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London WC1N 2LS(GB)**(54) **Apparatus coupling a sail to a mast.**

(57) Apparatus is provided which permits a sail (2) to be switched from non-camber induced mode to camber induced mode simply and effectively. To achieve this a coupling (7) is provided on a mast, the coupling including a pair of arms (14, 15) extending towards the rear of the sail and converging to define an area (16) within which a forward end of a sail and respective batten (6) can move freely. Anchor means in the form of a plate (8) is disposed within the area (16) and receives a forward edge (4) of the sail and respective batten. The plate (8) can be selectively adjustable, by means of a strap (10) between a forward position proximate either side of the mast, at which forward position the sail is in its non-camber induced mode, and a rearward position away from the mast, at which rearward position the sail is in its camber induced mode. In a second aspect of the invention there is provided apparatus including a sail having one or more battens and one or more couplings (7) of the type described.

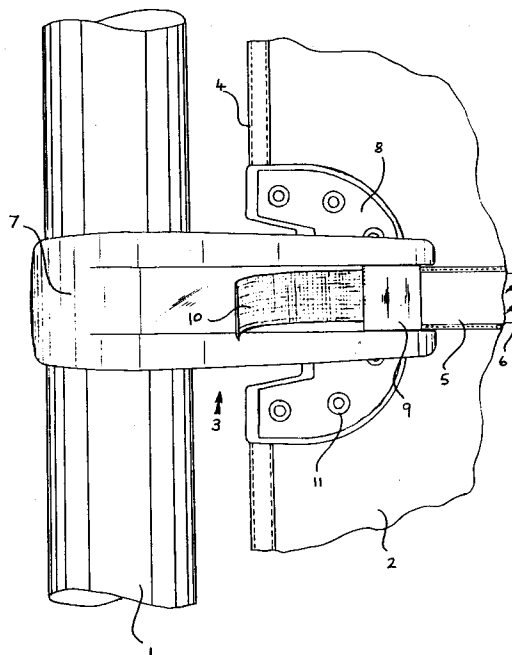


FIGURE 1

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This invention relates to sailing apparatus such as, for example, apparatus used by windsurfers.

Such apparatus typically comprises a sail, a mast and a surfboard upon which the windsurfer stands. Usually, although not essentially, the sail includes an elongate sleeve at the forward end thereof into which is inserted the mast, the sail being retained on the mast by downward tension from a downhaul connected to the lower end of the mast. A number of battens are usually provided on the sail and contained in batten pockets sewn therein, the battens serving to support, for example, areas of roach in the sail.

It is known to incorporate devices in such sailing apparatus to improve the camber of the sail to, in turn, improve the overall performance of the apparatus. One such way of achieving this end is to utilize what is commonly referred to as a camber inducer, being a device comprising a collar which at least partially surrounds the mast on the rearward side thereof i.e. the side facing the main area of sail, the collar being rotatable on the mast and being adapted to receive the forward end of a batten, typically in such a manner as to permit the forward end of the batten to move laterally i.e. to waggle, whilst restraining forward movement of the batten so that it does not come into contact with the mast. Such camber inducers have the advantage of effectively providing a double joint such that when compressive forces are transmitted to the batten and hence the mast via a batten tensioner at the other end of the batten proximate the leach of the sail, the collar tends to swivel to the left or right, as desired, of the mast and because of the batten's ability to move laterally within the collar, a high degree of camber may be induced into the forward part of the sail which would otherwise be impossible if the batten were simply rigidly connected to the collar.

Such camber inducers have found popularity in the sport of windsurfing because of the consequential increase in aerodynamic efficiency in many wind conditions and points of sail, particularly when sailing upwind. However, it is known that inducing high degrees of camber can cause handling problems, for example, during transitions from one tack to another, or when the apparatus is overpowered. This latter problem can be alleviated to some extent by simply increasing the pressure on the out-haul and the downhaul which thereby tends to flatten the sail somewhat but this procedure can be tricky to perform during use of the apparatus on the water and it does not always reduce the camber to the desired level.

However, the handling problems associated with a camber induced sail can never be completely eliminated by outhauling and downhauling the sail. Such a camber induced sail will always

exhibit handling disadvantages during transitions relative to a similar but non camber-induced sail, the latter affording a lower level of aerodynamic efficiency and hence power. This is because in order for the sail to be easily handled there is a need to be able to de-power the sail during e.g. transitions and other types of sailing where full power is unnecessary.

In view of the foregoing considerations, it may be said that there are essentially two different categories of sail available, with mutually exclusive advantages and disadvantages. Camber induced sails have greater aerodynamic efficiency and speed but poorer handling relative to non-camber induced sails. On the other hand, non-camber induced sails are easily handled but are less aerodynamically efficient because, by definition, they have a shallower draft.

