$6.00

Introduction to Ornamental Milling

www.legacywoodworking.com

VOLUME TWO

800-279-4570

Legacy Woodworking Machinery

a division of Phantom Engineering, Inc.

1122 South 900 East
Provo, Ut 84606

TURN WITHOUT A LATHE!

Featuring

THE LEGACY ORNAMENTAL MILL

Introduction to Ornamental Milling

Using the Legacy to create TURNINGS WITHOUT A LATHE!

Lathe	*vs.*	*Legacy*
• Skill based system. Requires hand-eye coordination, physical strength and dexterity.		• Mechanically based system.
• Requires manual manipulation of gouges.		• Uses the predetermined shape & diameter of the router bits to create the design, creating clean cuts and making duplication much easier.
• Generally uses a storyboard layout to assist in the design of the piece.		• Can follow or duplicate from a pattern.
• Can follow or duplicate from a pattern. (copy attachment required) Quality of cut is extremely rough, requiring excessive sanding.		• Adjustable bed allows for turnings to be straight or tapered.
• Without copy attachment, turning requires a "cut & measure", "cut & measure" process. Which is time-consuming and inaccurate.		• Turnings can be round, square, multi-sided, or spiraled.
• Straight or tapered turnings are created by the operator adjusting the depth of the gouge.		• Up to 83" stock capacity.
• Stock rotates between 800-2400 rpm - if stock is out of balance spindle whip occurs making the part extremely unsafe.		• Router cuts up to 21,000 rpm - resulting in an extremely smooth finish.
• Turnings must be round.		***Plus the Legacy allows you to do things you will never be able to create on a lathe. Such as:***
• Most lathes are limited to a 36" stock capacity.		• Add reeds and flutes.
• 10 minutes to learn, a lifetime to master.		• Add joinery i.e. mortises, tenons, dados, dovetail slots, pocket holes, etc.
		• Create custom flat and circular mouldings.
		• Create square or multi-sided spindles or posts.

Turning on a lathe is nothing more than creating shapes. As simple as that sounds, it requires the operator to develop a set of physical skills, using gouges to scrape unnaturally against the grain of the wood.

Creating turnings on the Legacy uses the predetermined shapes and diameters of router bit profiles, making the turning process much simpler. The Legacy also allows you to follow a custom-built pattern to turn and duplicate shapes.

The finial design pictured left, uses 3 different router bits (black shapes) to layout the design.

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Legacy Builder:
Tracy Anderson

Featured Project:
Gate-Leg Table

Technique:
Milling the Hollow Spiral

Tracy Anderson had his first real woodworking experience in Junior High woodshop. Even as an 8th grader, Tracy thoroughly enjoyed building with wood and attributes his enjoyment to a great instructor. One of Tracy's favorite experiences of Junior High wood shop occurred around Christmas time each year when he and his older brother Andy would build presents together.

Unfortunately, the fun in wood shop stopped short of High School due to a teacher lacking in enthusiasm and structure. With no guidance, Tracy became bored and, as any adventuresome teenager might, Tracy made various projects (and disasters) on his own until he was eventually kicked out of class.

A few years after high school, Tracy moved to California, where he lived and worked with his older brother Andy. Still interested in building things, Tracy used Andy's table saw (this was pretty much his only serious woodworking tool) to build a waterbed. In time, Tracy became so hard up for a chance to build that he would go to Andy's machine shop (which had metal working tools, not woodworking) in order to construct his latest project.

Eventually, this woodworking hobby took hold of both brothers, and D & A, one of the companies in which Andy was a partner and where Tracy was employed, set up a shop with a few more tools and together the brothers contentedly built many more projects.

Legend has it that one day Andy came to Tracy with this idea for a new tool. He knew he wanted to be able to index and taper with it, but at that time, even Andy didn't really know all that it would do.

The gate-leg table is patterned after a piece from the Kaufman Collection of American Furniture located at the Smithsonian Institute and was created entirely on the Legacy.

With his idea, Andy designed and manufactured the first rudimentary version of what we know today as the Legacy Ornamental Mill. Eventually the two brothers got so involved with, and excited by, the new machine that they decided they might just have a marketable product. So . . . they bought a list of names of woodworkers in their area and put on a seminar. Lo and behold, people really liked what they saw. By 1991 the brothers decided to start the business full time and move it to Utah –where the brothers grew up and their initial woodworking

"This machine really gives me energy when I watch people in amazement of what it can do. And these people are almost always only seeing a tiny bit of what this machine is capable of, they only scratch the surface."

"It's exciting being part of an original idea, concept, & product that so dramatically changes the industry and gives any woodworker the opportunity to move to a level higher than his (or her) peers."

experiences began.

