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The invention relates to a support plate for a plant substrate which is used to make a roof green.

Making rooves of flat structures green is becoming increasingly popular since general awareness of the environment is developing towards nature conservation and its improvement. Unfortunately, making rooves of flat structures green is still being hindered by the expensive and complex equipment used to make the rooves green in this way.

When a roof is made green, a layer of earth has be applied which must always be drained so that rain water which has collected and which is not able to drain through the bottom of the water-tight flat roof is conveyed out of the plant substrate. The plant substrate must have open pore spaces to allow air to enter for micro-organisms to continue to breed.

However, if a drainage system is set up, this conversely requires irrigation. Usually, this is done artificially by setting up a moisture measuring apparatus, or the like.

DE-PS 27 55 958 describes a thick-walled, properly heat-insulating support plate made of foam plastics material, but its drawback is that it is considerably tedious to manufacture. The support plate according to DE-OS 30 45 390 with very thin walls and preferably made of drawn polyethylene which has been further developed from that of DE-PS 27 55 958 is not sufficiently heat-insulating, and therefore its drawback is that it can only be used with rooves where the actual support plate does not have to make any major contribution to the heat insulation.

The aim of the invention is to obtain an automatic drainage and irrigation system which merely requires simple means cheap to manufacture and not requiring any maintenance, the system also providing effective heat insulation for the roof.

This problem is solved according to the invention by a support plate for a plant substrate which is used to make a roof green in that the support plate is designed as a water storage trough which is free of through openings and which is made of a per se known foam plastics material plate, the water

storage trough having overflow water discharge passages which only start from the top side of the edge web portions or from central web portions which are at approximately the same height, and which lead to the underside of the plate and to the grid-like groove array arranged there, and the free interior space of which is filled by a number of randomly shaped protuberances or ribs, free of cavities, which extend to the top side of the plates, which protuberances or ribs are of a width which does not exceed approximately a thumb's width in thickness, and which have a spacing between them which corresponds to said width, and characterised in that disposed over a plurality of protuberances or ribs is a wick cloth which partially projects into the intermediate space between the ribs, and characterised in that a per se known irrigation fleece covers one or more foam plastics material plates with the wick cloth.

Further inventive features and variant features are characterised in the claims.

The simple three-part basic structure according to the invention is made of only a few structural parts which are cheap and easy to manufacture.

There will now follow a more detailed description of three embodiments of the invention with the aid of the drawings, wherein:

- Figure 1 is a cross-section through a flat roof which has been made green,
- Figure 2 is a plan view of a foam plastics material plate, on a smaller scale, of a first embodiment,
- Figure 3 is a cross-section through the object of Figure 2, along the sectional line III-III in Figure 2,
- Figure 4 shows the bottom side of the foam plastics material plate according to Figure 2,
- Figure 5 is a cross-section through a flat roof which has been made green, on which the second embodiment of foam plastics plates has been arranged,

- Figure 6 is a plan view of a foam plastics material plate according to Figure 5, on a smaller scale,
- Figure 7 is a cross-section through the object according to Figure 6, along the sectional line VII-VII,
- Figure 8 is a view of the underside of the foam plastics material plate according to Figure 5,
- Figure 9 is a plan view and partial representation of two support plates, the edges of which are inserted into each other, according to a third embodiment,
- Figure 10 is a cross-section through the object according to Figure 9, along the sectional line X-X,
- Figure 11 is a plan view of an arrangement of six juxtaposed support plates according to Figure 9 with a continuous water pipe, and
- Figure 12 is a cross-section through the object according to Figure 11, along the sectional line XII-XII.

The drawing of Figure 1 shows that foam plastics material plates 3,3,3,... close together are placed on the flat roof 1 made of steel concrete and a vapour-locking layer 2 which is placed thereupon. This embodiment is composed of standard thermally insulated plates designed in the conventional way with an edge and an underside and manufactured using known plate manufacturing machines.

However, the top side of these foam plastics material plates 3 is designed in a special way. As can be seen in Figure 2, the foam plastics material plate 3 is designed as a water storage trough, and thus has no water through-flow openings in the bottom wall.

Expediently, the free interior of the water storage trough is sub-divided into four areas 8,8,8 and 8 by mutually transversely extending central ribs. These central web portions are equal in height to the edge web portions. Unlike

these latter, at least one of the central web portions has a plurality of through openings 9 which act as water discharge passages for overflow water. The upper intake openings of these water discharge passages 9 are disposed in the plane of the top side of the foam plastics material plates 3, so that rain water which has collected only begins to drain out when the four interior areas 8 are filled with water.

