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(54) **SYSTEM FOR GROWING PRODUCE IN GREENHOUSES WITH ASSISTED COMPLEMENTARY SOLAR ENERGY**

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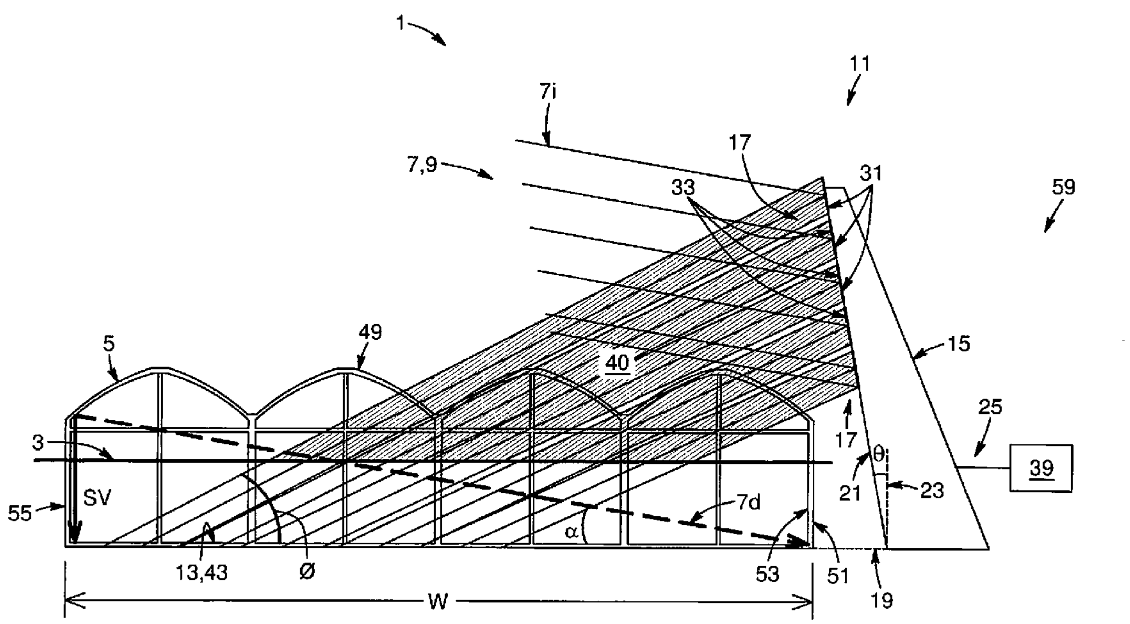
(57) **ABSTRACT**

This invention relates to a system (**1**) for growing produce (**3**) in greenhouses. The system (**1**) includes at least one greenhouse (**5**) for housing the produce (**3**) to be grown, the at least one greenhouse (**5**) being positioned, shaped and sized for receiving direct sun rays (**7***d*). The system (**1**) also includes at least one reflector assembly (**11**) proximate to the at least one greenhouse (**5**) and being positioned, shaped and sized for redirecting indirect sun rays (**7***i*) by-passing the least one greenhouse (**5**), towards at least one targeted area (**13**) within the at least one greenhouse (**5**), so as to provide said at least one greenhouse (**5**) with assisted complementary solar energy.