One might wonder what it would be like to work so closely with one's brother. Tracy says he doesn't mind it much; in fact, Tracy has pretty much worked with Andy all his life. The brothers grew up on a farm/ranch where, for all intents and purposes, eldest brother Andy was the foreman. The brothers did all their chores–hauled hay, cut cattle and so forth–together. And together, it seems, they were meant to be. According to Tracy, everywhere Andy has worked, Tracy has followed his big brother each step of the way. In fact, Tracy has never had to interview for a job!

"[Working with Andy] . . . has been very easy. Andy is a great man of execution. Occasionally there are moments of frustration, but these are few and far between–and after these moments have been resolved, the business and the product seem to grow even stronger." Besides the perk of being with his brother, Tracy just really loves what he does for a living. *"It's exciting being part of an original idea, concept & product that so dramatically changes the industry and gives any woodworker the opportunity to move to a level higher than his (or her) peers."*

When asked about some of Tracy's favorite projects, Tracy enthusiastically talked about the wainscot in the piano room of his home. Tracy actually claims that it came to him in a dream. Apparently, he woke up, sketched it, and magically, it fit together perfectly, without any setbacks when it came time to build. It's possible Tracy's been sniffing a little too much lacquer . . . but the project is still beautiful and people are really impressed when they drop by for a visit.

Tracy's current project is a drop-leaf table (the one pictured is a prototype made of alder, the final piece is being made of mahogony) that can be considered the endeavor of a master craftsman–bearing in mind that Tracy's formal training was capped with being kicked out of High School wood shop, this is quite impressive. Though he wouldn't personally consider himself a "master craftsman," Tracy feels that the *Legacy Ornamental Mill* gives him a master's edge. And to prove this is so, Tracy has been constructing, and will finish, the entire project with no other tools besides a drill, a table saw and his *Legacy Ornamental Mill*.

Tracy's enthusiasm about his job and his involvement with the *Legacy Ornamental Mill* is certainly palpable. As Tracy simply puts it, *"I love what I do and I would never trade paths."*

Shop Notes Available!

Top Right: *Close-up view showing how the leg locks into the frame. The rail and the leg are joined together using a loose tenon.*

Above: *A view from the top showing the framework. Two legs are fixed, two opposing legs swing out 90 degrees to bring the round top into use. All parts are joined together without the use of mechanical fasteners.*

Left: *For $200 in materials and 20 hours in labor, Tracy Anderson transformed his living room into an elegant music room.*

Bottom: *Closeup view of rosette and dentil moulding, both created on the Legacy.*

Creating the Hinge for the Gate-leg Table

The finger joints which are used to hinge the two gate-legs on the table are created using either the horizontal or vertical bench vises. When using the horizontal vises (pictured below right), the finger joints will be rounded over on the inside as a result of the rotation of the router bit. If the desired look is a square finger joint (left) then you will want to use the vertical vises, holding the workpiece on end, allowing the tip of the bit to mill the joints with square corners.

VERTICAL VISES

Squared Insides

MILLING TIPS:

- Notice the thin piece of wood on the back side of the material. This will eliminate tearout as the bit comes through the material.
- Using a 1/2" diameter double-flute straight cutter will give you consistent widths between the fingers.
- It is best to control the router with the lead screw. Once the first (outside) cut has been made, rotate the handle 4 turns (1 turn = 1/4", 4 turns = 1" or 1/2" of space and 1/2" of finger).
- If you want the ends of the hinges to be rounded over (top left and bottom right photos), it is best to use a point-cutting roundover bit first, milling the finger joints last. Otherwise you risk tearing out the material on each of the fingers.
- The hinge is joined together with a dowel (bottom right). Align the pieces with a board on each side and drill a hole the proper width for the dowel, stopping short of going all the way through on the last finger.

HORIZONTAL VISES

Round Insides

HOW TO: MILLING THE REEDED LEGS

Problem: The reeds on the table leg stop before cutting into the unreeded portions of the leg, how is this done.

Solution: In order to achieve this kind of transition the pieces must be created seperately. The trick then becomes "how do you join the pieces so that they are centered to each other?" Because the Legacy will self-center the pieces as they are cut, it is best to drill a mortise into the end of the workpiece (Fig. A) (take note that the mortise depth should not exceed 1". If you need the mortise to be deeper, go back after the piece has been milled and drill the mortise deeper). The mortise now receives the dead center of the tailstock (Fig. B). The piece is then milled to its final design and the result is a mortise that is exactly center to the piece (Fig. C). The corresponding pieces have tenons milled on the ends, and the legs or posts match up perfectly.

Problem: When creating reeds and flutes from the top the cut is made down the center line using the 0" mark on the scale, however when reeds and flutes are cut on a contour from the side it is difficult to tell when the router bit is exactly center. What is the best way to insure that the reeds and flutes are cut exactly down the center of a contoured piece?