The interior areas 8 are also filled with a number of protuberances or ribs 10, between which only one free intermediate space of no more than a thumb's thickness in width remains open. The afore-mentioned protuberances or central ribs 10 are, in turn, no greater than a thumb's thickness in width. By selecting their size thus, up to about 50% of the capacity of the internal areas 8 is filled by the ribbed bodies and up to 50% is filled by water which has collected. The numerous support ribs 10 which are placed close together mean that the entire area of the foam plastics material plates 3 can be loaded with weight, and that the free intermediate spaces between the support ribs 10 at the same time remain free.

This is necessary if a wick cloth 4 is to be placed on each interior area 8, the central part of this wick cloth being embedded vertically inside a central groove between the support ribs 10 arranged in pairs.

Placed upon the foam plastics material plate provided with four wick cloths is an irrigation fleece 5 which is expediently made of a rot-proof polyester felt.

The irrigation fleece 5 can be arranged in the way of a rolled item over a plurality of foam plastics material plates 3.

The afore-described foam plastics material plates with the four wick cloths 4 placed inside them and the irrigation fleece 5 placed thereon form a suitable base for any plant substrate 6. The high number of support ribs 10 means that the plant substrate 6 is supported at a large number of locations, and it is ensured at the same time that the high number of free intermediate spaces remaining between the support ribs 10 will create sufficient space for receiving rainwater. The wick cloth 4 and the irrigation fleece 5 placed over the free intermediate spaces also provides them with an adequately solid roof.

The underside of each foam plastics material plate 3 is designed in the conventional way and has an orthogonal grid-like groove array 12 which can be produced by a large number of box supports 11.

The above-described device therefore permits the necessary drainage, and it also permits automatic irrigation since the wick cloth 4 and the irrigation fleece 5 allow rainwater collected due to the capillary forces in the intermediate spaces between the intermediate ribs 10 to rise again if necessary. It is therefore possible to abandon a separate irrigation control system.

The first embodiment of a support plate, described in Figures 1 to 4, has the drawback that it can only be used on flat rooves without any inclination. If the rooves have a slight inclination, the rainwater collected by the support plate described initially would drain off from the very deep-lying side edge of the carrier plate, so that the support plate would not retain the rainwater collected.

The problem is therefore posed of proposing a modified and improved embodiment of a support plate of the kind mentioned in the introduction which can also be used, and this in particular for inclined flat rooves.

This problem is solved by way of a second embodiment of a support plate of the kind described in the introduction in that the free interior space is subdivided by a number of mutually parallel intermediate web-portions into an equal number of areas, with a wick cloth being arranged in each area.

The drawing of the second embodiment according to Figures 5 to 8 reveals that foam plastics material plates 23, 23, 23 which are placed close together are placed on the flat roof 1 made of steel concrete and upon a vapour-barrier layer 2 placed thereon.

The top side of these foam plastics material plates 23 reveals another special feature.

The free interior of a foam plastics material plate 23 is subdivided by a number of mutually parallel intermediate web-portions 13, 13,... into an equal

number of areas 28, 28, wherein a wick cloth 24, 24,... is arranged in each area 28, 28,....

The intermediate web portions 13, 13,... are equal in height to the edge web portions. Unlike these latter, an intermediate web portion 16 can have a plurality of water discharge holes 29, 29,... which are expediently connected to one another by a water drain channel 17.

A further intermediate web portion 15 extending transversely thereto does not have any of these water discharge holes 29, 29,... since this intermediate web portion is disposed in the extent of the greatest direction of fall, whereas the afore-mentioned intermediate web portion 16 extends exactly in the horizontal extent. This means that it is possible for excess rainwater which has collected to drain off in the direction of the central web portion 15 and when it has passed the central web portion 16 extending transversely to the central web portion 15 the rainwater may be collected by the water overflow channel 17 and conveyed away by the water discharge holes 29.

The free interior areas 28 are filled by a number of protuberances or ribs 20, between which only one free intermediate space remains open which is no more than a thumb's thickness in width. The afore-mentioned protuberances or central ribs 20 are, in turn, no more than a thumb's thickness in width. The ribs 20 are designed as extensions of the intermediate web portion 13 and extend at an acute angle thereto.

