

Repairing the Delaminated Recurve Limb

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INTRODUCTION

What follows is an ingenious technique invented by Dave Keable of Bauple in Queensland. It was tested quite successfully on his own take-down recurved bow, the upper limb of which was delaminated when it was run over by his Hilux. The technique is also easily applicable to a one-piece recurved bow also. Jeff Challacombe of Maryborough assisted Dave with the preparation of the gluing surfaces and the gluing process using his expertise in making modern longbows.

The technique involves the use of a jig which is made from easily available materials at very little cost and is astonishingly simple in construction. It involves mounting the delaminated limb against two blocks of wood mounted on a backing board so that the limb is positioned in its original shape. It is held in that position by the jig and a series of small clamps holding fitted small paired blocks which are placed around the area of the recurve where the delamination has occurred.

The technique is also applicable to delaminations which occur at the wedge end of the take-down limb and to single piece recurved bows where the delamination extends to the tip. The technique requires that the delamination is open rather than closed at each end such as where it may occur mid-limb without extending to the limb ends. If the delamination extends just short of the tip or the butt of the wedge, it may be gently prised apart to enable access.

After reading this article thoroughly and understanding it, we strongly advise practice runs of the process before any glue is mixed and applied. Once that is done, the point of no return is passed. Care should be taken NOT to further damage the inside surfaces of the separated limb.

The whole simple process takes far longer to explain than to do.

DIAGNOSING THE DELAMINATION

Things to assess before beginning any work are –

- the length of the delamination,
- how much of it follows a glue line or travels through or across core laminations,
- how many laminations are affected and the degree and area of any wood loss,
- how well the laminations fit back together,

It should be noted that where an open delamination occurs at either end of a take-down limb, the backing lam will often be longer than the belly lam because it is on the inside of the curve and has straightened out somewhat as in Figure 1 below.

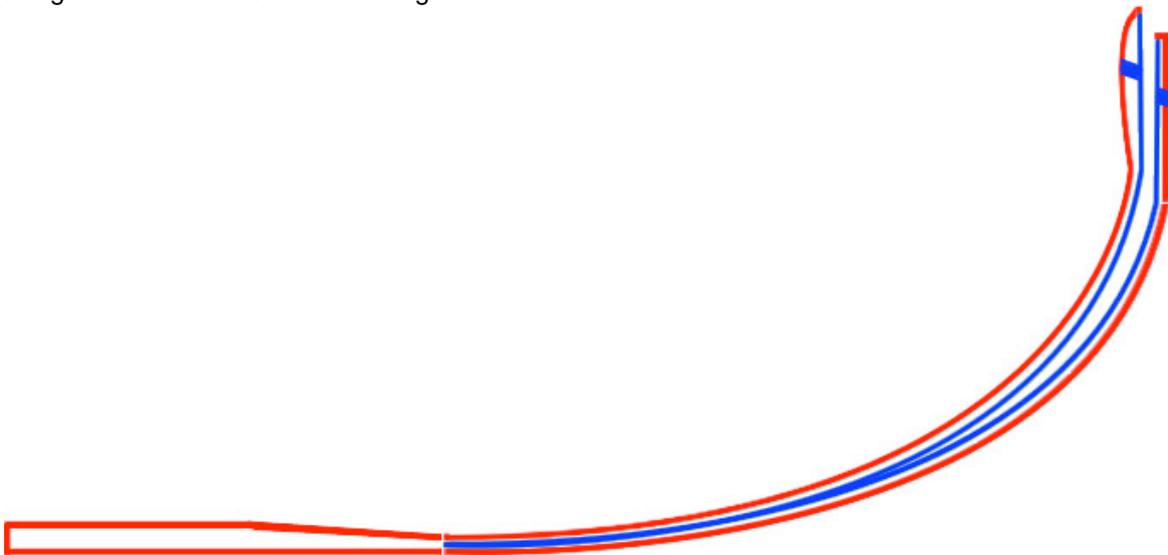


Figure 1 - Delamination showing lengthening of delaminated inside curve. The same would occur to a lesser degree with a wedge end limb delamination. Note the misalignment of the string nock grooves.

