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UNDULATING TENSIONED ROOF CONSTRUCTION

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Fig. 1

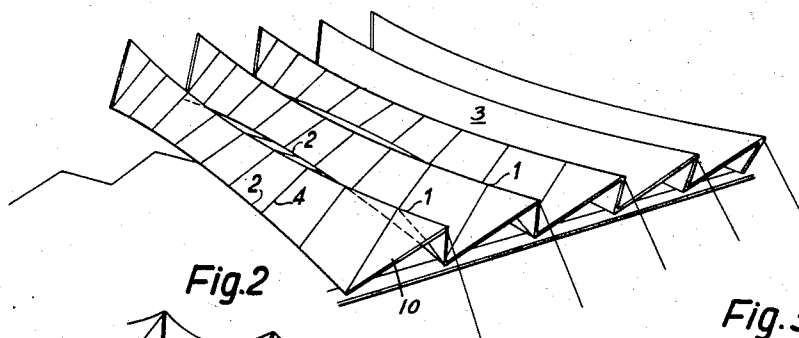


Fig. 2

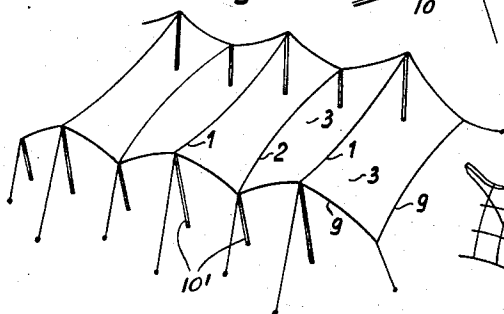


Fig. 3

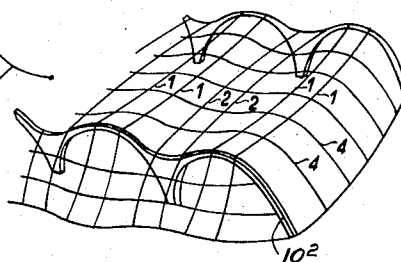
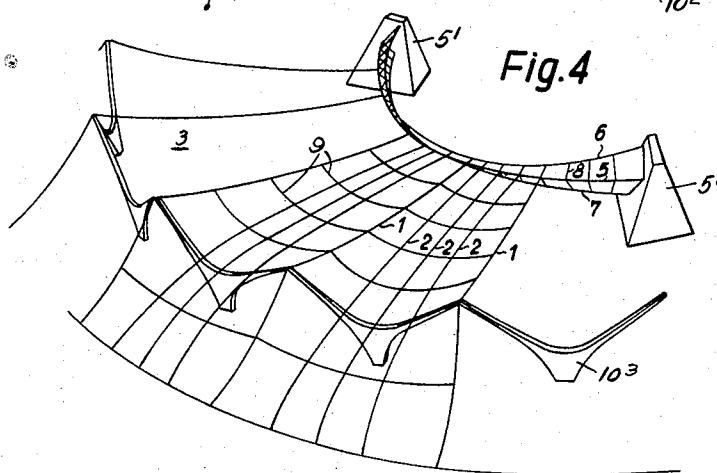


Fig. 4



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UNDULATING TENSIONED ROOF CONSTRUCTION

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7 Claims. (Cl. 108—1)

The present invention concerns roof structures. Attention has recently been directed in building roof structures having a roof sheathing or skin which is suspended between fixed supports stressed merely by tension. As already known, it is established that roof structures, which consist of carrier ropes or cables hanging down, and upwardly curved tensioning ropes or cables drawn over them at a right angle, have a favourable effect but do not permit of the covering of extensive surface areas.

It is the principal object of the present invention to provide an undulating rope or cable construction.

It is another object of the present invention to provide a roof structure in which carrier ropes, tensioned between fixed points and sagging, support the roof skin which is maintained in a stretched condition by tensioning ropes tensioned between the carrier ropes, extending parallel thereto and curving upwardly. The forces of the tensioning ropes are directly received by a diaphragm-like roof skin of sheet metal, fabric or the like, and are transmitted to the carrier ropes by transverse ropes extending at right angles to the carrier and tensioning ropes.