Solution: The best way to insure alignment of the router down the center of the workpiece is to start by removing the workpiece (be sure and mark the prong of the mounting hub and the corresponding hole on the drive center so that the workpiece can be installed back into the machine the same way it came out - more on this later). With the workpiece out of the way, align the tip of the bit with the tip of the dead center on the tailstock (Fig D). Now lock the plunge depth of the router, you are now set to cut along the center line of the workpiece. Take note however, that this will work only if the bed is set to level. If for some reason the bed has been set on a taper - the router bit is going to cut an angle across the piece.

Align the cutting tip with the tip of the tailstock dead-center, insuring a cut along the center line of the workpiece.

Problem: You claim that everything on the gate-leg table was created on the Legacy, yet the stock capacity is far less than the diameter of the round table top, was that also created on the Legacy, if so how?

Solution: In order to create large round table tops or arches you will need to pick up the circle cutting center. It mounts to the adjustable bed rails (Fig E) and creates a pivot point with which you can rotate the material. In order for this to work the piece must sit on top of the adjustable bed rails, and below the fixed rails (where the router rides) (Fig F). The router is locked into place and as the workpiece rotates it creates a round circle.

A 2-bit combination for creating a 6" barley twist

Start by using a 3" diameter rope moulding bit. Create a 2-start rope with a 6" pitch (pitch is distance of linear travel for complete rotation).

Using the 6" barley twist combo bit plunge on the top of one of the rope beads to create a cove. *Note: The bit is referred to as a 6" barley twist combo bit; in fact the diameter is 3" and when combined with a 3" rope bit - it creates a 6" diameter barley twist.*

Make the cut in 3-5 passes, plunging deeper on each pass.

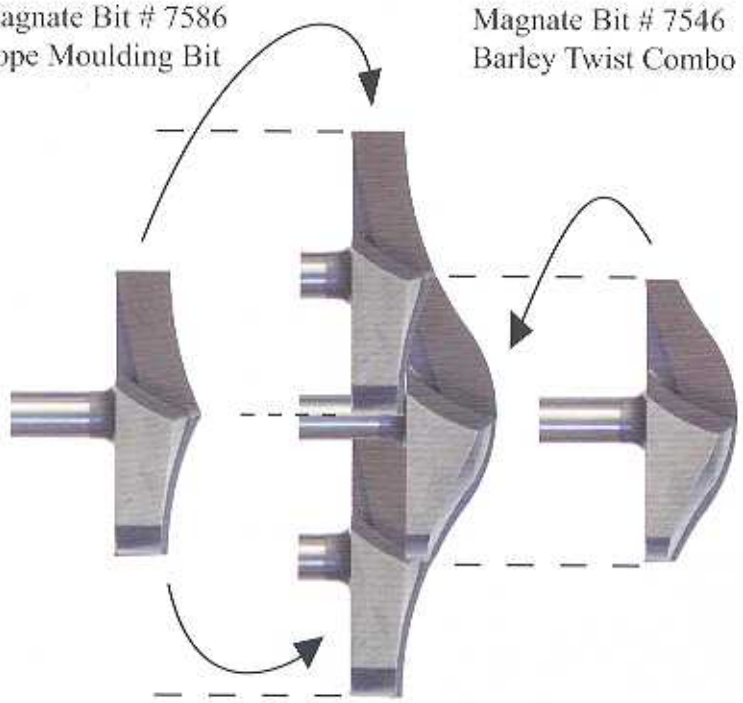
The final pass should match up with the edge of the bead on each of the sections of rope.

Left: *A 6" single start barley twist on a 6" pitch using the two bit set (pictured next page). The diameter of the workpiece is 4".*

Bits are available from Magnate at 800-827-2316
Magnate also makes: bit #7544, a 4" barley twist combo bit
bit #7545, a 5" barley twist combo bit

