Dave Blair

STANLEY®

OPERATION OF

THE MODERN ROUTER

50¢

CONTENTS

This comprehensive booklet illustrates and describes many uses of the Portable (hand fed) Electric Router — and is written for amateur woodworkers. There are numerous photographs and drawings which will, we hope, suggest a number of practical set-ups for work right in your shop. The high speed and smooth cutting of these routers will help add a professional finishing touch on all your woodworking projects so you'll have more pleasure and more satisfaction from all your shop work.

WHAT IS A ROUTER?

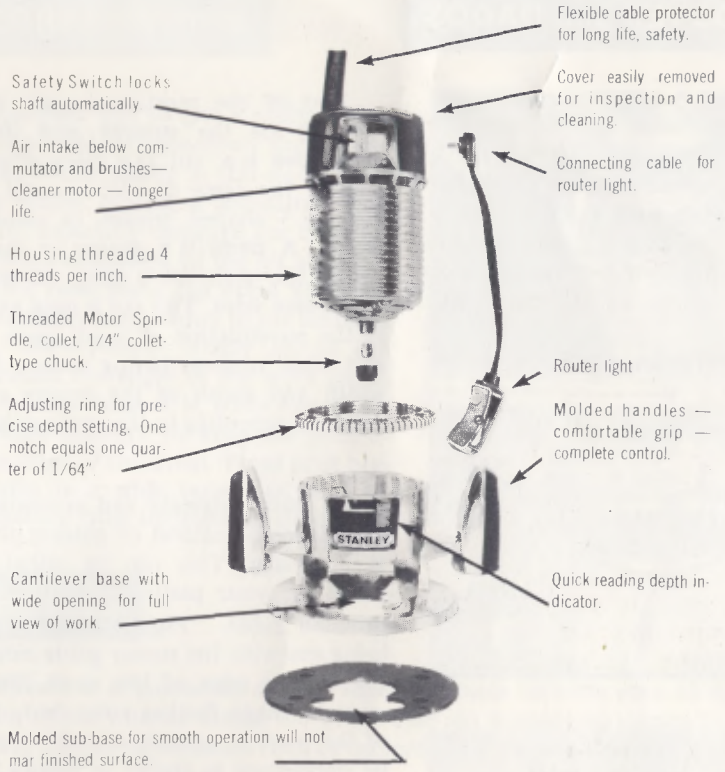


Figure 1 - Exploded view of Router

Mechanically speaking the router is one of the simplest of all power tools. It consists of two pieces; a motor with a chuck mounted on one end of the armature shaft, and a base which holds the motor upright. A bit or cutter is mounted in the chuck and protrudes down below the surface of the base to do the cutting. The depth of the cut can be adjusted by sliding the motor up or down inside the base and locking it at the desired depth setting. The maximum depth of cut is determined by the length of the bit being used. A wide variety of bits and cutters are available which produce different shapes and types of cuts. Other accessories can be attached to the base for various guiding purposes or the router can be moved about freehand.

The router makes a cut so smooth that in many cases sanding is unnecessary. This smoothness of cut is produced by the high speed at which the router motor turns. Since there are no gears in a router the bit is turning at the same speed. Routers run at speeds averaging from 18,000 to 35,000 R.P.M. compared to a normal speed of 2,500 R.P.M. for a 1/4" drill or 5,000 R.P.M. for a circular saw.

But the router is probably the most versatile of all power tools in terms of the different kinds of jobs it can do. It is both a cutting and a shaping tool which can be used with great precision.

