

Rudder

(11/5/2010)

Although not visible in this pic, the rudder has several questionable repairs. So I'm considering rebuilding the rudder. Working on the rudder would be simpler if I could remove it from the boat. Let's see what's involved ...

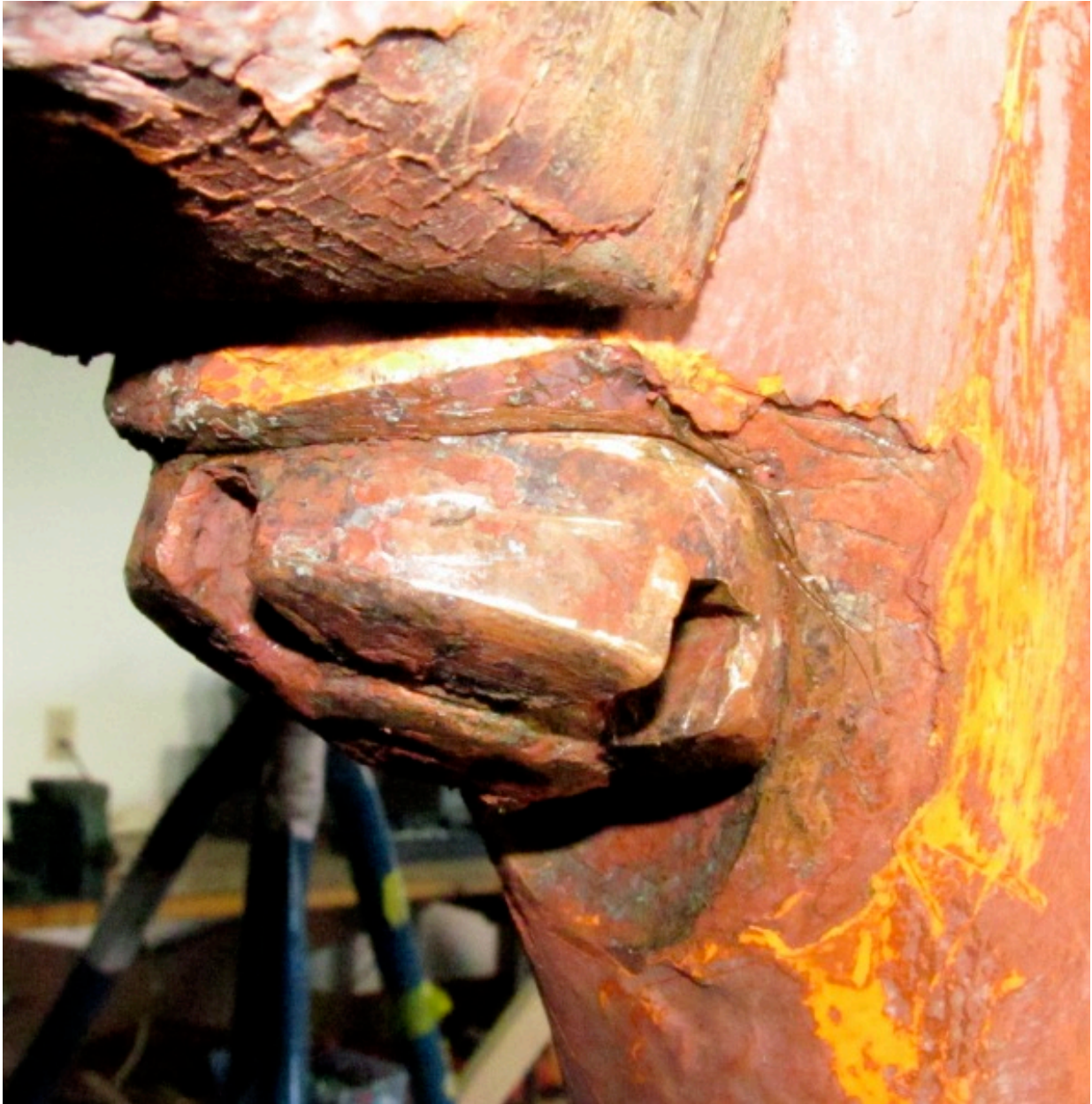


The rudder is attached to the boat by a pintle and gudgeon at the bottom and by the rudder stock at the top. To remove the rudder (it seems), you first need to remove the rudder stock. The rudder will then fall away from the boat allowing you to lift the rudder out of the gudgeon. Here are views of the rudder stock at the top of the rudder tube and at the top where the tiller attaches.





