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(71) Applicant: **R.P. GROW-TEC INNOVATIONS LTD.** [IL/IL]; 1934000 Gazit (IL).

(72) Inventors: **RAZIEL, Shlomy**; 1934000 Gazit (IL). **MINES, Ori**; 1934000 Gazit (IL). **GALANT, Nir**; 1934000 Gazit (IL). **PINCHUK, Omer**; 20 Hisin St., 6428422 Tel Aviv (IL). **AMAR, Ron**; 21 Argaman St., 1790600 Shimrit (IL). **HACOHEN, Ilan**; 1232500 Gadot (IL). **BAR-SADE, Raz**; 1934000 Gazit (IL). **MALA-MUD, Ran**; 1912500 RamatZvi (IL). **KATZIN, Doron**; 14 HaEmek St., 4526214 Hod HaSharon (IL). **MATRASO, Israel**; 4 Emek HaHula St., 7175476 Modiin (IL).

(74) Agent: **BRESSLER, Eyal** et al.; DR. EYAL BRESSLER LTD., Yitzchak Rabin St. 1, Global Towers A, 18th floor, 4925110 Petach Tikva (IL).

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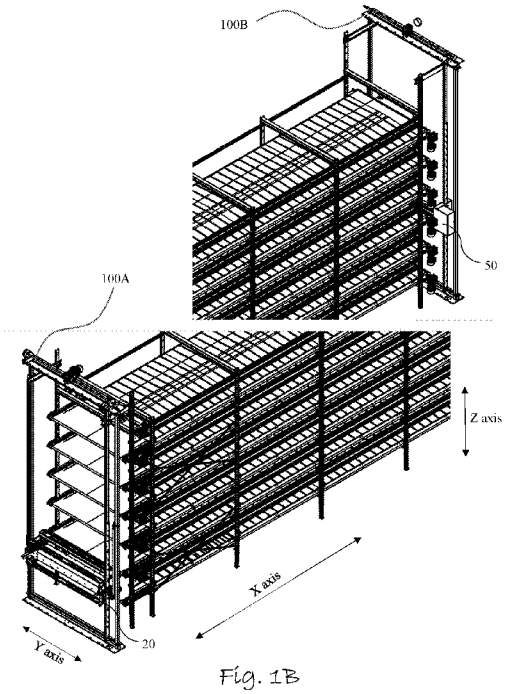


Fig. 1B

(57) Abstract: The present invention enables an indoor continuous sprout hydroculture system with synchronized seeding and harvesting operations comprising either one or a vertically extended stack of two or more horizontal endless conveyors, each of which is positioned along system's length; seeding module located at conveyor's starting portion; an irrigation module located above said conveyor; and harvesting module located at conveyor's ending portion. The invention also discloses an effective method of hydro-culturing sprout in an indoor environment by a continuous sprout system useful for synchronized seeding and harvesting operations; providing either one or a vertically extended stack of two or more horizontal endless conveyors, each of which is positioned along said system's length; locating a seeding module at conveyor's starting portion; locating an irrigation module above said conveyor; and locating harvesting module at conveyor's ending portion.

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A CONTINUOUS SPROUT CULTIVATING SYSTEM WITH SYNCHRONIZED SEEDING AND HARVESTING OPERATIONS AND METHODS THEREOF

FIELD OF THE INVENTION

[1] The present invention generally pertains to an indoor continuous sprout system with synchronized seeding and harvesting operations and methods thereof. The invention also related with means and methods for synchronizing sprout seeding and harvesting by a continuous conveyor having automatic seeding module, irrigation boom, automatic cutter, and optionally, one or more fusion sensors enabling the synchronization.

BACKGROUND OF THE INVENTION

[2] Fresh green vegetation or sprout is an essential input that plays a significant role in animal feed, see Ahamed, Md Shamim, et al. "Present Status and Challenges of Sprout Production in Controlled Environments: A Review." Smart Agricultural Technology (2022): 100080. Ahamed et al., as others, further underline that sprout in the form of sprouted grains such as barley, wheat, sorghum, maize, alfalfa, oats, millets, rye, triticale, sunflower seeds, and lentils can be grown in an environmentally controlled system. Commercial hydroponic sprout companies report that about 6 to 10 kg of fresh sprout could be produced from 1.0 kg grain within 7-10 days in controlled spaces with hydroponic techniques by providing suitable temperature, humidity, and light in the growing rooms. The basic principle for the hydroponic sprout system is that cereal grains respond to water or nutrients rich solutions (nitrogen, phosphorus, potassium, sulfur, magnesium) for germination as well as growth to produce green plants in the short time of 6-9 days. This system has no chance of soil-borne insects, pests, disease attacks, and weed infestation because nutrients are directly fed to the roots and plants placed in trays of different dimensions.

[3] The world's population is growing rapidly and with it the need for a regular supply of milk, meat and poultry originating from livestock. In inverse proportion, however, the amount of soil and water available for growing food for these animals is declining at an accelerated rate. Studies show that hydroponic cultivation of animal feed has improved nutritional values compared to traditional field farming methods. Hydroponic growing in a Controlled Environment Agriculture (CEA) method allows continuity in growing and supplying food

regardless of seasons and weather effects. In addition, CEA is proven to save more than 95% in water and land for reaching the same crops levels as in the open fields .

[4] The biggest challenge reported was the high investment costs required to set up this high-end technology especially for the fully automated greenhouse farms, see Gumisiriza, Margaret S., et al. "Can soilless farming feed urban East Africa? An assessment of the benefits and challenges of hydroponics in Uganda and Tanzania." Environmental Challenges 6 (2022): 100413. Gumisiriza et al. cite others who identified high startup costs as a challenge for adoption of hydroponic farming technology. These costs include hydroponic equipment, and typically modules of the irrigation system, such as: nozzles, PVC pipes, hydroponic net cups, see also Сапаков, А. З., С. З. Сапакова, and Д. Е. Осер. "LITERATURE REVIEW OF HYDROPONIC DEVICES FOR GROWING GREEN SPROUT." Izdenister natigeler 3 (91) (2021): 85-95., greenhouse construction, costs of fertilizers, electricity for system installation, and climate monitoring systems among others.

SUMMARY OF THE INVENTION

[5] It is hence the aim of the present invention to disclose an indoor continuous sprout hydroculture system with synchronized seeding and harvesting operations, characterized by a main longitudinal axis X, main transverse axis Y and height along axis Z; comprising one or more, optionally all members of a group consisting of either one or a vertically extended stack of two or more horizontal endless conveyors [$1_{(n-1)}$, 1_n, $1_{(n+1)}$], each of which is positioned along the system's length (X axis); seeding module (20) located at conveyor's starting portion (100A); an irrigation module (60) located above the conveyor; and harvesting module (50) located at conveyor's ending portion (100B).

[6] It is also an object of the invention to discloses the system as defined above, wherein the system further comprising one or more fusion sensors enabling the synchronization; and wherein at least one of the following is held true: at least one sensor is selected from a group consisting of thermometer, wet bulb thermometer, ambient light sensor, relative humidity detector, spectrophotometer in visible (e.g., for green and/or yellow color detection), NIR or IR spectra, UV detector, VOC sensor, fluorescence detector, smoke detector, movement detector, microphone for detecting abnormalities of acoustic profile samples, time resolved sprout growth, weight and height changes at time, illuminance detector, light scattering sensor, and any combination thereof; at least one sensor located at roots-level sensor, leaf-size detector and/or leaf-level sensor, configured for measuring a parameter or parameters selected from a

group consisting of conductivity sensor, moisture sensor, residual chlorine sensor, pH sensor, turbidity sensor, dissolved oxygen sensor, ORP sensor, COD sensor, ammonia nitrogen ion sensor, chlorophyll sensor, blue-green algae sensor, thermal sensor, ion probe sensor, impedance, salinity, osmolarity, fluid flowing rate and fluid dynamics, water-content, and water activity (aW) and any combination thereof; at least one sensor is selected from a group consisting of plant's (sprout's) height sensor, high-weight converting means and any combination thereof; sensor for detecting levels of crops' nutritional factors; sensor for monitoring industrial and agrotechnical parameter; at least one sensor is selected from a group consisting of PTZ, light sensor, camera, video, CCD, MEMS optical device, spectrophotometer or photo detector, provided within or on a platform, the platform is selected from a group consisting of a boom, static holder, 2D or 3D movable platform, on-line real-time activated sensor and any combination thereof; sensor, e.g., a camera configured for verifying seed and harvest quality; and the one or more fusion sensors is in connection, via a cordial or wireless communication lines, with one or more members of a group consisting of a processor, remote alarming system, operating system, conveyors, cleansing module and actuating mechanisms thereof, the seeding module, the irrigation module, the irrigation module.

[7] It is another object of the invention to discloses the system as defined in any of the above, wherein belt is tilted along at least one portion of its length, the tilts is in an angle θ in respect to the Y axis. The angle θ is optionally ranging from 1 to 33 degrees; from 1 to 15 degrees; from 1 to 7.5 degrees; or from 1 to 4 degrees, i.e., about 4 degrees.

[8] It is another object of the invention to discloses the system as defined in any of the above, wherein the conveyor belt is tilted along at least one portion of its length in either concave or convex manner so that maximal and minimal heights of the conveyor belt at the portion is positioned in a middle portion of belt's width.

[9] It is another object of the invention to discloses the system as defined in any of the above, wherein the concave or convex slopes are in an angle θ1 and θ2 in respect to the Y axis; and the angles θ1 and θ2 are ranging from 1 to 33 degrees; from 1 to 15 degrees; from 2 to 7.5 degrees; or from 2.5 to 4 degrees. \

[10] It is another object of the invention to discloses the system as defined in any of the above, wherein conveyor belt's top texture is characterized by Ra, RMS and Rt are as defined by ISO 4287:1997, incorporated herein as a reference; namely Ra, ranging from 25 μm to 0.025 μm; or 6.3 μm to 0.1 μm; or 1.6 μm to 0.1 μm; RMS, ranging from 1100 to 1.1; or 275 to 4.4 or 64 to 0.8; or Rt, ranging from 100 to 0.3; or 25 to 0.8; or 18 to 1.2.

[11] It is another object of the invention to discloses the system as defined in any of the above, wherein belt's top texture is characterized by HLB < 10; or > 10; or ranging from 1 to 3; or ranging from 3 to 6 or ranging from 7 to 9or ranging from 13 to 16 or ranging from 8 to 16 or ranging from 16 to 18. Commercially available Z 10/2 F/V1-30 WHITE conveyor belt by Ziligen A.Ş. (Turkey) provides well e.g., in this specification.

[12] It is another object of the invention to discloses the system as defined in any of the above, wherein the irrigation module is a watering boom, actuatable above the conveyor, along the Y axis.

[13] It is another object of the invention to discloses the system as defined in any of the above, wherein the system further comprising water recycling subsystem characterized by that a water collecting module is located belt's width (Y axis), either or both (i) for belt's concave cross section - adjacent to conveyor belts' side end(s) and (ii) belt's convex cross section - in conveyor belts' middle portion.

[14] It is another object of the invention to discloses the system as defined in any of the above, wherein the system further comprising a water treatment module, configured for providing at least one member of a group consisting of water filtration, water decontamination, water fertilization and any combination thereof.

[15] It is another object of the invention to discloses the system as defined in any of the above, wherein the system further comprising a belt cleansing module, configured for providing at least one member of a group consisting belt's cleaning, conveyor belts' sterilization, belt's pre-seeding treatment, including wetting, providing the conveyor belt with predefined measures of soil, substrate, growth formulations and a combination thereof.

[16] It is another object of the invention to discloses the system as defined in any of the above, wherein t the conveyor belt cleansing module comprises a rotatable brush (e.g., polyamide, e.g., Nylon™ fibers brush) provided within a housing (e.g., a metal or plastic cage); the housing having an opening configured by means of size and shape (1_Z) to temporarily accommodate conveyor belt's front side, and to cleanse the portion within the encapsulated environment provided within the housing.

[17] It is another object of the invention to discloses the system as defined in any of the above, wherein the conveyor belt cleansing module further comprises one or more members of a group consisting of brush cleaning plate, carding or doping brushes for brush cleaning, vacuum system providing the housing inner portion in negative pressure, plate sterilization modules, including an NTP system, sprayers and purging outlets, applicators of disinfecting fluids

(steam, H_2O_2, ozone, chlorinated GRAS materials etc.), static electricity emitter, and any combination thereof.

[18] It is another object of the invention to discloses the system as defined in any of the above, wherein the conveyor belt cleansing module further comprises actuating mechanism configured to move the along X, and Z-axes, optionally also along Y-axis.

[19] It is another object of the invention to discloses the system as defined in any of the above, wherein the conveyor belt cleansing module further comprises cleansing unit X-axis positioning piston in connection with the housing.

[20] It is another object of the invention to discloses the system as defined in any of the above, wherein the conveyor belt cleansing module further comprises cleansing unit Z-axis positioning mechanism, in connection with the housing.

[21] It is another object of the invention to discloses the system as defined in any of the above, wherein the cleansing unit Z-axis positioning mechanism comprises grooved (14) or teethed (12) erected construction (10) into which Z-locking latch (13), in connection with the housing are temporarily attached.

[22] It is another object of the invention to discloses the system as defined in any of the above, wherein seeding module (20) located at conveyor's starting portion (100A) comprises a seeding unit and a seeding module actuating unit.

[23] It is another object of the invention to discloses the system as defined in any of the above, wherein the seeding unit comprising seeding inlet and seeds outlet; the outlet is provided on top the conveyor belt's starting portion (100A), configured to apply a predefined measure of sprout's seeds on belt's ever-rotating upper surface.

[24] It is another object of the invention to discloses the system as defined in any of the above, wherein the seeding module actuating unit comprising actuating mechanism configured to move the along along X, and Z-axes, optionally also along Y-axis.

[25] It is another object of the invention to discloses the system as defined in any of the above, wherein the conveyor belt cleansing module further comprises seeding unit X-axis positioning piston.

[26] It is another object of the invention to discloses the system as defined in any of the above, wherein the seeding module further comprises Z-axis positioning mechanism.

[27] It is another object of the invention to discloses the system as defined in any of the above, wherein the Z-axis positioning mechanism comprises grooved (14) or teethed (12) erected construction (10) into which Z-locking latch (13), in connection with the housing are temporarily attached.

[28] It is another object of the invention to discloses the system as defined in any of the above, wherein the system further comprising seeding and conveyor belt cleansing integrated module, respectively configured for both *(i)* seeding sprout seeds on the conveyor belt and *(ii)* providing at least one member of a group consisting conveyor belt's cleaning, conveyor belts' sterilization, belt's pre-seeding treatment, including wetting, providing the conveyor belt with predefined measures of soil, substrate, growth formulations and a combination thereof.

[29] It is another object of the invention to discloses the system as defined in any of the above, wherein the seeding and conveyor belt cleansing integrated module respectively comprises *(i)* a seeding unit and a seeding module actuating unit; and *(ii)* a rotatable brush, provided within a housing (e.g., a metal or plastic cage); the housing having at least one first and at least one second openings; each of the at least one first opening is a seeds outlet; the outlet is provided on top the conveyor belt's starting portion (100A), configured to apply a predefined measure of sprout's seeds on belt's ever-rotating upper surface; the each of the at least one second opening is an aperture configured by means of size and shape (1_Z) to temporarily accommodate conveyor belt's front side, and to cleanse the portion within the encapsulated environment provided within the housing.

[30] It is another object of the invention to discloses the system as defined in any of the above, wherein the seeding and conveyor belt cleansing integrated module conveyor belt cleansing module respectively comprises *(i)* seeds container with one or more inlets and outlets; and *(ii)* one or more members of a group consisting of brush cleaning plate, brush cleaning rotatable brush, vacuum system providing the housing inner portion in negative pressure, plate sterilization modules, including an NTP system, sprayers and purging outlets, applicators of disinfecting fluids (steam, H_2O_2, ozone etc.), static electricity emitter, and any combination thereof.

[31] It is another object of the invention to discloses the system as defined in any of the above, wherein the seeding and conveyor belt cleansing integrated module conveyor belt cleansing module actuating mechanism configured to move the along X, and Z-axes, optionally also along Y-axis.

[32] It is another object of the invention to discloses the system as defined in any of the above, wherein the seeding and conveyor belt cleansing integrated module conveyor belt, comprises cleansing unit X-axis positioning piston in connection with the housing.

[33] It is another object of the invention to discloses the system as defined in any of the above, wherein the seeding and conveyor belt cleansing integrated module c Z-axis positioning mechanism, in connection with the housing.

[34] It is another object of the invention to discloses the system as defined in any of the above, wherein the seeding and conveyor belt cleansing integrated module Z-axis positioning mechanism comprises grooved (14) or teethed (12) erected construction (10) into which Z-locking latch (13), in connection with the housing are temporarily attached.

[35] It is another object of the invention to discloses the system as defined in any of the above, wherein the conveyor belt comprises a plurality of evenly spaced along X axis erected ribs extending along Y axis [5(n-1), 5n, 5(n+1)]. Hence, e.g., seeds will be cultivated on and adjacent to ribs, and a cut cake is thus provided without cutting the sprout. Ribs shape and distances define the sprout cake rustled in the process.