GROOVES and DADOS

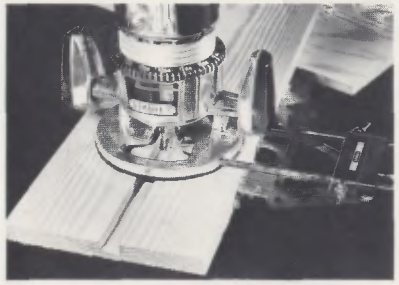


Figure 2

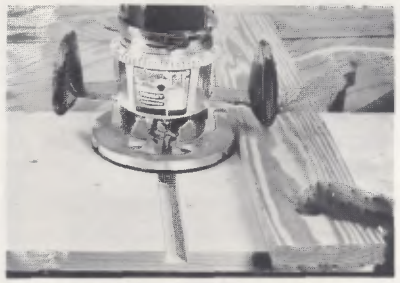


Figure 3

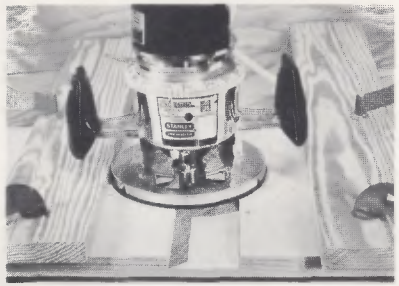


Figure 4

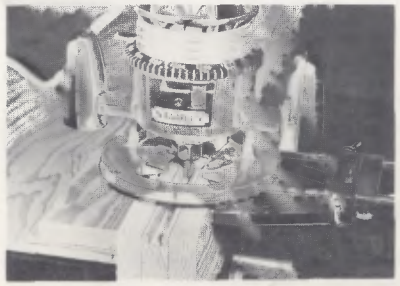


Figure 5

Two of the most basic cuts in woodworking are the **groove** and the **dado**. A **groove** is a cut in a piece of wood running in the same direction as the grain. It may be V shaped, square, or various other shapes. A **dado** is a groove or channel cut across the grain of a piece of wood and has square sides. This cut is used extensively in the construction of book cases, cabinets and other projects having shelves. Both the width and depth of the groove and dado will vary according to the application.

To obtain straight and accurate grooves and dados a method of guiding the router is necessary. This can be either a guide made for your particular router or an improvised guide. **Figure 2** shows a groove being cut with the router guide riding along the outside edge of the work. Where cuts must be made further away from the edge of the work or at various angles a guide can be improvised as shown in **Figure 3**. The guide can be a straight piece of wood or straight edge thick enough to let the outside edge of the router base ride along it.

For many sizes of smaller dados and grooves a router bit the exact diameter of cut needed is available. This allows the cut to be made in only one pass. However, for larger dados and grooves this is not practical. **Figure 4** shows a large dado being cut with two clamped boards acting as guides which limit the outside travel of the router base. The router can be moved about freely within these guides and will produce the exact cut needed. **Figure 5** shows a groove being cut in the narrow edge of a piece of wood. The work is clamped between two scrap pieces of wood which provide a wider support for the router base to ride on.

WHAT YOU CAN DO WITH A ROUTER

DECORATIVE TRIM

The quickest way to give a really professional look to almost any woodworking project is to add an attractively shaped decorative trim to the outside edges of the piece. The router excels in this work, doing it both quickly and easily. **Figure 6** shows a router cutting a decorative trim, using a bit especially designed for this purpose. The lower portion of the bit acts as a pilot which rides along the wood while the upper portion cuts the wood to the shape of the bit. The operator simply moves the router around the edges of the work piece, no matter what shape it is, while exerting a small inward pressure to keep the pilot against the edge of the wood. These pilot bits are available in a wide variety of sizes and shapes. In some cases several shapes can be obtained from the same bit simply by changing the depth setting of the router.

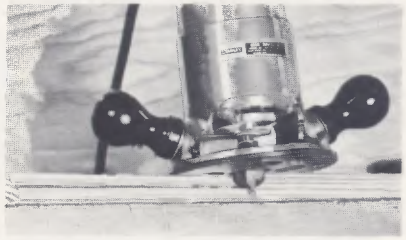


Figure 6

RABBETING

The **rabbet** is a groove or square edged cut made into the edge of the work. It may run either with or across the grain. This cut is used extensively in jointing and in many special applications such as cabinet doors, window screens and drawer fronts.

The quickest and easiest way of making this cut is by using a special rabbeting bit shown in **Figure 7**. The bottom portion of this bit acts as a pilot and rides around the edge of the wood while the rabbet is formed by the cutting portion of the bit. A rabbet can also be cut with a straight bit used in conjunction with a router guide as shown in **Figure 8**. In this application a block of wood can be attached to the face of the straight guide which in effect lengthens the face of the guide helping to produce a smooth cut, especially in corners. Cutting a rabbet into an inside corner can be accomplished by attaching a triangular shaped block of wood to the face of the router guide as shown in **Figure 9**.

When rabbeting across the grain, the ends of the rabbet should be cut first in order to minimize the chance of splintering the wood.

