Sept. 12, 1961 R. MACULAN 2,999,340

SURFACE SUPPORTING STRUCTURE

Filed Aug. 13, 1954

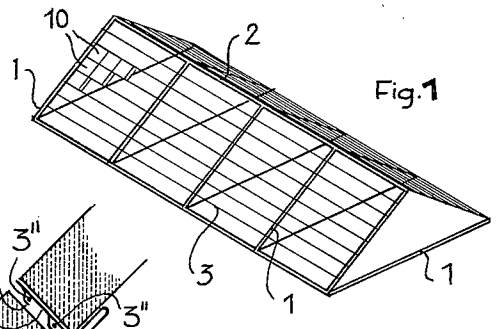


Fig. 1

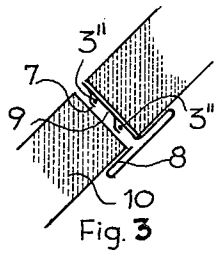


Fig. 3

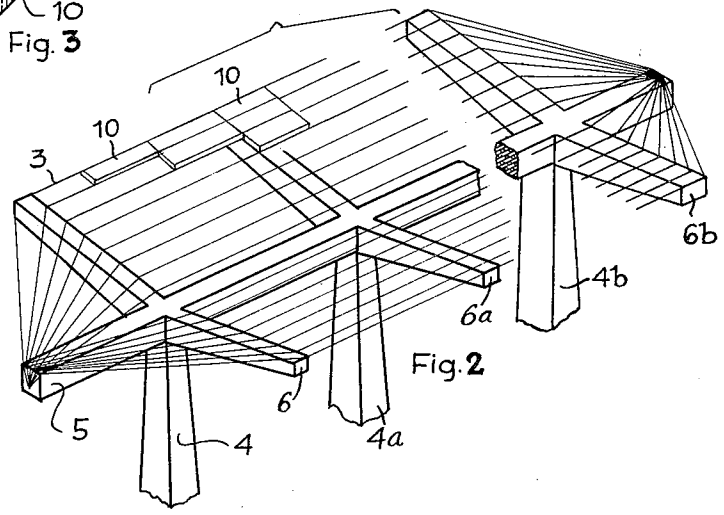


Fig. 2

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SURFACE SUPPORTING STRUCTURE

Rudolf Maculan, 6 Herrengasse, Vienna I, Austria; Ernst Meissner, guardian of Alexander Maculan, heir of said Rudolf Maculan, deceased

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1 Claim. (Cl. 50—49)

The present invention relates to a surface supporting structure made of wires or cables of high-grade steel or natural or artificial fibres of glass or the like.

In the prior art wires are partly employed as bearers for the roof skin to replace rafters so that they run from purlin to purlin to reduce the span, or they are exclusively used as a substitute for the roof lathings or battens.

The primary object of the invention is to provide an entire carrying structure for the roof skin consisting of wires stretched between the trusses, said wires being of high-grade and of high tensile strength, as e.g. the steel wires used in pre-tensioned concrete.

Another object of the invention is to provide a wire superstructure for a surface support offering a considerable saving in weight and material by fully utilizing the advantageous properties of high-grade, high tensile, strength wires or cables made of steel or natural or artificial fibers of glass or the like.

Still another object of the invention is to provide wires or cables stretched between braced abutments exclusively in the longitudinal direction of the surface e.g. a roof surface under a tension of at least 2000 kg./cm.^{2}, these wires being guided on supporting bearers eventually interposed.

Yet another object of the invention is to render superfluous all kinds of rafters and laths which create a considerable portion of the weight of the roof structure. This permits designs of the skin of the roof in such a manner so as to make them self-supporting from one of the tensioned wires to the next permitting the skin to be fastened to the wires.

Another object of the invention is to employ the tensioned wire structures of the present invention as a carrier for suspended sheeting to form molds for suspended concrete platforms, permitting partial surrounding or embedding of the tensioned wire itself in the concrete to carry and to reinforce it.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings in which like reference numerals designate like parts throughout the figures thereof and wherein:

FIGURE 1 shows a perspective view of the invention as applied to a common gable roof;

FIGURE 2 is a perspective view of the invention as applied to a cantilever type of roof;

FIGURE 3 is a sectional detail view to an enlarged scale, of a modification showing the manner in which roof plates or sheeting may be attached to the taut cables.

Referring in detail to the drawing and in particular to FIGURE 1, there is shown a common gable type roof comprising principals 1 rigidly connected in longitudinally-spaced relation at their bases by any suitable means such as pole plates, not shown, and at their tops or apices by ridgepiece 2. These principals or, more particularly, their upper edge surfaces, conjointly define a roof area. Solid wires or cables 3 which may be of high-tensile steel, are secured at their ends only to, and tensioned between, the two end principals 1, parallel with ridgepiece 2 and at spaced intervals along the sloping upper edge surfaces

of the principals. The tension employed will be of the order of at least 2000 kg./cm.^{2} or between 28,000 and 29,000 p.s.i. Stressing of the cables may be effected by conventional means such as stretching screws.

Roof covering 10 in the form of sheets, plates or strips of light metal or steel, corrugated or plain, and other materials, is attached directly to the cables 3 at intervals therealong.

