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Ventimiglia

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[54] **METHOD AND APPARATUS FOR STRETCHING STRIP OF SHEET MATERIAL ON RIGID SUPPORTS**

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[52] **U.S. Cl.** ..... **52/2,** 52/741, 135/15 CF, 135/1 R, 52/222

[51] **Int. Cl.** **E04g 11/04,** E04b 1/00, E04b 1/347

[58] **Field of Search** ..... 52/222, 273, 741, 63, 243, 52/419, 2; 135/1 R, 15 CF

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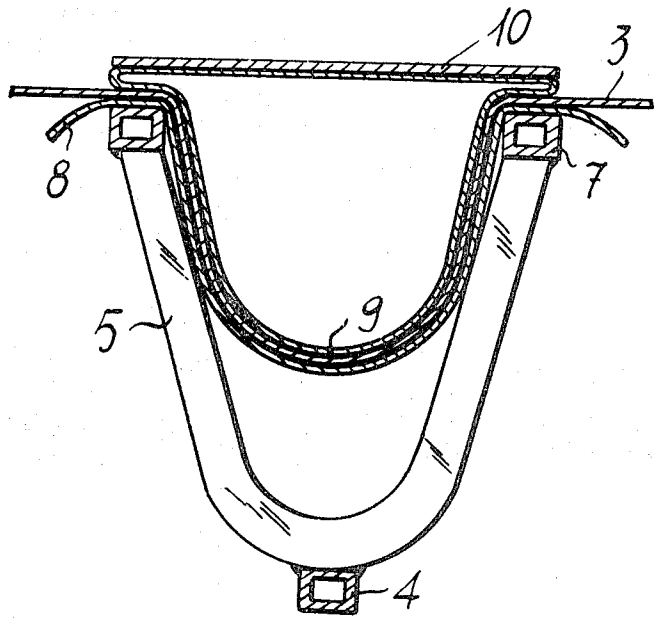
[57] **ABSTRACT**

Method for stretching strips of flexible sheets, consisting of laying the strip on two rigid supports, and above said strip a tubular element, superimposing on the latter an inextensible strap which is restrained at its ends. By inflating the tubular element, an even stretching for the flexible strip is provided.

