

WOODRAT

A PRACTICAL COMPANION TO THE TECHNICAL MANUAL

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Introduction

This manual is not intended to replace the excellent technical manual that you received with your Woodrat. It should be used as a practical aid to further understanding this very powerful, creative woodworking tool.

The technical manual, although very comprehensive, is not an easy read when first starting out, and can be a little confusing when trying to get to grips with basic principles.

The techniques in this manual have been developed from several years experience teaching the woodrat to novice and experienced users. There are many different ways of using the woodrat to achieve the same thing, and I make no claim that my way is the only way. If, however you follow the lessons contained herein you will, by the time you reach the final chapter, have a much clearer understanding of this wonderful tool. I am sure you will then start to develop your own way of doing things.

The lessons are structured to give you a sound understanding of increasingly complex principles. Many of the techniques in each chapter, although based on a single type joint, have something in common with other types of joints. You should therefore complete each chapter to the letter.

Each lesson is a detailed step by step guide that does not require any reference to the technical manual, in fact, I would urge you to put the technical manual to one side until this course is complete, you will then be able to tackle the more complex ideas with a new understanding.

WOODRAT SET-UP

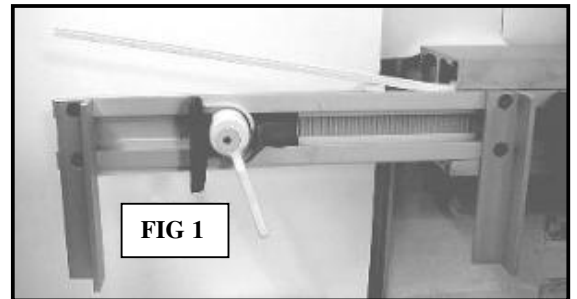
Although the Woodrat is machined and assembled to high tolerances, like all machines it needs to be fine tuned before use. Please take the time and follow the instructions below, it will pay dividends in the end, especially when you are making some of the more fancy joints such as double inlayed dovetails etc.

1.. Do not assemble the various components to the woodrat yet, mount the basic frame where you intend to work.

2.. Using the hand wheel, move the sliding bar to the right until about 5 cm (2 in) is protruding from the channel, check the tension of the bowden cable by squeezing the cable towards the sliding bar. you should JUST be able to touch the sliding bar with the cable, if not then adjust the cable by slackening the back nut on the tuning screw and re-tension the cable with the Allen key provided. If the tension is too tight the sliding bar will tend to be jerky when moving with the hand wheel, adjust the cable until the action is smooth.

3.. You may well find that there is some play in the sliding channel, i.e. it moves when pushed and pulled away from you, this is caused during assembly as they sometimes tend to be a bit heavy handed when pushing the white tongue into the two grooves in the sliding channel.

To rectify this and to take up wear and tear after prolonged use, extend the sliding channel fully to the left of the "I" beam frame, using a flat screw driver or similar, gently push the TOP white tongue out of its groove up to the side of the frame, See Fig 1

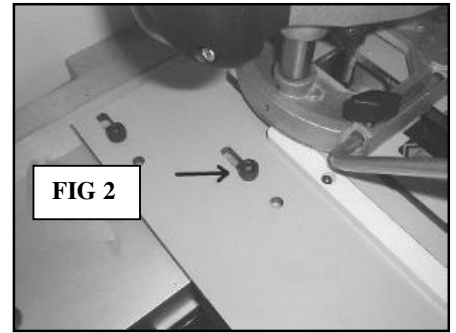


Leave the tongue loose and then move the sliding channel FULLY to the right of the frame, this pushes and re-seats the tongue into the groove, repeat the operation for the right-hand side. There is no need to re-seat the lower groove, as the weight of the sliding bar keeps the tongue correctly seated. You may find that the sliding bar feels a bit stiff, if this is the case then a few drops of silicon oil on the tongues will make it smooth again, You may also find that you have to re-adjust the Bowden cable. You will find that this procedure has taken out all the play in the sliding bar.

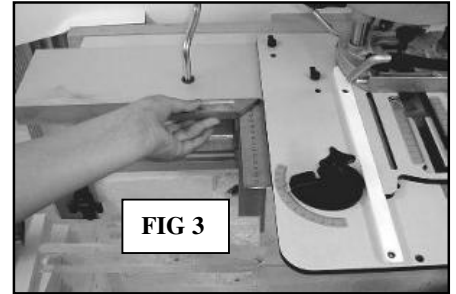
4.. Cut and fix the dust chute into position.

Now fix the base plate to the "I" beam frame, I would suggest you use the 2nd slot position for fixing the base plate as 90% of all your work will be done with the base plate in this position. See Fig 2

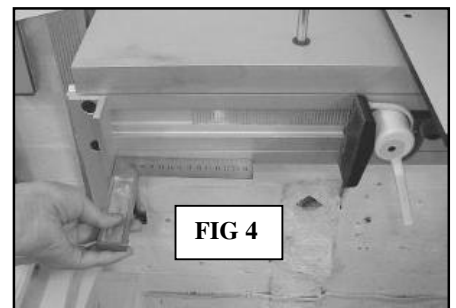
The purpose of having 3 fixing positions is for through dovetail jointing only and for no other purpose, more about this later.



Make sure that the base plate is pushed firmly against the cap head screws. and then check the base plate for square relative to the "I" beam frame. See Fig 3 If you should find that it is not square (very unlikely) then with a fine round file, file out one end of the slots until square.



5... Bolt the LEFT hand fixed fence to the sliding bar, check for square against the face of the "I" beam frame, if it should be out square use paper shims between the fence and "I" beam frame until square. Then square up the second fence. See Fig 4



Now check the fence for square against the UNDERSIDE of the base plate. See Fig 5 Adjust by slackening the fence screws and adjusting until square, (there is enough slack in the counter sink to do this). Slide the cam lock onto the sliding bar. Now repeat for the RIGHT hand fence. I find that it is worth gluing 300 grit sand paper to the fixed fences as this gives a better grip, (you must do this to BOTH fences other wise you will be out of registration by the thickness of the sand paper)



6.. Assemble the 2 cams to the base plate

7.. The router plate is partially pre-drilled for the Elu 177/DW625 and Elu96 routers, if you have a different machine you must drill your own fixing holes in the router plate, you can do this by taking off the Tufnell base plate from your router and using it as a template, if yours is the fixed type of base plate then you can make a paper template. IT IS VITAL that you mount your router so that the collet/cutter is EXACTLY in the middle of the Woodrat router plate channel and is in line with the 2 INNER pre-drilled holes on the Woodrat router plate. Please take care with this set-up or you will have problems when cutting through dovetails.

8.. Try fitting the centre plate into the channel in the router base plate, you will probably find that it is very tight or will not fit at all, gently sand the sides of the centre plate until you get a FIRM fit.

9.. Place ONE of the little orange buttons into the rear of the base plate, don't bother with the front one at this stage.

That's it you're ready to go.

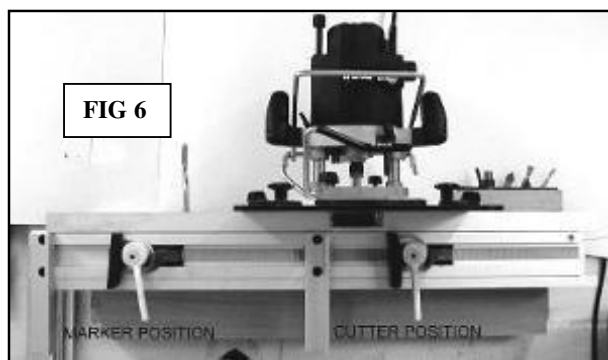
Well almost

MARKER POSITION

The woodrat is capable of producing almost any type of joint you can think of, as well as functioning as a router table, cutting raised panels, mouldings, dado rails etc. Whatever you intend to use your machine for, you will inevitably want to cut Comb and Dovetail joints. The manual, although very comprehensive can be a little confusing, and I find, as many people do, that the instructions are somewhat disjointed (excuse the pun)

The following instructions are based on my own practical experiences and the training courses that I have been running for many years. It is IMPORTANT that you complete the following exercises TO THE LETTER, as this will give you an in-depth understanding of the way the rat works in pretty well all jointing procedures.

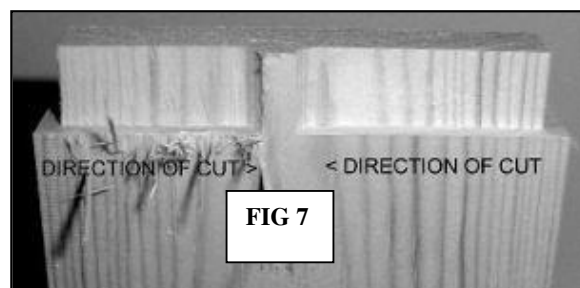
The first and most important aspect to understand is the relationship between the CUTTING POSITION and the MARKER POSITION. The marker position is the cam - clamp and fence on the Left hand side of the machine face. The cutting position is the cam-clamp and fence on the Right hand side of the machine face. (SEE FIG 6)



The following exercises will require 6 or 7 pieces of wood prepared to the following dimensions:- 200mm x 95mm x 12mm. Pine will do as this is only practise. You will also require a 10mm straight router bit.

Before we start looking at the Marker/Cutter relationship, let's talk about the cut direction first. If you have used your router on a conventional router table or free hand on the bench, you will know that you have to feed the cutter into the wood against the rotational direction of the cutter, this of course is for safety reasons. If you cut with the directional rotation of the cutter, the cutter will grab, and try to fling the wood off the table and may be very dangerous.

Although cutting against the rotational direction of the cutter is the safe way, it's not in fact the best way to cut wood, as the action of the "Upcut" pulls the wood fibres out and leaves a rough finish, and when cutting end grain produces severe "breakout" (SEE FIG 7)

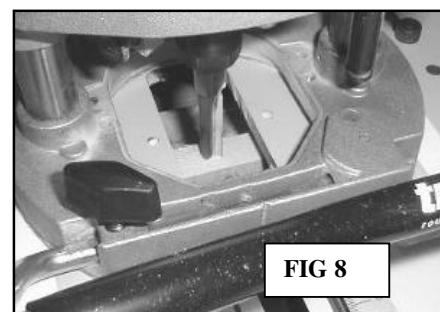


Large multi-head spindle moulders grip the wood mechanically and feed the wood in the SAME direction as the cutter rotation. This is called a "down cut," and produces a much better finish, and prevents breakout on the end grain.

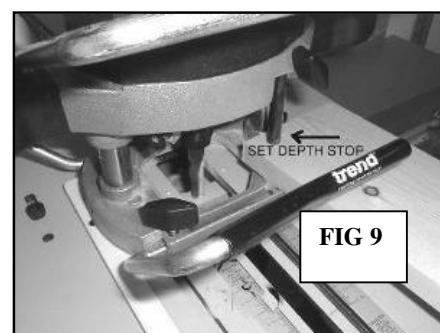
Because the Rat also grips the wood, all cuts are made as a down cut. In other words the cutter goes in a **clockwise** direction around the wood. Try it and see for yourself.

Place one of the prepared pieces in the CUTTER POSITION. Make sure that it is flush against the face of the machine, and snug under the base plate. Depth the cutter to about 10mm in FRONT of the wood and make a cut from LEFT to RIGHT (anti clockwise) Lots of breakout. Now make the same cut on the other end, but this time from RIGHT to LEFT (clockwise) No breakout and no grabbing, and a much better finish. This is how all the Comb and Dovetail joints are made on the Rat

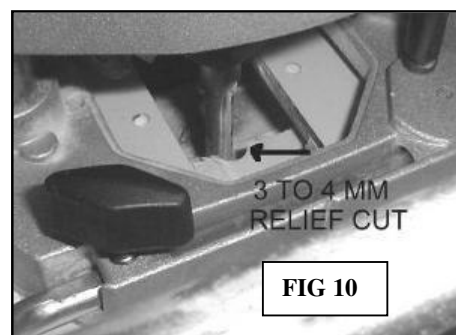
Now for the Marker and Cutting position relationship. Keep the 10mm cutter in the router, Take a piece of the prepared wood, and mark one face with the letter "F." Put this piece into the CUTTING POSITION with the "F" facing you . Plunge the router so that the cutter is sitting on top of the wood, SEE FIG 8 and lock the plunge. This is called ZEROING the CUTTER.



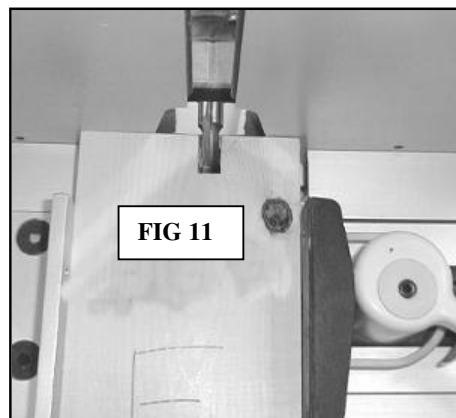
Keep the plunge locked, place a second piece between the depth gauge and the turret stop. Drop the depth gauge on to the wood and lock off. The cutter is now set to plunge to the thickness of the wood. (SEE FIG 9)



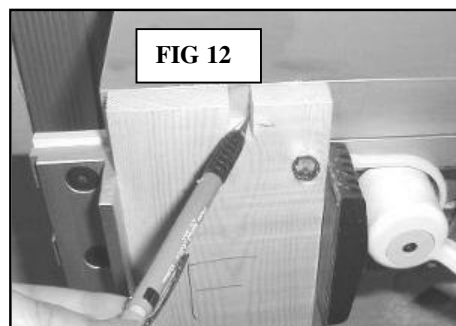
Now plunge the cutter BEHIND the wood and lock off the plunge. Position the wood so that the cut will be approximately in the centre of the wood. No need to be too fussy about finding the centre. Switch on and pull the cutter towards you into the wood, DON'T pull the cutter all the way through, make a cut of about 3 or 4 mm deep, as a relief cut. SEE FIG 10 This prevents breakout when the cut is completed.



Now un-plunge the router and re-position the cutter in FRONT of the wood. SEE FIG 11. Plunge the router again and finish the cut pushing away from you. I prefer to make all the cuts this way, as the force of the cutter is towards the machine face. This makes sure that the workpiece has no tendency to slip in the clamp.

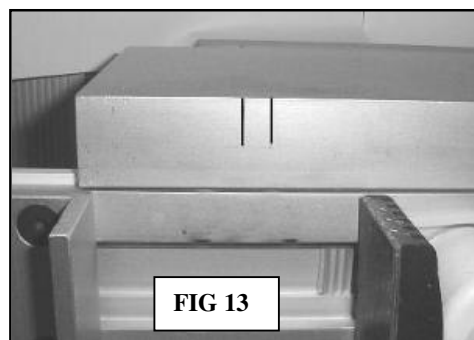


At this point it is VITAL that you DO NOT move the rack handle, (not even a gnats whisker). CAREFULLY remove the wood from the cutting position and place it into the MARKER POSITION. It is VITAL that you keep the face marked "F" towards you. (SEE FIG 12) and that the wood is FLUSH with the top of the machine.



Now take a pencil with a fine point and mark the slot you have just cut on the face of the machine, you only have to mark the 2 vertical sides, there is no need to mark the base. It is VITAL that you make sure that the pencil point is flush to the sides of the cut socket.

