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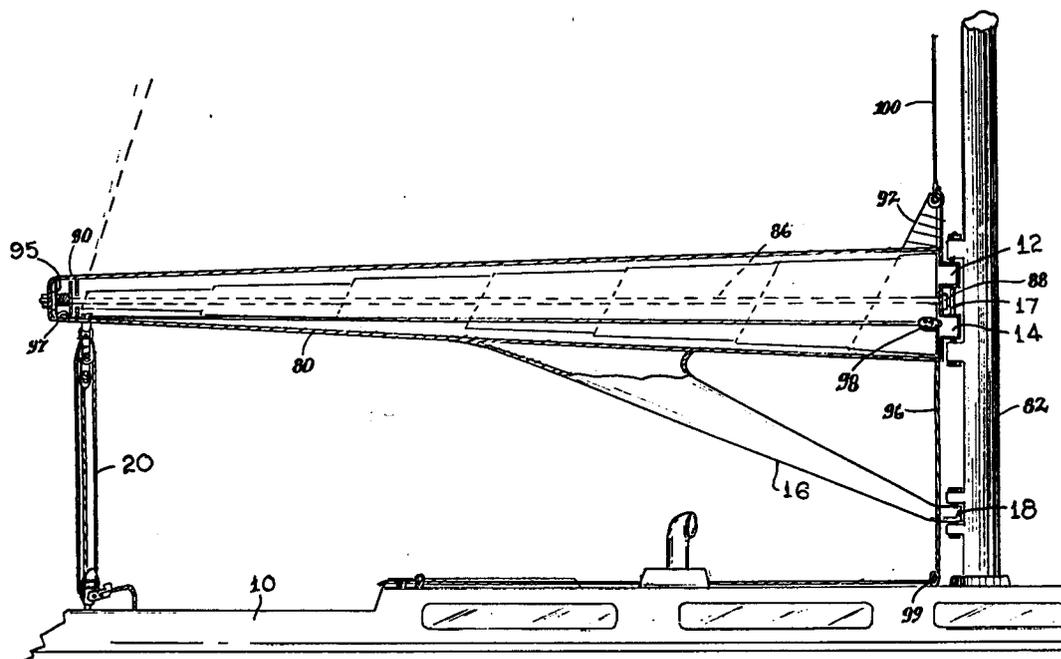
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**Furling system for sailboat.**

The boom (80) comprises an elongate body having a hollow portion for receiving the sail (92). The forward end of the boom is hinged to the mast (82) at spaced locations (12,14) around axes substantially parallel to the mast, the hinged connections (12,14) permitting sideways movement of the boom while holding the boom at a fixed angle of about 88 degrees to the mast to permit uniform furling of the

sail into the boom (80). The body of the boom is formed or molded with decreasing cross section from the forward portion to the rear, in order to most efficiently accommodate the body of the furled sail. The boom furling is highly reliable and convenient. The arrangement eliminates the need for a separate support for the boom while the sail is lowered.



*Fig. 1*

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The present invention relates to a system for the furling of a mainsail of a sailing craft, in which the sail is lowered and collected in a cavity in a boom.

One known method of mainsail furling, as described in U.S. patent No. 4,811,677, is to provide an enlarged cylindrical hollow boom containing a rotating shaft, which is used to wind up the mainsail around the foot as the sail is being lowered. Another known method is to roll up the sail around its luff either in an enlarged cavity in the mast or in an area at the rear of the mast.

Furling of the mainsail into the boom, rather than onto the mast, is highly preferred for a variety of reasons. The mainsail normally carries relatively inflexible battens extending horizontally in the sail, and these cannot be rolled up around a vertical axis into the mast. Also, in order to receive the sail, the size and weight of the mast must be excessive, resulting in increased air turbulence and negative righting moment.

While furling into the boom provides a superior technical solution, no successful systems have been forthcoming. The boom is normally connected to the mast with a gooseneck fitting, which allows the boom to tilt at an angle to the mast, and this causes the sail to roll up evenly or more tightly along one edge and become jammed or tear. Also, the battens must enter the cavity in the boom in parallel to the roller furling axis, or they will also jam or break.

