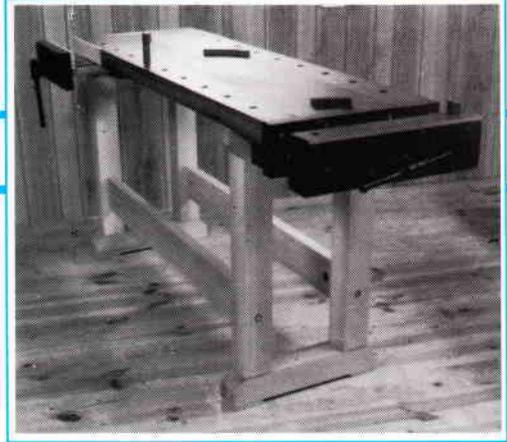


Work Bench

Designed and constructed
by John Holman.

This project provides a very useful item of workshop equipment that additionally has much visual appeal to the connoisseur of woodwork. The workbench is based on the traditional European-style cabinet maker's bench, and its system of tail vice, side vice, and two sets of parallel bench dog holes provides a clamping system of great versatility.

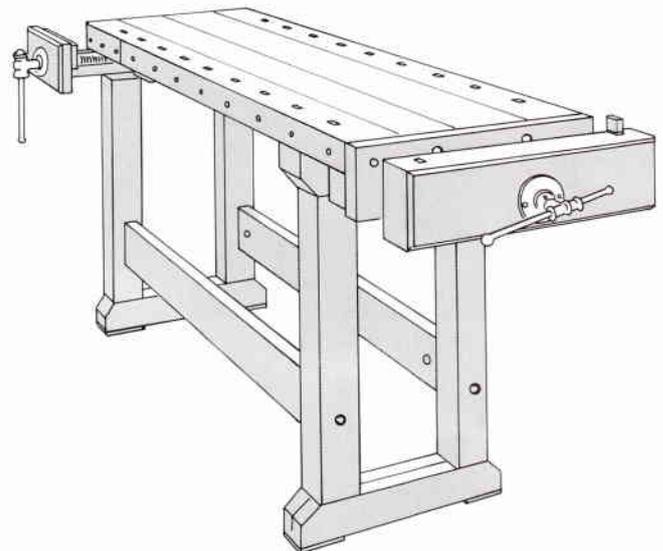
The construction of the workbench is quite straightforward. The only complications arise from the making and attachment of the two vices; detailed instructions are given to guide you through this area. Australian made "DAWN" components are used for the vices. If you have difficulties in obtaining these from your local supplier, our Customer Service Department can assist. Please write or phone for details.



Component Specifications *All dimensions are in mm.*

Part	Description	Quantity	Width	Thickness	Length	Part	Description	Quantity	Width	Thickness	Length
A	Outer side rail	2	60 x	60	x 1500	V	Stretchers	2	140 x	40	x 1200
B	Inner side rail	2	60 x	60	x 1500	W	Bearer halves (centre notch)	2	90 x	45	x 510*
B'	Plywood tongue	2	25 x	6	x 1500	X	Bearer halves	6	90 x	45	x 510*
C	Centre plank	2	135 x	40	x 1500	X'	Foot Pads	4	90 x	12	x 90
C'	Plywood Tongue	1	25 x	6	x 1500	Y	Stretcher bolts	4	3/8" dia.		x 150
D	End rail	1	60 x	60	x 498*	Z	Coach screws	4	3/8" dia.		x 125
E	Tail vice face	1	135 x	40	x 510*						
F	Tail vice head inner	1	135 x	40	x 510*						
G	Tail vice head outer	1	135 x	40	x 510*						
H	Side vice head	1	135 x	40	x 340						
I	Tail vice guide block	2	60 x	60	x 120						
J	Side vice guide block	1	60 x	60	x 260						
K	Tail vice guide rod	2	30 dia.		x 500						
L	Side vice guide rod	2	30 dia.		x 430						
M	Guide rod stop pegs	4	6 dia.		x 40						
N	Bench top dowels	24	12 dia.		x 150*						
O	Side vice soft jaw	2	60 x	12	x 340						
P	Bench screw	2	1 1/8" dia.		x 450						
Q	Bench screw nut	2									
R	Bench dog	4	19 x	19	x 150						
S1	End clamp bolts	2	3/8" dia.		x 100						
S2	End clamp bolts	2	3/8" dia.		x 125						
T	Small coach screws	11	1/4" dia.		x 75						
U	Legs	4	90 x	90	x 843						

*Cut to length during construction.



Note: See Figure 1 for Component Identification.

Tool Requirements

1. ESSENTIAL Triton Workcentre and your power saw. 7 1/4" power saws will not be able to cut through the 60mm thick side rails without double-cutting. (See your Operating Manual for details). The instructions assume use of an 8 1/4" or 9 1/4" saw.

Extension table, or outboard work support jig; electric drill plus drill stand, or drill press; 1/2" dowelling bit; 11/16" (18mm) and 15/16" (24mm) spade bit; 3/8" long shaft bit; 1/4", 9/32", 3/16", 17/64" drill bits; 30mm kreffing cutter (flat bottom hole-boring bit, as used for installing cabinet fittings); belt and/or orbital sander; measuring tape; ruler; square; pencil; spanners and sockets for 3/8" and 1/4" coach screws and bolts; screwdriver; minimum of three bar or pipe clamps for 510mm wide bench top; 1/2" mortice chisel for cleaning out bench dog holes.