From the foregoing it will be apparent that there is a need to provide apparatus which can quickly and easily be switched from what may be termed camber induced mode to non-camber induced mode, the latter being representative of sailing apparatus in common use prior to the adoption of camber inducers of the type described and vice versa.

It is an object of the present invention to provide apparatus in which the aforementioned disadvantages are obviated and with which it is possible to simply and quickly vary the amount of camber in a sail by switching from camber induced mode to non-camber induced mode, or to positions intermediate these extremes.

According to a first aspect of the invention there is provided apparatus for coupling a sail, of the type requiring or including one or more battens, to a mast, the apparatus comprising a collar at least partially surrounding the mast and adapted to be rotatable thereon, a pair of relatively rigid arms extending from either side of the collar proximate the mast in a direction generally towards the rear of the sail, the arms converging to define an area within which a forward end of the sail and respective batten can move freely, anchor means for receiving said forward edge of the sail and respective batten within said area, the position of said anchor means being selectively adjustable between a forward position proximate either side of the mast, at which forward position the batten is relatively uncompressed such that the sail essentially assumes a non-cambered mode and a rearward position away from the mast, at which rearward position the batten is relatively compressed such that the sail can essentially assume a camber induced mode.

Preferably, the anchor means is adapted to be fixed, e.g. by rivets, to the forward edge of the sail although it will be appreciated that it may instead,

simply slideably receive the forward edge of the sail as in, for example, an appropriately sized slot, a wider slot being provided for the batten. The anchor means may comprise a relatively rigid plate including such a slot for receiving the forward edge of a sail and a further slot for receiving the forward end of a batten. The plate may also include a recessed portion at the forward end thereof of a width greater than the width of each of the arms such that the forward edge of the sail can take up a position on either side of the mast forward of the arms when the anchor means is in its forward position proximate either side of the mast.

The anchor means may be adjustable between forward and rearward positions by means of a strap fixed to one of the arms and releasably securable to the other arm, the anchor means being trapped by the strap such that when the strap is fully tightened the anchor means assumes the rearward position, thereby compressing the batten and causing it to bend, and when the web is fully released, the anchor means assumes a forward position on either side of the mast, thereby releasing the compression of the batten so that the sail assumes an essentially non-cambered mode. Obviously, the strap may be used to position the anchor means intermediate the forward and rearward positions to adjust the amount of camber. Equally obviously, the strap may be adjustable from the sides of both arms if desired.

A spring-biassed switch may be provided to trap part of the strap to thus secure the anchor means in any desired position at or between the rearward position and the forward position. The switch itself may comprise a toggle adjacent to or within one or both of the arms, with one end of the toggle being biassed against part of the respective arm to thus trap a corresponding part of the strap such that upon pressure being applied to the other side of the toggle, the strap can be released.

The apparatus may further include a roller at the end of each arm adapted to bear against the batten and/or that part of a sail adjacent the batten to reduce friction therewith during forward or rearward movement of the anchor means.

The apparatus may further be provided with a rotatable tube within the collar adapted to be slideably received on the mast, the outside of the tube acting, at least in part, as a bearing for the mast to facilitate or improve rotation of the coupling thereon and to reduce friction therebetween. Thus, the tube may be adapted to grip the mast so that, in use, it does not rotate relative to the mast, the collar rotating on the tube. The tube may also include internal ribs which bear against the outside of the mast, the space between the ribs facilitating egress of sand or other unwanted materials from the gaps between the ribs. The tube may extend

further up the mast then the width of the collar to assist in keeping the collar properly orientated with respect to the mast, i.e. to help prevent it from rocking.

According to a second aspect of the invention, there is provided apparatus comprising a sail of the type requiring or including one or more battens, the sail being connectable to a mast by one or more couplings, each coupling comprising a collar for at least partially surrounding the mast and being adapted to be rotatable thereon, a pair of relatively rigid arms extending from either side of the collar proximate the mast in a direction generally towards the rear of the sail, the arms converging to define an area within which a forward end of the sail and the respective batten can move freely, anchor means for receiving said forward edge of the sail and respective batten within said area, the position of said anchor means being selectively adjustable between a forward position proximate either side of the mast at which forward position the batten is relatively uncompressed such that the sail essentially assumes a non-camber induced mode, and a rearward position away from the mast, at which rearward position the batten is relatively compressed such that the sail can essentially assume a camber induced mode.

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

Figure 1 is a side elevation of part of a windsurfing sail and mast assembly incorporating or comprising apparatus according to the invention. Figure 2 is a schematic sectional view corresponding to Figure 1 but with part of the inside of the apparatus of the invention exposed. Figure 3 is a schematic plan-view of the apparatus of Figure 1 showing the mode of operation thereof.

Figure 4 is an exploded view of the anchor means utilizing the apparatus according to the invention of Figures 1 to 3.

Figure 5 is an end elevation of the anchor means of Figure 4 in its assembled position.

