

A SOLAR BIO-GREENHOUSE FOR YEAR-ROUND CULTIVATION OF ENVIRONMENTALLY FRIENDLY PLANT PRODUCTS

The invention relates to the field of agriculture and can be used for producing plant cultivation systems, particularly, in a solar bio-greenhouse for year-round cultivation of environmentally friendly plant products.

BACKGROUND

There are known similar complexes and devices to be mentioned as equivalents to the claimed subject that are protected by patents of the Russian Federation: for useful models—Nos. 69698, 93208, 116011, 121691, and for inventions—Nos. 2025957, 2066526, 2115292, 2124828, 2267255, 2283578, 2391812. More specifically, the useful model according to patent No. 69698 is designed for disposal of livestock waste, cultivation and processing of any greenhouse crops, producing carbon dioxide as well as solid and liquid organic fertilizers. The problem to be solved by the proposed bio complex is disposal of livestock farms waste and improving the economic performance of a bio complex. The problem is solved due to the fact that the bio complex comprises a multi-tiered greenhouse with the systems of heating, illumination, watering and ventilation. The heating system is represented by heated digestion tanks, between which greenhouse spaces are located for cultivation of vegetable crops and mushrooms, additionally, the bio complex is equipped with a mini thermal power plant and a vessel for carbon dioxide, premises for processing and canning the product, and a refrigerated warehouse. The multi-tiered greenhouse is equipped with mobile platforms for maintenance. The bio complex is designed as a two-storied facility.

According to patent No. 93208, the useful model related to alternative power sources, particularly to greenhouses with soil heating by ground heat exchangers with a liquid heat carrier heated by solar radiation energy using solar collectors. The technical effect of such useful model is reduction in material input ratio of the structure due to structural combination of the functions of a transparent protective dome and a solar collector. To achieve the technical effect, the transparent protective dome made of a translucent material (such as cellular polycarbonate) is equipped with frontal lower

water-supply and upper water-drainage pipes, filled with the liquid heat carrier and connected by such pipes in the liquid heat carrier circulation system. Three-way thermally actuated valve to divert the heated liquid heat carrier to a heat accumulator in the hottest time of the day are included into the useful model and tapped into the liquid heat carrier circulation system.

According to patent No. 104014, the useful model relates to the field of agriculture, namely to garden greenhouses for cultivation of vegetables, plants, and flowers. The greenhouse structure that features a translucent roofing and a gable roof may be used for protection and cultivation of various plants in the protected grounds on personal garden plots. The problem to be solved by such useful model is reduction in labor cost for the greenhouse installation, improvement of the microclimate parameters inside the greenhouse, creation of comfortable conditions during planting and harvesting the crop, increase in the duration of temperatures required for crop cultivation. To resolve the technical problem, the greenhouse, including a sectoral frame, end walls, a gable roof and a translucent roofing, is designed so that the section represents a M-shaped rectangular frame coupled on the inside by coupling elements, wherein the side wall is positioned at an angle of 2-3 degrees to the central axis of the greenhouse, a supporting frame with braces is installed inside the greenhouse. The end wall has a door unit, wherein the door opens outwards, and has coupling elements made in the form of rhombus. The gable roof is made of elements composed of two sections joined together at an angle, and the side wall of the greenhouse has a window leaf that is configured to move along the wall, wherein the opening is made in the form of a grate.

According to patent 2124828 for invention, the bio complex is designed for cultivation of plants, breeding fish and poultry. The technical object of the invention is a complex cultivation of plant and animal products and a significant increase in productivity. The bio complex comprises a greenhouse with a pond that communicates with a poultry house. This allows for cultivating, simultaneously and comprehensively, both plant and animal products diversified both in terms of species composition and origin, at any latitudes and independently of the environment. As each isolated section has its own microclimate, and bio humus for fertilizing the plants

and live feed for fish and water birds is produced from worms, plant residues and compost in the cultivator of the bio complex, this eliminates the need for using chemicals and enables the application of a non-waste technology. The use of a greenhouse, a pond and a poetry house equipped with life-support systems within one bio complex, allows for gathering several harvests of plant products within a year, as well as animal products with an increased biomass.