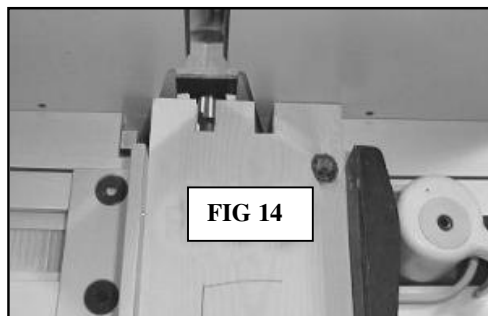
This mark is all you need to be able to make ANY style of Comb joint to any pitch and size of sockets or pins. SEE FIG 13



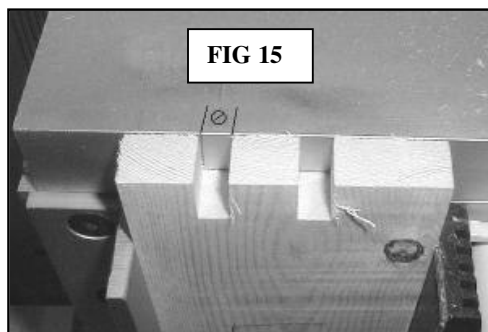
YOU MUST REMEMBER THAT THE MARK YOU HAVE JUST MADE REPRESENTS THE SIZE OF THE CUTTER YOU HAVE IN THE ROUTER, AND NOT THE SIZE OF THE SOCKETS AND PINS YOU ARE EVENTUALLY GOING TO MAKE. THIS RULE APPLIES TO ALL JOINTS.

ALSO REMEMBER THAT THE OUTSIDE OF THE PENCIL LINE REPRESENTS THE CUTTING EDGE OF THE ROUTER BIT. THIS IS A VERY IMPORTANT POINT AS YOU WILL SEE WHEN WE MAKE A FULL COMB JOINT.

Remove the piece of wood from the marker position and place it in the CUTTING POSITION again. Make another cut any place you choose across the width, and REMEMBER to keep the face marked "F" towards you. SEE FIG 14



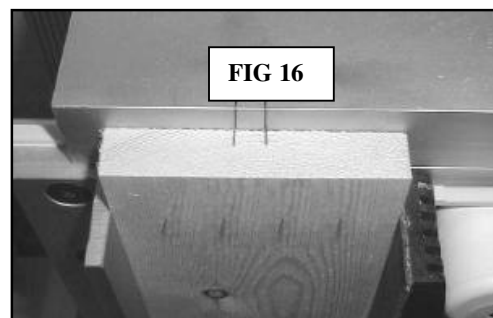
Again, without moving the rack, place it once more in the MARKER position. Although the second cut was made in a different position IT STILL LINES UP WITH THE ORIGINAL PENCIL MARK. SEE FIG 15.



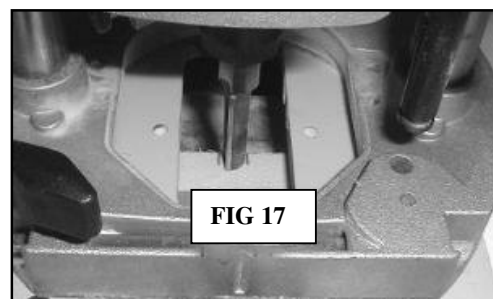
If you think about this for a bit the penny will drop. It has to line up because the 2 fixed fences move TOGETHER. So if the right hand fence is moved say 2 inches to the left, the left hand fence has to follow. Notice I have marked the top of the machine with 2 lines matching the 2 marker lines on the face of the machine, this is just a visual aid, so that you can see where the proper marker lines are on the face of the machine. Understanding what this pencil mark is really telling you is one of the keys to fully understanding the Rat.

To make sure we do have a full understanding lets make just one more cut, but this time in a slightly different way.

Take another piece of the prepared wood, but this time place it in the MARKER POSITION and JUST BELOW THE MACHINE TOP SURFACE, so that the pencil line is exposed a little. Position the wood in front of the pencil mark in any position across the width you like. (SEE FIG 16) Mark the top of the wood with 2 lines corresponding to the 2 lines on the face of the machine. Remove the wood (DON'T MOVE THE RACK HANDLE) and place it in the CUTTER POSITION.



Lower the router bit onto the top of the wood, and, as you can see, the cutter lines up perfectly with the 2 lines. SEE FIG 17 Make the cut if you like, and replace the wood back into the MARKER POSITION. You still have perfect registration with the original pencil marks.



So, what the original pencil mark on the face of the machine in the MARKER POSITION is really telling you, is where the cut is going to take place in the CUTTING POSITION.

POINTS TO REMEMBER

Make all your cuts in a clockwise direction (DOWN CUT) to give a better finish. VERY IMPORTANT WHEN CUTTING PINS.

When cutting a socket, make a relief cut of about 3 or 4 mm into the wood from the back , then finish the cut from the front. This prevents breakout as the cutter completes the cut.

After making the socket for the registration mark, keep the same face towards you when placing the wood into the MARKER POSITION.

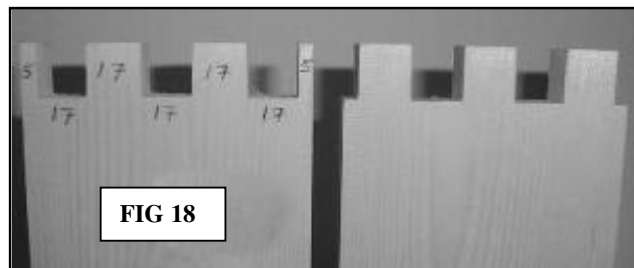
DO NOT MOVE THE RACK HANDLE AFTER CUTTING THE REGISTRATION SOCKET OR BEFORE MAKING THE ORIGINAL REGISTRATION MARK. If you do then you MUST cut a new socket before marking up.

You do NOT have to use the prepared stock to make the socket for the registration mark. Any scrap piece will do, so long as you depth the cutter for the thickness of the material you are going to make your box, "or whatever", out of. The OUTSIDE of the pencil mark in the registration position represents the cutting edge of the router bit

COMB JOINT

This exercise will use the stock you have prepared earlier i.e. 200mm x 95mm x 12mm, and the same 10mm straight cutter.

Place a piece of scrap wood into the CUTTER POSITION, zero the cutter and depth the cutter for the thickness of the wood (12mm), just as we did for the previous exercise. Make a single socket, and transfer the wood to the MARKER POSITION (Keeping the SAME face towards you AND without moving the rack handle) then make the pencil registration mark, discard the scrap. The Comb joint we are about to cut is going to look something like (FIG 18)

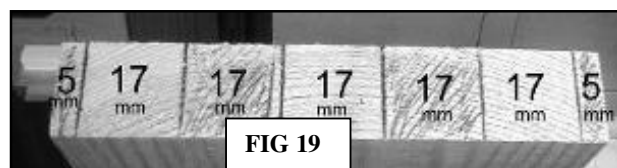


Although I have shown exact dimensions, for this exercise, the finished dimensions only need to be approximate, because what we are learning here, is the relationship of the pencil registration mark to the first part of the joint, enabling us to cut the second part of the joint to achieve a snug fit between pins and sockets.

If, when we finish the joint, it should turn out as in FIG 18 all well and good, if it comes out looking a bit cockeyed, don't worry we will be looking at achieving exact dimensions and symmetry later on

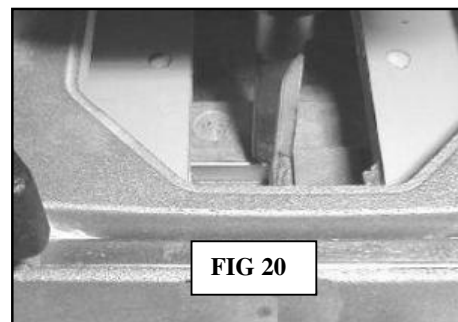
But first mark a piece of the prepared wood as shown in FIG 19

This method of marking and cutting pins and sockets is a valid way of working on the woodrat, because this is the way you would proceed if cutting by hand.

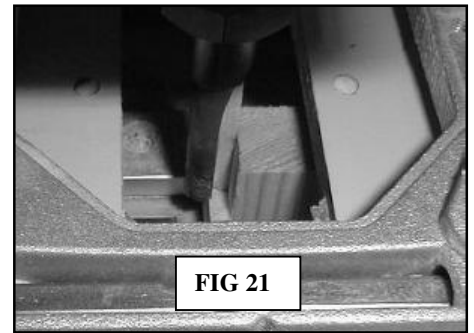


However it is not the most accurate, and will not give you symmetry across the joint, but it is the simplest way for the moment. You may be wondering why we are not using the parallelogram supplied with the machine. It cannot be used if you want symmetry, as there is too much guesswork in placing the rails across the board and marking out the joints. Try it if you like but you will soon see for yourself. So lets get back to FIG 19. The shaded areas are going to be cut out, to leave 2 shoulders of 5mm and 2 full sockets of 17mm.

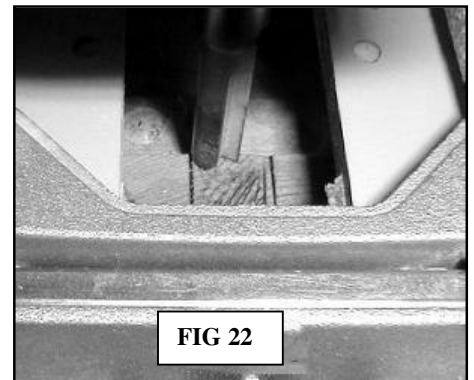
Place the wood you have just marked out into the CUTTING POSITION and position the right hand side of the cutter on the first pencil line SEE FIG 20. Then plunge the cutter IN FRONT of the wood (Remember cuts go CLOCKWISE TO AVOID BREAKOUT)



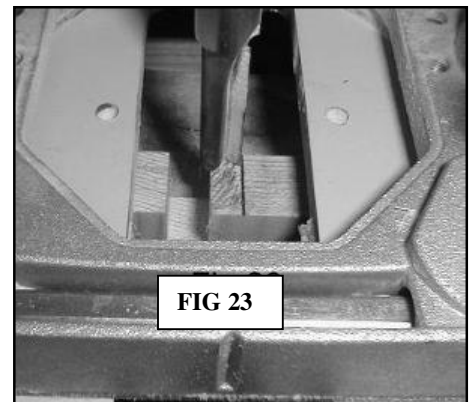
Then make the cut. This of course will cut a shoulder of 5mm. SEE FIG 21



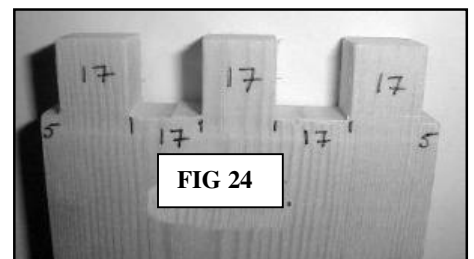
Move the wood to the **LEFT** until the LEFT hand side of the cutter is aligned with the next pencil mark SEE FIG 22. Plunge the cutter and make the cut (Remember the relief cut first).



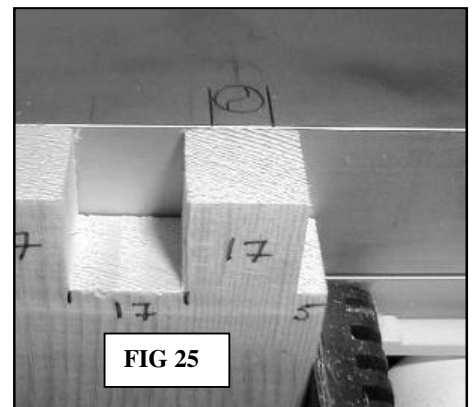
Now move the wood to the left again by 7mm. Plunge the cutter in front of the wood, and make another cut. We now have a socket of about 17mm SEE FIG 23



Repeat the steps from FIG 20 for the remaining sockets to complete the first half of the joint, and you should end up with something looking like FIG 24. If the finished dimensions aren't quite as expected, don't worry, we will be looking at methods of achieving greater accuracy later.



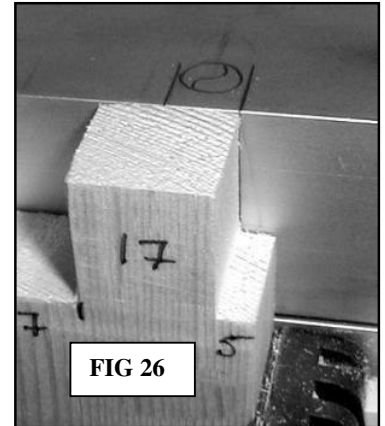
Now for the second part of the joint. Place the piece with the cut sockets and pins in the MARKER POSITION with the top of the timber flush with the top of the machine. Position the right hand pin in front of the pencil mark so that the mark is approximately in the center of the pin. SEE FIG 25



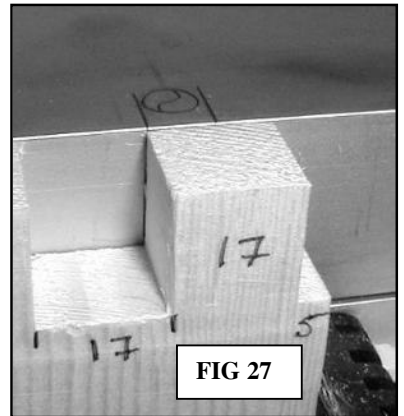
Now place a blank piece of the prepared wood into the cutting position, and make a cut (remember to make a relief cut at the back of the wood first then reposition and finish the cut from the front)

Move the Rack to the left until the RIGHT HAND pencil mark is JUST COVERED by the RIGHT HAND face of the first socket SEE FIG 26.

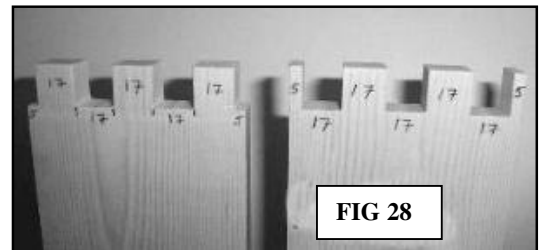
It is vital that you ONLY JUST cover the pencil line, remember the OUTSIDE of the pencil line corresponds to the cutting edge of the straight bit. Make another cut from the FRONT to the back (Remember all cuts go clockwise to give a better finish)



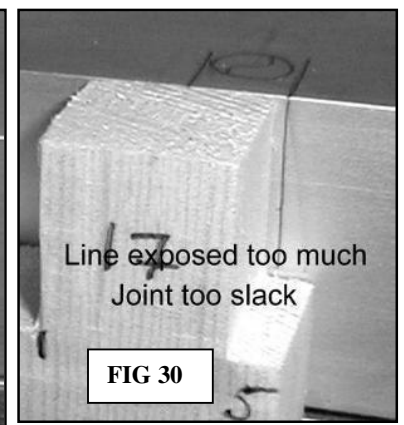
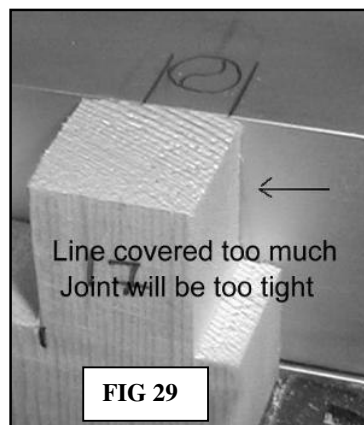
Move the rack to the RIGHT until the left hand face of the pin JUST COVERS the LEFT HAND pencil mark SEE FIG 27 and make another cut, but this time from the BACK.