Figure 6 is a side elevation of apparatus according to the second embodiment of the invention attached to a mast.

Referring firstly to Figure 1, there is shown part of a mast 1 and a sail 2 which is coupled to the mast by apparatus shown generally at 3 in a manner to be described below. The forward end 4 of the sail 2 includes a stitched reinforced edge. At right-angles to the sail edge 4 is a stitched batten pocket 5 within which can be seen part of a batten 6. The batten is secured against movement in the pocket 5 away from the mast by means of a conventional batten tensioner (not shown) which is used to tension the sail 2.

The apparatus 3 comprises a coupling 7 in the form of a collar, anchor means in the form of an ear-shaped plate 8, a toggle switch 9 and an adjustable strap 10. The ear-shaped plate 8 has a thin central slot (not shown) within which is disposed the sail 2 and a slightly larger slot for receiving the batten pocket 5. The plate 8 is secured to the sail 2 by means of rivets 11 which each pass through one side of the plate 8 and the sail 2 and emerge at the other side of the plate 8 (not shown) such that the plate 8 is effectively secured to the sail 2 and thus the batten pocket 5.

In Figure 2 it will be seen that the plate 8 includes a recessed portion 12 which is wider than the width of the coupling 7, for reasons which will be explained below.

The plate 8 has a slot 13 at the forward end thereof within the recess 12 and through which is received part of the strap 10.

In Figure 3 it will be seen that the coupling 7 has two arms 14, 15, arm 14 corresponding to part of the coupling 7 as shown in Figure 1 and arm 15 corresponding to that part of the coupling shown in Figure 2. The arms 14, 15 converge in a direction towards the rear of the sail defining an area 16 within which the forward edge of the sail 2 (not shown) and batten 6 (shown in outline) can move. It will be seen from Figure 3 that part of the strap 10 is anchored to arm 15 near the rearward end thereof by a rivet 17, from where the strap is looped through slot 13 in plate 8 and is then trapped by switch 9 such that on release thereof, the plate 8 and thus sail 2 and batten 6 move forward to the position shown in outline, or to any intermediate positions therebetween depending on the extent of release of the strap 10. The position shown in solid line depicts the apparatus in its fully camber induced mode and in which the batten is fully compressed by virtue of the strap 10 being tightened, and the position shown in outline depicts the apparatus in its non-camber induced mode with the sail 2 and forward end of batten 6 being positioned on the left hand side of the mast when viewed from the rear of the sail, although it will be appreciated that the plate 8, sail 2 and batten 6 could also move to the right hand side of the mast 1, depending upon the tack required.

Movement of the plate 8 and hence sail 2 and batten 6 is achieved by pulling on the free end of the strap 10, to move the plate rearwards and by releasing the strap by pressing the toggle switch 9, the plate resumes its forward or "rest" position.

It will be noted that in the position shown in outline, the recessed portion 12 of the plate 8 is trapped within the corner defined by the collar 7 and arm 14 and in this position the end of the batten 6 and hence the sail cannot move further forwards. Even so, it will also be noted that in view

of the presence of the recess 12, the leading edge 4 of the sail 2 is able to take up a position next to the mast forward of arm 14 to the position shown at "A". Of course, the plate 8 could instead equally occupy the corner defined by the collar 7 and arm 15, depending upon the tack required.

At the rear of the arms 14, 15 shown in Figure 3, there are also respective rollers 18, 19 which are adapted to bear against the outside of the batten pocket 5 (not shown) and facilitate essentially frictionless contact between the apparatus 3 and the sail 2 and batten pocket 5. Also, ribs 20 are provided on the inside of a tube 21 within the Collar 7, the tube acting as a bearing for the mast upon which the collar 7 is rotatable and the ribs serving to permit the egress of sand etc. from around the mast.

In Figure 4 there is shown an exploded view of the plate 8 in which it will be seen that it is comprised of two parts 8a and 8b, each part including a recessed portion 22a, 22b.

In Figure 5 is shown an endwise elevation of the plate 8 shown in Figure 4 in its fully assembled position in which it will be seen that there is a large central slot 22, defined by the recesses 22a and 22b shown in Figure 4, and a thin slot 23 running along the entire width of the plate 8. Slot 22 is used to receive the forward end of the batten pocket 5 within which is a batten 6. Slot 23 is used to receive the forward end of the sail 2, the sail being secured within the slot 23 by rivets (not shown) inserted in the holes provided therefore as shown in Figure 4.

