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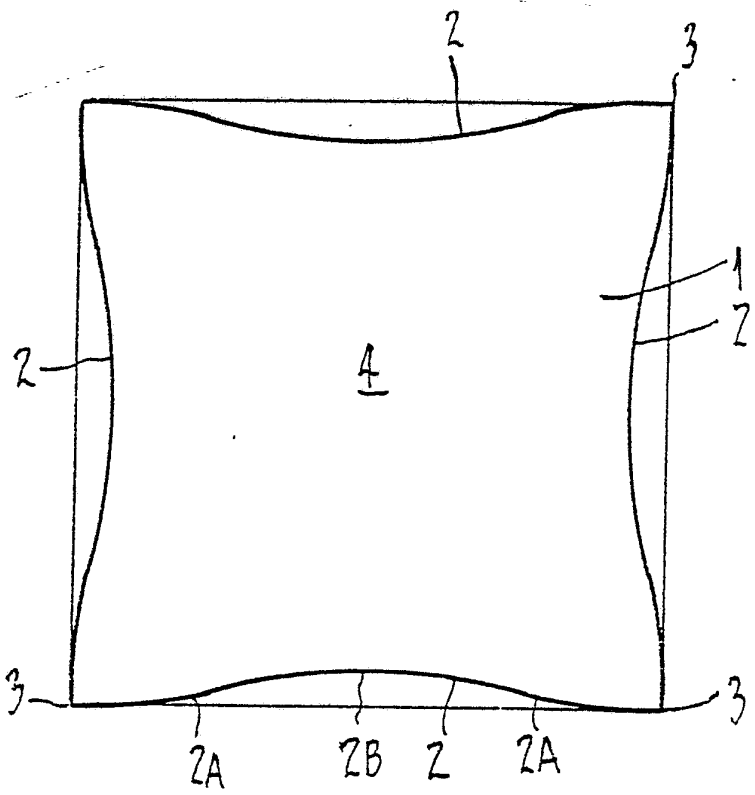
**Published**
*With international search report.*

**(54) Title:** A CANOPY




**(57) Abstract**

A method of erecting a canopy from panels of stretch fabric having inelastic or low stretch tendons along the edges of each pad. Wherein diagonally opposite corners of the panels are fastened to support posts arranged in a predetermined array and the remaining corners are drawn together with corresponding corners of adjacent panels to tension the tendons and the stretch fabric. The tendons are preferably fastened to the stretch fabric in a curve which is concave with respect to the adjacent panel edge, and the curve is preferably a bell shaped curve.

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TITLE: A CANOPY

This invention relates to a canopy and has been devised particularly though not solely as a shade canopy.

It is necessary in many applications to provide an overhead canopy for shelter or shade and particularly in agricultural situations to provide shade for plants. Many other applications also require the provision of overhead canopies to protect or shade articles which are placed outside to prevent degradation from ultra-violet light. In the past shade canopies have been provided using various types of structures to support either opaque awnings or shade cloths using a rigid frame structure or a large number of upright poles or posts to support the cloth. It is a disadvantage of such systems that the poles or posts must be closely spaced in order to prevent excessive sagging of the canopy fabric which is difficult from the point of view of cultivation or the placing of large objects beneath the canopy.

It is therefore an object of the invention to provide a canopy which will obviate or minimize the foregoing disadvantages in a simple yet effective manner or which will at least provide the public with a useful choice.

Accordingly in one aspect the invention consists in a method of erecting a canopy comprising the steps of erecting a plurality of posts in a predetermined array, providing a plurality of panels of canopy fabric of stretch material having inelastic or low stretch tendons fastened thereto at or adjacent the panel edges,

fastening diagonally opposite corners of each said panel to selected ones of said posts and drawing together the remaining corners of adjacent panels so as to tension said tendons and hence tension said stretch fabric.

Preferably said tendons are fastened to said fabric continuously along the length of each tendon.

Preferably said panel edges are substantially straight and the tendons are fastened thereto in a curve having each end thereof at adjacent corners of the panel and extending inwardly into the panel at the mid-portion of the panel edge.

Preferably said curve is a bell shaped curve being convex with respect to the panel edge adjacent the corners of the panel and concave with respect to the panel edge adjacent the mid portion of the panel edge.

