The Use of Collapsible Molds for Violins, Cellos, and Basses: Resolution of Two Common Variations on the Inner Mold

MIKE CARLSON, ROSS HILL, AND DON KENNEDY

INTRODUCTION

This article represents a written summary of a presentation made at the fall meeting of the VSA in 2015 in Baltimore, Maryland.

TWO METHODS

Traditionally there are two common ways of building a stringed instrument, both using an internal mold. In the first method, the ribs and linings are assembled. Then, the mold is removed, and the ribs are attached to the back. This is the classic Cremonese methodology, as described in Johnston and Courtnall.

Some technique is required to do this, which might include the following: working really fast to a scribed outline, using pins, a dry clamping followed by glue placement with a palette knife in sections, or the use of a spider (that holds the ribs in the prescribed shape with many legs). Figure 1 shows a spider and Fig. 2 shows the use of a palette knife on a cello from a YouTube video by Matteo Fanltoni [1].

The second common method is to glue the ribs onto the back with only the lower linings attached*. The mold is then removed with the back on. The upper linings are then attached afterward. This methodology is described in books by Juliet Barker [2] and Karl Roy [3], or the DVD series by Prier [4]. This technique is taught at Mittenwald. In Mirecourt, France, the mold is sometimes offset vertically to the top, allowing lower linings to be attached. Some technique is required for this, which includes a delicate touch for removing the blocks, usually done with a tap of a hammer and careful removal of the mold.

PROS AND CONS OF DIFFERENT METHODS

The first method can be a bit tricky when it comes to removing the ribs from the mold. It is easier to do if the mold is thinner. A thinner mold means less control on the vertical orientation of blocks and ribs. While attaching the back, the ribs are positioned to a scribe line around the back. If you clamp the ribs down on the inside of the line or outside of the line, the ribs end up a bit crooked. It is also important to make sure the clamps are directing the clamping force just downward and not at an angle. Good quality clamps can help with this, although they are more expensive and care is still required.

The second technique keeps the ribs straighter. It is an indicator of provenance. (It's still best to have the clamps well vertically oriented.) The mold cannot be taken out with the upper linings on because they block the removal of the mold. It is very difficult not to change the shape of the ribs slightly when adding the top linings.

In summary, the major underlying issues are outline control and keeping the sides vertical. These problems become more acute with deeper ribs. It is, therefore, critical on basses and cellos and somewhat less critical on a violin. There are clearly pros and cons to both methods. A summary table is included below in Table 1.

OBJECTIVE

We have developed a number of molds that are collapsible and which represent another option. This eliminates the compromises with the two

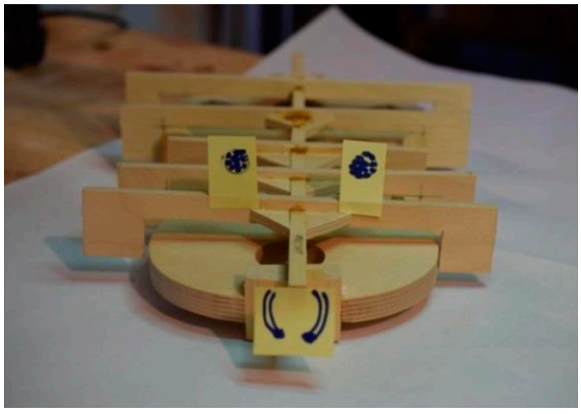

Figure 1. Outline spider for gluing.

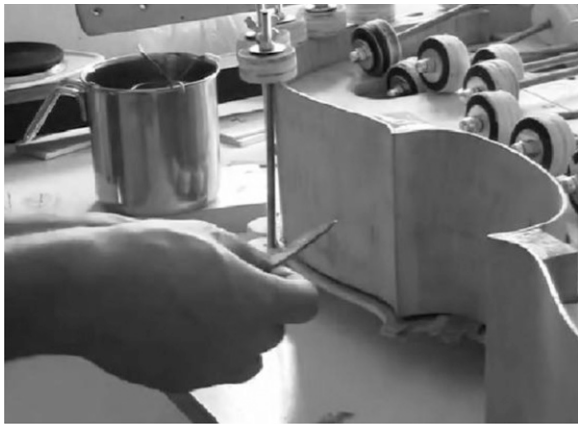

Figure 2. Palette knife glue Matteo Fantoni [3].

most common existing traditional methods. Both sets of linings are attached on a stable mold and the back glued on with the ribs straight and with a fixed outline. More work is required to build the mold. This simplifies the process of removing the mold and can be used many times. On balance, it's about the same amount of work. A collapsible mold can also be used for repairs. There are a couple of other objectives associated with an improved mold design:

A number of comments are in order. Making the mold out of heavy plywood makes the molds heavy and difficult to handle, especially for a bass. The solution here is to use more layers with thinner wood and an internal frame to hold the shape.