Magnate Bit # 7586
Rope Moulding Bit

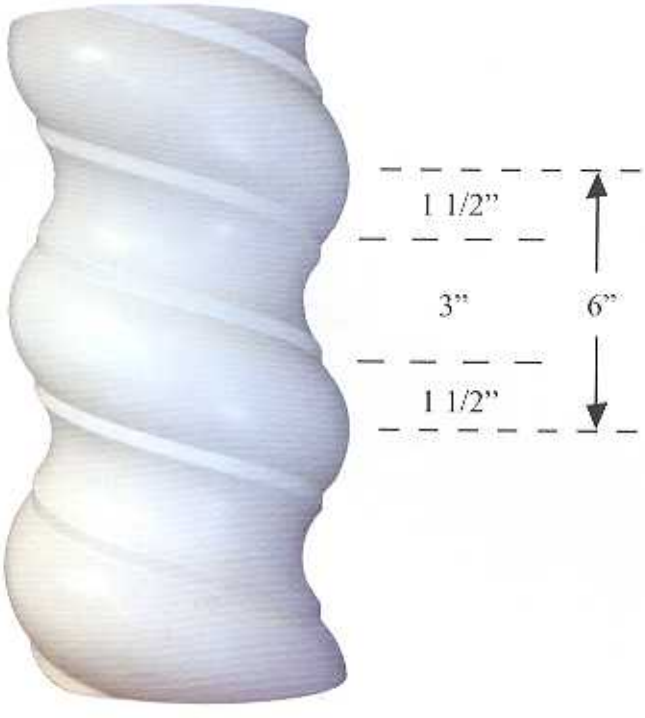
Magnate Bit # 7546
Barley Twist Combo Bit



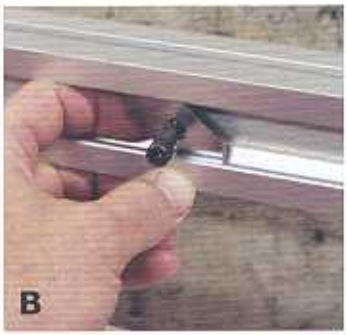
Above: *2 router bits (each is 3" diameter) combine to cut in 3 positions to form a 6" diameter barley twist bit. The first bit, (#xxx) creates a 2-start rope. The second bit (#xxx) plunges on top of one bead of rope and creates the 3" belly of the twist as the cut is made deeper.*

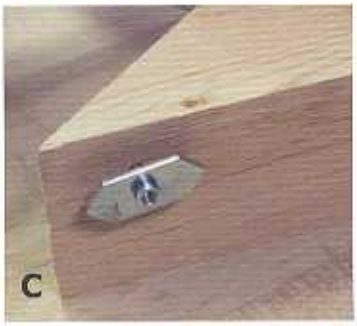
Right: *Brett Anderson (Anderson Mantel & Cabinet - Springville, UT) created a 2-start barley twist on 10" diameter columns. A 12" pitch was achieved by using the 2X gear multiplier set.*

Below: *Frederick Haas (Grace Design - Lake Park, FL) created this column by using a combination of custom ground router bits. It is an 8" diameter piece, using a 6" single start spiral.*



Using the insert-style locking plates to create a storyboard



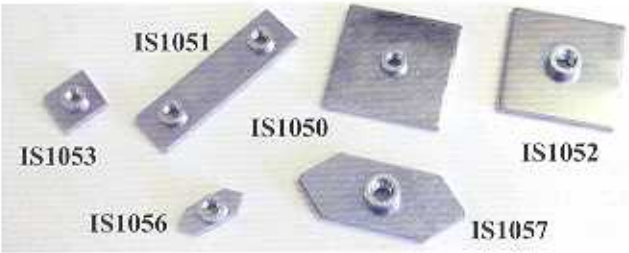


The insert-style locking plates have been designed for easy installation into the channels of the extruded rails. Whereas the square locking plates slide into the channel from the end and are essentially permanent, the insert-style are easily placed into the channel from the front (Fig A). As you thread the screw into the plate, the plate rotates in the channel (Fig B) and locks down.

Locking plates can be used in a variety of ways; the most obvious being to attach various accessories (i.e. horizontal and vertical vises) to the Legacy. One technique you may not have considered is to mount a board to the rails of the machine and create a "storyboard" (Fig H) which can be used as a reference for duplicating parts. When you make the cuts on the part and your satisfied with the position you can then make the corresponding cut on the storyboard (Fig E-G). Using storyboards is an easy way to go back after a period of time and guaranty the part will be a perfect match. Storyboards record the bit used, the position of the cut, and the exact plunge depth of the cut.

To create the storyboard, use the locking plates to mount a blank piece of material to the rails of the machine (Fig D) (the material pictured is thicker than is generally necessary). As a general rule it is best to mount the storyboard to the adjustable bed rail (Fig H). Since the adjustable rail is always in sync with the head and tailstock (and subsequently the part), it doesn't matter where the bed is set. When the storyboard is mounted to the fixed rail (Fig D-F), the only way to duplicate the piece in the future is if the bed is set back to the original position. When mounting the storyboard to the fixed rail it must be mounted on the side. When mounting to the adjustable rail it can be mounted on either the top or the side of the rail. In any case, take care to mount the storyboard in a manner which will be easy to remember and duplicate (Fig D - the storyboard is flush with the rail).