Preferably said panels are rectangular and said posts are arranged in a rectangular array.

Preferably five said posts are provided in said rectangular array, therebeing one said post at each corner and one post in the middle, and wherein four said panels are provided, each panel being fastened first to the centre post and one corner post and then having the other two diagonally opposite corners drawn together with the adjacent corners of the adjacent panels at the mid-points of the sides of the rectangular array.

Preferably said fabric comprises a stretch knit fabric and said tendons comprise rope or webbing.

Preferably said fabric comprises knitted shade cloth and said tendons comprise webbing of the type commonly used for automotive seat belts.

Preferably said webbing is sewn to said fabric along the entire length of the webbing.

In a further aspect the invention consists in a canopy comprising an array of posts and a plurality of panels stretched therebetween at the desired height,

each said panel being formed from stretch fabric material having inelastic or low stretch tendons fastened thereto at or adjacent the panel edges in a curve extending inwardly between the panel corners so that when the tendons are tensioned between the posts the curved tendons at least partially straighten drawing fabric from the middle area of the panel and tensioning the panel.

Preferably said curve is a bell shaped curve being convex with respect to the panel edge adjacent the corners of the panel and concave with respect to the panel edge adjacent the mid-portion of the panel edge.

Preferably said fabric comprises a stretch knit fabric and said tendons comprise rope or webbing.

Preferably said fabric comprises knitted shade cloth and said tendons comprise webbing of the type commonly used for automotive seat belts.

Preferably said webbing is sewn to said fabric along the entire length of the webbing.

In a still further aspect the invention consists in a rectangular canopy panel of stretch fabric having inelastic or low stretch tendons fastened thereto at or adjacent the panel edges in a curve extending inwardly between the panel corners.

Preferably said curve is a bell shaped curve being convex with respect to the panel edge adjacent the corners of the panel and concave with respect to the panel edge adjacent the mid-portion of the panel edge.

Preferably said fabric comprises a stretch knit fabric and said tendons comprise rope or webbing.

Preferably said fabric comprises knitted shade cloth and said tendons comprise webbing of the type commonly used for automotive seat belts.

Preferably said webbing is sewn to said fabric along the entire length of the webbing.

Notwithstanding any other forms that may fall

within its scope one preferred form of the invention will now be described by way of example only with reference to the accompanying drawings in which:

Figure 1 is a plan view of a fabric panel used in a canopy according to the invention,

Figure 2 is a plan view of a canopy according to the invention,

Figure 3 is a side elevation of the canopy shown in Figure 2,

Figure 4 is a cross-sectional elevation to an enlarged scale of the footing for a post used in the canopy according to the invention, and

Figure 5 is a cross-sectional elevation to an enlarged scale of the footing for a tie-down used in the canopy according to the invention.

In the preferred form of the invention a canopy particularly used as a shade canopy and using a fabric shade cloth is constructed as follows although it will be appreciated that the invention may be utilized in any situation where it is desired to provide an overhead canopy.

The canopy is formed from a plurality of panels such as that shown at 1 in Figure 1 which may be formed from any desired stretch material and which in the preferred form of the invention are formed from knitted polyetheylene shade cloth. A typical cloth is that made by Gale Pty. Ltd. of Australia as Elderado Weathershade. The panel may be of any desired size and may be formed from a single length of knitted cloth or from a number of lengths of cloth sewn together to form a large rectangular array. In the example of the invention shown in the accompanying drawings each panel may for example be approximately 50 feet (14.33m) along each side. Each panel is provided with inelastic or low stretch tendons fastened to the panel at or adjacent the panel edges. In the preferred form of the invention the tendons are formed from webbing 2 sewn to the panel fabric adjacent each edge. The tendons

are formed from a type of webbing commonly used for automotive seat belts although it will be appreciated that other forms of webbing, rope or cable may be used in this application. The webbing is sewn continuously to the panel fabric in a curve extending inwardly between the panel corners 3 so that when the webbing is tensioned (as will be described below) the curve at least partially straightens drawing the fabric from the middle area 4 of the panel.