[36] It is another object of the invention to discloses the system as defined in any of the above, wherein the irrigation module comprises one or more members of group consisting of actuation mechanism, sensor, and applicator.

[37] It is another object of the invention to discloses the system as defined in any of the above, wherein the actuation mechanism is configured to move one or more water irrigation devices along X, and Z-axes, optionally also along Y-axis.

[38] It is another object of the invention to discloses the system as defined in any of the above, wherein the irrigation devices are selected from a group consisting of drip irrigation, water emitter, sprinkler (61), subsurface drip irrigation, sprayer, fogger, micro-spray or micro-sprinkler, mini-bubbler irrigation, and any combination and variant thereof.

[39] It is another object of the invention to discloses the system as defined in any of the above, wherein the applicator (62) is selected from a group consisting of fertilizing facility, sprout cutter and means for harvesting the sprout or portions thereof, decontaminating facility, light emitter, fluid (liquid and gas) dispenser and any combination thereof. Sensors are locatable on or in connection with the irrigation boom, e.g., about 0.3 to 200 mm, or between 5 mm to 50 mm above the belt.

[40] Processor, in connection with sensors and modules defined hereinabove, is utilizable to calculate AI algorithm for (i) growth optimization and hence (ii) belt-movement rate, seeding rate and harvesting rates. Such a synchronization is not disclosed nor enabled by technology disclosed in the art.

[41] It is another object of the invention to discloses the system as defined in any of the above, wherein the harvesting module comprises one or more members of group consisting of an actuation mechanism, cutting member, sensor and any combination thereof.

[42] It is another object of the invention to discloses the system as defined in any of the above, wherein the actuation mechanism is configured to move one or more water irrigation devices

along the along X, and Z-axes, optionally also along Y-axis; in its linear reciprocating movement along the Y axis, a cutting member slices the sprout to predefined measure;

[43] It is another object of the invention to discloses the system as defined in any of the above, wherein the cutting member is a member of group consisting of sharp blade (e.g., straight knife-like member, round, rectangular, saw-like or a disc-like or pizza-slicer-like member), water jet cutter, heat or plasma cutter, movable jaws or guillotine-like cutter and any combination of variant thereof.

[44] It is another object of the invention to discloses the system as defined in any of the above, wherein the harvesting module (50) is or comprises one member of a group consisting of Cutting/harvesting module, two configurations. knife goes down and conveyor belt advances along axis x, knife goes along axis Y (and also axis Z),

[45] It is another object of the invention to discloses the system as defined in any of the above, wherein the system further comprising a post-harvesting module for providing at least one member of a group consisting of adding fluids, drying, mixing to provide a predefined mixture, pressing, packaging, packing, binding, blending (to blend two or more products harvested in neighboring conveyor belts or products provided from a remote locations) baling, further cutting the hereto cut sprout and otherwise handling, storing, and transporting the same. [e.g., a harvesting module located along the X axis, after the cutter]

[46] It is another object of the invention to discloses the system as defined in any of the above, wherein the system further comprising at least one module of NTP configured to kill at least two orders of magnitudes of molds in a less than five minutes, by ionizing circulated air flow.

[47] It is another object of the invention to discloses the system as defined in any of the above, wherein non-thermal plasma (NTP) is provided in connection with one or more members of a group consisting of seeds to be sown, seeds contained within seeds feeding silo, airflow provided in connection with the seeds, adjacent the conveyor belt, an applicator located in an irrigation boom, airflow provided in connection with the conveyor belt, airflow provided in connection with the cutting module, and any combination thereof.

[48] It is another object of the invention to discloses the system as defined in any of the above, wherein NTP configured to kill at least two orders of magnitudes of molds in a less than five minutes, by ionizing air flowing at the approximate environment of the system.

[49] It is another object of the invention to discloses the system as defined in any of the above, wherein the system further comprising means selected from a group consisting of adding to or enriching with at least one additive the drying air; drying the air; coalescent and conventional oil separating, liquid receiving and treating, eliminating pathogens by emitting NTP; filtering

he air; contacting the air with a material-binding solid-phase or liquid-phase sorbents; bubbling air in a liquid phase for liquid extraction of a material; admixing material-binding agent with the inflowing air.

[50] The aforesaid material is optionally selected from a group consisting of oxygen, carbon dioxide, hydroxyl-containing materials, esters, carboxylic acids, fatty acids, amino acids, peptides, terpenes, water immiscible materials, materials miscible in organic solvents, ethylene, methane, aromatic materials, odors, nitrogen and nitrogen-containing materials, surfactants, volatile organic compounds, toxins, hazard materials, halogens, small particles, dust and fine particles, inorganic matter, pollen, dyes and pigments, insects and organs thereof, contaminations, magnetic materials, viruses, microorganisms, mixtures, and derivatives thereof.

[51] It is another object of the invention to discloses the system as defined in any of the above, wherein the system is configured for heterogenic cultivation, so that one of the following is held true: mixed varieties of sprout are cultivated in a same conveyor belt; in a same conveyor belt, two or more varieties of sprout are cultivated side by side; and mixed varieties of sprout are cultivated in a same cultivating system, namely at least one first variety is cultivated in at least one first conveyor belt, and namely at least one second variety is cultivated in at least one second conveyor belt.

[52] Examples are cultivating Spirulina and sprout; soil bacteria that fix nitrogen (e.g., *Rhizobium*) and/or other plants, such as legumes, fixing nitrogen from the air into ammonia, which acts as a natural fertilizer for the plants, are cultivatable with other varieties of sprout.

[53] It is another object of the invention to discloses in any of the above, sprout is one or more crops, including forms of sprouted grains such as barley, wheat, sorghum, maize, alfalfa, oats, millets, rye, triticale, sunflower seeds, and lentils and other crops, such as spirulina, algae etc., useful for animal and human feed.

[54] Another object of the invention to disclose a method of hydro-culturing sprout in an indoor environment by a continuous sprout system useful for synchronized seeding and harvesting operations; this system (optionally as defined hereinabove) is characterized by a main longitudinal axis X, main transverse axis Y and height along axis Z. The method comprises at least one step, or optionally all steps as follows: providing either one or a vertically extended stack of two or more horizontal endless conveyors [$1_{(n-1)}$, 1_n, $1_{(n+1)}$], each of which is positioned along the system's length (X axis); locating a seeding module (20) at conveyor's starting portion (100A); locating an irrigation module (60, e.g., figures 121, 122, 121a) above the conveyor; and locating harvesting module (50) at conveyor's ending portion (100B).

[55] It is another object of the invention to discloses the method as defined above, wherein the method further comprising steps of providing one or more fusion sensors enabling the synchronization; wherein at least one of the following is held true: the method further comprises step of providing at least one sensor is selected from a group consisting of thermometer, wet bulb thermometer, ambient light sensor, relative humidity detector, spectrophotometer in visible, NIR or IR spectra, UV detector, VOC sensor, fluorescence detector, smoke detector, movement detector, microphone for detecting abnormalities of acoustic profile samples, time resolved sprout growth, weight and height changes at time, illuminance detector, light scattering sensor, and any combination thereof; the method further comprises step of providing at least one sensor located at roots-level sensor, leaf-size detector and/or leaf-level sensor, configured for measuring a parameter or parameters selected from a group consisting of conductivity sensor, moisture sensor, residual chlorine sensor, pH sensor, turbidity sensor, dissolved oxygen sensor, ORP sensor, COD sensor, ammonia nitrogen ion sensor, chlorophyll sensor, blue-green algae sensor, thermal sensor, ion probe sensor, impedance, salinity, osmolarity, fluid flowing rate and fluid dynamics, water-content, and water activity (aW) and any combination thereof; the method further comprises step of providing at least one sensor is selected from a group consisting of plant's (sprout's) height sensor, high-weight converting means and any combination thereof; the method further comprises step of providing sensor for detecting levels of crops' nutritional factors; the method further comprises step of providing sensor for monitoring industrial and agrotechnical parameter; the method further comprises step of providing at least one sensor is selected from a group consisting of PTZ, light sensor, camera, video, CCD, MEMS optical device, spectrophotometer or photo detector, provided within or on a platform, the platform is selected from a group consisting of a boom, static holder, 2D or 3D movable platform, on-line real-time activated sensor and any combination thereof; the method further comprises step of providing sensor, e.g., a camera configured for verifying seed and harvest quality; and the method further comprises step of providing the one or more fusion sensors in connection, via a cordial or wireless communication lines, with one or more members of a group consisting of a processor, remote alarming system, operating system, conveyors, cleansing module and actuating mechanisms thereof, the seeding module, the irrigation module, the irrigation module.

[56] It is another object of the invention to discloses the method as defined above, wherein the method further comprising a step of tilting the conveyor belt along at least one portion of its length, the tilts are in an angle θ in respect to the Y axis.

[57] It is another object of the invention to discloses the method as defined above, wherein the method further comprising step of providing angle θ is ranging from 1 to 33 degrees; from 1 to 15 degrees; from 1 to 7.5 degrees; or from 2 to 5 degrees.

[58] It is another object of the invention to discloses the method as defined above, wherein the method further comprising step of either continuously or temporarily tilting the belt along at least one portion of its length in either concave or convex manner so that maximal and minimal heights of the conveyor belt at the portion is positioned in a middle portion of belt's width.

[59] It is another object of the invention to discloses the method as defined above, wherein the method further comprising step of providing the concave or convex slopes are in an angle θ1 and θ2 in respect to the Y axis; and the angles θ1 and θ2 are ranging from 1 to 33 degrees; from 1 to 15 degrees; from 2 to 7.5 degrees; or from 2.5 to 4 degrees.

[60] It is another object of the invention to discloses the method as defined above, wherein the method further comprising step of providing the conveyor belt's top texture in parameters selected from Ra, RMS and Rt, as defined by ISO 4287:1997, namely Ra, ranging from 25 μm to 0.025 μm; or 6.3 μm to 0.1 μm; or 1.6 μm to 0.1 μm; RMS, ranging from 1100 to 1.1; or 275 to 4.4 or 64 to 0.8; or Rt, ranging from 100 to 0.3; or 25 to 0.8; or 18 to 1.2.

[61] It is another object of the invention to discloses the method as defined above, wherein the method further comprising step of providing belt's top texture to be characterized by HLB < 10; or > 10; or ranging from 1 to 3; or ranging from 3 to 6 or ranging from 7 to 9or ranging from 13 to 16 or ranging from 8 to 16 or ranging from 16 to 18.

[62] It is another object of the invention to discloses the method as defined above, wherein the irrigation module is a watering boom, actuatable above the conveyor, along the Y axis.

[63] It is another object of the invention to discloses the method as defined above, wherein the method further comprising step of providing water recycling subsystem characterized by that a water collecting module is located belt's width (Y axis), either or both (i) for belt's concave cross section - adjacent to conveyor belts' side end(s) and (ii) belt's convex cross section - in conveyor belts' middle portion.

[64] It is another object of the invention to discloses the method as defined above, wherein the method further comprising step of providing a water treatment module, configured for providing at least one member of a group consisting of water filtration, water decontamination, water fertilization and any combination thereof.

[65] It is another object of the invention to discloses the method as defined above, wherein the method further comprising step of providing a conveyor belt cleansing module, configured for

providing at least one member of a group consisting conveyor belt's cleaning, conveyor belts' sterilization, belt's pre-seeding treatment, including wetting, providing the conveyor belt with predefined measures of soil, substrate, growth formulations and a combination thereof.

[66] It is another object of the invention to discloses the method as defined above, wherein the method further comprising step of providing conveyor belt cleansing module, the module comprises a rotatable brush provided within a housing; the housing having an opening configured by means of size and shape (1_Z) to temporarily accommodate conveyor belt's front side, and to cleanse the portion within the encapsulated environment provided within the housing.

[67] It is another object of the invention to discloses the method as defined above, wherein the method further comprising step of providing the conveyor belt cleansing module with one or more members of a group consisting of brush cleaning plate, brush cleaning rotatable brush, vacuum system providing the housing inner portion in negative pressure, plate sterilization modules, including an NTP system, sprayers and purging outlets, applicators of disinfecting fluids, sstatic electricity emitter, and any combination thereof.

[68] It is another object of the invention to discloses the method as defined above, wherein the method further comprising step of providing the conveyor belt cleansing module to further comprises actuating mechanism configured to move the along X, and Z-axes, optionally also along Y-axis s.

[69] It is another object of the invention to discloses the method as defined above, wherein the method further comprising step of providing the conveyor belt cleansing module with a cleansing unit X-axis positioning piston in connection with the housing.

[70] It is another object of the invention to discloses the method as defined above, wherein the method further comprising step of providing the belt cleansing module with a cleansing unit Z-axis positioning mechanism, in connection with the housing.

[71] It is another object of the invention to discloses the method as defined above, wherein the method further comprising step of providing the cleansing unit Z-axis positioning mechanism with a grooved (14) or teethed (12) erected construction (10) into which Z-locking latch (13), in connection with the housing are temporarily attached.

[72] It is another object of the invention to discloses the method as defined above, wherein the method further comprising step of locating a seeding module (20) at conveyor's starting portion (100A) and providing it with a seeding unit and a seeding module actuating unit.

[73] It is another object of the invention to discloses the method as defined above, wherein the method further comprising step of providing the seeding unit with seeding inlet and seeds

outlet; the outlet is provided on top the conveyor belt's starting portion (100A), configured to apply a predefined measure of sprout's seeds on belt's ever-rotating upper surface.

[74] It is another object of the invention to discloses the method as defined above, wherein the method further comprising step of providing the seeding module actuating unit with actuating mechanism configured to move the along X, and Z-axes, optionally also along Y-axis.

[75] It is another object of the invention to discloses the method as defined above, wherein the method further comprising step of providing the conveyor belt cleansing module with a seeding unit X-axis positioning piston.

[76] It is another object of the invention to discloses the method as defined above, wherein the method further comprising step of providing seeding module with a Z-axis positioning mechanism.

[77] It is another object of the invention to discloses the method as defined above, wherein the method further comprising step of providing the Z-axis positioning mechanism with grooved (14) or teethed (12) erected construction (10) into which Z-locking latch (13), and further providing the same in connection with the housing.

[78] It is another object of the invention to discloses the method as defined above, wherein the method further comprising step of providing a seeding and conveyor belt cleansing integrated module, respectively configured for both *(i)* seeding sprout seeds on the conveyor belt and (ii) providing at least one member of a group consisting conveyor belt's cleaning, conveyor belts' sterilization, belt's pre-seeding treatment, including wetting, providing the conveyor belt with predefined measures of soil, substrate, growth formulations and a combination thereof.

[79] It is another object of the invention to discloses the method as defined above, wherein the method further comprising step of providing the seeding and conveyor belt cleansing integrated module respectively with *(i)* a seeding unit and a seeding module actuating unit; and *(ii)* a rotatable brush (e.g., a nylon fibers brush), locatable within a housing; providing the housing having at least one first and at least one second openings; each of the at least one first opening is a seeds outlet; providing the outlet on top the belt's starting portion (100A), applying a predefined measure of sprout's seeds on belt's ever-rotating upper surface; by means of size and shape (1_Z) configuring the each of the at least one second opening is an aperture to temporarily accommodate conveyor belt's front side, and to cleanse the portion within the encapsulated environment provided within the housing.

[80] It is another object of the invention to discloses the method as defined above, wherein the method further comprising step of dependent claims comprising step of providing *(i)* seeds container with one or more inlets and outlets; and *(ii)* one or more members of a group

consisting of brush cleaning plate, brush cleaning rotatable brush, vacuum system providing the housing inner portion in negative pressure, plate sterilization modules, including an NTP system, sprayers and purging outlets, applicators of disinfecting fluids, static electricity emitter, and any combination thereof.

[81] It is another object of the invention to discloses the method as defined above, wherein the method further comprising step of configuring the same to move the along X, and Z-axes, optionally also along Y-axis or otherwise moving the same along X, and Z-axes, optionally also along Y-axis.

[82] It is another object of the invention to discloses the method as defined above, wherein the method further comprising step of connecting a cleansing unit X-axis positioning piston with the housing.

[83] It is another object of the invention to discloses the method as defined above, wherein the method further comprising step of connecting a Z-axis positioning mechanism, in connection with the housing.

[84] It is another object of the invention to discloses the method as defined above, wherein the seeding and conveyor belt cleansing integrated module Z-axis positioning mechanism comprises grooved (14) or teethed (12) erected construction (10) into which Z-locking latch (13), in connection with the housing are temporarily attached.

[85] It is another object of the invention to discloses the method as defined above, wherein the method further comprising step of providing a plurality of evenly spaced along X axis erected ribs extending along Y axis [5(n-1), 5n, 5(n+1)].

[86] It is another object of the invention to discloses the method as defined above, wherein the method further comprising step of providing the irrigation module with one or more members of group consisting of actuation mechanism, sensor, and applicator.

