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(71) Applicant and

(72) Inventor: SNYDERS, Mark [AU/AU]; 4 Alexandria Parade, Coogee, NSW 2034 (AU).

(74) Agent: RANTZEN, Henry, John; 85 John Street, Woolahra, NSW 2025 (AU).

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Declaration under Rule 4.17:

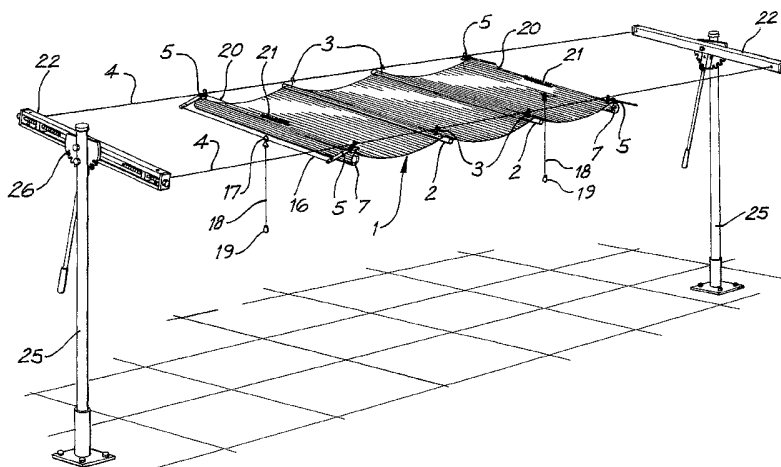
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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: OVERHEAD SCREEN



(57) Abstract: An overhead screen (1) is attached in a detachable manner to a pair of parallel runs of a wire strand (2) extending between two beams (22) which are arcuately movable in the vertical plane to different positions at which they can be locked by a locking unit (26 and 31) fixed between each member (22) and a post (25). The screen (1) is supported at each end by a rigid end-member (7) extending perpendicularly to the strand runs and has its intermediate portion supported by stiff spaced battens (2) extending parallel to the end-members. Downwardly opening hooks (3) projecting upwardly from the battens (2) allow them to be readily attached to, and detached from the strand runs. Mechanisms (5) at the ends of the end-members (7) have hooks similar to the batten hooks (3) to suspend the end members (7) from the strand runs. Pull cords (16) attached to the mechanisms (5) rotate the hooks of the mechanisms in unison against a resilient bias to turn them about vertical axes from positions at which their movement along the strand runs is resisted, to positions at which they allow the strand runs to pass freely through them. This allows the end-member to be moved to a different position along the strand runs and then held there by releasing the pull cords.

OVERHEAD SCREEN**Field of the invention**

This invention relates to an overhead screen and is more specifically, although not exclusively, concerned with a screen which can be moved to and locked at different positions in an adjustable manner and can be extended and contracted for convenience in order to provide at the different positions different degrees of protection from overhead ambient conditions.

State of the art

Adjustable screening assemblies are well-known. One form of such a screen assembly used to protect farm crops from excessive sunlight uses a rigid framework enclosing a crop-growing area and having an array of rollers carrying screening cloths and arranged along one side of the framework. Wires and pulleys are used to unwind the screening cloths to different extents so that they pass over the rollers and framework to provide the required degree of protection. Another form of screen assembly relies on a number of rigid screening panels mounted on a frame structure and moveable along overhead rails to provide the required screening. Both of these screen assemblies suffer from the disadvantage that their reliance on a rigid structure having numerous components makes them costly to purchase and erect.

Object of the invention

An object of the invention is to provide a relatively simple and inexpensive overhead screen assembly.

The invention

In accordance with the present invention an overhead screen assembly comprises: a screen of rectangular shape; end-members for supporting marginal portions of the

screen at one pair of opposite sides; spaced, stiff supports extending parallel to the end-members to support the intermediate portion of the screen; first means for suspending the end-portions of the supports from a pair of parallel spaced overhead strand portions in a manner which permits the supports to be moved to different positions along the strand portions; attachments connecting each end of at least one end member to respective runs of the strand; mechanisms controlling the positions of respective attachments and positioned at opposite ends of said one end-member, the mechanisms being operable to move the attachments between two conditions at one of which they resist movement along the strand portions and at the other of which the attachments allow such movement while supporting said one end member on the strand portions; and, second means for operating the mechanisms in unison to enable said one end-member to be moved, as required, to a different position along the strand portions.

Preferably the supports are provided by battens. Suitably the screen is looped over successive battens and fixtures such as screws are used to hold the screen on the battens.

Definition

In this specification the term “comprises” or “comprising” in a sentence defining the invention is to be understood as meaning that the features listed in the remainder of the sentence are the bare minimum essential for the carrying out of the invention and the definition is not to be regarded as excluding a combination of features which includes but is not limited to the recited bare minimum of features.

Preferred features of the invention

Preferably the supports and end members are supported from the strand portions by downwardly opening hooks extending upwardly and which are dimensioned to allow the hooks to be manually detached from the strand portions by lifting them so that

the strand portions pass through the openings of the hooks. This allows the screen to be detached bodily from the strand portions and stored, if not required.

Suitably beams are provided at opposite ends of the strand portions. These beams conveniently have associated locking and indexing units which are releasable to allow
5 the beams to be turned in the vertical plane about a horizontal axis positioned between the two strand portions. The locking and indexing units may be constructed to hold the beams in a desired angular position with respect to the vertical.

Conveniently one of the beams includes adjustment equipment operable to vary the tension of the strand portions which may each form part of a continuous strand which
10 has its ends attached to one of the beams and which undergoes a return loop in the second of the beams.