8 Claims, 4 Drawing Figures



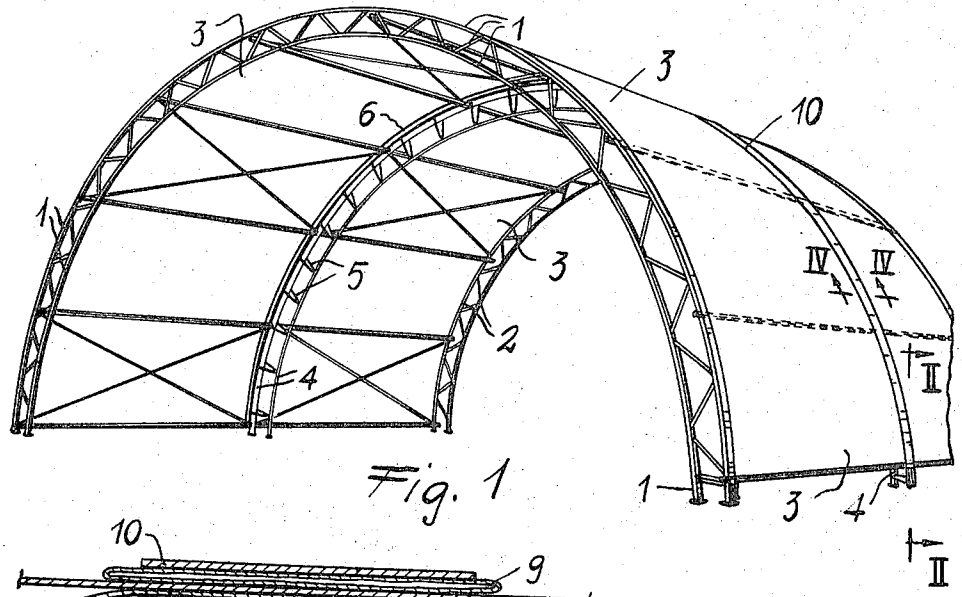


Fig. 1

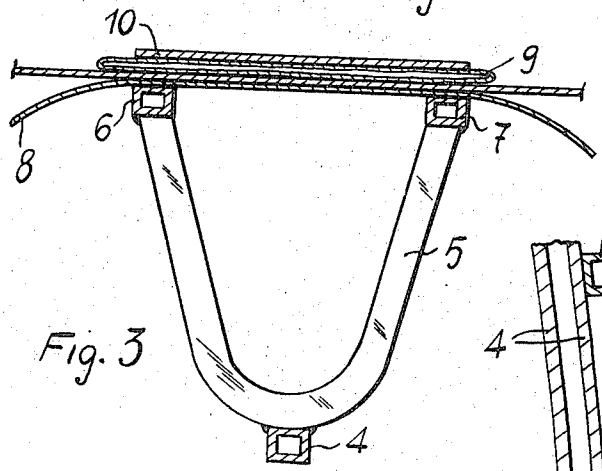


Fig. 3

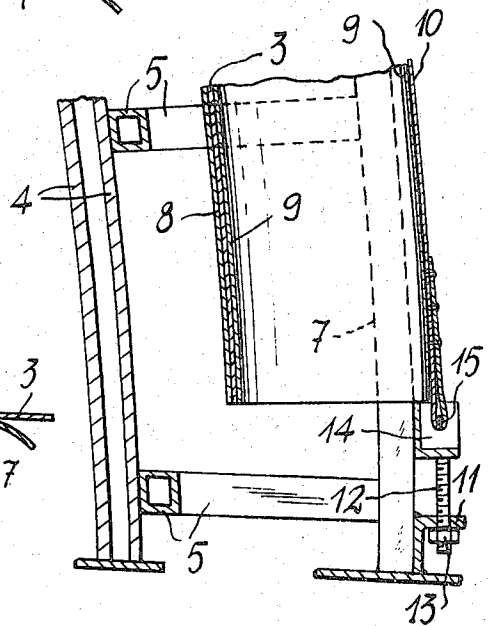


Fig. 2

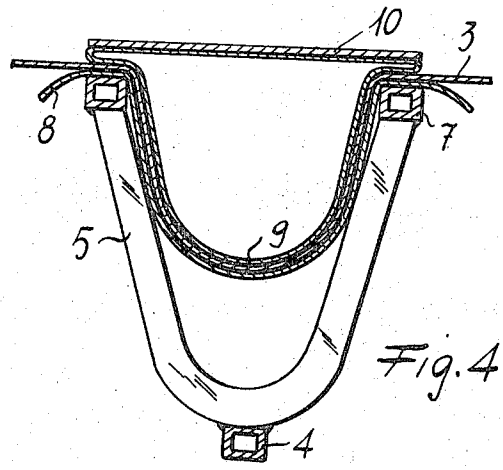


Fig. 4

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METHOD AND APPARATUS FOR STRETCHING STRIP OF SHEET MATERIAL ON RIGID SUPPORTS

This invention relates to a method for stretching strips of flexible sheet material on rigid structures.

It is well known that when strips of flexible sheet material are to be stretched on rigid structures, firstly said strips are secured at an end thereof to said structures, then tensioning the strips by gripping the same at the other end thereof. Such a method suffers from substantial disadvantages, due to the fact that where the flexible material strips are of a somewhat considerable size, it would be quite impossible to provide for a sufficient stretching thereof, as required, and particularly it would be impossible to evenly stretch such strips on the entire surface thereof. Another disadvantage is that to accomplish the above mentioned tensioning, the flexible material strips are gripped at separate localized areas of the free end thereof where the tensioning is effected, with the result that very often the strips break at the tensioning locations: in order to obviate to such a disadvantage, the flexible material strips are given a somewhat reduced tension on the rigid structures supporting the strips.