Although the curve may be a simple curve which is concave when viewed from the panel edge it has been found that a curve of this type over tensions the fabric in the areas adjacent the corners 3. It is therefore preferred to sew the webbing to the fabric in a bell shaped curve being convex with respect to the panel edge over the areas 2A adjacent the corners of the panel and concave with respect to the panel edge over the area 2B adjacent the mid-portion of the panel edge. The depth of the curve may be varied to suit the fabric used and the panel size but it has been found suitable with knitted polyetheylene shade cloth in panels 14.3m along each side to use a curve depth of 500mm between the panel edge and the webbing at the mid-point of the side.

In one form of the invention the canopy may be erected using fourteen posts comprising twelve edge posts P1-P12 and two centre posts P13 and P14 as shown in Figure 2. The canopy may however be formed to any required size or configuration using a basic rectangular array of four panels 13 based on four corner posts P13, P5, P9 and P7 and a centre post P14. It will be appreciated that the basic rectangular array may be repeated any number of times to build up a shade canopy to cover the desired area.

Each edge post is supported by guy wires 7 which are anchored into the ground by any convenient anchor such as a block of concrete buried in the ground. The posts may similarly be supported on any suitable footing such as that shown in Figure 4. It is desirable

that the posts can rock on the footing 16 to give an elastic structure which can move to absorb wind loadings or other abnormal loadings in use. The posts are further located by diagonal guy wires 10 which also serve to locate the centre posts P13 and P14.

Once the rectangular array of posts has been erected, fabric panels such as that shown in Figure 1 are positioned within the array and opposite diagonal corners of the panels are secured to the posts at the desired height which is normally at the top of the posts. In this manner the diagonally opposite corners of the panels are fastened to their adjacent posts P1, P3, P13, P5, P11, P14, P9 and P7. The remaining diagonally opposite corners of the panels are then drawn together with the adjacent corners of the adjacent panels at points P2, P4, P12, T1, T2, P6, P10 and P8. Where these points coincide with a post, i.e., around the perimeter of the canopy, they may then be fastened to that post. At the intermediate points T1 and T2 it is not necessary to provide a post but desirable to provide tie-down wires 5 (Fig. 5) from the tension point to an anchor block 6 buried in the ground. The tie-down wires 5 serve to restrain the canopy in windy situations and prevent upward bowing or ballooning.

The drawing together and tensioning operation may be performed by any suitable tensioning apparatus. As the corners are drawn together to points 11 the webbing tendons 2 are tensioned causing the curve of the webbing to straighten and tension the fabric across the entire area of the panels.

Once the panels have been drawn together and tensioned the edges of adjacent panels (outside the tendons) may be fastened together to form a continuous cover. The fastening may be by way of clips or lacing but preferably by sewing using a small hand held portable sewing machine.

The basic rectangular array of four panels 13 erected as described may be repeated to cover any desired area and it has been found that by using four such basic rectangular arrays it is possible to cover an area of one acre. The area so covered has the advantage that there are only five internal posts within the acre area leaving large free areas for cultivation or storage. The canopy formed according to the invention is very resilient and capable of withstanding high wind loadings and furthermore because it is an elastic tensioned structure the canopy is able to resist impact from various objects such as falling branches without significant damage to the canopy.

In this manner a canopy can be provided which is simple and easy to erect and which can cover large areas of land in a simple and cheap manner with the use of a minimum number of support posts.

Although the canopy has been described in a certain size and using a certain material it will be appreciated that the basic canopy system may be applied in many different applications requiring different canopy sizes and using different fabric to suit the intended application.

1. A method of erecting a canopy comprising the steps of erecting a plurality of posts in a predetermined array, providing a plurality of panels of canopy fabric of stretch material having inelastic or low stretch tendons fastened thereto at or adjacent the panel edges, fastening diagonally opposite corners of each said panel to selected ones of said posts and drawing together the remaining corners of adjacent panels so as to tension said tendons and hence tension said stretch fabric.

2. A method of erecting a canopy as claimed in claim 1 wherein said tendons are fastened to said fabric continuously along the length of each tendon.

3. A method of erecting a canopy as claimed in either claim 1 or claim 2 wherein said panel edges are substantially straight and the tendons are fastened thereto in a curve having each end thereof at adjacent corners of the panel and extending inwardly into the panel at the mid-portion of the panel edge.