In Figure 6 there is shown a sail and mast assembly in accordance with the teaching of the second aspect of the invention, the sail 2 including at the forward edge thereof a pair of luff sleeves 24, 25 slideably mounted on a mast 1. The sail also includes an eyelet 26 for attaching to an outhaul (not shown) and at the end of each batten pocket 5 there is disposed a batten tensioner 27 of conventional type, comprising a buckle by which compressive forces can be transmitted to the forward end of each batten. In the drawing it will be seen that the coupling 7 is mounted for rotation about the mast 1 at the bottom end of the luff sleeve 24. Although one coupling is shown in the drawing, it will be obvious to those skilled in the art that two or more couplings could be used if desired, it being understood and appreciated that if more than one such coupling is used it may be desirable to provide means for common adjustment of all such couplings as, for example, by the use of a pulley system.

Although the invention has been described with reference solely to a sail and mast assembly, nevertheless it will be appreciated that the invention could also be used, for example, in other flex-wing

apparatus such as in microlite aircraft, hanggliders etc.. Thus, the terms "sail" and "mast" as used herein are intended to cover such other assemblies as use the same principle of the invention described herein.

Claims

1. Apparatus for coupling a sail, of the type requiring or including one or more battens, to a mast, the apparatus comprising a collar at least partially surrounding the mast and adapted to be rotatable thereon, a pair of relatively rigid arms extending from either side of the collar proximate the mast in a direction generally towards the rear of the sail, CHARACTERIZED IN THAT the arms converge to define an area within which a forward end of the sail and respective batten can move freely, anchor means are provided for receiving said forward edge of the sail and respective batten within said area, the position of said anchor means being selectively adjustable between a forward position proximate either side of the mast at which forward position the batten is relatively uncompressed such that the sail can essentially assume a non-camber induced mode, and a rearward position away from the mast, at which rearward position the batten is relatively compressed such that the sail can essentially assume a camber induced mode. 10 15 20 25 30
2. Apparatus according to Claim 1 further characterized in that the anchor means is adapted to be fixed to the forward edge of the sail. 35
3. Apparatus according to Claim 1 or Claim 2 further characterized in that said anchor means comprises a relatively rigid plate including a slot for receiving the forward edge of a sail and a further slot for receiving the forward edge of a batten. 40
4. Apparatus according to Claim 3 further characterized in that said plate also includes a recess portion of a width greater than the width of each of the arms such that the forward edge of the sail mast take up a position on either side of the mast forward of the arm thereof when the anchor means is in its forward position either side of the mast. 45 50
5. Apparatus according to any preceding claim further characterized in that said anchor means is adjustable between said forward and rearward positions by means of a strap fixed to one arm and releasably securable to the other arm, the anchor means being trapped by the 55

strap such that when the strap is fully tightened the anchor means assumes the rearward position and when the web is fully released, the anchor means assumes the forward position on either side of the mast.

6. Apparatus according to Claim 5 further characterized in that it includes a spring-biased switch adapted to trap part of the strap to thus secure the anchor means in any desired position at or between the rearward position and the forward position.
7. Apparatus according to Claim 6 further characterized in that the switch comprises a toggle adjacent to a rib on an arm, with one end of the toggle being biased against the rib to thus trap part of the strap such that upon pressure being applied to the other side of the toggle, the strap is released.
8. Apparatus according to any preceding claim further characterized in that it includes a roller at the end of each arm adapted to bear against the batten and/or that part of a sail adjacent the batten to reduce friction therewith during forward or rearward movement of the anchor means and hence sail and batten.
9. Apparatus according to any preceding claim further characterized in that it includes a rotatable tube within the collar adapted to be slideably received on a mast, the outside of the tube acting, at least in part, as a bearing for the mast to facilitate or improve rotation of the coupling thereon and to reduce friction therebetween.
10. Apparatus according to Claim 9 further characterized in that the tube includes ribs on the inside thereof, the ribs being adapted to bear against the outside of the mast and the space is between the ribs facilitating egress of sand or other unwanted materials.
11. Apparatus comprising a sail of the type requiring or including one or more battens, the sail being connectable to a mast by one or more couplings, each coupling comprising a collar for at least partially surrounding the mast and being adapted to be rotatable thereon, a pair of relatively rigid arms extending from either side of the collar proximate the mast in a direction generally towards the rear of the sail, CHARACTERIZED IN THAT the arms converge to define an area within which a forward end of the sail and respective batten can move freely, anchor means are provided for receiving said

forward edge of the sail and respective batten within said area, the position of said anchor means being selectively adjustable between a forward position proximate either side of the mast at which forward position the batten is relatively uncompressed such that the sail can essentially assume a non-cambered mode, and a rearward position away from the mast, at which rearward position the batten is relatively compressed such that the sail can essentially assume a camber induced mode.