Good clamping options are important, in particular, good angle and force for the corner blocks to get a tight fit.

The lining process is actually a laminating process. When the laminations (rib and liner) are glued together, there is a big increase in stiffness and the shape is locked in. This is best done with the outline tightly controlled i.e. on the mold.

With small wooden blocks on top and bottom, it is possible to lift the edges of the instrument up and thereby protect the edges from getting damaged. If one unscrews the blocks, then you can put the entire instrument on a flat/level sandpaper surface and ensure that the edges are even and flat. The lift blocks can then be reattached.

Table 1. Comparison of methods for traditional molds.

Cremona	Mittenwald
Both linings are placed in the mold	Only bottom linings on the mold
The ribs have to be extracted from the mold to glue on the back	The sides are definitely straight (clue in identification)
The sides are trickier to get straight	Outline on the back is locked in when attached to the back
Outline with pencil	Slightly more difficult to get mold out–be gentle while removing blocks
Preclamp and glue sections	
Use spider to hold sides vertical	
More difficult to get outline control	Shape will change slightly as upper linings are added
Typically see holes in the mold for clamping	Typically see square opening for clamping

Table 2. Objectives for collapsible molds.

Light weight–easier handling
Good clamping options and angles
Install upper and lower linings on the mold
Protect linings while supporting the instrument
Flatten the top and bottom of the ribs and blocks on the mold
Trim linings with some support and ease of access
Collapse mold with back glued on–with both sets of linings
Can use clamps to pull the mold off blocks controlled force and no follow through

The use of a controlled hammer blow to remove blocks takes a considerable touch. One option is to use screws, particularly on larger instruments, such as cellos and basses. With a collapsible mold it is possible to get access to the screws during disassembly.

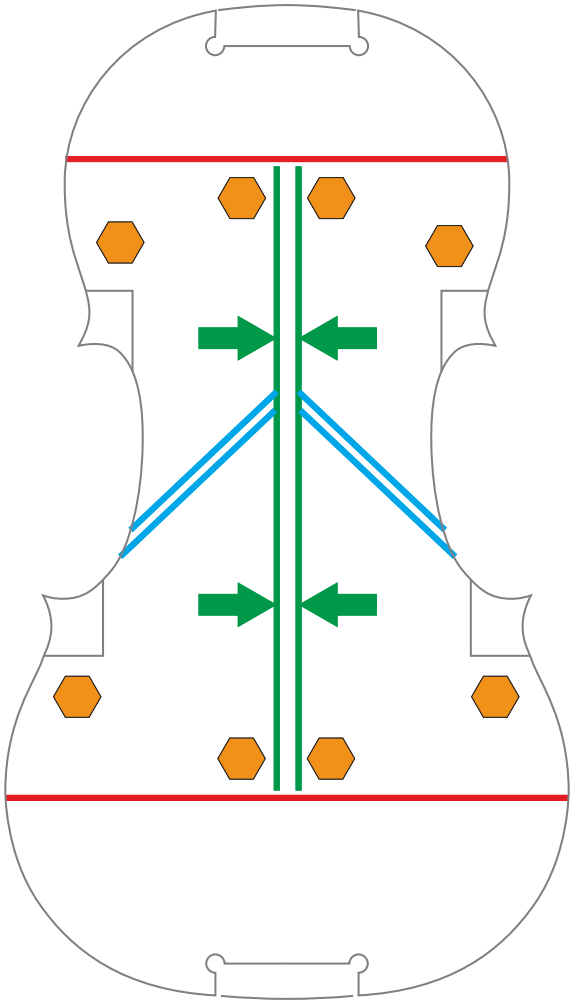

Figure 3. Upper layer.

