

Cutting 10° angle of Bench
End Feet

The miniature Mark V toy, the Mark .5 as we call it, appears at first glance to be a difficult project, but with closer examination, you will see all the pieces are relatively simple to build and assemble. There is a total of only 3 1/4 board feet of lumber in this toy. A board 7' long by 6 1/2" or 7" wide will be sufficient; along with three 1" dia., one 5/8" dia., and one 3/8" dia., dowel rods. The Mark .5 will take about forty hours to build.

To start this project you must cut to rough size all parts. The rough dimensions can be found in the Bill of Materials - the finished dimensions are found in the detail drawings.)

First, glue up stock for the Headrest "B", Tie Bar "C", Pivot Arm Base "D". The grain pattern on the sides of the Pivot Arm Base "D" should be vertical. Also, glue up Pivot Arm "E", Headstock "J", and Carriage "L". Set these pieces aside to dry COMPLETELY before you start machining them.

Now, make the Bench Ends "A" legs. Start by marking the Bench Ends with the 7" angle. Then cut the legs. You can cut on the elliptical saw, bandsaw, or by hand. Then cut the elliptical contour at the bottom of the table to form the Bench End. Next, mark out the angles on the sides of the Bench End. Similarly, to the way you cut the face angles, and then drill the front corner of each leg. Assemble each bench end around the front corner of each leg. Assemble each bench end using glue and clamps to hold pieces in place. After the glue has dried, place each bench end down on the table of your workbench, adjust it to a 10° angle and cut the top edge and feet. Then, cut the Bench Ends to the 10° angle. For the Bench Ends, you need your drill press and drill the three assembly holes in the top of each Bench End. You might need a 10° backup board to steady the Bench End while drilling.

Next, take care of the Upper Ways "G" and Lower Ways "H". Cut each piece exactly to length from as straight of a one-inch diameter dowel as you can find. Then turn down the center section of each of the Upper Ways to 15/16" diameter, leaving a 3/4" length of original diameter at each end of the dowel. Now, drill series of 1/4" holes 1/2" deep in the Upper Way EXACTLY on center. It is important to get the holes on center so the Steel Pins will screw smoothly

The Headrest "B". The Bar "C". Pivot Arm Base "D". Pivot Arm "E". Headstock "J", and Carriage "L" are all made using similar construction techniques. First, you must mark the locations of the finished piece and the center lines of the holes. Then, use the finished piece to mark all "L" holes accurately. Then, the boring carried out — small holes first. Again, drill the "L" holes EXACTLY where marked. Finally, use the finished piece to mark the "B" holes. When cutting the contours, you are cutting the blocks. When cutting the contours first and saw your way around to the front-to-back contour to give a flat, square surface on the sides, cut the left-to-right contours. Front-to-back and left-to-right are the directions the blade is moving. Finally, file and the pieces to their finished shape.

All that has to be done to the Table "P" is to mark and then machine the saw blade slot, the two miter gauge slots and the two recesses on the bottom for the Protractor Tilt Stop "N". The miter gauge slots can be cut with a dado spread, a router, or with a back saw and then the scrap chiseled out. The saw slot and the two recesses can be cut with the router, mortiser or with chisels.

Each Protractor Tilt Stop "N", for strength, must be made from two pieces sandwiched, or laminated, together with the grain of one piece running horizontally and the grain of the second running vertically. To accomplish this, the second member must be resawed or split into two pieces 3/16" thick. This resawing is done on the bandsaw usually, but can be done with a hand plane if the bandsaw is not available. The pieces needed to make one of these stops are: 1) a piece of rough saw marks from the surface, and 2) a piece of stock for the holes and the lower rounded contour. Next, drill the holes, cut the outside contour and then sand the edges smooth.

The Table Support Bars "M" are fairly simple pieces but, once again, accuracy is essential. First, cut the 5/8" dowel to

Cutting 10° angle of Bench
End Top

Drilling Assembly Pin Holes

Drilling Upper Way Pin Holes

Primary compound cutting
of Headrest

Secondary sawing of Headrest

Table Support Bar alignment

Pivot Arm and Base assembly

Table and Carrizano assembly

length, then drill a 1/4" hole EXACTLY on center, 1/4" from the end. Assemble the Protractor Tilt Stop "N" you just made with a Pivot Pin "G" to the front Table Support Bar. The lower Stop Pin hole gives you an exact mark to drill your Stop Pin hole in the Table Support Bar. This hole must be exactly on center so the table will set level. Remove the Protractor and Pivot Pin. Mark and drill the remaining Stop Pin holes, making sure the rest of the holes are EXACTLY in line with, and parallel to, the first two. Finally, round the top of the Table Support Bar "N" so the table will tilt.