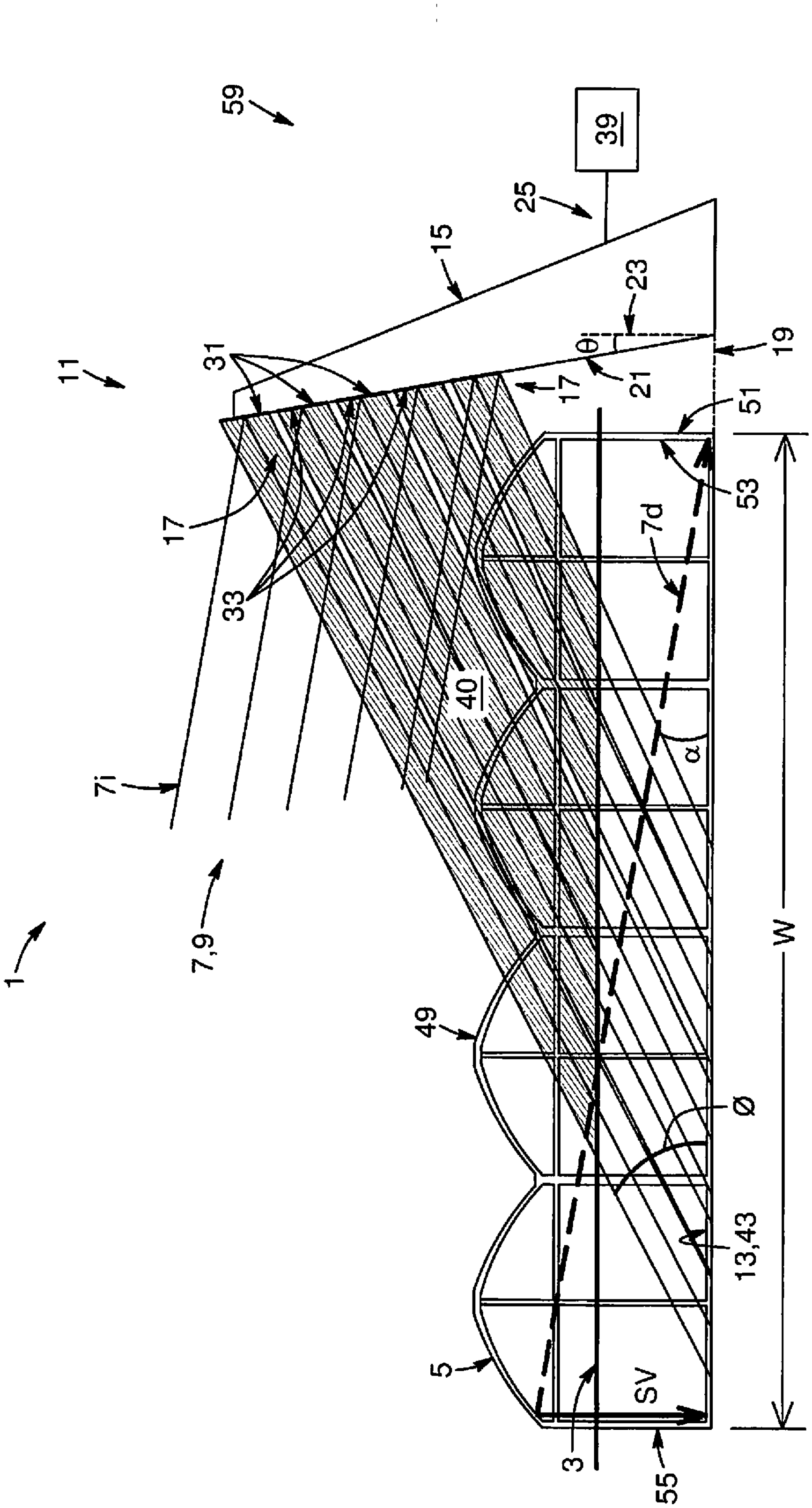

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FIG. 1

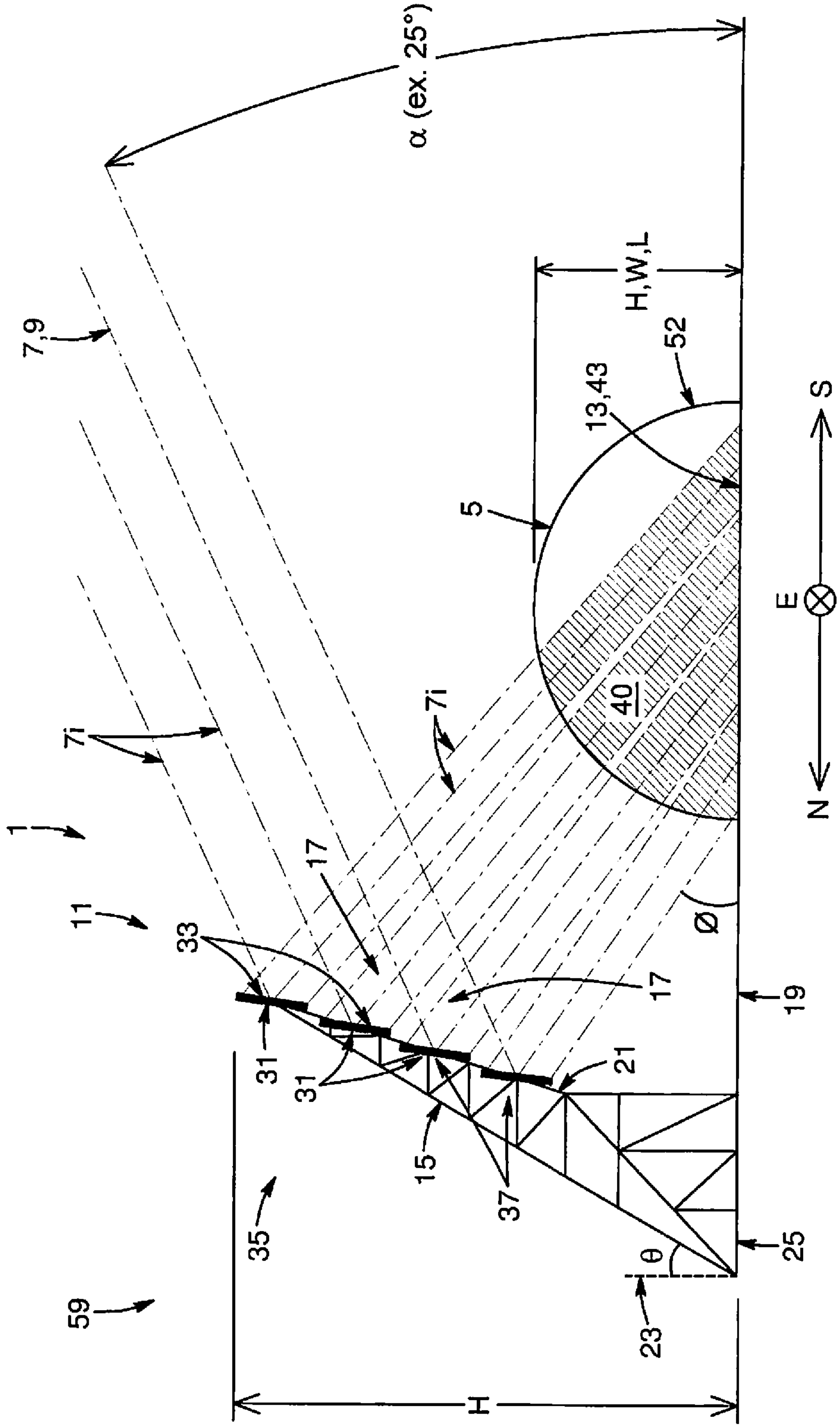

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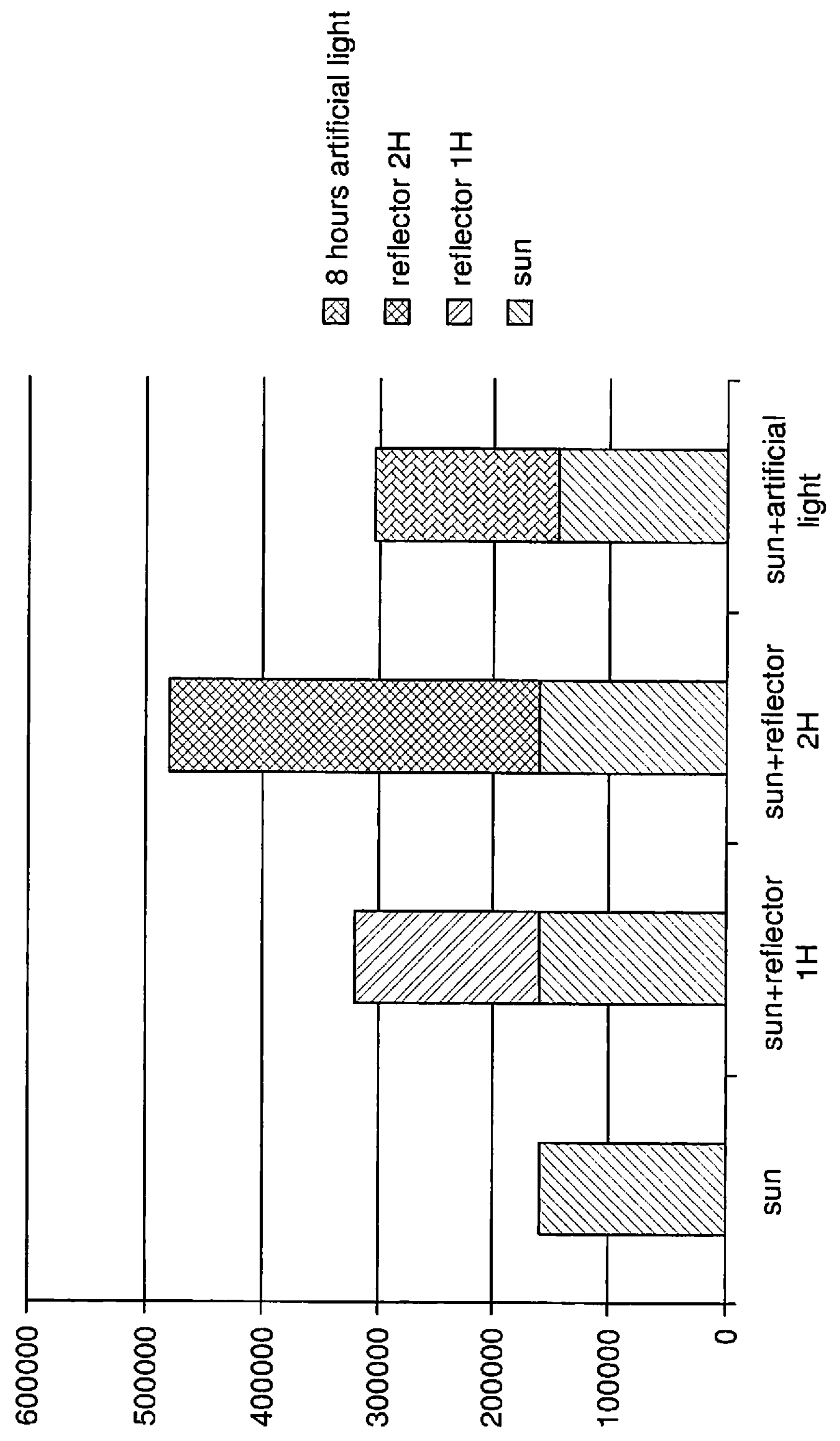
FIG. 2


8 hours artificial light
reflector 2H
reflector 1H
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sun+reflector 2H
sun+artificial light

FIG. 3

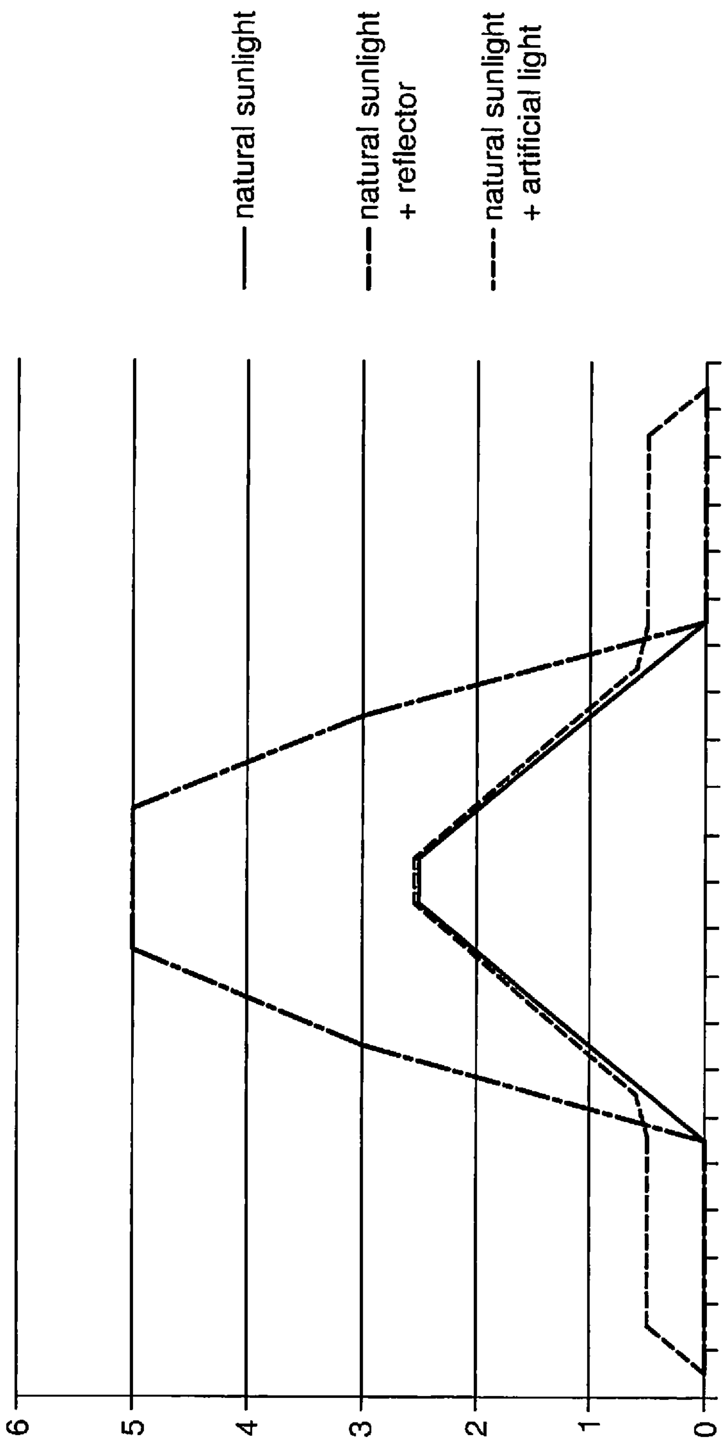
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FIG. 4

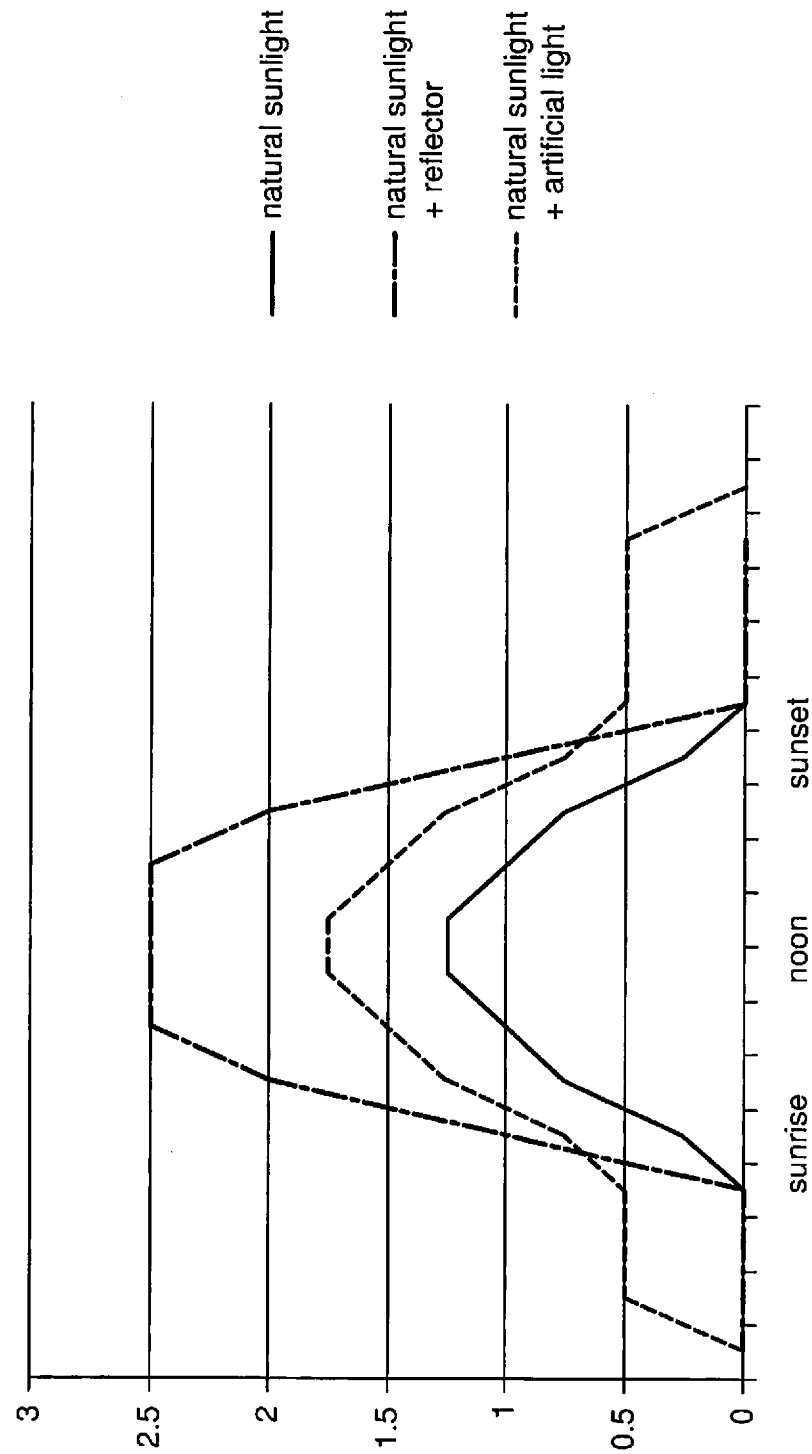
natural sunlight
natural sunlight
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FIG. 5