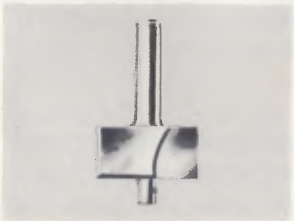


Figure 7

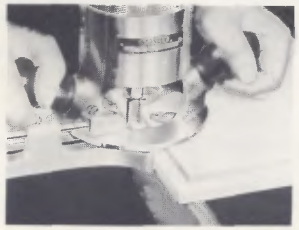


Figure 8

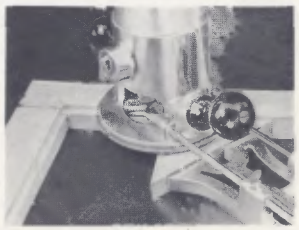


Figure 9

CIRCULAR CUTS

Circular cuts can be made very neatly and accurately with the router. **Figure 10** shows a circle cut by a router with a trammel point attached to one of the guide rods of the router guide. The upper "knob-like" portion of the trammel is held down on the work while the lower portion, which is a needle-like point, anchors into the wood and acts as a center-point similar to the action of a compass. The router is then moved in a circle around this center point producing a perfect circle. **Figure 11** shows a different type trammel point in use. In some cases this trammel point is included with the router guide.

Another method of making circular cuts near the outside edge of a round piece of work is shown in **Figure 12** using the router guide with the straight edge plate removed.

Circles and other irregular shapes can also be cut by using templets and templet guides as explained later on in this manual.

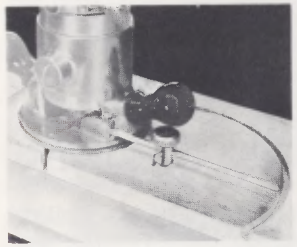


Figure 10

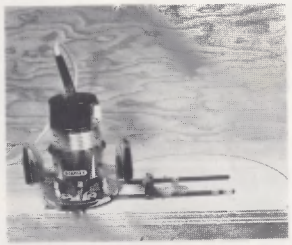


Figure 11

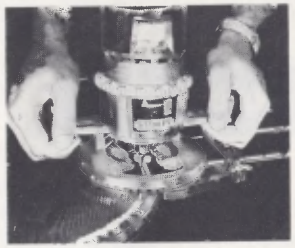


Figure 12

TEMPLET ROUTING

Templet routing, or the use of a templet, templet guide, and router bit in combination is a routing method often employed by professional craftsmen where irregular or intricate shapes or designs are to be accurately duplicated in wood, plastic, aluminum or other materials. With this method the exact same cut can be produced many times. Common examples are dovetail joints (pages 14 and 15) and hinge butt routing (page 9) for installing doors.

The templet itself is a pattern or "stencil" cut to the shape which is to be duplicated. Hardboard or ¼" plywood are good materials for making templets as they are easy to cut, have enough strength, and are relatively inexpensive.

The templet guide which is mounted in the bottom of the router base is a round metal disc with a tubular lip which protrudes down below the router base. This lip rides against the edge of the templet, following its contour, while a router bit protrudes down through the hole in the center of the templet guide and makes the required cut. **Figure 13** illustrates this procedure.

TEMPLET ROUTING

Templet guides are available in a variety of sizes; some typical ones are shown in **Figure 14**. **Figure 15** shows the important dimensions you should consider when selecting the correct templet guide for your job.

The "A" dimension of the templet guide must be less than the thickness of the templet you are using. Otherwise the router will not sit down flat on the templet. The "C" dimension should be slightly larger than the diameter of the router bit to give the bit clearance. The work being cut will vary in size from your templet by the distance between the cutting edge of the bit and the outside diameter of the templet guide. You should make allowances for this difference when designing your templet.

To make the cut, clamp the finished templet to the work to be routed out. With the sub-base and templet guide attached to the router, place the straight bit into the work until the router base is flat on the templet. Then guide the router along the edge of the templet always keeping the templet guide in contact with the templet edge until the pattern is completely cut. This procedure can be repeated as often as necessary.

Another method of templet routing is to use a combination panel bit shown in **Figure 16** in combination with a templet which is mounted on the opposite side of the work. The point of the bit drills through the work and the pilot portion of the bit follows the shape of the templet while the cutter portion of the bit makes the cutout. No templet guide is required when using this bit.