Introduction of the drawings

The invention will now be described in more detail, by way of example, with reference to the accompanying largely diagrammatic drawings, in which:-

15 In the drawings

FIGURE 1 is a perspective view partly broken away, of an overhead screen as seen from above and one side, the screen being mounted on a pair of horizontal parallel runs of a support strand extending between support beams respectively provided on a pair of upright spaced posts;

20 FIGURE 2 is an enlarged view of a detail of figure 1, and shows how battens carrying the weight of the intermediate portion of the screen are attached in a readily detachable manner to the parallel runs of the support strand;

FIGURE 3 is a perspective view from above of a mechanism used at the corners of the screen to fix its ends in chosen positions along one run of the strand, a ringed
25 portion of the mechanism being shown as an enlarged detail to assist understanding;

FIGURE 4 is a plan view of part of figure 3;

FIGURE 5 is a perspective view to an enlarged scale of an assembly mounted at the upper ends of each of the posts of figure 1;

FIGURE 6 is a vertical section through figure 7 taken on the line and in the direction
5 of the arrows VI-VI in that figure;

FIGURE 7 is a partly broken-away view of the back of a support beam containing equipment for adjusting the tension of the runs of the strand;

FIGURE 8 is a side view of a locking and indexing unit attached between each of the beams and a post and used to tilt the plane containing the two runs of the strand to
10 suit different applications and overhead ambient conditions; and,

FIGURE 9 shows an arrangement in which a screen assembly is adjustable to collect optimum solar energy as well as providing overhead protection.

Description of preferred embodiment

Figure 1 shows a rectangular screen 1 made up from closely spaced parallel reeds
15 wired, tied or bound together so that the screen is flexible in the direction of its length but not in the direction of its width. The screen is supported at intervals along its length by stiff parallel battens 2 extending parallel to the reeds and provided close to their ends with upwardly projection hooks 3 shown in more detail in figure 2, which are each looped over one of two horizontally-extending parallel runs of a strand 4 of
20 plastics-covered wire. The hooks 3 open downwardly towards the adjacent end of the battens 2.

The screen 1 extends over the tops the battens 2. The hooks 3 have threaded stems 6 which pass downwardly through the screen 1 and their lower ends are screwed into

holes in the battens 2. The screen 1 is thus held in position by the stems 6 and the weight of its intermediate portion is supported by the battens 2.

The two end-portions of the screen 1 are each wrapped around a stiff end-tube 7 as shown in figure 3, and has its convolutions 8 attached to the tube 7 by means of the mechanisms shown generally at 5. The mechanism 5 has a pivot pin 10 which passes vertically downwards through the end tube 7 and through the convolutions 8 of the screen 1 wrapped around the end-tube 7, to hold the mechanisms and end-portion of the screen in place. The pin 10 is rigidly attached to the end-tube 7. A first-order, angled lever 11 has two arms 12 and 13 and is pivoted at 9 to the protruding upper end of the pin 10 so that the arm 12 extends horizontally over the screen as shown in figure 3. An upwardly projecting hook 14 is attached at its lower end to the pivot 9 and opens downwardly. The arm 13 of the lever 11 extends beyond the end of the screen 1 and slopes slightly downwardly as shown. Holes 15 are formed towards the free end of the arm 13 for the attachment of a pull cord 16 that extends horizontally parallel to but spaced from the end-tube 7. The cord 16 passes through an eyelet 17 located in the centre of the wrapped-around portion of the screen 1 as shown in the ringed detail of figure 3. A triangular connector 50 dimensioned to be too large to pass through the eyelet 17, is attached to the ends of the two pull cords 16 which respectively extend to the two mechanisms 5 disposed at opposite ends of the end-tube 7.

The two arms 12 are biased resiliently towards one another by two tie cords 20 which are respectively connected to opposite ends of a coiled tensioning spring 21 as shown in figure 1. The spring 21 exerts sufficient bias on the two levers 11 to urge them towards the positions shown in figures 3 when the connector 50 engages the underside of the eyelet 17. The hook 14 provides an attachment attempting to twist the tensioned strand. This effectively locks the mechanism 5 in its position on the strand.

A pendant cord 8 having a knob 19 at its lower end, hangs from the connector 50. By pulling the knob 19 downwards, the bias of the spring 21 is overcome and the associated lever 11 is turned so that it assumes the position shown in broken outline in figure 4. The other lever 11 is likewise rotated and this movement turns the hooks 14 to a second condition at which they each lie in a plane which extends almost at right angles to the runs of the strand 4 passing through them. The strand runs can now pass freely through both hooks 14 and, by pulling the knob 19, the corresponding end-member of the screen 1 can be moved to whatever new position along the strand runs is required. When the knob 19 is released, the tension of the extended spring 21 causes the hooks 14 to re-assume their first condition on the runs of the strand as illustrated in figures 3 and 4 so that the end member is prevented from moving.

The two runs of the strand 4 extend horizontally between the two end-portions of two parallel metal support beams 22 of channel-shaped cross-section as shown in figures 6 and 7. The channels in the beams 22 provide access for mounting the strand runs. The free edge-portions of the sides of each channel are turned inwardly to provide beads 23 extending along their lengths and which act to strengthen the beams 22.

Turning now to figure 8, each beam 22 is pivoted at its centre to an upright support post 25 used to hold the ends of the horizontal runs of the strand 4 above ground level and to allow tilting to selected angles. The pivot is provided by a horizontal bolt 24 which passes through an indexing plate 26 shown in figure 5, and fixed to the post 25. The indexing plate 26 has an arcuate lower rim 28 formed with a line of notches 27 as illustrated, and forms part of an indexing and locking unit.

The centre of the underside of the beam 22 carries a hollow bracket 30. A cranked handle 31 arranged as a second-order lever projects downwardly from the bracket 30, and has an upper end 32 pivoted to rotate around a pivot shaft 33 arranged inside the bracket 30 and extending horizontally parallel to the beam 22. A locking pin 34 fixed to the handle 31 passes horizontally through a hole 35 in the front of the bracket 30 and in which it is axially slidable. The pin 34 also passes through a coiled

compression spring 36 arranged between the inside the bracket 30 and the handle 31. The spring 36 urges the handle 31 towards the post 25 as shown. The end of the pin 34 projecting from the bracket 30 on its side nearest the post 25 carries a collar 37 at its end. The collar 37 is sized to fit into any of the line of notches 27 formed around
5 the underside of the rim of the plate 26 as shown in figure 5. The collar 37 can be retracted from a notch 27 with which it is engaged, by pulling the handle 31 away from the post 25 against the resilience of the spring 36. This enables the beam 22 to be swung to a different arcuate position around the pivot bolt 24. The collar 37 can then be re-inserted into another notch 27 to hold the beam 22 in a new selected
10 position. By similarly adjusting the beam 22 attached to the other post 25, the plane containing the two parallel runs of the strand 4 can be set at different angles to allow the screen 1 to be tilted as required to suit the direction of the prevailing sunlight, for example.