Repeat the procedures from FIG 25 for the remaining 2 pins. You should now have two parts looking something like Fig 28
Put the 2 pieces together and you should have a snug fitting joint.



If the fit is tight, then the pencil mark was covered too much, if on the other hand the fit is very slack, then the pencil mark was exposed too much. SEE FIG's 29 and 30



Points to Remember.

- The pencil mark in the marker position represents the cutter, not the size of socket you wish to make. If you intend to make 17mm sockets, but are using a 10mm cutter, and then the marks are 10mm in size.
- Any piece of scrap may be used to cut the socket for the initial registration mark, PROVIDING YOU DEPTH THE CUTTER FOR THE WOOD YOU INTEND TO MAKE THE PROPER JOINT FROM. After a bit of thought you will see that, in fact, it doesn't matter for a comb joint because the socket has parallel sides but it does matter for dovetails because the sides of the socket are angled. So get into the habit of always depthing for the joint in question, then you won't make mistakes later on.
- After making the initial registration socket, keep the same face towards you and do not move the handle when transferring the piece to the registration position. If you do forget which face is which or move the handle (even a gnats whisker) then start again, and re-cut the socket.
- The quality of the pencil registration is VITAL because it represents the cutter. Make sure you snug the pencil to the walls of the socket. The thickness and density of the line doesn't matter in theory, but I have found from several years of teaching the Rat, that the eye gets fooled by the density and thickness of the pencil mark. A darker line seems to be exposed more than a faint line, so always use the same pencil when making the registration. For years I have used a 0.5mm clutch pencil, and I always get the results I expect, whether I'm using my own machine or demonstrating on a new one.
- When registering a pin against the pencil mark remember to JUST cover the line for a snug fit. If you cover the line too much the fit will be tight. If you have too much line showing the fit will be Slack

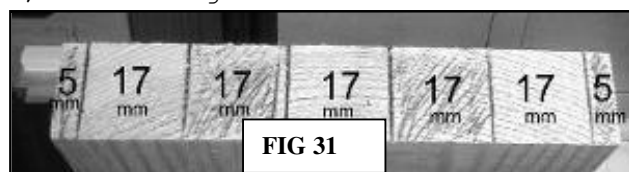
MEASUREMENT AND SYMMETRY

The joint we have just cut only had approximate dimensions for the pins and sockets because, apart from marking out with a pencil there isn't a method of making an exact measurement on the Rat itself, (or so it would seem). Ok there is the parallelogram supplied with the machine and it will give you pins and sockets that appear to be evenly spaced and symmetrical, but they won't be because you are guessing where to draw the lines and position them, as you have no-doubt discovered.

It could be argued that differences in layout of the pins and sockets makes the joint look as if it has been hand cut, and that's OK. But it does mean that you have to be very careful to use the correct pins in the marker position to cut the correct sockets, (FOR EACH CORNER) And if it's a box you are making, then the four pieces will only go together in the correct sequence, and that means that you have very little choice when trying to match grain pattern around all 4 sides.

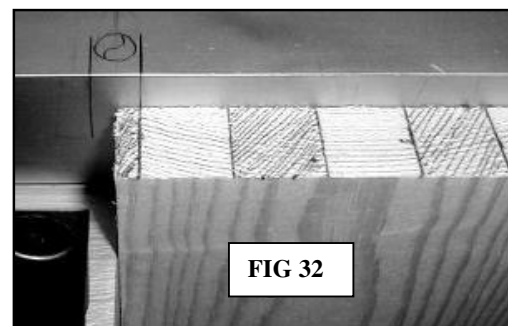
The next exercise is going to teach you to make a joint that will fit ANYWAY YOU CHOOSE to put it together, and we are going to do it WITHOUT MAKING EXACT MEASUREMENTS. This exercise is a most important one, because, although we are still making a comb joint, the technique applies to many other types of joint, including dovetails.

We will continue with the 10mm cutter, and the wood prepared to the previous dimensions.
SEE FIG 31

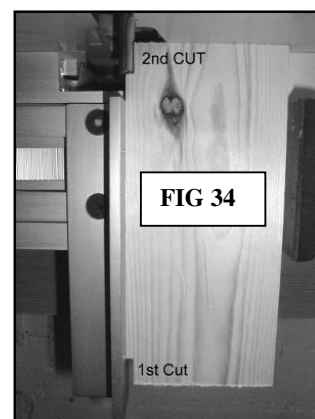
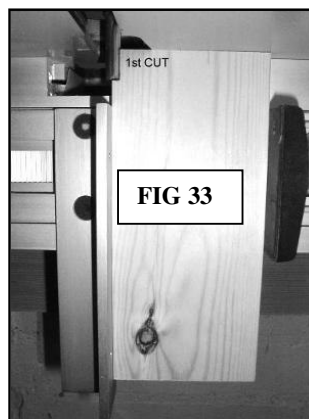


APART FROM THE SCRAP PIECE USED TO MAKE THE REGISTRATION MARK, YOU DO NOT HAVE TO KEEP THE SAME FACE OF THE WOOD TOWARDS YOU IN THE MARKER OR CUTTING POSITION (trust me) all will be obvious when we have finished.

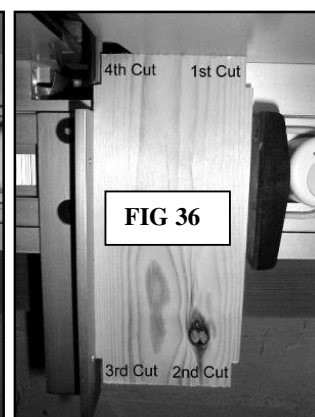
Place the piece of wood marked with the shaded sockets in the MARKER position and position it as shown. SEE FIG 32



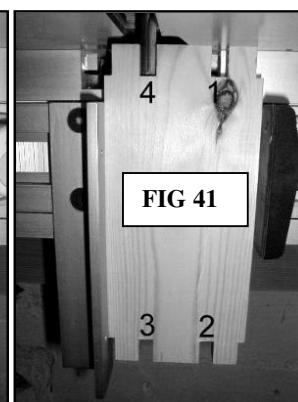
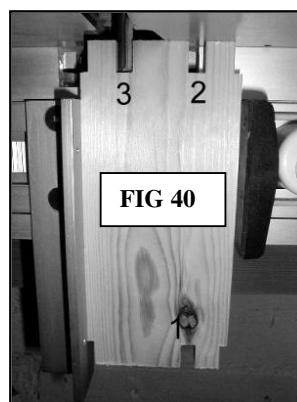
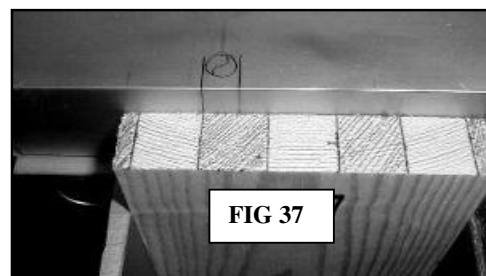
Place a blank piece of the prepared stock into the CUTTER position. Plunge the cutter in front of the wood and then make the cut. SEE FIG 33 WITHOUT MOVING THE HANDLE Remove the piece in the CUTTING position, and replace back in the CUTTING position as shown in FIG 34 by upending the wood as if in a head over heels motion. Plunge the cutter and make a 2nd cut.



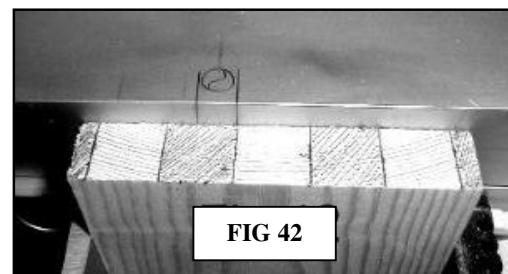
Again, WITHOUT MOVING THE HANDLE, remove the piece from the cutting position, and replace it as shown in FIG 35 by twisting the wood round as if in a spinning top motion. Plunge the cutter and make another cut. Finally, WITHOUT MOVING THE HANDLE remove the piece of wood, and replace it as in FIG 36 by upending the wood as if in a head over heels motion. Plunge the cutter and make the cut. All four cuts have been made with the position set as in FIG 32. This has produced four shoulders identical to each other. Now for the other sockets.



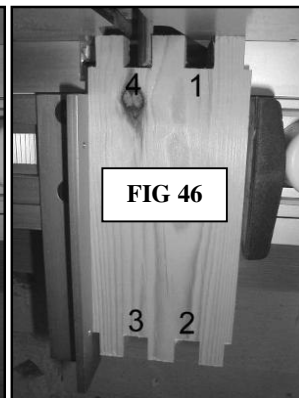
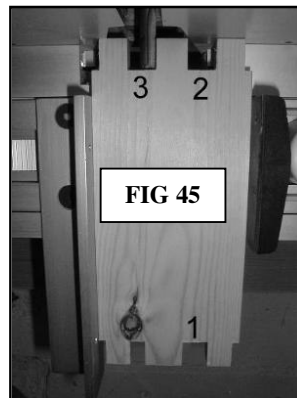
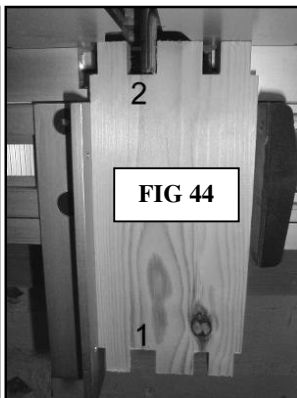
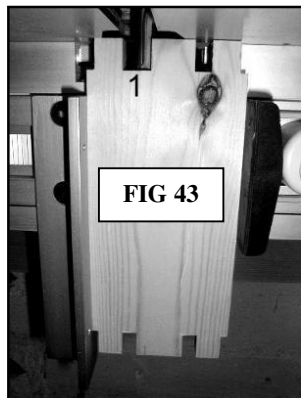
Position the wood in the MARKER POSITION as shown in FIG 37. Then make four more cuts using the same procedures and techniques as used for the shoulders. SEE FIG's 38,39,40,41



We now have four shoulders of 5mm each and four sockets of 10mm each. The four 10mm sockets need to be made 17mm wide. Reposition the wood in the MARKER POSITION as shown in FIG 42

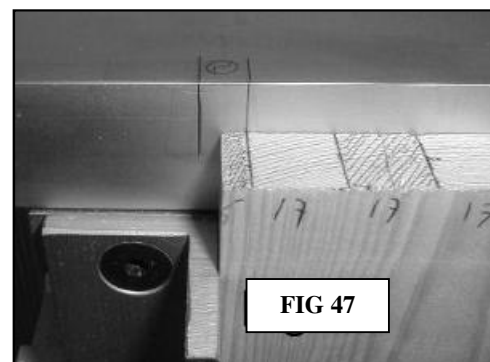


Then make four more cuts as in FIG's 43 to 46. The sequence is exactly the same as FIG's 38 to 41. Remember not to move the handle until all four cuts are completed.

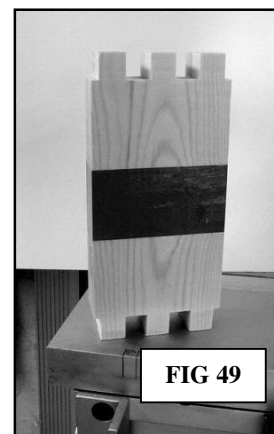
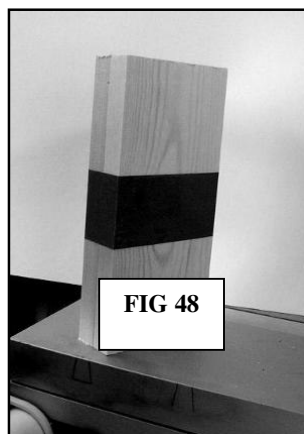


You now have a piece of board that is symmetrical both ends and both faces. Place one end of the cut board into the marker position, it doesn't matter which face or which way round. Place another uncut board into the cutter position and cut the pins. You do NOT have to rotate and upend this piece for each cut as the symmetry is in the board that is in the marker position. Just cut each pin as you did for the previous exercise. When you have cut the pins on one end, upend the board and cut the other end. You should now have two boards that will go together which ever way you choose.

So far we have only cut two sides of a box. So lets make a complete box using the symmetrical technique. Cut four pieces of board for two sides and two ends of a box, the length's to suit you. Mark one end of one piece as we did before, SEE FIG 47, and place it into the MARKER POSITION.



Take the two remaining boards and using brown parcel tape, strap them together as in FIG 48, and then place them into the CUTTING POSITION. Keeping the rack position set as in FIG 47 make four cuts for each shoulder, then repeat all the other cuts following the sequence from FIG 38. You should now have two boards with pins and sockets all identical. SEE FIG 49



Unstrap the two cut boards and place one of them into the marker position. Strap up two blank pieces and place them into the cutting position then cut both ends as in Fig's 43 to 46. Remember you do not have to flip and rotate these pieces as the symmetry is already in the board that is in the cutting position. When you have finished you will have four sides of a box that will go together any way you choose.

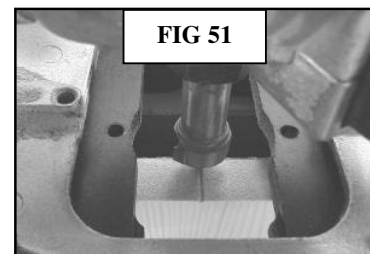
The above method of marking out and cutting pins and sockets for comb joints is the simplest and most accurate. It does, at least, allow you to place your joints exactly where you want them and to any dimension. In-fact this is the method you would use if you where cutting by hand, the only difference being that you are using a single router bit as a tenon saw and chisel.

However it is not quite so simple for dovetails because the joint is angled. I mentioned before that there are even more accurate ways of marking out that have applications for other types of joints, especially dovetails, so lets look at one particular method first so we can apply the technique to through dovetails.

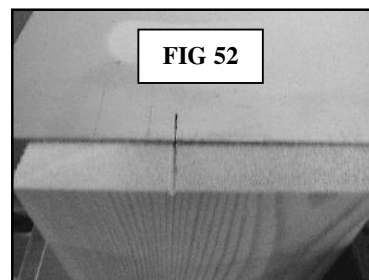
You will need a cutter with a fine tip such as in FIG 50. Place the cutter into the router, place a piece of wood, any size, any width, and any thickness into the cutting position. Position the cutter over the wood anywhere across the width.



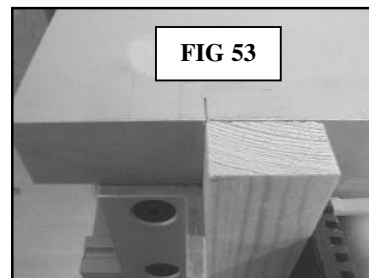
Switch on, then make a very shallow cut, about 1mm deep. SEE FIG 51 Switch off, then **very** carefully, and without moving the rack handle, remove the wood, keeping the same face towards you. Place it into the marker position.



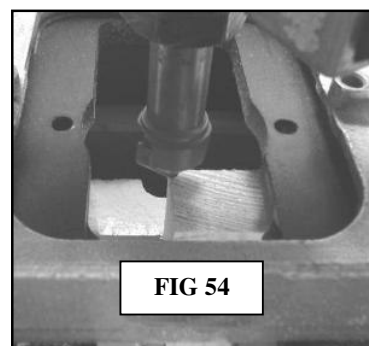
Take a fine pencil and transpose the cut line onto the top of the woodrat. SEE FIG 52. This line represents the **centre** of ANY cutter you subsequently place into the router.