However, one rib 14 of an intermediate web portion 13 is wider than the other ribs 20 and has an insertion slot 7 for a wick cloth 24 to be partly inserted and clamped therein. Part of this wick cloth 24 is therefore placed over the top side of the rib 14 of greater width, and is partly embedded in the free intermediate space of the free interior area 28. This means that rainwater which has collected is sucked up from the free interior area 28 by the wick cloth 24, and is conducted upwardly to an irrigation fleece 5 covering the foam plastics material plate 23.

The second embodiment thus likewise permits the necessary drainage, and at the same time automatic irrigation since the wick cloth 4 and the irrigation fleece 5, due to capillary forces, allow rainwater which has collected in the

intermediate spaces between the support ribs 20 to rise again if necessary. On the other hand, a sufficient amount of water collects in the areas 28 formed by the large number of intermediate web portions 13, even if the flat roof is inclined.

Due to the not insignificant water absorption capacity of the two embodiments of the support plates which have been dealt with up until now, the problem exists that when filled with water the support plates can become really very heavy. With new inclined rooves which are to be set up this can be accounted for computationally. With existing inclined rooves which are to be made green, this is not however possible, and in some cases there could be reservations about making a roof green for static reasons.

In such cases the problem is posed of designing a support plate in such a way that the weight per square meter is reduced and a given size is not exceeded.

This problem is solved by a third embodiment in that the top sides of the top and bottom web portion and of any central web portions of the support plate have water overflow channels extending in the direction of fall, and the support plate which abuts against the ridge line has on the upper edge web portion thereof a part of a continuous water pipe extending parallel to the ridge line and having a water outlet opening j-e, into which water is supplied, if necessary.

According to the drawing of the third embodiment in Figures 9 to 11, the top edge web portion 31 of a support plate 34 at a lower level is joined to the bottom edge web portion 32' of an adjacent support plate 34' at a higher level by way of the two inter-engaging strip-shaped projections 46 and 47.

Water overflow channels 36 which extend transversely to the longitudinal axes of the edge web portions 31 and 32 are provided on the top sides of these joined together top and bottom edge web portions 31 and 32, these water overflow channels also continuing in the central web portions 33, so that water which has collected in the support plates can drain off in the direction of fall marked by the arrow 35 in dependency on the depth cut of the water overflow channels 36 and the degree of fall of the flat roof in question.

As can be seen in Figure 10, the amount of water 45 which remains and is stored on the inside of the bottom edge web portion 32 of each support plate 34 depends, as stated hereinabove, on the depth to which the water overflow channel 36 is cut and on the inclination of the roof.

Figure 9 also shows that the top edge web portion 31 of a support plate 34 has two edge extensions 43, 43 which engage in corresponding recesses 44, 44 in the bottom edge web portion 32 of the adjacent support plate 34'. This prevents water from draining at the sides out of the channel formed by the strip-shaped projection 46. The significance of this feature will become apparent from the following exposition given with reference to Figure 11.

The top edge web portions 31' of the support plates 34', 34', 34', ..., thus the top-most support plates, which are arranged directly on the ridge line 37 have a continuous water pipe 18 into which water can be supplied, if necessary, which then issues from a water outlet opening 39 in each support plate and which fills the channel formed by the strip-shaped projection 46 with water. This water which has collected in the channel then passes through the water overflow channels 36 into the interior of the support plate 34' and thence through the other water overflow channels 36 into the next support plates 34 disposed at a lower level.

The water pipe 18 is expediently manufactured from a slightly flexible plastics material tube which can be joined to each support plate 34', approximately at the centre of the edge web portion 31, by means of a clamping clip 30. The water pipe 18 then curves up towards the longitudinal side of the support plate 34', so as to then pass through the extensions 43, be pushed back down by means of the next clamping clip 30, and then be joined to the adjacent support plate 34'.

The water pipe 18 can take its water supply from a rain cistern in the cellar of a house which can be supplemented if necessary by the public drinking water network.

In this way it is possible to supply only enough water through the water pipe 18 to make the support plates only slightly loaded in weight by water collected, so that inclined rooves of low carrying capacity can be provided

with green rooves as well. In addition, it is therefore easily possible to supply the amount of water needed for the vegetation, even during periods of extremely low rainfall.