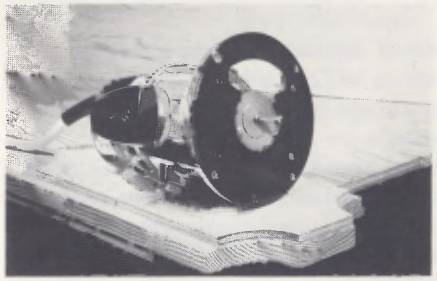


Figure 13

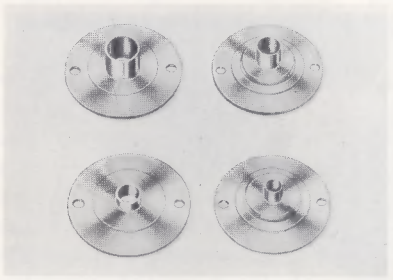


Figure 14

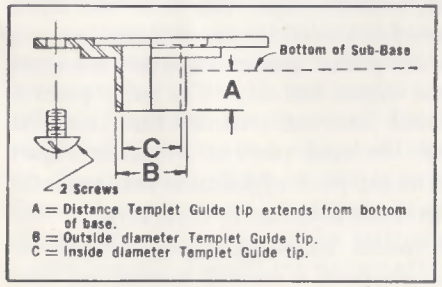


Figure 15

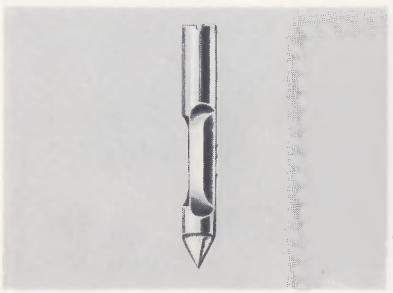


Figure 16

FREEHAND ROUTING

In the hands of an experienced operator the router can be an extremely efficient shaping and carving tool, turning out beautiful engraving and decorative cuts in the briefest time. With practice it becomes a relatively easy matter to write your name or any other inscription into wood and other materials. Shallow cuts are easier because there is less resistance to your movements. As the depth of cut is increased, more downward pressure on the router and a slower feed are required.

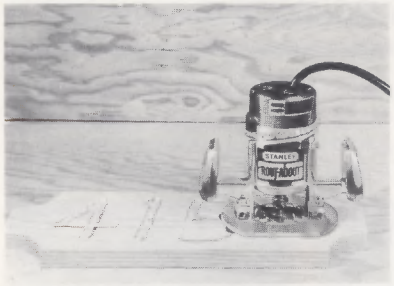


Figure 17

Signs such as the ones seen in many parks are made with the router; usually the long straight portions of the letters are made with the help of a guide but the curved portions are free-handed.

Bits most commonly used in sign making and other decorative line work are "V" grooving, veining, and core box bits.

LAMINATE TRIMMING

Figure 18

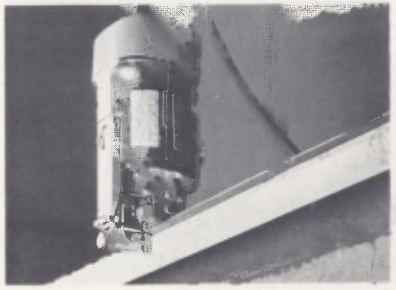


Figure 19

One of the major uses of the router is in the cutting and trimming of plastic laminates. These are the hard smooth plastics used on table tops, counter tops and other areas. Some of the better known brand names are Formica, Micarta, Wilson Art, Consoweld, and Textolite. The router cuts and trims these materials with speed and accuracy.

The most common method of making tables, counter tops, etc. is to use either plywood or particle board as a base material with the plastic laminate contact cemented to the edges and top. The edge piece is mounted first and trimmed flush with the top of the work piece as shown in **Figure 18**. The top piece of plastic is then mounted and trimmed as shown in **Figure 19**.

A special bit is often used on this cut which produces a smooth beveled cut thus eliminating the sharp corners around the

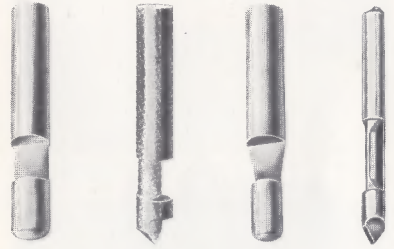
LAMINATE TRIMMING

top edge of the piece. These bits are available in bevels of $7\frac{1}{2}^{o}$, 10^{o}, and 22^{o}.

Although laminate trimming can be done with almost any router and the proper accessories, certain types of routers are favored more than others in cabinet and fixture shops where laminates are constantly being trimmed as a part of the manufacturing process. The router shown in **Figure 19** is especially designed as a high speed "laminate trimmer" with special features such as a tilting base and comfortable contour for one-hand operation.

Tungsten carbide is one of the hardest man-made materials and because of the hardness and abrasive properties of plastic laminates it is imperative to use either carbide tipped or solid carbide bits.