[87] It is another object of the invention to discloses the method as defined above, wherein the method further comprising step of configuring the actuation mechanism to move one or more water irrigation devices along X, and Z-axes, optionally also along Y-axis or otherwise moving the same along X, and Z-axes, optionally also along Y-axis;

[88] It is another object of the invention to discloses the method as defined above, wherein the method further comprising step of providing the irrigation devices with one or more members of a group consisting of a drip irrigation, water emitter, sprinkler, subsurface drip irrigation, sprayer, fogger, micro-spray or micro-sprinkler, mini-bubbler irrigation, and any combination and variant thereof.

[89] It is another object of the invention to discloses the method as defined above, wherein the method further comprising step of providing the applicator with one or more members of a group consisting of fertilizing facility, sprout cutter and means for harvesting the sprout or portions thereof, decontaminating facility, light emitter, fluid (liquid and gas) dispenser and any combination thereof.

[90] It is another object of the invention to discloses the method as defined above, wherein the harvesting module comprises one or more members of group consisting of an actuation mechanism, cutting member, sensor and any combination thereof.

[91] It is another object of the invention to discloses the method as defined above, wherein the actuation mechanism is configured to move one or more water irrigation along X, and Z-axes, optionally also along Y-axis; in its linear reciprocating movement along the Y axis, a cutting member slices the sprout to predefined measure.

[92] It is still another object of the invention to discloses the method as defined above, wherein the cutting member is a member of group consisting of sharp blade (e.g., straight knife-like member, round, rectangular, saw-like or a disc-like or pizza-slicer-like member), water jet cutter, heat or plasma cutter, movable jaws or guillotine-like cutter and any combination of variant thereof.

[93] It is another object of the invention to discloses the method as defined above, wherein the method further comprising step of post-harvesting the hereto harvest sprout by means of a post-harvesting module by providing at least one member of a group consisting of adding fluids, drying, mixing to provide a predefined mixture, pressing, packaging, packing, binding, blending (to blend two or more products harvested in neighboring conveyor belts or products provided from a remote locations) baling, further cutting the hereto cut sprout and otherwise handling, storing, and transporting the same.

[94] It is another object of the invention to discloses the method as defined above, wherein the method further comprising step of providing at least one module of NTP configured to kill at least two orders of magnitudes of molds in a less than five minutes, by ionizing circulated air flow.

[95] It is another object of the invention to discloses the method as defined above, wherein the method further comprising step of directly or indirectly administrating the NTP with one or more members of a group consisting of seeds to be sown, seeds contained within seeds feeding silo, airflow provided in connection with the seeds, adjacent the conveyor belt, an applicator located in an irrigation boom, airflow provided in connection with the conveyor belt, airflow provided in connection with the cutting module, and any combination thereof.

[96] It is another object of the invention to discloses the method as defined above, wherein the method further comprising step of configuring the NTP to kill at least two orders of magnitudes of molds in a less than five minutes, by ionizing air flowing at the approximate environment of the system.

[97] It is another object of the invention to discloses the method as defined above, wherein the method further comprising step of providing the NTP by means selected from a group consisting of adding to or enriching with at least one additive the drying air; drying the air; coalescent and conventional oil separating, liquid receiving and treating, eliminating pathogens by emitting NTP; filtering he air; contacting the air with a material-binding solid-phase or liquid-phase sorbents; bubbling air in a liquid phase for liquid extraction of a material; admixing material-binding agent with the inflowing air. The method of claim 40 or any of dependent claims wherein aforesaid material is selected from a group consisting of oxygen, carbon dioxide, hydroxyl-containing materials, esters, carboxylic acids, fatty acids, amino acids, peptides, terpenes, water immiscible materials, materials miscible in organic solvents, ethylene, methane, aromatic materials, odors, nitrogen and nitrogen-containing materials, surfactants, volatile organic compounds, toxins, hazard materials, halogens, small particles, dust and fine particles, inorganic matter, pollen, dyes and pigments, insects and organs thereof, contaminations, magnetic materials, viruses, microorganisms, mixtures, and derivatives thereof.

[98] It is another object of the invention to discloses the method as defined above, wherein the method further comprising step of of configuring the system for heterogenic cultivation, so that one of the following is held true: cultivating mixed varieties of sprout in a same conveyor belt; cultivating in a same conveyor belt, two or more varieties of sprout side by side; and cultivating mixed varieties of sprout are cultivated in a same cultivating system, namely at least one first variety is cultivated in at least one first conveyor belt, and namely at least one second variety is cultivated in at least one second conveyor belt.

BRIEF DESCRIPTION OF THE FIGURES

[99] The present invention will become more fully understood from the detailed description and the accompanying drawings, wherein

[100] **Figures 1A-E** illustrate an indoor continuous sprout hydroculture system with synchronized seeding and harvesting operations, characterized by a main longitudinal axis X, main transverse axis Y and height along axis Z; according to an embodiment of the invention;

[101] **Figure 2A-B** illustrate the system and modules thereof according to a set of embodiments of the invention;

[102] **Figure 3A-B** illustrates seeding modules according to a few embodiments of the invention;

[103] **Figure 4A-B** illustrate harvesting (cutting) according to a few embodiments of the invention; and,

[104] **Figure 5** illustrates a cultivating synergy provided by fusion sensor according to a few embodiments of the invention

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[105] The present invention will now be described more fully hereinafter with reference to the accompanying drawings, in which a preferred embodiment of the invention is shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, this embodiment is provided so that this disclosure will be thorough and complete and will fully convey the scope of the invention to those skilled in the art.

[106] The term "**post-harvest**" is the stage of crop production immediately following harvest, including cooling, cleaning, sorting and packing. The instant a crop is removed from the ground, or separated from its parent part, it begins to deteriorate. The term also refers to the point in time in which an agricultural commodity is harvested for sale, trade, or other human use. With respect to edible commodities e.g., fruit, vegetables, and fungi or non-edible commodities that are picked, e.g., flowers, the commodity begins its existence as "post-harvest" after picking. For non-edible commodities e.g., trees, shrubs, flowering plants and/or seedling stocks, post-harvest is the point at which the commodity is packed, harvested or otherwise prepared for marketing.

[107] The term "**plants**" means all plants and plant populations, which includes, desirable and undesirable wild plants, cultivars and plant varieties (whether or not protectable by plant variety or plant breeder's rights). Cultivars and plant varieties can be plants obtained by conventional propagation and breeding methods, which can be assisted or supplemented by one or more biotechnological methods such as by use of double haploids, protoplast fusion, random and directed mutagenesis, CRISPR/Cas, grafting, RNAi, molecular and/or genetic markers, and/or by bioengineering and genetic engineering methods. The term "**plant parts**" means all above ground and below ground parts and organs of plants such as shoot, leaf, blossom and root, whereby for example leaves, needles, stems, branches, blossoms, fruiting

bodies, fruits and seed as well as roots, corms and rhizomes are listed. Crops and vegetative and generative propagating material, for example cuttings, corms, rhizomes, runners and seeds also belong to plant parts.

[108] The term "**additive**" refers in a non-limiting manner in this connection to biocides and preservatives (e.g., metal salts, quaternary amine, bromomethane, ozone), plants hormones (e.g., ethylene and derivatives thereof, 1-methylcyclopropene), plants breeding agents and genetic materials, enzymes and coenzymes, plant extracts, microorganisms such as probiotics, germination agents, fertilizes, acidulants and buffers, carbon dioxide, anti-caking agents, nitrogen gas, antifoaming agents, antioxidants, bulking agents, emulsifiers, flavor enhancers, perfuming agents, fruit and seed-coating agents, fertilizers, mineral salts, calcium carbonate containing dust, stabilizers, starches, thickeners, UV stabilizers, blockers or enhancers, vitamins and minerals and any combination, derivatives and mixtures thereof.

[109] It is in the scope of the invention wherein the sensor is a device that produces an output signal for the purpose of sensing a biological, chemical, agrotechnical and of course, physical phenome. In a broa definition, a sensor is a device, module, machine, or subsystem that detects events or changes in its environment and sends the information to other electronics, frequently a computer processor. sensor and interchangeably. It is well in the scope of the invention wherein sensor, or interchangeably, a detector, is useful for detecting at least one parameter selected form a group consisting of air temperature, humidity, wet-bulb temp., ΔH, relative humidity, crop's water activity, air flow-speed, air flow direction, air flow volume, electrical conductivity, sound parameters (speed, pressure level, pitch, duration, loudness, timbre and texture), parameters of light and electromagnetic radiation, including intensity, spectra, pulses' pattern, continuous wave patterns; additive concentration, weight, including time resolved weight of the rack, the tray and dried crop, analytics, including chemical, microbial and biological detecting or measuring means, and any combination thereof.

[110] As used herein, the term "**about**" refers to an amount that is near the stated amount by 10%, 5%, or 1%, including increments therein.

[111] Reference is now made to **figures 1A** to **4B**, each of which schematically illustrates in a non-limiting manner, and in some of the cases, an out-of-scale manner, one of a few embodiments of the invention: namely, **Figures 1A-E** illustrate an indoor continuous sprout hydroculture system with synchronized seeding and harvesting operations, characterized by a main longitudinal axis X, main transverse axis Y and height along axis Z; according to an embodiment of the invention; **Figure 2A-E** illustrate the system and modules thereof according

to a set of embodiments of the invention. The modules are, one or more of the following: either one or a vertically extended stack of two or more horizontal endless conveyors [$1_{(n-1)}$, 1_n, $1_{(n+1)}$], each of which is positioned along the system's length (X axis); seeding module (20) located at conveyor's starting portion (100A); an irrigation module (60) located above the conveyor; and harvesting module (50) located at conveyor's ending portion (100B). **Figure 3A-B** illustrates seeding modules according to a few embodiments of the invention; and **Figure 4A-B** illustrates harvesting (cutting) according to a few embodiments of the invention.

EXAMPLE 1

[112] Reference is now made to figures **1A-1E**, schematically illustrates a (preferably yet not necessarily indoor located-) continuous (at intervalley operated-) sprout (namely, also sprouts) hydroculture system (schemes 100, 101) with synchronized seeding and harvesting operations. The system is characterized by a main longitudinal axis X, main transverse axis Y and height along axis Z. The system, *inter alia*, comprises either one or a plurality of vertically extended stack substantially-horizontal endless conveyor belts [1(n-1), 1n, 1(n+1)] (see illustration 103B), each of which is positioned along system's length (X axis). Portions of both front and back illustration if the system are illustrated in drawings 105a1 and 105a2.

[113] The belts are either continuously or intermediately cycled in one of the following manners (i) in a predefined velocity, (ii) in a time resolved velocities-profile, (iii) in a feedbacked manner, namely, as a function of fusion sensor output. Hence for example, for a first variety of sprout, at least one first belt is configured to cycle in a first rate; whilst for a second variety of sprout, at least one second belt is configured to cycle in a second (higher or lower) rate.

[114] As an another for example, for a homogeneous sprout cake, at least one first belt is configured to cycle in a first rate; whilst for a heterogeneous sprout's cake, where synergistic growth is recorded (e.g., growth of sprouts with nitrogen fixating plants' varieties), at least one second belt is configured to cycle in a second (higher) rate is utilizable.

[115] Another example is that for at relatively cold ambient temperatures at least one first belt is configured to cycle in a first rate; whilst for higher ambient temperatures, at least one second belt is configured to cycle in a second (higher) rate.

[116] Seeding module (20) is located at conveyor's starting portion (100A). An irrigation module (60, illustrations 121-123, 121a, 123a) located above the conveyor. harvesting module (50) is located at conveyor's ending portion (100B). As shown in scheme 101 and 102, the conveyor belt comprises a plurality of evenly spaced along X axis erected ribs extending along Y axis [5(n-1), 5n, 5(n+1)].

[117] System 100 is designed to provide on a daily basis ten tons of sprouts that grow in a completely controlled indoor environment. The system shown here is based on an array or a stack of dedicated six-level racks system each. Each level, 30 m long by 2 m wide, carries a special conveyor belt, which is the growing medium for the sprouts. Above each conveyor belt, a water resist led light system and an irrigation system. Along each conveyor belt, gutters are installed on both sides to collect the drain irrigation water for recycling and reuse. The entire facility has six to seven of such six-levels conveyor systems. The entire system is fully automatic or autonomously operated, and comprises means for feeding seeds from silos to an autonomous sowing system that serves each floor. In the same way, the "harvest" system is fully automatic so each one of the 6-level racks-system is served separately. The complete system is controlled by a central industrial controller that runs a growing protocol that manages the complete process including climate, lighting, irrigation, sowing and harvesting.

EXAMPLE 2

[118] In most of the other commercial growing sprout systems, the growing media is trays placed on a conveyor. This concept wastes potential growing space and requires complex cleaning actions of each tray between growing cycles. In addition, harvesting (e.g., cutting) is rather problematic because the "sprout carpet" (or 'cake') required to be pulled out of the tray prior to it cutting to the right size.

[119] In the hereto defined system and methods, the growing media is the conveyor belt itself. The conveyor belt is constructed so that it is sloping from the center along the entire length of the conveyor towards the margins. This design creates water draining to dedicated gutters at each side of the conveyor, so drainage water will be recycled and reused. This drainage system allows appropriate oxygen supply to the roots while preventing molds to develop at the roots.

[120] It is in the scope of the invention wherein water flow rate (smooth belt upper surface) is as follows: $V = \sqrt[2]{2g * belt\ width * \sin(\text{theta})}$.

[121] The conveyor belt is optionally tilted along at least one portion of its length in linear manner, concave or convex manners so that maximal and minimal heights of the conveyor belt at the portion is positioned in a middle portion of belt's width; wherein the concave or convex slopes are in an angle theta 1 [θ1] and theta 2 [θ2] in respect to said Y axis; and the angles θ1 and θ2 are ranging from 1 to 33 degrees; from 1 to 15 degrees; from 2 to 7.5 degrees; or from 3 to 4 degrees.

[122] In case belt is not smooth along its upper surface, water velocity decreases. conveyor belt's top texture in parameters selected from Ra, RMS and Rt, as defined by ISO 4287:1997, namely

a. Ra, ranging from 25 μm to 0.025 μm; or 6.3 μm to 0.1 μm; or 1.6 μm to 0.1 μm;
b. RMS, ranging from 1100 to 1.1; or 275 to 4.4 or 64 to 0.8; or
c. Rt, ranging from 100 to 0.3; or 25 to 0.8; or 18 to 1.2.

Additionally, or alternatively, belt's topmost texture may be characterized by its hydrophobicity, as defined e.g., in HLB scale. HLB < 10; or > 10; or ranging from 1 to 3; or ranging from 3 to 6 or ranging from 7 to 9 or ranging from 13 to 16 or ranging from 8 to 16 or ranging from 16 to 18.

EXAMPLE 3

[123] Reference is made again to figures 2A-2B, schematically depicting boom-irrigation mechanism. There are two common concepts of irrigating commercial indoor sprout: First is flooding with drips that are installed at the end of a dedicated "growing-gutter". This method is problematic because the flow of water down the gutter is not uniform and is disturbed by the developing roots. Spraying water with static nozzles with round or square spraying patterns that are installed above the entire growing area of the sprouts. Second is nozzles mounted on pipes along the growing area when the pipes rotate back and forth in a suitable pattern in order to cover the required irrigation area. In a commercial sprout-growing system in indoor conditions, hundreds and even thousands of nozzles are required for coverage of the entire growing area. Each nozzle must be adjusted so it will spray water exactly where needed and requires periodic maintenance in order to treat clogged nozzles .

[124] In the hereto defined system and methods, irrigation is based on nozzles mounted on a pole (boom) which is installed across each conveyor belt and moves along it while spraying the water. This method saves hundreds of nozzles and makes it possible to grow different types of sprouts along the conveyor belt so that each variety receives the amount of water it needs. The movement of the boom and quantity of water is managed and monitored by controller and sensors.

EXAMPLE 4

[125] Pathogens such as bacteria, viruses and molds float in the air and pose a great danger to the quality of the sprouts. To reduce this problem as much as possible, installed in system100 facilities NTP systems. The system consists of independent units mounted on the HVAC ducts,

thus ensuring optimal distribution throughout the space. Each unit contains a high voltage transformer connected to unique patented electrodes which produce electrical energy that ionized the air. Ionized air is distributed throughout the room and destroys the cell shell of the pathogens and thus they are neutralized.

[126] An NTP was found effective to kill molds in a few minutes by ionizing the air, without requiring to add any additional chemicals. It is acknowledged that the number of NTP units (or their output) is proportional to the room size. Unlike other anti-molds treatments such as UV, in which molds will only be affected if they pass in proximity to the UV bulb, the hereto presented NTP system blows ionized air into the room, creates an atmosphere which neutralizes existing molds and prevents development of new ones. Commercially available NTP and NTP-like means, are commercially available, including, e.g., DUCT™ 70MIC4C product, by Jonix S.p.A. B Corporation (Italy) and Sterionizer™ D6 by FILT AIR Ltd (Israel).