Returning to figures 6 and 7, it will be seen that the interior of one of the beams 22
15 has the two ends of the strand 4 attached to it in an adjustable manner. The other beam 22 is of simpler construction as it serves only to carry a return loop of the strand 4 as will be described later.

The beam 22 of figures 6 and 7 has, towards its ends, two inlet holes 40 through which end-portions of the parallel runs of the strand 4 enter the beam 22. Smooth
20 cylindrical rods 41 are set at their ends in the side walls of the beam 22 adjacent the inlet holes 40 and allow the strand end-portions to turn horizontally and smoothly through ninety degrees inside the beam 22. The end portions of the strand 4 then pass one another and are anchored in holes 42 formed through respective travelers 43 mounted inside the beam 22. The travelers 43 are metal blocks shaped to slide
25 lengthwise along the interior of the beam 22. The holes 42 enable the ends of the strand 1 to be securely attached to respective travelers 43.

The position of each of the travelers 43 along the beam 22 is determined by a lead screw 44 having a nut formation 45 at one end outside an end cap 46 closing the end

of the beam 22. The lead screw 44 passes through a threaded central opening 47 in the traveler 43 as shown in figure 6 so that rotation of the formation 45 moves the traveler axially through the beam 22.

5 The second beam 22 disposed at the other end of the parallel runs of the strand 4 is required only to accommodate the return loop of the strand 4 and therefore is provided only with the two inlet holes 40 and two rods 41. These guide the strand 4 around the return loop with very little frictional resistance so that the tension in the strand 4 remains the same throughout its effective length.

Operation of preferred embodiment

10 The sliding screen assembly is set up and used as follows:

The two posts 25 are positioned where they are required. The beams 22 are attached to respective posts and the handles 31 are operated to engage each collar in one of the notches 27 at a position at which the handles 31 lie alongside the posts 25. The strand 4 is attached to one of the traveler blocks 43 and the other end of the strand is
15 threaded through the remote hole 40 and then through the corresponding hole of the second beam 22. The strand end is passed around the rods 41 of the second beam 22 and then out through its second hole 40 to complete a return loop for the strand. The end of the strand is then taken back to the first beam 22 and passed through the hole 40 and around the adjacent rod 41 in its interior. The end of the strand 4 is led
20 through the second beam 22 alongside the other end-portion of the strand, and secured to the distant traveler block 43 by way of the three anchor holes 42 formed through it.

Initial slackness in the strand is taken up by turning the heads 45 of the adjusters so that the traveler blocks 43 are progressively separated inside the beam 22 until the
25 required tension in the strand 4 is achieved.

The screen 1 is unwound and laid flat on the ground. Its shorter ends are wrapped around the end members until the required length of the screen extends between them. The pivot pins 10 are passed through the convolutions of the screen 1 which are wrapped around the end members 7 as shown in figure 3, and the threaded shank of the eyelet 17 is mounted likewise so that the eyelet 17 is positioned at either the underside or front of the end-member 7. If the screen 1 is to cover an area where it will not be accessible from beneath, such as if it is required to cover a swimming pool, the eyelet 17 is attached to the top of the end member 7.

The pull cords 16 are attached to the respective ends 13 of the levers 11 and their other ends are threaded through the eyelet 17 and attached to the triangular connector 50 when it is positioned close to the eyelet 17. The pendant cord 18 is also attached at one end to the connector 50 and the tie cords 16 are each attached between the connector 50 and an arm 13 of a respective levers 11. The other arm 12 of the lever 11 is connected by one of the tie cords 20 to a respective end of the tensioning spring 21. The effective lengths of the tie cords 20 is selected to bias the levers 11 under the tension of the tie cords 20 to the positions shown in figures 3 and 4.

Finally the battens 2 are placed beneath the screen 1 at chosen spaced positions. The hooks 3 are passed through the top of the screen so that their lower threaded ends 6 can be screwed into the end-portions of the battens 2, as shown in figure 2, until the hook lies in substantially the same vertical plane as the batten 2.

The screen is lifted into position. The hooks 3 at the ends of the battens 2 are looped over the parallel runs of the strand 4 and finally the pendant cord 18 (shown in the ringed detail of figure 3) is pulled to move the spring-tensioned levers 13 through almost ninety degrees from the positions shown in figure 4. This allows the hooks 14 of the mechanisms 5 to be looped in turn over respective runs of the strand 4 to attach the end members 7 to the strand 4. The pendant cord 18 is then released so that the levers 11 return under the bias of the spring 21 to the positions shown in figures 3 and 4. The hooks 14 are now at positions to resist movement of the strand through them.

The pendant pull cords 18 allow the two ends of the screen 1 to be moved independently and separately so that the screen can be folded to a condition at which it hangs in closely-spaced compact folds from the strand runs 4, to a condition at which it is fully extended along the strand runs. By moving the end members 7 of the screen separately, the screen can be moved to a chosen location and with a chosen extension to cover a selected area beneath it.

Modifications of preferred embodiment

The movement of the screen can be controlled remotely by tensioning the pull cords 18 with the aid of a powered capstan (not shown) which may be remotely controlled if desired and can be positioned at the upper end of one or both of the posts 25 and connected through cords to each end of the screen. Also, one or both beams 22 may be wall-mounted rather than mounted at the upper ends of a respective post 25. Likewise the manual system described and used to tilt the screen, may be replaced by a power-driven system which may, if desired, be remotely controlled.