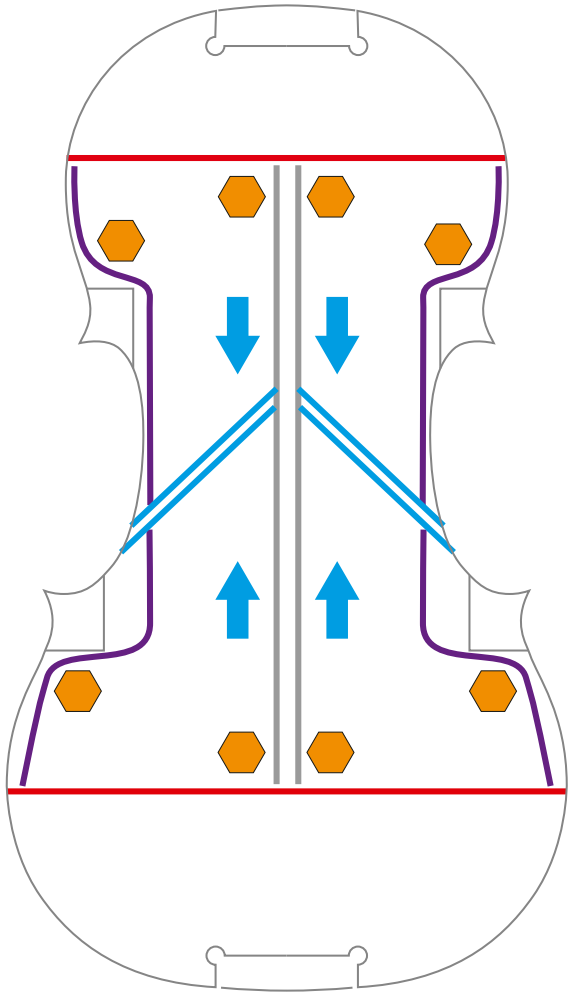

Figure 4. Middle layer.

One interesting option with hand clamps is that they can be reversed and used to pry the instrument off the mold. There is less follow through with a steel bar clamp, and this reduces the potential from a hammer blow that is stronger than necessary.

With partial disassembly of the mold, the linings can be trimmed with the instrument outline still supported. The objectives are summarized in point form in Table 2.

MECHANISM

There is more than one way to make a mold. The example below is for a violin. However, the principles can be adapted to all instruments. Essentially, you have two choices, to start from the end blocks or start with the corner blocks. We have started with the sides. The mold is made in three layers.

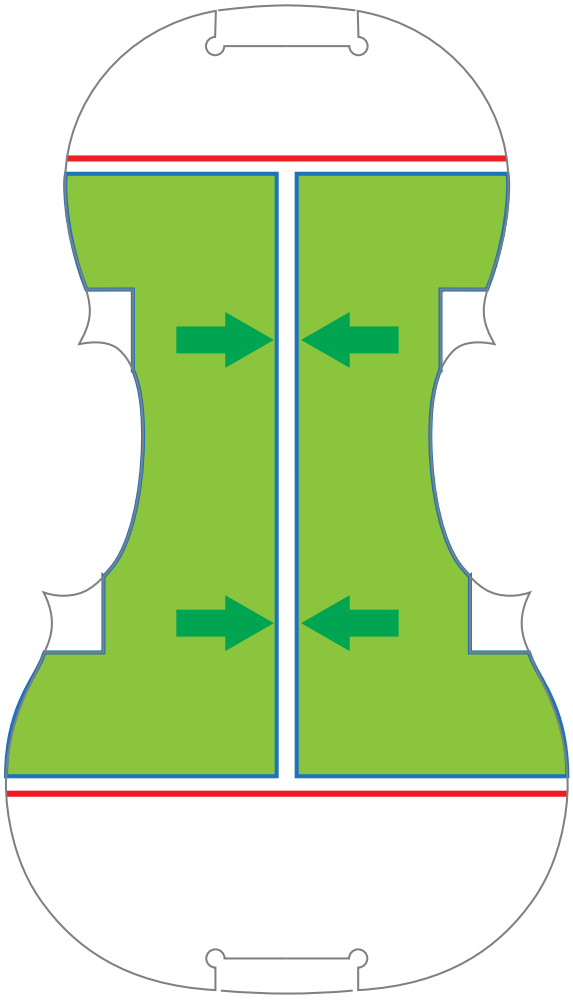

Figure 5. Violin mold.

A gap must be placed in the middle to allow the inward collapse. This provides for clearing the linings and the removal of the mold in parts. Figure 3 shows the first step.

The screws that go through to the bottom layer are removed. Then, the middle sections of the top layer are moved inward and off the corner blocks. Note the gap between the green lines in Figure 3.

The middle layer shown in Figure 4 also has a gap between the two blue lines. Note that the upper redline must be located above the widest part of the upper bout, and the lower red line must be located slightly below the widest part of the lower bout.

There is a gap between the instrument outline and the outside of the middle layer in the center section shown with the purple line. The end sections are moved toward the center and removed.

This leaves two pieces of the center section on the bottom (shown in Fig. 5) that are easily removed directly.

MOLD USAGE

The entire mold is shown in Fig. 6. It is used almost exactly the same way as a classic violin mold. The blocks are glued in with hide glue and a layer of paper. The small wooden blocks held on with brass screws provide lining protection. The layers are held together with small stove bolts from the local DIY store. Nuts are countersunk and glued. Clamping zones have also been supplied that are a hybrid of the traditional circles and the large square opening.

MOLD CONSTRUCTION

Construction of the molds is not difficult. Three layers are laid out from outlines as shown in Fig. 7. Guide holes and pins are used for indexing. The red lines are located above the widest point in the upper bout and below the widest point in the lower bout.

The outline is cut with all three layers together using pins.