2. USEFUL Long length stops on Workcentre; expanding bit (to 30mm); router and 45 degree chamfering bit for vice edges; long pipe clamps (1.8m) for gluing bench end rails; half-round rasp; handsaw; flat steel file; gouge for bench screw flange seats.

Construction Details

Material Shopping List

1. WOOD A heavy dense hardwood is best for the bench top, for stability and shock-absorption. We used seasoned Jarrah; other choices could be kiln dried Vic. Ash, Tas. Oak, or a tropical hardwood such as Merbau or Queensland Maple. For the underframe, a softwood such as Pine or Oregon is best. All timber should be straight and DAR for this project. If you can, buy the legs pre-cut to the exact length to avoid the need for double-cutting.

Top and Vices:

135 x 40 hardwood - 2 @ 1.5; 1 @ 2.1

60 x 60 hardwood - 4 @ 1.5; 1 @ 1.2

Frame and Legs:

90 x 90 softwood - 4 @ 843mm or 2 @ 1.8

90 x 45 softwood - 4 @ 1.2

140 x 45 softwood - 2 @ 1.2

12mm dowel - 2 @ 1.8

30mm dowel* - 1 @ 2.1

Vice Jaw Liner-pine:

90 x 12 - 1 @ 0.9

Other:

25 x 6 plywood - total of 4.5m; offcuts may be suitable

Plywood foot pads:

4 @ 90 x 90 x 12 thick - offcuts may be suitable

Stop Pegs:

4 @ 40mm long x 6mm dowel - offcuts may be suitable

*If you cannot source 30mm dowel, the closest Imperial size at around 29mm will be satisfactory.

2. FASTENING

3/8" zinc plated machine bolts, each with nuts and two washers: 4 @ 150mm; 2 @ 125mm; 2 @ 100mm.

3/8" zinc plated coach screws and washers: 4 @ 125mm.

1/4" zinc plated coach screws and washers: 11 @ 75mm.

Zinc plated woodscrews: 8 @ 12g x 40mm - Stretcher Locating Pins; 16 @ 8g x 30mm - Softwood Vice Face (O), Foot Pads; 12 @ 6g x 25mm - Bench Nut and Flanges.

Glue: A strong glue is necessary for the bench top. We used Selloys '308 High Stress Resin Glue'. You will need at least two packs. For the underframe we used a PVA glue.

3. OTHER Two 'Dawn Carpenter's Bench Screws', 18" long x 1 1/8" thread, complete with handles and nuts. Available from hardware stores that sell Dawn products, or our Customer Service Department. Wax candle or similar for lubricating screws and guide rods. Scrap pieces Red Gum or Jarrah for Bench Dogs.

