A Method for roofing a lightweight construction, comprises the steps of fastening a prefabricated trellis of metal wires to an upper frame of said lightweight construction, so that said trellis spans over an area of said lightweight construction, and putting a sheeting material on said trellis.
METHOD FOR ROOFING A LIGHTWEIGHT CONSTRUCTION AND ROOF STRUCTURE

INTRODUCTION

[0001] The present invention relates to a method for roofing a large-surface lightweight construction as e.g. a greenhouse or an inexpensive industrial construction or warehouse covering an area of more than 5000 m².

[0002] A roof of such a lightweight construction usually comprises a sheeting material, e.g. a plastic film, supported by a supporting structure, which is mounted to an upper frame of the lightweight construction. A second structure is placed on the plastic film and fastened to the upper frame of the lightweight construction, so as to hold the plastic film in its predetermined position.

[0003] The supporting structure and the second structure are generally formed of several generally crossed metal wires, which are manually knotted together at respective crossing points so as to form a knotted net. The mesh size of such a knotted net lies usually between 20 and 30 cm, which means that the number of manually produced knots per m² lies between 9 and 25 knots/m². It follows that for a roof surface of about 10000 m², the number of knots to be produced for the two structures lies between about 180000 and 500000 knots. It should be clear that the manufacture of such a roof is extremely time consuming and accordingly rather expensive.

OBJECT OF THE INVENTION

[0004] The object of the present invention is to provide a simplified method for roofing a lightweight construction.

GENERAL DESCRIPTION OF THE INVENTION

[0005] In order to overcome the above-mentioned problems, a method for roofing a lightweight construction according to the present invention, comprises the steps of fastening a prefabricated trellis of metal wires to an upper frame of said lightweight construction, so that said prefabricated trellis spans over an area of said lightweight construction, and putting a sheeting material on said prefabricated trellis. The use of a prefabricated trellis instead of single wires, which have to be manually connected in order to form a supporting net, substantially reduces the workload on site for roofing the lightweight construction, resulting in a reduced time of construction of the lightweight construction. Moreover, the number of needed highly qualified workers on the construction site is substantially lower than for state of the art constructions so that the overall construction costs are considerably reduced.

[0006] Since the supporting net is no longer manually produced on the construction site, the mesh size of the prefabricated trellis can be smaller than the mesh size of conventional supporting nets. This means however that the carrying capacity of the so produced roof structure is increased with respect to the state of the art. Furthermore, the reduced mesh size prevents the sheeting material to sag into the mesh openings so that the sheeting material forms an even surface. Accordingly, accumulation of rainwater on the roof is effectively prevented.

[0007] The prefabricated trellis can be mechanically fabricated from steel wires e.g. by weaving or by clamping. The steel wires are preferably low carbon wires having a diameter in the range of 1.2 to 4 mm. A trellis made of such wires is less expensive than a trellis made of strands or metal cables. In a preferred embodiment, the trellis is fabricated by welding of the steel wires so as to form a welded mesh.

[0008] Depending on the size of the area to be covered said supporting structure can comprise several adjacent webs of prefabricated trellis. In this case, the fastening of said prefabricated trellis comprises the fastening of a first web on two opposite sides of said upper frame of said lightweight construction, and subsequently fastening a second web on said two opposite sides of said upper frame, said second web being adjacent to said first web, said second web extending parallel to said first web and overlapping said first web partially. The webs are preferably fastened to the two opposing shorter sides of the upper frame and extend parallel to the longer sides of said frame. The first web is preferably mounted adjacent to a frame element of one of the longer sides of the frame and fastened to this frame element. The next wall will then be laterally displaced towards the inside of the lightweight construction. The displacement between two webs is preferably smaller than the width of said web, so that two adjacent webs partially overlap each other. At the at the overlapping portion, two adjacent webs may then be fastened together, e.g. manually or by means of clips or hog rings.

[0009] During the mounting of the supporting trellis, the webs, which are already in place, are preferably tensed in a direction parallel to said opposite sides. This ensures that the finished supporting structure is correctly tensed.

[0010] In a preferred embodiment, several auxiliary metal cables are tensed between two opposite sides, e.g. the two longer sides, of said upper frame of said lightweight construction prior to fastening said prefabricated trellis. These cables can be fastened to the frame elements of the longer sides of the frame so as to be spaced in a direction parallel to said opposite sides of said upper frame and extend substantially parallel to each other. These cables can support the prefabricated trellis during and after the mounting thereof. It has to be noted that the distance between two adjacent cables is much larger than the mesh size of said trellis. A typical distance would be e.g. 2 m.