The screen may be made of a range of different materials. However the use of parallel reeds for the construction of the screen is preferred, as this allows air to pass through the screen to lessen wind-loading and allow convecting air currents to pass upwardly through the screen so that the space beneath it remains cool. Also a parallel reed form of construction results in a soft broken or dappled light pattern beneath it which is restful and pleasing to the eye.

Figure 9 shows a different embodiment of the invention in which a screen assembly is modified to collect solar energy.

A screen 60 of flexible construction and which may be of the type described with reference to earlier figures, is strung from a pair of parallel strands 61 extending between a pair of beams 63 which can be turned in the vertical plane about rotational axes 64. One of the beams is connected through an indexing and locking unit 65 to a

wall 66 and the other beam is connected through a similar unit 67 to an upright post 68 positioned so that the strand portions 61 extend approximately north to south with the post 68 being at the north end of the strand 61, in the southern hemisphere. The locking units 65 and 67 are designed to be either hand adjusted as is the case with the locking units of earlier figures, or to be adjusted by electrical motors (not shown).

The screen 60 is supported from the strands 61 at spaced intervals along its length by downwardly-opening hooks 62 in similar manner to the screen 1 of earlier described figures. Likewise each end of the screen 60 is supported from the strands by a releasable locking mechanisms 69 constructed and operating as already described with reference to earlier figures.

The screen 60 hangs in generally "V"-shaped folds 70 between the hooks 62 as shown in the figure. The sides of the folds are referenced 71 and 72 respectively. The included angle of the fold, when partially opened, determines the extent to which the screen 60 is extended along the strands 61. This angle is shown in figure 9 as being about one hundred and twenty degrees. A solar energy collection panel 73 is mounted on the upper surface of each of the sides 72 so that it faces north, in the case of the southern hemisphere and south in the case of the northern hemisphere.

With the arrangement shown, the angle of the beams 63 with the horizontal is varied by the associated locking and indexing units 65 and 67 throughout the day, as also is the length to which the screen 60 is extended as this varies the angle made by the panels 73 with the horizontal. Thus the control of the locking units 65 and 67 and the extension of the screen 60 can be determined by a computer to maintain the panels 73 at the optimum angle to collect the maximum amount of solar energy available throughout most of the day.

CLAIMS

1. An overhead flexible screen assembly, comprising: a screen of rectangular shape; end-members for supporting marginal portions of the screen at one pair of opposite sides; spaced, stiff supports extending parallel to the end-members to support the intermediate portion of the screen; first means for suspending the end-
5 portions of the supports from a pair of parallel spaced overhead strand portions in a manner which permits the supports to be moved to different positions along the strand portions; attachments connecting each end of at least one end member to respective runs of the strand; mechanisms controlling the positions of respective
10 attachments and positioned at opposite ends of said one end-member, the mechanisms being operable to move the attachments between two conditions at one of which they resist movement along the strand portions and at the other of which the attachments allow such movement while supporting said one end member on the strand portions; and, second means for operating the mechanisms
15 in unison to enable said one end-member to be moved, as required, to a different position along the strand portions.

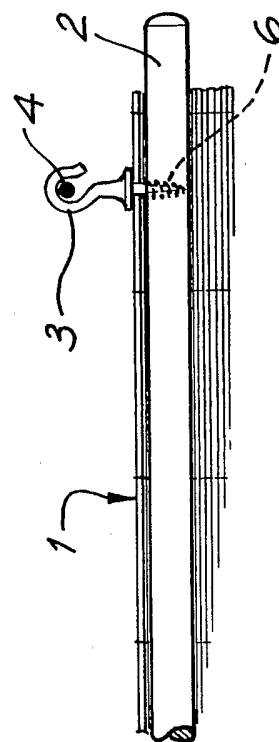
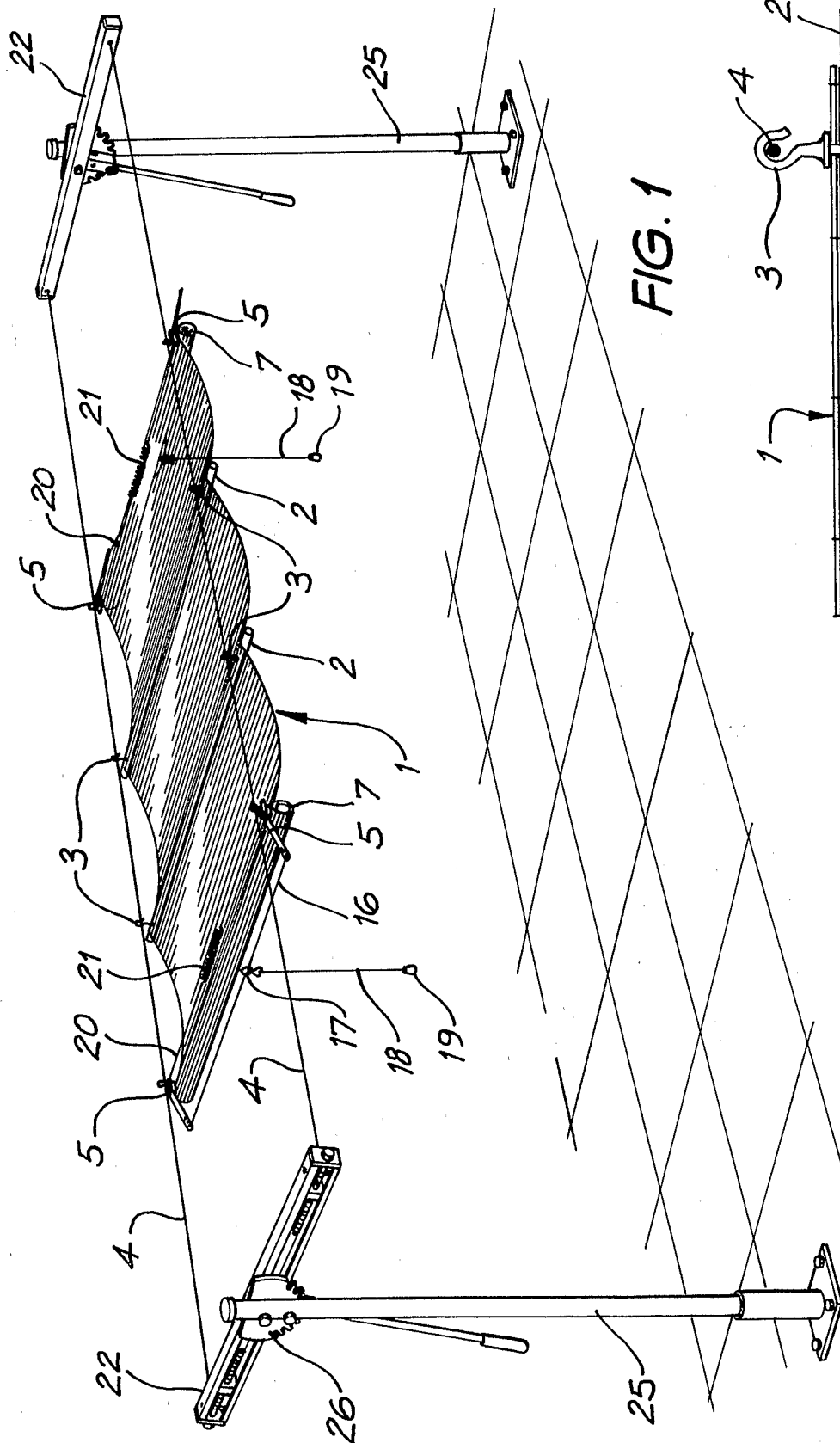
2. An assembly as set forth in claim 1, in which the second means comprises pull cords and the supports comprise battens.

