GETTING THE MOST OUT OF YOUR BAND SAW and SCROLL SAW

★ EIGHTH EDITION

Published by DELTA

GETTING THE MOST
OUT OF YOUR

BAND SAW AND SCROLL SAW

(EIGHTH EDITION)

A DELTA-CRAFT PUBLICATION

Edited by
SAM BROWN

A Complete Handbook Describing Band Saw and Scroll Saw Operation in the Home Workshop with Over Two Hundred Photographic Illustrations and Line Drawings

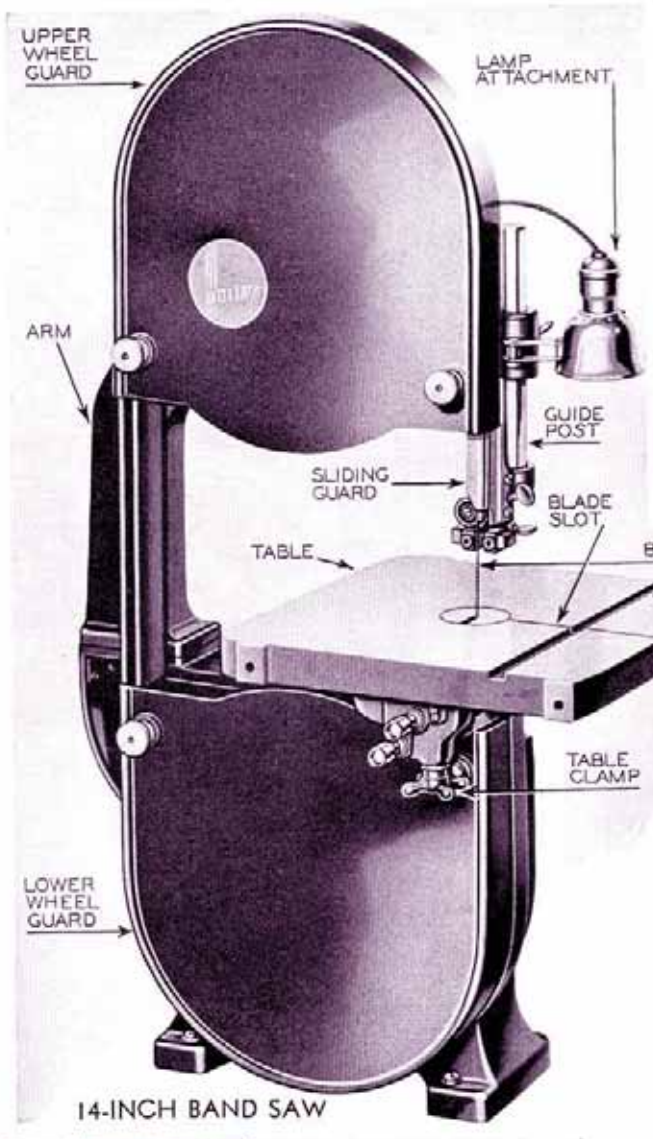
DELTA MANUFACTURING COMPANY
Milwaukee Wisconsin
Printed in U. S. A.

Form BS-737-10-41 (5)

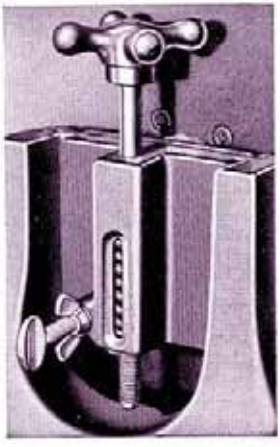
MAIN CONTENTS

GETTING THE MOST OUT OF YOUR BAND SAW AND SCROLL SAW

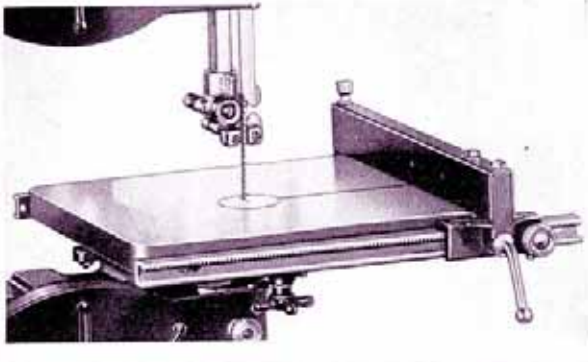
The Band Saw . . . Indispensable in the shop for curved or straight-line sawing. This machine, combined with the scroll saw, gives the operator complete mastery of curved work in wood, metal or plastic.



14-INCH BAND SAW



ADJUSTMENTS FOR BLADE TENSION AND WHEEL TILT.