Below is a detail of how the rudder stock attaches to the rudder. The stock at the lower end fits into a bronze casting, which is attached with drifts/bolts to the wooden rudder. I believe that the stock is tapered with a key. It's threaded at the end and a castle nut (shown in the pic) with cotter pin that holds it in place.



I was able to remove the castle nut (with an improvised spanner; see pic below),



but I can't seem to free the stock from the rudder casting. I suppose 45 yrs. of salt-water service might have something to do with that! Here are some pullers that I've tried.





I've been careful not to apply too much force for fear of breaking something. I'd like to apply heat to the casting, but the deadwood and rudder are too close for comfort.

11/26/2010:

To get help with this problem, I posted a thread on the Woodenboat Forum. I received numerous replies offering many innovative tips. To relieve the suspense, I'll tell you that the rudder is now safely on the shop floor; however, I think that it's worthwhile to reflect on the history leading up to this happy occasion.



First we might ask, why remove the rudder? In fact, this was a common question from the members of the Forum. The rudder itself is not in terrible shape, but due to drying out, there are substantial gaps (up to 3/16") between the planks making up the rudder (see the pic below).

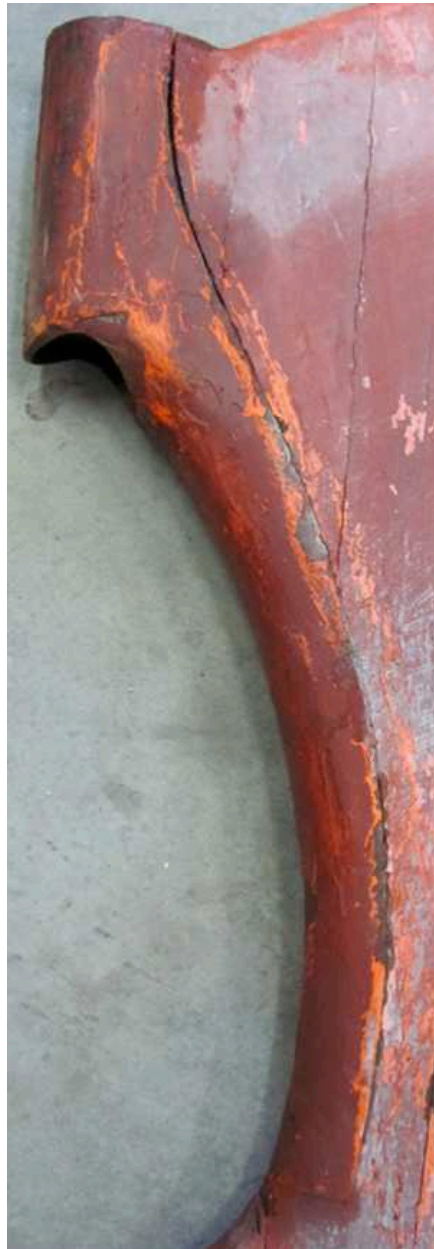


Finally, regardless of the condition of the rudder, I would like to inspect the bearing surfaces to be sure I don't have any unforeseen problems.

So based on these arguments, I've decided to remove the rudder. Whether or not I rebuild/replace it is another matter.

The key to the successful disassembly of any component is understanding how all the pieces fit together - or more importantly, how they come apart and in what order. In the absence of factual data, you make assumptions and proceed accordingly, until you discover otherwise. So it was with this rudder.

After scraping away years of paint, I could see that the rudder stock entered the top of the rudder through a large bronze casting and was held in place with a large castle nut. The casting can be seen in the pic below.