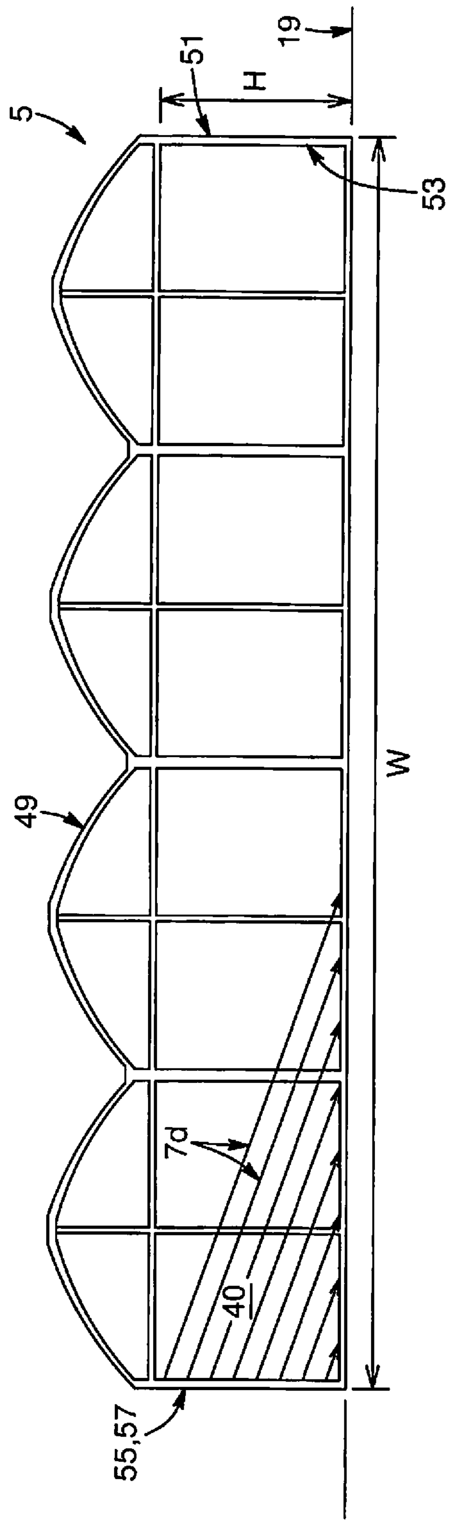

FIG. 6

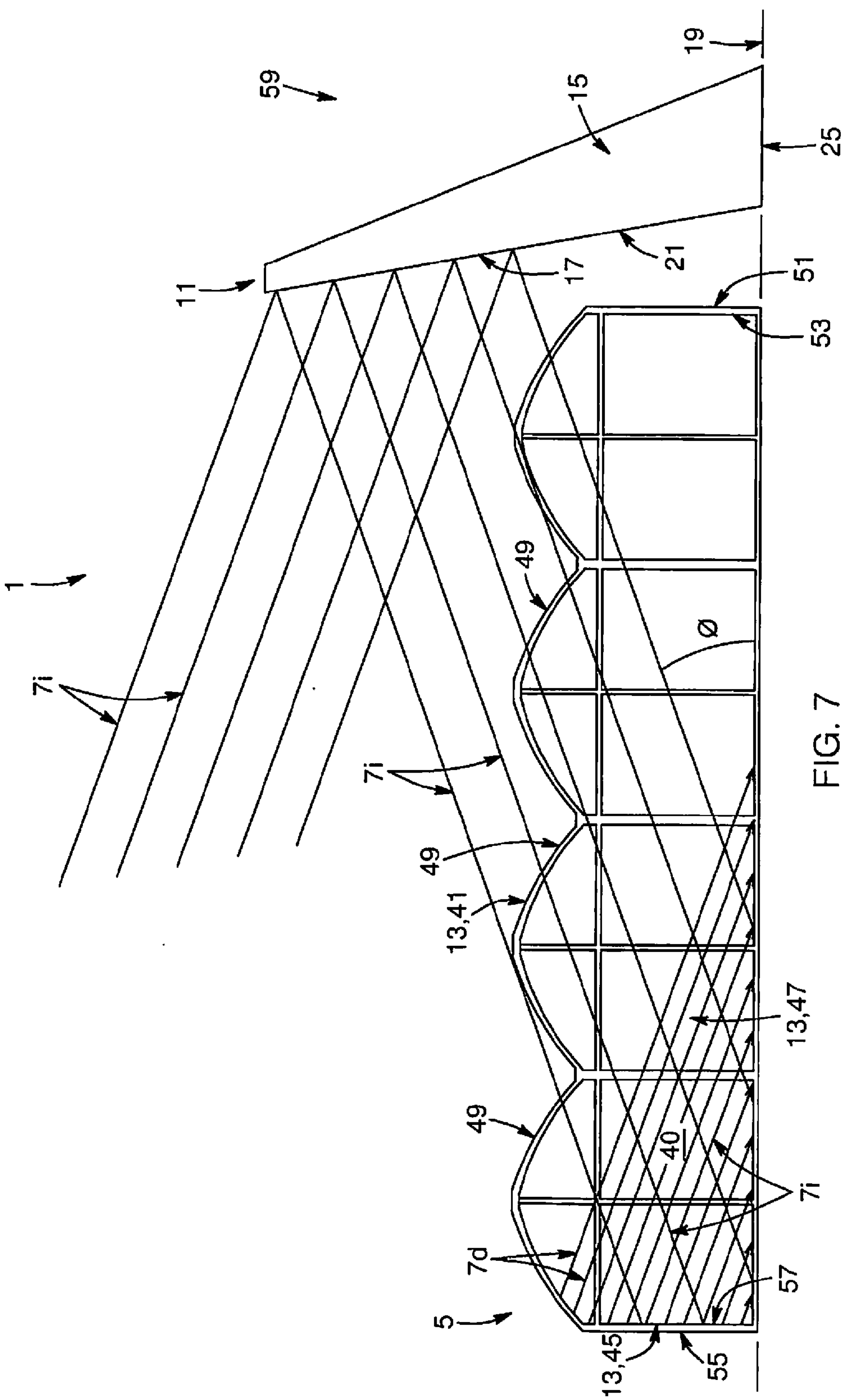
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FIG. 7

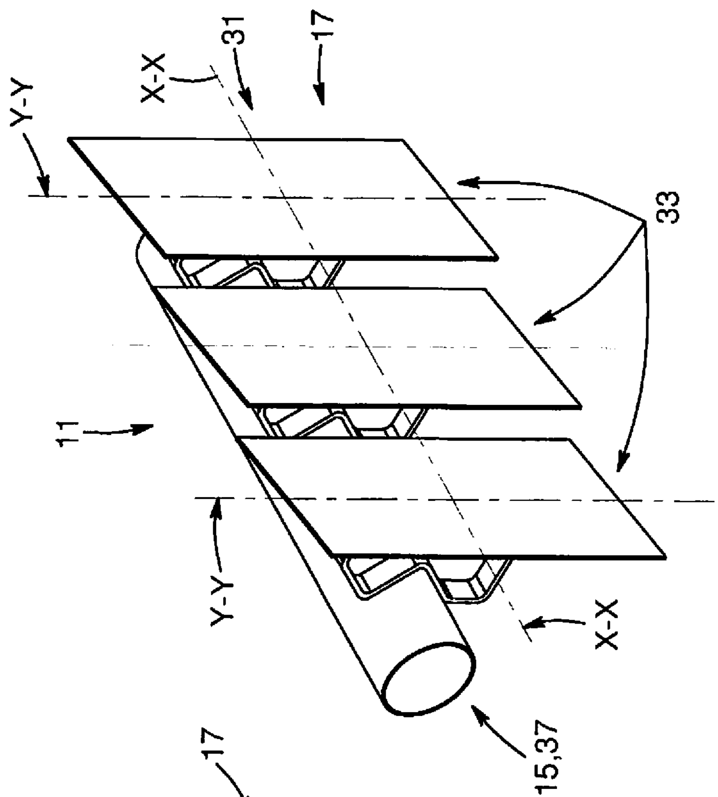

FIG. 9

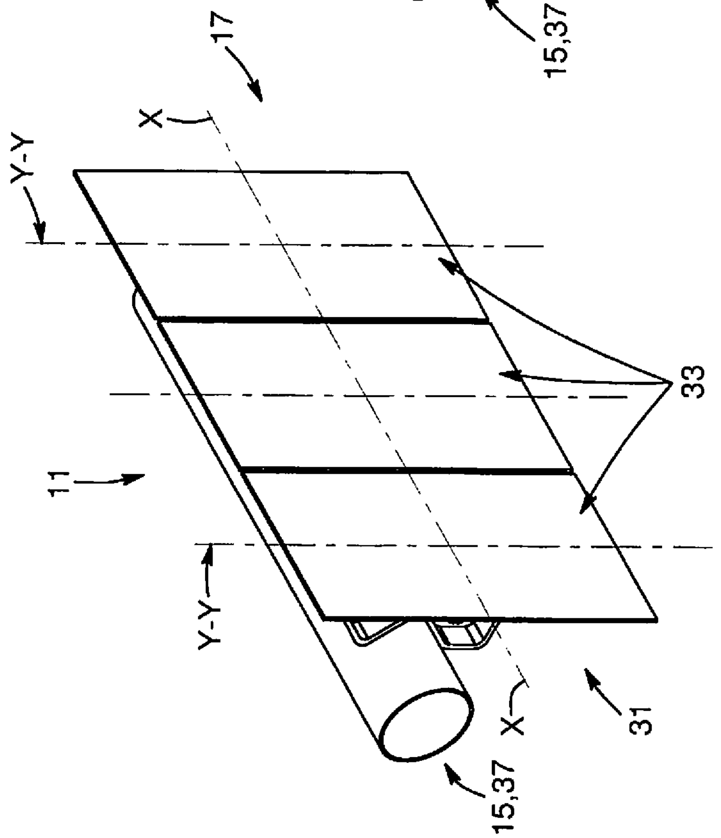

FIG. 8

SYSTEM FOR GROWING PRODUCE IN GREENHOUSES WITH ASSISTED COMPLEMENTARY SOLAR ENERGY

FIELD OF THE INVENTION

[0001] The present invention relates to a system for growing produce in greenhouses. More particularly, the present invention relates to a system for growing produce in at least one greenhouse with assisted complementary solar energy, as well as to a corresponding method of growing such produce.

BACKGROUND OF THE INVENTION

[0002] It is well known to grow produce, such as fruits, vegetables, flowers and other plants for example, in greenhouses. Greenhouses are typically covered by a transparent material which allows natural light produced by the sun to enter the greenhouse and activate the photosynthesis process for growing plants.

[0003] In the regions of the world which experience cold winters, like those north of the 42^{nd} parallel, greenhouses often do not receive enough natural light to grow fruits and vegetables and maintain healthy plants during the coldest winter months (typically December to February). Indeed, this problem is observed in more temperate regions as well as during the months of the year where there are fewer hours of daylight.

[0004] For most applications, the intensity of natural light itself never changes. However, the sun's "height", usually expressed as the angle it makes with the horizon, does vary throughout the year. During winter, the sun rises to a lower angle. The light rays produced by the sun during these months therefore have to cross a longer distance in the atmosphere. Greenhouses are generally oriented along a north-south axis so as to provide maximum exposure to the light rays of the sun. For these greenhouses, the light rays produced by the sun during these winter months penetrate into the greenhouses by the south vertical wall. The total light energy that can enter a greenhouse is generally limited by the height of the south vertical wall, and to some dilution which occurs along the greenhouse floor.

[0005] Another aspect which reduces the natural light energy received in greenhouses is fewer hours of daylight that take place during the winter months. For most northern latitudes, the reduction of daylight hours follows a curve having its lowest points in December and January.