According to patent 2267255, the invention relates to the field of agriculture, particularly, to protective complexes for plants, including greenhouses and orangeries fitted with electrical and other equipment to care for plants and thermophilic shrubs cultivated at home or under small-scale production conditions. The base of the protective complex for plant cultivation is a pit with a supporting frame equipped with a transparent protective cover. The plastic walls of the pit extend slightly beyond the basement of the supporting frame and are reinforced by a folding screen, whereas the pit beds contain ground provided with a thermal layer and elements for soil heating, connected by a pipe with an overhead closed tank suspended under the complex roof, forming, together with the structure of the pit filled with soil and top fertile soil, a common vessel with regulated water supply and drainage using electronic valves installed both on drain branch pipes and on the pipe itself. Using electronic devices and the principle of communicating vessels, a protective complex is created wherein it is possible not only to set the optimum level of water in the ground and the watering time, but also to maintain an optimum mode of heating, lighting, thus regulating the plant growth.

According to patent 2391812 for invention, the device comprises a plant cultivation system including a multi-tiered racking structure for plant vegetation trays, a system that creates required climate and light conditions, the latter including at least one light source configured to move up and down between the tiers of the racking structure, that comprises a means providing for continuous reverse motion of the light source between the tiers during the plant irradiation. The rack comprises a section of shelves, mounted by tiers on four supports. The sections are combined into modules, each of which comprises three sections arranged sequentially in series, two end sections and one central section, coupled by a hinge

connection configured to turn the end section around the vertical axis towards the module center forming an U-shaped profile. The use of the invention makes it possible to accelerate the plant development by ensuring a uniform plant lighting, increasing the density of the photosynthetic photon flux, avoiding overheating and damage to the cultivated plants leaves, as well as reducing light losses.

The technical solution which is the most closed to the proposed solar bio-greenhouse in terms of the used essential features (the closest analogue) is the bio complex according to the patent for useful model No. 116011. This useful model relates to the field of agriculture and is designed for disposal of livestock waste, cultivation and processing of any greenhouse crops, producing carbon dioxide, as well as solid and liquid organic fertilizers. The technical effect of such useful model is reducing heat loss and maintenance of desired temperature in the heated digestion tank and in the greenhouse, a rational use of electric power. The bio complex comprises a greenhouse with lighting and ventilation systems, a hopper for loading the raw material, a gasholder, a container for unloading bio fertilizers, a biogas plant including a unit for preliminary preparation of the raw material, a cogeneration plant, a biogas separation system, a heat exchange module with vessels, a heat exchangers unit, heated digestion tank equipped with collectors for feeding the raw material and unloading the pulp and collectors for biogas collection made in the form of cylindrical metal tanks with heat insulation. The greenhouse comprises a warm air supply unit, and its ventilation system is formed by a warm air inflow system and an exhaust hood with heat recovery.

Among the drawbacks of the known devices used for the said purposes, including the closest analogue, it should be noted their energy efficiency and performance that are relatively low for a number of practical situations and do not ensure the required growth and development rates of the cultivated environmentally friendly plants.

SUMMARY

The problem solved by the claimed device is improvement of a solar bio-greenhouse in order to eliminate the said drawbacks of the known devices

while achieving a technical effect in terms of increasing its energy efficiency and performance for higher growth and development rates of the cultivated environmentally friendly plants.

The said technical effect is ensured, particularly, due to the following interconnected set of essential features of a bio-greenhouse composed of a south side, topped with a translucent cover, and a north side, topped with an opaque cover, that are inseparably structurally interconnected and installed on a basement part and basement supports or without basement. These parts are equipped with heat accumulation, ventilation and heat flow distribution systems, systems of micro-drop watering and lighting, as well as an automated micro-climate control and monitoring system. Herewith the south side is divided by vertical transparent partitions into autonomous sections in an number selected within a range of 2 to 20 for cultivation of environmentally friendly plants, and the north side is composed of four elements that are unequal in terms of volume: a technical zone of the household block, a zone for filling, packing and storage of the finished product, a process zone for bio humus production by earthworms, an auxiliary zone for temporary storage of organic compost, enclosed from the outside with a heat-insulated wall. The process zone comprises process beds filled with organic compost and separated by paths arranged for free movement of worker with mobile platforms thereon.