Using an improvised spanner, I was able to remove the castle nut. I could then see that the end of the stock was tapered and was keyed into the rudder head. So it seemed obvious to me that to remove the rudder, you had to remove the stock from the rudder head (my first assumption).

As you can see from my earlier postings, I devised two "pullers" for this purpose, but even using both of them simultaneously, I was not able to free the stock. This is when I turned to the Forum.

Several respondents informed me that the typical way of removing a rudder is to remove the shoe/lower bearing/gudgeon and lower the rudder, stock and all. With this approach, you don't have to remove the stock while it's on the boat. Then you can take the rudder to a shop with a big press, apply heat if necessary (not as much wood to worry about catching fire), and voila!

Great tip, says I. One question ... how do I lower the rudder far enough for the stock to clear the top bearing (probably need 4 ft or so) with the boat on 16" blocks?

No problem, says they. Just raise the boat up 4 ft. Ahh, you say the garage ceiling isn't that high, then dig a hole below the rudder. Ahh, the floor is concrete, I see ... no problem, concrete is easily repairable.

Ok, good tip, but since my wife would surely shoot me if I cut a hole in her new garage, I'll save this for option #2!

The Forum was not deterred. If you can't get enough space to remove the rudder in tact, then split the rudder in two. This would actually work quite well, if I were committed to replacing the rudder. Make this option #3.

So we're back to removing the stock. I assumed that the stock was held in place solely by the castle nut. Maybe, the Forum offered, something else was holding the stock in place? Good point. I've broken many an item in my day because of the "hidden screw." So I carefully inspected the rudder head casting. No keyway set screw. No evidence of a drift through the head and stock. But ... what do we have here? I can barely see through a gap between planks that a bolt holding one of the rudder planks definitely enters the rudder head. The question is whether or not the bolt impinges on the stock.

Logic argues that it would not impinge by design. Presumably, the rudder would be built on a bench and then lifted in place and the stock inserted. If the bolt protruded into the taper, you couldn't insert the stock (another assumption). The only other possibility is that the bolt was added after the stock was inserted - seems unlikely.

So, on the advice of the Forum, I proceeded cautiously. I applied a liberal amount of penetrating oil and used the two pullers to put the stock under load for several days. On occasion, I would give the lower end a good rap with a 5 lb. hammer (not directly on the stock, of course).

After three days, convinced that nothing but corrosion was holding the stock, I decided to increase the load from my 20 ton jack. I did a rough calculation and determined that I could apply about 50 lb of pressure on the jack handle before exceeding the yield strength of the stock. A couple of pumps (well below 50 lbs.) and "pop" it came loose! Just a little pop, not like the explosion I experienced when removing the prop. I guess bronze on bronze isn't as nasty as stainless on bronze.

After a mild celebration, I took to removing the stock. After a few more pumps on the jack, the stock meet unexpected resistance. What's going on, I asked. I expected the stock to raise easily!

A quick inspection revealed the problem - the key. A keyway is milled into the stock and the rudder head to house the key, but there is no corresponding keyway in the top bearing and I'm trying to pull the key through the bearing! So assumption #1 was only partially correct. There is

no way to pull the stock up with the key in place. Instead, you have to remove the bottom bearing (gudgeon) first, and then drop the rudder clear of the stock.

So it's off with the bottom bearing. The bottom bearing is a large bronze casting held to the keel with five 3/8" bronze rivets.



I proceeded to drill the heads off the rivets and drive them out with a drift and hammer. A bit of prying and hammering and the gudgeon dropped free.



The rudder is quite heavy (maybe 100 lbs), so while removing the gudgeon, I supported the rudder with a rope around the stern tube. Then lowered it slowly until the rudder cleared the stock. Placing the rudder aside, I took to removing the stock. The first couple of feet came easily, but then I needed a bit of tapping with a hammer to clear the rest (I should have remove the corrosion from the top of the stock before trying to remove it - impatience!).