EXAMPLE 5

[127] Roughness includes the finest (shortest wavelength) irregularities of a surface. Roughness (referred to as tool marks) generally results from a production process or material condition. Roughness is measured in a transversal direction to the main grooves. – The mean arithmetical value “Ra” in μm is assumed for roughness measurements. Surface Texture is the variation in the surface in the form of roughness, waviness, lay, and flaws. In practice, both the words – “Surface Texture” and “Surface Roughness” are used to explain common meaning of surface roughness symbols. Waviness includes the more widely spaced (longer wavelength) deviations of a surface from its nominal shape. Waviness errors are intermediate in wavelength between roughness and form error. It’s the deviation of much larger space that come about from deflection, vibration, heat treatment, etc. Lay refers to the predominant pattern of the surface texture. Ordinarily, lay is determined by the particular production method and geometry used. Flaws are defects, or irregularities, that occur more or less at random over the surface. These defects can be such things as cracks, blow holes, ridges, scratches etc. Ra is a measure of the average roughness of a surface. It is a unitless quantity that expresses the average height of the surface irregularities, or peaks and valleys, over a given length. It is hence in the scope of the invention wherein conveyor belt's top texture is characterized by Ra, RMS and Rt (defined by ISO 4287:1997) values are as defined by ISO 4287:1997, incorporated herein as a reference; namely Ra, ranging from 25 mm to 0.025 mm; or 6.3 mm to 0.1 mm; or 1.6 mm to 0.1 mm; RMS, ranging from 1100 to 1.1; or 275 to 4.4 or 64 to 0.8; or Rt, ranging from 100 to 0.3; or 25 to 0.8; or 18 to 1.2.

EXAMPLE 6

[128] The hydrophilic–lipophilic balance of a surfactant is a measure of the degree to which it is hydrophilic or lipophilic, determined by calculating values for the different regions of the molecule, as described by Griffin, William C. (1949), "Classification of Surface-Active Agents by 'HLB'" (PDF), Journal of the Society of Cosmetic Chemists, 1 (5): 311–26, archived from the original (PDF) on 2014-08-12, retrieved 2013-05-25. It is well in the scope of the invention wherein belt's outermost HLB value is selected from values as defined hereinafter: 10 >Lipid-soluble (water-insoluble), 10 <Water-soluble (lipid-insoluble); 1 to 3: anti-foaming agent; 3 to 6: W/O (water in oil) emulsifier; 7 to 9: wetting and spreading agent; 13 to 16: detergent; 8 to 16: O/W (oil in water) emulsifier; to 18: solubiliser or hydrotrope. HLB 8 is found utilizable in some of the belts; whereas HLB 14 is utilizable in other belts. One example of hydrophobic belt is a silicon-made top portion (HLB ± 12).

[129] Zeta potential is a physical property which is exhibited by any particle in suspension, macromolecule or material surface. The present invention indicates that belts' zeta potential influences water flow along the Y-axis slope, providing useful tool for growth optimization. Hence for example, high zeta potential is provided in belts made of DRAGIT® E 100 by Evonik Operations GmbH (DE) is a cationic copolymer based on dimethylaminoethyl methacrylate, butyl methacrylate, and methyl methacrylate with a ratio of 2:1:1; whilst DRAGIT® L 100 i.e., methacrylic acid-ethyl acrylate copolymer (1:1) is provided with negative high zeta potential and much different water flowing characteristics.

[130] Summary of estimated and reported zeta potential values for the tested polymers, see Barbosa, Joao AC, et al. "Using zeta potential to study the ionization behavior of polymers employed in modified-release dosage forms and estimating their pKa." International journal of pharmaceutics: X 1 (2019): 100024 is hereto presented and incorporated herein as a reference:

Commercially available polymer-coated belts	**$Zeta_{max}$**
Synthetic polymers	
EUDRAGIT E100	+24.88
HP-50	−14.69
HP-55	−19.75
HPMC AS-LF	−15.25
EUDRAGIT L100	−29.88
HPMC AS-HF	−8.76
EUDRAGIT S100	−27.61

EXAMPLE 7

[131] Reference is now made to figures 3A-3B, schematically illustrating a seeding module (20) located at conveyor's starting portion (100A) comprises a seeding unit and a seeding module actuating unit; optionally, the seeding unit comprising seeding inlet 31i and seeds outlet 31o; the outlet is provided on top belt's 36 starting portion (100A), configured to apply a predefined measure of sprout's seeds on belt's ever-rotating upper surface; additionally, or optionally, the seeding module actuating unit comprising actuating mechanism configured to move the along X, and Z-axes, optionally also along Y-axis.

[132] The conveyor belt cleansing module (e.g., members 33-35) may further comprise one or more seeding unit X-axis positioning pistons 35. Additionally, or optionally, the seeding module further comprises Z-axis positioning mechanism; additionally, or optionally, the Z-axis positioning mechanism (Zm) comprises, *inter alia*, grooved (14) or teethed (12) erected construction (11, assembly 10) into which Z-locking latch (13), in connection with the housing 39 are temporarily attached.

[133] Another example is a seeding and conveyor belt cleansing integrated module respectively comprises *(i)* a seeding unit and a seeding module actuating unit; and *(ii)* a rotatable brush, provided within a housing (e.g., a metal or plastic cage); the housing having at least one first and at least one second openings; each of the at least one first opening is a seeds outlet; the outlet is provided on top the conveyor belt's starting portion (100A), configured to apply a predefined measure of sprout's seeds on belt's ever-rotating upper surface; the each of the at least one second opening 38 is an aperture configured by means of size and shape (1_Z) to temporarily accommodate belt's front side, and to cleanse the portion within the encapsulated environment provided within the housing; optionally, the seeding and conveyor belt cleansing integrated module conveyor belt cleansing module respectively comprises *(i)* seeds container with one or more inlets and outlets; and *(ii)* one or more members of a group consisting of brush cleaning plate, brush cleaning rotatable brush, vacuum system providing the housing inner portion in negative pressure, plate sterilization modules, including an NTP system, sprayers and purging outlets, applicators of disinfecting fluids static electricity emitter, and any combination thereof. Sprayer 38 is adapted to provide the belt with a wet-cleanse and outlet 39 collects drained water of the same.

EXAMPLE 8

[134] Reference is now made to figures 4B-B, schematically illustrating a harvesting module, according to one example, that comprises one or more members of group consisting of an actuation mechanism, cutting member, sensor and any combination thereof; the actuation mechanism is configured to move one or more water irrigation devices along X, and Z-axes, optionally also along Y-axis; in its linear reciprocating movement along the Y axis, a cutting member slices the sprout to predefined measure; the cutting member is a member of group consisting of sharp blade water jet cutter, heat or plasma cutter, movable jaws or guillotine-like cutter and any combination of variant thereof. The harvesting module (50) comprises, configures as or interconnected with cutting/harvesting module, two configurations. knife goes down and conveyor belt advances along axis x, knife goon axis Y (and also axis Z). It may comprise or be interconnected with a post-harvesting module for providing at least one member of a group consisting of adding fluids, drying, mixing to provide a predefined mixture, pressing, packaging, packing, binding, blending baling, further cutting the hereto cut sprout and otherwise handling, storing, and transporting the same.

EXAMPLE 9

[135] As said above, system 100 may comprise one or more fusion sensors enabling a synchronization of all modules to maximize sprout growth. It is well in the scope of the invention wherein at least one sensor is selected from a group consisting of thermometer, wet bulb thermometer, ambient light sensor, relative humidity detector, spectrophotometer in visible (e.g., for green and/or yellow color detection), NIR or IR spectra, UV detector, VOC sensor, fluorescence detector, smoke detector, movement detector, microphone for detecting abnormalities of acoustic profile samples, time resolved sprout growth, weight and height changes at time, illuminance detector, light scattering sensor, and any combination thereof;

[136] at least one sensor located at roots-level sensor, leaf-size detector and/or leaf-level sensor, configured for measuring a parameter or parameters selected from a group consisting of conductivity sensor, moisture sensor, residual chlorine sensor, pH sensor, turbidity sensor, dissolved oxygen sensor, ORP sensor, COD sensor, ammonia nitrogen ion sensor, chlorophyll sensor, blue-green algae sensor, thermal sensor, ion probe sensor, impedance, salinity, osmolarity, fluid flowing rate and fluid dynamics, water-content, and water activity (aW) and any combination thereof.

[137] It is also in the scope of the invention wherein at least one sensor is selected from a group consisting of sprout's height sensor, high-weight converting means and any combination thereof.

[138] It is also in the scope of the invention wherein sensor for detecting levels of crops' nutritional factors.

[139] It is also in the scope of the invention wherein sensor is provided and utilized for monitoring industrial and agrotechnical parameter.

[140] It is also in the scope of the invention wherein at least one sensor is selected from a group consisting of PTZ camera, light sensor, camera, video, CCD, MEMS optical device, spectrophotometer or photo detector, provided within or on a platform, said platform is selected from a group consisting of a boom, static holder, 2D or 3D movable platform, on-line real-time activated sensor and any combination thereof.

[141] It is also in the scope of the invention wherein one or more sensors or arrays thereof are provided and utilized. The one or more fusion sensors areutilizable in connection, via a cordial or wireless communication lines, with one or more members of a group consisting of a processor, remote alarming system, operating system, conveyors, cleansing module and actuating mechanisms thereof, said seeding module, said irrigation module, said irrigation module.

[142] An example of a fusion sensor is a synergistic aggrotech optimization of sprout cultivation is herein described. Several sensors are wirelessly interconnected with a remote processor.

[143] At least one first sensor is a monochromator (550nm, green color), leaves' green color is an indication of sprout wealth, line 501;

[144] At least one second sensor is a monochromator (580nm, yellow color), leaves' yellow color is an indication of sprout dryness, line 502;

[145] At least one third sensor is a thermometer (wet bulb temperature), line $503_{\text{dry bulb}}$;

[146] At least one forth sensor is a thermometer (ambient temperature), line $503_{\text{wet bulb}}$, indicating in combination with wet bulb temperature for ambient' s relative humidity, (RH line is not shown);

[147] At least one fifth sensor is a belt recycling velocity dynamometer (cm hr^{-1}), line 504;

[148] At least one sixth sensor is water irrigation flux monitor (L hr^{-1}), line 505;

[149] At least one seventh sensor is liquid-fertilizer irrigation flux monitor (mL hr^{-1}), line 510;

[150] At least one seventh sensor is water irrigation flux, (lit. hr^{-1}); and

[151] At least one eight sensor is a spectrophotometer (visible wavelength) for detecting sprout height (cm) for calculating growth rate (mm day^{-1}), line 511.

[152] The synergy is as follows: sprouts are grown in a system according to this invention for e.g., seven days. Along the second to 5^{th} day of growing, color of sprouts' leaves is continuously measures, showing a decrease in green color 501, and reciprocal increase in yellow color 502. At the same time, average sprots height increase is measured (511), and hence sprouts growth

increase rate (mm day^{-1}) is determined. It is indicated that along the first 5 days, sprouts growth rate 512 is significantly lower than required in this system (513). Average wet and dry bulb temperatures (503_{DB} & 503_{WB}, respectively) remain constant along this time period. Similarly, water and fertilizer irrigation fluxes are constant (505 & 510 respectively). At the mid of the fifth day of growth (517), green color values (550nm) decreased below a predefined critical value ($501_{critical}$), and concurrently, yellow color values (580nm) increased over a predefined critical value ($502_{critical}$). As sprouts growth rate (512) is low, and relevant parameters (e.g., ambient temperature, RH, fertilizer flow rate and water flow rate) remain constant, water irrigation flux increase (508) from low watering rate 506 to a higher watering rate 509, and optionally, sprouts have been watered with extra-portion of water (peak 507). Such a new watering plan soon benefit the sprouts (line 518), so that green color set back to high normal (501opt) whilst yellow color set back to low normal (502opt). Concurrently, sprouts growth rate return to high normal (515).

[153] In the specification, there have been disclosed typical preferred embodiments of the disclosure and, although specific terms are employed, they are used in a generic and descriptive sense only and not for purposes of limitation. Some typical embodiments of the disclosure have been described. Many more examples, modifications and variations of the disclosure are possible in light of the above teachings. For instance, although the disclosure and the claims indicate specific steps to perform the invention, the steps described are not limited to a particular sequence of performance and in some circumstances two or more of these steps could be undertaken simultaneously. It is therefore to be understood that within the scope of the appended claims the disclosure may be practiced otherwise than as specifically described, and the scope of the disclosure is set out in the claims.

CLAIMS

1. An indoor continuous sprout hydroculture system with synchronized seeding and harvesting operations, characterized by a main longitudinal axis X, main transverse axis Y and height along axis Z; comprising

   a. either one or a vertically extended stack of two or more horizontal endless conveyors [$1_{(n-1)}$, 1_n, $1_{(n+1)}$], each of which is positioned along said system's length (X axis);
   b. seeding module (20) located at conveyor's starting portion (100A);
   c. an irrigation module (60) located above said conveyor; and
   d. harvesting module (50) located at conveyor's ending portion (100B);

   said system further comprises seeding and conveyor belt cleansing integrated module, respectively configured for both (i) seeding sprout seeds on the conveyor belt and (ii) providing at least one member of a group consisting conveyor belt's cleaning, conveyor belts' sterilization, belt's pre-seeding treatment, including wetting, providing said conveyor belt with predefined measures of soil, substrate, growth formulations and a combination thereof;

   said seeding and conveyor belt cleansing integrated module respectively comprises (i) a seeding unit and a seeding module actuating unit; and (ii) a rotatable brush, provided within a housing (e.g., a metal or plastic cage); said housing having at least one first and at least one second openings; each of said at least one first opening is a seeds outlet; said outlet is provided on top said conveyor belt's starting portion (100A), configured to apply a predefined measure of sprout's seeds on belt's ever-rotating upper surface; said each of said at least one second opening is an aperture configured by means of size and shape (1_Z) to temporarily accommodate belt's front side, and to cleanse said portion within the encapsulated environment provided within said housing; optionally, said seeding and conveyor belt cleansing integrated module conveyor belt cleansing module respectively comprises (i) seeds container with one or more inlets and outlets; and (ii) one or more members of a group consisting of brush cleaning plate, brush cleaning rotatable brush, vacuum system providing said housing inner portion in negative pressure, plate sterilization modules, including an NTP system, sprayers and purging outlets, applicators of disinfecting fluids static electricity emitter, and any combination thereof.

2. The system of claim 1 or any of its dependent claims, further comprising one or more fusion sensors enabling said synchronization; wherein at least one of the following is held true:
   a. at least one sensor is selected from a group consisting of thermometer, wet bulb thermometer, ambient light sensor, relative humidity detector, spectrophotometer in visible (e.g., for green and/or yellow color detection), NIR or IR spectra, UV detector, VOC sensor, fluorescence detector, smoke detector, movement detector, microphone for detecting abnormalities of acoustic profile samples, time resolved sprout growth, weight and height changes at time, illuminance detector, light scattering sensor, and any combination thereof;
   b. at least one sensor located at roots-level sensor, leaf-size detector and/or leaf-level sensor, configured for measuring a parameter or parameters selected from a group consisting of conductivity sensor, moisture sensor, residual chlorine sensor, pH sensor, turbidity sensor, dissolved oxygen sensor, ORP sensor, COD sensor, ammonia nitrogen ion sensor, chlorophyll sensor, blue-green algae sensor, thermal sensor, ion probe sensor, impedance, salinity, osmolarity, fluid flowing rate and fluid dynamics, water-content, and water activity (aW) and any combination thereof;
   c. at least one sensor is selected from a group consisting of sprout's height sensor, high-weight converting means and any combination thereof;
   d. sensor for detecting levels of crops' nutritional factors;
   e. sensor for monitoring industrial and agrotechnical parameter;
   f. at least one sensor is selected from a group consisting of PTZ, light sensor, camera, video, CCD, MEMS optical device, spectrophotometer or photo detector, provided within or on a platform, said platform is selected from a group consisting of a boom, static holder, 2D or 3D movable platform, on-line real-time activated sensor and any combination thereof;
   g. one or more sensors; and
   h. said one or more fusion sensors is in connection, via a cordial or wireless communication lines, with one or more members of a group consisting of a processor, remote alarming system, operating system, conveyors, cleansing module and actuating mechanisms thereof, said seeding module, said irrigation module, said irrigation module.

