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EDC Section 13

Improvement of the Vanguard 420 Tiller Extension

Problem

The design of the Vanguard 420 tiller extension is inherently flawed, allowing it to dislocate from the rudder during intense movement or stress.

Introduction

In intercollegiate sailboat racing, there are three major boat classes which are sailed across the country. The most widely used is the Vanguard 420, due to its durability and wide-bodied stability. The 420 represents a remarkable example of nautical ingenuity; however, this does not mean it is flawless. The tiller extension causes major problems when used in intense and rough conditions. In the current design, the tiller extension is a strip of wood approximately 3 feet long and 1" x 2" which sticks into the top part of the rudder and is held on solely with a piece of twine and a clam-cleat (a cleat which uses a ropes own tension to keep it taut). The problem with the arrangement is that clam-cleat cannot provide enough tension to keep the tiller extension from falling out. More importantly, this does not keep tension during swift lateral movements caused by strong jerky tiller movements. Unfortunately, these jerky movements are used during every sailboat race and

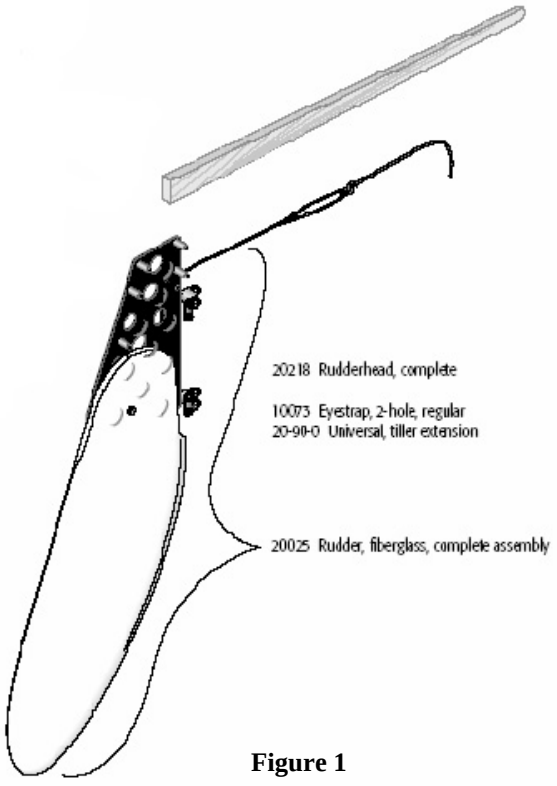

Figure 1

even during normal sailing in moderate to heavy winds. The end result of this is a dislocation of the twine from the cleat and a separation of the tiller extension from the rudder, which can be devastating during a race and dangerous during heavy wind conditions. This negligence could end up costing the Vanguard Company both in the form lost customers, and of lawsuit settlements caused by injury due to a faulty tiller.

To amend this problem, I propose a two step process to address this problem, implemented with two separate tiller modifications: the first an add-on to existing tillers to make them safe and secure, and the second a permanent change to the manufacture of 420 rudders and tiller extensions.

Interim Add-On

Design Overview:

The interim add-on requires no further modification to the existing 420 rudder. This device would attach to existing 420 tiller extensions via screws and consist of 4 pieces: 2 spring-loaded locks and 2 stoppers. This device would work with two spring-loaded locks that would slide under the rudder's connecting screws and then would pop up to lock the tiller extension between the spring-loaded locks and the stoppers to thoroughly secure the tiller extension. This modification would serve as an interim fix until the permanent rudder could be manufactured and mass produced. It would require no modification to the production of the 420 rudders or tiller extensions other than what the customer would do himself.

Cost:

The cost of the interim add-on would be extremely minimal. The price of the manufactured materials, which would include 4 molded plastic pieces, 16 screws and 2 small springs would all cost under two dollars for materials and most likely assembly.