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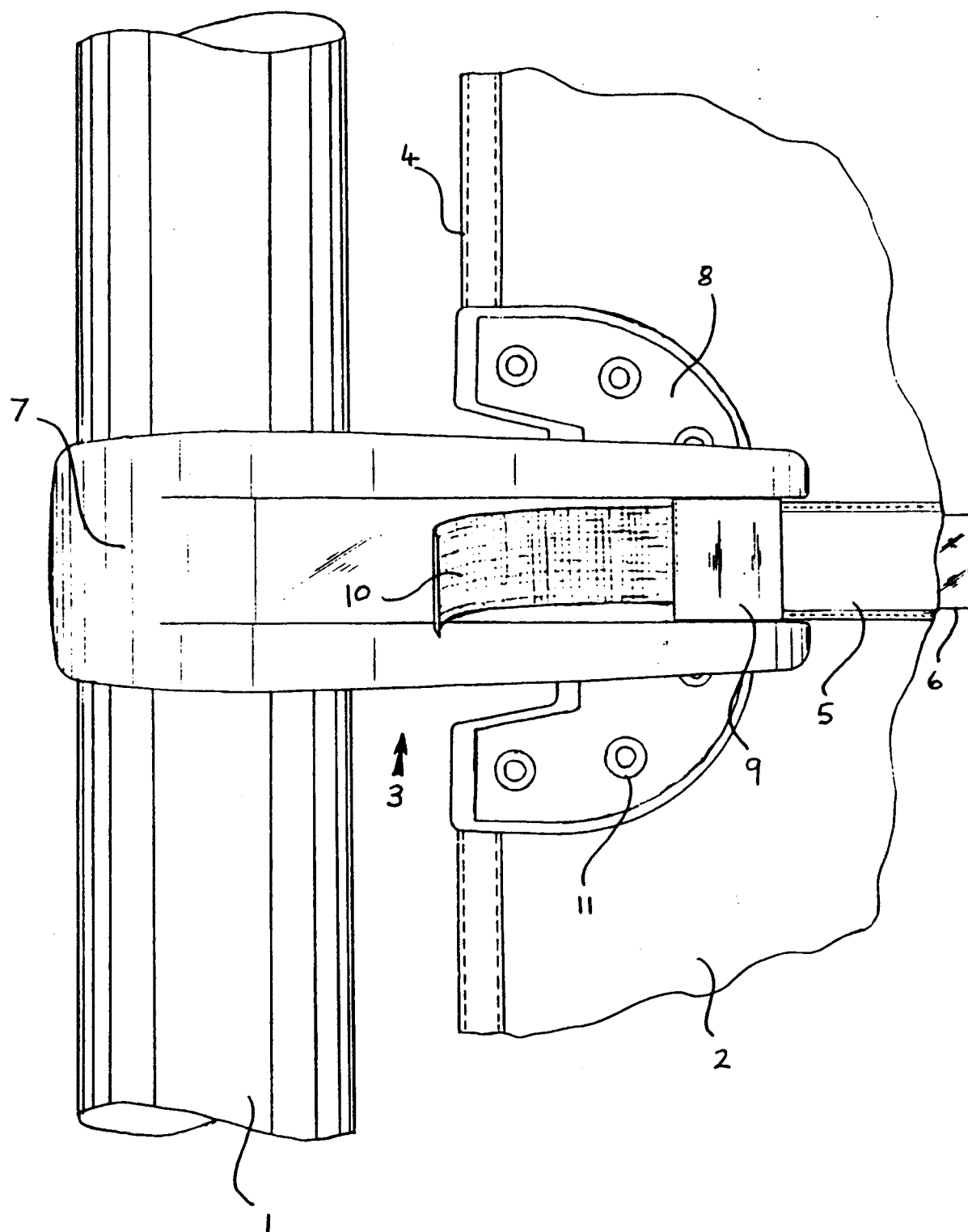