MU
MEUBELUNIEK
Meubelrestauratieshop
Meubelmakerij

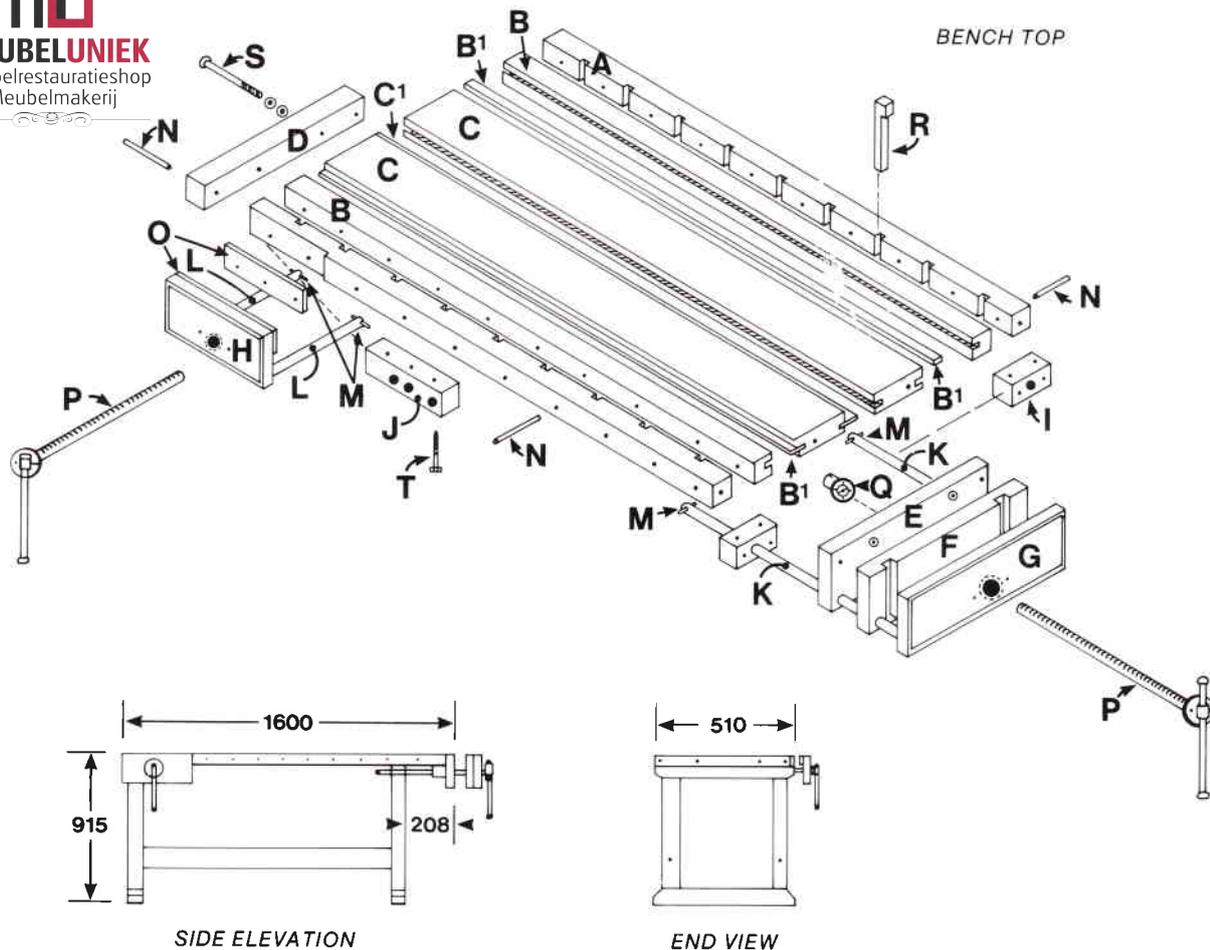


FIGURE 1A

General Points

1. The edge joins of the centre planks (C) and the inner side rails (B) are strengthened by the insertion of plywood tongues. The edge joins of the outer and inner side rails (A,B) are strengthened by dowels drilled all the way through outside edges of (A).

The end rail (D) and tail vice face (E) joins to the bench top are likewise strengthened by dowels; hidden bolts further secure these components.

2. The leg bearers (X) demonstrate a "post and rail" technique, where the through mortises are created by the joining of trenched mating components.

With your saw in the crosscut mode, cut the long pieces for the bench top to length. A stop on long workstop extensions is helpful to keep them all exactly the same length, to avoid having to trim the completed top. You will need an extension table or support jig. Lay all the pieces out and test fit the edges and sides to get the best fit and the best top face, then mark the pieces for identification.

2 Convert to the rip mode, and rip your 6mm thick plywood offcuts for the splines to 25mm wide. A total of 4.5m length is required, which may be made up of random lengths in each spline groove.

3 Set the blade height to 14mm (to ensure spline tongues do not bottom in their grooves) and the fence at 17mm initially, remove the guard and riving knife, and rip a

central groove in both edges of the 135mm x 40mm centre planks (C). Make one pass over the blade with each face in turn against the fence (a high fence extension is helpful) and check your plywood tongue for fit in the resultant groove. If necessary move the fence in a fraction and repeat until the tongues are a free sliding fit in all grooves. Check that the edges of the planks will meet i.e. tongues are not bottoming in their grooves. Do not try for too tight a fit, it will make assembly difficult and not allow sufficient space for glue.

4 Without changing the setting, make one pass of the inner edge of both inner side rails (B), with the upper face against the fence. This will make the upper edge of the groove the same distance from the bench top, but because the side rails are thicker, you cannot turn the material over for the second pass. Instead, move the fence out by 3mm and make a second pass to complete the groove. Test fit the tongues and move the fence slightly for another pass if necessary. Note that there are no grooves in the outer side rails (A), which are dowelled.

5 Coat tongues, grooves and edges with glue and clamp the centre planks (C) together. Make sure they lay flat and the ends are in line. When the glue has set, add the inner side rails (B) in a similar manner. Because these are of a thicker material, the centre planks will need to rest on blocks 20mm high.

6 The inner edges of both outer side rails (A) are rebated next, to make the bench dog holes. Lay the rails side by side and mark the rebates on their inner edges at 150mm

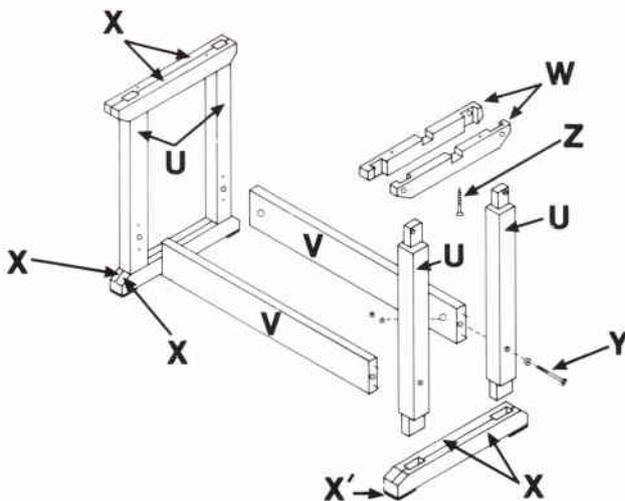


FIGURE 1B

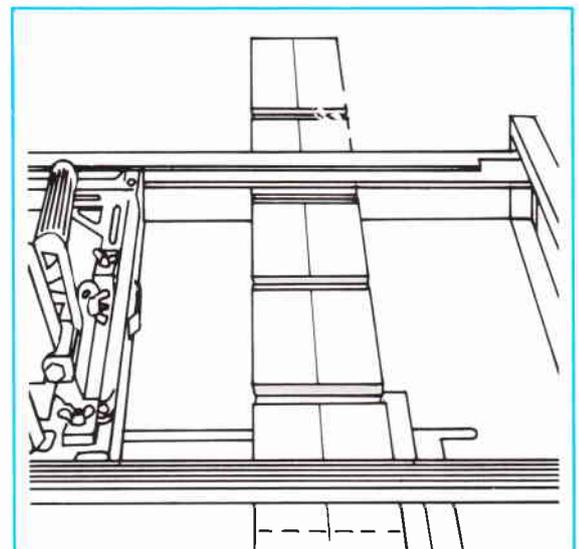


FIGURE 2

intervals, starting at the tail vice end. Recommended size for the rebates is 20mm square (to give a little clearance for the bench dogs). Set the saw blade height to cut 20mm deep into the wood. Clamp the rails together and make the rebates 20mm wide and deep. **Figure 2.**

Test fit the rebate size with a piece of 19 x 19mm material.