Various techniques are used in trimming plastic laminates; the most commonly used methods center around 3 different types of bits. One type is a bit on which the guide or pilot is formed by the lower portion of the bit with the cutting edge just above this. This type of bit will fit almost any router and no separate guide is needed. Four different bits of this type are shown in **Figure 20**. Bit **A** is a flush trimming bit used to produce clean sharp square corners on such cuts as the edge piece prior to installing the top piece of plastic. Bit **B** gives the same flush cut but will also drill through a piece of laminate already bonded to the counter top where a sink or similar cutout exists. Bit **C** produces a fine finish trim cut at a $7\frac{1}{2}^{o}$ bevel which is used on the top piece of laminate. These bits are all especially designed for laminate trimming and are made of solid carbide. They have a short shank for greater resistance to high torque loads and are small in diameter which makes them more effective in confined areas. Bit **D** is used similarly to bit **B** but this combination panel bit is carbide tipped and has greater length which gives it usage in other areas. A lubricant such as wax or petroleum jelly should be used with all the above bits to prevent marring when the pilot is riding on an already installed piece of laminate.



A B C D

Figure 20

Another type of bit in general usage is one on which a ball bearing is fastened to the lower portion of the bit and acts as a pilot, following around the shape of the work piece, while the cutting edges just above it do the trimming. A bit of this type is the flush trimmer shown in **Figure 21** which is a carbide tipped bit used for making sharp square corners. This bit can deliver very long bit life because of the length of the cutting

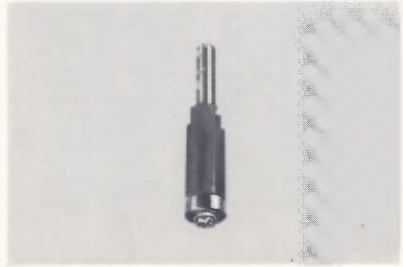


Figure 21

LAMINATE TRIMMING

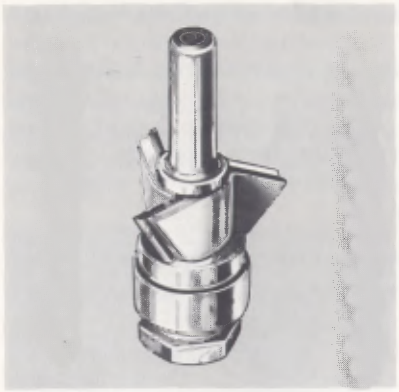


Figure 22

Figure 23

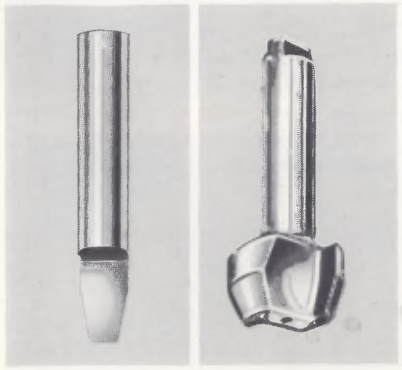


Figure 24

edges which in some cases are 1" long. The router depth setting is raised or lowered to make use of different portions of the cutting edge. The laminate trimming assembly shown in **Figure 22** consists of a separate cutter and ball bearing mounted on an arbor. The bearing acts as the pilot and this unit can be used for either flush or bevel trimming simply by changing the cutter. Flush trim cutters are available for this unit as well as 3 different bevel cutters which produce 10^{O}, 22^{O}, or 45^{O} bevels.

A third commonly used method of trimming plastic laminates is by replacing the normal router sub-base with a laminate trim kit such as the one pictured in **Figure 23**. With this assembly a ball bearing or pilot is mounted on a guide arm which is separate from the bit. The bearing acts as a pilot, riding against the edge of the work piece, while the bit comes down through the router base and does the cutting just above the bearing. The arm can be moved in or out to adjust the fineness of the cut.

Two different bits are available for use with this type of trimmer; bit **A** in **Figure 24** is solid carbide and bit **B** is carbide tipped. These bits can be used to make either bevel or flush cuts depending on the depth at which they are set. The lower portion of the bit will produce a bevel cut when the router is set at a shallow depth while the upper portion of the bit will produce a flush cut when the depth setting is lowered. Some in and out adjustments of the lower guide arm will be necessary when changing from one type trimming to the other.

The router straight guide can be used in combination with a carbide tipped bit for trimming plastic laminates, however great care should be exercised in setting the guide properly.