The middle section has a gap between the two blue lines. Note that the middle layer is

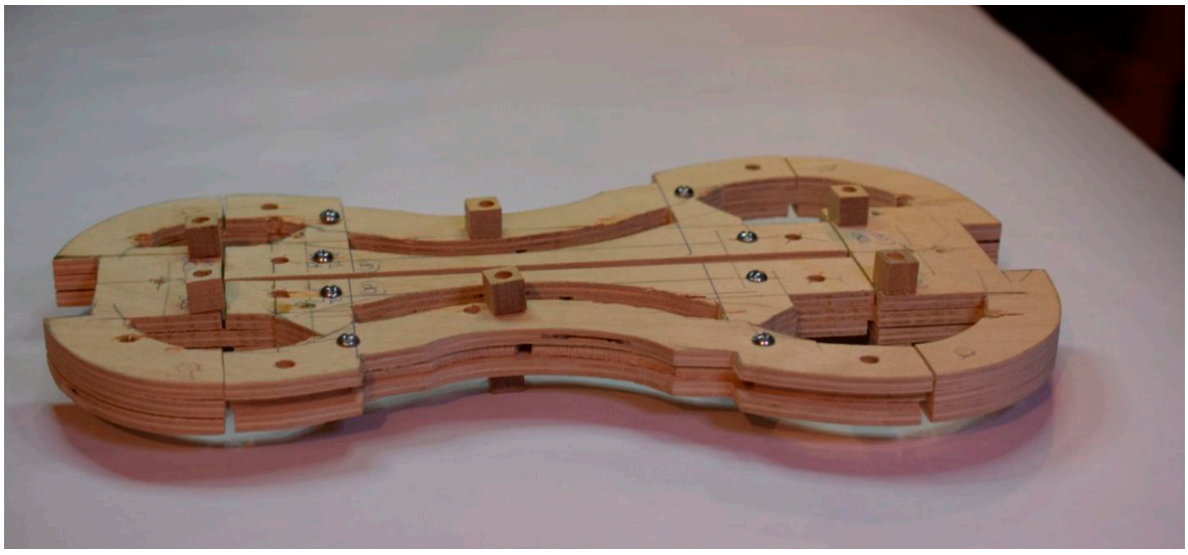

Figure 6. Construction.

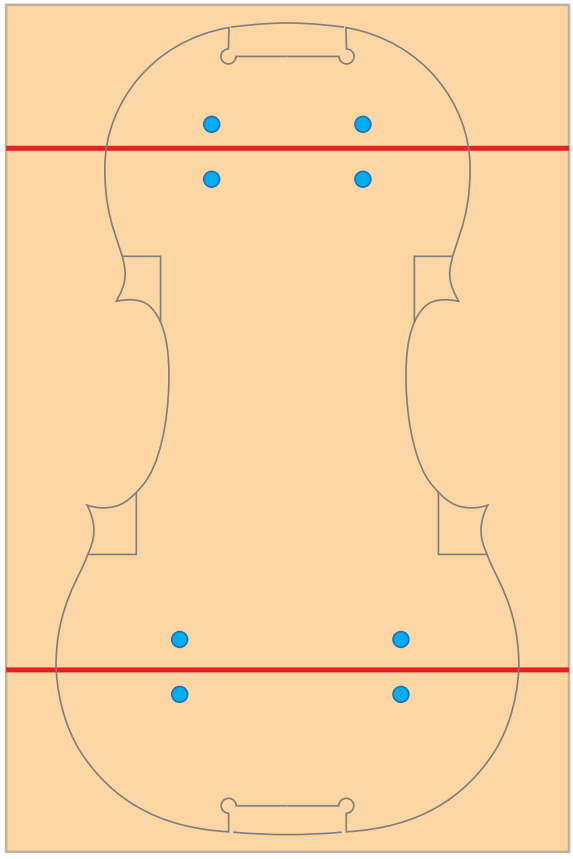

Figure 7. Lower layer.

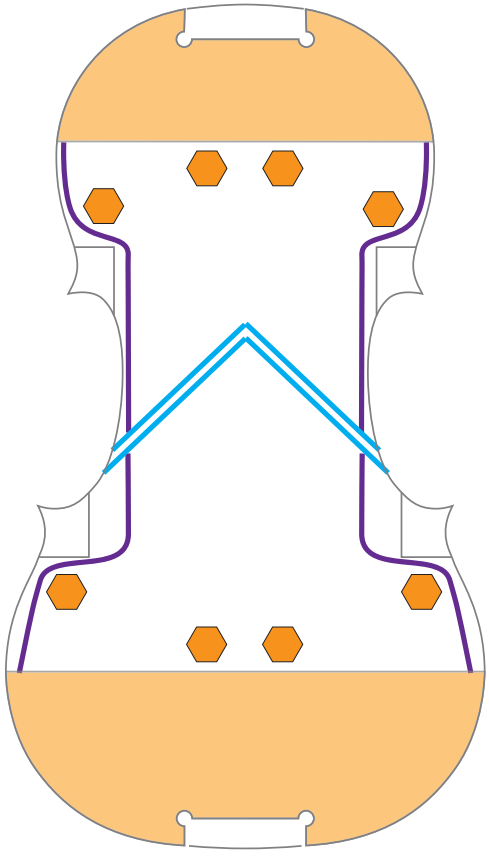

Figure 8. Construction II.