4. A method of erecting a canopy as claimed in claim 3 wherein said curve is a bell shaped curve being convex with respect to the panel edge adjacent the corners of the panel and concave with respect to the panel edge adjacent the mid-portion of the panel edge.

5. A method of erecting a canopy as claimed in any one of the preceding claims wherein said panels are rectangular and said posts are arranged in a rectangular array.

6. A method of erecting a canopy as claimed in claim 5 wherein five said posts are provided in said rectangular array therebeing one said post at each corner and one post in the middle and wherein four said panels are provided each panel being fastened first to the centre post and one corner post and then having the other two diagonally opposite corners of the panel drawn together with the adjacent corners of the adjacent panels at the mid-points of the sides of the rectangular array.

7. A canopy comprising an array of posts and a plurality of panels stretched therebetween at the desired height each said panel being formed from stretch fabric material having inelastic or low stretch tendons fastened thereto at or adjacent the panel edges in a curve extending inwardly between the panel corners so that when the tendons are tensioned between the posts the curved tendons at least partially straighten drawing the fabric from the middle area of the panel and tensioning the panel.

8. A canopy as claimed in claim 7 wherein said curve is a bell shaped curve being convex with respect to the panel edge adjacent the corners of the panel and concave with respect to the panel edge adjacent the mid-portion of the panel edge.

9. A canopy as claimed in either claim 7 or claim 8 wherein said fabric comprises a stretch knit fabric and said tendons comprise rope or webbing.

10. A canopy as claimed in claim 9 wherein said fabric comprises knitted shade cloth and said tendons comprise webbing of the type commonly used for automobile seat belts.

11. A canopy as claimed in any one of claims 7 to 10 wherein said tendons comprise webbing which is sewn to said fabric along the entire length of the webbing.

12. A rectangular canopy panel of stretch fabric having inelastic or low stretched tendons fastened thereto at or adjacent the panel edges in a curve extending inwardly between the panel corners.

13. A rectangular canopy panel as claimed in claim 12 wherein said curve is a bell shaped curve being convex with respect to the panel edge adjacent the corners of the panel and concave with respect to the panel edge adjacent the mid-portion of the panel edge.

14. A rectangular canopy panel as claimed in either claim 12 or claim 13 wherein said fabric comprises knitted shade cloth and said tendons comprise webbing of the type commonly used for automobile seat belts.

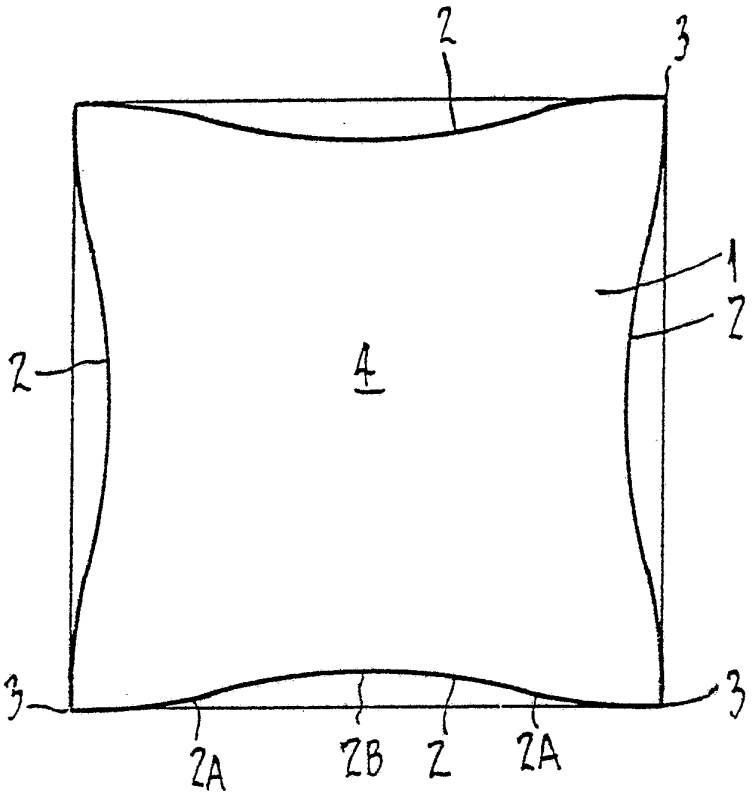



FIG. 1.