[0006] Such a combination, of reduced sun height and reduced daylight, limit greenhouse operations in these northern latitudes to a reduced number of months each year. To compensate for the reduction of natural light received in the greenhouse, some producers install a large quantity of artificial lights having a light emission spectrum similar to PAR (Photosynthetically Active Radiation) lighting, which is a spectrum range known to have an influence on photosynthesis. However, a disadvantage of this compensation technique is that the installation cost of this artificial lighting and recurring energy costs make this action unfeasible for many producers. Indeed, many producers will only use such a compensation technique in order to supply an annual volume of produce for their clients, thus allowing them to maintain, or have the possibility of obtaining, a distribution contract with groceries or distributors. It will be appreciated that producers often disadvantageously operate at a loss with this technique during the coldest months of the year (especially, in North American markets).

[0007] Known to the Applicant are the following patent documents: CA 1,155,433; CA 1,237,367; CA 1,282,049; CA 2,685,957; CA 2,687,383; CA 2,738,036; CA 2,738,647; CA 2,768,264; CA 2,788,251; U.S. Pat. No. 608,755; U.S. Pat. No. 3,741,631; U.S. Pat. No. 3,981,151; U.S. Pat. No. 4,050,777; U.S. Pat. No. 4,137,897; U.S. Pat. No. 4,154,221; U.S. Pat. No. 4,198,953; U.S. Pat. No. 4,209,222; U.S. Pat. No. 4,219,008; U.S. Pat. No. 4,242,833; U.S. Pat. No. 4,252,107; U.S. Pat. No. 4,266,179; U.S. Pat. No. 4,318,394; U.S. Pat. No. 4,351,588; U.S. Pat. No. 4,529,123; U.S. Pat. No. 4,676,434; U.S. Pat. No. 5,813,168; U.S. Pat. No. 6,485,152 B2; U.S. Pat. No. 8,000,014 B2; U.S. Pat. No. 8,146,296 B2; U.S. Pat. No. 8,247,753 B2; U.S. Pat. No. 8,408,199 B1; U.S. Pat. No. 8,528,541 B2; U.S. Pat. No. 8,578,650 B2; U.S. Pat. No. 8,714,774 B2; U.S. Pat. No. 8,745,919 B2; U.S. Pat. No. 8,748,731 B2; U.S. Pat. No. 8,776,785 B2; US 2005/0034751 A1; US 2007/0062105 A1; US 2009/0314347 A1; US 2010/0059043 A1; US 2010/0101560 A1; US 2010/0175686 A1; US 2010/0251618 A1; US 2011/0114080 A1; US 2011/0167716 A1; US 2011/0197968 A1; US 2012/0037152 A9; US 2012/0067339 A1; US 2012/0125400 A1; US 2012/0152307 A1; US 2012/0174478 A1; US 2012/0198763 A1; US 2013/0042523 A1; US 2013/0063930 A1; US 2013/0092234 A1; US 2013/0220305 A1; US 2013/0232868 A1; US 2013/0276382 A1; US 2013/0305601 A1; and FR 2 979 423 A1.

[0008] The Applicant is also aware of the some of the disadvantages that may be associated with such conventional systems: a) some use the concentration of sun light on a focal point of a solar panel so as to create electrical energy, thus reducing the total light energy available for a larger area; b) some direct natural light into a size-restricted opening or inlet, thus reducing the total light energy available for a larger area; c) some are unsuitable for greenhouses which require relatively even light coverage over a larger surface area; d) some may not be suitable for use when the sun's height is reduced during the colder months of the year in northern latitudes; e) etc.

[0009] Hence, in light of the aforementioned, there is a need for an improved device or system which would be able to overcome or at the very least minimize some of the aforementioned prior art disadvantages.

[0010] Indeed, there is always a need to continue improving and find better and/or different ways of growing produce in greenhouses, especially ways that would be particularly useful during North-American winters, for example.

SUMMARY OF THE INVENTION

[0011] An object of the present invention is to provide a system which, by virtue of its design and components, satisfies some of the above-mentioned need and which is thus an improvement over other relate systems, devices and/or methods known in the prior art.

[0012] In accordance with the present invention, the above object is achieved, as will be easily understood from the present description, with a system such as the one briefly described herein and such as the one exemplified in the accompanying drawings.

[0013] More particularly, according to an aspect of the present invention, there is provided a system for growing produce in greenhouses, the system comprising:

[0014] at least one greenhouse for housing the produce to be grown, the at least one greenhouse being positioned, shaped and sized for receiving direct sun rays from the sun; and

[0015] at least one reflector assembly proximate to the at least one greenhouse and being positioned, shaped and sized for redirecting indirect sun rays by-passing the least one greenhouse, towards at least one targeted area within the at least one greenhouse, so as to provide said at least one greenhouse with assisted complementary solar energy.

[0016] The at least one erect support structure may be substantially perpendicular with respect to a ground surface, or it may be substantially slanted with respect to the ground surface, in which case it can be inclined towards the at least one greenhouse. Also, in some embodiments, a given side of the at least one erect support structure facing the at least one greenhouse, and the at least one reflective surface, may be substantially coplanar.

[0017] The at least one reflective surface may be inclined at an operative angle (e) with respect to a vertical plane so as to redirect sun rays towards the at least one targeted area within the at least one greenhouse at a given effective angle (ϕ). According to optional embodiments, the operative angle (e) of the at least one reflective surface ranges between about 30 degrees and about 40 degrees with respect to the vertical plane, whereas the effective angle (ϕ) can ultimately range between about 0 degrees and about 90 degrees.

[0018] The at least one reflective surface may be displaceable along at least one degree of freedom (translation, rotation, tilting, horizontally, vertically, etc.) with respect to the at least one erect support structure in order to redirect sun rays into the at least one greenhouse at optimal angles.

[0019] The at least one erect support structure may include a solid structure, or a truss structure, and optionally, may be mountable onto a base, in which case, the at least one erect support structure thereof can be moveable along at least one degree of freedom (translation, rotation, tilting, etc.) with respect to said base, and such movement can be done in relation to a movement of the sun.

[0020] Similarly, the base can be moveable along at least one degree of freedom with respect to a ground surface, and can be moveable in relation to a movement of the sun.

[0021] According to a particular embodiment, the at least one reflective surface is positioned on a northern side of the at least one greenhouse, and the at least one reflective surface faces southward.

[0022] The at least one reflective surface may have a height based on at least one parameter selected from the group consisting of: a) a width of the at least one greenhouse; b) a desired light penetration angle; c) a height of a side of the at least one greenhouse; and d) limitations imposed by local by-laws.

[0023] The at least one reflective surface may have a length being substantially equal to a length of the at least one greenhouse, but the length of the at least one reflective surface may be based on a side orientation of the sun, and/or on a correction factor for compensating a misalignment of the at least one greenhouse.

[0024] The at least one reflective surface may also include at least one row of reflective panels extending along a length of said at least one reflective surface, and according to a particular embodiment, the at least one row of reflective panels are parallel to a north-facing wall of the at least one greenhouse.

[0025] The reflective panels may be operatively mountable to the at least one erect support structure, and may be moveable via an actuating mechanism along at least one degree of freedom with respect to said at least one erect support structure. The actuating mechanism may include at least one servo-motor.

[0026] The reflective panels may be independently actuated with respect to each another, or alternatively, they may be dependently actuated with respect to each another. The reflective panels may also be synchronously actuated with respect to each another.

[0027] According to one optional embodiments: the reflective panels are operatively tiltable with respect to the at least one erect support structure via a corresponding axle; a lowermost row of reflective panels is located higher than a given height of the produce to be grown inside the at least one greenhouse; the reflective panels are selected from the group consisting of flat panels, folded panels, curved panels, concave panels and convex panels; and the reflective panels may be moveable in relation to a movement of the sun.

[0028] The present system may comprises a sun-tracker for tracking a movement of the sun, and reflective panels of the at least one reflector assembly may be operatively actuated based on signals received from the sun-tracker. The at least one erect support structure may also be selectively orientated based on signals received from the sun-tracker.

[0029] According to different possible embodiments, the at least one targeted area may include: a) at least one roof area of the at least one greenhouse; b) at least one floor area of the at least one greenhouse; c) at least wall area of the at least one greenhouse; d) at least intermediate area of the at least one greenhouse; e) other portions of the at least one greenhouse; f) etc.

[0030] Also, the at least one targeted area may variable in size, in location and/or in shape, via an operation of the at least one reflector assembly. Also, the at least one targeted area may include a plurality of different targeted areas via a corresponding operation of different reflective panels of the at least one reflector assembly.

[0031] According to other possible embodiments, the at least one greenhouse may comprise a roof configured for allowing indirect sun rays redirected from the at least one reflector assembly to penetrate through said roof. The roof may be made of a material selected from the group consisting of a translucid material, a translucent material, a transparent material and/or a perforated material.

[0032] According to one particular embodiment, the at least one greenhouse may be oriented along an east-west axis. Optionally also, an interior portion of a northern upright wall of the least one greenhouse may be provided with a reflective material to reflect sun rays back into the at least one greenhouse. Further optionally, a given portion of a southern upright wall of the at least one greenhouse may be made of a material for configured for allowing sun rays to penetrate therethough, and into the at least one greenhouse, in which case, the material of the given portion of the southern upright wall may be selected from the group consisting of a translucid material, a translucent material, a transparent material and/or a perforated material.

[0033] According to another aspect of the present invention, there is also provided a reflector assembly to be used proximate with at least one greenhouse for growing produce, the reflector assembly being positioned, shaped and sized for redirecting indirect sun rays by-passing the least one greenhouse, towards at least one targeted area within the at least one greenhouse, and the reflector assembly comprising:

[0034] at least one erect support structure, separate from the at least one greenhouse; and

[0035] at least one reflective surface, operatively mountable onto the at least one erect support structure, for reflecting indirect sun rays towards the at least one targeted area within the at least one greenhouse.

[0036] According to yet another aspect of the invention, there is also provided a kit with components for assembling the above-mentioned system and/or reflector assembly.

[0037] According to yet another aspect of the present invention, there is also provided a set of components for interchanging with components of the above-mentioned kit.

[0038] According to yet another aspect of the present invention, there is also provided a method of assembling components of the above-mentioned kit and/or set.

[0039] According yet another aspect of the present invention, there is also provided a method of growing produce with the above-mentioned system, greenhouse and/or reflector assembly.

[0040] More particularly, according to yet another aspect of the present invention, there is also provided a method of growing produce in greenhouses, the method comprising the steps of:

[0041] a) providing at least one greenhouse for housing the produce to be grown, the at least one greenhouse being positioned, shaped and sized for receiving sun rays directly from the sun; and

[0042] b) redirecting sun rays by-passing the at least one greenhouse towards at least one targeted area within said at least one greenhouse.

[0043] Step b) may comprise the step of redirecting sun rays with at least one of the above-mentioned reflector assembly.

[0044] According yet another aspect of the present invention, there is also provided a plant (ex. farm, etc.) provided with the above-mentioned system, greenhouse and/or reflector assembly, and/or commercialized with the above-mentioned method(s).

[0045] According to yet another aspect of the present invention, there is also provided a method of doing business with the above-mentioned system, greenhouse, reflector assembly, kit, set and corresponding method(s).

[0046] The objects, advantages and other features of the present invention will become more apparent upon reading of the following non-restrictive description of optional embodiments thereof, given for the purpose of exemplification only, with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0047] FIG. **1** is a side elevational view of a system including at least one greenhouse and at least one reflector assembly, according to an optional embodiment of the present invention.