HINGE BUTT ROUTING

Hinges in most doors are mounted flush with the surface of the door and jamb allowing the door to fit snugly when closed. For cutting the mortises in which the hinges are set, the router is unbeatable. Professionals who mount a large number of doors use a door and jamb butt templet, which is designed especially for this work. These templets are completely adjustable for two or three hinge mortises on any normal size door. When using this templet it is necessary to use a templet guide specially designed for this use. A special hinge mortising bit is also available which gives excellent chip clearance and leaves a very smooth cut.

Figure 25 illustrates the door and jamb butt templet in position on the door. The templet guides the router so that hinge mortises are cut to uniform size and depth quickly, accurately and easily. Using the same settings, a perfect fit is insured by transferring the templet from the door to the door frame for cutting out the hinge mortise on the door jamb. **Figure 26** shows the router in position to cut a mortise. The hinge mortising bit is protruding down through the templet guide to do the cutting while the router is guided around by the templet guide riding against the edge of the door and jamb butt templet.

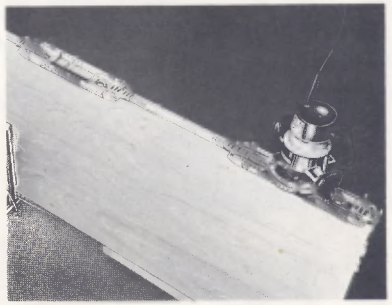


Figure 25

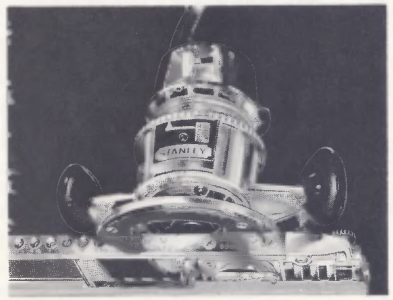


Figure 26

Because bits leave a curve at the corners of the cut it will be necessary to cut the corners square with a chisel for square cornered hinges. For round cornered hinges the cut is left as it was finished by the router bit.

If a door and jamb butt templet is not practical for you a templet can be improvised as in **Figure 27** from plywood or hardboard and tacked to the edge of the door or jamb. Here you must make all the measurements yourself to suit your particular hinge butt, templet guide and router bit.

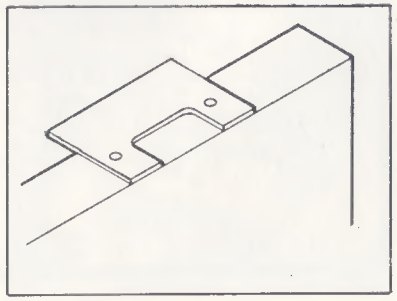


Figure 27

JOINTING

The router's versatility and ease of operation become apparent when it comes to making first class professional looking wood joints. This is where the router really goes to work for you, cutting your building time to a fraction. **Figure 28** illustrates a variety of commonly used wood joints which are merely combinations of grooves, dados, rabbets and mortises. Four of the most popular joints used by professionals are explained.