Many racing sailboats are equipped with so-called boom vang, which is a line or other device secured between the boom and the deck. The vang is used to hold the end of the boom down when the boat is sailing on a reach, thereby presenting maximum sail area. Thus, the vang is used only to control the shape of a flying sail and is not employed in connection with sail furling.

In the present invention, the boom is molded or formed from reinforced plastic or other materials, and the forward portion is hinged to the mast at spaced locations around axes substantially parallel to the mast. The hinged arrangement holds the boom at a predetermined fixed angle of about 88 degrees to the mast to permit uniform furling of the sail into the boom. The body of the boom is formed or molded with a decreasing cross section from the forward portion to the rear, in order to most efficiently accommodate the body of the furling sail. This combination of features renders the concept of boom furling more reliable and convenient. The arrangement also eliminates the need for a separate support for the boom while the sail is lowered, such as a separate line, or topping lift, extending from the top of the mast to the rear of the boom. The hinges may be installed on a vertical slide on the mast to enable the boom to move

up and down, while retaining the fixed angle.

In the drawings, Figure 1 is a side view of a portion of a sailboat illustrating the boom and furling system of the present invention. Figures 2 and 3 are sectional views of two different forms of the boom which may be employed. Figure 4 is a side view showing a boom release feature.

Figure 1 illustrates the upper or deck portion of sailboat 10 on which an upright or vertical mast 82 is mounted in a conventional fashion. The mast 82 is designed to carry the luff of a mainsail 92 in a conventional fashion, with the head of the sail being raised and lowered by a halyard 100.

The boom 80 is preferably made or formed from a molded plastic material reinforced with fiber such as carbon or glass. Metals such as aluminum any also be used. The boom is of one piece construction have a main body, the forward portion of which is hinged at 12 and 14 around a vertical pin 17 secured from the mast. The boom also includes an integral leg 16 extending downwardly on an angle from a lower medial portion of the boom toward a lower portion of the mast, with the end of the leg being hinged at 18 to the mast in a similar manner. Since the boom is hinged to the mast at spaced locations as shown, the angle of the boom to the mast is fixed, and this angle is set at the correct angle to allow the sail to be uniformly furled. The angle of the boom to the mast is fixed in the order of 86° to 90°, and preferably at 89°. Movement of the mast is limited to sideways movement in a horizontal plane. More than two hinges may be employed, and the forward portion of the boom may be solid and continuous, rather than in the branched form as shown.

As shown in Figures 1 and 2, the boom may be hollow with a cone-shaped cavity 84, which decreases in cross-section from the forward to the rear portion. Since the boom may be made on a mold, the outer shape may be streamlined, and the internal cavity may be formed to more exactly fit the form of the furled sail. The boom has an upper longitudinal slot 83 through which the sail and battens are received.

The furling mechanism itself may be conventional in nature and may include a shaft or rod 86 extending longitudinally and centrally in the boom cavity and includes a forward enlarged head, with the rear end of the rod being secured to the drum of a reel 95 located in the end 90 of the boom. Location of the drum in the rear of the boom is preferable so as not to interfere with the luff of the sail entering the boom cavity. The foot of the sail is secured to the rod such that, as the rod is rotated, the sail is wound about the rod as shown in Figure 2. A line 96 may be passed around a series of turning pulleys 99, 98 and 97 and wrapped around the reel 95. Thus, the line 96 may be pulled from

the cockpit to rotate the reel and the shaft in order to furl the sail while the halyard 100 is being lowered. Since the boom is supported at all times at a fixed angle, the mainsheet system 20, extending between the end of the boom and the deck, is employed only to control lateral movement of the boom.

Another version of the boom is shown in Figure 3, in which the boom 40 has an upper widened U-shaped cavity for receiving the sail 114 as it is being furled, which in this case, is performed by folding the bottom of the sail back and forth into the cavity. This arrangement may be preferable in the case of sails which contain battens 116 which would not otherwise be capable of roller furling. However, since the battens are normally all arranged at a fixed angle, the boom is held at the same angle to assure uniform furling regardless of which method is used.