[0048] FIG. **2** is another side elevational view of a system including at least one greenhouse and at least one reflector assembly, according to another optional embodiment of the present invention.

[0049] FIG. **3** is a graph showing a theoretical solar energy received in a greenhouse for different lighting systems.

[0050] FIG. **4** is a curve showing representative values of light received on a sunny day as a function of time for different lighting systems.

[0051] FIG. **5** is a curve showing representative values of light received on a cloudy day as a function of time for different lighting systems.

[0052] FIG. **6** is a side elevational view of at least one greenhouse receiving solar energy from natural sunlight (i.e. "direct sun rays"), according to an optional embodiment of the present invention.

[0053] FIG. **7** is a side elevational view of at least one greenhouse receiving solar energy from natural sunlight (i.e. "direct sun rays") and at least one reflector assembly (i.e. "indirect sun rays"), according to an optional embodiment of the present invention.

[0054] FIG. **8** is a partial perspective view of a reflector assembly according to another optional embodiment of the present invention, the reflector assembly being shown containing at least one row of reflective panels, the panels being shown juxtaposed against one another, in a given intermediate configuration.

[0055] FIG. **9** is another perspective view of what is shown in FIG. **8**, the panels being now shown separate from one another, in another intermediate configuration, to better illustrate how the panels are configured to be displaceable along a plurality of different degrees of freedom, including being slidably moveable along a given support axle, and being tiltable along separate horizontal and vertical axes.

DETAILED DESCRIPTION OF OPTIONAL EMBODIMENTS OF THE INVENTION

[0056] In the following description, the same numerical references refer to similar elements. Furthermore, for sake of simplicity and clarity, namely so as to not unduly burden the figures with several reference numbers, only some figures have been provided with reference numbers, and components and features of the present invention illustrated in other figures can be easily inferred therefrom. The embodiments, geometrical configurations, materials mentioned and/or dimensions shown in the figures are preferred, for exemplification purposes only.

[0057] Moreover, although the present invention was primarily designed for growing produce via solar energy inside a given structure, such as a greenhouse and/or the like, it may be used with other objects and/or in other types of applications, as apparent to a person skilled in the art. For this reason, expressions such as "growing", "produce", "solar energy", "greenhouse", "inside", "structure", etc., used herein should not be taken so as to limit the scope of the present invention and include all other kinds of objects and/or applications with which the present invention could be used and may be useful (ex. for heating the given structure via a radiant heating with the reflector assembly, etc.).

[0058] Moreover, in the context of the present invention, the expressions "system", "assembly", "kit", "device", "station", "plant", "unit", and "farm", as well as any other equivalent expressions and/or compounds word thereof known in the art will be used interchangeably, as apparent to a person skilled in the art. This applies also for any other mutually equivalent expressions, such as, for example: a) "redirecting", "reflecting", "reorienting", "reusing", "intersecting", "capturing", "inputting", "adding", "multiplying", etc.; b) "sun rays", "sun light", "day light", "natural light", "solar energy", "solar radiance", "solar heat", etc.; c) "towards", "into", "about", etc.; d) "structure", "greenhouse", "targeted-environment", etc.; e) "enabling", "allowing", "promoting", "fostering", "encouraging", etc.; f) "growing", "cultivating", "producing", "heating", "treating", "processing", etc.; g) "produce", "vegetables", "fruits, "flowers", "plants", "items", "objects", etc.; h) "erect", "upright", "raised", "vertical", etc.; i) "wall", "surface", "area", "portion", "region", etc.; j) "reflector assembly", "reflective surface", "reflective wall", "reflectors", "panels", etc.; k) "moving", "displacing", "driving", "displacing", "supporting", "gliding", "conveying", "rotating", "pivting", "tilting", etc.; as well as for any other mutually equivalent expressions, pertaining to the aforementioned expressions and/or to any other structural and/or functional aspects of the present invention, as also apparent to a person skilled in the art.

[0059] Furthermore, in the context of the present description, it will be considered that all elongated objects will have an implicit "longitudinal axis" or "centerline", such as the longitudinal axis of a sun ray for example, or the centerline of a bore, for example, and that expressions such as "connected" and "connectable", or "mounted" and "mountable", may be interchangeable, in that the present invention also relates to a kit with corresponding components for assembling a resulting fully assembled and operational system (and/or a plant including the same).

[0060] In addition, although the preferred embodiments of the present invention as illustrated in the accompanying drawings comprise various components, and although the preferred embodiments of the system (and/or portions thereof) and corresponding parts as shown consist of certain geometrical configurations as explained and illustrated herein, not all of these components and geometries are essential to the invention and thus should not be taken in their restrictive sense, i.e. should not be taken so as to limit the scope of the present invention. It is to be understood, as also apparent to a person skilled in the art, that other suitable components and cooperation thereinbetween, as well as other suitable geometrical configurations may be used for the present system and corresponding parts/components according to the present invention, as will be briefly explained herein and as can be easily inferred herefrom by a person skilled in the art, without departing from the scope of the present invention.

LIST OF NUMERICAL REFERENCES OF SOME CORRESPONDING POSSIBLE COMPONENTS ILLUSTRATED IN THE ACCOMPANYING DRAWINGS

[0061] **1**. system
[0062] **3**. produce (ex. vegetables, fruits, flowers, plants, etc.)
[0063] **5**. greenhouse
[0064] **7**. sun rays (or also simply "solar energy")
[0065] **7*d***. direct sun rays (i.e. those intersecting directly the greenhouse from the sun)
[0066] **7*i***. indirect sun rays (i.e. by-passing the greenhouse and redirected afterwards)
[0067] **9**. sun
[0068] **11**. reflector assembly
[0069] **13**. targeted area
[0070] **15**. erect support structure (of reflector assembly)
[0071] **17**. reflective surface (of reflector assembly)
[0072] **19**. ground surface (ex. horizon)
[0073] **21**. a given side (of the support structure, which faces the greenhouse)
[0074] **23**. vertical plane
[0075] **25**. base (of support structure)
[0076] **27**. height (of reflective surface)
[0077] **29**. length (of reflective surface)
[0078] **31**. row (of reflective panels)
[0079] **33**. reflective panels (or simply "reflectors")
[0080] **35**. actuating mechanism (ex. servo-motor)
[0081] **37**. axle
[0082] **39**. sun-tracker (or simply "tracking system")
[0083] **41**. roof area of the greenhouse (as possible "targeted area")
[0084] **43**. floor area of the greenhouse (a possible "targeted area")
[0085] **45**. wall area of the greenhouse (as possible "targeted area")
[0086] **47**. intermediate area of the greenhouse (as possible "targeted area")
[0087] **49**. roof (of greenhouse)
[0088] **51**. northern upright wall (of greenhouse)
[0089] **53**. reflective material (of northern upright wall)
[0090] **55**. southern upright wall (of greenhouse)
[0091] **57**. material (of southern upright wall)
[0092] **59**. farm (provided with the present system and/or reflector assembly)
[0093] W. width (of greenhouse)
[0094] H. height (of greenhouse)
[0095] L. length (of greenhouse)
[0096] e. operative angle (i.e. angle between reflective surface and vertical plane)
[0097] ϕ. effective angle (i.e. angle between reflected sun rays and ground surface)
[0098] α. horizon angle (i.e. angle between direct sun rays and the horizon)
[0099] X-X. horizontal axis (about which the reflective panel can rotate)
[0100] Y-Y. vertical axis (about which the reflective panel can rotate)

[0101] Broadly described, the present system (**1**) allows for the use and enhancement of natural light and solar energy for growing produce (**3**), such as fruits, vegetables, flowers and other plants, in a given structure, such as a greenhouse (**5**) for example, during all months of the year, and particularly during the winter months in a northern environment, without resorting to artificial lights, for example.

[0102] According to one general aspect of the present system, there is provided a reflector assembly (**11**) for reflecting solar energy (**7**) against a greenhouse (**5**), the reflector assembly (**11**) comprising: a) an erect support structure (**15**) disposed adjacent to the greenhouse (**5**); and b) a reflective surface (**17**) being mountable to the support structure (**15**) and positioned, shaped, and sized for reflecting solar energy (**7**) against a targeted area (**13**) of the structure.

[0103] In some optional embodiments, the structure is a greenhouse (**5**) having a roof made of a transparent material. Optionally, the solar energy (**7**) is reflected through the top of the greenhouse (**5**). The targeted area (**13**) can be the floor area (**41**) of the greenhouse or some part thereof, and the solar energy (**7**) can be reflected through the top of the greenhouse (**5**) and onto the floor area (**41**) of the greenhouse (**5**). In most embodiments, but not necessarily all, the greenhouse (**5**) is oriented along an east-west axis.

[0104] In some optional embodiments, the support structure (**15**) includes a reflecting wall having a reflective surface (**17**), the reflecting wall being positioned on a northern side of the greenhouse (**5**). Further optionally, the reflecting wall is oriented so as to face in a southerly direction. Yet further optionally, the length of the reflecting wall (or reflective surface (**17**)) is substantially equal to a length of the greenhouse (**5**).

[0105] The angle (e) of the reflective surface (**17**) with respect to a vertical plane (**23**) is adjusted to obtain an optimal reflected angle (or effective angle (e)) of the solar energy (**7**) penetrating the greenhouse (**5**) by the roof (**49**). Such an angle can be about 30° to about 40°. Further optionally, the reflective surface (**17**) is angled so that the solar energy (**7**) can penetrate perpendicularly through the roof (**49**), thereby avoiding reflecting a part of the solar energy (**7**) away from the greenhouse (**5**).

[0106] In some optional embodiments, the reflective surface (**17**) is pivotally mountable to the support structure (**15**) so as to pivot in response to a movement of the sun. The reflector assembly (**11**) can have a plurality of reflector rows (**31**) disposed substantially horizontally, each reflector row (**31**) having a plurality of reflectors (**33**) disposed adjacent to one another along the reflector row (**31**). Each of the reflectors (**33**) and/or reflector rows (**31**) can be rotated and/or pivoted by suitable motors in response to the movement of the sun. Optionally, the lowest reflector row (**31**) can be positioned at a height greater than the height of the produce (**3**) to be grown (or greater than the height of an object intended to receive the reflected solar energy (**7**), etc.). Further optionally, the inside of a north upright wall (**51**) of the greenhouse (**5**) is made of a reflective material (**53**) in a way to reflect inside the structure, the natural sunlight (**7*d***) that has penetrated laterally by a south wall (**55**), for example.

[0107] In some optional embodiments, the present system (**1**) has a sun-tracker (**39**) for tracking the position of the sun and/or light rays. The sun-tracker (**39**) can output a signal to a corresponding processor so as to control the orientation of the support structure (**15**) and/or reflector assembly (**11**).

[0108] According to another aspect of the present invention, there is provided a method for reflecting solar energy (**7**) against a greenhouse (**5**), the method comprising the steps of: a) determining an angle (a) of the sun (**9**) relative to the horizon; and b) orientating one or more reflectors (**33**) so as to reflect the solar energy (**7**) against a targeted area (**13**) of the greenhouse (**5**).