[0011] After the supporting structure has been mounted in the above-described manner and covered by a suitable sheeting material, a second structure is placed on the sheeting material for securing the sheeting material against breeze. The second structure can e.g. be a hand-knotted net of metal wires, the mesh size of which can be much larger than the mesh size of the supporting structure. The wires for producing the hand-knotted net can at least partially be integrated into the prefabricated trellis, so that these wires automatically run out with the trellis. In a preferred embodiment the second structure is a second prefabricated trellis of metal wires placed on said sheeting material and fastened to said upper frame of said lightweight construction.

[0012] It has to be noted, that the fastening of the trellis to said upper frame of the lightweight construction may be achieved by several mounting techniques. The wire ends of the trellis can e.g. simply be wound around a frame element or knotted to the frame element. In an alternative embodiment, the free wire ends are fixed by clamping means such as simple screws or by a clamping latch, which is screwed
onto the frame element. In yet another embodiment, the free wire ends are fastened to a border element, which can be fastened by known techniques to the frame element. The border element can comprise a steel cable or a metal bar, which can be fastened to the frame element by means of wire material, by means of straps or clips or by means of hooks.

[0013] The present invention also relates to a roof structure for lightweight construction, comprising a supporting structure and a sheet material placed on said supporting structure, said supporting structure being mounted on an upper frame of said lightweight construction and spanning over an area of said lightweight construction, wherein said supporting structure comprises at least one prefabricated trellis of metal wires, e.g. a welded mesh.

[0014] In a preferred embodiment said supporting structure comprises several adjacent webs of prefabricated trellis, said webs being fastened on two opposite sides of said upper frame of said lightweight construction. The adjacent webs are preferably mounted so that each of said webs partially overlaps the adjacent webs, said adjacent webs being fastened together at an overlapping portion of said webs. During the mounting of the supporting structure, the webs, which are already in place, are preferably tensed in a direction parallel to said opposite sides. This ensures that the finished supporting structure is correctly tensed. It has to be noted that the roof structure constitutes in principle a sort of tent roof construction. This whole construction is preferably tensed by further fixing the trellis to several ground anchors.

[0015] The supporting structure may further comprise several auxiliary metal cables, said metal cables being tensed between two opposite sides of said upper frame of said lightweight construction, said cables extending substantially parallel to each other and being spaced in a direction parallel to said opposite sides of said upper frame, said cables for supporting said prefabricated trellis.

[0016] In order to hold a sheeting material placed on the supporting structure in place, a second prefabricated trellis of metal wires, is preferably placed on said sheeting material and fastened to said upper frame of said lightweight construction.

DETAILED DESCRIPTION WITH RESPECT TO THE FIGURES

[0017] The present invention will be more apparent from the following description of a not limiting embodiment with reference to the attached drawings, wherein

[0018] FIG. 1: shows a first step of an embodiment of the method for roofing a light-weight construction;

[0019] FIG. 2: shows an auxiliary tensioning appliance;

[0020] FIG. 3: shows a view of several adjacent and overlapping webs of trellis;

[0021] FIG. 4: shows a detail of FIG. 3;

[0022] FIG. 5: shows a first embodiment of a fastening means for fastening the trellis to an upper frame of the construction;

[0023] FIG. 6: shows a second embodiment of a fastening means;

[0024] FIGS. 7-9: show further embodiments of fastening means.

[0025] FIG. 1 shows schematically a part of a lightweight construction such as a greenhouse. The construction comprises a peripheral upper frame 10, which is mounted on several uprights 12. The upper frame can be formed of several steel profiles 14, e.g. two longitudinal profiles and two transverse profiles, which are assembled in a generally rectangular frame. In one direction of this frame 10, several steel cables 16 are tensed between two opposite sides of the frame, e.g. the longitudinal profiles, so that they extend across the frame. The steel cables are spaced along the longitudinal frame profiles and are fastened to these profiles of the frame. These cables will support the prefabricated trellis during and after the mounting thereof. It has to be noted that the distance between two adjacent cables is much larger than the mesh size of said trellis. A typical distance would be e.g. 2 m.

[0026] After mounting the cables and thus forming a first supporting structure, a first web of prefabricated trellis 18, e.g. of welded mesh, is placed on said cables 16. The first web extends normally to the cables 16 between the two opposite transverse frame profiles and is fastened to these transverse profiles. The first web of welded mesh is placed adjacent to one of the longitudinal profiles and is further fastened to this longitudinal profile.

[0027] After the web of welded mesh is securely fixed to the longitudinal profile, it is preferably tensed in a direction normal to the longitudinal frame. This can be achieved e.g. by auxiliary tensioning appliances 20, which are temporarily mounted between the cables 16 and the web 18. The tensioning appliance (see FIG. 2) can for instance comprise hook means 22 for gripping the metal wires of the web and clamping means 24 for clamping a metal cable, said hook means 22 and said clamping means being connected by elastic means 26.