Also at this time, cut a rebate 280mm long x 12mm deep on the end of one outer side rail (A) -opposite edge to dog rebates; this is for the softwood piece (O) which serves as a face for the side vice. (**Figure 3** shows location of rebate).

7 Clamp the outer rails (A) in position on the bench top with bar or pipe clamps and drill between the dog holes for dowels with a 1/2" dowelling bit. Drill as deeply as your bit will allow; if the bit is more than 120mm long then make your dowel centres 25mm down from the bench top surface so the dowels go through the splines and into the centre planks as well.

8 Cut dowels to a little more than the depth of your drill holes, and cut a longitudinal groove or file a flat on them for their full length to allow the glue to escape from the bottom of each dowel hole. Clamp, glue and dowel the side rails in place. When dry, saw off the protruding dowel and trim level with a sharp chisel.

9 If the ends of the bench top are not exactly even, they should be trimmed. An extension table or support jig will be essential and because of the width of the bench top, larger saws will need to start with a plunge cut. See the Operating Manual for details.

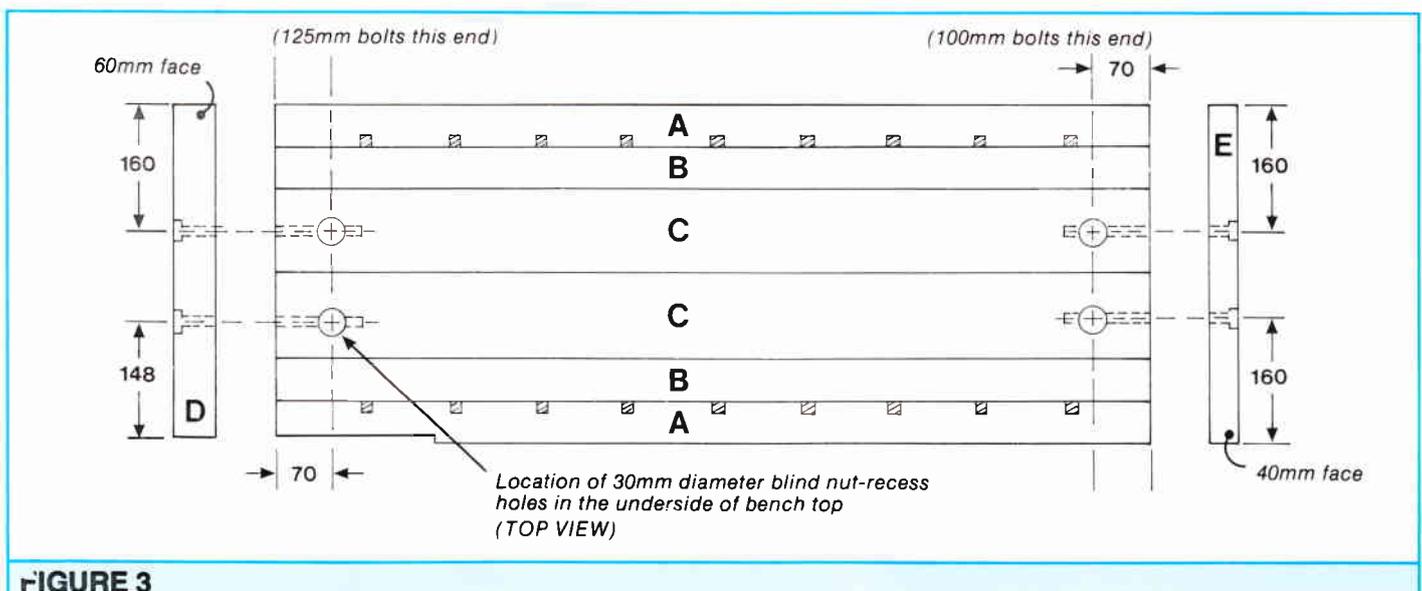
10 Measure the width at each end of the completed bench top and cut the end rail (D) and tail vice components (E,F,G) to length. Mark the tail vice head inner component (F) for dog recesses, ensuring that they are in line with the rows of dog holes in the bench top. Raise the sawblade to cut 20mm deep and make the dog rebates, 20mm wide as before.

11 The end rail (D) and tail vice face (E) are secured to the bench top by bolts. The heads of the bolts are recessed in (D) and (E), the nuts are hidden in blind holes in the bench top. **Figures 3 and 4.**

Turn the bench top face down. See **Figure 3** for the locations of the required holes. Use an electric drill and the 30mm krefting cutter to bore holes 30mm deep. Mark the stem of the boring bit with tape or texta pen to avoid drilling right through the bench top.

Turn the bench top back over, face up, and clamp the end rail (D) and tail vice face components in place, level with the bench top. Mark the desired hole positions, countersink with a 15/16" spade bit 12mm deep, then with a 3/8" bit drill through both components in line with the centres of the blind holes underneath. Drill far enough to mark the end grain of the bench top, unclamp and remove the end components and continue to drill holes through into the 30mm blind holes. Drill right across the width of the holes and continue through the other wall of the hole, as far as the length of your drill bit will allow.