It is yet another object of the present invention to provide a capacious supporting arrangement of great rigidity which is stressed only by tension in all members by the tensional forces initially applied by means of the tensioning ropes and which permits of the covering surfaces being of more or less any length or extent and which makes important improvements with regard to the art by reason of its simple construction, both of tents with a fabric roofing and of solid construction having a fanned out roof sheathing, steel, glass or concrete.

With these and other objects in view, which will become apparent in the following detailed description, the present invention will be clearly understood in connection with the accompanying drawings, in which:

Figures 1 and 2 are perspective views showing the simplest form of construction or roof structures in accordance with the invention;

Fig. 3 is a perspective view showing a modified structure; and

Fig. 4 is a perspective view showing a further modified structure.

In the basic embodiment of the present invention, shown in Figs. 1 and 2, the roof skin or sheathing 3 forms sharp angles on preferably catenary carrier ropes 1 and tensioning ropes 2. The carrier ropes extend generally horizontally but hang in a curve between supports or fixed anchorages at their ends with the center of the carrier ropes lower than their ends. Each of the carrier ropes 1 is spaced apart from its adjacent carrier ropes. The roof skin or sheathing 3 is carried by the carrier ropes 1. The tensioning ropes 2 are disposed above the roof skin or sheathing 3 and arranged in such manner that each of the tensioning ropes 2 is disposed between a pair of adjacent carrier ropes 1. The tensioning ropes form a curve the center of which is higher than its ends and the ropes 1 and 2 are arranged in such manner that

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the roof skin or sheathing 3 is kept in tensioned condition substantially throughout its entire area.

In order to enhance the support of the roof skin or sheathing 3, transverse ropes 4 are also provided which extend at right angles to the ropes 1 and 2. By arranging several adjacently disposed tensioning ropes the troughs of the undulations may be rounded and the crests thereof likewise by the arrangement of several adjacently disposed carrier ropes (Fig. 3).

The undulating crests are tensioned between fixed points which are normally constructed as supports or fixed anchorages 10, 10', 10² and 10³, respectively, for the load, or consist of tensioned pressure rods, series of arcs or V supports.

It has been established that the entire undulating net system can be rested upon a main lifting or inner circular rope to cover a circular ring segment, circular segments or circular ground plans.

In the case of an arrangement in the form of a circular segment (Fig. 4), which, for example, is important for large open aircraft hangars, the free edge of the roof must be bent upwardly or supported on the main lifting rope 5 by a supporting system of a lifting carrier rope 6 and a lifting tensioning rope 7 which are interconnected with stay ropes 8 and the entire supporting system is carried by end posts 5'.

The roof sheathing or skin inside the fields can also be carried by auxiliary lifting ropes 9 with a very simplifying effect. By this means the forces engaging on the edge of the roof sheathing 3 are concentrated at only a few points.

In accordance with another embodiment of the present invention the catenary carrier ropes 1 are disposed along segmental radii relative to each other and have a plurality of rigid tension receiving points at the outer ends of the radii. Furthermore, additional ropes 5, 6 and 7 are provided between two fixed anchorages 5' in a curve concentric through the mentioned segmental radii and thus constitute a flexible anchorage at the inner ends of the radii. Inverted catenary tensioning ropes 2 are also disposed as segmental radii intermediate two adjacent carrier ropes above the roof skin or sheathing 3 and connected at their outer ends to a tension receiving point and at their inner ends to a carrier rope.

Any structural members may be regarded as ropes according to the present application which are only hypothetically resistant to bending, but substantially only stressed by tension.

While I have disclosed several embodiments of the present invention it is to be understood that these embodiments are given by example only and not in a limiting sense, the scope of the present invention being determined by the objects and the claims.

I claim:

1. In a roof structure including a skin of sheet material, a plurality of carrier ropes extending generally horizontally but hanging in a curve with the center thereof lower than the ends, means for supporting the ends of said carrier ropes, each of said carrier ropes being spaced apart from its adjacent carrier rope, said skin of sheet material resting upon and disposed on top of said carrier ropes, and a plurality of tensioning ropes resting upon and disposed on top of said skin, each of said tensioning ropes being disposed between each pair of adjacent carrier ropes and assuming a curve with the center thereof higher than its ends, all said carrier ropes maintaining said skin in raised position and all said tensioning ropes preventing a lifting of said skin from said carrier ropes and tensioning the entire skin area.