2. The system of claim 1, wherein said belt's is tilted along at least one portion of its length, said tilts is in an angle θ in respect to said Y axis; said angle θ is ranging from 1 to 33 degrees; from 1 to 15 degrees; from 1 to 7.5 degrees; or from 1 to 4 degrees.
3. The system of claim 1, wherein said conveyor belt is tilted along at least one portion of its length in either concave or convex manner so that maximal and minimal heights of said conveyor belt at said portion is positioned in a middle portion of belt's width; wherein said concave or convex slopes are in an angle θ1 and θ2 in respect to said Y axis; and said angles θ1 and θ2 are ranging from 1 to 33 degrees; from 1 to 15 degrees; from 2 to 7.5 degrees; or from 2.5 to 4 degrees.
4. The system of claim 1, wherein conveyor belt's top texture is characterized by Ra, RMS and Rt are as defined by ISO 4287:1997, namely
    a. Ra, ranging from 25 μm to 0.025 μm; or 6.3 μm to 0.1 μm; or 1.6 μm to 0.1 μm;
    b. RMS, ranging from 1100 to 1.1; or 275 to 4.4 or 64 to 0.8; or
    c. Rt, ranging from 100 to 0.3; or 25 to 0.8; or 18 to 1.2;
    d. additionally, or alternatively, wherein conveyor belt's top texture is characterized by HLB < 10; or > 10; or ranging from 1 to 3; or ranging from 3 to 6 or ranging from 7 to 9or ranging from 13 to 16 or ranging from 8 to 16 or ranging from 16 to 18.
5. The system of claim 1 or any of its dependent claims, wherein said irrigation module is a watering boom, actuatable above said conveyor, along the Y axis.
6. The system of claim 1 or any of its dependent claims, further comprising water recycling subsystem characterized by that a water collecting module is located belt's width (Y axis), either or both (i) for belt's concave cross section - adjacent to belt's side end(s) and (ii) belt's convex cross section - in belt's middle portion.
7. The system of claim 1 or any of its dependent claims, further comprising water treatment module, configured for providing at least one member of a group consisting of water filtration, water decontamination, water fertilization and any combination thereof.
8. The system of claim 1 or any of its dependent claims, further comprising conveyor belt cleansing module, configured for providing at least one member of a group consisting conveyor belt's cleaning, conveyor belts' sterilization, belt's pre-seeding treatment, including wetting, providing said conveyor belt with predefined measures of soil, substrate, growth formulations and a combination thereof.

9. The system of claim 8 or any of its dependent claims, said conveyor belt cleansing module further comprises one or more members of a group consisting of brush cleaning plate, brush cleaning rotatable brush, vacuum system providing said housing inner portion in negative pressure, plate sterilization modules, including an NTP system, sprayers and purging outlets, applicators of disinfecting fluids, static electricity emitter, and any combination thereof.
10. The system of claim 8 or any of its dependent claims, said conveyor belt cleansing module further comprises actuating mechanism configured to move said along X, and Z-axes, optionally also along Y-axis; said conveyor belt cleansing module further comprises either or both (i) cleansing unit X-axis positioning piston in connection with said housing; and (ii) cleansing unit Z-axis positioning mechanism, in connection with said housing.
11. The system of claim 10, or any of its dependent claims, said cleansing unit Z-axis positioning mechanism comprises grooved (14) or teethed (12) erected construction (10) into which Z-locking latch (13), in connection with said housing are temporarily attached.
12. The system of claim 1 or any of its dependent claims, wherein seeding module (20) located at conveyor's starting portion (100A) comprises a seeding unit and a seeding module actuating unit; optionally, said seeding unit comprising seeding inlet and seeds outlet; said outlet is provided on top said conveyor belt's starting portion (100A), configured to apply a predefined measure of sprout's seeds on belt's ever-rotating upper surface; additionally, or optionally, said seeding module actuating unit comprising actuating mechanism configured to move said along X, and Z-axes, optionally also along Y-axis.
13. The system of claim 12 or any of its dependent claims, said conveyor belt cleansing module further comprises seeding unit X-axis positioning piston; additionally, or optionally, said seeding module further comprises Z-axis positioning mechanism; additionally, or optionally, said Z-axis positioning mechanism comprises grooved (14) or teethed (12) erected construction (10) into which Z-locking latch (13), in connection with said housing are temporarily attached.
14. The system of claim 1 or any of its dependent claims, said seeding and conveyor belt cleansing integrated module conveyor belt cleansing module actuating mechanism configured to move said along X, and Z-axes, optionally also along Y-axis; optionally, said seeding and conveyor belt cleansing integrated module conveyor belt, comprises cleansing unit X-axis positioning piston in connection with said housing; optionally, said seeding and

conveyor belt cleansing integrated module c Z-axis positioning mechanism, in connection with said housing; further optionally, said seeding and conveyor belt cleansing integrated module Z-axis positioning mechanism comprises grooved (14) or teethed (12) erected construction (10) into which Z-locking latch (13), in connection with said housing are temporarily attached.

15. The system of claim 1 or any of its dependent claims, said conveyor belt comprises a plurality of evenly spaced along X axis erected ribs extending along Y axis [5(n-1), 5n, 5(n+1)].

16. The system of claim 1 or any of its dependent claims, wherein said irrigation module comprises one or more members of group consisting of actuation mechanism, sensor, and applicator; said actuation mechanism is configured to move one or more water irrigation devices along X, and Z-axes, optionally also along Y-axis; said irrigation devices are selected from a group consisting of drip irrigation, water emitter, sprinkler, subsurface drip irrigation, sprayer, fogger, micro-spray or micro-sprinkler, mini-bubbler irrigation, and any combination and variant thereof; said applicator is selected from a group consisting of fertilizing facility, sprout cutter and means for harvesting the sprout or portions thereof, decontaminating facility, light emitter, fluid dispenser and any combination thereof.

17. The system of claim 1 or any of its dependent claims, wherein said harvesting module comprises one or more members of group consisting of an actuation mechanism, cutting member, sensor and any combination thereof; said actuation mechanism is configured to move one or more water irrigation devices along X, and Z-axes, optionally also along Y-axis; in its linear reciprocating movement along the Y axis, a cutting member slices the sprout to predefined measure; said cutting member is a member of group consisting of sharp blade water jet cutter, heat or plasma cutter, movable jaws or guillotine-like cutter and any combination of variant thereof.

18. The system of claim 1 or any of its dependent claims, wherein harvesting module (50) comprises, configures as or interconnected with cutting/harvesting module, two configurations. knife goes down and conveyor belt advances along axis x, knife goon axis Y (and also axis Z),

19. The system of claim 1 or any of its dependent claims, further comprising a post-harvesting module for providing at least one member of a group consisting of adding fluids, drying, mixing to provide a predefined mixture, pressing, packaging, packing, binding, blending

baling, further cutting the hereto cut sprout and otherwise handling, storing, and transporting the same.

20. The system of claim 1 or any of its dependent claims, further comprising at least one module of NTP configured to kill at least two orders of magnitudes of molds in a less than five minutes, by ionizing circulated air flow; optionally, said NTP is provided in connection with one or more members of a group consisting of seeds to be sown, seeds contained within seeds feeding silo, airflow provided in connection with said seeds, adjacent said conveyor belt, an applicator located in an irrigation boom, airflow provided in connection with said conveyor belt, airflow provided in connection with said cutting module, and any combination thereof.

21. The system of claim 1 or any of its dependent claims, said system is configured for heterogenic cultivation, so that one of the following is held true:

a. mixed varieties of sprout are cultivated in a same conveyor belt;

b. in a same conveyor belt, two or more varieties of sprout are cultivated side by side; and

c. mixed varieties of sprout are cultivated in a same cultivating system, namely at least one first variety is cultivated in at least one first conveyor belt, and namely at least one second variety is cultivated in at least one second conveyor belt.

22. A method of hydro-culturing sprout in an indoor environment by a continuous sprout system useful for synchronized seeding and harvesting operations; said system is characterized by a main longitudinal axis X, main transverse axis Y and height along axis Z; said method comprising steps as follows:

a. providing either one or a vertically extended stack of two or more horizontal endless conveyors [$1_{(n-1)}$, 1_n, $1_{(n+1)}$], each of which is positioned along said system's length (X axis);

b. locating a seeding module (20) at conveyor's starting portion (100A);

c. locating an irrigation module (60) above said conveyor; and

d. locating harvesting module (50) at conveyor's ending portion (100B);

wherein said method comprises a step of providing a seeding and conveyor belt cleansing integrated module, respectively configured for both *(i)* seeding sprout seeds on the

conveyor belt and *(ii)* providing at least one member of a group consisting conveyor belt's cleaning, conveyor belts' sterilization, belt's pre-seeding treatment, including wetting, providing said conveyor belt with predefined measures of soil, substrate, growth formulations and a combination thereof; additionally, or optionally, the method additionally comprising step of providing said seeding and conveyor belt cleansing integrated module respectively with *(i)* a seeding unit and a seeding module actuating unit; and *(ii)* a rotatable brush, locatable within a housing; providing said housing having at least one first and at least one second openings; each of said at least one first opening is a seeds outlet; providing said outlet on top said belt's starting portion (100A), applying a predefined measure of sprout's seeds on belt's ever-rotating upper surface; by means of size and shape (1z) configuring said each of said at least one second opening is an aperture to temporarily accommodate conveyor belt's front side, and to cleanse said portion within the encapsulated environment provided within said housing; additionally, or optionally, the method comprising step of providing *(i)* seeds container with one or more inlets and outlets; and *(ii)* one or more members of a group consisting of brush cleaning plate, brush cleaning rotatable brush, vacuum system providing said housing inner portion in negative pressure, plate sterilization modules, including an NTP system, sprayers and purging outlets, applicators of disinfecting fluids, static electricity emitter, and any combination thereof; additionally, or optionally, the method comprising step of configuring the same to move said along X, and Z-axes, optionally also along Y-axis or otherwise moving the same along X, and Z-axes, optionally also along Y-axis; additionally, or optionally, the method comprising step of connecting a cleansing unit X-axis positioning piston with said housing; additionally, or optionally, the method comprising step of connecting a Z-axis positioning mechanism, in connection with said housing.

said seeding and conveyor belt cleansing integrated module Z-axis positioning mechanism comprises grooved (14) or teethed (12) erected construction (10) into which Z-locking latch (13), in connection with said housing are temporarily attached; additionally, or optionally, the method comprising step of providing a plurality of evenly spaced along X axis erected ribs extending along Y axis [5(n-1), 5n, 5(n+1)].

23. The method of claim 22 or any of its dependent claims, further comprising steps of providing one or more fusion sensors enabling said synchronization; wherein at least one of the following is held true:
    a. said method further comprises step of providing at least one sensor is selected from a group consisting of thermometer, wet bulb thermometer, ambient light sensor, relative humidity detector, spectrophotometer in visible, NIR or IR spectra, UV detector, VOC sensor, fluorescence detector, smoke detector, movement detector, microphone for detecting abnormalities of acoustic profile samples, time resolved sprout growth, weight and height changes at time, illuminance detector, light scattering sensor, and any combination thereof;
    b. said method further comprises step of providing at least one sensor located at roots-level sensor, leaf-size detector and/or leaf-level sensor, configured for measuring a parameter or parameters selected from a group consisting of conductivity sensor, moisture sensor, residual chlorine sensor, pH sensor, turbidity sensor, dissolved oxygen sensor, ORP sensor, COD sensor, ammonia nitrogen ion sensor, chlorophyll sensor, blue-green algae sensor, thermal sensor, ion probe sensor, impedance, salinity, osmolarity, fluid flowing rate and fluid dynamics, water-content, and water activity (aW) and any combination thereof;
    c. said method further comprises step of providing at least one sensor is selected from a group consisting of sprout's height sensor, high-weight converting means and any combination thereof;
    d. said method further comprises step of providing sensor for detecting levels of crops' nutritional factors;
    e. said method further comprises step of providing sensor for monitoring industrial and agrotechnical parameter;
    f. said method further comprises step of providing at least one sensor is selected from a group consisting of PTZ, light sensor, camera, video, CCD, MEMS optical device, spectrophotometer or photo detector, provided within or on a platform, said platform is selected from a group consisting of a boom, static holder, 2D or 3D movable platform, on-line real-time activated sensor and any combination thereof;

g. said method further comprises step of providing sensor, e.g., a camera configured for verifying seed and harvest quality; and

h. said method further comprises step of providing said one or more fusion sensors in connection, via a cordial or wireless communication lines, with one or more members of a group consisting of a processor, remote alarming system, operating system, conveyors, cleansing module and actuating mechanisms thereof, said seeding module, said irrigation module, said irrigation module.

24. The method of claim 22 or any of dependent claims, further comprising a step of tilting said conveyor belt along at least one portion of its length, said tilts is in an angle θ in respect to said Y axis; angle θ is ranging from 1 to 33 degrees; from 1 to 15 degrees; from 1 to 7.5 degrees; or from 2 to 5 degrees.

25. The method of claim 22 or any of dependent claims, further comprising a step of either continuously or temporarily tilting said belt along at least one portion of its length in either concave or convex manner so that maximal and minimal heights of said conveyor belt at said portion is positioned in a middle portion of belt's width; said concave or convex slopes are in an angle θ1 and θ2 in respect to said Y axis; and said angles θ1 and θ2 are ranging from 1 to 33 degrees; from 1 to 15 degrees; from 2 to 7.5 degrees; or from 2.5 to 4 degrees.

26. The method of claim 22 or any of dependent claims, further comprising a step of providing said conveyor belt's top texture in parameters selected from Ra, RMS and Rt, as defined by ISO 4287:1997, namely

a. Ra, ranging from 25 mm to 0.025 mm; or 6.3 mm to 0.1 mm; or 1.6 mm to 0.1 mm;

b. RMS, ranging from 1100 to 1.1; or 275 to 4.4 or 64 to 0.8; or

c. Rt, ranging from 100 to 0.3; or 25 to 0.8; or 18 to 1.2;

conveyor belt's top texture is additionally, or optionally characterized by HLB < 10; or > 10; or ranging from 1 to 3; or ranging from 3 to 6 or ranging from 7 to 9 or ranging from 13 to 16 or ranging from 8 to 16 or ranging from 16 to 18.

27. The method of claim 22 or any of dependent claims, wherein said irrigation module is a watering boom, actuatable above said conveyor, along the Y axis; additionally, or optionally, the method comprising step of providing water recycling subsystem characterized by that a water collecting module is located belt's width (Y axis), either or both (i) for belt's concave

cross section - adjacent to conveyor belts' side end(s) and (ii) belt's convex cross section - in conveyor belts' middle portion.

28. The method of claim 27 or any of dependent claims comprising step of providing a water treatment module, configured for providing at least one member of a group consisting of water filtration, water decontamination, water fertilization and any combination thereof.

29. The method of claim 22 or any of dependent claims comprising step of providing a conveyor belt cleansing module, configured for providing at least one member of a group consisting conveyor belt's cleaning, conveyor belts' sterilization, belt's pre-seeding treatment, including wetting, providing said conveyor belt with predefined measures of soil, substrate, growth formulations and a combination thereof; additionally, or optionally, the method comprising step of providing conveyor belt cleansing module, said module comprises a rotatable provided within a housing; said housing having an opening configured by means of size and shape (1_Z) to temporarily accommodate conveyor belt's front side, and to cleanse said portion within the encapsulated environment provided within said housing; additionally, or optionally, the method comprising step of providing said conveyor belt cleansing module with one or more members of a group consisting of brush cleaning plate, brush cleaning rotatable brush, vacuum system providing said housing inner portion in negative pressure, plate sterilization modules, including an NTP system, sprayers and purging outlets, applicators of disinfecting, static electricity emitter, and any combination thereof.

30. The method of claim 22 or any of dependent claims comprising step of providing said conveyor belt cleansing module to further comprises actuating mechanism configured to move said along X, and Z-axes, optionally also along Y-axis; additionally, or optionally, the method providing said conveyor belt cleansing module with a cleansing unit X-axis positioning piston in connection with said housing; additionally, or optionally, the method comprising step of providing said belt cleansing module with a cleansing unit Z-axis positioning mechanism, in connection with said housing.

31. The method of claim 30 or any of dependent claims comprising step of providing said cleansing unit Z-axis positioning mechanism with a grooved (14) or teethed (12) erected construction (10) into which Z-locking latch (13), in connection with said housing are temporarily attached.

32. The method of claim 27 or any of dependent claims comprising step of locating a seeding module (20) at conveyor's starting portion (100A) and providing it with a seeding unit and a seeding module actuating unit; additionally, or optionally, the method comprising step of providing said seeding unit with seeding inlet and seeds outlet; said outlet is provided on top said conveyor belt's starting portion (100A), configured to apply a predefined measure of sprout's seeds on belt's ever-rotating upper surface; additionally, or optionally, the method comprising step of providing said seeding module actuating unit with actuating mechanism configured to move said along X, and Z-axes, optionally also along Y-axis; additionally, or optionally, the method comprising step of providing said conveyor belt cleansing module with a seeding unit X-axis positioning piston.
33. The method of claim 32 or any of dependent claims comprising step of providing seeding module with a Z-axis positioning mechanism; optionally, said Z-axis positioning mechanism with grooved (14) or teethed (12) erected construction (10) into which Z-locking latch (13), and further providing the same in connection with said housing.
34. The method of claim 24 or any of dependent claims comprising step of providing said irrigation module with one or more members of group consisting of actuation mechanism, sensor, and applicator.
35. The method of claim 22 or any of dependent claims comprising step of providing a harvesting module comprises one or more members of group consisting of an actuation mechanism, cutting member, sensor and any combination thereof; optionally, said actuation mechanism is configured to move one or more water irrigation devices along X, and Z-axes, optionally also along Y-axis; in its linear reciprocating movement along the Y axis, a cutting member slices the sprout to predefined measure.
36. The method of claim 22 or any of dependent claims comprising step of post-harvesting the hereto harvest sprout by means of a post-harvesting module by providing at least one member of a group consisting of adding fluids, drying, mixing to provide a predefined mixture, pressing, packaging, packing, binding, blending, baling, further cutting the hereto cut sprout and otherwise handling, storing, and transporting the same.
37. The method of claim 36 or any of dependent claims comprising step of providing at least one module of NTP configured to kill at least two orders of magnitudes of molds in a less than five minutes, by ionizing circulated air flow.