Notably, at the tip end of a delamination, the inside delamination will be longer and most notably, the alignment of the string nock grooves will be out.

Crucial to the success of this procedure will be the ability to use the jig to re-align these separated halves of the string nock so that the limb will regain its former shape accurately. These nock grooves must be kept clear of oozing glue during the procedure so that they can be aligned accurately.

BUILDING THE JIG

Have a look at Figure 2 below. The jig consists of a large piece of flat board of heavy ply or chipboard, two positioning blocks, A and B. Block C to protect the tip overlay from the clamp holding it to Block B.

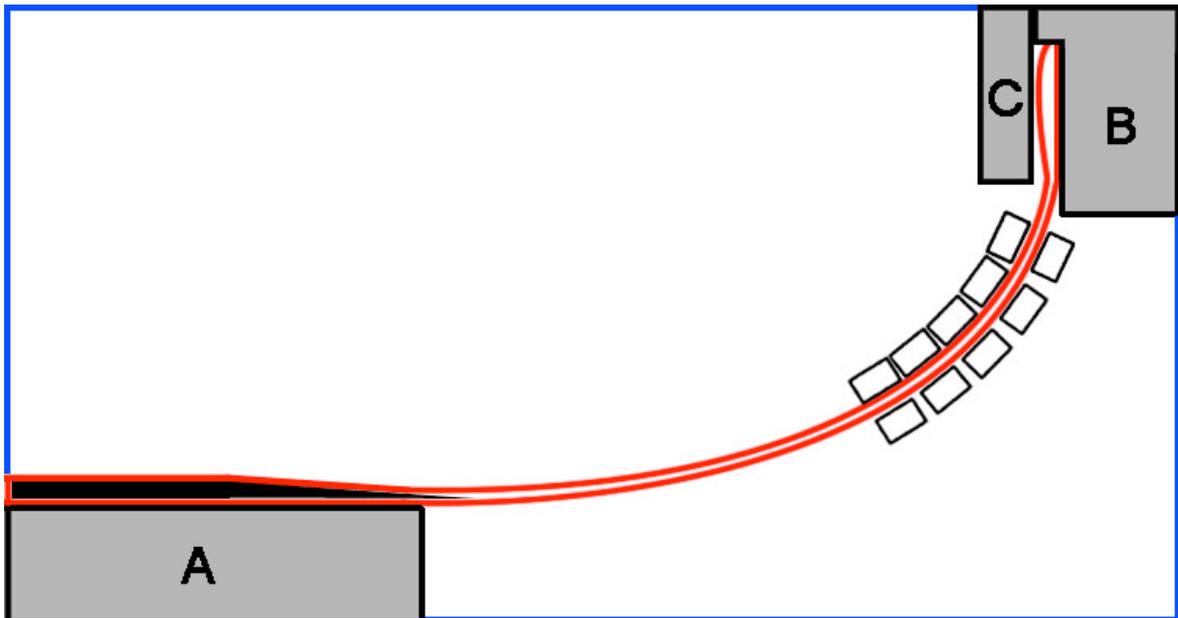


Figure 2 - The regluing jig. Note the positioning of the components explained in the text.

Block A is a rectangle the length of the wedge, while block B is an inverted 'L-shaped' block, where the toe of this block is used to 'trap' the tip of the limb and help in aligning the string nock halves. Block A can be fixed, but blocks B and C must be moveable. The toe of block B need not be integral. It can be removable also if necessary because different limbs will have different thicknesses of tip overlay which must be allowed for.

The red limb shape is drawn on the jig using the sound limb as a template so that the profile is known to which the repaired limb must be matched. The blue line represents the base board of the jig.

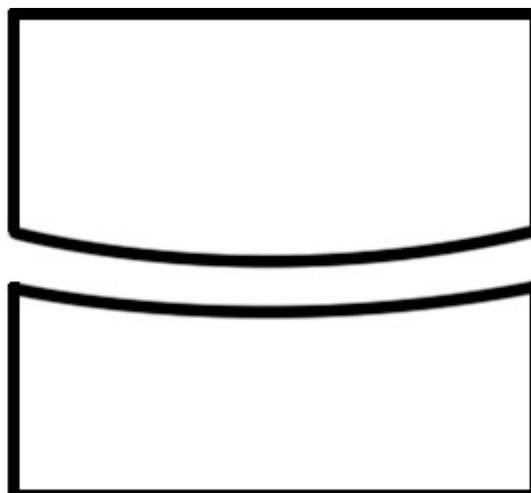


Figure 3 - Curved Clamping Blocks

The other parts of the jig are a series of small paired radiused blocks which fit on either side of the limb and are used to clamp the separated halves together.

