Build an Eli Terry Pillar and Scroll Clock

Featured Piece of the Month – September 2022

Bruce Wedlock

Introduction

The Eli Terry Pillar & Scroll Clock was the first shelf clock built in the United States. Eighteenth century clocks used wooden movements which were too deep for a shelf clock. Construction was limited to tall clocks. Eli Terry developed and patented in 1816 a thin wooden movement, and the Connecticut shelf clock industry was born. Terry also developed the concept of interchangeable parts to economically mass produce his movements a century before Henry Ford. Well-known clockmakers Seth Thomas and Silas Hoadley got their starts as joiners building tall clock cases for Terry, and subsequently were licensed to start their own businesses making this popular shelf clock. The next thirty years saw over a hundred thousand of these inexpensive clocks made and sold to homes throughout the country.

The original Terry clocks had a 30-hour weight-driven movement which required a 32" high case. This clock is scaled to two-thirds that height as were later commercial models when 8-day brass movements became available.

Building this clock requires a wide range of woodworking skills. The case work involves high precision as its many fitted parts are visible. Construction entails accurate milling several thickness of stock, resawing, applying veneer, spindle turning, cutting dovetails, routing mortises and edging, and scroll sawing. Many pieces are mirror images which can easily lead to careless error, but the result is a period piece that is a joy to behold.

This clock will incorporate a quartz movement which significantly simplifies the construction and reduces cost over the mechanical movement. Should you prefer to use a mechanical movement, be sure to obtain the movement before starting construction. Check the depth between the dial board and case back to insure adequate clearance. Increasing the widths of the top, sides and base are the only changes necessary.

The construction drawings and patterns for this project are available as links in context to *.pdf* files and listed in the Appendix at the end of this document. They can be viewed and printed letter size. The construction drawings can also be emailed to a print facility to obtain full-scale *C*-size drawings. Links to these *.pdf* files are shown as *Assembly Drawing*.

Materials

The original Terry clocks had a decorative grain on the door and scrolls as shown on the left clock above. That clock is mahogany with zebrawood veneer. The right-hand clock has no decorative veneer and is made in cherry. In either case, veneer is needed for the scrolls for a vertical grain direction and to strengthen the short grain. Applying the veneers as described in *Veneering the Terry Clock* is best done before starting the actual case construction.

The project requires primary wood of 4/4 x 6" x 100" rough and a 6/4 x 3" x 24" to be resawn and milled as described in the *Cut List*. Some 1/4" plywood and veneer are also required.

Accurate tools are essential. For drilling you should have quality brad point bits, and a 9/16" Forstner bit. If you don't have brad point bit set, then purchase the sizes you will need. Hardware and tools are listed in the *Sources for Terry Clock* file.

Building the Case

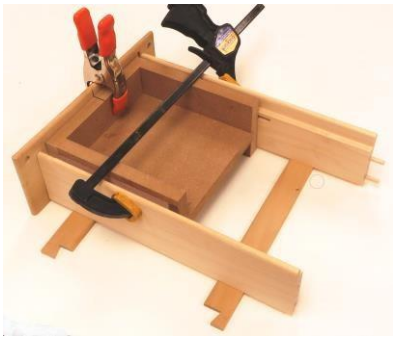
Refer to the *Cut List*. The clock case consists of the base *B*, sides *C,* top *D* and battens *E*. Resaw *DE,* mill the pieces to their final thickness, and joint the edges. Rip 1-3/4" for the legs *M* from *CM* and set aside. Mill a 1/4" deep chamfer on the four edges of *CX*, rip them off and set aside for the glass retainers *X*.

Mill base and top to their final dimensions. Refer to the *Base, Top & Plinths* drawing. Mill a 3/8" bull nose on the front and ends of the top before ripping to width. DO NOT ROUT the front and ends of the base. Fasten top and base with back edges flush and centered with double-sided tape. Matching pieces of blue tape joined with a drop of cyanoacrylate (*CA*) glue works very well. On the top lay out and simultaneously drill the two 17/64" through pillar holes in the front corners. Drill the 1/4" x 5/16" deep stopped hole in top for the center plinth. DO NOT DRILL the dowel assembly holes.

Refer to *Left Side, Batten & Pillar* drawing. Cut the sides *C* to 14-1/2" length. Select the front edges and mill a 3/8" deep rabbet 13/16" wide in the inside front edge of each side. Mill a 3/8" bull nose on the front edges. On the inside of the sides, mill a 1/4" by 1/4" groove 8-3/4" down from the top and 1/4" in from the rabbet edge. Rip to 3-9/16" in width. Caution: Be sure to make a right- and left-hand side.