Fit the clamp bolts, washers and nuts, and test clamp the end components in place. When satisfactory, drill two 1/2" dowel holes through each component into the centre of the end grain of the outer rails. Separate the components and continue drilling to deepen the holes.



12 Stack the tail vice face and head components (E,F,G) in their relative positions and clamp firmly together, vice face (E) on top. Mark the positions of the 30mm centre and guide rod holes, (Figure 5) and bore through the top component to mark the one below. Remove the top component (E) and reclamp the two vice head components back together. Bore through at the marked positions as before, into the bottom components, unclamp and remove the vice head inner. For the remaining piece (vice head outer) bore right through with the centre hole only, stopping about half way through for the two outer guide rod holes.

When boring in this way with the cutter, you will need to use a drill press or stand, and to hold the cutter near its shaft end so that enough cutter protrudes from the drill chuck to bore right through the 40mm thick material and mark the piece below.

Coat the meeting faces of the vice head components (F,G) with glue and clamp together until set, holes in line. Glue and dowel the end rail (D) and tail vice face (E) to the bench top, using the clamp bolts. If available, it is a good idea to use pipe clamps as well. Figure 6.

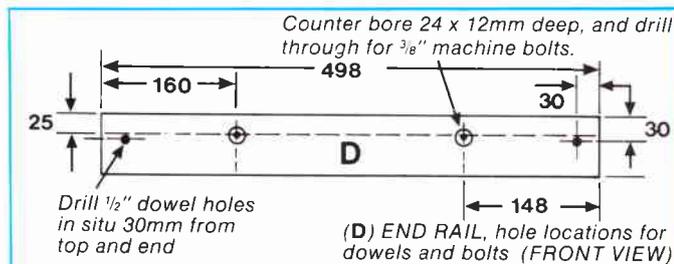


FIGURE 4

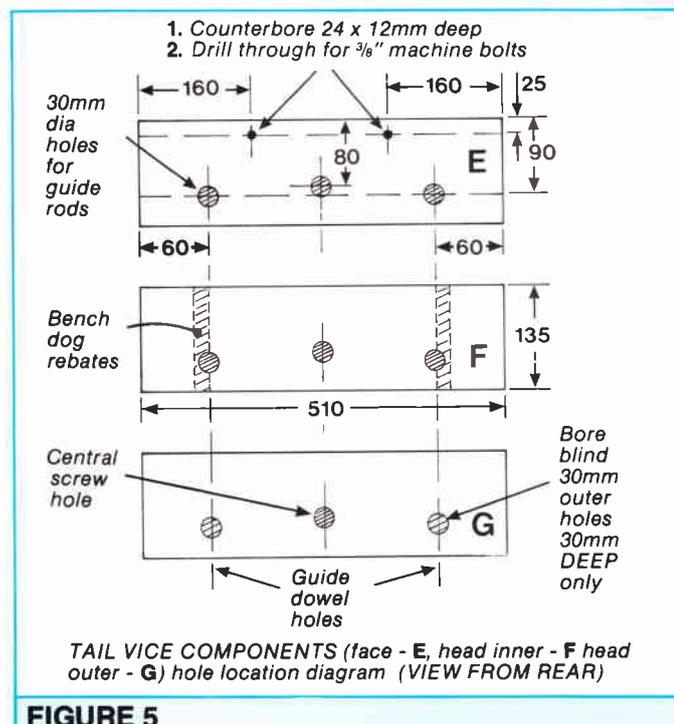


FIGURE 5

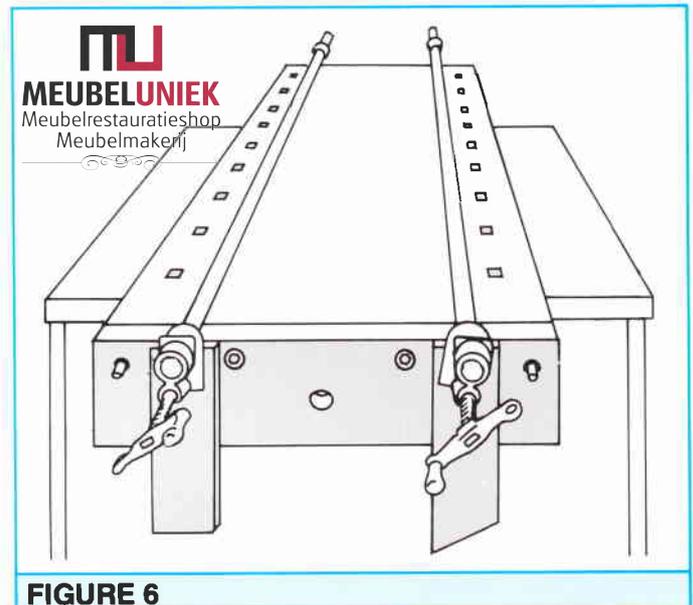


FIGURE 6

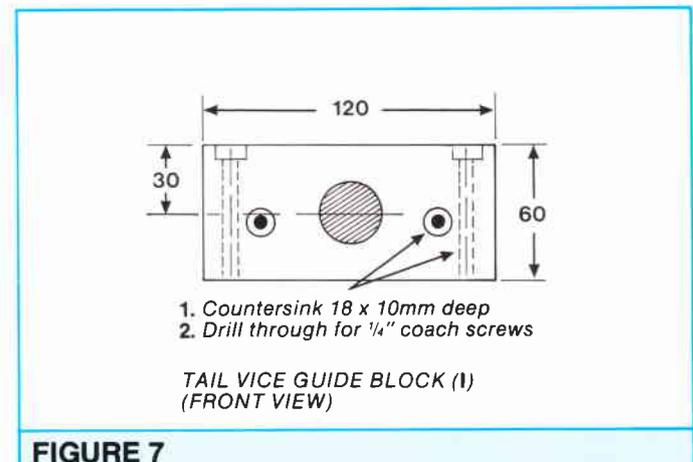


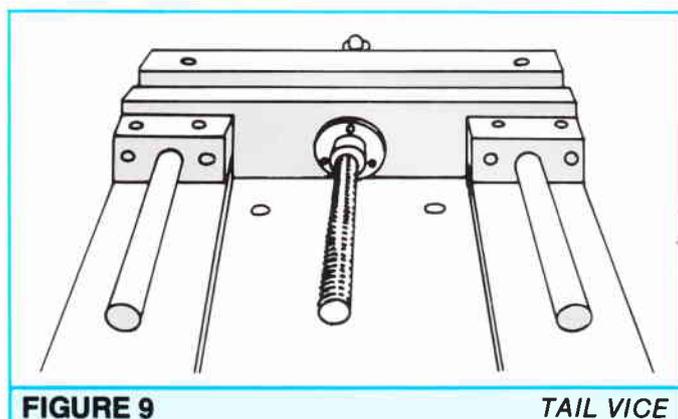
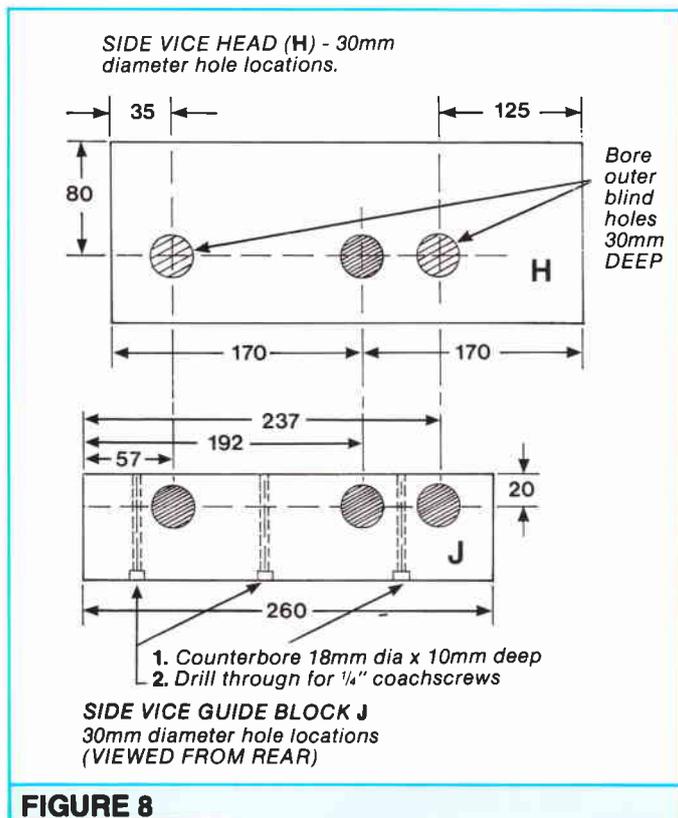
FIGURE 7