[0109] According to yet another aspect of the present invention, there is provided a system for capturing solar energy, the system comprising: a) a structure (ex. greenhouse, etc.) having a targeted area (**13**) for receiving solar energy (**7**); b) a substantially erect support structure (**15**) disposed adjacent to the structure (ex. greenhouse, etc.); and a reflector assembly (**11**) being mountable to the support structure (**15**) and positioned, shaped, and sized for reflecting solar energy (**7**) against the targeted area (**13**) of the structure (ex. greenhouse, etc.).

[0110] As previous mentioned, and according to a general aspect, there is provided a system (**1**) for reflecting solar energy (**7**) against a structure, such as a greenhouse (**5**) an example of which is shown in FIGS. **1** and **2**. The present system (**1**) can be any assembly or configuration of components, such as the ones described below, which allows for the solar energy (**7**) of the sun (**9**) to be redirected, thrown back, shifted, etc. towards the structure so as to impact the structure or some part thereof. The expression "solar energy" refers to the radiant light and heat produced by the sun (**9**) and directed towards the earth. The term "against" refers to the ability of the present system (**1**), and of its reflector assembly (**11**), to direct the solar energy (**7**) so that it impacts the structure or some part thereof. For example, the structure is a greenhouse (**5**) in most optional embodiments. In such an example, the solar energy (**7**) can be directed against the greenhouse (**5**) such that it penetrates into the greenhouse (**5**) and toward the floor area (**43**) of the greenhouse (**5**) where the plants to be cultivated are located. In another possible example, the solar energy (**7**) can be reflected against a wall area (**45**) of the greenhouse (**5**), such as a "green" wall for example, which contains plants. It can thus be appreciated that the solar energy (**7**) can be reflected against any desired part of the structure, or away from the structure, as desired.

[0111] As previously mentioned, the structure can be a greenhouse (**5**). It is appreciated that the present system (**1**) is not limited to being used only with a greenhouse (**5**), and thus the term "greenhouse", is meant in its broadest sense. Indeed, the structure can be any edifice, building, architecture, complex, or other construction where it is desirous to have solar energy (**7**) directed thereagainst. In some optional embodiments, the greenhouse (**5**) has a roof (**49**) made of a transparent material. Such a transparent material can be plastic or glass sheeting, for example. This allows for the solar radiation (**7**) to be reflected against the top of the greenhouse (**5**) and through its roof (**49**), thereby advantageously allowing the solar radiation (**7**) to penetrate the greenhouse (**5**) and impact the plants growing therein. In some optional embodiments, the interior surface of a northern vertical wall (**51**) of the greenhouse (**5**) can be covered in, or made from, a reflective material (**53**). This advantageously allows for the northern vertical wall (**51**) to reflect the solar energy (**7**) arriving through the southern vertical wall (**55**), assuming a structure oriented along an east-west axis, towards the targeted area (**13**) of the greenhouse (**5**) and/or plants, thereof, for example. The greenhouse (**5**) can be oriented along an east-west axis, as shown in FIG. **2**. As previously explained, in northern climes where the focus is on greenhouse production during the summer months, greenhouses are typically oriented along a north-south axis to maximize interception of the light generated by the sun (**9**) as it travels over the width of the greenhouse (**5**). The orientation of the greenhouse (**5**) along an east-west axis allows for an increased exposure time to the solar energy (**7**) of the sun (**9**) as it rises in the east and sets in the west.

[0112] The present system (**1**) has at least one erect support structure (**15**), an example of which is shown in FIGS. **1** and **2**. The support structure (**15**) can be any construction that extends in an upright manner (ex. vertically, slanted, etc.) from the ground surface (**19**) and which is positioned in proximity to the greenhouse (**5**). The support structure (**15**) can extend perpendicular to the ground surface (**19**), or at some angle with respect to a vertical plane (**23**). The support structure (**15**) can also be mounted to a base (**25**) so that it can move, rotate, pivot, etc. so as to track the movement of the sun (**9**). It can thus be appreciated that the support structure (**15**) can take many different shapes and configurations to achieve the above-mentioned functionality. For example, and in one possible embodiment shown in FIG. **1**, the support structure (**15**) can be a solid wall. In another possible embodiment, and as shown in FIG. **2**, the support structure (**15**) can be a truss tower.

[0113] As previously explained, and according to some possible embodiments, the support structure (**15**) can include a reflecting wall having at least one reflective surface (**17**). The reflective surface (**17**) can be any face of the reflecting wall which is oriented towards the greenhouse (**5**) and which allows for the solar radiation (**7**) to be reflected against the greenhouse (**5**). Optionally, and as shown in FIG. **2**, the reflecting surface (**17**) can be positioned on a northern side of the greenhouse (**5**), or of a group of greenhouses (**5**), when it or they are oriented along an east-west axis, such that the reflective surface (**17**) faces southward. Such a configuration advantageously allows the reflective surface (**17**) to intercept the solar energy (**7**) which by-passes the greenhouse (**5**) so as to reflect and/or redirect it towards the greenhouse (**5**).

[0114] The length (**29**) of such a reflective surface (**17**) (i.e. the distance it extends into the page of FIG. **2**) can vary. In some optional embodiments, the length (**29**) of the reflective surface (**17**) is substantially equal to the length (L) of the greenhouse (**5**) when oriented along an east-west axis. Such a length (**29**) can be adjusted or corrected based on the following non-limitative list of factors: a) to compensate for the side orientation of the sun (**9**) which varies throughout the day; b) correction for the misalignment of the greenhouse (**5**) along the east-west axis; c) etc. Similarly, the height (**27**) of the reflective surface (**17**) (i.e. the distance it extends away from the ground surface) can vary. In some embodiments, the height (**27**) of the reflective surface (**17**) is determined according to at least some of the following factors: a) the width (W) of the greenhouse (**5**); b) the desired light penetration angle (e); c) the height of a side wall (**51**,**55**) of the greenhouse (**5**); d) limitations imposed by local rules or by-laws; e) etc.

[0115] In some optional embodiments, and as previously mentioned, the support structure (**15**) is inclined relative to a vertical plane at an angle (e). Optionally, the angle (e) of the support structure (**20**) and/or of reflective surface (**17**) with respect to the vertical plane (**23**) is adjusted to obtain an optimal solar energy penetration angle (e) into the greenhouse (**5**) by the roof (**49**). For example, such a process of adjustment can provide the angle (e) with values between about 30° and about 40° Further optionally, the reflective surface (**17**) is angled so that the solar energy (**7**) can penetrate perpendicularly through the roof (**49**), thereby advantageously avoiding reflecting a part of the solar energy (**7**) away from the greenhouse (**5**) and optimizing the amount of solar energy (**7**) received by the plants.

[0116] As previously explained, the present system (**1**), also referred to herein as "reflector system" (**1**), has a reflector assembly (**11**), an example of which is shown in FIGS. **1** and **2**. The reflector assembly (**11**) can be fixedly or removably mounted to some part of the support structure (**15**), thus allowing it to be displaced in response to the movement of the sun (**9**), for example. The reflector assembly (**11**) is positioned so that it can reflect the solar energy (**7**) against the targeted area (**13**) of the greenhouse (**5**). The targeted area (**13**) can be any space or surface on or within the greenhouse (**5**). In most embodiments, but not necessarily all, the targeted area (**13**) can be the floor area (**43**) of the greenhouse (**5**) or some part thereof. This advantageously allows the solar energy (**7**) to be reflected towards the plants growing in proximity to the floor area (**43**) of the greenhouse (**5**), for example. It can thus be appreciated that the reflector assembly (**11**) can take many different shapes and configurations to achieve such functionality.

[0117] In some embodiments, the reflector assembly (**11**) has one or more rows (**31**) of reflective panels (**33**), hereinafter referred to also as "reflector rows" (**31**). The reflector rows (**31**) can extend substantially horizontally along the length of the reflector assembly (**11**), and can extend along a length (**29**) that is substantially equal to the length (L) of the greenhouse (**5**), or which extends beyond the length (L) of the greenhouse (**5**), for example. In the embodiments where the greenhouse (**5**) is oriented along an east-west axis, the reflector rows (**31**) can be substantially parallel with the north-facing wall (**55**) of the greenhouse (**5**). Such an orientation of the reflector rows (**31**) may advantageously allow them to reflect an optimized amount of solar energy (**7**) against the greenhouse (**5**). Each reflector row (**31**) can be connected to the support structure (**15**) via an axle (**37**) or other similar device which allows the reflector rows (**31**) to pivot along a horizontal axis and/or a vertical axis so as to advantageously maintain a constant penetration angle (e) of the reflected solar energy (**7**) into the greenhouse (**5**) even as the height of the sun (**9**) changes during the day. Such an axle (**37**) or support can be made of steel so as to better support the reflector rows (**31**) both while stationary and while pivoting.

[0118] Each reflector row (**31**) can have one or more reflective panels (**33**) (or simply "reflectors" (**33**)) for reflecting the solar energy (**7**) against the greenhouse (**5**). The reflectors (**33**) can be disposed adjacent to one another in both a horizontal direction, and/or a vertical direction. Each reflector (**33**) can be made of a base covered by any suitable reflecting material. Each reflector (**33**) can also be made of a structural material having the desired reflection capabilities. The shape and orientation of each reflector (**33**) can vary, as required. Indeed, in most embodiments, the reflectors (**33**) can be substantially flat panels, but reflectors (**33**) which are folded, curved, concave, and/or convex in one or more axes are also within the scope of the present disclosure.

[0119] Just as the reflector rows (**31**) can be displaced (e.g. pivoted, moved, tilted, etc.), in some embodiments, the base of each reflector (**33**) is mounted to an actuating mechanism (**35**) which can control its orientation and maintain its position when not rotating. Such a mechanism (**35**) advantageously allows for the individual and automatic control of the orientation of the reflective face of each reflector (**33**) so that the reflective face can continuously optimize the solar energy (**7**) it reflects towards the greenhouse (**5**). It can thus be appreciated that both the reflectors (**33**) and the reflector rows (**31**) on which they are mounted can be independently and automatically positioned to as to optimize the solar energy (**7**) directed against the greenhouse (**5**). Indeed, the angle at which each reflector (**33**) is oriented on each reflector row (**31**) can be different from the angle of other reflectors (**33**) in the same reflect row (**31**), and/or from the angle of other reflectors (**33**) in other reflector rows (**31**). Such a configuration may advantageously allow the reflector assembly (**11**) to reflect solar energy evenly against the entire targeted area (**13**) (e.g. floor) of the greenhouse (**5**) and/or portion(s) thereof.

[0120] In some optional embodiments, the present system (**1**) has a tracking system, or simply "sun-tracker" (**39**), for tracking the movement of the sun (**9**). Such a tracking system (**39**) can follow the height of the sun (**9**) and its lateral position that also changes during the day, and output a signal to control the orientation of the support structure (**15**), reflector rows (**31**) and/or reflectors (**33**). For example, the signal outputted by the tracking system (**39**) can command servo-motor(s) to pivot or rotate the reflector rows (**31**) along a horizontal axis and/or a vertical axis of the reflective surface (**17**). Such a tracking system (**39**) also allows for the control of the support structure (**15**), reflector rows (**31**) and/or the reflectors (**33**) when not being used. For example, the tracking system (**39**) can automatically disable the pivoting of the reflector rows (**31**) during nighttime. In another example, the tracking system (**39**) can command the reflectors (**33**) to orient themselves to face away from the greenhouse (**5**), so as to stop reflecting the solar energy into the greenhouse (**5**) if the energy level becomes too high (e.g. noon during summer time). In yet another example, the tracking system (**39**) can command the reflector rows (**31**) to face downward in case of violent wind, ice storm, or other problematic situation.