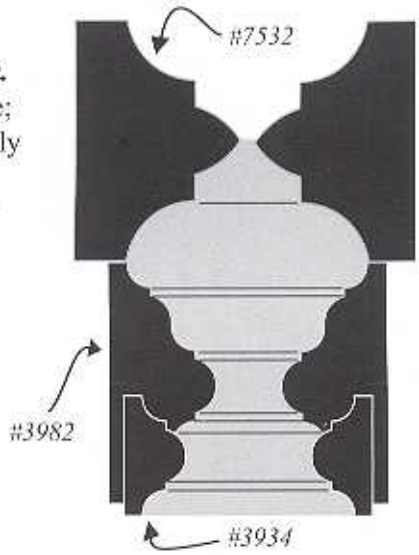
Available locking plates (does not include capscrews)



IS1053 - (Small - Single hole) 10-32 x 1 narrow - $1.20 each
IS1051 - (Double hole) 10-32 x 2 narrow - $1.50 each
IS1050 - (Large - Single hole) 10-32 x 1 wide - $1.30 each
IS1052 - (Large - Single hole) 1/4-20 x 1 wide - $1.50 each
IS1056 - (Small 10-32) Insert style .625 lock plate - $1.20 each
IS1057 - (Large 1/4-20) Insert style 1/5 lock plate - $1.50 each

Assortment pack - 4 of each locking plate (24 total) - $28.00

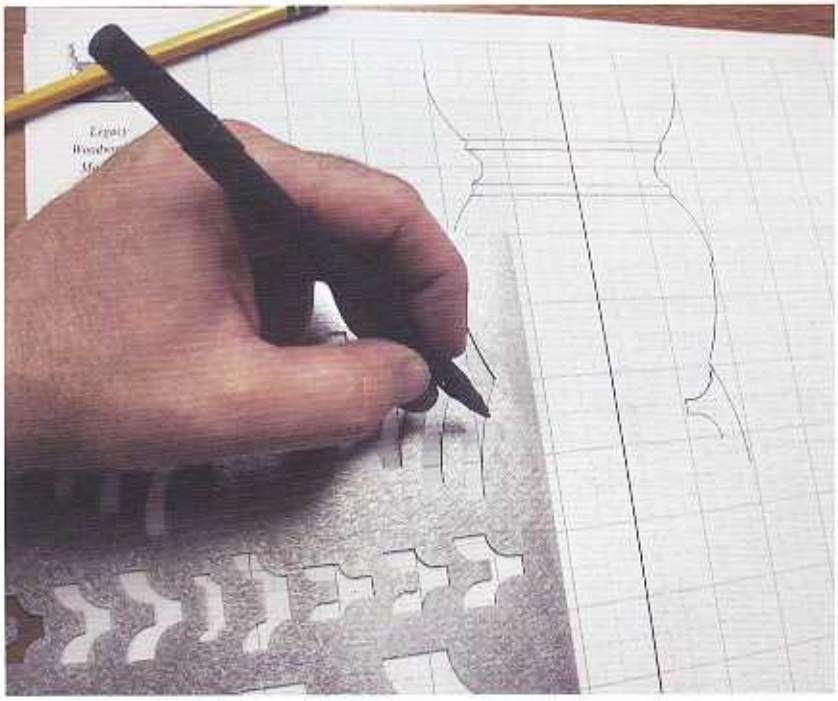
Legacy Design Kit



Creating turnings on the Legacy has several distinct advantages over a lathe. Including ***speed***, ***ease of use***, and ***repeatability***, not to mention router bit profiles are; (to borrow an old computer term) WYSIWYG (what-you-see, is-what-you-get). Not only can you see the profile of the cut, but by matching up router bit profiles (right) you can design the piece before you ever make a cut. To make the design process easier Legacy has a *NEW* Design Kit available.

The ***Legacy Design Kit*** consists of:

- 3 - Templates containing 107 router bit profiles (27 design styles)
- 1 - 11" x 39", 50 page DesignPad (Spindle Layout)
- 1 - 13" round DesignPad (Determining divisions for reeding & fluting)



This design kit allows you to lay out the shape of the piece before making any cuts. Use the router bit profiles positioned next to each other to determine the position of the design along the length as well as the desired depth of the cut. Once the design has been decided, purchase the necessary bits to complete the project.

Eliminates guesswork, saves time & money!

< Tool Holder

This handy device mounts to the Legacy to keep the router bits and wrenches close by. Includes (10) 1/4" holes & (10) 1/2" holes. Fits both 1000EX and 800EX. Mounting hardware included. 4" x 20"

Julie & Scott Johnson demonstrate the usefulness of a protective picket fence around the family christmas tree.

Using the Legacy to create a decorative snowman picket fence to protect small children from potentially toppling a christmas tree!