38. The method of claim 36 or any of dependent claims comprising step of directly or indirectly administrating said NTP with one or more members of a group consisting of seeds to be sown, seeds contained within seeds feeding silo, airflow provided in connection with said seeds, adjacent said conveyor belt, an applicator located in an irrigation boom, airflow provided in connection with said conveyor belt, airflow provided in connection with said cutting module, and any combination thereof.
39. The method of claim 36 or any of dependent claims comprising step of configuring the system for heterogenic cultivation, so that one of the following is held true:
    a. cultivating mixed varieties of sprout in a same conveyor belt;
    b. cultivating in a same conveyor belt, two or more varieties of sprout side by side; and
    c. cultivating mixed varieties of sprout are cultivated in a same cultivating system, namely at least one first variety is cultivated in at least one first conveyor belt, and namely at least one second variety is cultivated in at least one second conveyor belt.

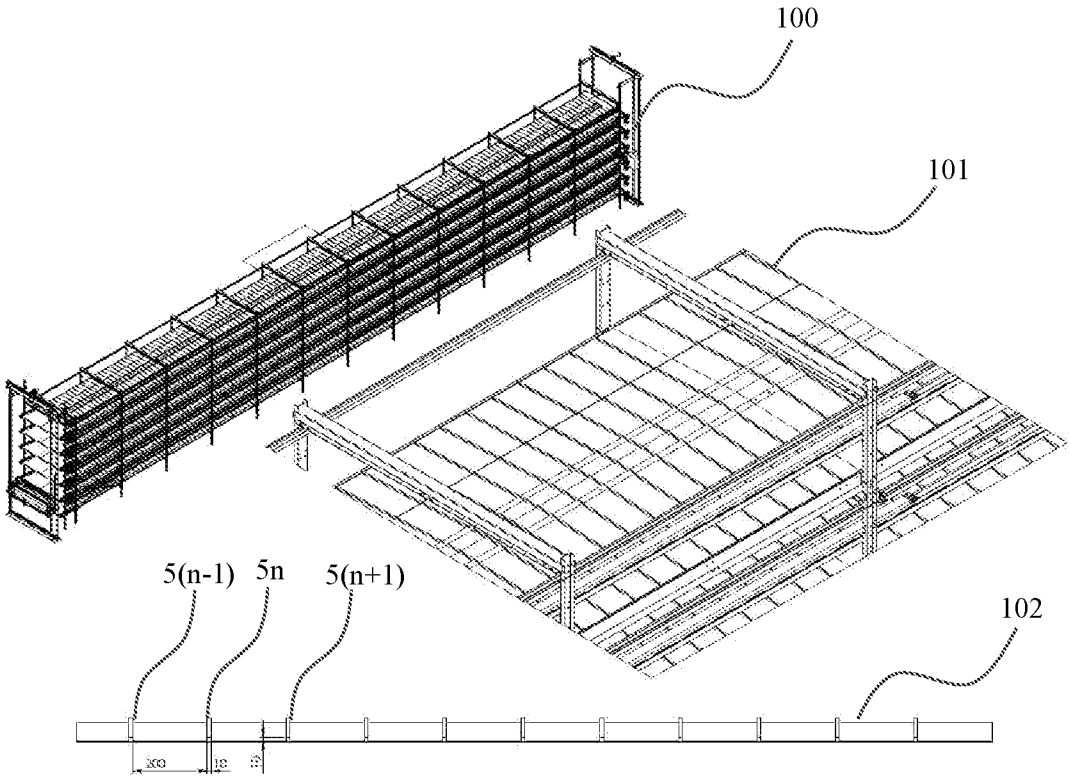


Fig. 1A

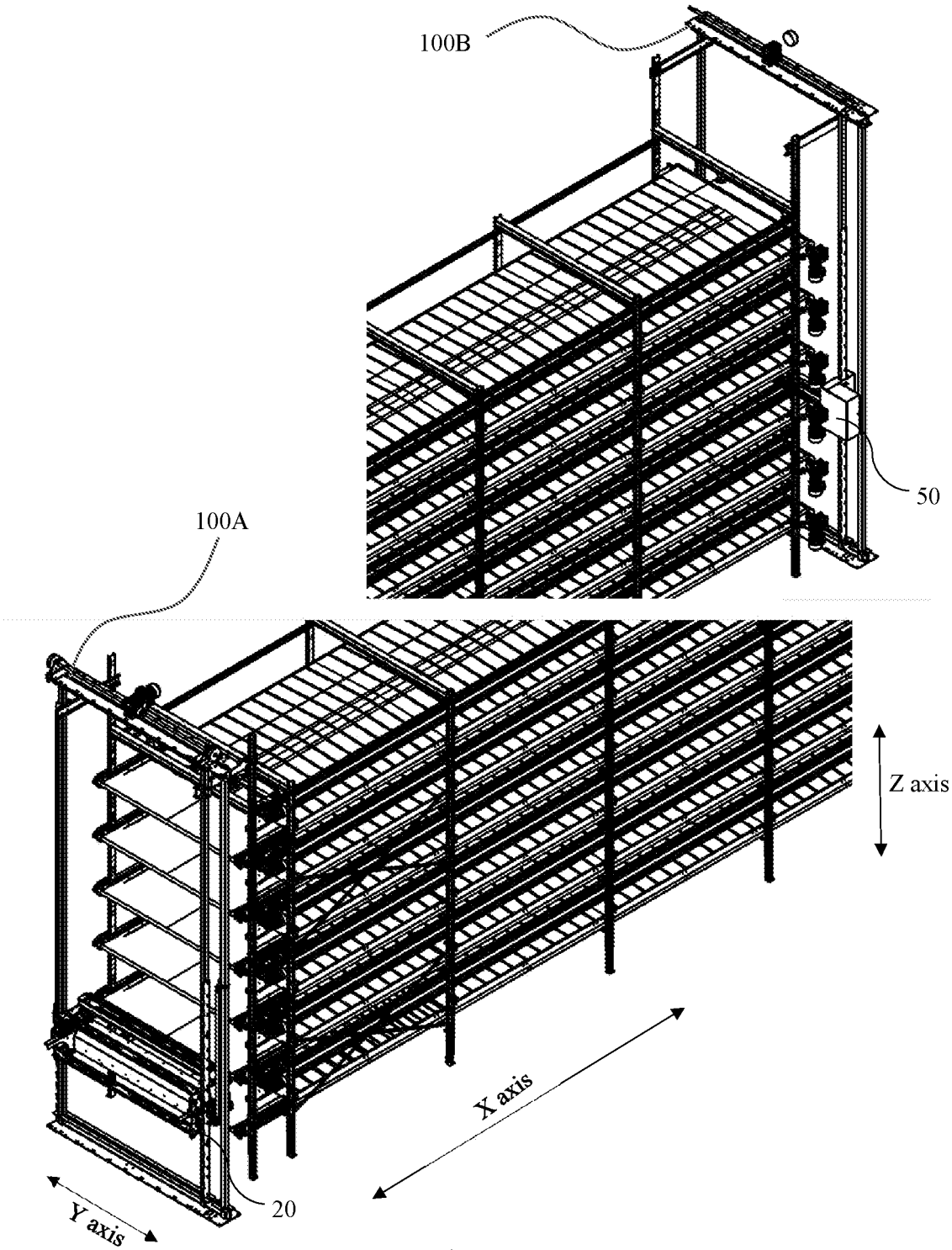


Fig. 1B

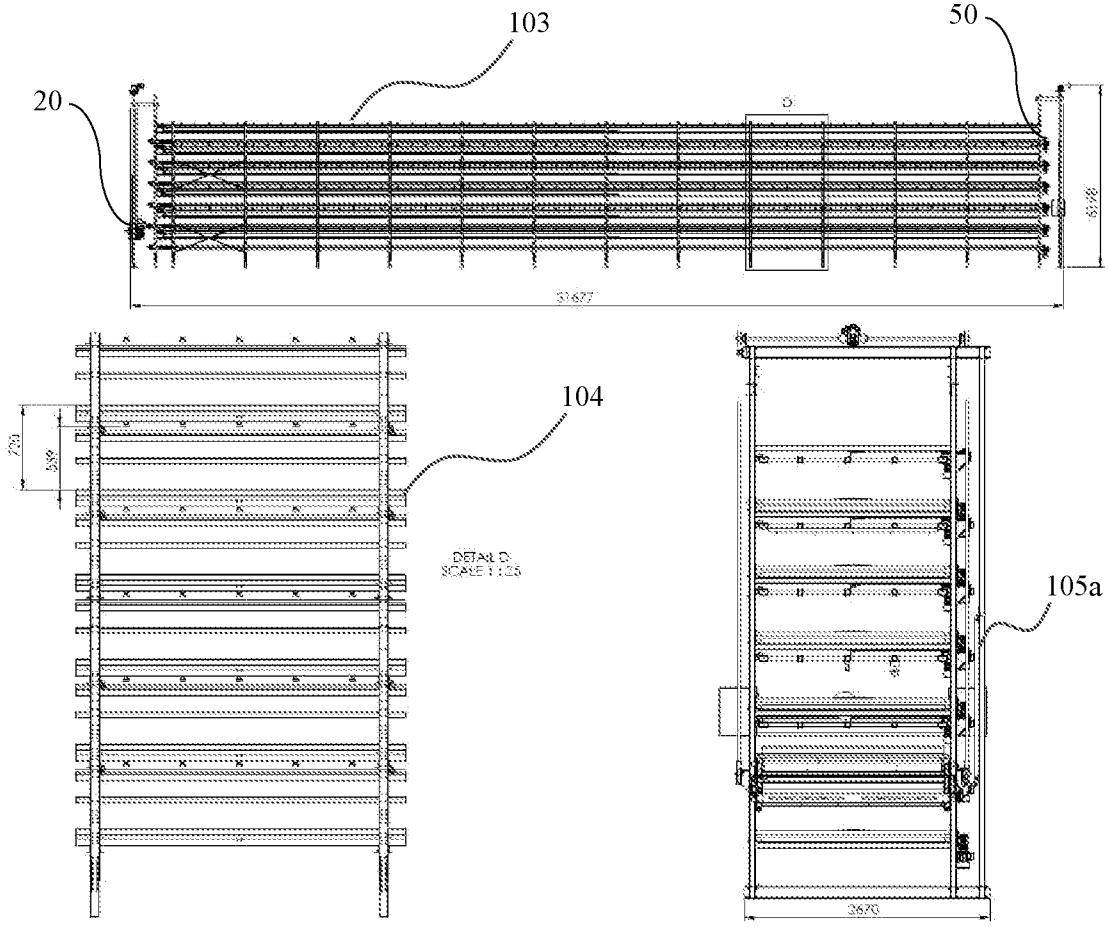


Fig. 1C

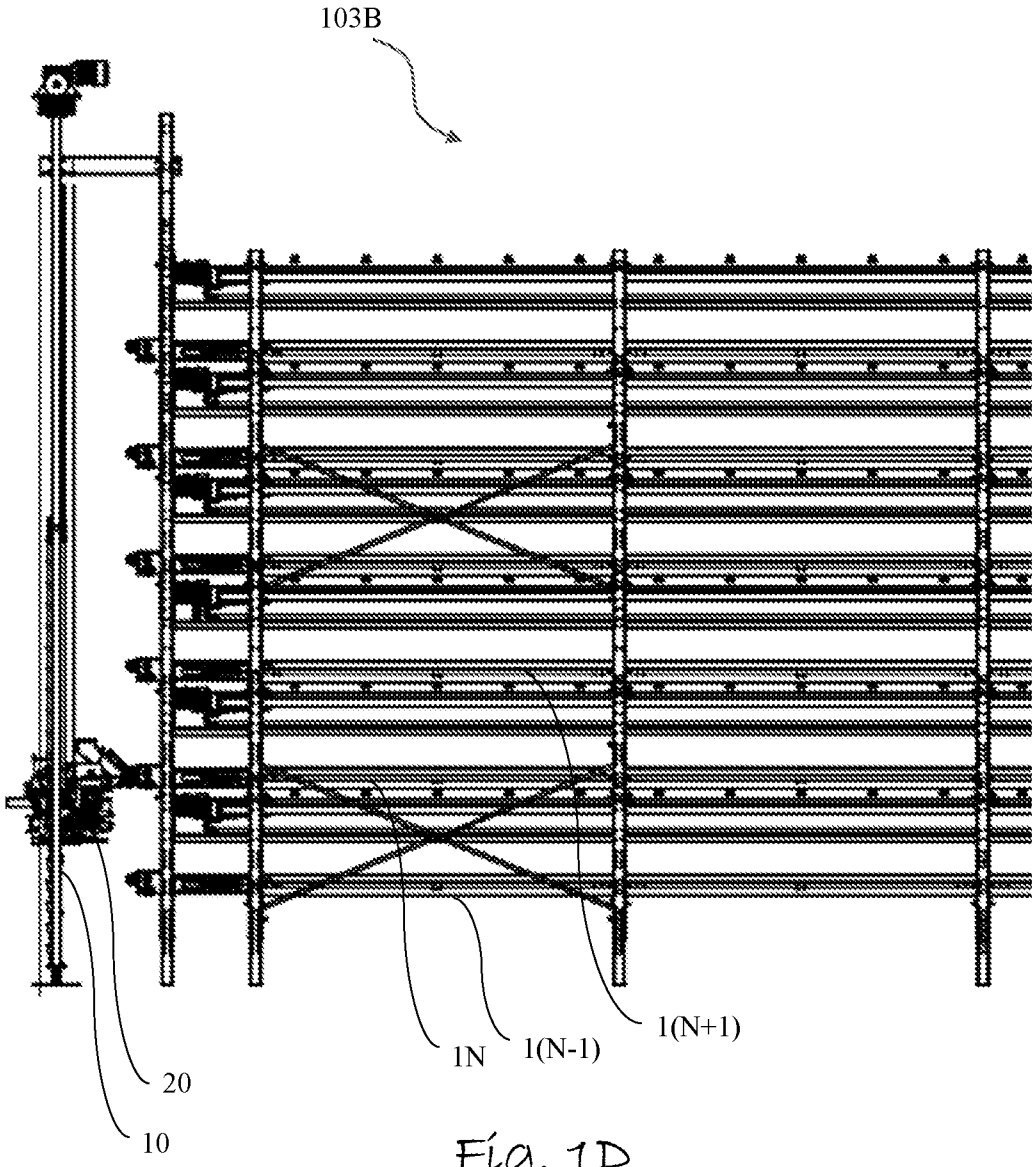


Fig. 1D

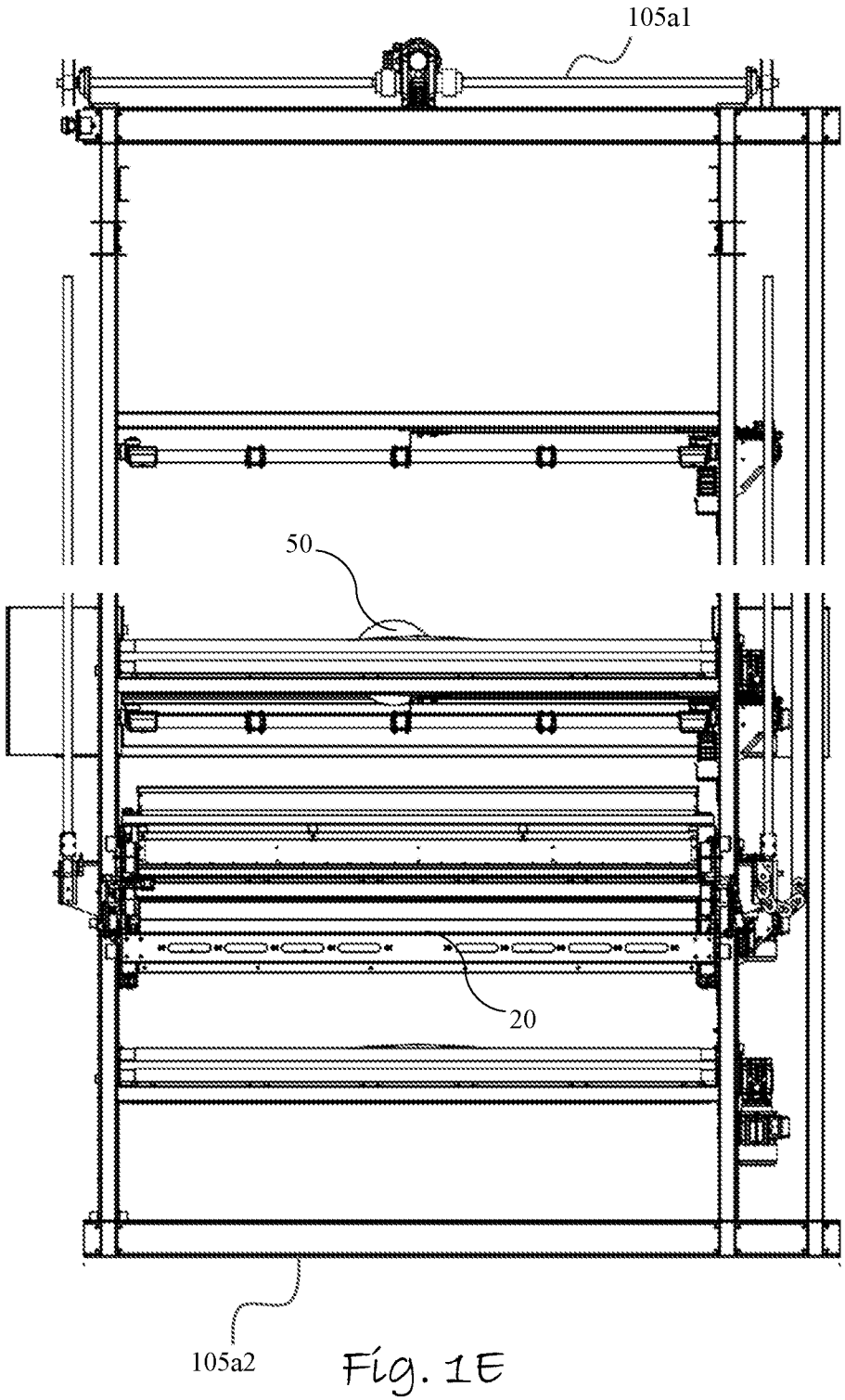


Fig. 1E

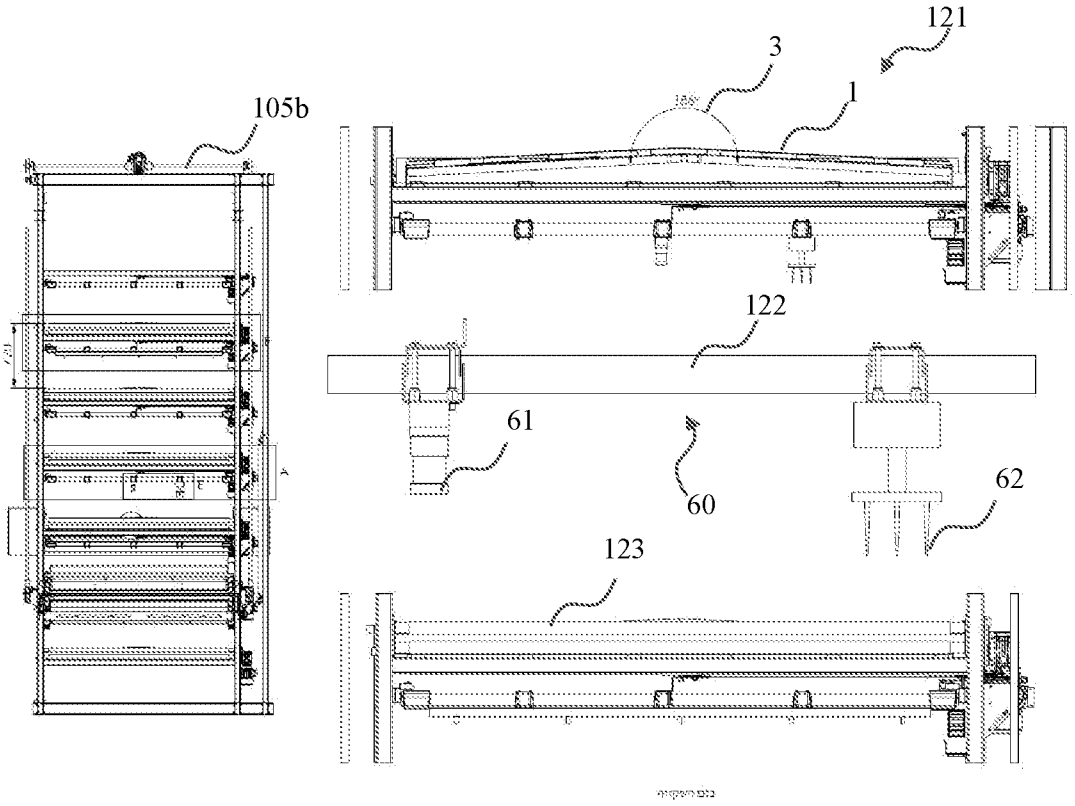


Fig. 2A