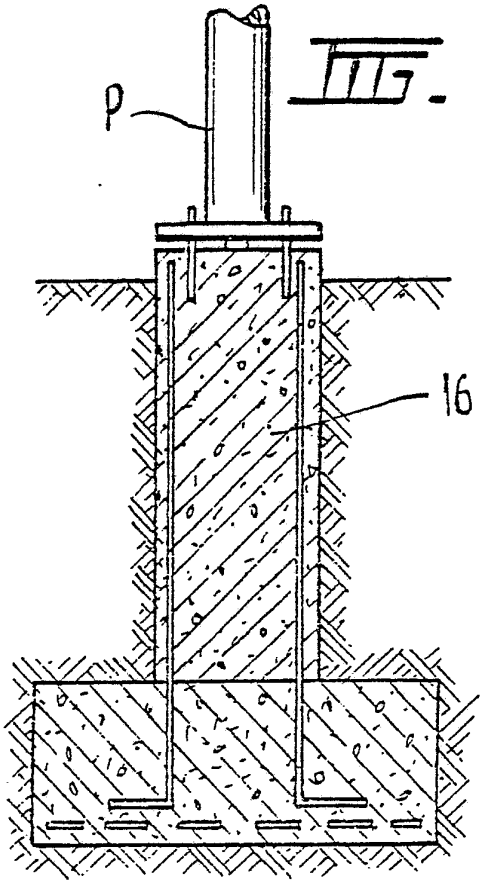



FIG. 4.

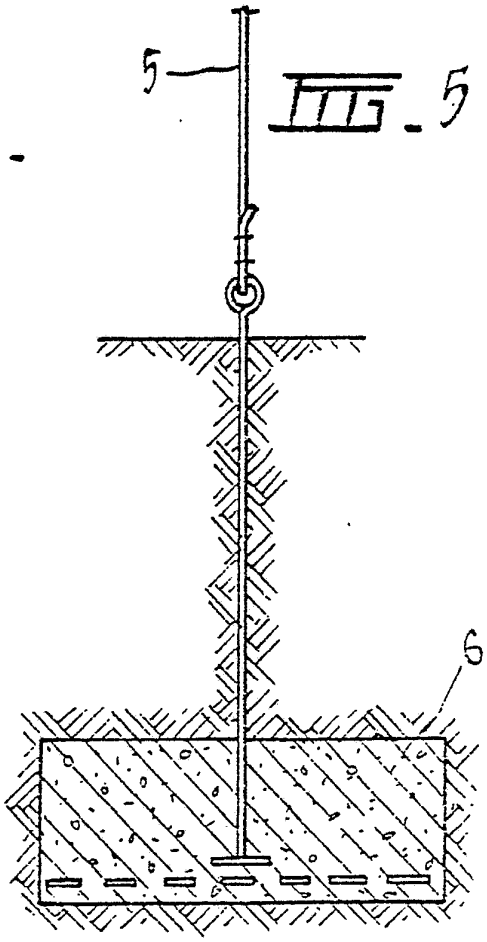



FIG. 5.