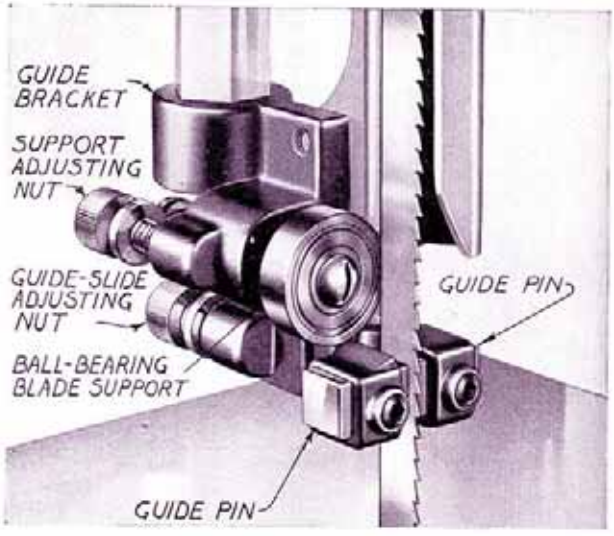


BAND SAW ON STEEL STAND

CHAPTER ONE

THE BAND SAW

Types of Band Saws.—There are various types of band saws. The largest of these—the band mill—is fitted with a wide blade and is used for sawing logs into planks. Then, there is the band resaw, which is used in lumber yards and millwork factories for resawing thick stock into thinner material. A third type is the band scroll saw, used extensively for sawing all kinds of curved work or combinations of curved and straight work, and to some extent for resawing. It is this type of band saw which is found in the home and small professional shop, and the type with which this book is concerned.



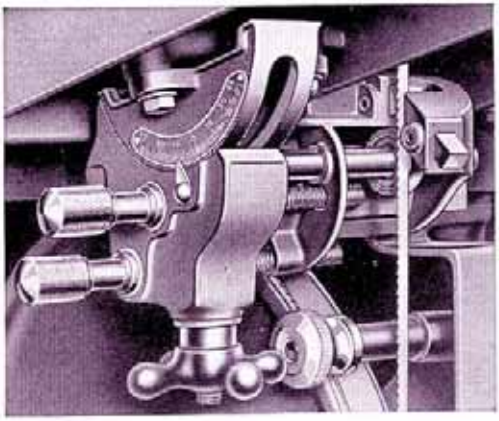
Upper guide of a modern 14-inch band saw. Micrometer controls permit accurate independent setting of guide pins and blade support.

Construction.—All band saws operate on the same general principle. The saw itself is a flexible band of steel, with teeth cut on one edge. The saw is strained over two vertical wheels or pulleys, fitted with rubber tires and provided with adjustments for centering the saw upon the rims and for giving the saw the correct tension. To prevent the blade from twisting sidewise in the cut, and to give it support when cutting, the band saw is provided with guides, the design of which varies with different makes of saws. There are two guides, one located above and the other below a table with it fitted horizontally between the two pulleys. The table is fitted with a hole through which the blade works. Adjustments permit of tilting the table a full 45 degrees to the right, so that bevel cuts can be made. A 10-degree left tilt is also usually provided so that table adjustments can be made.

Size.—The size of the band saw is measured in terms of the pulley diameter. Thus, a saw with 10-inch diameter pulleys would be called a 10-inch saw; a saw with 14-inch wheels would be called a 14-inch saw, etc. Size is also sometimes expressed in terms of the throat opening, that is, the distance between the two vertical portions of the blade. It can be seen that the throat opening of a 14-inch saw, for example, would be 14 inches, minus about ¼ inch which is taken up by the blade guard. Other important dimensions of the band saw are the table size and the height between the table and upper guide. The table size is usually proportionate to the pulley size, being about the same length or a little larger on the side than the diameter of the pulley. The distance between the table and lower guide is usually 6 inches.

Installation.—The band saw should preferably have a central location in the shop. A wall position or even a corner location is quite satisfactory for the average run of work. Since the band saw is used extensively for rough cutting in making small blocks, etc., a position close to the workbench is indicated. The mounting for the machine can be either a steel stand or suitable wood bench. The band saw table should be from 42 to 44 inches from the floor, this being the "elbow height" of the average worker.

Power and Speed.—For most work around the home or small shop, a ½ H. P. motor will supply ample power. Only a constant-speed, 1725 R. P. M. motor should be used. The band saw blade should travel at a rate from 1500 to 2200 feet per minute. On a



Under-table view showing guides and trunnion mounting.

14-inch saw, a pulley speed of 600 R. P. M. will give the correct cutting speed of 2200 F. P. M. Nothing is gained by running the machine faster than this except where wide blades are used extensively. Narrow blades run at higher speed will have a shorter cutting life, and will show a tendency to clog in the cut unless in first-class condition.