A further disadvantage in known tensioning systems for flexible material strips resides in that such a tensioning needs rather delicate, hard-working and time-waste operations to be carried out.

The main object of the present invention is to provide a method by which strips of flexible sheet material can be fully evenly stretched on rigid structures, particularly for greenhouse covering.

Another object of the invention is to provide a stretching method of the above character, according to which method said strips can be given a desired amount of readily adjustable controllable stretching.

A still further object of the invention is to provide a method by which the stretching of flexible sheet material strips on rigid structures can be extremely simply and readily carried out without any risk of causing breakages in the strips.

These and still other objects are accomplished by a method which is characterized in that a strip of flexible sheet material is laid on a pair of rigid supports arranged close and substantially parallel to each other, above said sheet material and at said rigid supports an air-tight deformable tubular element is arranged and extends along said supports, and above the tubular element there is positioned a substantially inextensible elongate element, of which the free ends are restrained to fixed locations, said tubular element being provided with at least one valve for introducing a pressure fluid therein.

For a more clear understanding of the features for the method according to the present invention, an embodiment thereof will now be described, as given by mere way of not limiting example, reference being had to the accompanying drawing in which:

FIG. 1 is a perspective view showing three metal lattices, on which a flexible material strip is laid and stretched;

FIG. 2 is an enlarged view showing a detail, as taken along the line II—II of the structure in FIG. 1; and

FIGS. 3 and 4 are enlarged views taken along the line IV—IV of the structure in FIG. 1, showing the structure

prior to stretching the flexible material strip and after the stretching thereof, respectively.

Referring first to FIG. 1, it will be seen that between two metal ribs 1 and 2 there extends a strip of flexible sheet material, comprising for example a thin plastic material sheet 3, the ends of which are secured by any known means on the ribs 1 and 2.

Between the end ribs 1 and 2 a further metal rib is positioned and comprises a curved section 4, while a pair of metal supports 6 and 7 are fast therewith by means of a plurality of forks 5, said supports 6 and 7 being close and parallel to each other.

A shielding strap 8 (FIGS. 3 and 4) also made of flexible material, such as plastic material, is laid above said supports 6 and 7. The flexible sheet 3, the free ends of which are restrained on ribs 1 and 2, bears and extends on this shielding strap. Above said sheet 3 and at said supports a tubular element 9 is placed, this tubular element being made of deformable material and air-tight while an inextensible elongate element, such as comprising a metal strap 10 extending with the tubular element above sheet 3 along the rigid supports 6 and 7, is positioned on said tubular element 9. On the tubular element 9 a valve of any known type is mounted, which valve is not shown in the drawing for the sake of simplicity since its description is not essential for understanding the present invention, and through which a pressure fluid can be introduced into the tubular element: preferably this fluid is air, the pressure of which can be at a very low rate, such as between 0.2 and 1.0 atmosphere above ambient atmosphere. The free ends of the metal strap 10 are secured to the two lower ends of the underlying metal rib, a bracket 11 being fast therewith and having a hole through which a screw 12 carrying a bolt 13 will extend, this screw being fast with a cradle 14 carrying a rigid rod 15, about which each end of the metal strap 10 is wrapped and secured.

After securing the strip of flexible sheet 3 to the end ribs and positioning on said strip 3 the tubular element 9 and strap 10, prior to inflating said tubular element, the cross-section for the structure at the section IV—IV will assume the configuration as shown in FIG. 3, where the strap 10 is given only a slight tension as provided by rotating the bolts 13 on screws 12 by means of any wrench.