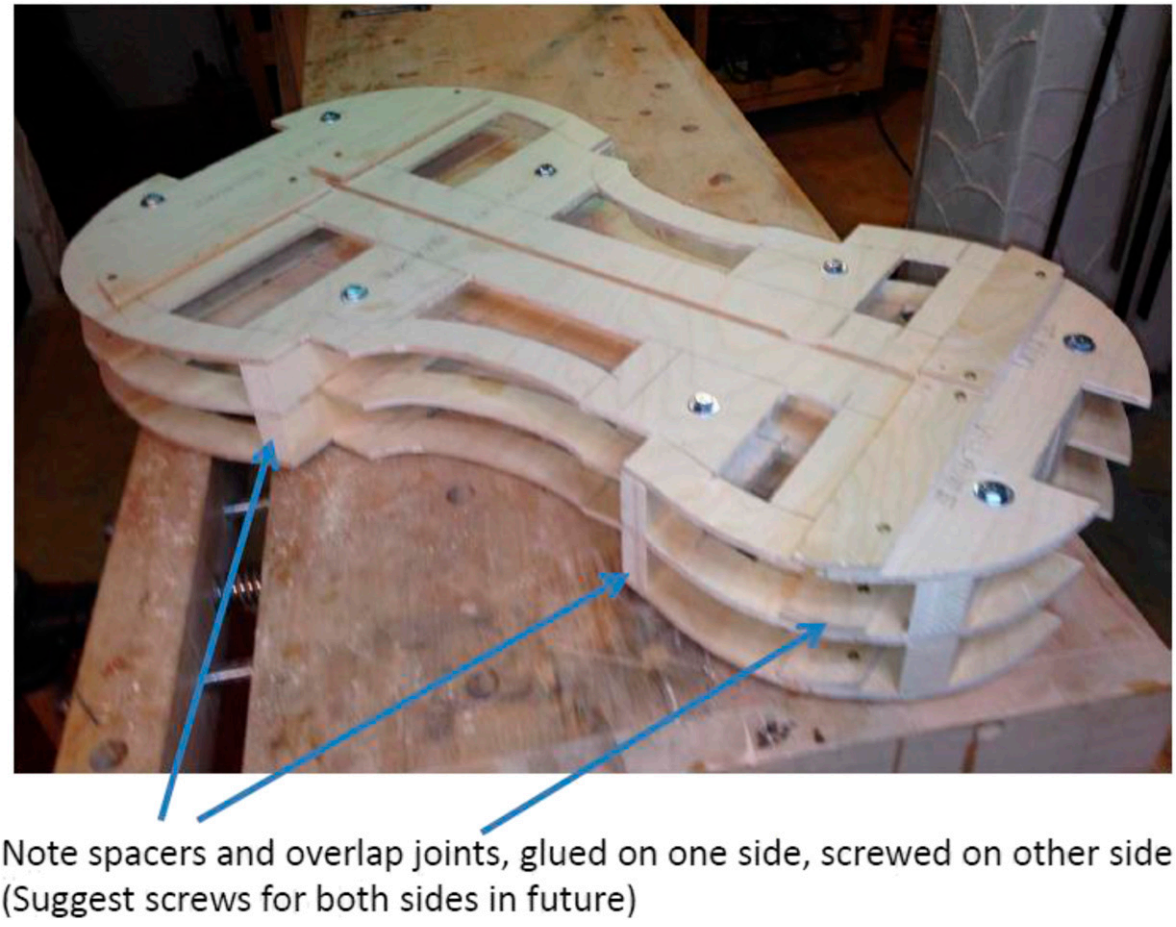

Figure 9. Cello mold with three layers.

trimmed along the purple line to provide clearance, such as for the corner blocks. All three layers are glued together at the upper and lower ends of the middle layer and the end sections are therefore thicker.

A gap in the middle is required in the upper and lower layer. I have included a gap in the picture of the third layer in Fig. 8. This may not be necessary. When the three layers are unscrewed the middle layer lifts up.

SPACERS

For cellos, the best method includes some spacers to allow the full height of the ribs to be defined. Note that the top and bottom layers leave room for the linings to be attached with the mold. See Fig. 9.

In this mold, the bolts have been put through the spacers to hold them in place. There are flat strips added to hold each layer with screws on the detachable side (the ends) and glue on the permanent connection side (in the middle). Note that wood blocks were glued to the middle layer to attach the corner blocks to—see the next Fig. 10. Also note the clamp openings. These also significantly reduce the weight of the mold and make it easier to handle. More holes or sections can be added as necessary.