Guides — The most common type of band saw guide consists of two square pins, one on each side of the blade. There is also a back guide or support, usually a ball-bearing wheel, which supports the blade as the work is pressed against it. With minor variations in the mounting, the lower guide is identical with the upper guide. The top photo on this page shows the lower guide of a typical 14-inch band saw, the controls for the guides and support being carried to the front of the table.

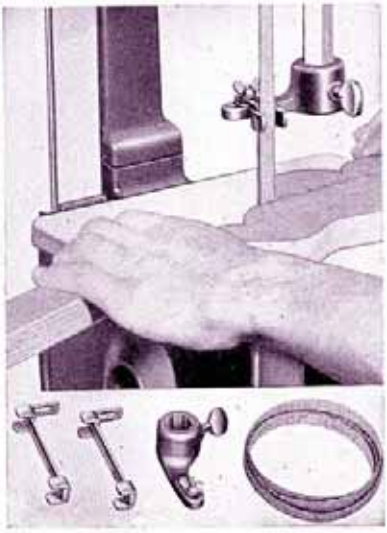
Tilting Table.—The band saw table is carried on two trunnions and is locked in place with two star wheels. A scale and pointer shows the exact degree of tilt at any position. A leveling stop pin is provided so that the table can be quickly and accurately returned to level position. This pin can be seen in the photograph in oval. The pin can be removed entirely for left tilt, also it can be adjusted to obtain the correct table setting.

Sanding Equipment.—Some band saws are equipped with auxiliary guides which permit the use of a narrow sanding belt instead of the usual band saw blade.

Height Attachment.—The capacity of the band saw can be increased to 12 inches by the addition of an extension block which increases the length of the upper arm. Longer blades are, of course, necessary, as well as an auxiliary blade guard and a longer guide support bar, both of which are mounted as before.

Table Guides.—Table guides on the modern small band saw include both fence and miter gage, these units being similar to equipment used on the circular saw.

Above, table tilted, showing leveling stop pin. Right, the band saw converted for belt sanding. Below, belt and driving pulleys can be fully guarded.



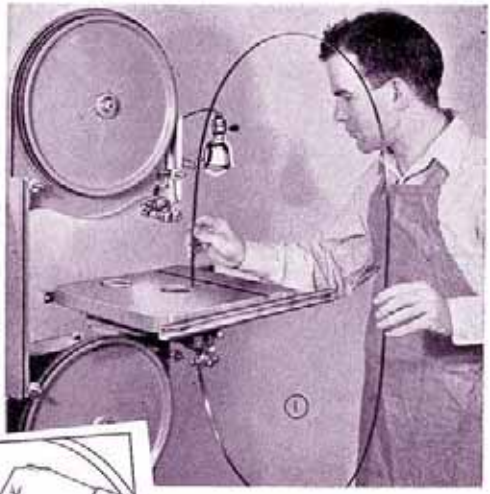
Belt Guard.—In keeping with the modern safety trend in the construction of small power-driven tools, the band saw can be fitted with a metal guard which completely encloses the belt and pulleys.

Blade Fitting. — Before a new blade can be fitted on the band saw, it is necessary to remove both the lower and upper wheel guards by unscrewing the knurled

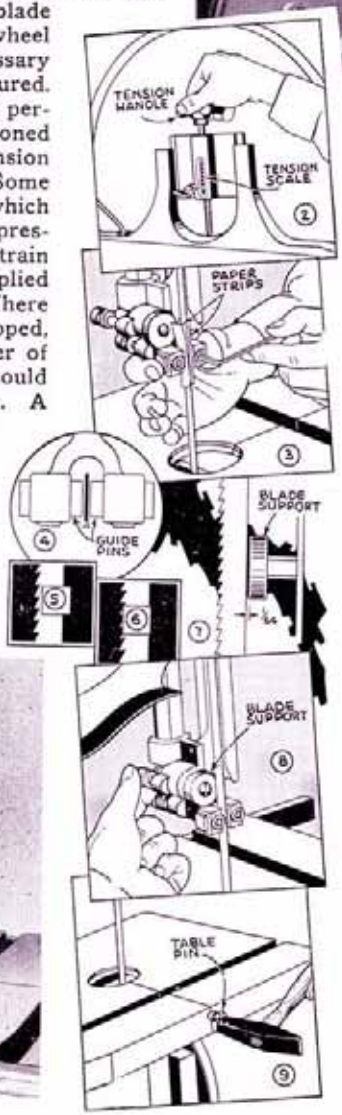
knobs which hold them in place. The table insert and table alignment pin are removed. The tension on the blade already mounted is slacked off by turning the tension handle, after which the blade can be slipped off the wheels and out through the slot in the table. The new blade is fitted to the wheels by reversing this procedure, as shown in Fig. 1. Before the blade is fitted in place, it is advisable to back off the guide pins and roller support, so that they will not effect the centering of the blade. With the blade in place on the wheels. the upper wheel is raised by means of the tension adjustment handle until the blade is held lightly. The saw is then turned by hand to see that the blade is centered on the rims of the wheels. If the blade does not center, the upper wheel is tilted in or out as necessary until perfect tracking is secured.