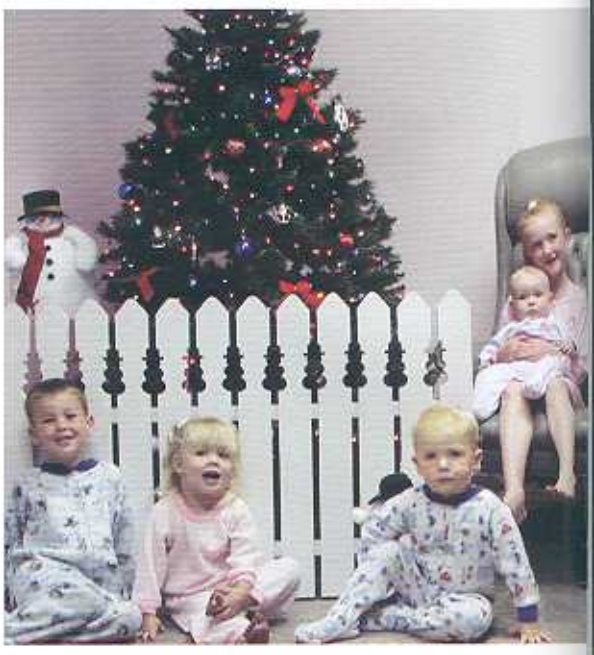
Using the horizontal bench vises, Legacy's Neil Johnson was able to create a snowman version of a fence he created originally 25 years ago (left). Neil's latest version (below right) is his first project using the Legacy. Creating a storyboard (see page 10) while making the cuts on the first side, meant that the cuts on the second side would be easily replicated. With less than $10 in materials, and an hours worth of work, this fence makes a great christmas gift, or can be sold as a craft item at the local christmas fair. Project plans are provided on the next page.

Six pieces of material are set on edge in the horizontal bench vises. The thicker piece of material on the outside edge is a 2" x 4" that serves two puposes; first, the material will back up the pickets to prevent tearout as the router mills through the back edge, and second, it is used to create a storyboard which can be used as a depth gauge when the pieces are flipped over to mill the opposite edge of the pickets. The board on the end is used as a fence to align all of the pieces.

With the router locked into place on the long axis (x-axis), Neil Johnson slides the router towards him on the short axis (y-axis).

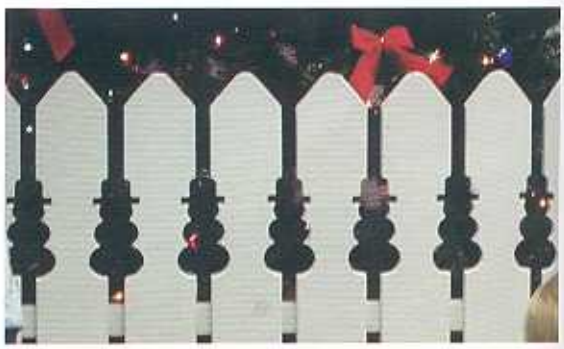
The router bit profiles, positioned at the proper depth, reveal the shape of one side of the snowman.

Notice the tearout on the 2" x 4", and the pattern which has been created. This pattern acts as a storyboard and can now be used over and over again, making setup for future pickets fast and accurate.