Figure 10 also shows the screws used to hold the corner blocks in place. This is also done for the end blocks. Holes were added to the top and middle sheets to make separation of the end and middle sections easier for the disassembly of the middle and bottom layers. The center spine is held in place by the spacers and layers and simply pulls out during disassembly.

Figure 10. Cello Mold with top layer removed.

Clamping is straight forward as shown in Fig. 11. This is for the last rib added. Note the stronger screw clamp and cauls used to get a tight fit on the corner blocks on the RHS lower bout.

BASSES

For the bass, a more defined "skeleton" works better. This provides more stiffness for the mold and ribs. The cross pieces are notched on the center spline and on the cross-piece. They are then glued together. Reinforcing triangles have been added to keep the cross pieces oriented correctly as shown in Fig. 12.

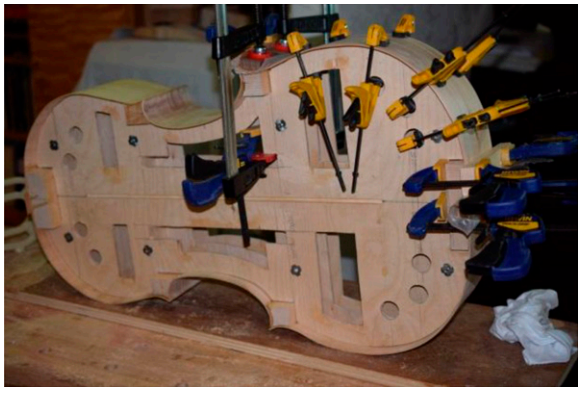

Figure 11. Rib clamping.

Holes also Reduce Weight

On the LHS of Fig. 12, the top layer has been removed. This is for a double bass. There are two layers for this mold on top and bottom. There is a reinforcement in the center section in a middle layer. For this mold, the top and bottom were divided in quarters. While this worked, the system used on the cello and violin works better. Note that the linings have been glued on with the mold on. The neck block is attached with a total of four screws. The back has a bend and this requires support as shown in Fig. 13.

It is much more difficult to get the ribs vertical on a bass due to the high rib height. Figure 14 shows the inside view of a bass that has had the back attached with the mold inside. Gluing

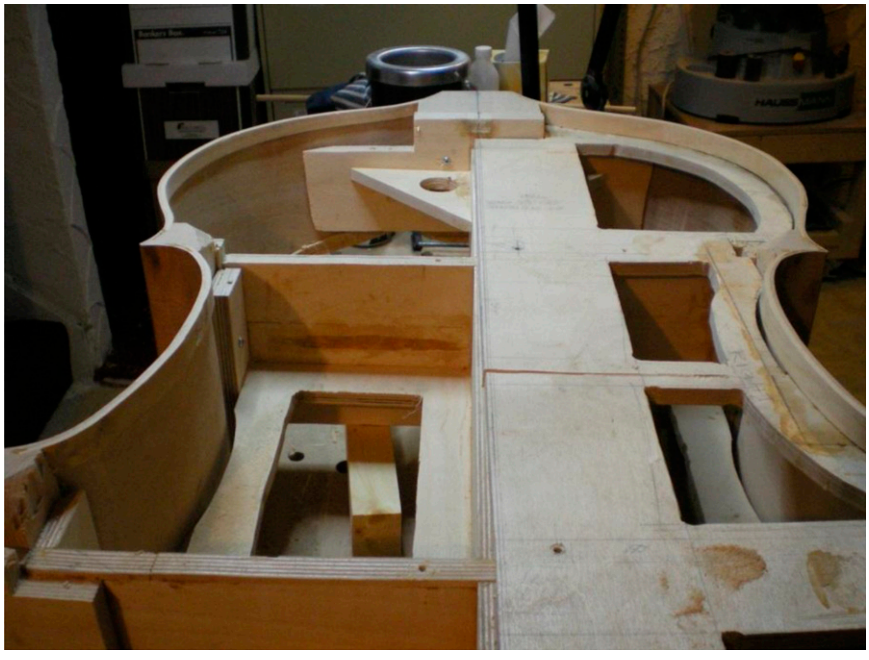

Figure 12. Top of bass being flattened.

Figure 13. Bass collapsible mold.