In FIGURE 2 there is shown a construction of great utility for sheltering railway and airport loading platforms and other areas which may or may not, be enclosed by siding. In this construction a number of spaced columns such as 4, 4*a* and 4*b* are rigidly interconnected at their tops by a ridgepiece 5. Cantilever arms 6, 6*a* and 6*b* extend laterally outwardly from the ridgepiece which at one or both ends extends an appreciable distance beyond the nearest or adjacent arm. Cables 3 extend over and across the arms parallel with ridgepiece 5 and at the terminal arms 6 and 6*b* converge to the contiguous end of the ridgepiece, to which they are secured. The cables merely pass about suitable abutments, not shown, upon terminal arms 6 and 6*b* so that substantially the entire tension in them is taken by ridgepiece 5. Thus, when the parts 5, 6, 6*a*, etc., are of concrete, ridgepiece 5 is compressed by the cables such that internal reinforcement thereof may be reduced over that otherwise required, or even rendered superfluous. In the figure being explained, laterally extending arms 6, 6*a* and 6*b* conjointly define a roof area.

The structure shown in FIGURE 3 comprises fastening holders 9 for attachment of the roofing skin. The holders 9 are secured to the wires 3". In this instance, instead of a single wire 3, a pair of wires are provided. A flanging tongue 7 integral with the holder 9, which may be made of a metal strip, may be used for this purpose for connection with the wires. The upper side of the holder preferably is profiled for receiving the roofing skin 10 and has recesses or folds 8 mounted below the roofing skin 10.

The holders 9 simultaneously will impart to the pre-tensioned wires a certain rigidity and will serve as carriers for receiving sound or heat damping layers or for carrying a specified plate lining.

The fastening of the wires or cables to the terminal trusses or the like may be executed by conventional means. The wires may be rigidly attached to the one terminal girder and anchored to the other terminal girder and may be tightened e.g. by means of a stretching screw. But it is also possible to maintain the tension by means of a weight, whereby a part of the building, e.g. a front wall, or the like may be used as weight, in order to prevent the wires from oscillating in a vertical plane. The wires may be affixed from beneath by additional wires arranged in the middle of the individual fields defined by two adjoining beams. Furthermore, the abutment forces generated by tensioning the wires against the shoulders of the skeleton structure may be employed advantageously to brace the entire building, or of a part of the building subjected by the useful load to tensile or to bending stresses. The compressive pre-tension imparted in accordance with the present invention to a concrete portion of a building may be increased up to a point where the flexion-traction reinforcement may be found superfluous. In the manner analogous to the pre-tensioning of steel wire concrete reinforcement, tensions may be generated in accordance with the present invention in a building in various manners to release parts of a building from excess tensile and bending stresses.

In certain cases it is advisable to utilize the forces of traction acting through the wires to apply a compressive force to the building. In such an instance the tensile forces are conducted down into the soil by way of termi-

nal structures and through the foundations. Thus it is possible to erect buildings which at their ends are provided with two rigid blocks relatively heavy, but of small surface, whereas the total large-surface intermediate structure is elastic, consisting e.g. of stretched wires with an elastic roof skin. This feature is of particular importance in cases of air-raid danger, or of unreliable building ground such as in case of earthquake risks when a settlement of the intermediate trusses may eventually have to be reckoned with. In those cases in which a compression resisting plate should appear in the final state, the parts of the building, serving for the anchorage of the pre-tensioned wires, must be braced in respect to each other only by pressure members arranged for the duration of the erection. As soon as the compression resisting plate will have set, these pressure members are to be removed, whereby after the setting of the plate the anchorage of the stretched wires is also to be removed so that the traction of the steel wires is maintained by the plate.

The roofing skin of the surface supporting structure always must be designed in such a manner that it is self-supporting between the wires. Corrugated iron sheets, profile sheets of all kind, rigid plates made of various materials are employed for this purpose, also flexible materials of a sufficient tensile strength, such as rubber mats, tent-cloth, and the like may be used. The tensioned wire of the present invention also may be employed as carriers for suspended sheeting such as laid for pouring concrete plates, of high compressive strength. Preferably light concrete with filler mixed therein are employed herewith. The structures of the present invention also may be used as means of support of sheetings to form surface linings and sound and heat damping barriers.

A preferred mode of execution of this invention consists in the roofing skin being not fastened to individual wires spaced at certain distances but to bundles of wires consisting of two or more pre-tensioned wires. This arrangement permits of obtaining a displaceable fastening means for certain roofing systems. The pre-tensioning of these wires may then be executed by twisting two or more parallel and contiguous wires whose ends are rigidly fixed.

The wire structures of the present invention may be

surrounded partially with concrete or entirely embedded therein. Because of the sag the wires embedded in concrete run within the fields corresponding to the moment curve which feature is of advantage in respect to static structures.

Cables may be made of fibres of natural or artificial glass (acryl resins), adapted to resist high tensile forces.

In the claims, the term "principal" has the usual meaning of "the construction which gives shape and strength to a roof, generally one of several trusses of timber or iron."

I claim:

A roof construction comprising a pair of spaced erect standards, a ridgepiece supported atop and rigidly interconnecting said standards, a plurality of pairs of cantilever arms secured to said ridgepiece, the arms of each said pair extending laterally outwardly therefrom in opposite directions at spaced intervals along said ridgepiece, said arms conjointly defining a sloping roof area, said ridgepiece having each end extending beyond the adjacent one of said pairs of arms, a plurality of spaced cables extending over and across and supported by said arms and tensioned therebetween in parallel relation with said ridgepiece, all said cables at said ends converging toward and secured under tension to the contiguous extending end of said ridgepiece whereby the same is directly compressed by the tension in said cables, and metallic sheeting extending over and supported on and by said cables, said sheeting extending over said roof area and being attached to said cables at intervals only therealong.

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