13 Cut to length, the side vice head (H), the tail vice guide blocks (I) and the side vice guide block (J). Mark the 30mm hole positions for the side vice head (H). Figure 8. Note that the guide rod holes are offset, both to clear the bench legs and to allow workpieces to be clamped firmly when placed vertically through the vice. Bore the centre hole right through, and the two guide rod holes only half way through, as before.

14 Turn the bench over once more, and clean all glue from the underside. Clamp the tail vice guide blocks (I) in place hard up against the rear surface of the vice face, and with the 30mm hole borer in an electric hand drill, bore through from the front of the vice face to mark the positions of the guide rod holes on the block. Unclamp the blocks and carefully transfer the centre of the marked hole to the other side of the block by squaring around and measuring. With a drill stand or drill press, bore through on the marked positions from both sides to meet in the middle of the block.

Construction Details

An expanding bit, if you have one, will allow you to bore straight through in one operation. Clean up any slight step where the holes meet with a half-round rasp or file, and check that the guide rod dowel is a free sliding fit through the block. Mark for the clamping coach screws, countersink 11/16" x 10mm deep and drill 1/4" holes right through in both planes as shown in **Figure 7**. Offset the holes slightly so that the screws do not intersect in the middle of the block. Clamp the blocks back in place, locating with a length of dowel right through vice face and block and check that the block does not protrude from the side of the bench top. Trim it if necessary. Use the 1/4" drill to drill through the block holes slightly into the bench top underside and the back of the vice face. Remove the blocks and drill 3/16" on these marks 25mm deep for the coach screws. Coat blocks with glue, add washers and coach screws and glue and screw in place.