[0121] Several modifications could be made to the present system (**1**) without departing from the scope of the present invention. For example, FIGS. **8** and **9** illustrate another possible embodiment for the reflector assembly (**11**), and corresponding reflective surface (**17**), wherein for a same given row (**31**) of reflective panels (**33**), said panels can be configured to be displaceable along a plurality of different degrees of freedom, including a rotating (pivoting, tilting, etc.) movement along a horizontal axis so as to move up and down, for example, in order to compensate for the vertical movement of the sun (**9**) during the day, and/or a rotating (pivoting, tilting, etc.) movement along a vertical axis from side to side, for example, in order to compensate for a lateral movement of the sun (**9**) during the day.

[0122] Contrasting FIGS. **8** and **9** further exemplifies how the reflective panels (**33**) can be configured to be displaceable via a sliding movement along a corresponding support axle (**37**) (whether it be a common axle (**37**) for all panels (**33**), or a separate support axle (**37**) for each panel (**33**)), for example, so as to selectively vary an effective width/length (**29**) of the reflective surface (**17**) of the reflector assembly (**11**), depending on the particular applications for which the present system (**1**) is intended for, and the desired end results.

[0123] As may now be better appreciated, the above-mentioned positioning/adjustment of the reflective panels (**33**), via corresponding actuating mechanism(s) (**35**), along at least two different axes (for example, a horizontal axis, and a vertical axis), enables to compensate the reflector assembly (**11**) for the vertical angle of the sun (**9**), and for the lateral angle of the sun with respect to an axis of the greenhouse (**5**) and/or with respect to an axis of the support structure (**15**) which supports the reflective panels (**15**).

[0124] Thus, the present system (**1**) could ultimately be used without a sun-tracker (**39**) if a proper positioning/adjustment program (ex. a computer program, etc.) was employed for the reflective panels (**33**). The program could be based, for example, on time and day/date of the year, on the corresponding latitude where the system (**1**) is being used, and other parameters, etc.

[0125] Finally, and according to the present invention, the present system (**1**) and corresponding parts can be made of substantially rigid materials, such as metallic materials, hardened polymers, composite materials, cementitious mixture, and/or the like, as well as possible combinations thereof, depending on the particular applications for which the system (**1**) is intended, and the desired end results.

[0126] Having described some of the optional components and features of the present system (**1**), some of the potential benefits of the use of the present invention will now be described. It will be appreciated that the following description of potential benefits of the present reflector system (**1**) is based on certain theoretical assumptions, and that the amount and nature of actual benefits may vary depending on different factors, etc.

[0127] Notwithstanding, and as may now be better appreciated, the present system (**1**) can provide a multiplication of the solar energy (**7***d*,**7***i*) penetrating into the greenhouse (**5**) when compared to the solar energy (**7***d*) that would penetrate into the greenhouse (**5**) in the absence of such a system (**1**). Referring to FIG. **2**, a reflector assembly (**11**), installed outside of the north-facing side (**51**) of the greenhouse (**5**) that is oriented along an east-west axis, reflects the solar energy (**7***i*) inside the greenhouse (**5**) that would have otherwise passed above the greenhouse (**5**). The reflective surface (**17**) of the reflector assembly (**11**) allows for this reflected solar energy (**7***i*) to penetrate into the greenhouse (**5**) at a suitable angle (e) via the roof (**49**) so as to distribute the solar energy (**7**) evenly within the greenhouse (**5**).

[0128] The intensity of natural light without clouds measured on the ground can be around 120,000 lux, "lux" being a measure of luminous flux per unit area. The light intensity on the floor of a greenhouse (**5**) using artificial lighting is around 20,000 lux, which roughly corresponds to the intensity of natural light on a cloudy day. It can thus be appreciated that natural light can have a greater intensity than artificial lighting, and it would therefore be desirous to optimize use of natural light. As a reference, the light intensity on a desk of an office is between 400 and 600 lux, and about 300 lux in a manufacturing area.

[0129] An area near the 42^{nd} parallel will be used as a reference for the following examples:

[0130] The angle (a) that the sun (**9**) makes with the horizon at noon in July is about 66°, which allows the solar energy (**7**) to penetrate through the roof (**49**) of the greenhouse (**5**), thus distributing the solar energy (**7**) uniformly within the greenhouse (**5**). The producer can therefore have a large plant density (i.e. quantity of plants per area), and thus have high productivity. In July, there is also a longer period of sunlight, which allows for a longer growing period each day. In contrast, during December and January, the angle (a) that the sun makes with the horizon at noon is about 20°. At such low angles (a), the solar energy (**7**) often penetrates into the greenhouse (**5**) through its vertical side walls (**51**,**55**). The amount of sunlight (**7**) which can reach the floor of the greenhouse (**5**), shown schematically in FIG. **1** as vertical sunlight vector SV, is thus limited by at least the following factors: a) the height of the vertical walls (**51**,**55**) of the greenhouse, b) the width (W) of the greenhouse, and c) the angle (a) that the sun makes with the horizon.

[0131] Consider the example of a sunlight vector SV which impacts an opposed corner of the greenhouse (**5**), as shown in FIG. **1**. In such a case, the maximum height of the sunlight vector SV equals the width (W) of the greenhouse multiplied by tan α, or W×tan α. The height of sunlight vector SV when α is about 66° (i.e. generally the case in July) is more than six times larger than when α is about 20° (i.e. generally the case in December and January). It is known that in this same reference area (i.e. the floor of the greenhouse (**5**)), the solar energy (**7**) measurement on the floor is about 12,000 joules/cm2/day in January, and 60,000 joules/cm2/day in July, representing roughly the same ratio of variation as the height of the sunlight vector SV discussed above for these two periods of the year.

[0132] As explained above, artificial lightning in the greenhouse **52** may supply as much as six times less energy than natural lighting from the sun. We can say therefore that the energy produced by eight hours of artificial light is roughly equal to the solar energy produced by about 1.3 hours of sunlight in the summer. Furthermore, all the lamps used for the artificial lighting create shade which reduces the natural light penetration all day long, thus reducing productivity. In fact, lamp shading decreases natural sunlight, and thus, total daily energy.

[0133] Referring now to FIG. **3**, the possible addition of solar energy (**7**) can be better appreciated. At all times of the year, the solar energy (**7**) received in the greenhouse (**5**), for example, can be represented by the sunlight vector SV. Taking the month of January as an example, the solar energy (**7**) received can be approximated as being about 1/6 of the intensity of natural light without clouds measured on the ground in the summer months, which can be around 120,000 lux. Thus, the sunlight vector SV in January corresponds to a solar energy (**7**) value of about 120,000 lux/6, or 20,000 lux.

[0134] The height of the reflector assembly (**11**) (i.e. of the reflective surface (**17**)) can be measured from a top of the greenhouse (**5**) (i.e. such as the roof (**49**), or the northern vertical wall (**55**)). If this height is about two times greater than the length of the sunlight vector SV, for example, then the total solar energy received in the greenhouse (**5**) will equal SV+2×SV=3SV. Thus, roughly theoretically calculated, if the height of the reflector assembly (**11**) from the top of the greenhouse (**5**) was equal to the length of the sunlight vector SV (i.e. 1×SV), the solar energy received in the greenhouse (**5**) during January over an eight-hour day would be roughly equivalent to 20,000 lux×(1SV+1SV)×8 hours, which equals about 320,000 lux/day. Similarly, and again roughly theoretically calculated, if the height of the reflector assembly (**11**) from the top of the greenhouse (**5**) was equal to twice the length of the sunlight vector SV (i.e. 2×SV), the solar energy (**7**) received in the greenhouse (**5**) during January over an eight-hour day would be roughly equivalent to 20,000 lux×(1SV+2SV)×8 hours, which equals about 480,000 lux/day.

[0135] Such a theoretical result can be better appreciated when compared to the theoretical amount of solar energy received in a greenhouse (**5**) using artificial lighting over the same eight-hour day during January. The solar energy in such a situation might be equal to the solar energy received from the sunlight vector SV (corrected for the shading produced by the artificial lighting hanging from the roof (**49**) of the greenhouse (**5**)) plus the solar energy received from the artificial lighting. This can amount to the following equation:

[20,000 lux×90% (shading correction)×8 hours]+[20,000 lux×8 hours]=304,000 lux/day

[0136] Reference is made to FIG. **3**, which better shows the contrast in solar energy between the above-described techniques during the months of December and January. The bar described as "sun" represents the solar energy received in the greenhouse (**5**) when no reflector assembly (**11**) or artificial lighting is used, and has a value of about 16,000 lux. The bar described as "sun+reflector **1**H" represents the solar energy received when the reflector assembly (**11**) is located a height of one sunlight vector SV from the top of the greenhouse (**5**), and has a value of about 310,000 lux. The bar described as "sun+reflector **2**H" represents the solar energy received when the reflector assembly (**11**) is located a height of two sunlight vectors SV from the top of the greenhouse (**5**), and has a value of about 480,000 lux. Finally, the bar described as "sun+artificial light" represents the solar energy received when no reflector assembly (**11**) is used, and only artificial lighting is employed. This bar has a value of about 300,000 lux. It can thus be appreciated that the use of the present system (**1**) (and of its reflector assembly (**11**)), at any suitable height from the top of the greenhouse (**5**), may advantageously provide for a multiplication or addition of the solar energy (**7**) received within the greenhouse (**5**) when compared to using no reflector system (**1**), and even when compared to using artificial lighting.

[0137] FIG. **4** provides approximate curves for the sunlight received on a sunny eight-hour day when no reflector system (**1**) is used, when α reflector system (**1**) one sunlight vector SV in length from the top of the greenhouse (**5**) is used, and when natural sunlight is combined with artificial lighting. FIG. **5** provides similar approximate curves for a cloudy day, and it should be noted that the artificial lighting during a cloudy day is on for about sixteen hours. As can be seen from the curves of both FIGS. **4** and **5**, the use of the present reflector system (**1**) may advantageously prolong the period of the day when plant growth is most productive. Indeed, and as can be seen, the use of the reflector system (**1**) may allow the plants to receive an equivalent amount of solar energy (**7**) at around 08:00 that is received by the plants at around noon with the use of natural light alone, or with the use of natural light and artificial lighting. Similarly, the use of the reflector system (**1**) may allow the plants to receive an equivalent amount of solar energy (**7**) at around 16:00 that is received by the plants at around noon with the use of natural light alone, or with the use of natural light and artificial lighting. It can thus be appreciated that the solar energy (**7**) received by the greenhouse (**5**) has a major increase because of the solar energy (**7**) reflected by the reflector system (**1**) from the moment of sunrise to the moment of sunset. The reflector system (**1**) may thus advantageously allow for high speed growing of the plants to start earlier in the day (i.e. during the morning) and finish later in the day (i.e. around sunset).

[0138] As can be easily understood when referring to the accompanying drawings, the following optional components and features of the present system (**1**) and corresponding method of growing produce may offer several advantages with respect to the prior art, as will be explained in greater detail hereinbelow.

