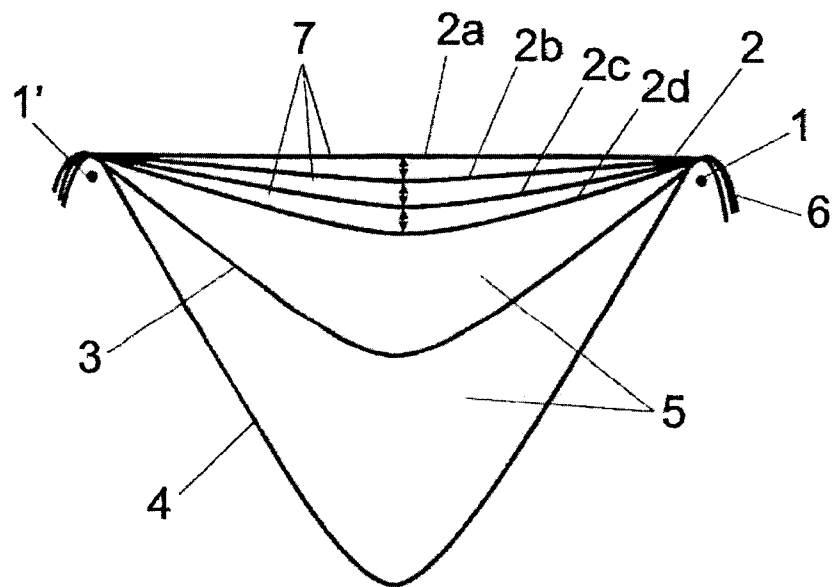


FIG. 2

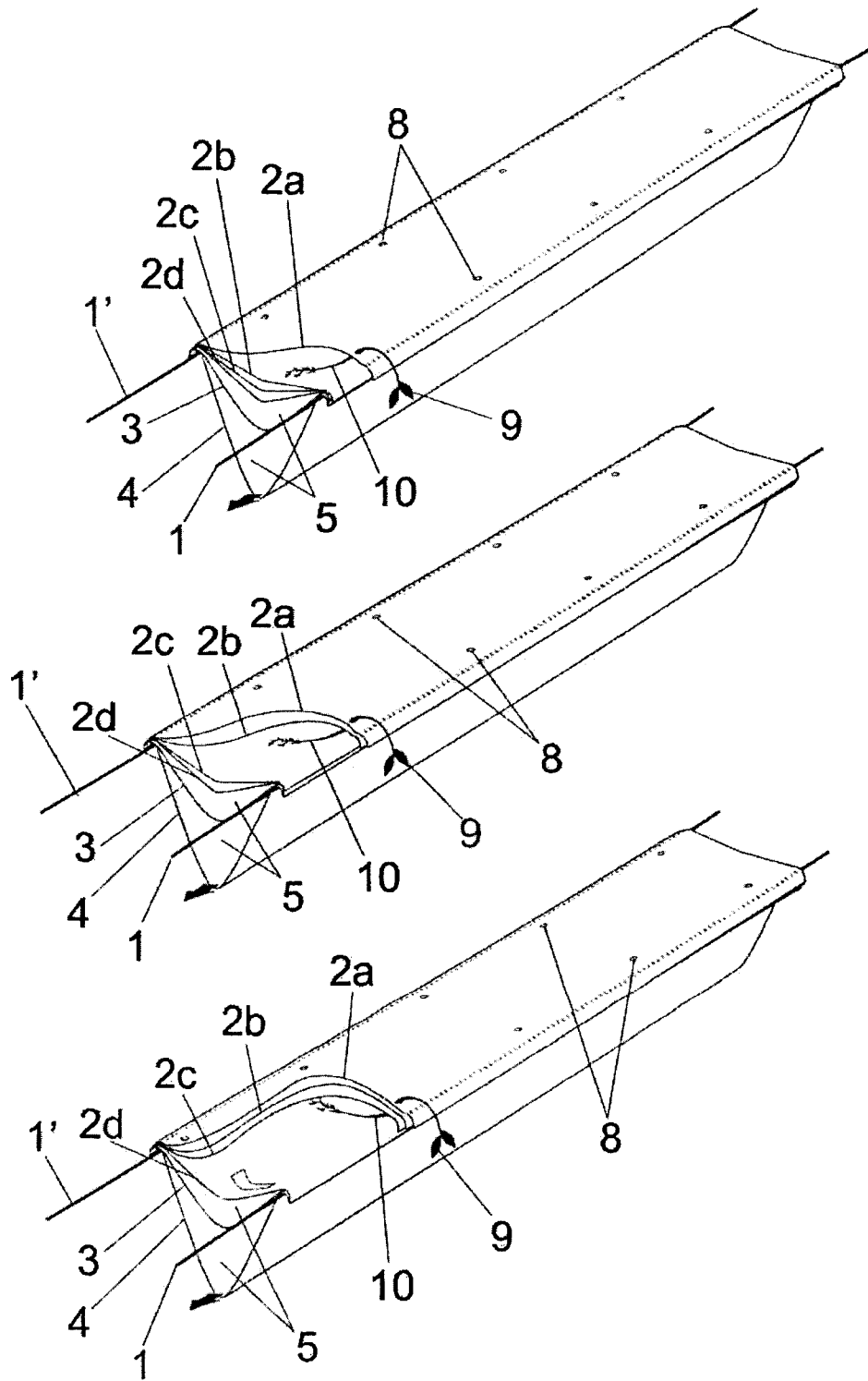