The surfaces of these blocks which bear against the limbs are radiused so the surface against the back of the bow are convex and that which is against the belly of the limb is concave as shown in Figure 3 above. The amount of radiusing of these blocks is achieved by using the sound limb as the template. Sufficient must be made to completely extend past the length of the delamination.

The making of these small blocks is the most painstaking part of the jig. Any set will be custom made for an individual bow. Sometimes they may be found to adapt to other limbs, so don't throw them away. As accurate shaping of these blocks is necessary to ensure the even application of clamping pressure to the limbs, each pair must be matched to the position along the limb where it is intended to be placed.

Dave used 5 pairs of blocks matched to each other using the sequence of A-1, B-2, C-3, D-4 and E-5, where the numbered blocks fitted around the backing lam and the lettered blocks fitted around the belly lam. In Figure 4 below, it can be seen how the radiused blocks are positioned around the curve of the limb. It is crucial that these blocks are touching each other with no significant gaps between them.

The whole final setup is shown in operation in Figure 4. Note particularly, the use of the large G-clamps, and the small finger clamps on the radiused blocks around the recurve. The surfaces of the jig and the blocks are covered with Glad Wrap to prevent adhesion of the limb to the jig, **but the limb itself is not Glad Wrapped** because it must be clearly visible during the whole operation. The limb should be mounted with good clearance below it to allow for glue ooze and alignment.



Figure 4 - The jig in operation. The placement of the various clamps, Glad Wrap and masking tape on the limb can clearly be seen. At this stage, it is ready for the oven.

If the delamination occurs at the wedge end of the limb, the clamping blocks can be much simpler and without much radiusing if at all because of the negligible amount of curvature involved. But, the limb must still be made to fit a drawn template of the sound limb so both limbs match in curvature after the job is done. In this scenario of course, no radiused blocks will be needed for the limb curve.

PREPARING THE GLUE JOINT

Firstly, the glass backing and facing must be protected from glue ooze by applying masking tape from the tip to a level well past the end of the delamination.

The delaminated area must be prevented from lengthening further by the strategic positioning of a clamp just below the end of the delamination when the halves are spread open for inspection and preparation work as shown in Figure 5 below.

With the limb halves held open, work can commence on the surfaces to be glued. The broken wood surfaces only need dusting and degreasing prior to gluing and any exposed glue line surfaces will need roughening with 40 grit paper to provide an appropriate gluing surface.

This is also the time to do a dummy run on the jig to see how well the halves fit together and whether there are pieces of wood missing. Modern glues such as Smooth On can do wonders bogging holes, but if they are large, they can be unsightly. The other choice is to have to get another limb specially made for a takedown or to buy another complete one piece recurve – both options far more expensive.

At this stage, there is nothing lost other than time on this job, so you may as well give it a try.



Figure 5 - The delaminated limb protected with masking tape on the glass surfaces, a clamp preventing extension of the delamination while the limb halves are kept open for examination and preparation for gluing.

SETTING UP (THE FIRST PRACTICE RUN)

With the jig made and sufficient clamps available, it is time to mask the base of the jig, blocks A, B and C, plus the several radiused paired blocks individually with Glad Wrap. The delaminated limb has masking tape only on its back and belly faces. The clamps should not need protecting as they should be well clear of any oozing glue. But, this is what this first dummy run is about – finding out what can go wrong and preventing it and learning how to do a final set-up correctly.

The first thing is to mount the limb on Block A as close as possible to the template drawn on the base board. The belly half of the delaminate should be fairly close. Clamp it down well with a large G-clamp as shown in Figure 4 above, taking care that there is clearance below the limb as mentioned earlier.