3. An assembly as set forth in claim 1 or claim 2, in which the supports are
20 carried from the strand portions by downwardly opening hooks dimensioned to allow the strand portions to be manually detached from the hooks by way of the openings.

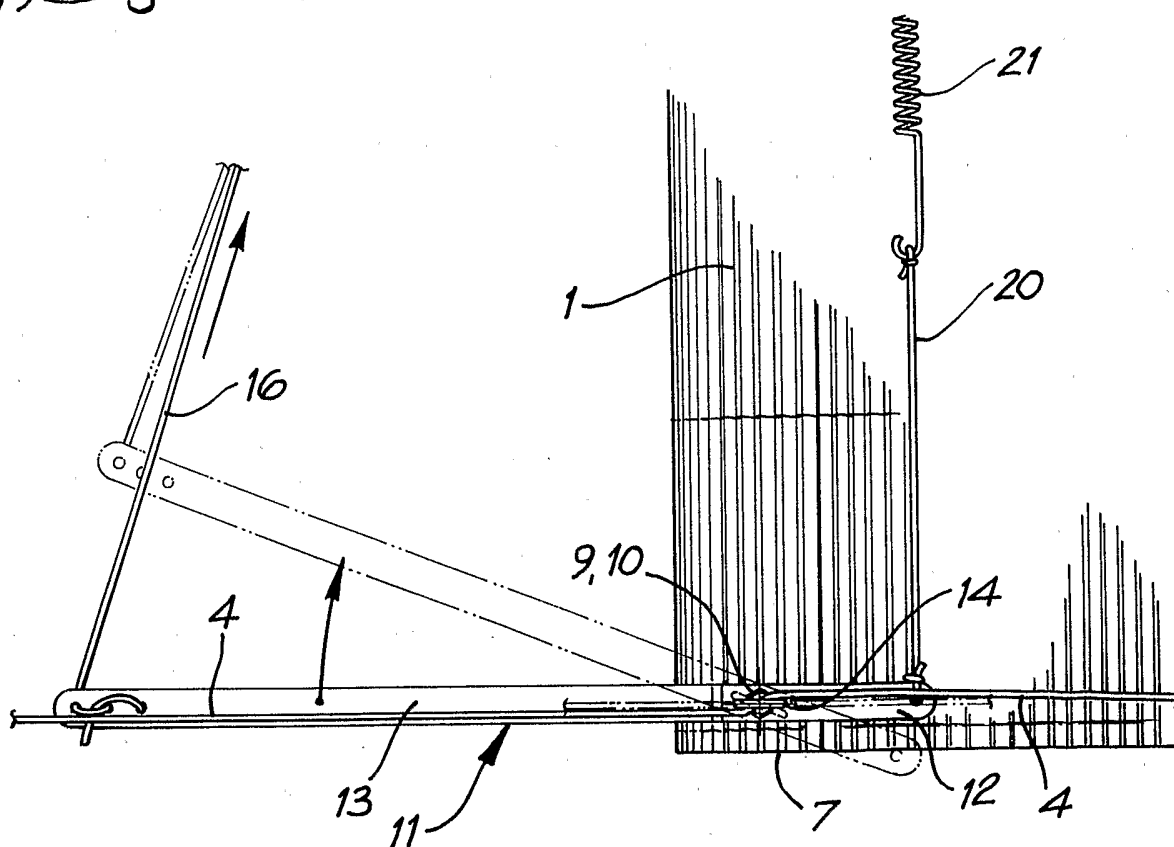
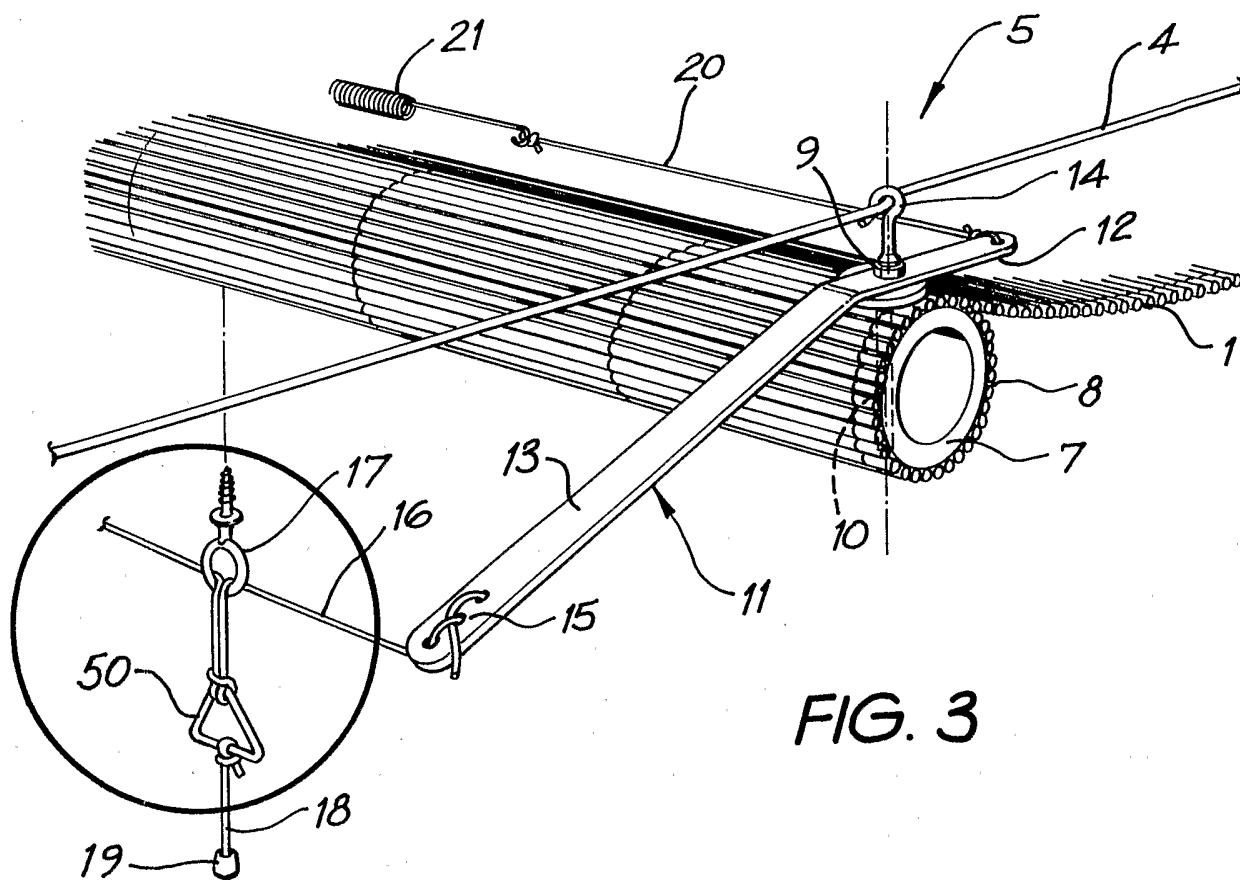
4. An assembly as claimed in any one of the preceding claims, in which each
25 mechanism has a downwardly-opening support hook dimensioned to be looped over a strand portion and rotatable by operation of the second means from a first orientation at which the plane of the eye of the support hook extends in the direction of the strand portion to resist its movement through the eye, and a