FIG. 3

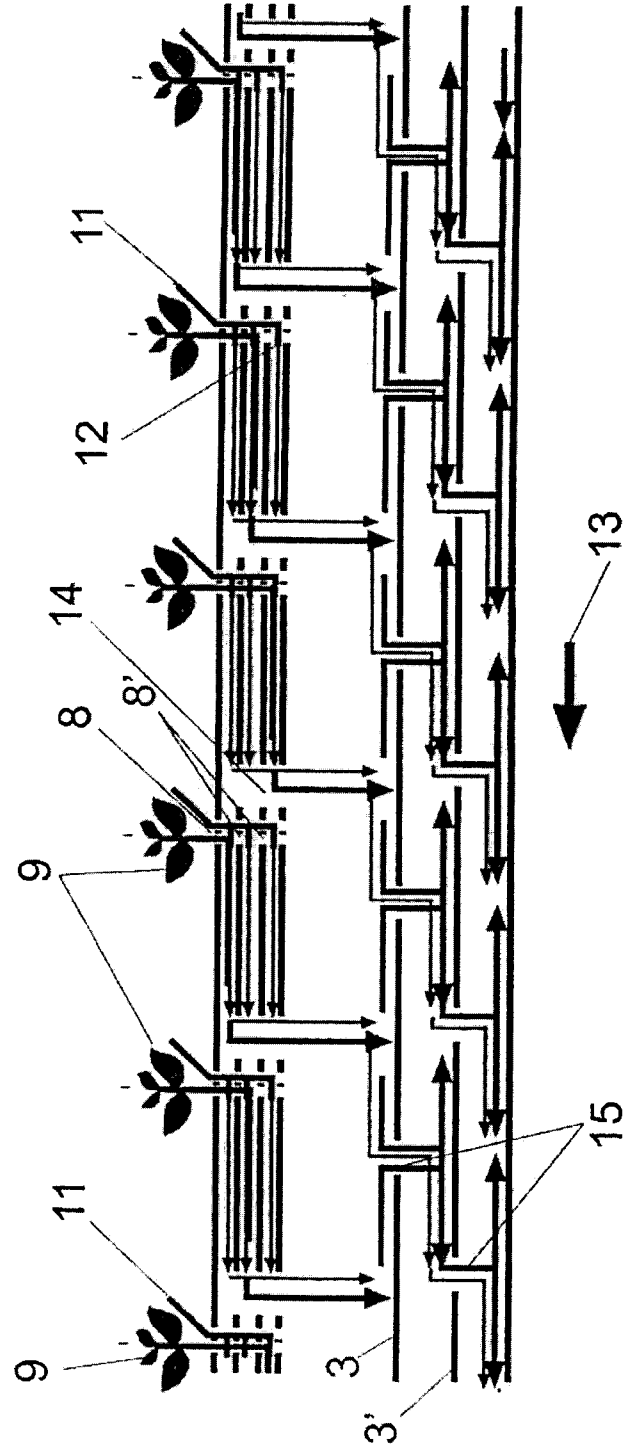


FIG. 4