Figure 4 illustrates a furling boom 22 in combination with other useful features. As mentioned previously, the boom need not have a separate leg but may have a continuous solid forward portion 23, which is hinged to the mast at two or more locations 28.

Figure 4 also shows the possibility of allowing the boom to move up and down relative to the mast while still maintaining the desired constant angle required for furling. Such movement is desirable in making sail adjustments and also as a safety feature to relieve pressure on the mainsail in strong gusts.

The hinges 28 may be secured on cars 46 which are retained in slidable engagement on a track 48 secured to the rear of the mast 14. Upward movement of the mast 22 may be restrained by a line 50 connected to the lower car 46, the line being passed through a suitable turning block, with the free end of the line secured to a cleat. Normal pressure on the sail will exert an upward pressure on the boom, and sudden high pressures may be relieved by releasing the line 50.

### Claims

1. A boom furling system for a sailboat having an upright mast in which the sail is lowered from the mast into a hollow portion of the boom in a furled condition, characterized in that the boom comprises a elongate body having a hollow portion for receiving the sail, the forward end of the boom being connected to the mast, at a pair of spaced hinged locations, the hinged connections permitting sideways movement of the boom while holding the boom at a fixed angle relative to the mast to assure uniform furling of the sail.
2. The furling system according to Claim 1, further characterized in that the boom has a cavity which has a larger cross section at the forward end than at the rear end.
3. The furling system according to Claims 1 or 2, further characterized in that the boom is of one piece molded construction of reinforced plastic.
4. The furling system according to Claim 1, further characterized by a rod extending along the cavity and connected to the bottom of the sail, and a device to rotate the rod and roll the sail around the rod while it is being lowered.
5. The furling system according to Claim 1, further characterized in that the cavity in the boom has an enlarged upper opening to receive the sail in a folded condition as it is being lowered.
6. The furling system according to Claim 1, characterized in that one of the connections is a hinge around the vertical pin.
7. The furling system according to Claim 1, characterized in that the forward portion of the boom comprises a main body hinged to the mast, and an integral leg hinged to the mast.
8. The furling system according to Claim 4, wherein the device to rotate the rod is a reel located at the rear end of the boom.
9. The furling system according to Claim 1, further characterized by a vertical slide connection between the boom and the mast permitting upward and downward movement of the boom while maintaining the fixed angle to the mast.
10. The furling system according to Claim 1 in which the fixed angle is 86° to 90°.