For example, place any piece of scrap into the marker position and align the left hand edge to the pencil line SEE FIG 53.



Replace the scrap into the cutter position, and as you can see the point of the cutter is exactly over the left hand edge, SEE FIG 54. This mark gives us a very accurate datum for a variety of measuring, and dimensioning a wide range of joints.



Before we can use this mark, a simple jig needs to be made as in Fig 55. The dimensions are not critical, however, all faces must be square.



I would suggest the following dimensions.

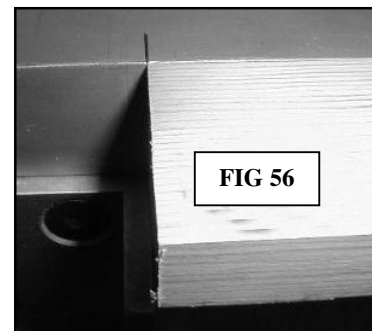
Upright pillar 200mm X 90mm X 20mm

Top shelf 200mm X 40mm X 20mm

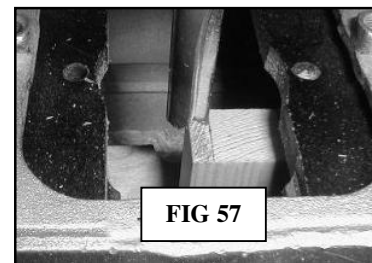
The left hand edge of the shelf **MUST** be flush with the left hand side of the pillar.

The shelf needs to be of a light coloured material such as MDF or white pine. Do not screw the shelf onto the pillar, as the top surface will be used to mark pencil reference lines etc. In the illustration shown I used hot glue.

Using the jig is very simple, but requires a little understanding, at first. Lets go back to the original dimensions we used for the Comb joint, SEE FIG 31. Mark up another piece of board as shown. Place the jig into the marker position and align the left hand edge to the scribed line on top of the woodrat
SEE FIG 56.



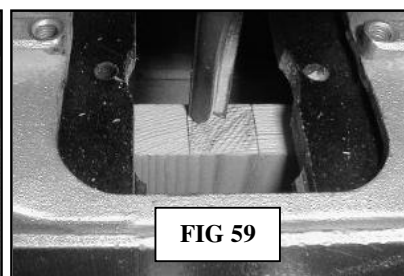
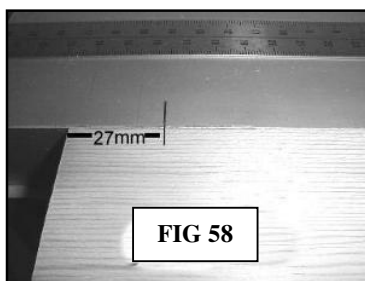
Place a 10mm bit into the router then place an uncut board into the cutting position.
SEE FIG 57.



Because the pencil mark on the left represents the centre of the cutter, the cutter will of course cut a 5mm shoulder. Depth the cutter and make the cut. Then flip the board round and cut the opposite shoulder, just as we did for the complete box. You now have 2 shoulders of 5mm.

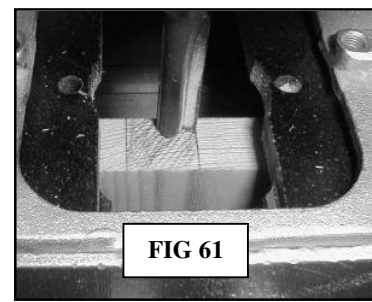
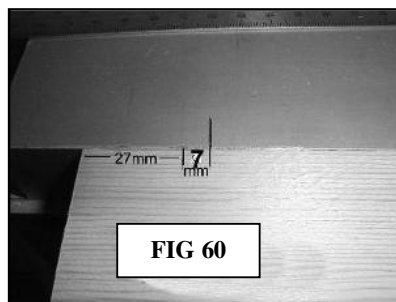
We now want to leave a pin of 17mm. On the top of the jig, draw a fine line **27mm** from the left hand edge. No, I have not made a mistake, although we want to leave a pin of 17mm, the cutter is 10mm, which we have to allow for. The shoulder was cut with the **right** hand side of the cutter, to leave a pin of 17mm we use the left hand side of the cutter.

Move the rack and jig to the first pencil line. SEE FIG's 58 and 59. Plunge the cutter and make the cut, flip the work round and make the second cut on the opposite side.



You now have 2 pins of 17mm, but the 2 sockets are of course only 10mm, which now have to be opened up to 17mm. From the first pencil mark on the jig measure off a distance of 7mm and draw a second line. Move the rack and jig to the second pencil line SEE FIG 60 and 61.

Plunge the cutter and make the cut, flip the work round and repeat the cut on the other side of the work piece.

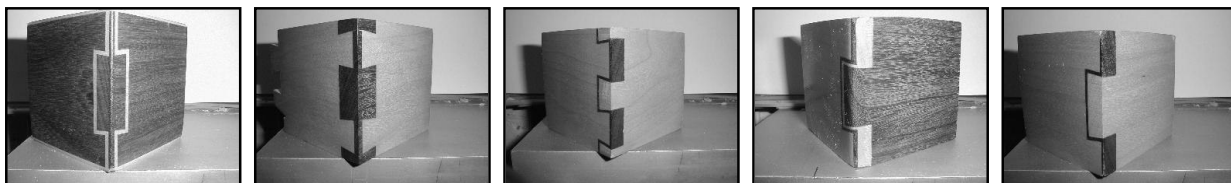


You now have 2 shoulders of 5mm, 3 pins of 17mm, and 2 sockets of 17mm. Practise this technique until you fully understand the concept. Apart from being a very accurate way of working, it's also a great way of repeating the joints for 2 or more boxes, simply move the rack to the pencil marks in-turn.

Once you are satisfied that you have placed the pencil mark representing the centre of the cutter accurately it's a good idea to make the mark a permanent feature by etching it in with a fine sharp point. I must emphasis that this mark is very important for many reasons. You will discover more and more uses for it as you become more experienced with your woodrat, so please take time to understand how to use it, it will pay dividends in the future.

THROUGH DOVETAILS

As a dovetailing jig, the woodrat has no equal. Unlike fixed or semi fixed jigs, it has the ability to make dovetails of almost any type pitch, or style you can think of. However unlike a fixed jig where the settings are built into the jig itself, the woodrat has to be set-up



by you, to suit the cutters to be used, and for the design and layout of the joint itself.

Herein lies the problem, no doubt you have found out for yourself that the manual is not too clear on the subject, and further if you do follow the directions they don't always work correctly, and on top of that the instructions only work for the woodrat cutters and not for any others. You may be happy just to use the woodrat cutters, but if you should have any of the them re-ground, then the set-up procedures in the manual don't work at all because diameter's and cutter geometry will change during the re-grinding procedure.

This chapter is devoted to through dovetails, and will take you through the procedures that will allow you to set-up and use any type of dovetail cutter you choose, you will also be able to cut dovetails to incredible accuracy such as those shown below.

Setting up for through dovetails is probably the hardest thing to understand on the woodrat, as the joint is cut with two cutters. The dovetails are of course cut with a dovetail bit, the pins however are cut with a straight bit. I urge you to simply follow the step by step guide and make a complete joint before you try to understand the theory. For this exercise the cutters used and shown are Woodrat's own No6 dovetail cutter, (15mm Diameter) this cutter is rather large for delicate joints but it allows more detail to be shown in the

photographs, the straight cutter is a two flute spiral Upcut of 8mm diameter. You may use any cutter you wish, as the set-up procedure is the same for any combination.

Cutting the dovetails is as simple as cutting the pins for a comb joint. For this exercise we will cut just one corner of a box, we will also use the same dimensions for the two boards that we used for all the previous exercises, i.e. 200mm X 95mm X 12mm. I suggest that you use a dovetail cutter with a base diameter of at least 10mm as this will make it easier for you to see and understand this exercise.

Place the dovetail cutter in the router and place a scrap piece of wood into the cutting position. Zero the cutter and set the depth for the thickness of wood to be used for the joint, just as we did for the comb joint.

Plunge the cutter and make a single cut, carefully remove the scrap piece and keeping the same face towards you (remember NOT to move the rack handle) place it into the marker position. It is absolutely vital that the top of the wood is flush with the top of the woodrat. SEE FIG 62

Notice I have cut a rebate in front of the scrap to allow the pencil to fit into the socket. If you need to cut a rebate because the wood is too thick to allow the pencil into the socket, you MUST cut the rebate first, before cutting the socket and placing the mark, otherwise the mark will be out of register with the cutter.

You should now have a nice dovetail pencil line on the face of the woodrat. SEE FIG 63.

Do not discard the scrap piece with the single dovetail socket, as we shall be using this to set-up for the pins.

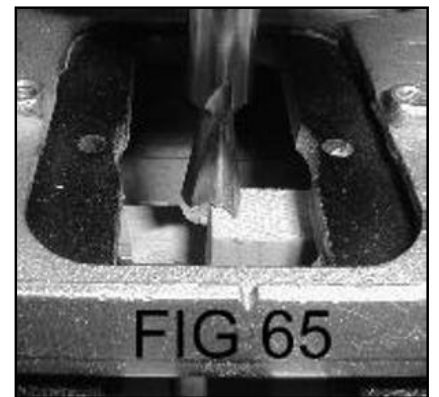
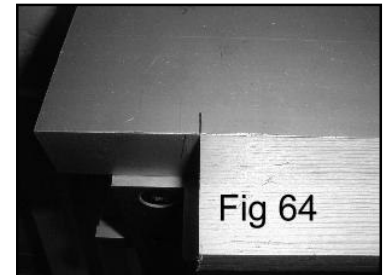
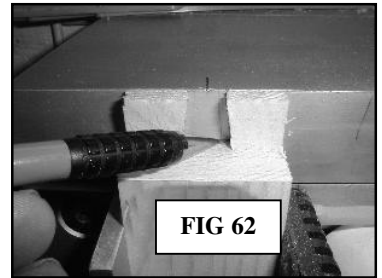


FIG 64

At this point we now need to cut all the dovetails. Place a blank piece of board into the cutting position, then place the measuring jig we made for the comb joints into the marker position, and align the left hand edge with the cutter centre line SEE FIG 64.

This will cut a shoulder of half the cutter diameter SEE FIG 65

In the photo the shoulder is 7.5mm as I am using a cutter of 15mm diameter.

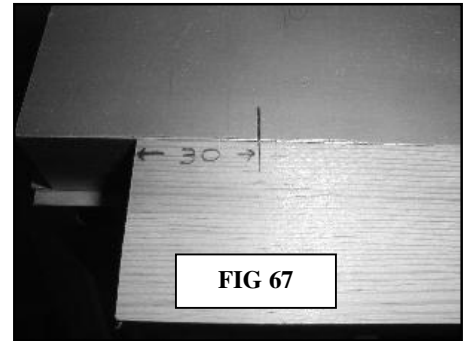


FIG 67

Cut the four shoulders by using the flip and turn method, as we did for the comb joint. You should then have four shoulders of half the cutter diameter. SEE FIG 66.

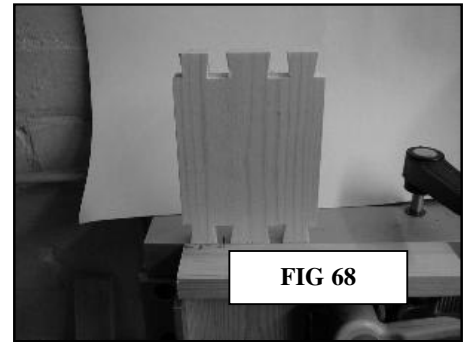


FIG 68

On the measuring jig, measure off a line twice the diameter of the cutter from the left hand edge as in FIG 67. I have shown 30mm in this photo as the cutter I am using is 15mm in diameter. If you are using a cutter of say 10mm, then set the distance as 20mm.

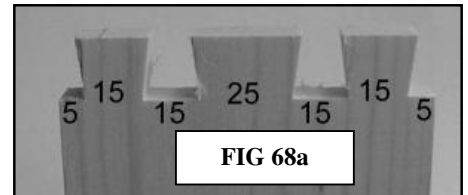


FIG 68a

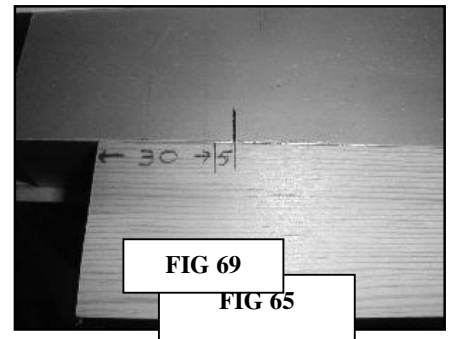


FIG 69

FIG 65

Replace the board with the cut shoulders back into the cutter position and make four more cuts at this setting, you will then have a board as in FIG 68. FIG 68a is a close up of the dimensions. Remember the board is 95mm wide. The two outside pins are 15mm with the centre pin at 25mm. To make this 15mm also 5mm needs to be taken off each cheek.

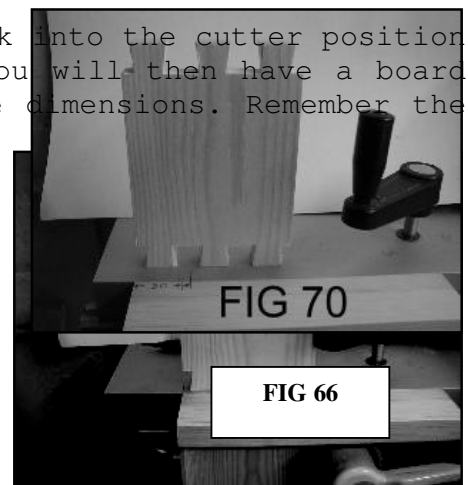


FIG 70

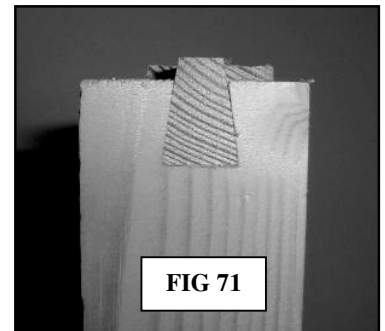
FIG 66

The marker jig has been marked up by 5mm

from the first 30mm mark. SEE FIG 69 and then moved to that position. Four more cuts are made at this position.

You should then have dovetails all evenly spaced. As in FIG 70. You will of course have to work out your own settings to suit the cutter diameter you are using. Just follow the techniques above and, again the penny will drop.

Time now to cut the pins, and for this we use a straight cutter, but before we are able to do so, we have to set the centre button and cams to suit the two cutters being used. It's important to realise that the values set on the button scale and cam scale are totally unique to the two cutters being used. Once the settings have been found, you use the same settings for any style of dovetail that you wish to cut with that combination of two cutters.



The settings do not change unless you change any one of the cutters, or have either of them re-ground. Over the years, this aspect of the woodrat has caused more confusion than any other technique. The set-up procedure we are going to follow now, is one that I have been teaching for many years, and from experience know that it is the most accurate and easiest to follow. It will also allow you to use any combination of cutters you choose, enabling you to be far more creative. However I urge you NOT to try and analyse the technique until you have followed the procedure to the letter. Simply follow the step by step guide, you will, I promise, discover that it is not as daunting as it appears.