[0028] A second web of welded mesh 28 can then be placed adjacent to said first web in such a way, that the first and second web partially overlap. The overlapping webs are shown in FIG. 3 and FIG. 4. The second web 28 is fastened to the two opposite transverse frame profiles and to the first web. The fastening to the first web is preferably done in the overlapping portion 30 of the two webs by connecting adjacent mesh wires together. The respective mesh wires can e.g. be fastened together by means of clips or hog rings 32. After the second web is tensed my means of tensioning appliances, further webs of welded mesh are mounted using the same method until the entire area of the lightweight construction is covered. It has to be noted that the auxiliary tensioning devices for tensing each of the webs can be removed once the respective web is tensed by the adjacent webs.

[0029] It has to be noted, that the fastening of the trellis to said upper frame of the lightweight construction may be achieved by several mounting techniques. The wire ends of the trellis can e.g. simply be wound around a frame element or knotted to the frame element. In an alternative embodiment, the free wire ends are fixed by clamping means such as screws and washers 34 (see FIG. 5) or by a clamping lath 36 (FIG. 6), which is screwed onto the frame profile 14.

[0030] Further mounting techniques are shown in FIGS. 7-9. In these embodiments, the free wire ends are fastened
to a border element 38, which can be fastened by known techniques to the frame element, i.e. the steel profile 14. The border element 38 can comprise a steel cable (FIGS. 7 & 8) or a metal bar (FIG. 9). This border element can be fastened to the frame element by means of wire material (see FIG. 7 and FIGS. 8a & b), by means of straps or clips (FIG. 8c & FIG. 9a) or by means of hooks (FIG. 9b). It should be noted that the mounting techniques shown in FIGS. 7, 8 and 9 advantageously allow to adjust the tension in the trellis after the mounting thereof. In fact, by tensioning or loosening the wire material, the clips or the hooks, the tension in the trellis may increased or decreased according to the requirements. Thus, if uprights are mounted within the area of the greenhouse in order to support the trellis, the tension in the trellis may be decreased in order to allow the trellis to be raised in the region of the upright. After the mounting of all the uprights, the tension can again be adjusted so as to provide the required final stability to the structure.

1. Method for roofing a lightweight construction, comprising the steps of fastening a prefabricated trellis of metal wires to an upper frame of said lightweight construction, so that said trellis spans over an area of said lightweight construction, and putting a sheeting material on said trellis.

2. Method according to claim 1, wherein said supporting structure comprises several adjacent webs of prefabricated trellis, characterised in that said step of fastening said prefabricated trellises comprises the steps of fastening a first web on two opposite sides of said upper frame of said lightweight construction, and fastening a second web on said two opposite sides of said upper frame, said second web being adjacent to said first web, said second web extending parallel to said first web and overlapping said first web partially.

3. Method according to claim 2, comprising the step of fastening said first and second web together at an overlapping portion thereof.

4. Method according to claim 2 or 3, comprising the step of tensioning said first web in a direction parallel to said opposite sides.

5. Method according to any of claims 1 to 4, characterised by the step of tensioning of several auxiliary metal cables between two opposite sides of said upper frame of said lightweight construction prior to fastening said prefabricated trellis, said cables extending substantially parallel to each other and being spaced in a direction parallel to said opposite sides of said upper frame, said cables for supporting said prefabricated trellis.

6. Method according to any one of claims 1 to 5, comprising the steps of putting a second prefabricated trellis of metal wires on said sheeting material and fastening said second trellis to said upper frame of said lightweight construction.

7. Roof structure for lightweight construction, comprising a supporting structure and a sheet material placed on said supporting structure, said supporting structure being mounted on an upper frame of said lightweight construction and spanning over an area of said lightweight construction, characterised in that said supporting structure comprises at least one prefabricated trellis of metal wires.

8. Roof structure according to claim 7, characterised in that said supporting structure comprises several adjacent webs of prefabricated trellis, said webs being fastened on two opposite sides of said upper frame of said lightweight construction.

9. Roof structure according to claim 8, characterised in that each of said webs partially overlaps the adjacent webs, said adjacent webs being fastened together at an overlapping portion of said webs.

10. Roof structure according to any one of claims 7 to 9, comprising several auxiliary metal cables, said metal cables being tensioned between two opposite sides of said upper frame of said lightweight construction, said cables extending substantially parallel to each other and being spaced in a direction parallel to said opposite sides of said upper frame, said cables for supporting said prefabricated trellis.

11. Roof structure according to any one of claims 7 to 10, characterised by a second prefabricated trellis of metal wires, said second trellis being placed on said sheeting material and fastened to said upper frame of said lightweight construction.

12. Roof structure according to any one of claims 7 to 11, characterised in that said prefabricated trellis of metal wires comprises a welded mesh.

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