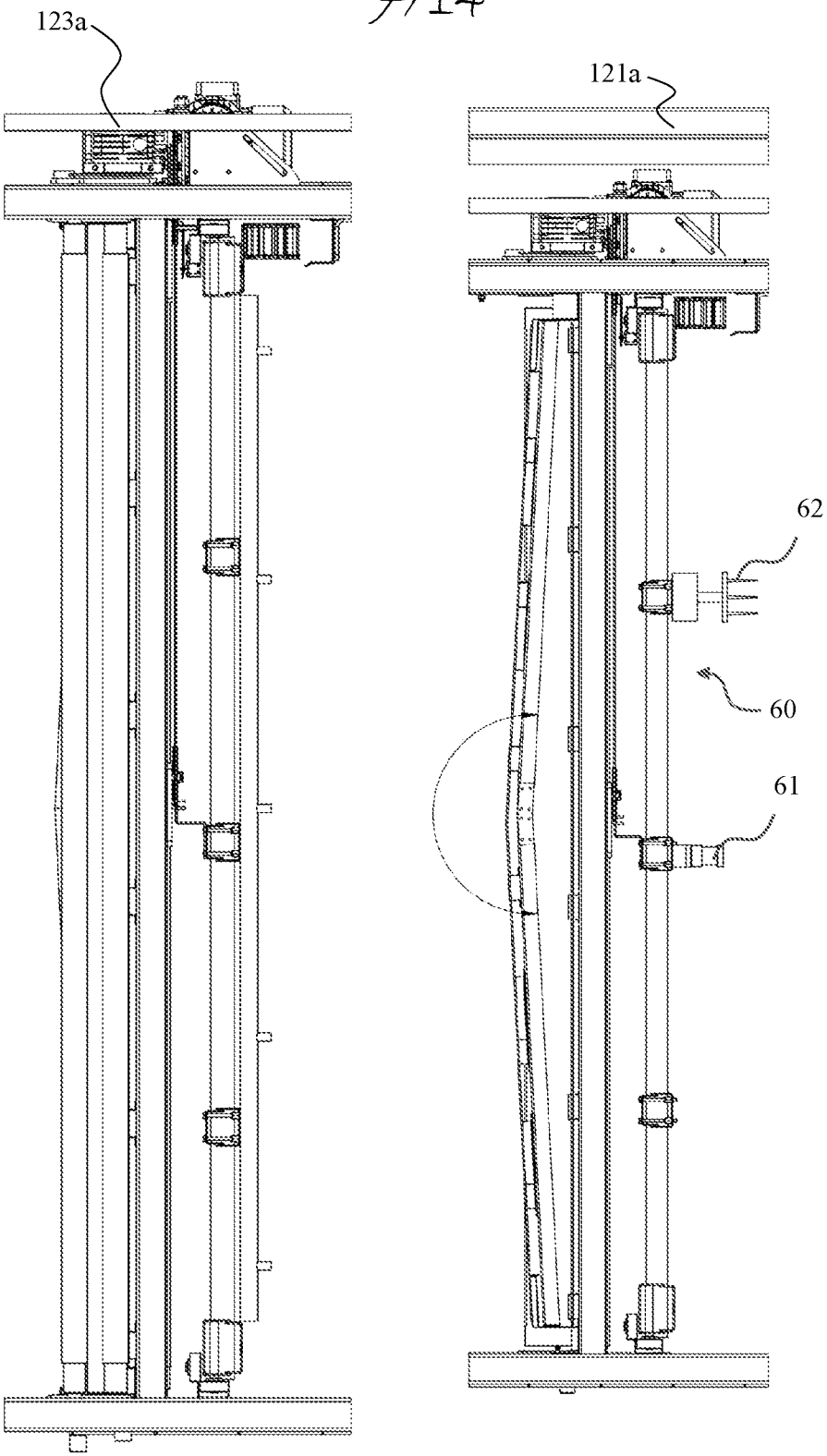


Fig. 2B

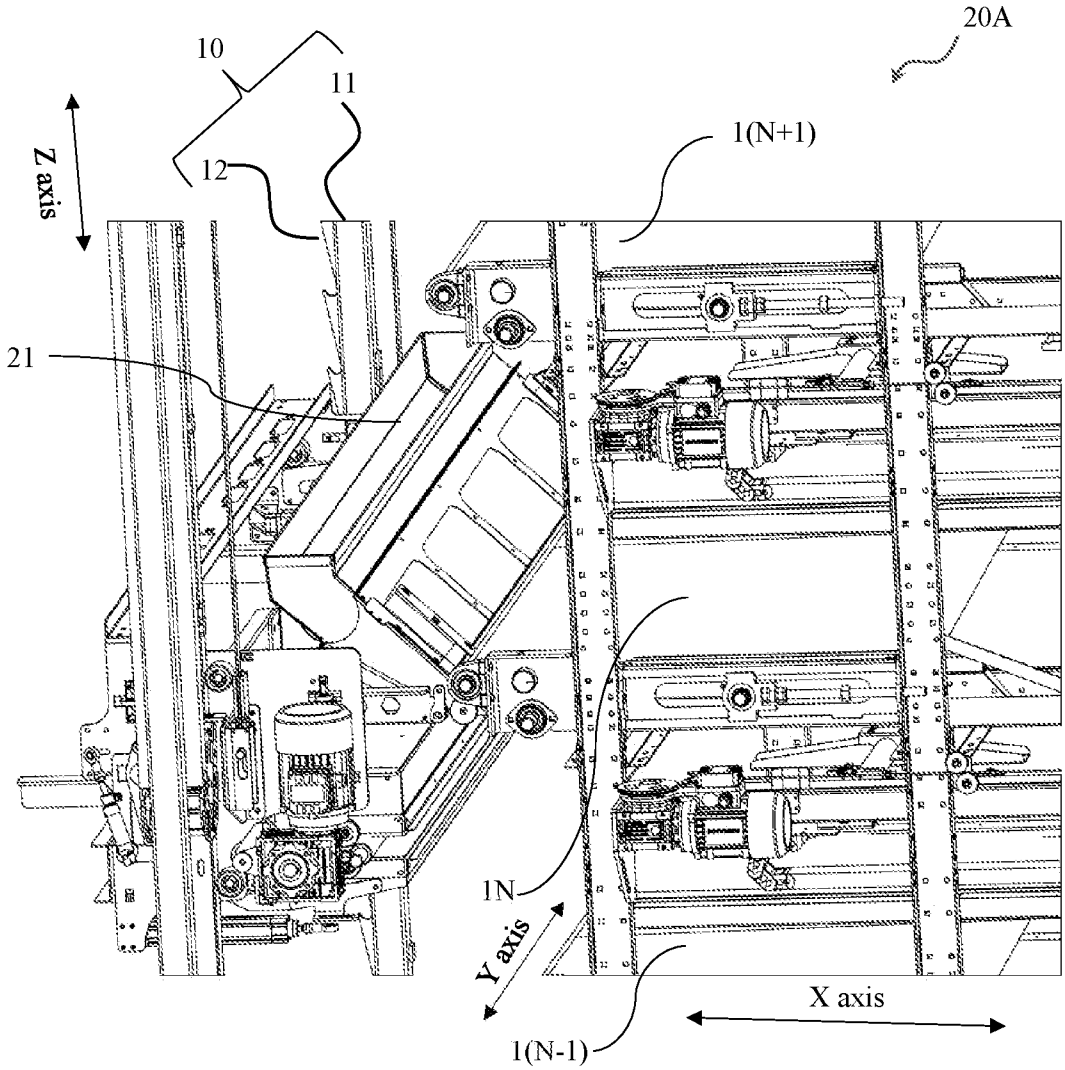


Fig. 3A

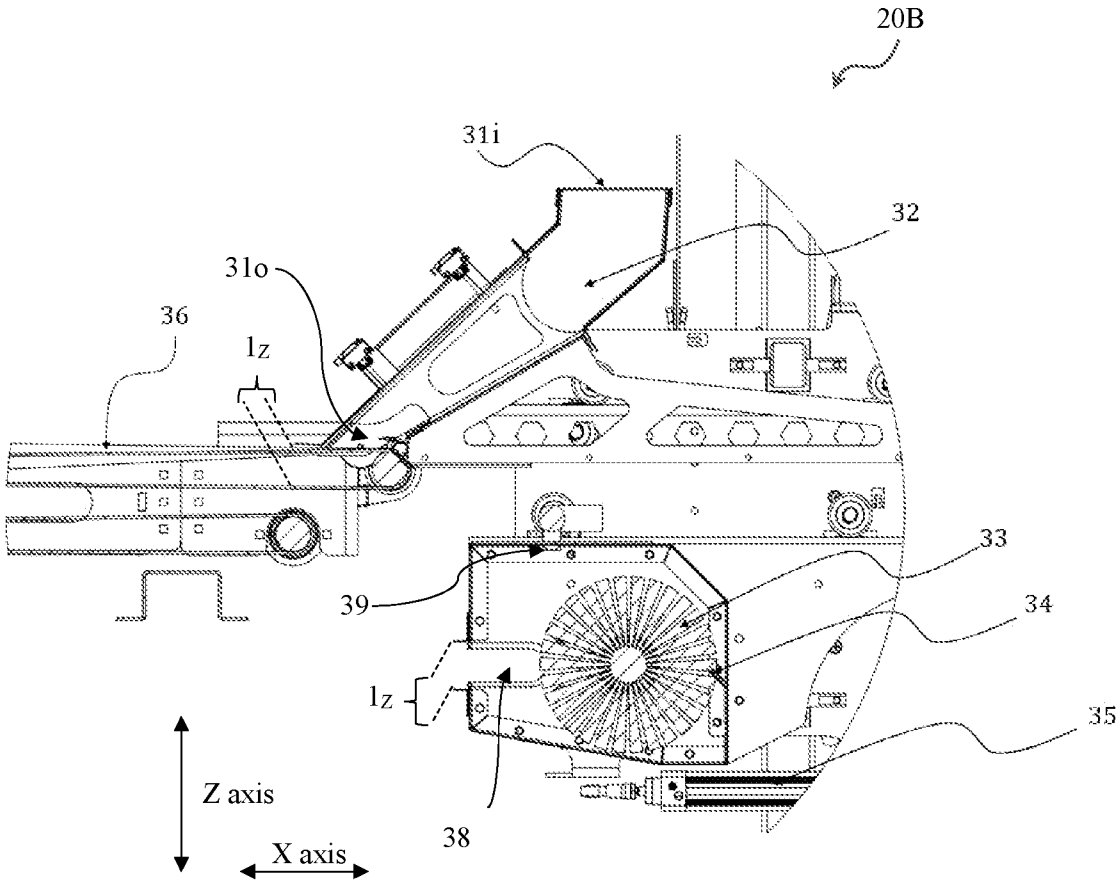


Fig. 3B

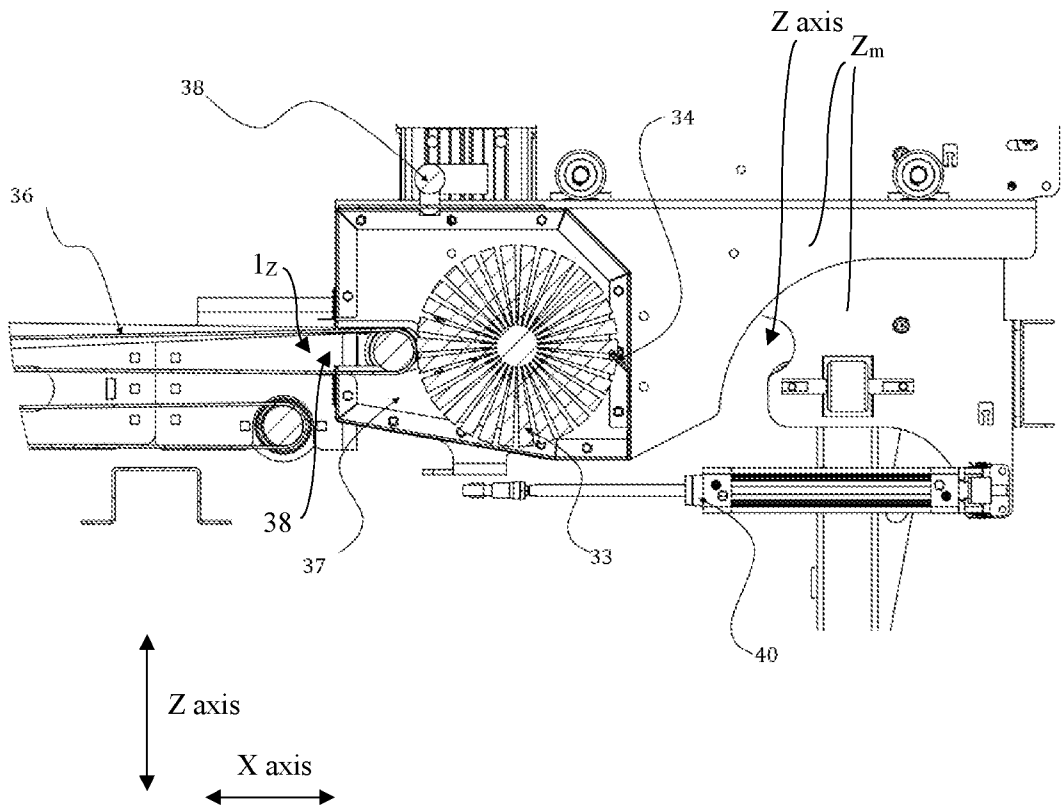


Fig. 3C

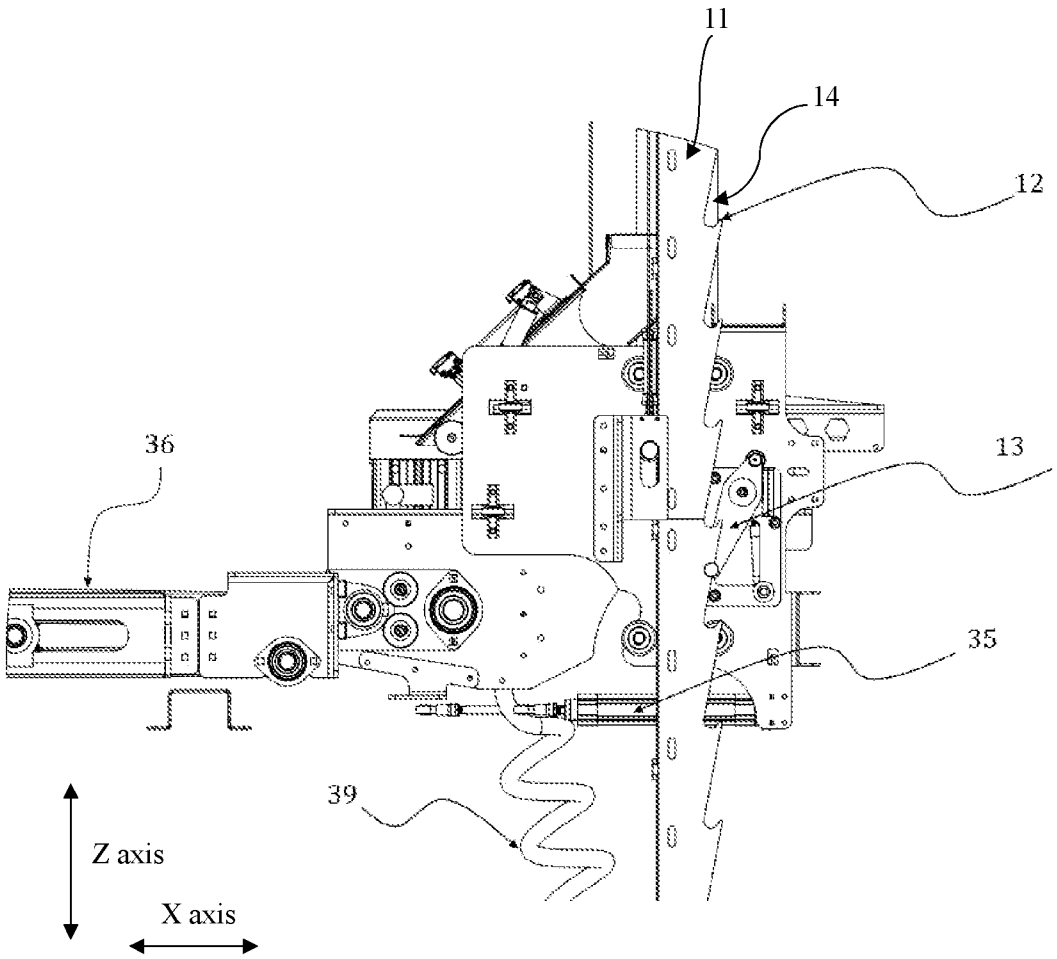


Fig. 3D

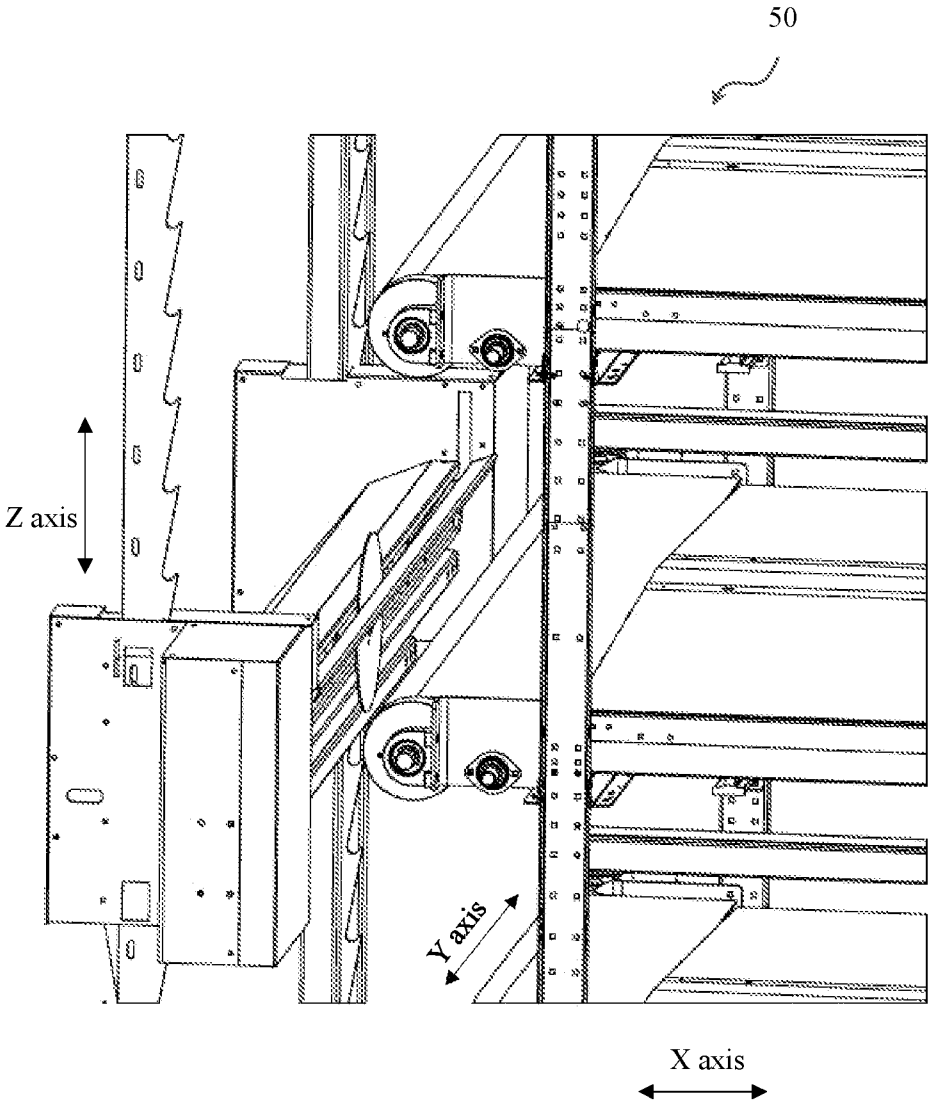


Fig. 4A

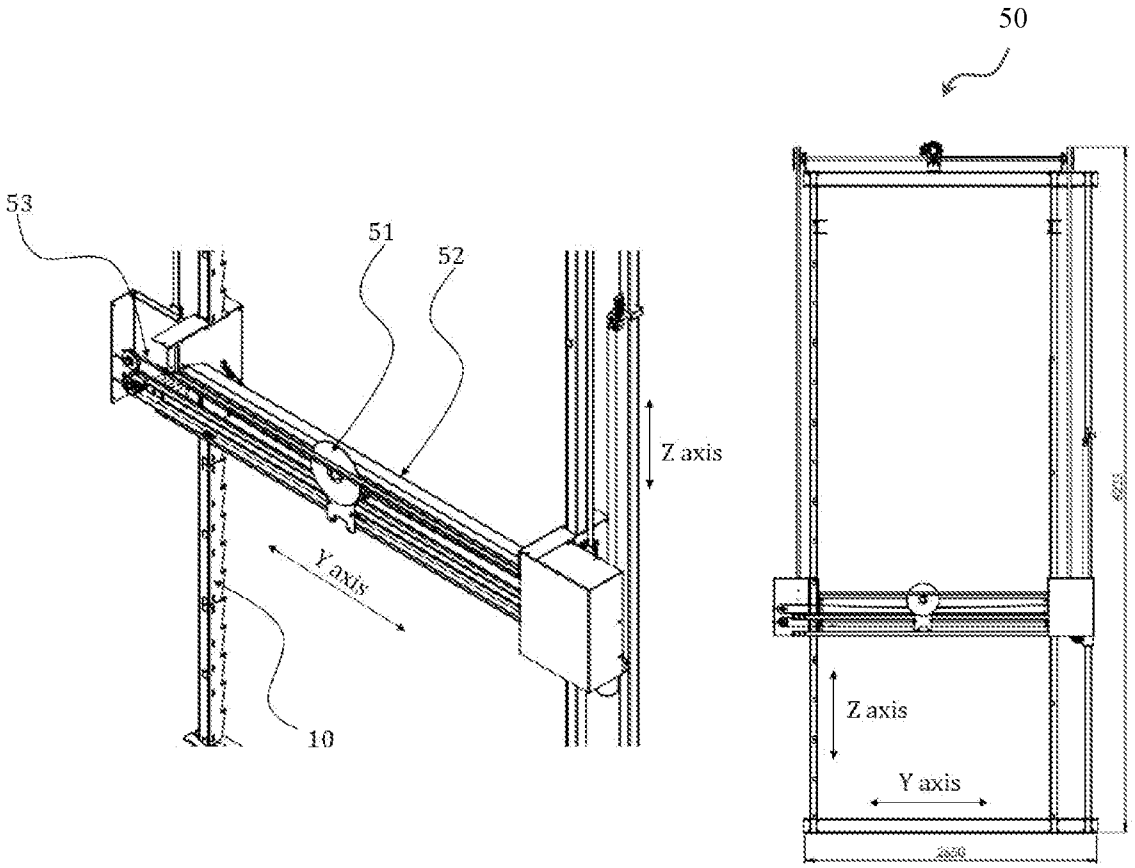


Fig. 4B

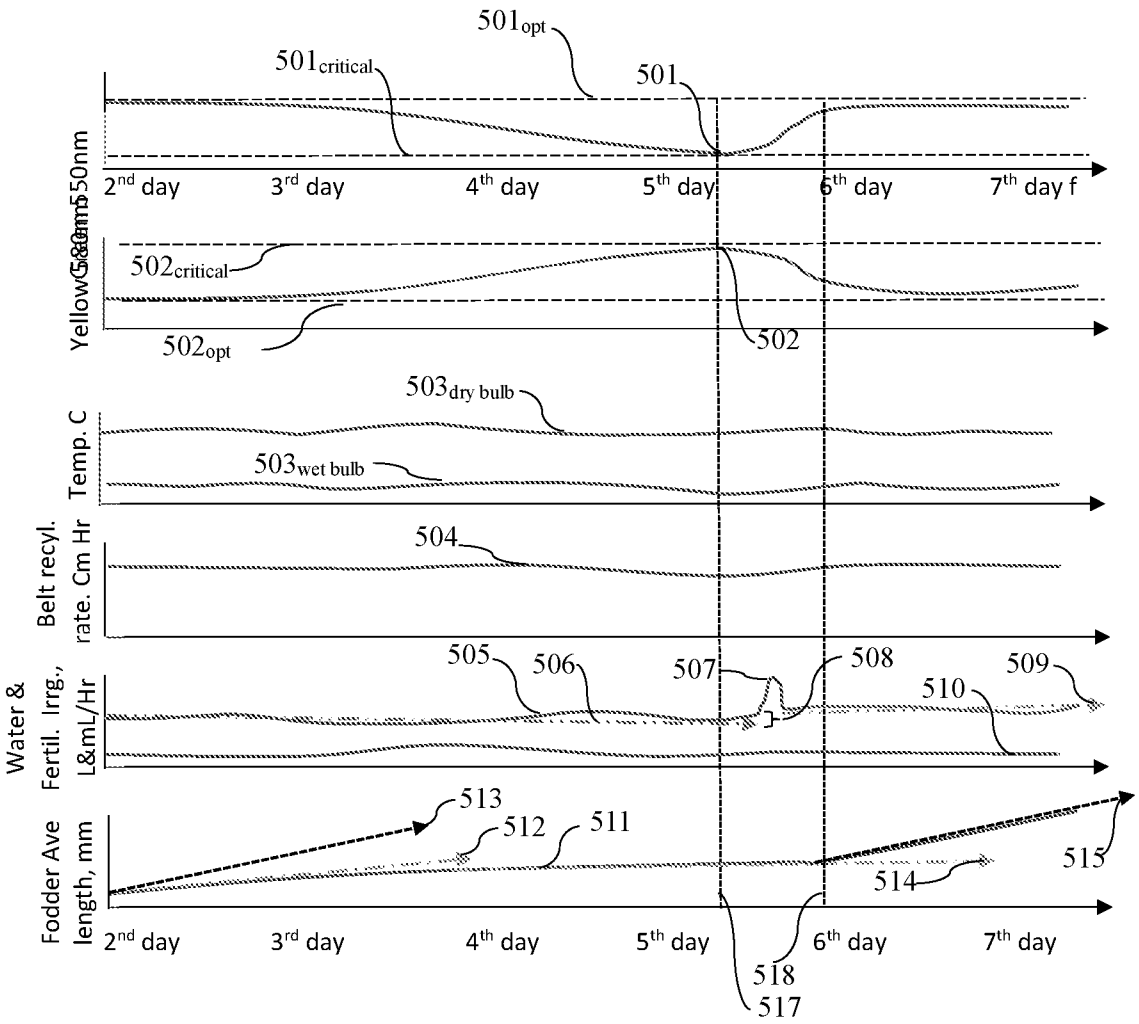

501opt
501critical
501
Yellow 550nm
2nd day
3rd day
4th day
5th day
6th day
7th day f
502critical
502opt
502
Temp. C
503dry bulb
503wet bulb
Belt recyl. rate. Cm Hr
504
Water & Fertil. Irrg., L&mL/Hr
505
506
507
508
509
510
Fodder Ave length, mm
513
512
511
514
515
518
517
2nd day
3rd day
4th day
5th day
6th day
7th day

Fig. 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IL2023/051171

A. CLASSIFICATION OF SUBJECT MATTER

A01G 31/04(2023.01)i; ***A01G 31/00***(2023.01)i; ***A01G 31/06***(2023.01)i; ***A01G 9/02***(2023.01)i; ***A01G 9/24***(2023.01)i
CPC:A01G 31/042; A01G 31/00; A01G 31/06; A01G 9/023; A01G 9/246; A01G 9/247

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 31/04; A01G 31/00; A01G 31/06; A01G 9/02; A01G 9/24
CPC:A01G 31/042; A01G 31/00; A01G 31/06; A01G 9/023; A01G 9/246; A01G 9/247

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

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

Databases consulted: Esp@cenet, Google Patents, Orbit, Similari (AI-based) Search terms used: hydroponic, hydroculture, conveyor belt, water, irrrigate, harvest