Mill a 1/4" round over on one edge of battens *E* and rip them to 1-1/2" in width. DO NOT CUT the battens to length at this time.

The assembly of the case is tricky because the sides do not align with any edge of the top or base. The dowel joint joinery with screw fasteners makes the repeated dry assembly convenient. A *Case Assembly Jig*, made from 3/4" *MDF* with *P150* sandpaper on the sides, is worth the time to accurately position these pieces.



To assemble the case, start by laying out the dowel and screw holes on the outsides of the top and base. Place one batten through the notches and the other past the end of the jig. Clamp the top to the jig's end with centerlines aligned and back edge on the table surface. Position the case sides on the battens and against the top and clamp them to the jig. The assembly is now ready to drill the dowel and screw holes.

The concentric holes are of different diameters. Start by drilling the four 1/4" dowel holes 3/4" deep into the sides. Drill the two screw holes 3/32" in diameter 3/4" deep into the sides. Replace the top with the base and drill the corresponding holes. Note: these hole diameters are for straight shank #6 *FHWS*. If you use a different style screw, adjust the diameters. Ream the 1/4" dowel holes in top and base to 17/64" to provide a smooth dry fit. Ream the screw holes in top and base to 5/32" and countersink for flush screws.

Glue 1/4" dowels in the sides. Dowel diameter can be accurately sized by driving them through a metal drill gauge. Avoid undersize dowels; they result in sloppy joints. Screw the case assembly together using *FHWS*: #6 x 1" in the top and #6 x 1-1/4" for the base. Trim dowels flush.

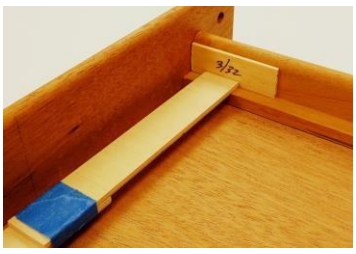
Rout the front and sides of the base with a Whiteside 3212 bit.

Lay out and cut dovetails on the battens. Lay out and cut matching dovetails in top and base and attach each batten to its side with three #4 x 1/2" brass-plated *FHWS*. Use a 5/64" pilot hole, enlarge the clearance holes to 1/8", and hand countersink the holes flush.

Building the Door

The door is held closed by a magnet with a key used to pull it open, so the drawing *Door* will be followed here. The instructions assume a veneered door. Directions for veneering the door are in *Veneering the Terry Clock*.

When making an inset door, one usually constructs the door frame and then planes it to fit the door casing, creating a uniform reveal. However, the veneer on the face of this door does not plane well; you can easily chip the end grain destroying the crisp edge appearance. To avoid this, rip the rails and stiles to their exact size, and then assemble them in the clock's case to produce the uniform reveal.



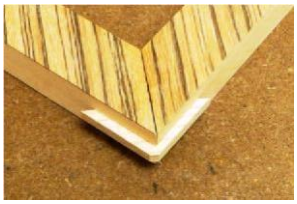
The first step is to rip the 5/8" thick (veneered) *N P Q* door stock into four 7/8" strips. Set aside the remaining cross rail piece. The reveal is determined by the *Brusso L-23* hinge which is 3/64". The rails and stiles must be cut with 45° miters precisely 3/32" shorter than the door case. Make a shim 3/32" thick as a gauge. Then measure the rail and stile lengths using story sticks and this shim.

If you don't have a jig for cutting perfect miters, take the time to make one. Avoid fudging with imprecise miter angles; it will mess up the door reveal. You can make a miter jig to cut complementary angles for perfect miters in a few minutes.

The story sticks are now the precise length for the rails and stiles. In laying out the cut lines, center the veneer joint on the rail and stile lengths. Be careful to cut the miters in the veneer grain direction.

To ensure the door is parallel to the case opening, assemble the door inside the case, keeping the reveal uniform around the door. The bottom rail and left stile are held tight against the case with spring clamps. Wedges on the opposite pieces provide the clamping force on the right stile and top rail. The miter ends can now be manipulated to provide uniform reveal and flush veneer surface joints. This assembly results in a door that perfectly matches the case shape.

To complete this assembly, place some blue tape in the case corners to block squeeze out and apply a small amount of five-minute epoxy to the miter surfaces. Place it to minimize squeeze out into the case corners. Clamp the bottom rail and left stile pieces in place with spring clamps while you place the remaining pieces. Insert wedges in the top and right sides. Adjust the wedges to align the door parts to provide a uniform reveal and flush surfaces. Don't push the wedges in too hard; just enough to hold the assembly. When the epoxy has cured, remove the door from the case.