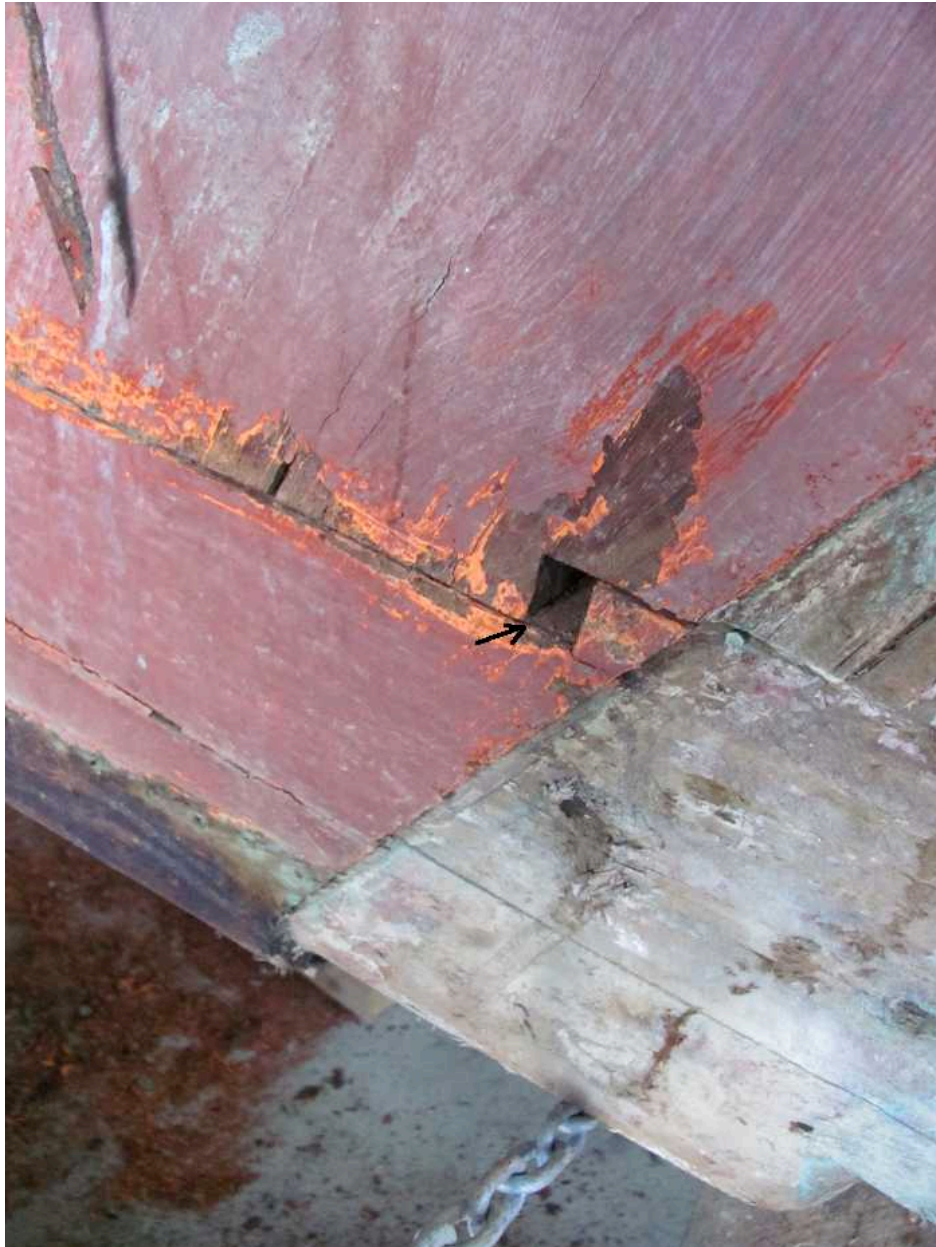
The following pics summarize the result.







Notice the square hole in the sternpost in the pic above. A close-up is provided below.



This hole is tapered and goes all the way through the stern post and was "filled" with a matching tapered wedge. The wedge applies a force between the deadwood and the stern post, evidently to drive the stern post tight against the knee. Because of the drying out, I could remove the wedge with my fingers.

Well that's it! Another mini-problem conquered. I wish to thank all those on the Woodenboat Forum who so graciously offered their advice.