Calculating the settings, involves cutting a single socket matching the dovetail cutter diameter, and cutting a single pin with the straight cutter to fit snugly. SEE FIG 71. Notice that the pin is protruding at the top of the dovetail, this is not important, as we are only interested in the geometry of the angles.

FIG 70

The first thing we have to do is to calculate the button setting. To do this we need to know the slope angle of the dovetail cutter. If you

have any of the woodrat dovetail cutters you will know that the angles are expressed in slope values. The half inch shank diameters are 1 in 6 slope and the quarter inch and 8mm shank cutters are 1 in 7.

The slope values are constant regardless of the base diameter of the cutters. The slope value makes the calculation that has to be performed a simple mental arithmetic calculation, rather than one involving sine, cosine and tangent calculations. If on the other hand you are using ordinary carbide cutters, you will know the angles are shown as degrees. To enable you to calculate the button setting with these cutters, the list below gives the equivalent slope values for any cutter from 6 degrees to 14 degrees.

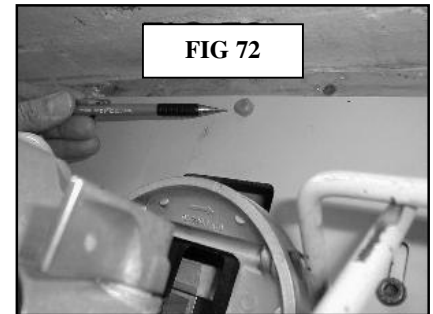
DOVETAIL DIAMETER	+	STRAIGHT BIT DIAMETER	X	SLOPE VALUE
2				

DEGREES SLOPE VALUE

6	9.51
7	8.14
8	7.12
9	6.31
10	5.67
11	5.14
12	4.70
13	4.33
14	4.01

Make a note of these slope values and keep them safe, as they will be very important for future reference

The formulae used to calculate the button setting is shown opposite. For this exercise I am using a dovetail cutter of 15mm diameter with a slope value of 1 in 6, and a straight bit of 8mm diameter.



So the calculation is:-

15mm PLUS 8mm EQUALS 23

23 DIVIDED BY 2 EQUALS 11.5

11.5 MULTIPLIED BY 6 EQUALS (69) THIS IS THE BUTTON SETTING

As another example, say you have a carbide cutter of 9 degrees with a diameter of 10mm, and a straight cutter of 8mm

10mm PLUS 8mm EQUALS 18

18 DIVIDED BY 2 EQUALS 9

9 MULTIPLIED BY 6.31 EQUALS (56.8) BUTTON SETTING

To set the button setting, place the centre plate into the housing, but do not tighten the Allen screw just yet. In this exercise I am using 69 as the button setting. But first we have to make sure that the router plate is hard against the orange back stop SEE FIG 72

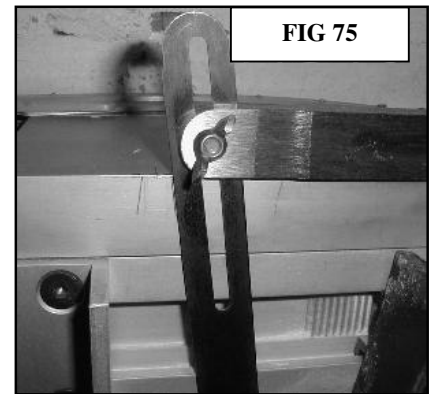
Set the button to the required setting (in this case 69) I am using the centre registration line, as this is how the base plate is bolted to the woodrat SEE FIG'S 73 and 74

The centre plate has three datum lines P1, P2, and P3.

I have set the P2 datum line at 69 on the scale, because the base plate is bolted to the woodrat in the P2 position.

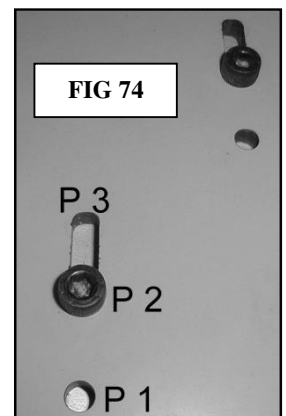
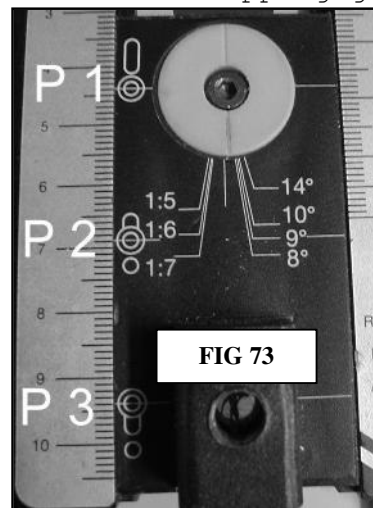
SEE FIG 74. If the base plate was bolted in the P1 position then the TOP datum line P1 would be used. The same follows for the P3 position. The reason for the 3 base plate and datum line positions is to accommodate a wide range of dovetail cutter diameters, from 1 eighth of an inch to over one inch.

For example if you were using a very small dovetail cutter and a small straight bit, you would probably have a button setting of less than 40. If you had the base plate bolted in the P2 position you would find that the button cannot be fixed to the router plate, because the "T" bar is beyond the housing. In this case you would simply bolt the base plate in the P1 position and then use the P1 datum.



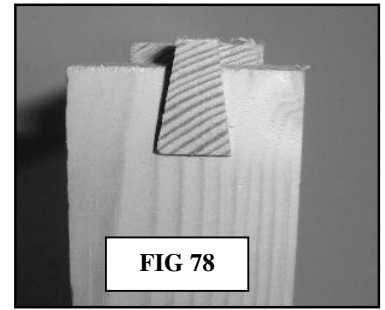
On the other hand if the button setting was a high value such as 95, then you cannot bring the P2 datum back far enough. So bolt the base plate in the P3 position and use the P3 datum. Try the numbers for yourself, you will see that it is quite self evident (remember to have the router plate against the back stop). The scale on the right hand side is only used for extremely large work such as whopping great 2" X 4" timbers, so unless you are building a barn you do not need to worry about it. But I will include the necessary instructions at the end of this exercise in a separate appendix.

So having calculated and set the button setting for your own cutters, lets cut the pin to fit the socket you cut previously SEE FIG 62. You will now require another piece of scrap of approximately 200mm X 10mm X 20mm,



Remove the two white guide rails, and place a straight cutter into the router. Place the scrap into the cutting position, Depth the cutter to suit the scrap, the depth is not very important as we are looking for a geometric fit rather than a flush fit. We now have to set the two

cams to match the angle of the dovetail cutter. Take a sliding bevel, and set the angle of the bevel to match as closely as you can to the pencil mark at the marker position. SEE FIG 75



Transfer the sliding bevel to the router plate, and set the router plate to match the angle of the bevel. SEE FIG 76

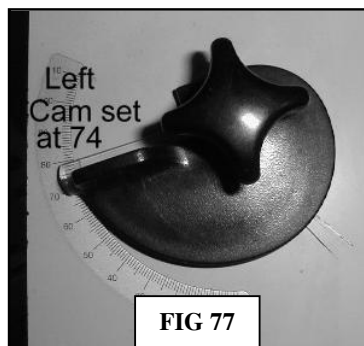
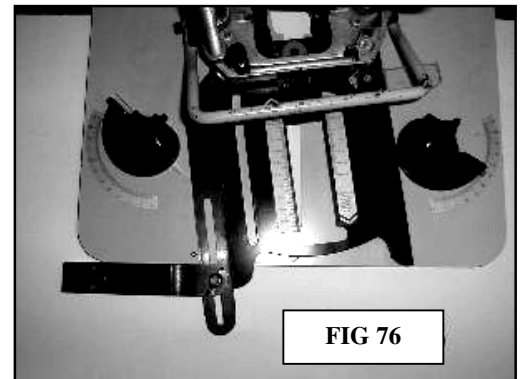
Bring the right hand cam into the router plate, and lock off. Note the reading of the cam, and then set the left hand cam to the same number. SEE FIG 77 and 77a.

Now make the cut on the scrap piece. Swing the router to the left so that the router plate is in contact with the cam. As you make the cut keep the router plate in contact with the cam at all times. Now swing the router to the right and make another cut. Trim the waste off the ends of the board (if any). Fit the pin to the socket SEE FIG 78.

As you can see, the pin is undersize. As the size of the dovetail base is known i.e. the same as the cutter (15mm). The pin can be measured to find the difference in size. In this case the pin was found to be 13mm wide across the widest part, the pin is therefore 2mm too small.

You are no doubt wondering why the pin is not fitting correctly, this is because the sliding bevel has been set against a very short datum line, so the chances of getting it exactly right are pretty slim, but it will get you very close. Therefore the cam has to be adjusted for the 2mm difference.

Remember we initially set the router plate against the sliding bevel, this produced a cam setting of **74** (on both cams) to adjust for the 2mm difference the two cams are re-set to **84**. This is because the cam scale is in millimetres, each division on the cam scale is worth 1/10 of a millimetre. Therefore to increase the pin size by 2mm the cam is increased by 10



division (1mm) on each cam, thus increasing the pin size by 2mm. Had the pin been 2mm oversize then the cams would have to be reduced to 64.

You will of course have to establish the cams and button setting to suit your own cutters, and you may have to cut two or three pins before you get the setting correct. But remember you only have to do this set-up procedure once for each set of cutters. If you paste the values on a card next to the woodrat, you then simply set the relevant numbers when you next cut through dovetails.

To summarise the set-up procedure.

- ☞ In any scrap piece of wood, cut a single socket with your chosen dovetail cutter. (Depth is not important)
- ☞ Mark the dovetail socket in the marker position.
- ☞ Calculate the button setting using the formula above.
- ☞ Set the button to the correct value on the correct datum line.
- ☞ Remove the white guide rails.
- ☞ Place your chosen straight cutter into the router and depth accordingly (remember depth is not critical)
- ☞ Place a sliding bevel against the dovetail mark and set the angle on the bevel.
- ☞ Transfer the angle on the bevel to the router plate and set the right hand cam against the router plate and lock off. Note the cam reading.
- ☞ Set the left hand cam to the same value as the right cam.
- ☞ Place a scrap piece of wood into the cutting position and cut a single pin.
- ☞ Offer the pin to the socket to check the fit.
- ☞ Adjust both cams for the difference in pin size (Remember that each division is worth 1/10 of a millimetre, increasing the value makes a bigger pin, decreasing the value makes a smaller pin.
- ☞ Re-cut another pin at the new cam setting and check the fit.

☞ Re-cut another pin if necessary. When you are happy with the fit, keep a note of the cam and button settings for future reference.



FIG 82

Now you have the button and cam settings, we can finish the pins. Place the board with the cut dovetails into the marker position as shown in FIG 79. Notice that the first pin is located against the left hand pencil line, and that the line is showing. Unlike the comb joint where we covered the line, **ALL THROUGH DOVETAILS ARE CUT WITH THE LINE SHOWING.**

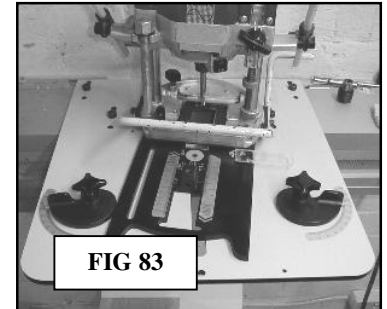


FIG 83

Plunge the router, then swing the router to the LEFT as in FIG 80, then make the cut. SEE FIG 81. You must keep a twist force on the router to keep the router base plate against the right hand cam. Notice we are aligned to the LEFT hand pencil mark, and the router is rotated to the left.

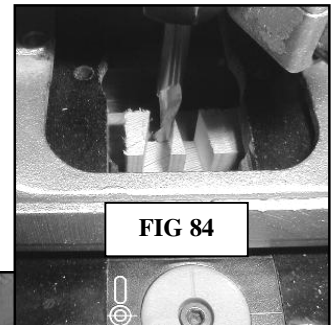


FIG 84

When the first cut is complete, move the rack to the right until the first dovetail is aligned to the LEFT hand pencil mark SEE FIG 82

Notice again that the pencil line is JUST showing,

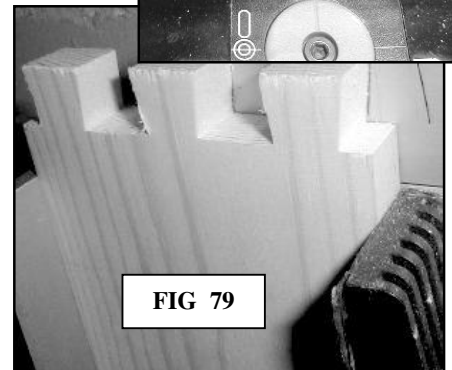


FIG 79

Swing the router base plate to the RIGHT SEE FIG 83, Again notice that we are aligned to the Right hand pencil mark, and the router is rotated to the RIGHT.

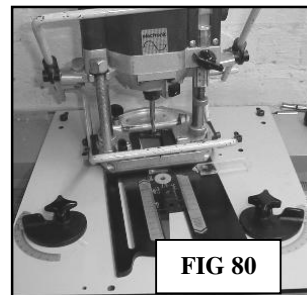


FIG 80

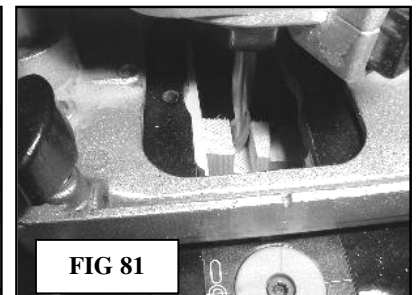
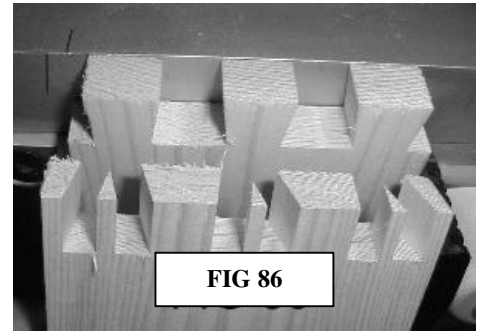


FIG 81

Now make the second cut SEE FIG 84

If you remove the board in the cutting position, and place it against the board in the marker position, you can see that you have cut the first socket for the first dovetail see Fig 85



Notice the waste in the centre of the socket. Leave this for the moment. Replace the board back into the cutting position. And repeat the process for the other two dovetails. I.e.

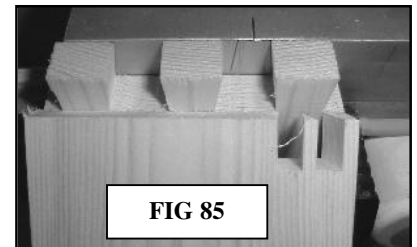
Move the rack to the LEFT pencil mark, rotate the router to the LEFT and make the cut.

Move the rack to the RIGHT pencil mark, rotate the router to the RIGHT and make the cut

Move the rack to the LEFT pencil mark, rotate the router to the LEFT and make the cut

Move the rack to the RIGHT pencil mark, rotate the router to the RIGHT and make the cut

You should now have a board looking as FIG 86. You now have to remove the waste material. Pop the board back into the cutting position, square up the router plate, position the waste in front of the cutter then rotate the cutter round the waste to remove it, repeat the operation for the other two waste pieces, and there you have it.