The next step is to strengthen the miters by inserting 1/8" thick splines in the door corners with the grain perpendicular to the miter. Using a spline jig and rip blade, cut the centered grooves and glue in the splines. These splines strengthen the door; the epoxy is just a temporary fastening for cutting the splines. Splines should just slide in gently; do not force them. When the glue is dry, trim the splines flush using a trim bit on the router table. Planing is not a good idea as you will risk chipping the end grain of the veneer.

Rip the center door rail 3/4" wide and dovetail it into the side rails. Position the rail so the dial opening in the door is a square. Finally rout the 1/4" x 7/16" rabbets inside the door openings for the glass and clean up the corners with a chisel.

Installing the Hinges

Install the door frame hinges first. The hinge mortise location is flush with the edge of the door with the hole diameter centered over the front edge of the door as shown in the drawing. Double-sided tape will hold the hinge accurately for outlining the mortise with a marking knife. The door clamped for routing the mortise is at the right.

Using a 3/16" bit in a trim router, set the depth of cut to match the hinge thickness. Carefully rout the mortise near the knife lines and finish with a chisel. The finished mortise is shown at the right. Drill pilot holes with a centering bit and fasten the hinge with #4 x 1/2" brass plated screws. Save the hinge's brass screws for final assembly.

Locating the matching hinge mortises in the base and top presents a precision measurement challenge. The solution is to not do any measurements, but rather just put the door together with the hinges in the correct location.

Start by placing a strip of double-sided tape in the general mortise location in the base. Next, fasten the matching part of the base hinge to the door hinge with blue tape rolled sticky side out. This will keep the hinges in proper position with the door closed.

With the top removed from the case, we can now place the door in the correct position to locate the base hinge mortise. The door needs to be offset a bit in front of the rabbet, and we need to establish the 3/64" reveal distance between the door and the case side. A piece of cardboard about 1/64" thick taped to the rabbet will offset the door, and a 3/32" steel rule will provide the uniform side reveal spacing. With these in position, slide the door down to press the hinge to the sticky tape on the base.

When the door is now slid away, the hinge will remain attached to the base in the precise position required. Disassemble the case and outline the base mortise with a marking knife. Rout the mortise with the trim router and clean it up with chisels. Install the hinge in the base.

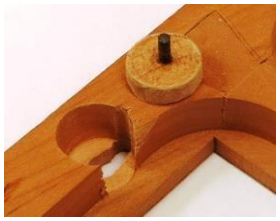
The same procedure is applied to mortising the hinge in the top. With double-sided tape on the hinge location on the top, and the hinge parts positioned with tape, insert the door on the base hinge, add the spacers and slide the top firmly into position onto the dowels. Remove the top, outline the hinge mortise and rout it. Shorten the hinge screws into the top, so they don't punch through, and install the hinge.

Plane a chamfer on the hinge side stile for swing clearance. You can now install the door and check for clearance on the lock side. Plane a bevel on the inside edge as required to provide the necessary spacing for the door to swing freely. Be careful not to plane the veneer.

Installing the Lock

For this project the door will be latched using a magnet. We need an arrangement to hold the key for appearance and to pull the door open. This construction is illustrated in the *Door* drawing.

Begin by laying out the location of two holes on the front of the left stile 7" and 7-1/4" from the bottom and 3/8" from the edge. Next drill a 1/16" through pilot hole at the 7-1/4" location. From the back of the stile enlarge the pilot hole with a 9/16" Forstner bit, 3/8" deep. From the front enlarge the pilot hole to 7/32" and drill a 5/32" hole at the 7" location 1/2" deep. Complete the keyhole opening with a fret saw.



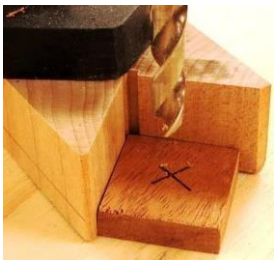
To hold the key, we need a 3/32" steel post. This is held in a 9/16" dowel 3/16" thick. Fashion the 3/32" post from 1/2" of the shank of a 3/32" drill. Since the drill is hardened, heat the area to be cut red hot with a torch and let it air cool. Then cut it with a hacksaw. Attach the post into the center of the dowel with *CA* glue. Glue the dowel in the stile, centering the post in the keyhole. File off the small tip on the key, insert it into the keyhole and check the rotation.