Considering now FIGS. 3 and 4 and assuming to supply slightly pressurized air into the tubular element 9, this element will inflate and being unable to outwardly expand, as prevented by the inextensible strap 10, it will inwardly expand between said rigid supports 6 and 7, as shown in FIG. 4, building up a swelling as clearly shown in FIGS. 1, 2 and 4, and drawing along said flexible sheet 3 and shielding strap 8: thus, the sheet 3 is readily uniformly stretched by a force evenly distributed and readily controllable to the desired value.

It has been found that as herein described, flexible sheets of any materials, also including cloth, can be thoroughly stretched without leaving any depressions or wrinkles: this is just due to the fact that the tension enables to remove any depression of the flexible strip, its outward facing surface is quite smooth and even and therefore no water deposits are to be found thereon, as well as no pockets, against which the wind might exert a substantial effect.

Instead of being made of a metal strap, it is evident that said strap 10 could be made of a cloth or fabric strap, or of any other inextensible material, and that the

rigid structure comprising said supports **6** and **7** could be of a configuration other than that shown, comprising for example two separate rigid structures juxtaposed to each other. Then, where the strip of flexible sheet material to be stretched should be of a flat configuration, it is apparent that also the rigid supports **6** and **7** have to assume a straight configuration, and in this case said strap **10** could comprise a rigid rod which is also straight and overlies said two supports.

In addition to its simplicity and ready provision, a not negligible advantage of the present system resides in that at any time the pressure can be increased within the tubular element **9** in order to increase the tension in the flexible sheet strip **3**, particularly to recover any elongations which often arise after laying.

It is also obvious that where the strip of flexible sheet material to be stretched is of a very substantial length, a plurality of systems similar to that herein described can be provided, systems which are spaced apart from one another and distributed along the length of said strip.

What I claim is:

1. A method for stretching a flexible sheet of material fastened to rigid structures and spanning a space between said rigid structure comprising the steps of:

arranging a pair of rigid supports in a substantially parallel, spaced-apart relationship adjacent one side of said sheet;

placing an air-tight, deformable, tubular element in a collapsed configuration on the other side of said sheet so as to be parallel to and within at least a portion of the space bridging said pair of rigid supports;

positioning a substantially inextensible elongated element against said tubular element on the side of said tubular element opposite the side facing said sheet;

restraining the free ends of said elongated element; and

introducing a fluid under pressure into said tubular element, whereby said tubular element tends to assume a non-collapsed configuration and to force a portion of said sheet into the space between said rigid supports.

2. The method as claimed in claim **1**, including the step of interposing a flexible shielding strap between said rigid supports and said sheet.

3. The method as claimed in claim **1**, wherein said step of introducing a fluid comprises introducing air.

4. An apparatus for stretching a flexible sheet of material fastened to rigid structures and spanning a space between said rigid structures comprising:

a pair of rigid supports held in a substantially parallel, spaced-apart relation, said pair of rigid supports being adapted for placing adjacent one side of said sheet;

an air-tight, deformable tubular element having a valve for introducing or expelling a fluid into said tubular element so that it can be expanded to a tubular configuration or to a collapsed configuration, said tubular element being adapted to position on the side of said sheet opposite said pair of rigid supports so as to be parallel to and within at least a portion of the space bridging said pair of rigid supports; and

a substantially inextensible elongated element located on the side of said tubular element opposite the side adapted to be positioned against said sheet, the ends of said elongated element having restraining means connected to said rigid supports and holding said elongated element in position against said tubular element.

5. The apparatus as claimed in claim **4**, including a flexible shielding strap located parallel to said pair of rigid supports and adapted for positioning between said sheet and said rigid supports.

6. The apparatus as claimed in claim **4**, wherein the width of said elongated element and of said tubular element is substantially the same as the distance between said pair of rigid supports.

7. The apparatus as claimed in claim **4**, wherein said elongated element comprises a metal strap.

8. The apparatus as claimed in claim **4**, wherein said pair of rigid supports are held by a U-shaped fork having one of each end joining one of each of said rigid supports to form an integrated rigid structure.

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