When removing waste remember the waste piece is ALWAYS THE WEDGE POINTING AWAY FROM YOU. I make this point because later on you may wish to make more fancy style dovetails, such as those shown on the first page of this chapter. You will then find that it is not quite so simple in identifying which is the waste and which isn't. Just remember, whatever the style of dovetail, the waste is always the wedge pointing away from you.

If the joint is a bit slack, then the pencil mark was exposed too much.

If the joint is a bit too tight then the pencil mark was covered too much.

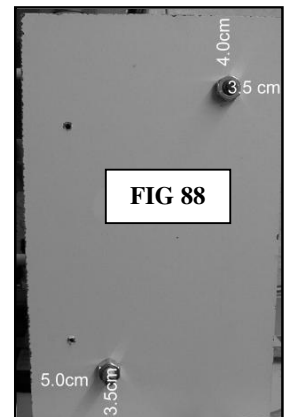
MITRE BOX

The mitre box is a very important jig for the Woodrat. It allows work to be offered to the cutter in a variety of ways, i.e. Batch production of dovetails or comb joints, bevels of various angles on the end of boards and clamping boards in a horizontal position. The problem with the mitre box is that, with use the box inevitably becomes cut about and chewed up pretty quickly, you will then have to buy a new one or make your own. Trying to copy the commercial mitre box can be a little tricky, so here is an alternative. SEE FIG 87



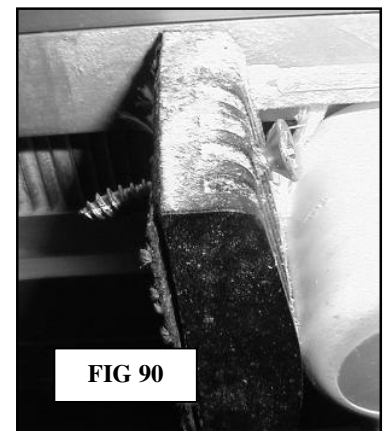
You will require two pieces of 20mm MDF or melamine faced chipboard, each cut to 15cm X 24cm. two 8mm or 10mm studding, each cut to 26cm. Five 8mm or 10mm nuts, and one 8mm or 10mm wing nut.

Drill each board for the studding to the dimensions shown in FIG 88 The dimensions are not at all critical, with the exception of the bottom hole, this needs to be at least 5cm from the left edge, so that the studding clears the fence.

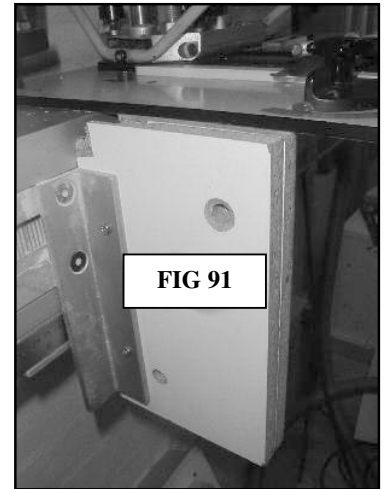


Before the box can be fixed to the woodrat, the fence and cam lock used for the cutting position has to be drilled. SEE FIG 89 and FIG 90

Drill these holes to accept self tapping chipboard screws. Note in fig 90 that the hole has been drilled at a slight angle. This is to allow easy access for the screw driver.



Place both boards in the cutting position and clamp up, make sure that both pieces are snug up against the bottom of the base plate. SEE FIG 91. Then screw the left hand board to the fence, and the right hand board to the cam lock. Open up the cam lock ready for the studding.



The box may be used in a variety of ways. Fig 92 shows the set-up for batch work. You will need to use the top studding for this operation as the right hand fence will splay out, because the cam lock is free to move in it's housing.

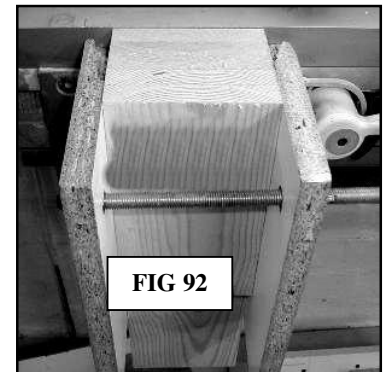
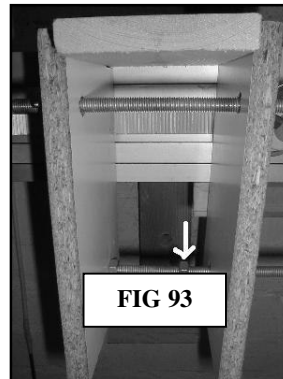
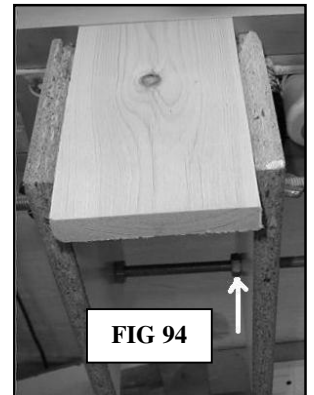


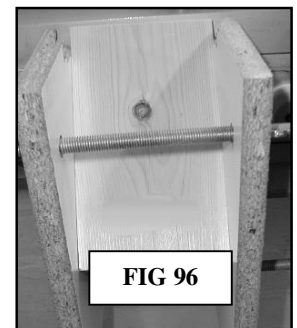
FIG 93 shows the set-up for holding work in the horizontal position. Note that the right hand fence has collapsed inwards at the bottom, again this is because the cam lock has free movement. To prevent the fence from collapsing, set the free floating nut on the bottom studding



to the width of the wood being cut SEE FIG 94



Finally, work pieces can be held at any angle you choose, SEE FIG 95. Lightly clamp the work piece in the cutting position, then set the angle, using the base plate as a 90 degree reference. Once the angle is set, clamp tightly and use the top studding to bring the fences in nice and tight. SEE FIG 96



Once the top edge of the box becomes chewed up and useless, simply clean the tops with a straight cutter, then raise the two boards and use them again.

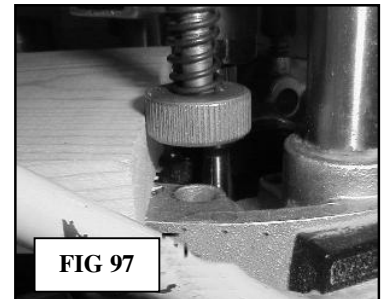
BLIND DOVETAILS

There are two ways of producing blind dovetails, The method shown in the technical manual, uses both the dovetail and straight cutter in much the same way as for a through dovetail, except that the cut with the straight cutter is "stopped" from making a through cut. This method requires the button and cam to be set as for a through dovetail, and also produces a joint that has to be finished by hand, because the corners of the sockets are rounded by the straight bit.

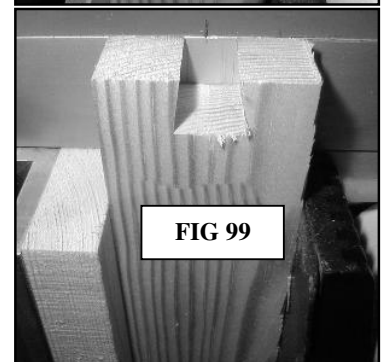
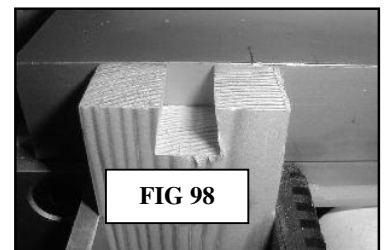
The alternative method does not require the button and cam to be set, as only the dovetail cutter is used for both pins and sockets. It has the added advantage, that the joint does not require the face to be finished by hand. It is this method that we will now look at in detail. Use any dovetail cutter of your choice, and work pieces prepared to the dimensions used for the previous exercises.

This method uses the mitre box, so fix the box in the cutting position first. As usual the first thing to do is to make a socket in any piece of scrap, and then mark up the socket in the marker position. As this is a blind dovetail the depth of cut has to be LESS than the thickness of the work piece.

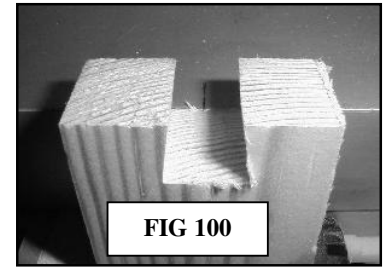
SEE FIG 97. Choose a setting to suit the thickness of the wood, 3 or 4mm less should be fine.



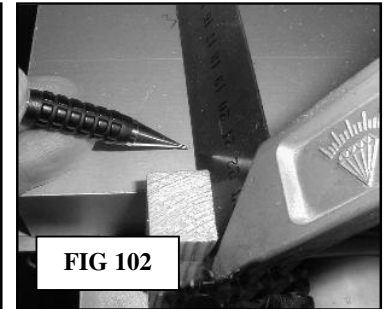
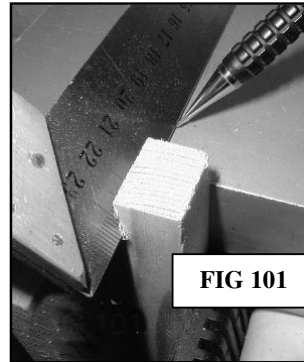
Cut the socket, and then transfer to the marker position, do not mark up just yet. You will notice that the socket is out of register with the cutter centre line. The difference is the thickness of the material used to make the mitre box. To bring the socket back into registration, use a packing piece of the same material used to make the mitre box. And place this against the marker position fence SEE FIG's 98/99



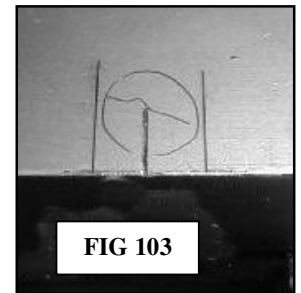
Marking up for this joint is a little different. Once you have the packing piece in position, raise the socket until flush with the top of the woodrat. SEE FIG 100



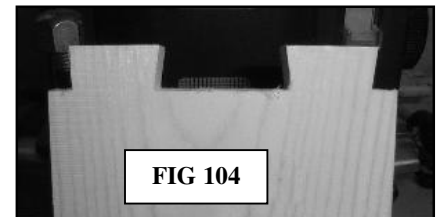
Take a small square, and snug the outside edge into the socket, SEE FIG 101. Then repeat for the opposite side of the socket, SEE FIG 102. If your square has a thick blade, you may find it useful to file a bevel on the outside of the blade, to give a more accurate registration with the corner of the socket.



You should now have a mark on top of the woodrat as in FIG 103. The two lines represent the base diameter of the dovetail cutter. You can, if you wish, draw a little circle between the lines just as a reminder for when it's time to cut the pins.

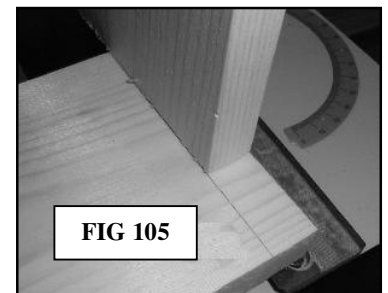


Now to cut the dovetails. Place a work piece into the cutting position in the usual way, i.e. vertically. Then cut two shoulders half the diameter of the cutter. Then cut a large socket in the centre of the work piece to leave two pins as in FIG 104.



Try to leave the pins about one and a half times the diameter of the cutter. I.e. 10mm cutter = 15mm pins. The reason for cutting these dimensions, is that you will find it easier to follow, and see the cutting procedure for the second part of the joint.

Take the uncut board and place a line to match the thickness of the board with the dovetails. SEE FIG 105.



Place this board into the mitre box in the horizontal position, with the pencil mark uppermost. Then place the button into it's channel, about half way along, and then tighten the allen screw. Unlike through dovetails, we are NOT setting a value on the scale. Now place an allen key into the button, then screw a star knob into the top of the button, but do not tighten just yet. SEE FIG 106.

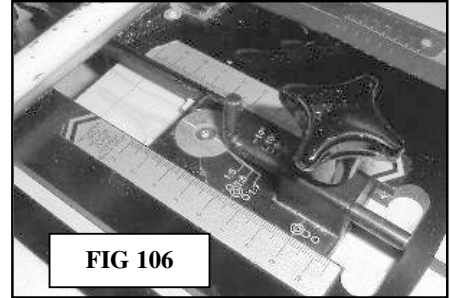


FIG 106

Raise the cutter, and position it to the pencil line as in FIG 107. Note that the cutting edge is orientated North and South. Bring the allen key forward against the router base, then lock the allen key with the star knob. This acts as a stop when we pull the cutter into the wood.

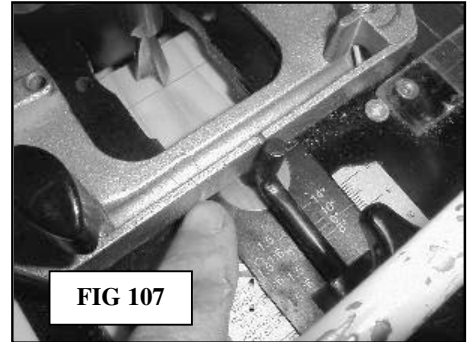


FIG 107

Now for the first cut. Place the board with the dovetails into marker position. The top of the board MUST BE a little proud of the top surface of the woodrat, about 1/2 mm will do fine. Position the left hand pin in front of the pencil mark at the marker position SEE FIG 108.

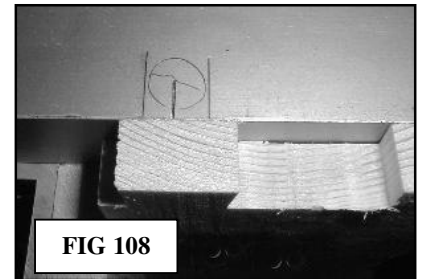


FIG 108

Plunge the cutter, lock off, and pull the cutter into the wood until the router base is against the allen key stop. SEE FIG 109. This cut has taken out the bulk.

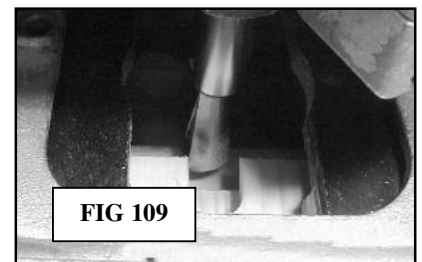


FIG 109

Now to cut for a fit. Place the square against the left hand edge of the pin and position the rack so that the edge of the square just covers the line, SEE FIG 110.