2. In a roof structure including a skin of sheet material, a plurality of groups of spaced apart carrier ropes,

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each of said carrier ropes extending generally horizontally but hanging in a curve with the center thereof lower than its ends, means for supporting the ends of said carrier ropes, each group of said carrier ropes being spaced from its adjacent group, said skin of sheet material resting upon and on top of said carrier ropes, and a plurality of groups of spaced apart tensioning ropes resting upon and disposed on top of said skin, each of said groups of tensioning ropes being disposed between a pair of adjacent groups of said carrier ropes, each of said tensioning ropes assuming a curve with the center thereof higher than its ends, all said carrier ropes maintaining said skin in raised position and all said tensioning ropes preventing a lifting of said skin from said carrier ropes and tensioning the entire skin area.

3. In a roof structure including a skin of sheet material, a plurality of carrier ropes extending generally horizontally but hanging in a curve with the center thereof lower than its ends, means for supporting the ends of said carrier ropes, each of said carrier ropes being spaced apart from the adjacent one of said carrier ropes, a plurality of transversely extending load distributing ropes disposed at spaced intervals from one another and carried on said carrier ropes, said skin of sheet material resting upon and disposed on top of said transverse ropes, and a plurality of tensioning ropes resting upon and disposed on top of said skin, each of said tensioning ropes being disposed between a pair of adjacent carrier ropes and assuming a curve with its center thereof higher than its ends, all said carrier ropes maintaining said skin in raised position and all said tensioning ropes preventing a lifting of said skin from said carrier ropes and tensioning the entire skin area.

4. In a roof structure including a skin of sheet material, a plurality of carrier ropes extending generally horizontally but hanging in a curve with its center thereof lower than its ends, each of said carrier ropes being spaced apart from its adjacent carrier ropes, said skin of sheet material resting upon and disposed on top of carrier ropes, a plurality of tensioning ropes resting upon and being disposed on top of said skin, each of said tensioning ropes being disposed between a pair of said carrier ropes and assuming a curve with its center thereof higher than its ends, a plurality of fixed tension receiving points, and edge tensioning ropes connected along each bounding edge of the skin for transmitting edge tension to at least one of said tension receiving points, all said carrier ropes maintaining said skin in raised position and

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all said tensioning ropes preventing a lifting of said skin from said carrier ropes and tensioning the entire skin area.

5. In a roof structure including a skin of sheet material, a plurality of carrier ropes extending generally horizontally but hanging in a curve with its center thereof lower than its ends, each of said carrier ropes being spaced from its adjacent carrier ropes, a plurality of transversely extending ropes disposed at spaced intervals from one another and carried on said carrier ropes, said skin of sheet material resting upon and disposed on top of said transverse ropes, and a plurality of tensioning ropes resting upon and being disposed on top of said skin, each of said tensioning ropes being disposed between a pair of said carrier ropes and assuming a curve with its center thereof higher than its ends, all said carrier ropes maintaining said skin in raised position and all said tensioning ropes preventing a lifting of said skin from said carrier ropes and tensioning the entire skin area.

6. In a roof structure including a skin of sheet material, a plurality of catenary carrier ropes disposed relatively to one another as segmental radii in plan, a plurality of rigid tension receiving points at the outer ends of the radii, two fixed anchorages, rope means extending between said anchorages in a curve in plan concentric with said segmental radii and constituting a flexible anchorage at the inner ends of the radii, said skin of sheet material resting upon and disposed on top of said carrier ropes, and a plurality of inverted catenary tensioning ropes above said skin, each of said tensioning ropes being also disposed as a segmental radius intermediate two of said carrier ropes and connected at its outer end to a tension receiving point and at its inner end to said rope means, all said carrier ropes maintaining said skin in raised position and all said tensioning ropes preventing a lifting of said skin from said carrier ropes and tensioning the entire skin area.

7. The structure, as set forth in claim 6, in which said rope means includes a main lifting rope, a lifting carrier rope and a plurality of interconnecting stay ropes.

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