Now, after that demanding piece, you can make one of the easiest. The Spindle Crank "K" has four dowel rods of four diameters and is self-explanatory. Be careful to turn the Arbor exactly to the dimensions given so there will be no problem fitting the saw blade and the drill chuck to the crank. Do not drill the 1/4" Arbor Stop Pin hole.

The various sized 400 pins are the exact task. There are eight pins of five different sizes. All the pins are made from 1/8" dia. dowel rod cut 1/2" long for the Pivot Arm Locking Pin, which is turned down at 2-1/2" for one piece of 1" dowel. To make the pins, mount the 1/2" drill chuck to the lathe headstock, cut the dowels one inch longer than drawings to allow room for mark the grip dowel without marking the aluminium pin. Mark the grip on the outside end and the shoulder on the inside end. Use the tool using the same technique as before to secure the tool using the screw. Then turn the chuck to the next size and repeat the drawing. The chuck dimension is important because if it is too loose the pins will fall from their holes, and if too tight a child won't be able to remove them easily. Finally, after the pins are turned, buff the pins with fine sandpaper to suffer the pin is turned properly, cut off using your parting tool. To prevent loss of the small pins, cut a small hole in the knob to insert and glue a short piece of cord. This cord can be inserted in a similar way to a local's hair to hold the pins there.

The saw blade is made from the same thin stock as the other blades. The "N" and "D" are cut by dropping the grain pattern, giving added strength to the stock. After the "N" and "D" are cut, the blade is ground to the minor diameter of saw teeth. Also, it might be handy to note that the major diameter of the blade is 1 1/2" above the minor diameter of saw teeth. Position of the 1" saw arbor drawing. Now lay out the 18, 10" radial lines across the saw. Draw in the teeth, then cut out radial lines. Next cut a 3/4" deep groove in the teeth. Then drill EXACTLY to the dimensions given of the 1/4" stop pin hole. The 1/4" hole in the crank flange and 1/4" hole in the saw blade coupler must line up exactly. This can be accomplished by drilling this 1/2" hole through the center of the coupler for the arbor, sliding the coupler over the arbor and drilling both 1/4" pin holes simultaneously. The next step is to glue the coupler onto the 1/2" saw arbor. After the glue has dried, complete the drilling of the 1/2" arbor hole through the blade.

The drill chuck is turned from a piece of 1" dia. dowel, 4-1/2" long. All measurements and angles are given on the drawing. First, before turning, three 3/32" holes should be drilled evenly around the piece, 11/16" from the top of the chuck. These holes are strictly cosmetic and may be omitted. After turning, drill 1/2" hole for crank arbor.

The final two parts, the Miter Gauge "U" and the Extension Table "V" are made from your scraps and the drawings are self-explanatory.

At this point, you have completed all assembly steps. The construction steps are ready to start assembly. The first step is to install the pivot pins into the Pivot Arm Base "D" and Pivot Arm "E". This is done with the two pieces clamped together and the Pivot Arm in the vertical position (lying down). After drilling, unclamp and round the Pivot Arm "E" Next, glue the Pivot Arm Ends "A" to their mating parts, the Headrest "B" and Buncher "C".

Now it's time to assemble the rest of the machine. Set aside and let dry. Now glue the side plates "F" and "G" onto the Pivot Arm Base "D" and the Pivot Pin "H".

Position the Table "N" and the Table Pivot Pins into the Headrest "B".

Attach the Carriage "J" to the Table Pivot Pins into the Headrest Bar "M". You MUST slide the Carriage "J" into the Headstock "K".

Apply pins to hold the front Upper Way and insert alignment.

Apply pins to the ends of all four ways in proper alignment.

Crimp this assembly with bar clamps running from end to end. After the glue dries, remove the clamps, insert the spindle, attach the blade w/ pin, slide the Table Support "L" into place.

Slide the Carriage, put the pins in place and tighten!