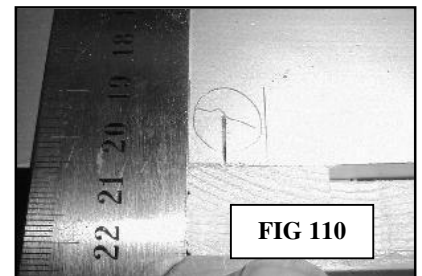
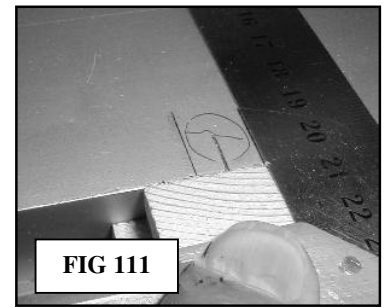
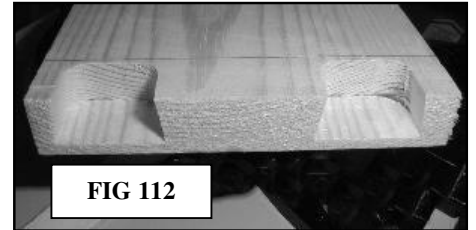


FIG 110

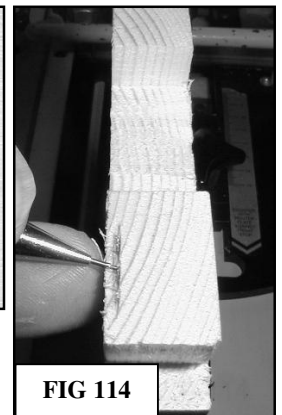
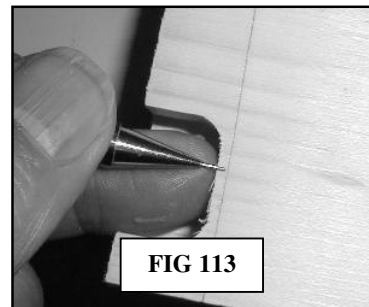
Now make a second cut. Place the square against the right hand side of the pin, reposition the rack to cover the line SEE FIG 111. Make the third cut. You will notice that there are two small ridges in the cut socket, simply pull the cutter into the socket and carefully traverse the rack right and left to remove them.



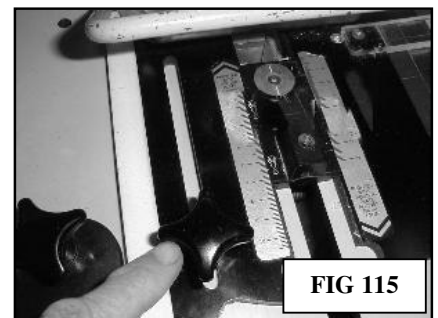
Position the right hand pin in front of the pencil mark, and repeat the three cuts for the second pin. You should now have a piece looking something like FIG 112.



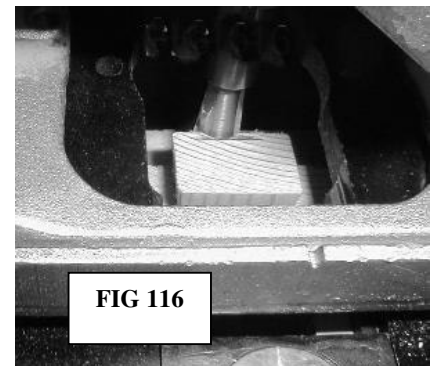
Although both pins and sockets have now been cut, we still have one more cut to do. You will have noticed that the top of the socket has not cut to the pencil line; this is because we set the cutter to the pencil line using the base of the cutter; as the cutter is angled, there will of course be a difference. Therefore a rebate has to be cut on the pins. Take the difference between the cut and the line, and transfer that to one of the pins. SEE FIG 113 and 114



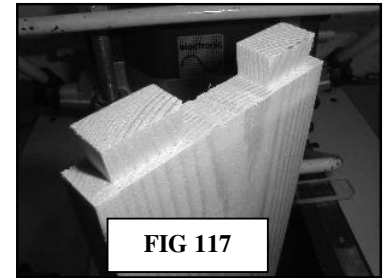
Remove the allen key from the button, then place the star knob into the router base slot on the left SEE FIG 115, do not tighten the star knob just yet.



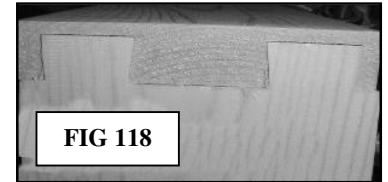
Place the board with the pins into the cutting position, make sure that the pencil line is towards the face of the woodrat. Switch on, then bring the cutter up to the pencil line SEE FIG 116.



Tighten the star knob to lock the router plate. Move the rack left and right, to make a cut the full width of the board. You should now have a board as in FIG 117.



Round off the corners of the pins with a chisel to accommodate the round shoulders of the sockets, and fit the two together SEE FIG 118.



If the fit is tight, it is easier to trim the dovetails rather than the sockets, if the joint is a bit slack (well, better luck next time). You may have realised that, marking the top of the woodrat, and then using the ruler, is exactly the same as for cutting comb joints. So the same rules apply. I.e. just cover the line.

This joint is primarily for draw fronts. However, the first two joints on page 1 of the previous chapter, are made using a combination of through dovetails and blind dovetails. This joint is worth persevering with, especially if you are into fancy boxes etc. For example, some of the joints shown on page one of the through dovetail chapter, are a combination of through and blind dovetails

HORIZONTAL TABLE

The woodrat makes an ideal router table, able to reproduce most functions normally associated with a standard router table. In many cases it is much easier and safer to use the woodrat, such as stopped fluting, miniature moldings, stopped housings, rebating, trenching, etc.

However to get maximum flexibility, and a wider range of techniques, something other than the "scrubbing brush", as suggested in the technical manual is required. SEE FIG 119 and 120. As you can see the construction is very simple. To use the table, simply clamp between the two cam locks.

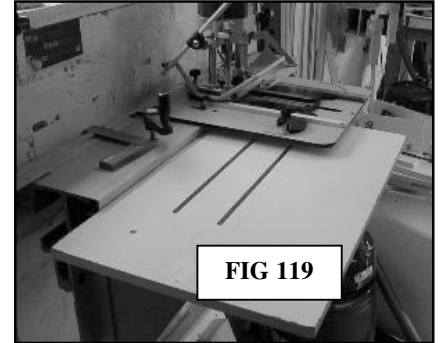


FIG 119

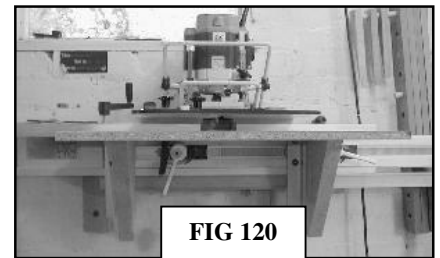


FIG 120

You can of course make this table to your own dimensions, but I have found the following to be just about right.

For the table top, use 18mm melamine faced chipboard cut to 61cmX 36cm.

The table supports are made from pine and cut to the following. SEE FIG 121 The pine should be at least 35mm thick, as this will give good stability and support to the top.

To fix the top, first place both supports into the cam locks, place the table on top of the supports, then simply screw the table to them, counter sinking the holes of course. It's not worth gluing as well, because the work top will inevitably become cut and chewed up with use. It's then a simple matter to replace it.

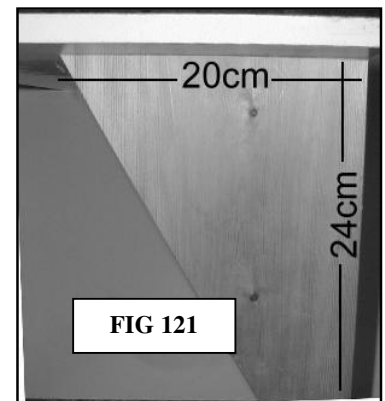


FIG 121

Once you have the table in position on the woodrat, you need to cut two slots each 10mm wide as in FIG 122 The dimensions are taken from the face of the woodrat.

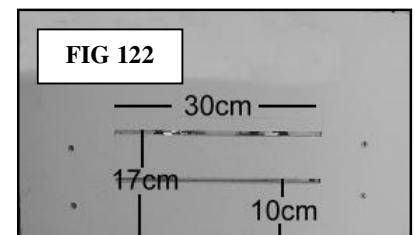
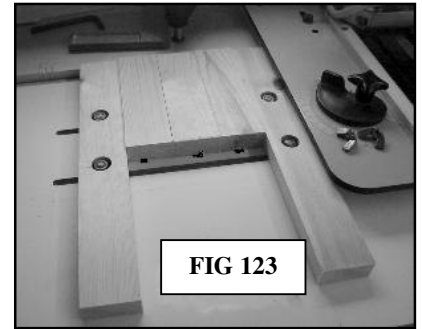


FIG 122

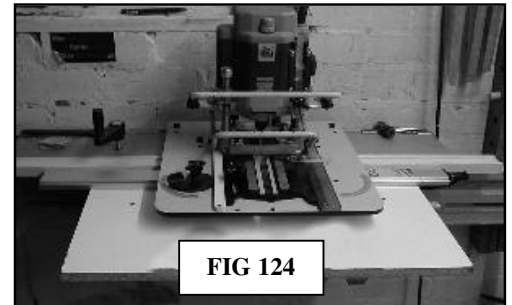
Now make two fences as in FIG 123. The thickness of the fence needs to be as thin as possible, but thick enough to allow the heads of each 8mm studding to be countersunk. The fences are fixed into position by butterfly screws underneath the table.



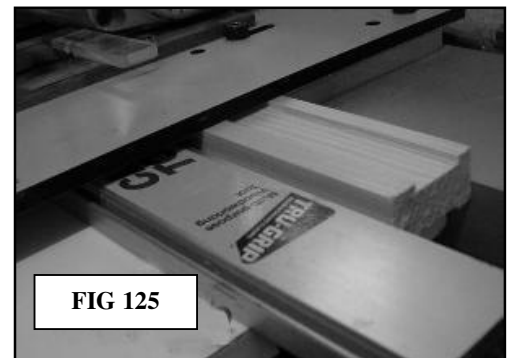
This is a great method for working on narrow end grain, either singly or in batches. Simply square up the left fence to the face of the woodrat, then bring the right fence into the work and lock off. To prevent work from moving North or South during the cutting, use a dab of hot glue on the ends of each piece. SEE FIG 123. As with all end grain cuts, don't make the cuts too aggressive, make 2 or 3 passes for safety.

For mouldings, rebating, and trenching type cuts, use the table as shown in FIG 124. The work to be cut, is against the face of the woodrat.

In the photo I am using a metal straight edge to act as a parallel fence in front of the work piece, so the work is supported on three sides; in fact, a straight wooden batten, "G" clamped at both ends, will do just as well, although the workpiece is supported on three sides,



I like to go one further and raise the table, so that the work is snug up against underside of the base plate. SEE FIG 125. When machining long mouldings, or rebates etc, the table remains stationary. You simply feed the work from LEFT to RIGHT then use a push stick for the final few cm.



By using the table in this way, your hands and fingers are well clear of the cutter and the workpiece is properly supported.

If you've ever tried cutting stopped housings on a router table, you will know how difficult and indeed dangerous, this can be. Stops have to be fixed to the fence, then the workpiece has to be lowered blind on top of the cutter. With the woodrat table it's an absolute doddle. Lets look at a simple dovetail housing for a bookshelf.

Place a dovetail cutter of your choice into the router. On the sides of the bookshelf, mark up where you want the shelves to be. Place the shelf support on the table as shown in FIG 126.

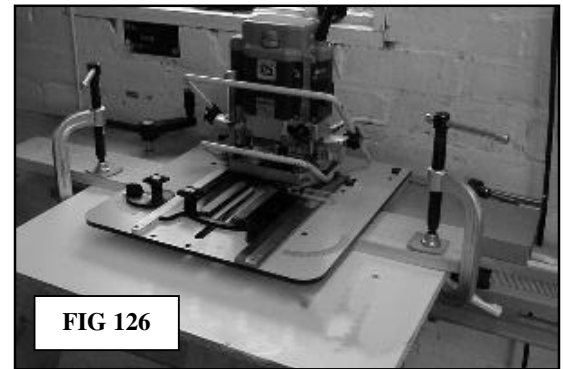


FIG 126

Raise the table so that the workpiece is snug beneath the base plate. Then position the first mark between the router plate channel.

Place the centre finder into position, and move the rack until the pencil line is aligned with the centre finder. SEE FIG 127.

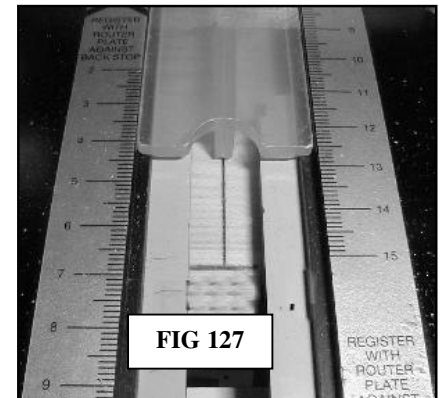


FIG 127

Remove the centre finder and zero the cutter to the workpiece, then set the depth to suit the thickness of the board and diameter of your cutter. Push the cutter to the back of the board, plunge the router and pull toward you to the stop mark. Don't be timid with this cut, else you will have severe burning and frayed edges. Repeat for all the other housings.

Cutting the end of the shelves to suit the housing is simplicity itself. Remove the router table, place a shelf into the cutting position in the usual way SEE FIG 128. Because the shelf supports were snug beneath the base plate when cutting the housings, and now so are the shelf ends, the cutter must be at the correct depth. However, reduce the depth by 1/2mm or so, this will give a little room for glue and expansion at the base of the cut.

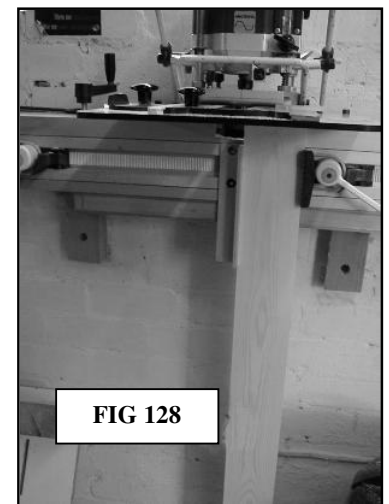


FIG 128

To finish the joint, you can if you wish, work out the difference between the base of the housing, and the width of the shelf, divide by 2 then layoff a line each side of the shelf end, then bring the cutter into the line.

Personally, I find it just as quick to pull the cutter into the wood lock of the router plate with the star knob, then make a shallow cut across the full width of the board. Then flip the board round and make a second cut. SEE FIG 129. Offer the end up to the housing, to see the difference, replace the shelf, adjust the router for half the difference, and make two more cuts.

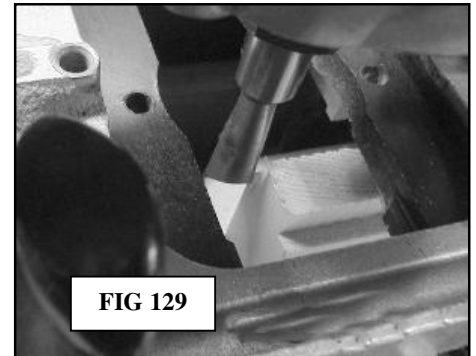


FIG 129

Once you have a fit you're happy with, keep the router plate locked off, then make two cuts for each of the remaining shelves. Now all you have to do is to cut the shoulders SEE FIG 130, and there you have it.

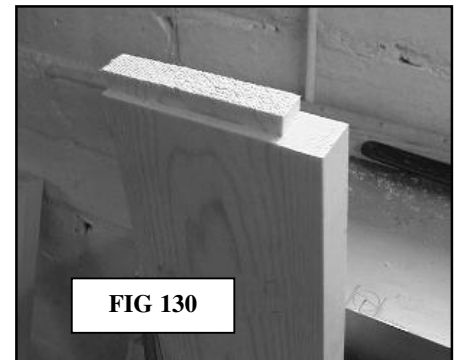


FIG 130

A nice variation on this theme is angled shelves for videos, cassettes, etc SEE FIG 131. Simply fix a block or wedge between the workpiece and woodrat face. This will set the support at any angle you choose.