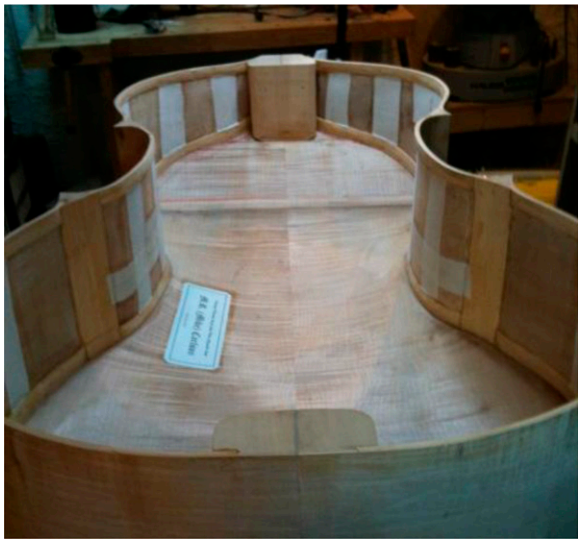

Figure 14. Sides vertical on large instrument.

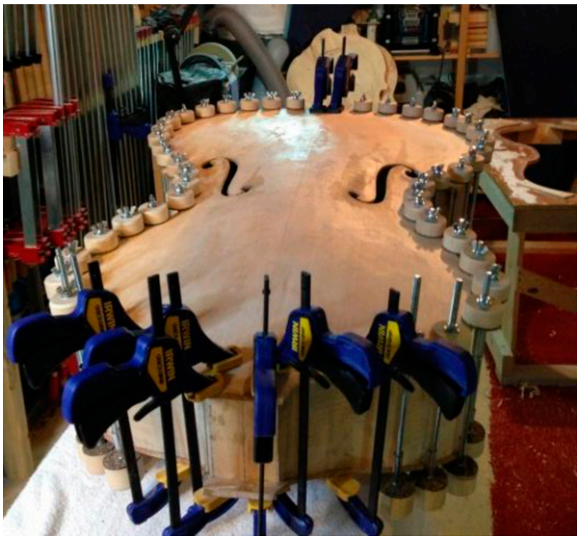

Figure 15. Top glued on–last step.

Figure 16. Mold with end collapse [5].

Figure 17. End collapse mold exploded [5].

Figure 18. Ribs shortened on mold.

Figure 19. New linings being installed.

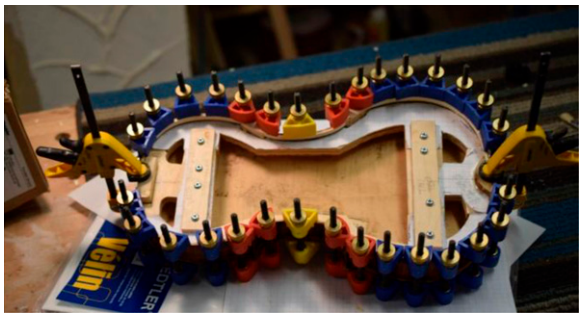

Figure 20. Ribs glued to back.

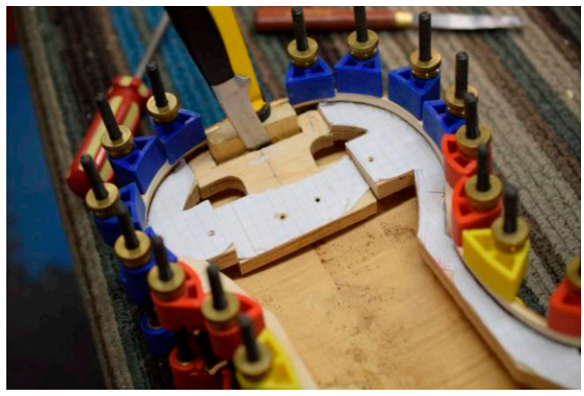

Figure 21. End block being collapsed.

the top on is the last step in assembling the instrument body, as shown in Fig. 15.

OTHER METHODS

There are other variations on the methodology outlined previously. One such variation for a violin is shown in Figs. 16 and 17. This design is from Christian Bayon and originated in Portugal [5].

It is hoped that others will be able to adapt the methodologies shown to their own applications. Most luthiers will make their own variations that suit their working style and their instrument design.

PRESENTATION

During the course of the session in Baltimore, the presentation moved to a hands own discussion of how the molds went together. The cello and violin mold were rapidly dissected by those in attendance, with the aid of a few tools. Quite a bit of discussion was generated.

One attendee showed a picture of a mold from the Oberlin construction project for cellos based on the mechanism shown in Figs. 16 and 17. The mold was laminated from MDF and was cut out with a computer cutter, a high precision variation. Collapsible molds are being used.

REPAIR

Since the presentation in Baltimore, a collapsible mold has been used for a repair. This repair was for a German factory violin on which the top had shrunk over the last 90–100 years. The violin restoration included fixing some three rib breaks, cracks in the top, as well as shortening the ribs. The top and back have shrunk more than the ribs.

The outline of the top and the back are traced onto a piece of paper and a new outline made up to fit inside both the top and bottom, with appropriate overhang. This mold uses a mechanism that collapses first off the end

Table 3. Features of collapsible molds.