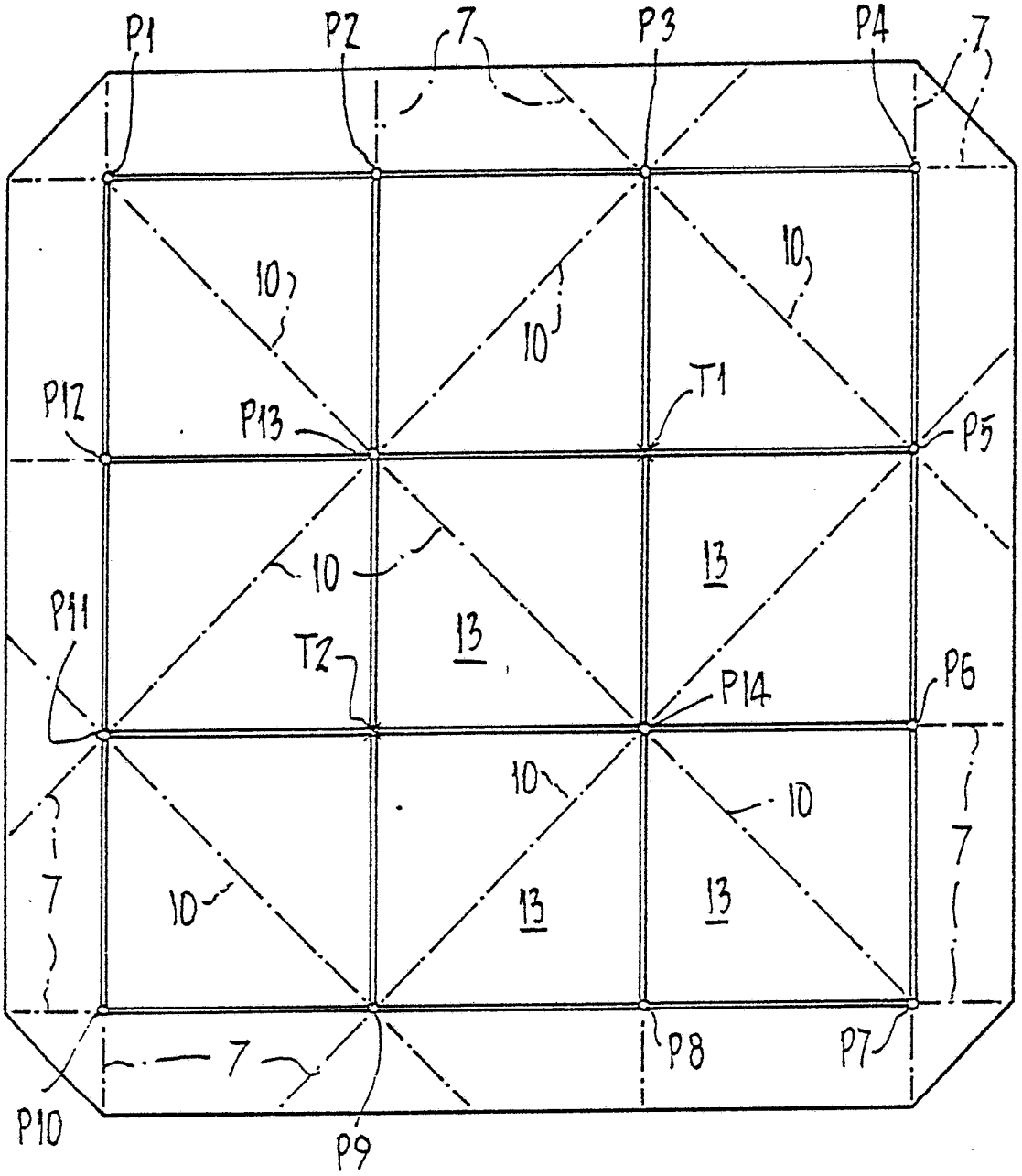
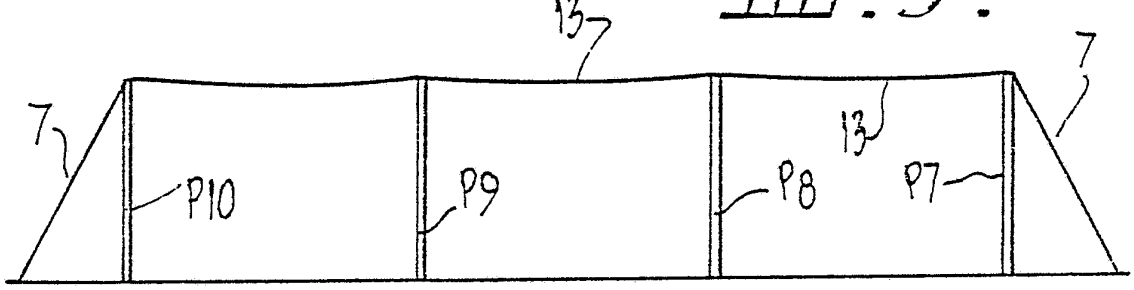



FIG. 2.