FIGURE 1

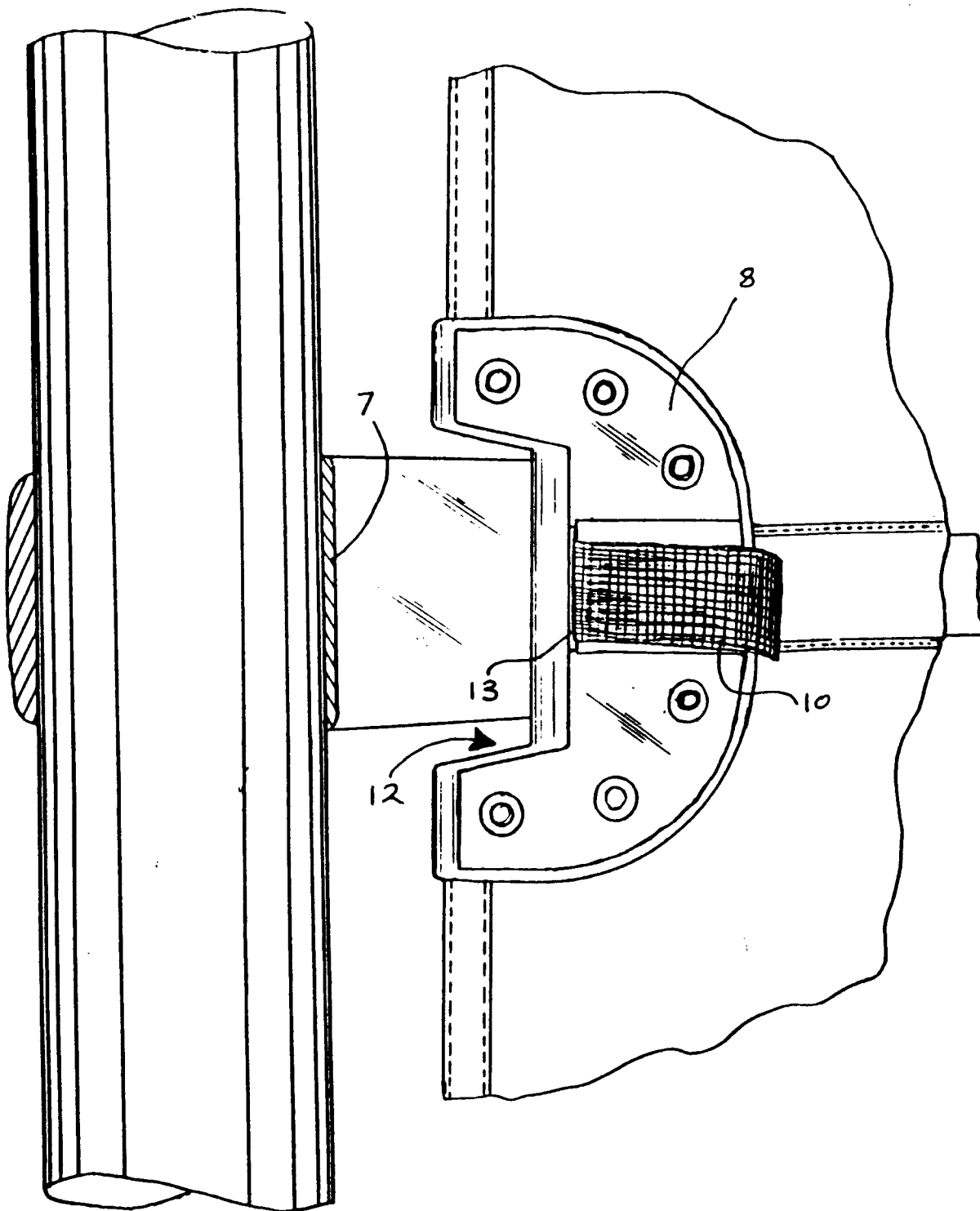


FIGURE 2

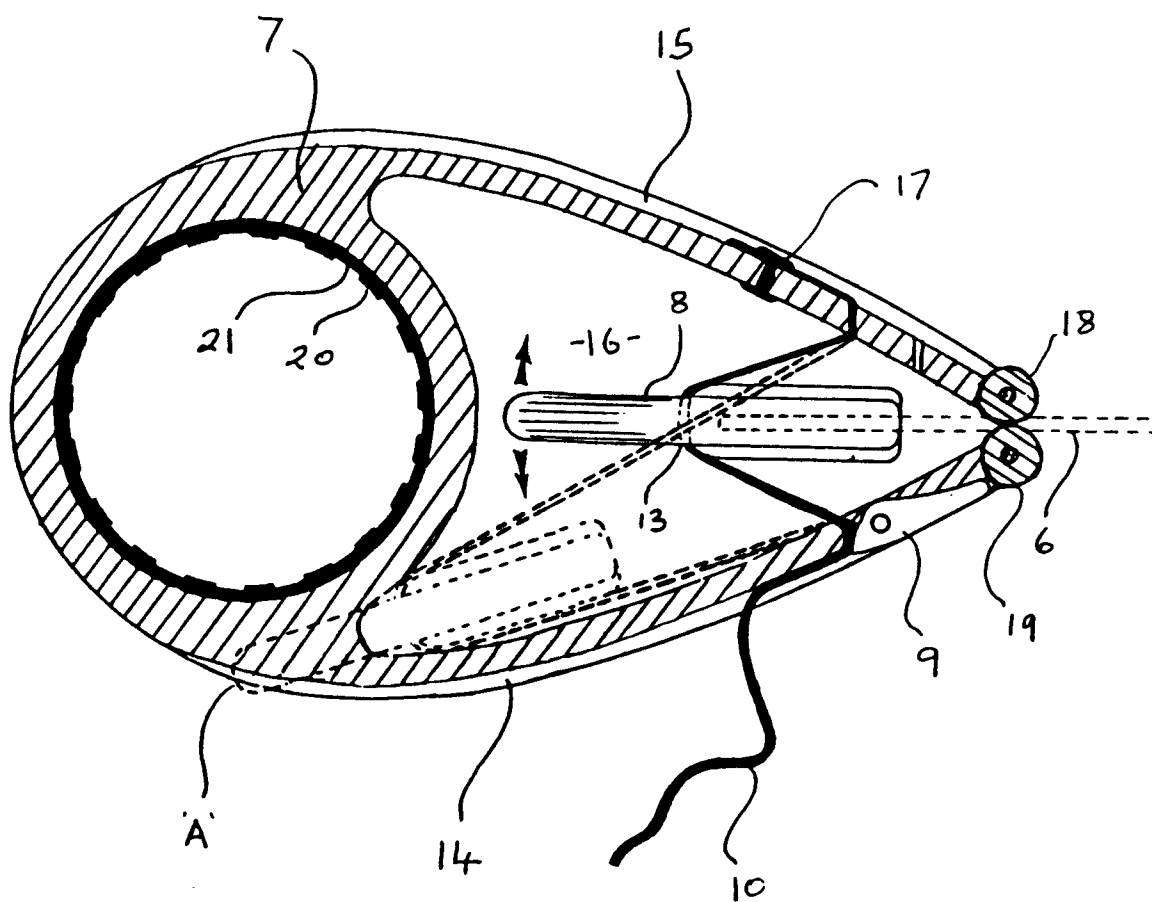