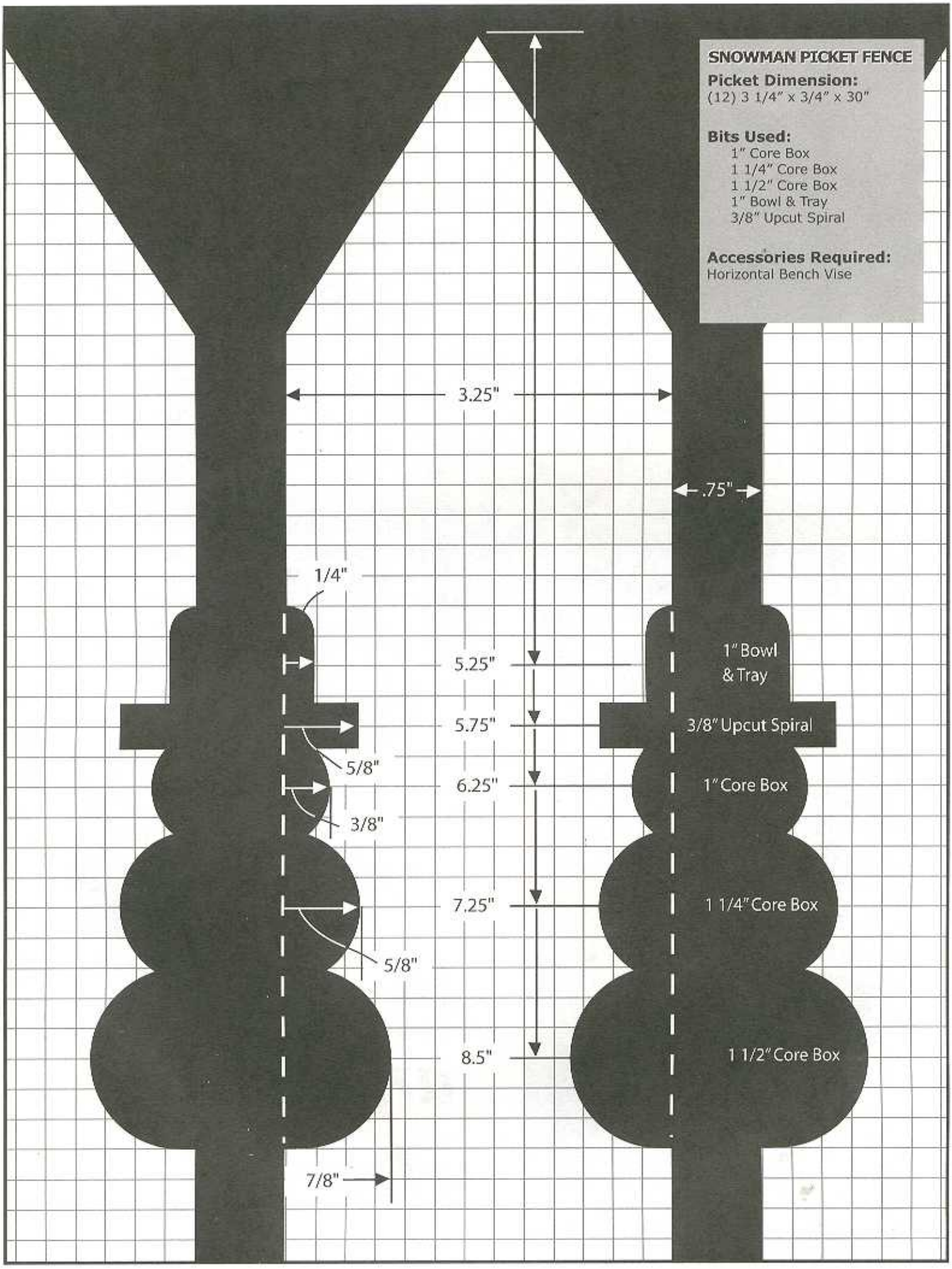


The second generation of Johnson's with the second generation christmas tree picket fence. Pictured are (l to r): James, Alora, Tyler, Hailey, & Emily.

Although the pickets themselves appear traditional - it's the negative space created by the pickets that create the snowman image. Twelve pickets were created to create 48" of fencing.



Using the Legacy design kit made the layout of the pickets to form the snowman shape fast and easy.


SNOWMAN PICKET FENCE
Picket Dimension:
(12) 3 1/4" x 3/4" x 30"
Bits Used:
1" Core Box
1 1/4" Core Box
1 1/2" Core Box
1" Bowl & Tray
3/8" Upcut Spiral
Accessories Required:
Horizontal Bench Vise
3.25"
.75"
1/4"
5.25"
5.75"
6.25"
7.25"
8.5"
5/8"
3/8"
5/8"
7/8"
1" Bowl & Tray
3/8" Upcut Spiral
1" Core Box
1 1/4" Core Box
1 1/2" Core Box

GALLERY & TESTIMONIALS

Richard - California Needed 5' of a 14" wide crown molding, milled it on the *Legacy* in 3 hours, start-to-finish. Richard took the final to a shop in San Francisco to have them bid on it. They told him it would take 2-3 weeks, and cost a minimum of $2000.

Carl - Florida A spiral turning job was turned away by five professional shops as being impossible to do. Carl completed the job in an afternoon and made $900.

Dave - Utah Needed a prototype to bid on a job, attempted to have a sample made on a CNC machine (shop rate $80 hr), it required 3 attempts in 2 days before they could successfully complete the operation. Dave milled the piece on the *Legacy* as a first time user, and finished it in 3-4 hours.

Terry - Alabama Created 250 rosettes for the remodel of his Alabama home, using the *Legacy* and the rotary table attachment. His contractor saw the potential of the *Legacy* for his business and immediately ordered a machine.

Fence Contractor - Illinois Made finials on the *Legacy* for a fence he built. His competitor called the homeowner to find out where he could purchase the finials - now he makes parts for his competitor.

Barry - Texas Building common cabinetry, nice, nothing too fancy, added 4-5 hours of work by creating fluted columns, rope molding, other decorative details on the *Legacy*, and added $1500 to the price of the cabinets.

Courtland - Missouri Had his *Legacy* 3 months, started doing ornamental turnings, featured in *Fine Woodworking* magazine *Current Work* (February 2001) section. Five months later entered a piece into the Memphis Woodturners competion, won *Best of Show*, and First place in the Advanced category as a novice *Legacy* user.