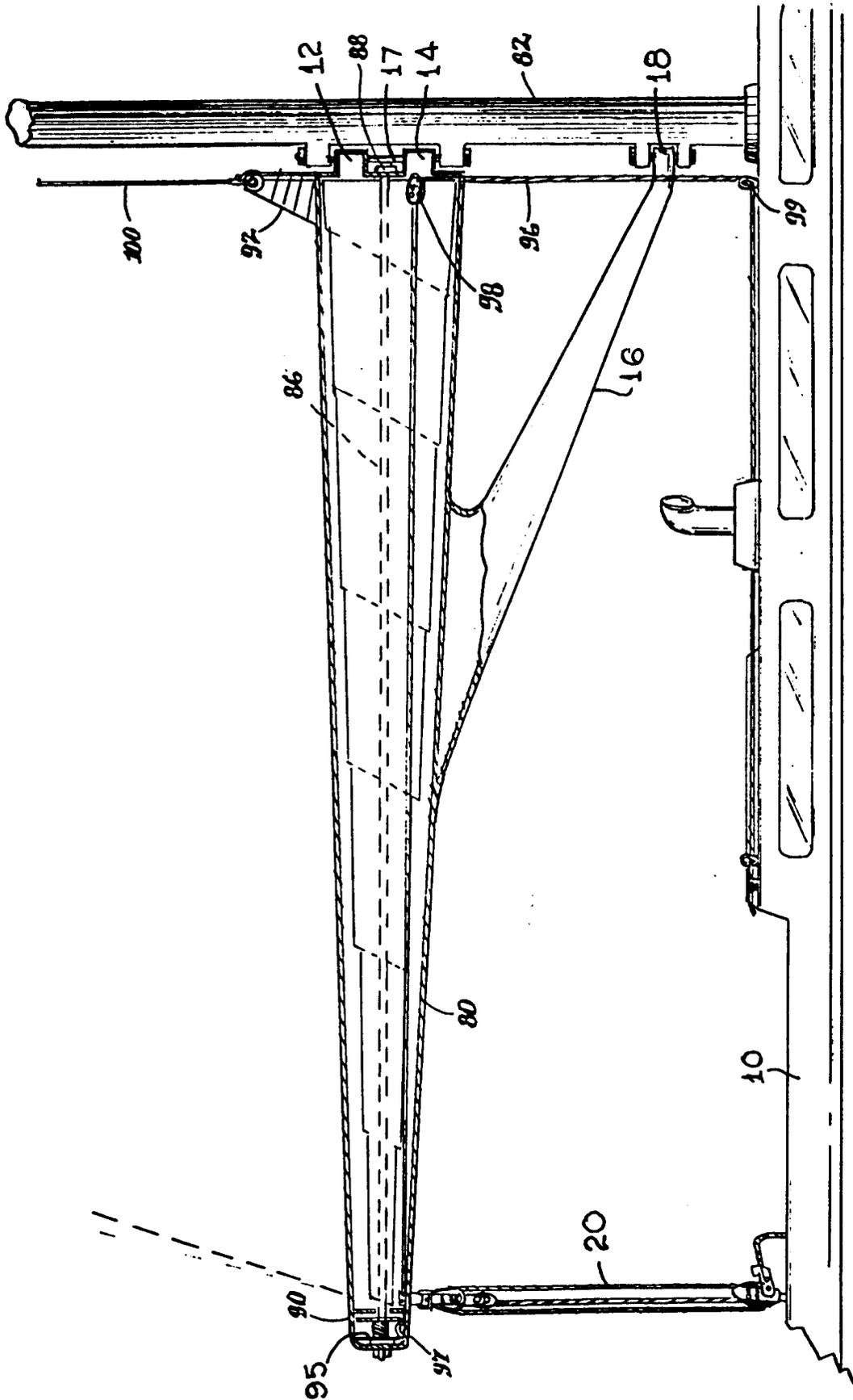
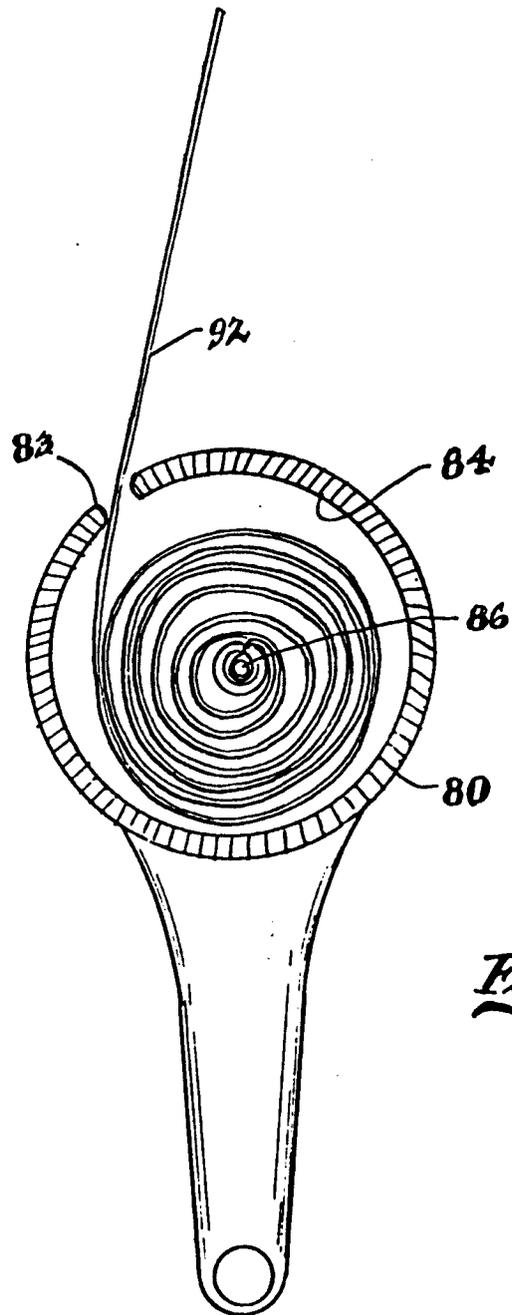
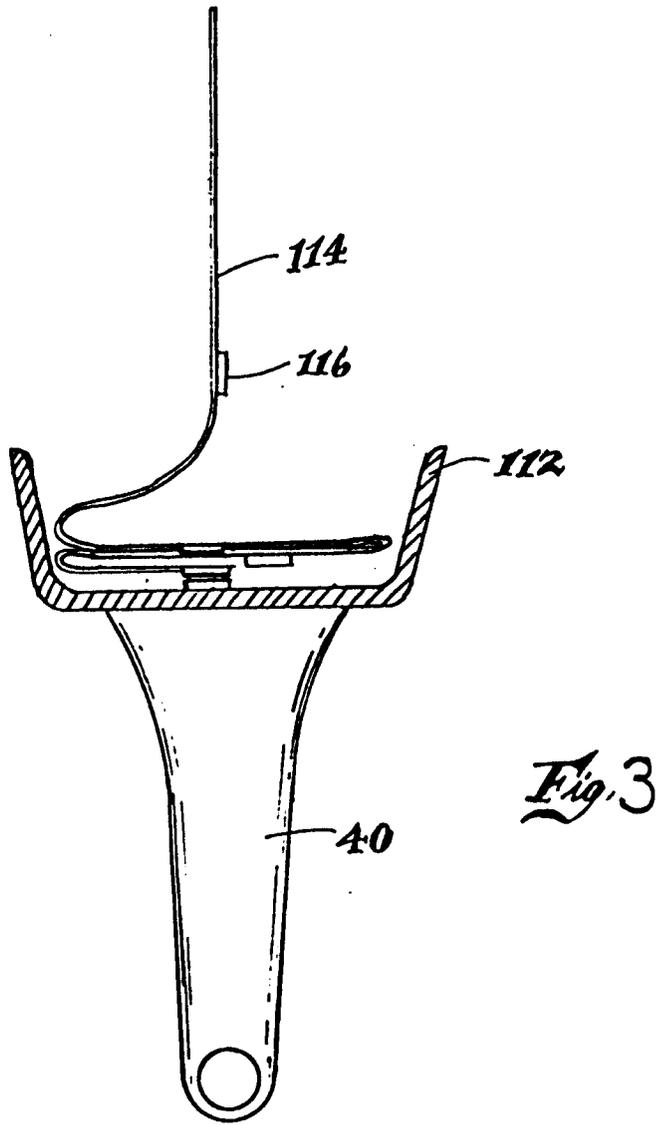


Fig. 1



*Fig. 2*







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)
X	GB-A-612 193 (WELLS-COATES) * page 8, line 6 - line 10 *	1,2,4,6	B63H9/10
Y	* line 57 - line 67; figures 6,9-11 * ---	8,9	
Y,D	US-A-4 811 677 (MOGENS)	8	
A	* abstract; figures 1,3 * ---	4	
Y	US-A-3 749 042 (PATRICK) * figure 3 *	9	
A	EP-A-0 396 269 (HOWLETT) * abstract; figures 3,4 * ---	3	
A	GB-A-2 237 546 (MITCHELL) * figure 1 *	7,10	
A	GB-A-2 195 111 (DOYLE) * abstract; figures 1,4 * ---	5	
A	FR-A-2 629 044 (MAILLARD) * figures 1,3 * -----	4,8	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			B63H
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 18 JUNE 1993	Examiner DE SCHEPPER H.P.H.
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X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			