second orientation at which the plane of the eye extends transversely of the strand portion to free its movement along the strand portion.

5. An assembly as claimed in any one of the preceding claims, in which a pendant pull cord controls the operation of both mechanisms in unison.
- 5 6. An assembly as claimed in any one of the preceding claims, in which one pair of ends of the strand portions are attached to respective ends of a beam pivoted to be turned about a horizontal axis midway between the strand portions, the beam having an indexing mechanism allowing it to be held in any one of a number of different positions around the beam pivot.
- 10 7. An assembly as claimed in claim 6, in which one of the beams contains a tension-adjustment device for altering the effective length of the strand portions which form sections of a single strand having a return loop supported by the second beam.
- 15 8. An assembly as claimed in claim 7, in which the adjustable device includes a traveler block inside the beam and to which one strand portion is attached, the block being movable lengthwise of the beam by a lead screw accessible from one end of the beam.
- 20 9. An assembly as claimed in claim 8, in which the first beam contains two traveler blocks independently movable along its length, and the end-portions of the strand pass one another inside the first beam and are connected to respective traveler blocks.
10. An assembly as claimed in any one of the preceding claims, in which both end members are moveable along the strand portions under the control of pull cords extending horizontally to one or both ends of the strand portions.



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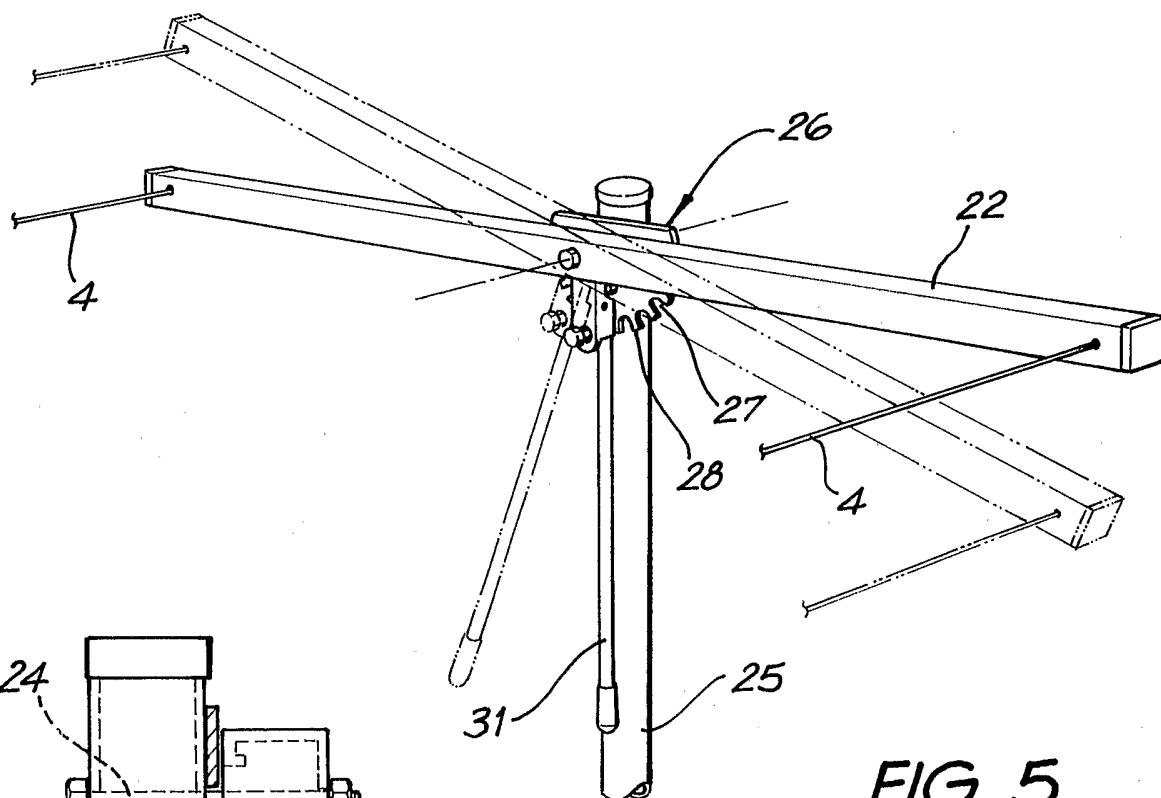