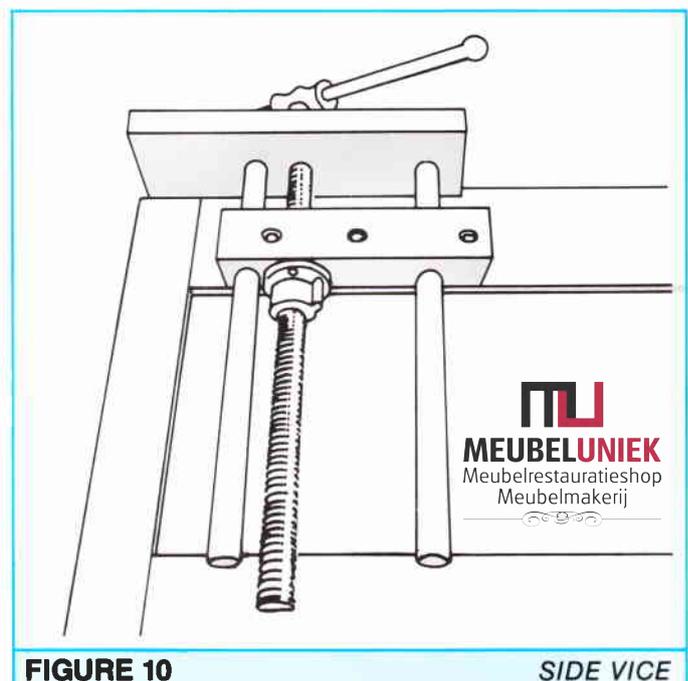


15 Mark out the side vice guide block (**J**) (**Figure 8**). Because the guide rod holes do not go all the way through the vice head, this must be done by careful measurement. Bore through from both sides in the same way as for the tail vice blocks, also countersink and drill through for coach screws in three places, this time in one plane only. Clamp in place 102mm from the end of the bench and flush with the step formed by the inner side rail (to make a wider face for the Bench Screw nut to bear on) and drill through to mark the bench top as before. Remove and drill 3/16" holes for the coach screws. Coat block with glue, add washers and coach screws, and screw into position.

16 Bowl-shaped recesses must now be chiselled around the centre holes of the vice head outer faces (**G,H**), for the convex flange of the bench screw to sit in. A 1/2" round gouge makes this easier, but it can be done with a small flat chisel. Check fit the bench screws, and when satisfied, drill for the locating screws.

17 If you wish to chamfer the outer corners of the vice heads for appearance sake, now is the time to do it, either with a hand plane or using a 45 degree bit in your router

18 Glue the guide rod dowels (**K,L**), cut to length, in place in the blind holes of the vice heads. Use a square to make sure they are exactly at 90 degrees to the vice head in both planes. When dry, drill 17/64" holes for the stop pegs (**M**) 12mm from the ends, in line with the long axis of the vice heads.



19 Lubricate the guide rods with candle wax and test fit the tail vice assembly. Ease the guide holes with a half-round rasp if necessary, until the vice closes smoothly. Screw the bench nut in place on the rear face of the vice inner component. **Figure 9.**

It is most convenient to screw the bench nuts on “backwards” with their flanges flat against the locating face. You can either use round-headed screws, or use a metal-quality countersink bit to countersink the screw holes on the “wrong” side of the nut flange.

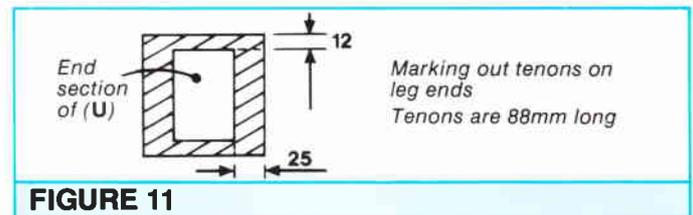
Do the same with the side vice. The nut flange will have to have two flats filed or hacksawed to allow it to sit in line with the centre hole, and to clear the guide rod. **Figure 10.**

20 This completes the work on the underside of the bench. Remove the vice heads, clean up and sand the underside of the benchtop if required and seal with one coat of Danish Oil. Leave the bench top face down for the present.

21 The underframe is made next. If the legs are not cut exactly to length, lower the worktable and double-cut the 90 x 90 material to 843mm. To ensure accurate tenon shoulders, the ends must be flat and square, without a step. Note that this measurement is to give a finished bench height of 915mm, to enable it to be used as an extension support for a Triton Workcentre fitted with adjustable feet. If you require a different finished height, adjust the leg length accordingly.

22 With the table still lowered, make the tenons. **Figure 11.** Clamp a stop block a little less than your bearer width (say 87 or 88mm) from the sawblade to ensure that your tenons do not protrude through the mortises. Adjust the sawblade height so it will cut 25mm deep into the wood, and place a leg against the stop. Make the first cut defining the shoulder and then cut away the rest of the wood to the end. Turn the leg over and repeat for the opposite face of the tenon. Repeat at the other end of the leg (tenons in the same plane!) and at both ends of the other three legs. Reset the sawblade to cut 12mm deep, and cut the other faces of the tenons in a similar manner.

23 To make the matching mortises, return the table to the normal working height, and cut the bearer halves (X) to length (should be 510mm). The width of the tenons you have made should be $(90 - 24) = 66\text{mm}$, and the thickness $(90 - 50) = 40\text{mm}$. Check this and then



mark the width carefully on all the bearer halves in the positions shown in **Figure 12.** Set the sawblade height so that it cuts half the tenon thickness deep (should be 20mm) into the bearer, test on scrap, and when satisfied, make the rebates, taping the bearer halves together in pairs or fours to ensure matching components.

24 Test fit the tenons by clamping the half-bearers temporarily together, and when satisfied, clamp together and glue in matching pairs. When dry, clean up excess glue, test fit to legs and mark for future identification.