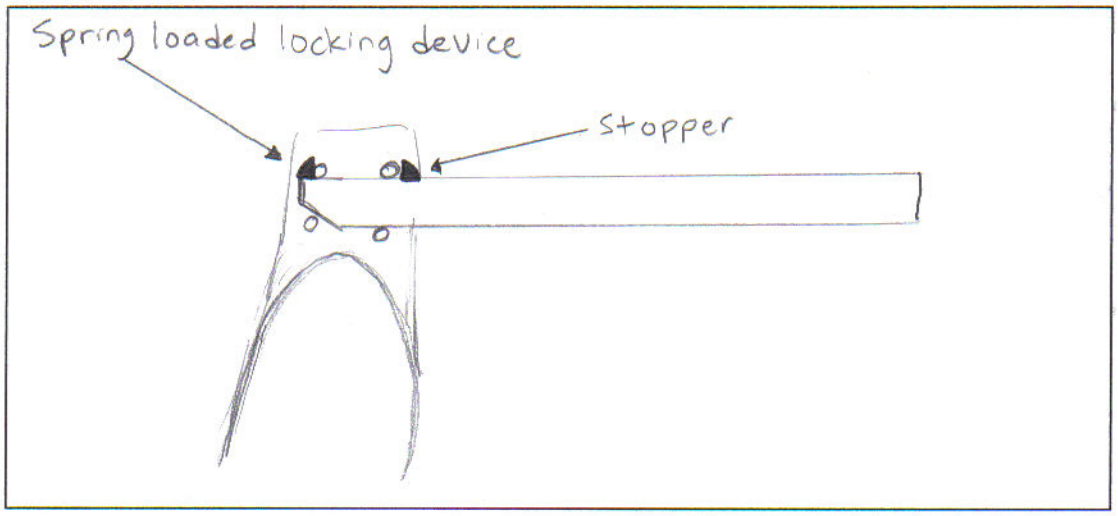

Figure 2

Redesign to 420 Rudder and Tiller Extension

Design Overview:

The first takes a key from the locking system on the 420 rudder and adds a small modification to both the rudder and tiller extension. A piece of metal would attach to the end of the tiller extension. The metal would be springy enough to pass under the top screws and would then lock to an 'L' shaped piece of metal placed on the back end of the rudder top. There would also be a stopper on the tiller extension to keep the rudder from going too far back and negating the locking spring. This locking system would be a great improvement over the existing clam-cleat because it would keep the tiller extension from becoming detached due to its locking spring. The way it would lock also would prevent it from having any complications from strong lateral movement.

Cost:

While more costly than the add-on solution, the redesign of the rudder and tiller extension require that only two pieces be attached to the existing system, which translates to a near minimal cost to change current production methods. The redesign also only requires two pieces of metal, costing near nothing for a materials cost.

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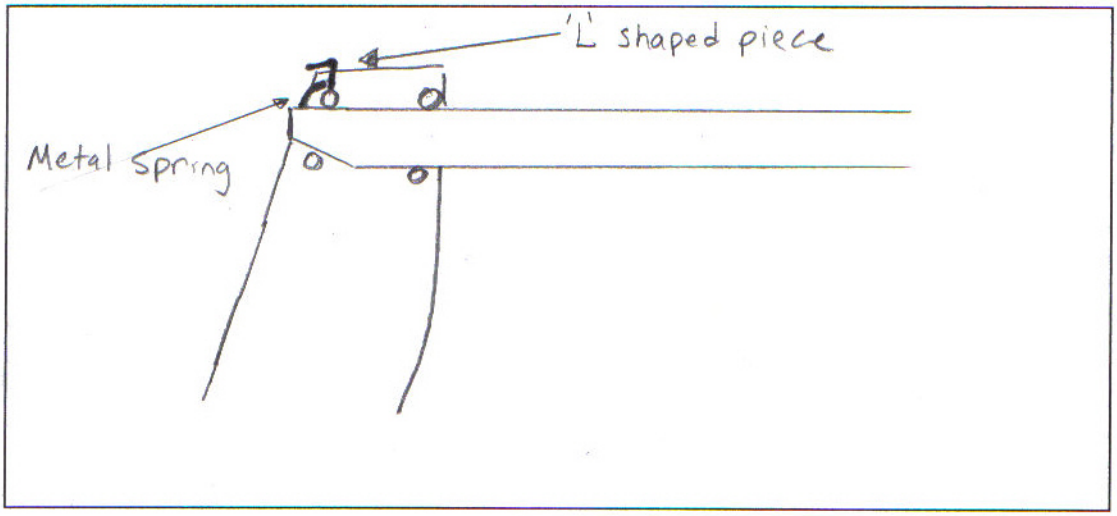

Figure 3

Recommendations for Future Action

The two tiller extension redesigns are to be used in conjunction to remedy the faulty tiller extension. The interim add-on is to be offered first to customers as an aftermarket addition to the 420 tiller extension and is to be used on customers who already own an existing 420 rudder and tiller. The add-on saves customers from having to replace their entire rudder and tiller system, and allows them to fix the faulty tiller for a minimal cost. The add-on is only a temporary solution. The redesign to 420 rudder and tiller extension given above is to be implemented on all new 420 rudder and tillers built, fixing the problem permanently and on all future products.

Conclusion

I highly recommend that the Vanguard Company takes these redesigns into consideration. These minor and low cost enhancements to the 420 rudder and tiller extension could solve what could potentially be a major problem for your company in the form of negligence and lawsuits.

References

Team Vanguard Sailboats. 10 May 2005
<http://www.teamvanguard.com/2005/base/content.asp?section=boats&dir=core&page=boats_index&boatid=1>.