FIGURE 3

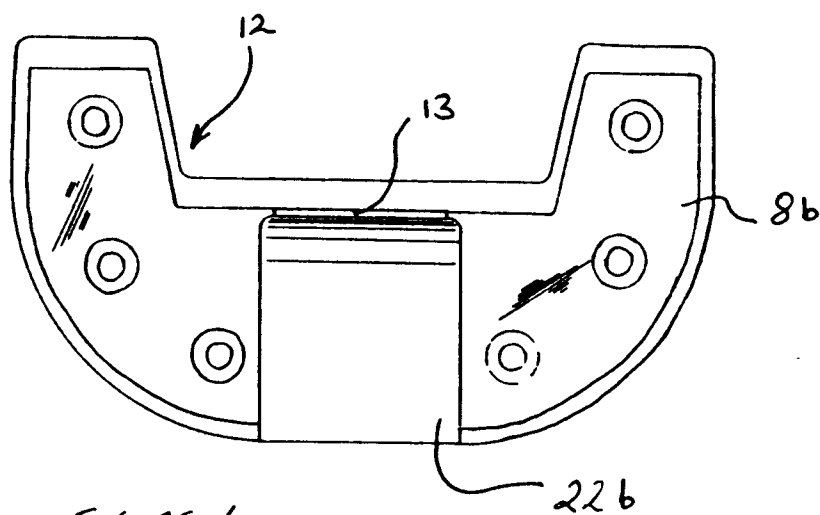
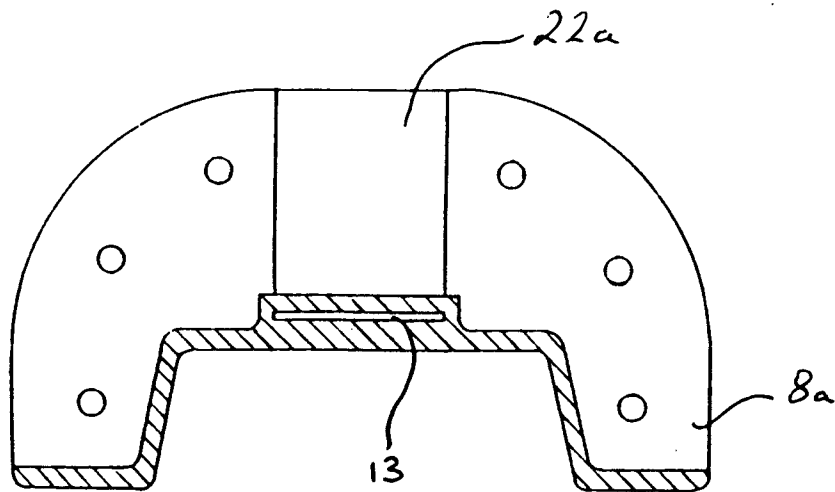