Mark a line 50mm in from the ends of the bearers and cut off the ends at 45 degrees for appearance. Rebate the upper bearer (W) at the tail vice end, in the centre of its top face, 35mm wide x 40mm deep for the bench screw to pass through.

25 Counterbore the outer end faces of the legs on the centre line and 280mm up from the bottom, 15/16" x 12mm deep, and drill through for the stretcher bolts. You will need a long 3/8" bit, or a 3/8" dowelling bit.

Assemble and glue each set of leg frames, countersunk holes to outside. When dry, clean up and fit 12mm plywood foot pads (X') with countersunk screws to aid stability on uneven floors.

26 Clamp the tail-vice end legs in position, onto the upside-down bench top, 208mm in from the bench end. Fit the vice head and guide rod assembly and carefully mark where the guide rod dowels will pass through the legs. They will go right through part of the tenons. Mark the hole centres for boring and carefully square round the bearer to transfer the hole location to the opposite side. Remove the leg assembly, and using a drill stand or press bore the 30mm holes through from each side to meet in the middle, in the same way as for the guide blocks. Because of the extra material thickness, the holes will only meet if the cutter is held right near its end. You may need to transfer the cutter to a hand drill to complete the hole. Rasp away any slight step caused by the holes not meeting perfectly, check with a piece of dowel for fit, and check that the guide rod assembly slides freely through when the leg frame is in position. **Figure 13.**

Construction Details

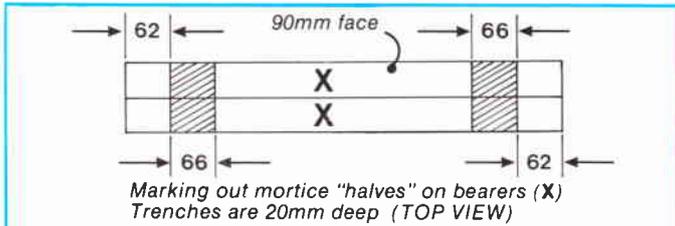


FIGURE 12

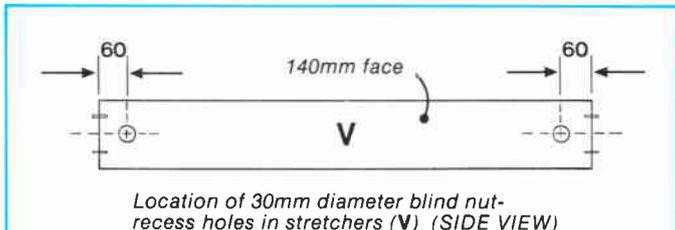


FIGURE 14

27 Cut the stretchers (**V**) to length from the 140 x 45 material, mark and bore the blind 30mm holes, 35mm deep and 60mm in from each end, in the centre of the width. **Figure 14.**

Drill the $\frac{3}{8}$ " bolt hole through from the ends, right across the blind holes and into their opposite sides.

28 The stretchers are further located with steel dowel pins. To make these, drill pilot holes in the end grain of the stretchers, halfway between the centre $\frac{3}{8}$ " hole and the outside edge. Screw in 40mm x 12g wood screws, leaving about 12mm of the screw protruding. Cut the heads off the screws with a hacksaw to leave steel dowel pins. Assemble the stretchers to the leg pairs with their bolts, and tighten the bolts sufficiently, while holding the stretchers square and in line, so that the pins mark the legs. Disassemble and drill 6mm holes 12mm deep at the marked positions.

29 Clamp the side-vice end pair of legs in position, 12mm in from the end of the bench and hard up against the side vice guide block. Counterbore $\frac{15}{16}$ " holes with a spade bit 12mm deep, about 50mm in from each leg into the bottom face of the top bearers (**X**). Stagger the holes so that they do not pass through the glue joint. Drill $\frac{3}{8}$ " holes with a long bit through the countersunk holes right through the top bearer and slightly into the bench top. Remove the leg pair and drill $\frac{9}{32}$ " 25mm deep for the coach screws, using tape or a pen mark on the drill bit to avoid drilling right through the bench top. Refit the legs with $\frac{3}{8}$ " x 125mm coach screws and washers, and using a suitable socket, tighten firmly.



FIGURE 13

30 Temporarily fit the stretchers to locate the tail-vice end set of legs. Counterbore, drill through and mark the bench top as before, remove legs and drill the holes for the coach screws. Reassemble with the coach screws and washers, stretchers first, and finally tighten all bolts.

Install the tail-vice head, passing the guide rods through the legs, and fit the stop pegs into their holes.

31 The bench is now nearing completion. Turn the bench back upright and belt sand the top, using coarse (if necessary), medium and finally fine grades of paper until it is perfectly flat and smooth. Make and fit a pair of soft vice jaws for the side vice from 12mm softwood, and screw them with countersunk wood screws to the bench and vice face. Wax the guide rods and fit the vice head, inserting the stop pegs into the holes in the end of the dowels as before.

32 Cut some bench dogs from strong hardwood, shaped as shown in **Figure 1**, with shanks sized to be a free sliding fit in the bench dog mortises. 19mm square should be about right for the shanks, test for a free sliding fit after cleaning out any glue from the holes with a mortise chisel.

33 Finally, give the bench top several coats of a penetrating sealer, such as Danish Oil, also the underframe if desired. You now have a magnificent craftsman's workbench, and if you treat it with care, and give it an occasional coat of sealer, you can confidently expect to be able to hand it down to your great-grandchildren.