[0139] Indeed, the reflector system (**1**) represents an important improvement on the previous art when used to grow fruits, vegetables and other plants in cold environments all year long. The reflector system (**1**) disclosed herein can be used to input natural light and solar energy (**7**) into a greenhouse (**5**). Indeed, the reflector system (**1**) is able to capture the solar energy (**7**) of the light (**7***i*) which would otherwise by-pass the greenhouse (**5**), and reflect this solar energy (**7***i*) into the greenhouse (**5**), as can be better appreciated by comparing FIGS. **6** and **7**. Such an addition and/or multiplication of solar energy (**7***d*,**7***i*) can be particular advantageous during the winter months at northern latitudes, where there is often not enough sunlight to grow crops.

[0140] Furthermore, the reflector assembly (**11**) and/or reflective surface (**17**) allows for an even, equal, and wide distribution of solar energy (**7**), thus preventing light concentration to a point where there is a risk of harmful heating. Such an even distribution of solar energy (**7**) may advantageously aid in the growth of plants throughout the year, including during traditional non-growing seasons.

[0141] Furthermore, the reflector system (**1**) can be adapted to suit any conventional greenhouse (**5**) covered by a transparent material, and which receives direct light (**7***d*) and/or reflected light (**7***i*). Indeed, according to the needs of a user, the reflector system (**1**) could be used for applications other than greenhouses (**5**), such as outside growing operations or solar heating, for example.

[0142] Of course, and as can be easily by a person skilled in the art, the scope of the claims should not be limited by the possible embodiments set forth in the examples, but should be given the broadest interpretation consistent with the description as a whole.

1. A system (**1**) for growing produce (**3**) in greenhouses, the system (**1**) comprising:

at least one greenhouse (**5**) for housing the produce (**3**) to be grown, the at least one greenhouse (**5**) being positioned, shaped and sized for receiving direct sun rays (7*d*) from the sun (**9**); and

at least one reflector assembly (**11**) proximate to the at least one greenhouse (**5**) and being positioned, shaped and sized for redirecting indirect sun rays (7*i*) by-passing the least one greenhouse (**5**), towards at least one targeted area (**13**) within the at least one greenhouse (**5**), so as to provide said at least one greenhouse (**5**) with assisted complementary solar energy, the at least one targeted area (**13**) including a plurality of different targeted areas (**13**) via a corresponding operation of different reflective panels (**33**) of the at least one reflector assembly (**11**).

2. A system (**1**) according to claim **1**, wherein the at least one reflector assembly (**11**) comprises:

at least one erect support structure (**15**), separate from the at least one greenhouse (**5**); and

at least one reflective surface (**17**), operatively mountable onto the at least one erect support structure (**15**), for reflecting indirect sun rays (7*i*) towards the at least one targeted area (**13**) within the at least one greenhouse (**5**).

3. A system (**1**) according to claim **2**, wherein the at least one erect support structure (**15**) is substantially perpendicular with respect to a ground surface (**19**).

4. A system (**1**) according to claim **2**, wherein the at least one erect support structure (**15**) is substantially slanted with respect to a ground surface (**19**), and inclined towards the at least one greenhouse (**5**).

5. A system (**1**) according to claim **2**, wherein a given side (**21**) of the at least one erect support structure (**15**) facing the at least one greenhouse (**5**) and the at least one reflective surface (**17**) are substantially coplanar.

6. A system (**1**) according to claim **2**, wherein the at least one reflective surface (**17**) is inclined at an operative angle (e) with respect to a vertical plane (**23**) so as to redirect sun rays (**7**) towards the at least one targeted area (**13**) within the at least one greenhouse (**5**) at a given effective angle (ϕ).

7. A system (**1**) according to claim **6**, wherein the operative angle (e) of the at least one reflective surface (**17**) ranges between about 30 degrees and about 40 degrees with respect to the vertical plane (**23**).

8. A system (**1**) according to claim **6**, wherein the effective angle (ϕ) ranges between about 0 degrees and about 90 degrees.

9. A system (**1**) according to claim **2**, wherein the at least one reflective surface (**17**) is displaceable along at least one degree of freedom with respect to the at least one erect support structure (**15**) in order to redirect sun rays (**7**) into the at least one greenhouse (**5**) at optimal angles.

10. A system (**1**) according to claim **2**, wherein the at least one erect support structure (**15**) includes a solid structure.

11. A system (**1**) according to claim **2**, wherein the at least one erect support structure (**15**) includes a truss structure.

12. A system (**1**) according to claim **2**, wherein the at least one erect support structure (**15**) is mountable onto a base (**25**), and wherein the at least one erect support structure (**15**) is moveable along at least one degree of freedom with respect to said base (**25**).

13. A system (**1**) according to claim **2**, wherein the at least one erect support structure (**15**) is moveable in relation to a movement of the sun (**9**).

14. A system (**1**) according to claim **12**, wherein the base (**25**) is moveable along at least one degree of freedom with respect to a ground surface (**19**).

15. A system (**1**) according to claim **14**, wherein the base (**25**) is moveable in relation to a movement of the sun (**9**).

16. A system (**1**) according to claim **2**, wherein the at least one reflective surface (**17**) is positioned on a northern side of the at least one greenhouse (**15**).

17. A system (**1**) according to claim **2**, wherein the at least one reflective surface (**17**) faces southward.

18. A system (**1**) according to claim **2**, wherein the at least one reflective surface (**17**) has a height (**27**) dimensioned in view of at least one parameter selected from the group consisting of: a) a width (W) of the at least one greenhouse (**5**); b) a desired light penetration angle; c) a height (H) of a side of the at least one greenhouse (**5**); and d) limitations imposed by local by-laws.

19. A system (**1**) according to claim **2**, wherein the at least one reflective surface (**17**) has a length (**29**) being substantially equal to a length (L) of the at least one greenhouse (**5**).

20. A system (**1**) according to claim **2**, wherein the at least one reflective surface (**17**) has a length (**29**) dimensioned in view of a side orientation of the sun (**9**).

21. A system (**1**) according to claim **2**, wherein the at least one reflective surface (**17**) has a length (**29**) dimensioned in view of a correction factor for misalignment of the at least one greenhouse (**5**).

22. A system (**1**) according to claim **2**, wherein the at least one reflective surface (**17**) includes at least one row (**31**) of reflective panels (**33**) extending along a length (**29**) of said at least one reflective surface (**17**).

23. A system (**1**) according to claim **22**, wherein the at least one row (**31**) of reflective panels (**33**) are parallel to a north-facing wall of the at least one greenhouse (**5**).

24. A system (**1**) according to claim **22**, wherein the reflective panels (**33**) are operatively mountable to the at least one erect support structure (**15**), and are moveable via an actuating mechanism (**35**) along at least one degree of freedom with respect to said at least one erect support structure (**15**).

25. A system (**1**) according to claim **24**, wherein the actuating mechanism (**35**) includes at least one servo-motor.

26. A system (**1**) according to claim **22**, wherein the reflective panels (**33**) are independently actuated with respect to each another.

27. A system (**1**) according to claim **22**, wherein the reflective panels (**33**) are dependently actuated with respect to each another.

28. A system (**1**) according to claim **22**, wherein the reflective panels (**33**) are synchronously actuated with respect to each another.

29. A system (**1**) according to claim **22**, wherein the reflective panels (**33**) are operatively tiltable with respect to the at least one erect support structure (**15**) via a corresponding axle (**37**).

30. A system (**1**) according to claim **22**, wherein a lowermost row (**31**) of reflective panels (**33**) is located higher than a given height of the produce (**3**) to be grown inside the at least one greenhouse (**5**).

31. A system (**1**) according to claim **22**, wherein the reflective panels (**33**) are selected from the group consisting of flat panels, folded panels, curved panels, concave panels and convex panels.

32. A system (**1**) according to claim **22**, wherein the reflective panels (**33**) are moveable in relation to a movement of the sun.

33. A system (**1**) according to claim **22**, wherein the system comprises a sun-tracker (**39**) for tracking a movement of the sun (**9**), and wherein reflective panels (**33**) of the at least one reflector assembly (**11**) are operatively actuated based on signals received from the sun-tracker (**39**).

34. A system (**1**) according to claim **33**, wherein the at least one erect support structure (**15**) is selectively orientated based on signals received from the sun-tracker (**39**).

35. A system (**1**) according to claim **1**, wherein the at least one targeted area (**13**) includes at least one roof area (**41**) of the at least one greenhouse (**5**).

36. A system (**1**) according to claim **1**, wherein the at least one targeted area (**13**) includes at least one floor area (**43**) of the at least one greenhouse (**5**).

37. A system (**1**) according to claim **1**, wherein the at least one targeted area (**13**) includes at least one wall area (**45**) of the at least one greenhouse (**5**).

38. A system (**1**) according to claim **1**, wherein the at least one targeted area (**13**) includes at least one intermediate area (**47**) of the at least one greenhouse (**5**).

39. A system (**1**) according to claim **1**, wherein the at least one targeted area (**13**) is variable in size via an operation of the at least one reflector assembly (**11**).

40. A system (**1**) according to claim **1**, wherein the at least one targeted area (**13**) is variable in location via an operation of the at least one reflector assembly (**11**).

41. A system (**1**) according to claim **1**, wherein the at least one targeted area (**13**) is variable in shape via an operation of the at least one reflector assembly (**11**).

42. (canceled)

43. A system (**1**) according to claim **1**, wherein the at least one greenhouse (**5**) comprises a roof (**49**) configured for allowing indirect sun rays (**7***i*) redirected from the at least one reflector assembly (**11**) to penetrate through said roof (**49**).

44. A system (**1**) according to claim **43**, wherein the roof (**49**) is made of a material selected from the group consisting of a translucid material, a translucent material, a transparent material and a perforated material.

45. A system (**1**) according to claim **1**, wherein the at least one greenhouse (**5**) is oriented along an east-west axis.

46. A system (**1**) according to claim **1**, wherein an interior portion of a northern upright wall (**51**) of the least one greenhouse (**5**) is provided with a reflective material (**53**) to reflect sun rays back into the at least one greenhouse (**5**).

47. A system (**1**) according to claim **1**, wherein a given portion of a southern upright wall (**55**) of the at least one greenhouse (**5**) is made of a material (**57**) for configured for allowing sun rays to penetrate therethough, and into the at least one greenhouse (**5**).

48. A system (**1**) according to claim **47**, wherein the material (**57**) of the given portion of the southern upright wall (**55**) is selected from the group consisting of a translucid material, a translucent material, a transparent material and a perforated material.

49. A kit with components for assembling a system (**1**) according to claim **1**, in order to grow produce inside at least one greenhouse (**5**), the kit comprising at least one reflector assembly (**11**) configured to be proximate to the at least one greenhouse (**5**) and being positioned, shaped and sized for redirecting indirect sun rays (**7***i*) by-passing the least one greenhouse (**5**), towards at least one targeted area (**13**) within the at least one greenhouse (**5**), so as to provide said at least one greenhouse (**5**) with assisted complementary solar energy, the at least one targeted area (**13**) including a plurality of different targeted areas (**13**) via a corresponding operation of different reflective panels (**33**) of the at least one reflector assembly (**11**).

50. A farm (**59**) being provided with a system (**1**) according to claim **1**.

51-53. (canceled)

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