It is important that the tips of the limbs, being narrower than the base of the limb, are not forced flat against the base board else this will cause limb twist which will remain after the glue has cured. The tips must ride above the surface of the base board in the same alignment with the rest of the limb as they would do in their normal position on the bow – as if the bow were laying on its side.

The tip is then pushed into position using block B which is mildly clamped in position so that it may be moved by tapping with a hammer. Block C is placed in front of the tip overlay to protect it. Block B can be tapped gently to position the limb immediately over the template drawn on the base board. At the same time, watch that the halves of the string nock grooves move into correct alignment with each other as the toe of block B forces the tip of the higher backing lam down into alignment with the tip of the belly lam (see Figures 1 and 2 again).

Once you are happy that you have got it right, take it all down and do it again to make sure.

THE GLUE-UP

The time has come. The practice runs have shown up any potential technical problems and they have been allowed for.

With the base board, the form blocks A, B and C, and the small radiused clamp blocks protected with Glad Wrap. The joint itself is cleaned and warmed to help the glue into the joint surfaces and dry out any remaining moisture as in Figure 6 below. Any radiant heat source should suffice for this task so long as the limb is not scorched or the fibre glass laminations are damaged.

The two-part epoxy is mixed according to manufacturer's instructions. Take note of the pot life of the mixed glue as this will dictate how efficiently you must work.



Figure 6 – Dave Keable warming the open glue joint in the lid of the hot box before gluing.

Referring back to Figure 1 above, it is apparent that the most difficult and problematical area of the separated limb to deal with is the last part of the split which is obviously the most difficult area in which to instil the glue.

In Figure 7 below, Dave Keable can be seen working the mixed glue into this very narrow part of the joint using fine wire. Using it like dental floss, he see-saws the glue well into the joint.