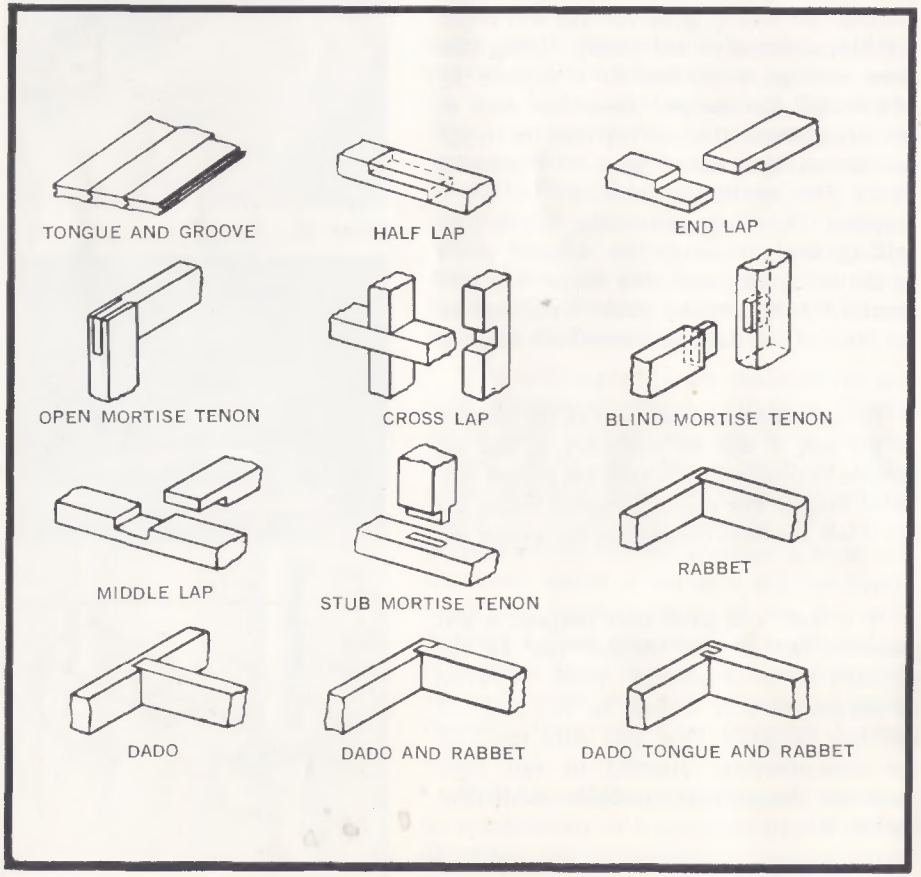
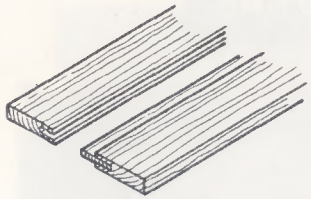


Figure 28

JOINTING



SPLINE JOINT

The **spline joint** is used for joining two pieces of wood together. It has the advantages of holding the pieces in place while being glued and clamped. It adds strength to the finished job.

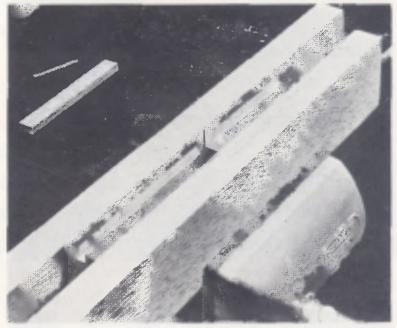
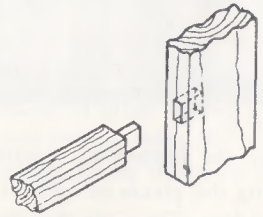


Figure 29

First select the proper bit. Since most splines are made of 1/4" plywood (because of its ability to withstand stress) use a 1/4" straight bit. Then decide how wide your spline will be. This is dependent on the width and thickness of the wood to be splined, but for 3/4" stock, a 1/4" depth cut should be enough. Thus you would need a 1/2" wide spline. Place the pieces to be joined in a vise with the edges to be joined facing up and the finished surfaces of these pieces facing one way. Make sure these edges are smooth and straight. **Figure 29**. Set your bit for the depth of cut desired and proceed to make the cut. The surfaces will line up perfectly giving you a smooth jib and a strong joint.

MORTISE and TENON

The mortise and tenon joint is the most popular type used in the construction of furniture, doors, window frames, storm sash, screens, screen doors and similar items.



It is very important that the **mortise** be located in the center of the piece of wood that is to be mortised, so that when assembled the outside edges will be flush with the adjoining piece. This will eliminate considerable sanding and finishing. When doing this with the router we suggest that you use a bit 1/16" or 1/8" smaller than the width the mortise is to be. Measure the distance from the edge of the mortise to the edge of the wood, set the gauge to this distance, from the nearest edge of the bit.