Light weight–easier handling	Yes
Good clamping options and angles	Yes
Install upper and lower linings on mold	Yes
Protect linings while supporting the instrument	Yes
Flatten top and bottom of ribs and blocks on mold	Yes
Trim linings with some support and ease of access	Yes
Collapse mold with back glued on–with both sets of linings	Yes
Can use clamps to pull mold off blocks–controlled force and no follow through	Yes

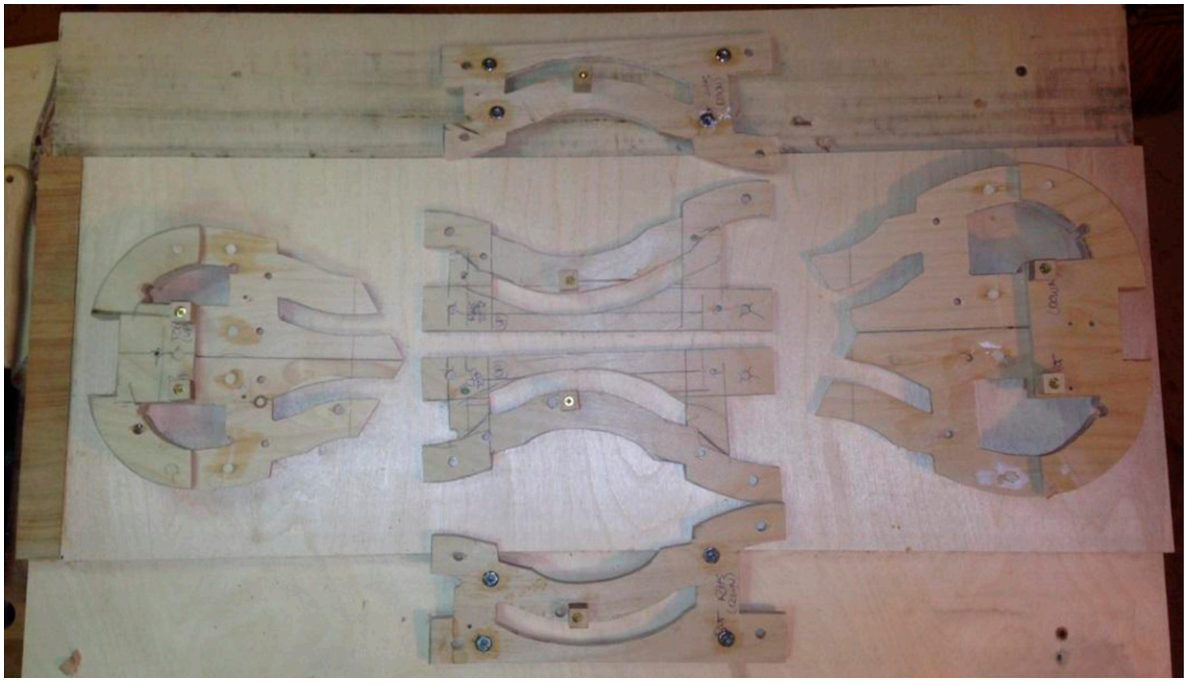

Figure 22. Violin mold exploded.

blocks. The mold keeps the ribs vertical and controls the outline. Figure 18 shows the ribs at the tail block. Note that there is a minor part of the endpin hole remaining on the right hand side. This shows the shortening.

Figure 19 shows new linings being attached with the mold inside the ribs. After this the ribs are glued to the back, similar to construction as shown in Fig. 20. The end blocks are then removed as shown in Fig. 21. Note the knife used to break the glue. The clamps are left on to provide support to the ribs as the glue joints are broken.

FEATURES

The molds outlined were designed to have a number of features that are summarized in Table 3. They do require somewhat more work to construct. The extra time must be weighed off against improved quality and ease of construction. The molds can be reused.

SUMMARY

The principles of a collapsible mold were presented for stringed instruments from violins through double basses. The reasoning and advantages were presented, as well as a number of variations. Construction of the molds was also outlined. The methodologies can be adapted to different preferences and needs. Discussions indicated that different variations of collapsible molds are being used. Figure 22 shows an exploded view of a typical violin mold.

REFERENCES

[1] YouTube; Matteo Fantoni, "Series of videos," is found at https://www.youtube.com/watch?v=T46uqUtNDbw&list=PLAzW_93em9h7h_PNZiWNq2f-YzUSvM65p.

[2] J. Barker, *Violin Making: A Practical Guide*. (Crowood, Marlborough, 2001).

[3] K. Roy, *The Violin Its History and Making*. (Karl Roy Private Printing, Barrington, NH, 2006).

[4] P.P. Prier, *When Trees Sing; The Complete Guide to Violin Making 15 Disc DVD Set*. (Peter Paul Prier Inc., Salt Lake City, UT, 2010).

[5] C. Bayon Maestronet, Portugal, is found at http://www.christianbayon.com.