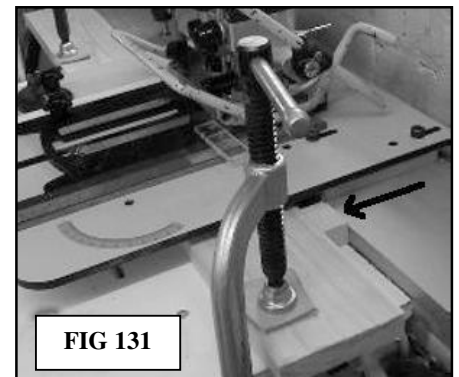


FIG 131

For working on small or awkward shaped pieces, try hot glue, if you haven't used hot glue as a clamping method before, try it, you will, I promise, be amazed.

In FIG 132 I have placed a small fillet of glue as indicated on both ends of the board.

You can also use the technique on the work bench for all sorts of clamping purposes

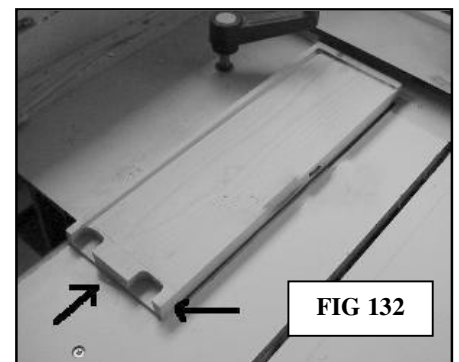


FIG 132

VERTICAL TABLE

The vertical table, perhaps not quite as versatile as the horizontal table, but nevertheless an essential jig if you're looking to work on large or awkward shaped boards, or even making raised panels. SEE FIG 133

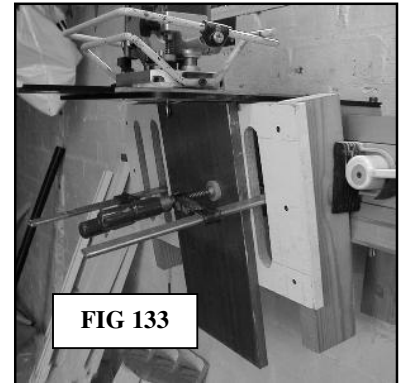


FIG 133

But perhaps the most important use of this jig is as a mortise rail. SEE FIG 134

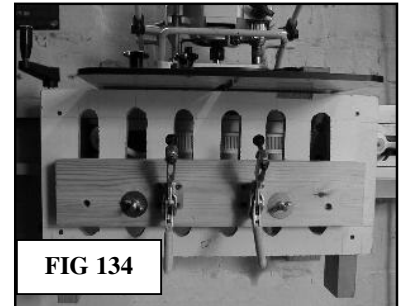


FIG 134

To make the basic table, you will require 2 vertical supports from material of your choice. Each support cut to 33cm X 7cm X 3cm. The only critical measurement is the width of 7cm, this allows sufficient clearance between the table and the left hand cam clamp.

For the table use 18mm chipboard or MDF. Cut to:- 52cm X 25cm. The slots in the table are to allow entry of "G" clamps, as in FIG 133. each slot dimension is 19cm X 3cm and are 7cm apart from centre to centre. The slots are also used to allow attachment of the mortise rail. SEE FIG 134

The mortise rail consists of 2 boards; the rail, with 2 toggle clamps, and the backing support with 8mm studding. SEE FIG 135



FIG 135

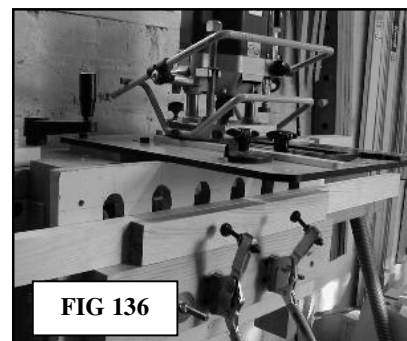
Cut the rail to:- 44cm X 9cm X 4cm

Cut the backing to:- 41cm X 6cm X 2cm. Do not exceed the length of 41cm, because the support has to fit between the 2 uprights. Cut 2 pieces of 8mm studding to 12cm.

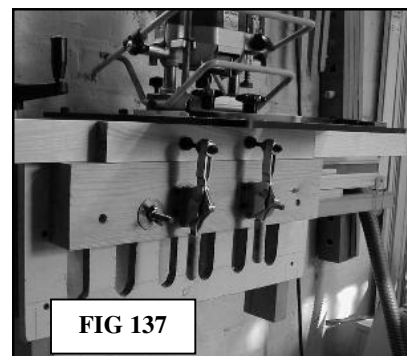
Drill the backing support to accept the studding, I won't give dimensions because your slots may be a little different than mine. Just make sure they are central to the slots in the board. The studding is fixed permanently to the backing support, I have simply used nuts and washers both sides.

Now drill the rail to accept the studding, drill these at 10mm, for ease of dismantling, when you want to use the jig as a table. The two toggle clamps are positioned to your liking, but 12cm apart works quite well. When fixing the toggle clamps make sure they are very firm, you may if you wish bolt them through the rail, I've used 40mm wood screws, each screwed in at a slight angle. Assembly is self evident, all you now require are 2 butterfly thumb screws and a couple of washers to suit.

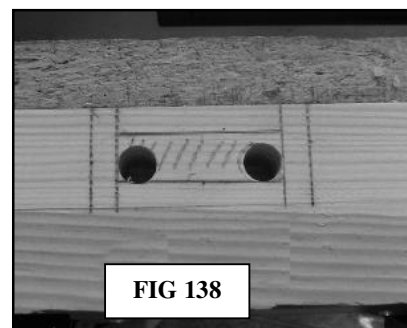
Cutting the mortise is straightforward. See FIG 136, the piece to be mortised is the inner rail with a packing piece on the outside.



Don't clamp with the toggle just yet, but raise the mortise rail up so that the workpiece is snug under the base plate, then tighten up the thumb screws, as in FIG 137



Having marked out for the mortise, place a straight cutter of your choice into the router, then depth for the mortise. Position the rack so that the cutter is aligned with both shoulders at one end of the mortise. lock off the router plate, then switch on and plunge to the full depth. Repeat for the other end. SEE FIG 138.



Now make a series of cuts as in FIG 139. Then traverse the rack to clean up SEE FIG 140. Making a series of vertical cuts to remove the bulk first, then cleaning up afterwards is kinder on the cutter with less chance of chatter or the cut becoming blocked.

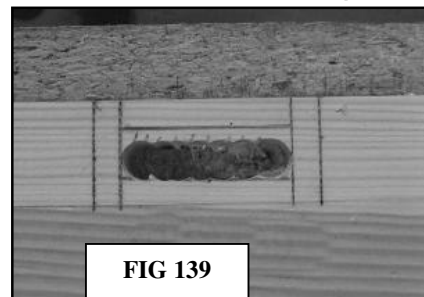


FIG 139

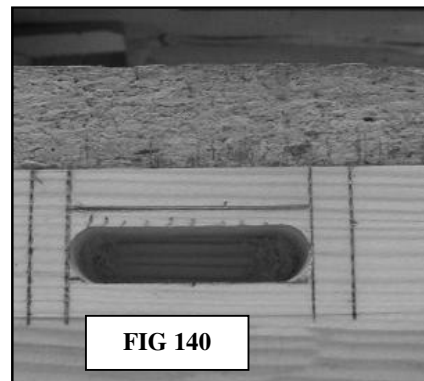


FIG 140

To finish the mortise, leave the router plate locked off, undo the toggle clamps, turn the rail around, then repeat as above. You should have a mortise as in FIG 141. The shoulders are of course rounded, so you will have to square with a chisel. There are some things even the Rat can't do "yet".

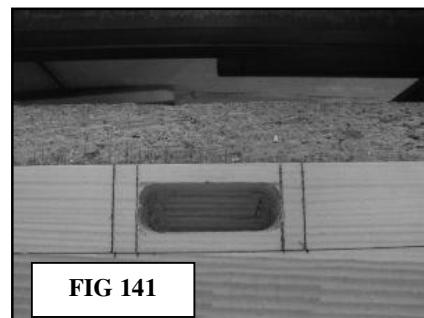


FIG 141

Now for the tenon. As the rail was snugged up under the router plate, the cutter is correctly depthed for the tenon. However you must reduce the depth of cut by about a 1/2 mm to allow for glue. Remove the vertical table, then place the piece you wish to tenon into the cutter position. You can if you wish, mark out the width of the mortise and then cut to the line. I find it just as quick to pull the cutter into the tenon, by a bit less than the shoulder, (this is the beauty of the woodrat, you can see what you are doing) lock off and then make the cut, flip the rail round then cut the other side at the same setting. SEE FIG 142 Remove the piece, offer it up to the mortise, note the difference, pop the tenon back into the cutting position and cut for the difference. When you have the fit you're happy with, cut the other two shoulders in exactly the same way.

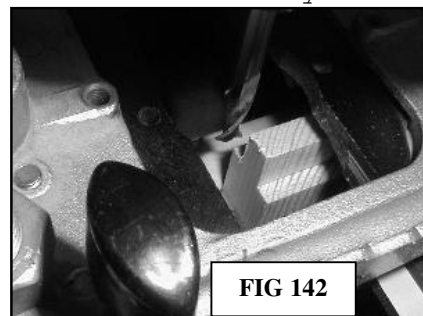
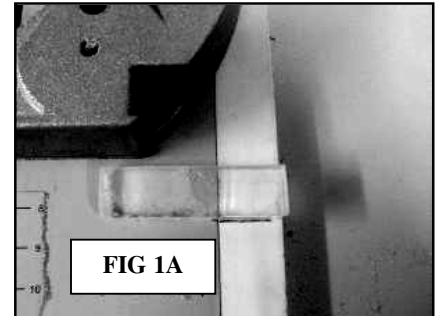


FIG 142

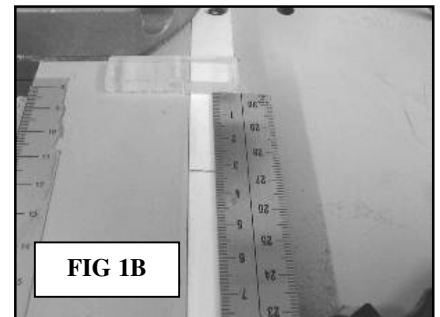
APPENDIX

You will often find the need to make a very accurate measurement and cutter placement, laterally. For example stopped housings, rebating, fine adjustments for fitting joints such as tenons etc. There are two ways of doing this. Lets look at the easy way first.

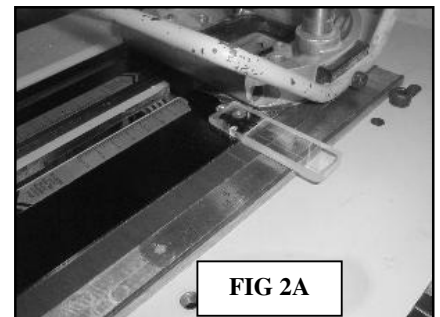
All you require for this is a small piece of Perspex, the dimensions are not critical, just make sure it covers the full width of the router plate guide, however it must be square to the router base plate. Super glue this to the router plate, as close to the base of the router as possible. SEE FIG A1



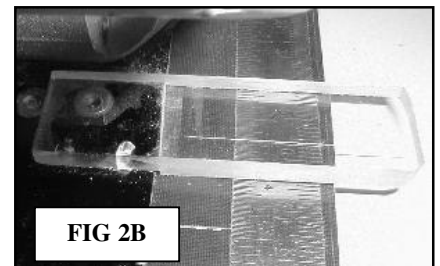
To use, simply lay off a line with a rule, SEE FIG 1B then bring the router forward until the edge of the Perspex is on the line, lock off with the star knob and make the cut.



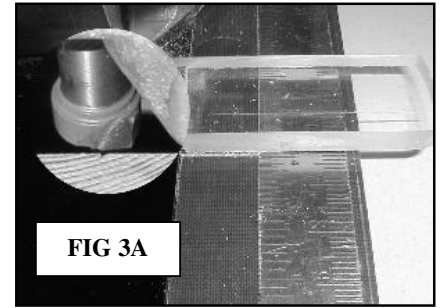
The second method, which is the one I prefer, requires a new right hand base plate guide SEE FIG 2A Construction is straightforward and can be made on the horizontal table. Use Tufnol for the guide, (which must be the same thickness as the router base plate), as this is hard wearing. The housing for the rule needs to be just deep enough for your rule, and not too tight, as the rule must be able to slide in it's housing.



You can see in FIG 2B that the plastic cursor has a fine line etched on the bottom surface, it is this line that you make your measurements from. As it is almost touching the rule, you can place the cursor without any parallax error.

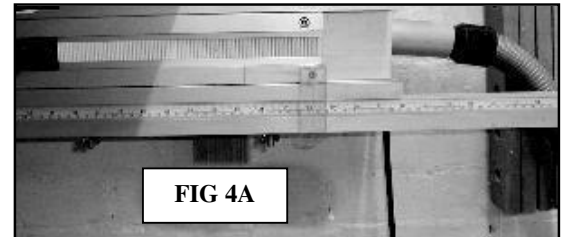


Also there is an etched line on the guide itself. With the cursor against the etched line, the centre of any cutter is exactly on the face edge of the woodrat. SEE FIG 3A From the inset you can see that all you have to do to etch this line is to place any cutter with a sharp point into the router, then align it with the back edge of any work piece in the cutting position. (inset) Lock off the router base plate, and etch the line. You now have a datum to work from. This is exactly the same technique we used in the section on measurement and symmetry, refer back to FIG 50 onwards.



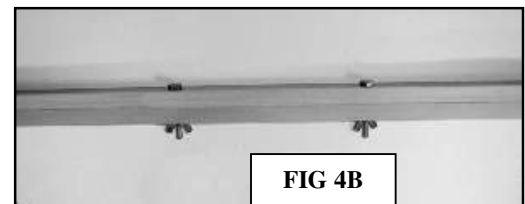
When using the horizontal and vertical table or large wide board, you cannot use the measuring jig in the marker position, as we did for the comb and dovetail joints. We need a jig that will allow any measurement across the full width of the woodrat.

On the bottom of the woodrat, you will see a "T" slot, this slot takes the head of a 8mm bolt or studding. This allows us to attach a batten with a rule to the underside of the frame. SEE FIG 4A If we then also attach a plastic cursor to the front of the frame, we have a very nice method of measuring across the whole width.



For the batten use MDF, or any timber that is stable. Then cut to:- 96cm X 4cm X 3cm. You will then need to cut a housing for whatever type of scale you want to use. I suggest you use a dovetail bit depthed for 1mm more than the thickness of the rule or scale. This will prevent the scale from falling out of the housing, as the fit must be a loose one to allow the rule or scale to move.

Drill two holes of 12mm diameter for the 8mm studding, the distance apart is not critical, 10cm either side of centre will do nicely, SEE FIG 4B. The holes are oversize to allow the batten to be pulled forward onto the cursor, so there is no parallax error.



The cursor is placed on the far right hand side of the moveable rack SEE FIG 5A To fix the cursor, drill and tap for a 4mm bolt. If you don't have a tap, then drill a hole slightly oversize of a 4mm nut, put three nuts onto the bolt, fill the hole with chemical metal (Isopon) then push the bolt with the three nuts, into the hole, let it set hard remove the bolt, clean up, and you have your threaded hole.

Make the cursor to fit the depth of the batten, scribe a fine line on the back. Screw the cursor to the woodrat, place the batten with rule into the "T" slot.

The rest is self evident, you will, I'm sure find this invaluable for many jobs.