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2018132441 A1 (HARKER ALVIN) 17 May 2018 (2018-05-17) the whole document	1-39
A	US 2022000043 A1 (MJNN LLC) 06 November 2022 (2022-11-06) the whole document	1-39
A	US 3425158 A (LESLIE B KYLE) 04 February 1969 (1969-02-04) see figure 2 and description thereof	1,2,13,22,23
A	WO 2021097368 A1 (80 ACRES URBAN AGRICULTURE INC) 20 May 2021 (2021-05-20) see paragraph 0075	1,2,22,23
A	US 10660282 B1 (PARRISH TAYLOR MICHAELMASON) 26 May 2020 (2020-05-26) see figures 8 and 11 and description thereof	1,22
A	US 2021321585 A1 (MARTIN IVAN Z) 21 October 2021 (2021-10-21) see paragraph 0078 and figures 1 and 2	1,21

☐ Further documents are listed in the continuation of Box C. ☑ See patent family annex.

* Special categories of cited documents:
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"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	Date of mailing of the international search report
18 December 2023	**21 December 2023**

Name and mailing address of the ISA/IL
Israel Patent Office
Technology Park, Bldg.5, Malcha, Jerusalem, 9695101,
Israel
Israel
Telephone No. **972-73-3927139**
Email: **pctoffice@justice.gov.il**

Authorized officer
VASL Robert
Telephone No.

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/IL2023/051171

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