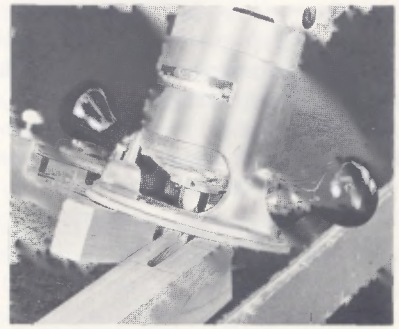


Figure 30

JOINTING

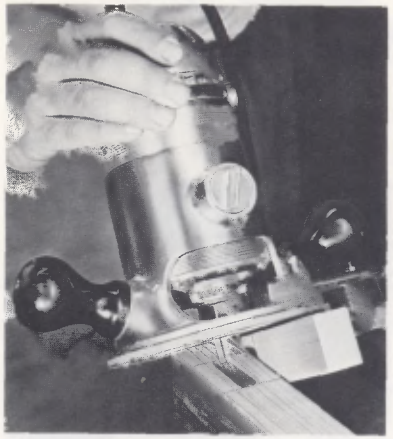


Figure 31

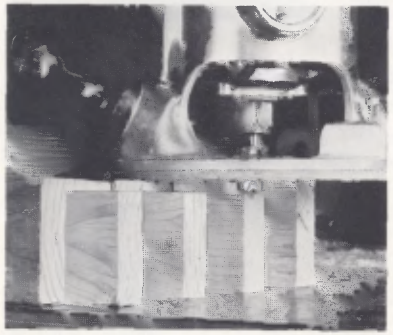


Figure 32

MORTISE and TENON

After making the cut from one side of the wood, **Figure 30** you will find the mortise 1/16" to 1/8" narrower than it should be. Turn the router around so the gauge rests on the other side of the wood and make another cut. This will remove the rest of the wood. **Figure 31**. Cutting from each side with a set distance of the straight and circular guide in relation to the bit insures that the mortise is centered in the wood. The length of the mortise can be controlled by making a mark on the work surface, or a simple fixture can be made to stop the base where desired. If you have several mortises to cut to the same dimensions, we suggest that you make a small fixture that will fit over the piece to be mortised with the proper guide to eliminate measuring.

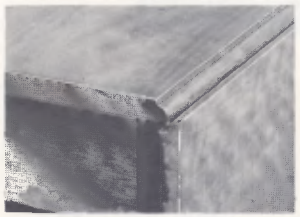
The distance between the mortise and the side of the wood is the correct depth setting for your router when cutting a matching tenon.

All the **tenons** for a number of pieces may be cut together. This can be done by placing the pieces of wood together as a unit (making sure the ends are square with the sides). Then set the straight edge improvised on the work at the correct position to provide the length of tenon desired. Pass the router, holding it against the straight edge, across all of the pieces. The bit will probably not be large enough in diameter to remove all the stock, but after making the shoulder cut, the material left between the shoulder and the end of the stock can be removed by using the router free hand. Turn the pieces over and repeat the operation on the other side, **Figure 32**, and make your third cut. Turn them over and make the fourth cut which will be the last step.

By cutting all the tenons at the same time they will be of uniform size. You will note that the corners in your mortises are round while the tenons have square corners. To make the two fit tightly simply clean out the corners of the mortises with a sharp hand chisel or you can accomplish the same result by rounding the edges of the tenons to fit the mortise.

JOINTING

DROP LEAF TABLE JOINT



This joint is used to hinge table leaves to table top. A cove bit makes the cut in the leaf. A rounding over bit having the same radius properly extended, makes the cut in the table top.

Hinges should be the drop leaf table type (Stanley Hardware Catalog Number 810). A core box bit is used to mortise the underside of the table top for the hinge barrels. Do not attempt to mortise the hinge itself into the work. For 3/4" stock use a rounding over bit and a core box bit whose cutting radius is 1/2".

In order to prevent costly errors, first make all cuts in scrap stock and mount hinges to these scrap pieces to make certain adjustments are correct. Proceed as follows:

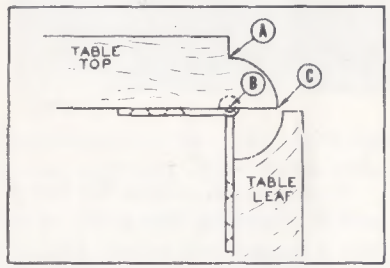


Figure 33

Step No. 1 - Insert the rounding over bit in the router chuck and adjust the motor in the base to the exact outline of the cut to be made in the table top. Dimension A-B should be the same as B-C **(see Figure 33)**. Point B is center of hinge barrel. Draw a line underneath the table top to extend this point to locate all hinges.

Step No. 2 - Place a smooth edged board underneath the edge of the table top, as the pilot of the bit overhangs the work. Make the cut in the table top.

Step No. 3 - Turn the top upside down and mark location of hinge barrels along center line. Rout with the core box bit the grooves for hinge barrels, using the router guide against the edge of the table top. Leave the table top upside down on your work bench.

Figure 34

Step No. 4 - Insert the cove bit in the router chuck. Place router on back surface of table, permitting bit to overhang end of table and adjust motor in base so that bit exactly matches contour of cut you made in table top. Lower motor additional 1/32" to allow clearance between leaf and top. Rout the cut along edge of table leaf.

Step No. 5 - Assemble hinges to leaf and top.