The door is latched by a pair of 1/4" rare earth magnets. Drill a 1/4" hole in the back of the left door stile 3/16" from the outside edge and 9" up from the base. The depth should be the thickness of the magnet. Drill a matching hole in the left side stile. To insert the magnets, first put them together and mark the outside ends with a magic marker. The marked surfaces will go into the holes insuring they will attract. The easiest way to insert a magnet is to attach it to a flat blade screwdriver with the marked surface out. Put a bit of *CA* glue in the hole and press the magnet in. The magnets should be a hair proud so their surfaces touch. Install the door and check the latching using the key to pull it open.

Plinths and Caps

The plinths and caps are multiple pieces of the similar dimensions shown in *Base, Top & Plinths*. Start by cutting a 6" length from the 6/4 stock and rip it in half. Mill one piece to a 1-1/8" square cross section for the plinth caps and crosscut pieces *H* 1/8" in thickness. This is best done using an adjustable stop block on a cutoff sled to prevent the small pieces from flying away. Three caps are required but cut a couple extra just in case. Mill the remaining pieces to a 7/8" square cross section for the plinths. Cut four pieces *U* 1/4" thick and two pieces 5/16" thick from the second piece for the pillar base and capitals. The 5/16" pieces are for fitting the pillars should they be turned a bit short.

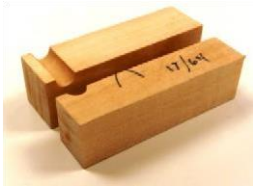
Mill 1/4" deep grooves for *F* and *G* in remaining two pieces as shown in *Base, Top & Plinths* drawing. If you make the plywood choice for the scrolls, cut the mortises in the plinths and legs to match the plywood thickness. Start 1/8" from the edge and work the width to the thickness of your scroll stock. Don't make the grooves too tight because of the short grain; make an easy slip fit. Cut two *F* pieces 13/16" long and one *G* piece 2" long.



The drawing shows various diameter holes drilled in the *F, G, H* and *U* centers. It is important that the holes be exactly centered, or the misalignment will be very apparent to the eye. To that end, use a *V*-block on the drill press to exactly center the holes in multiple pieces. Mill a small countersink on the 1/4" plinths to mate with the pillar beads, insuring a tight fit.

Pillars

The pillar turning is shown in *Left Side, Batten & Pillar* drawing. There are two critical measurements in this turning. The distance between the ends of the beads, shown as 14" in the drawing, should actually be the exact distance between the top and base of the case less the thickness of two 1/4" *U* plinths. Otherwise, the pillar will either be loose, or the top won't seat tight on the sides. To measure this distance stack two plinths on the base and set the exact distance to the top with a story stick. Use this to locate the outer edges of the bead turnings.

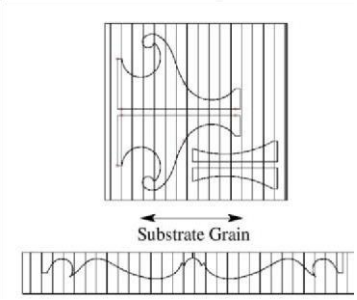


The second measurement is the diameter of the 1/4" dowel ends. These are best measured with a jig made from two pieces of wood clamped together and drilled 17/64"on the seam. Turn the dowel ends until the jig just fits smoothly.

Now check the fit of the pillar and plinth assembly to the case. If the pillar is a bit long, sand the bottom plinth to achieve the fit. Should it be too short, replace the bottom plinth with the 5/16" plinth and sand to fit. If there is a need to increase this thickness a small amount, glue a piece or two of veneer on the bottom plinth's bottom surface. With the fit correct, glue the plinths to the pillars with the chamfers against the beads.

Scrolls & Feet

Directions for veneering the scrolls are in *Veneering the Terry Clock*. As an alternative to veneering the scrolls, 1/4" hardwood plywood can be used. The initial milling of *J K L* for the scroll layout is also described there.



The drawings for the various scroll pieces are shown in the *Scrolls & Feet* drawing. The pattern outlines are shown in *Scroll Patterns*. Attach the patterns with repositionable spray adhesive to the (veneered) substrates as shown at the right. Cut the scrolls' straight edges on the table saw. The bottom scroll has three arcs of 3/4" diameter, one in the center and one at each end. Drill these first with a Forstner bit, then Scroll saw the patterns and finish shaping by drum sanding.

The feet are shown in *Scrolls & Feet* drawing. Mill the 1-3/4" wide stock, ripped from *C* when building the case, to 1/2" thickness. Fasten two layers with double-sided tape and attach the foot pattern. Cut and sand to shape. The curved end shape is sanded on a drum sander, fairing the curve with the arc at the end of the bottom scroll.