FIG. 5

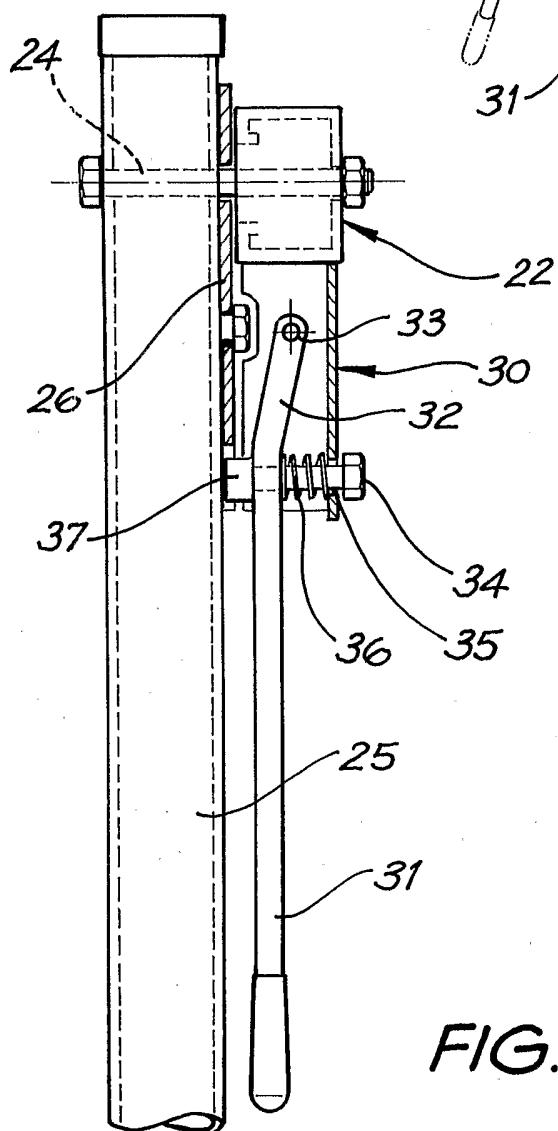


FIG. 8

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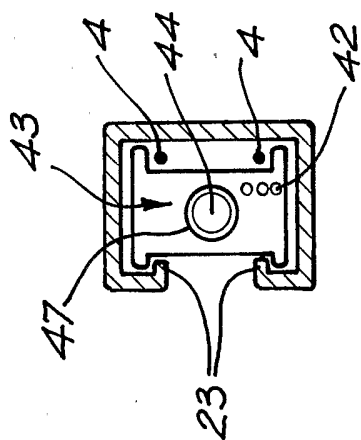