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CLAIMS

1. A support plate for a plant substrate which serves for making a roof green, comprising water storage troughs which are disposed one beside the other on the roof covering and whose bottom, which is free of through openings, has mutually crossing water drain grooves at the underside, whose interior is provided with upwardly projecting raised portions, and whose top side is connected by way of water discharge passages to the water drain grooves at the underside, and a filter and irrigation fleece which lies on the water storage troughs and which carries the plant substrate,

characterised in that

- the water storage troughs (3) which form the thermal insulation of the roof are formed from per se known foam plastics material,

- the water discharge passages (9) start from the top side of the trough side walls or from the top side of central web portions, if provided, which are of the same height as the trough side walls,

- the raised portions in the trough interior, which are also of the same height as the trough side walls, are of a width which does not exceed approximately a thumb's width, and have a spacing between them which corresponds to said width, and

- arranged on the raised portions and under the filter and irrigation fleece is a wick cloth which engages between the raised portions.

2. A support plate according to claim 1 characterised in that the free interior of the foam plastics material plate (3) is divided into four areas (8, 8, 8, 8) by two central web portions which extend transversely relative to each other.

3. A support plate according to claim 2 characterised in that provided in each interior area (8) of the foam plastics material plate (3) between the protuberances or ribs (10, 10,...) is a central groove for partially receiving a wick cloth (4).



4. A support plate according to claim 3 characterised in that the ribs (10, 10,...) are curved in an S-shape.

5. A support plate according to claim 1 characterised in that the applied irrigation fleece (5) comprises a roll web of rot-proof polyester felt.

6. A support plate according to claim 1 characterised in that

- the free interior is divided by a number of intermediate web portions (13, 13, ...) which extend parallel to each other into an equal number of areas (28, 28, ...), and
- a wick cloth (24, 24, ...) is arranged in each area (28, 28, ...).

7. A support plate according to claim 6 characterised in that provided in one or more of the intermediate web portions (16, 13) are a plurality of water discharge holes (29, 29, ...) which at the underside open into a system of water drain grooves (12, 12, ...).

8. A support plate according to claim 7 characterised in that the water discharge holes (29, 29, ...) are connected together by a water drain channel (17).

9. A support plate according to claim 6 characterised in that the ribs (20, 20, ...) are in the form of extensions of the intermediate web portions (13, 13, ...).

10. A support plate according to claim 9 characterised in that the ribs (20, 20, ...) extend at an acute angle relative to the intermediate web portions (13, 13, ...).

11. A support plate according to claim 9 characterised in that

- a rib (14) of an intermediate web portion (13) is wider than the other ribs (20, 20, ...) and



- has an insertion slot (7) for the partial insertion and clamping fast of a wick cloth (24).

12. A support plate according to claim 11 characterised in that the wider ribs (14, 14) of two adjacent interior areas (28, 28) are provided at the location of ribs (20, 20, ...) of odd ordinal numbers.

13. A support plate for a plant substrate which serves to make a roof green, comprising water storage troughs which can be disposed one beside the other on the roof covering and which have a bottom that is free from openings therethrough and whose interior is provided with upwardly projecting raised portions, and with a filter and irrigation fleece which lies on the water storage troughs and which carries the plant substrate,

characterised in that

- the water storage troughs (3) which form the thermal insulation of the roof are formed in per se known manner from foam plastics material,

- with an inclined arrangement of the water storage troughs, the top side of the respective upper and lower edge web portions (31, 32) and any central web portions (33) of the support plate (34) have water overflow channels (36) which extend in the direction of fall (35);

- the width of the raised portions and the spacing therebetween do not exceed approximately a thumb's width,

- lying on a plurality of raised portions (10) is a wick cloth (4) which projects partially into the intermediate space between the raised portions, and

- the support plate (34') which abuts against the ridge line (37) carries at its upper edge web portion (31') a part of a continuous water pipe (18) which extends parallel to the ridge line (37), with a water outlet opening (39) for each carrier plate, into which pipe water is fed as required.



14. A support plate according to claim 13 characterised in that the continuous water pipe (18) is fixed to each support plate by means of clamping clips (30).

15. A support plate according to claim 13 characterised in that the upper and lower edge web portions (31, 32) have at their outsides strip-shaped projections (46, 47) which are so profiled and undercut that the strip-shaped projections of two adjacent support plates engage one behind the other and positively connect to each other.

16. A support plate according to one of claims 13 to 15 characterised in that at the underside the support plate has a grid-like groove array which has overflow water discharge passages (9) which start from the top side of the edge or central web portions (31, 32, 33) and which lead to the underside of the plate.