FIGURE 4

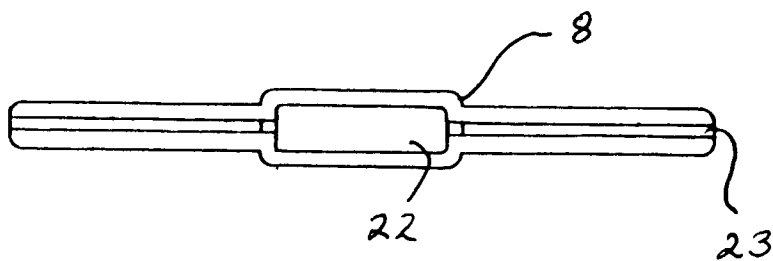
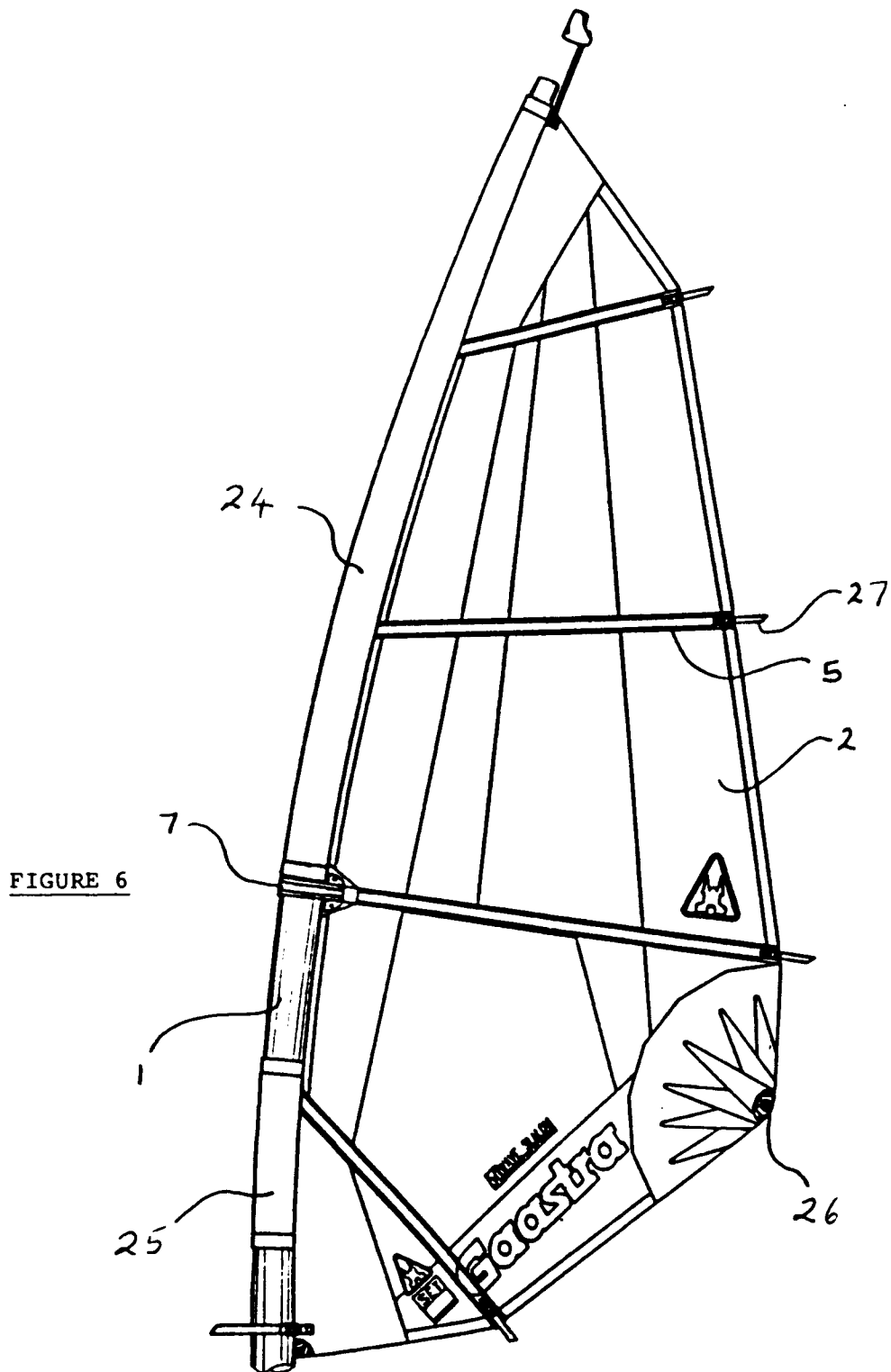


FIGURE 5





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EUROPEAN SEARCH REPORT

Application Number

EP 90 30 9308

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
E	EP-A-0 396 372 (NEIL PRYDE) * Column 5, lines 52-54; figures 2-5 * - - -	1,2,5,11	B 63 H 9/06
Y	US-A-4 625 671 (NISHIMURA) * Figures 6-8; column 9, line 58 - column 10, line 26 * - - -	1-5,11	
Y	WO-A-8 604 147 (NORTH) * Figures 4,6; page 9, lines 18-22; page 12, lines 10-14 * - - -	1-5,11	
A	DE-U-9 001 606 (SCHÜTZ-WERKE) * Figures 1,2; page 1, last paragraph * - - -	1	
A	WO-A-8 504 377 (GAASTRA) * Abstract; figures 1-5 * - - - - -	1	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			B 63 B B 63 H
Place of search		Date of completion of search	Examiner
The Hague		12 April 91	HUNT A.E.
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