Paul - Michigan As a furnituremaker Paul was bearly making a living, his wife had to work to help pay the bills. The first month he had his *Legacy* he got a job to make rope molding, it took him 2 weeks to complete and made $3000. At the same time he was building an entertainment center that took 4 weeks to complete and only made $3500. Now Paul makes components for cabinetmakers, finish carpenters, and contractors building multi-million dollar homes.

Alvin - Ohio Purchased the *Legacy* for his woodworking hobby, it now pays for all of his other hobbies.

Pete - Florida Made 212 Barley Twist legs in 1 month, "made a lot of money".

Jim - Pennsylvania Has milled "over 7000 pieces" in the year-and-a-half that he has owned his *Legacy*.

Richard - Utah After cutting his first mortise on the *Legacy*, he called us to see if we knew of someone who wanted to buy his mortising jig.

The *Legacy* is also used for prototyping by top Piano, Billiards, and Furniture manufactures in the U.S.

As a furnituremaker I am always looking for tools that set us apart from the rest. The Legacy Ornamental Mill is just the tool to do it. I have been using my Legacy for almost a year and I am turning out jobs that I could only dream about. "By working smarter and not harder" my machine has paid for itself over and over. That's not a statement, it's a fact! We are going into our second season with our machine and actually tripled our sales volume because of the caliber of our product. In short, we are making our own legacy in the custom woodworking business. Thank you."

Frederick Haas
President, Grace Designs

Created by Frederick Haas

I had never even turned on a router until last Saturday, and a week later, after 8 or 10 hours on the Legacy, I am doing tapers, reeds, and ready to try a mortise - and I AM HOOKED!!"

Marcia Benner

Created by William Heaton

The Legacy gives our kids a real advantage. On this one machine they can mill the parts, add the flutes, spirals or other decorative details, and then add the joinery. It's aslo very safe and a lot of fun for the kids to use. It not only builds beautiful furniture, it builds self-esteem."

Floyd Simmons
Kress High School

Created by Dean Mohring

My company makes cabinets, furniture, and architectural millwork for homes in the $800,000 to $10,000,000 range. The owners want one of a kind items and this equipment allows us to quickly do just that while commanding premium prices."

Dean Mohring
Rockton Hardwood Products

My ornamental milling capabilities have really put my business over the top! This has been my best year ever. My Legacy gave me the edge I needed, it's the main piece of equipmnt in my shop."

Tim Schoonard
Marywood Studio

Created by James Wolf

This does so much. I wish I had bought the Legacy 7 or 8 years ago - I wouldn't have spent so much money in the long run."

Paul Ferguson

I thought the price to be steep but the versatility, accuracy, and reproduceability have caused me to reconsider. If I couldn't get another, an offer of double what I paid wouldn't get it away from me."

E. Jay Loy

Created by Barey LaChance

GALLERY & TESTIMONIALS

Created by James Neff

When people ask me if I can do production work on the Legacy, I just show them this picture (left).

James Neff

Created by James Neff

When you find a machine that will work with you and not against you, something that fires up your imagination at age 79, and makes you look forward to each day, and each new cane with anticipation, then you have something of great value, more precious than silver or gold.

Monty Gould

Created by Mark Davis

This project (left) could NOT have been done without the mill. Your machine is what pushed me towards this level of craftsmanship.

Mark Davis

I am so excited about this machine! I just don't understand why anyone who does woodworking doesn't have this machine. The possibilities are endless.

Susan Nutter

There is no other tool that you can buy that pays for itself so quickly . . . if there is one tool I have in my shop that has paid for itself over and over again, it would be my Legacy Ornamental Mill.

Carl Tourigney

It's really a small investment for such a versatile money maker. It will give you the edge on your competition, because no one else will be able to offer the customers the detail and elegance. I may sound over enthusiastic, but we have built our business around our Legacy.

Dwayne Colvin
Oak Ridge Custom Furniture

Created by Michael W. Dotti M.D.

The great thing about the Legacy is that it allows me the freedom to create almost any design style I wish, from the simple to the ornate.

John Hennen

Created by Dr. Courtland Smith

I recently entered this covered bowl (left) in a woodturning contest sponsored by the Memphis woodturner's. There were 95 people from 5 states. It got 1st in the advanced class and Best in Show. They said that they liked it because it showed them something they had never seen before. There were no judges - each individual had one vote! I think that this backs up something that we've discussed before - that is that techniques used on your machine are generally well received by traditional woodturners. Of course they wanted to know what machine I was using. I bragged on the Legacy and gave them your web address.

Dr. Courtland Smith

Created by Dr. Courtland Smith