FIG. 3.



# INTERNATIONAL SEARCH REPORT

International Application No PCT/AU82/00186

## I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [3]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int. Cl.[3] E04B 1/347, A45F 1/00, 1/14; A01G 13/02, B60P 7/04, B60J 11/00

## II. FIELDS SEARCHED

Minimum Documentation Searched [4]

| Classification System | Classification Symbols |
|---|---|
| IPC | E04B 1/347; A45F 1/00; 1/14; A01G 13/02, B60P 7/04, B60J 11/00 |
| US Cl. | 47/26; 47/28 R |

Documentation Searched other than Minimum Documentation to the Extent that such Documents are included in the Fields Searched [5]

AU : IPC as above

## III. DOCUMENTS CONSIDERED TO BE RELEVANT [14]

| Category * | Citation of Document, [16] with indication, where appropriate, of the relevant passages [17] | Relevant to Claim No. [18] |
|---|---|---|
| X | AU,B, 3297/26 (HOSEASON COMPANY LIMITED) 31 May 1927 (31.05.27) | (1-2,7,12) |
| X | AU,B, 40495/78 (516815) (SPRUNG) 17 April 1980 (17.04.80) | (1,7,12) |
| X | US,A, 1622435 (FRAZEE) 29 March 1927 (29.03.27) | (1-2,7) |
| X | US,A, 3874396 (KIRKHAM) 1 April 1975 (01.04.75) | (1-2,7) |
| X | US,A, 4229914 (LUCAS) 28 October 1980 (28.10.80) | (1-2,7) |
| A | GB,A, 277443 (BERRY) 22 September 1927 (22.09.27) | (1,7) |
| X | GB,A, 637114 (FRIEDER) 10 May 1950 (10.05.50) | (1-2,7) |
| A | GB,A, 727178 (EDWARD R. BUCK AND SONS LTD) 30 March 1955 (30.03.55) | (1,7) |
| X | US,A, 3820840 (FORSBERG) 28 June 1974 (28.06.74) | (12,13) |
| X | US,A, 4162100 (MUSCILLO) 24 July 1979 (24.07.79) (& CA,A, 1077992) | (12,13) |

* Special categories of cited documents: [15]

"A" document defining the general state of the art which is not considered to be of particular relevance

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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

## IV. CERTIFICATION

| Date of the Actual Completion of the International Search [1] | Date of Mailing of this International Search Report [1] |
|---|---|
| 22 December 1982 (22.12.82) | 13 January 1983 (13-01-1983) |
| **International Searching Authority [1]** | **Signature of Authorized Officer [20]** |
| AUSTRALIAN PATENT OFFICE. | D.B. Cupitt |

Form PCT/ISA/210 (second sheet) (October 1981)

FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

| | | |
|---|---|---|
| X | US,A, 2979129 (KETCHUM) 11 April 1961 (11.04.61) | (12) |
| X | CH,B, 382000 (WEIDMANN & PITTET S.A) 14 November 1964 (14.11.64) | (12,14) |
| X | "THE COUNTRY LIFE BOOK OF NAUTICAL TERMS UNDER SAIL" Published 1978, by the HAMLYN PUBLISHING GROUP LTD LONDON. See pages 04.9 and 04.10 under chapter, "TYPES OF SAIL" and chapters "FORE-AND-AFT SAILS". | (12-14) |

V. ☐ OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE [10]

This International search report has not been established in respect of certain claims under Article 17(2) (a) for the following reasons:

1. ☐ Claim numbers _____, because they relate to subject matter [12] not required to be searched by this Authority, namely:

2. ☐ Claim numbers _____, because they relate to parts of the International application that do not comply with the prescribed requirements to such an extent that no meaningful International search can be carried out [13], specifically:

VI. ☐ OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING [11]

This International Searching Authority found multiple inventions in this International application as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this International search report covers all searchable claims of the International application.

2. ☐ As only some of the required additional search fees were timely paid by the applicant, this International search report covers only those claims of the International application for which fees were paid, specifically claims:

3. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:

4. ☐ As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

Remark on Protest

☐ The additional search fees were accompanied by applicant's protest.

☐ No protest accompanied the payment of additional search fees.