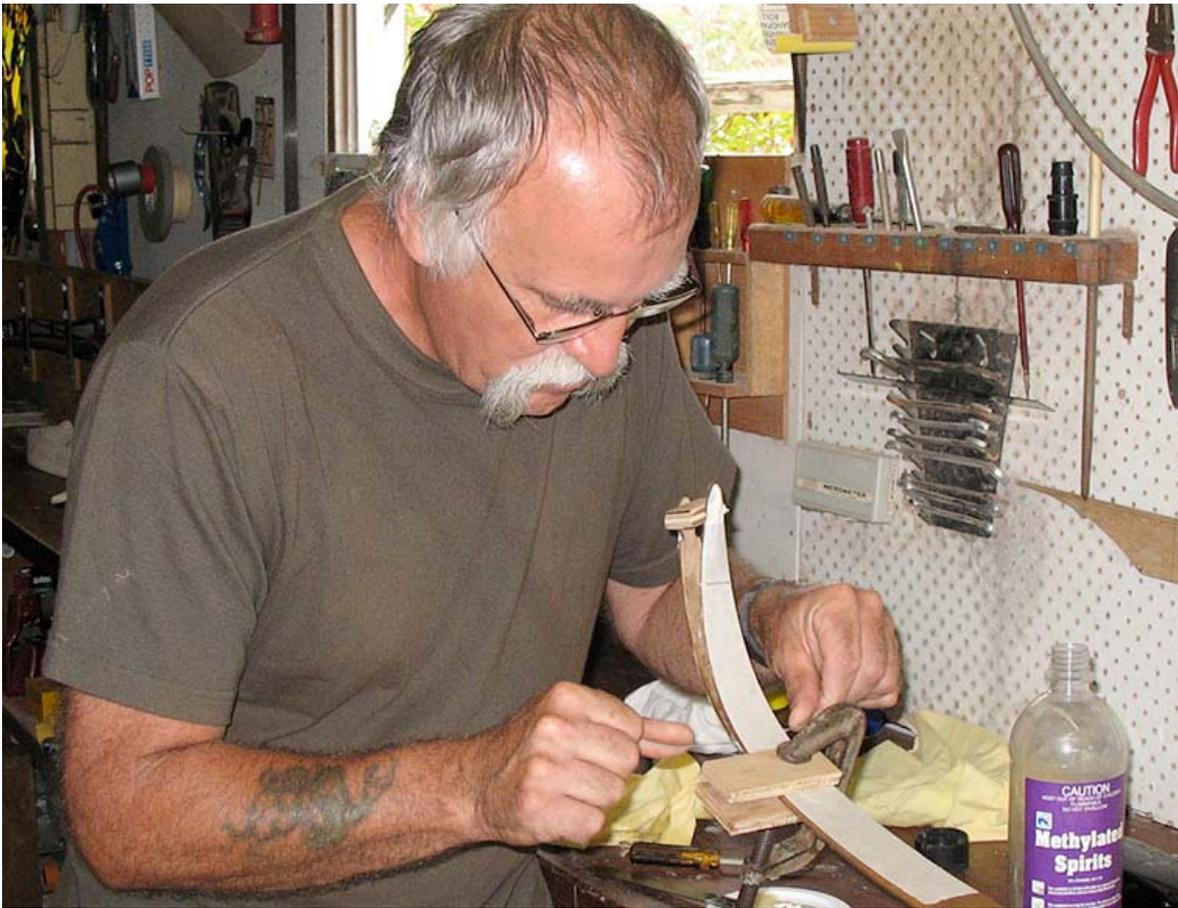


Figure 7 - Dave Keable working glue into joint using a wire thread. Note that the joint is clamped to prevent further splitting of the delamination while it is being worked on.

When you are satisfied that there is enough glue in the deepest part of the joint, both surfaces of the separation are 'well-battered' with glue and the joint brought together and fitted into the jig as has been practised in Figures 2 and 4 above.

It should be noted that the whole limb should be up off the surface of the base board so oozing glue has somewhere to go. The long frontal axis of the limb must be kept in the same alignment as when it was undamaged. Don't lay one side flat against the base board or the limb will be glued into a twisted shape.

As the limb clamps are applied, keep wiping the excess glue away so that you can see how well the joint is approximating and how well the string nock grooves are aligning and keep adjusting Block B until it does.

The limb clamps with their pre-shaped blocks are then applied to bring the joint together properly. Keep an eye on how the string nock grooves are aligning at the same time and make adjustments. A firm wrist tightness is sufficient for the big clamps and firm finger tightness is sufficient for the small clamps along the limb. We don't want to 'starve' the joint of glue by applying too much pressure or it will delaminate again. Block C is clamped to block B to ensure a good join right out to the tip.

Keep checking the alignment of the string groove nocks on either side of the joint, and that the whole limb aligns accurately with the template you have drawn on the base plate. Remember, string groove alignment is the key to the whole job. Incorrect alignment of these grooves even by a small amount will result in a limb which has greater or less recurve than originally, and your tiller may then be out of balance.

Once satisfied, you can put the whole job in your oven and leave it to cook. A temperature regulated hot-box such as some bowyers have is ideal since curing temperatures and times can be controlled, but inside your car on a warm/hot day will do the job also. Leave it for several hours in this instance and take it out to cool overnight before stripping the limb from the jig.

FINISHING

The next day, you can remove your newly repaired limb from the jig with care. Watch out for glue daags which are very sharp and should be removed with care before bending the limb.

Carefully examine the new glue lines for serious gaps and flex the limb a little to see if there is any place where the glue has not joined the limb halves. Look for light gaps through the joint.

If all is well, clean the limb down thoroughly and sand the edges smooth and remove any superficially adhering glue dabs. Check it against the opposing limb to see how well you matched the curves. Dave Keable's limb was 5mm less than the original shape, but showed no ill effects from shooting at all. It gained a little more positive tiller than before.

It is now time to bolt it to the riser again and brace it. Use a bow stringer so the tips are trapped if anything gives way. This is just common sense safety. With a bit of skill, you will have a completely satisfactory limb again and a sound bow with very little effort and a minimum of tools and, what is far better, not having had to outlay a sometimes prodigious amount of money for a replacement limb or set of limbs.

Shoot the limb in with dead shafts to make the recoil through the limb as mild as possible. When it has proven sound, shoot your normal shafts with increasing frequency, all the while checking its progress and how it is standing up to shooting.

If you have shot it toward 100 times with no problem, it will probably be as sound as can be reasonably expected and go on to a long shooting life.