FIG. 6

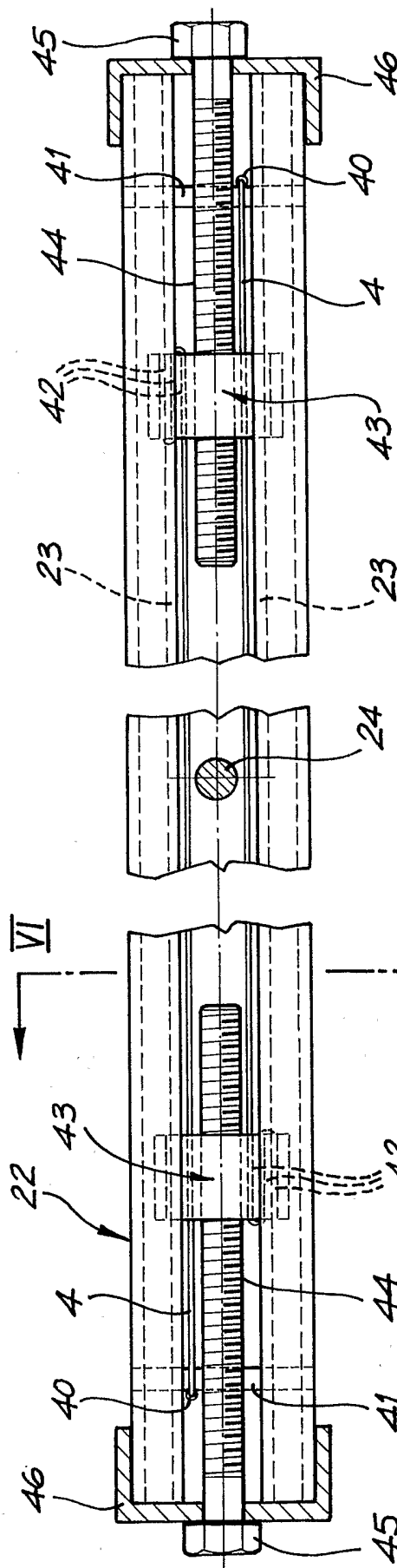


FIG. 7

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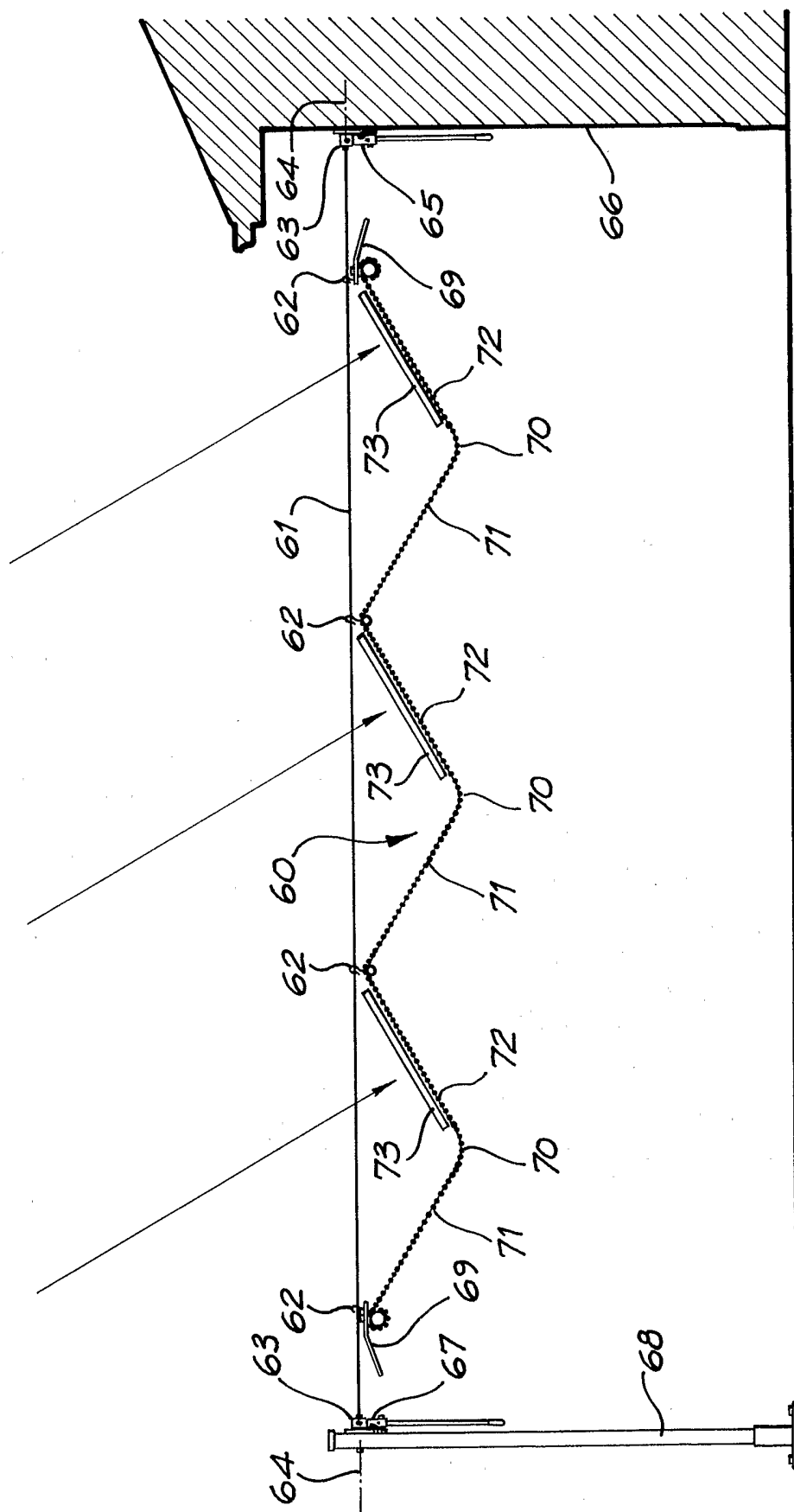


FIG. 9

INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU2005/001406

A. CLASSIFICATION OF SUBJECT MATTER Int. Cl. ⁷ : A01G 13/02, 9/14, 9/22, E04H 5/08, 15/58, E04F 10/02 According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched AU IPC A01G 13/02, 9/14, 9/22, E04H 5/08, 15/58, E04F 10/02 (1975 - 2005) Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) DWPI IPC A01G, E04H and keywords: screen, canopy, shade, protection, sail, cover, awning, panel, sun, solar, light, heat, flexible, pliable, resilient, wire, strand, cable, cord or similar terms.		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	AU 41790/93 A (TURNER et al) 6 January 1994 Whole document	1 - 10
A	AU 46069/93 A (TUBE TECHNOLOGY PTY. LTD.) 10 March 1994 Whole document	1 - 10
A	AU 28379/97 A (HALL) 15 January 1998 Whole document	1 - 10
A	WO 1997/034066 A1 (WITKOWSKI) 18 September 1997 Whole document	1 - 10
A	EP 0123226 A1 (HOME AND CASTLE INCORPORATED) 31 October 1984 Whole document	1 - 10
☒ Further documents are listed in the continuation of Box C ☒ See patent family annex		
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INTERNATIONAL SEARCH REPORT

International application No.
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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5692534 A (BRUMFIELD) 2 December 1997 Whole document	1 – 10
A	US 3481073 A (YOSHIDA et al) 2 December 1969 Whole document	1 – 10

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/AU2005/001406

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report			Patent Family Member				
AU	41790/93	NONE					
AU	46069/93	NONE					
AU	28379/97	NONE					
WO	9734066	AU	21855/97	EP	0886710	SE	9600997
EP	0123226	JP	59206584	US	4557310		
US	5692534	NONE					
US	3481073	NONE					
Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.							
END OF ANNEX							