A 1/4" mortise for the bottom scroll is milled 1/8" in from the front inside ends of the legs. Lay out with the mortise length matching the scroll tenons. Drill the waste and carefully pare to an easy fit. The short grain is very fragile so clamp a supporting piece during paring. Drill and countersink the 5/32" holes for the #6 x 3/4" screws and fasten the legs to the base 1/8" in from the front and sides.

With the top plinths installed on the dowels, trim the scroll tenons for easy fits in the plinths and leg mortises. Mark the location where the tenons enter the plinths and legs and rout a 45° half-thickness chamfer on the curved back edge of the scrolls up to the tenon entry marks. After chamfering the back edges of plywood scrolls, the grain edge can be dyed to minimize the ply appearance.

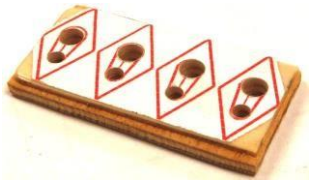
Miscellaneous

The back panel is 1/4" primary wood plywood, 9" x 14-1/2" cut to fit the back opening exactly. Fasten with six #4 x 1/2" brass plated screws. Drill 5/64" pilot holes, ream 1/8" clearance holes and hand countersink the screws flush.

Glue the 1/8" caps centered on the plinths using the finials as clamps.

The glass is fastened with the glass retainers *X* milled at the start of the construction. Miter the ends to fit the door openings. Drill and countersink two 5/64" holes in each retainer, 2" from the ends of the long pieces and 1-1/2" from the ends of the short pieces. These holes are offset as shown in the *Door* drawing to prevent the screws from touching the glass plates. With the glass in place, fasten using #1 x 3/8" flat head brass screws.

The lower glass panel is traditionally reverse painted. Acrylic paint works well. A pattern for a typical boarder and pendulum window is in *Painted Glass Circles*. Google *Eli Terry Clocks* for examples of pictures on these clocks.



The keyhole escutcheon is made from an old ivory piano key. The ivory key should release from the piano part by boiling in hot water. The ivory key is then fastened to a piece of 1/8" plywood with hide glue, and the escutcheon pattern fastened to the ivory with replaceable spray adhesive. Precisely drill the 3/16" and 1/8" holes with a brad point bit and complete the opening with a fret saw. Cut apart and shape the escutcheons on a disc sander with a zero-clearance plywood table. Use this assembly to lay out and cut the escutcheon mortise on the door. When the plywood fits, remove the ivory by heating in hot water and fasten in place with a drop of *CA* adhesive. This can be done after the finish has been applied.

Finishing is better done before assembly. Tape the scroll tenon ends to block the finish. If you wish to fill the grain, water-based clear *Aqua Coat* clear gel filler is a good choice. Shellac or water-based *General Finishes* gloss *Enduro-Var* urethane work very well.

Assemble top plinths and scrolls with a drop of *CA* glue and tape in place. Fasten scroll assembly to the top with a few 1/2" 23-gauge pins. Install finials.

The file *Patent Clocks.docx* is a *Word* file copy of the original label that was glued to the inside back behind the painted glass. Clicking the link will not display automatically. Instead, clicking will download the file to your computer. Edit it for your name and location, print it, trim, and paste it inside your back.

Movement Installation

Mill 1/4" plywood 8-1/4" square for the dial board *R*. Install in the case and locate the center of the top door opening for the clock axis. Drill a 5/16" hole. Print *Clock Dial* on light card stock or parchment paper and mount the dial to the dial board with a permanent coating of repositionable spray adhesive. Attach the quartz movement and align the minute hand location for the 12 o'clock strike by slight rotation of the movement. Fasten with #4 x 1/4" pan head steel screws. Install the dial assembly in the case and cut the pendulum to length for the window opening.

Conclusion

Credit is due Burt Ouelette who provided numerous suggestions to improve construction and, to Bill Barrett for editorial comments. Enjoy your reproduction of a famous Federal period clock.

Appendix - Eli Terry Clock Resource List

Attachment	Size
Assembly Drawing	293.59 KB
Veneering the Terry Clock	846.4 KB
Cut List	48.97 KB
Sources for Terry Clock	39.11 KB
Base, Top & Plinths	174.16 KB
Left Side, Batten & Pillar	69.98 KB
Case Assembly Jig	16.95 KB
Door	118.97 KB
Scrolls & Feet	111.25 KB
Scroll Patterns	115.94 KB
Painted Glass Circles	181.48 KB
Patent Clock Label (downloadable Microsoft Word document)	18.04 KB
Clock Dial	554.27 KB