After the blade is tracking perfectly, the saw blade is tensioned fully by turning the tension handle, as shown in Fig. 2. Some saws have a tension scale which indicates by means of a compression spring the exact strain which should be applied for any certain blade. Where the saw is not thus equipped, tensioning is largely a matter of experience. The blade should not be drawn up too tightly. A common method of checking where the saw is not fitted with a tension scale is done by placing the first and fourth fingers of the hand on one side of the saw with the thumb pressing midway between them on the opposite side. If the saw cannot be slightly flexed by the fingers, it is too tight and should be slacked off. In another tension test, the blade should flex about ⅛ inch from a true position with a light finger pressure when the guide is fully raised. These tests can be applied best to blades less than ½ inch wide. Wider blades are naturally much stiffer, and can be strained to a greater degree than narrow ones. If the saw is equipped with a tension gage, the operator should by all means take the tension from the gage. It will be noted that the spring tensioner registers strain; it has nothing to do with the length of the blade, and is just as accurate with re-brazed as with new blades.

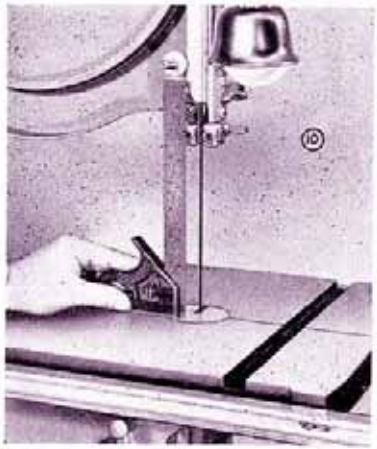
With the blade tracking correctly and properly tensioned, the guides can be set. The guide pins on either side of the blade must be close enough to the blade to prevent it from twisting, yet they should not come in actual contact

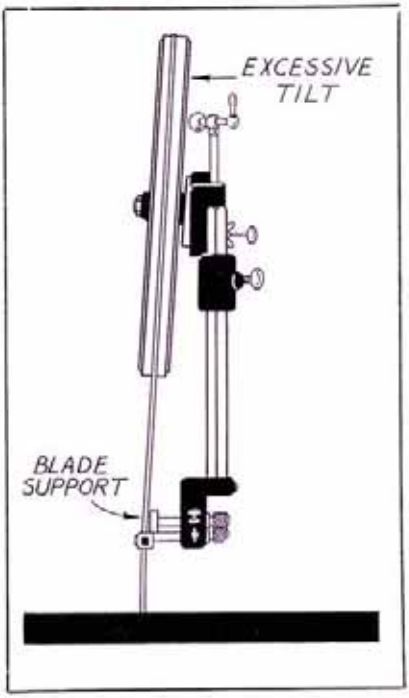


Above, inserting blade through table slot. Drawings at right show essential blade adjustments.



Below, the table must be adjusted so that it is at exact right angles to the blade.





Excessive tilt and mis-aligned guides are the two most common faults in adjusting blades on the band saw.

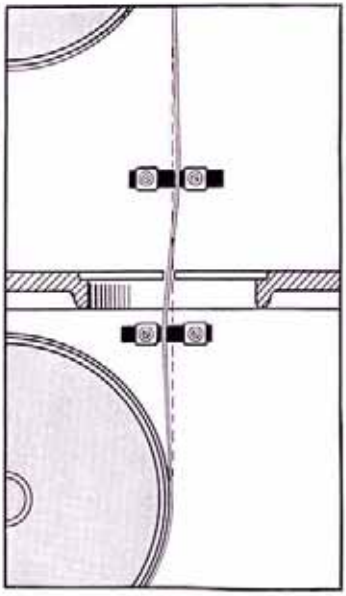
with the blade. A very accurate method of obtaining the correct clearance is shown in Fig. 3, where strips of paper are placed on either side of the blade while the pins are pressed inwards between the thumb and first finger. In doing this it is important that the blade should not be pushed out of a true vertical position. The bracket carrying the guide pins is now brought forward until the front edges of the guide pins are just behind the gullets of the saw blade teeth, as shown in Fig. 5. If the pins are too far forward, Fig. 6, the teeth of the blade will be worn against the pins; if the pins are too far back they will not properly support the blade.

The blade support is now brought forward, as shown in Fig. 8. It should not contact the blade, but should be set about 1/64 inch from the back of the blade, as shown in Fig. 7. The blade bears against the support only when it is actually cutting If the blade is allowed to run hard against the supports at all times, the back will become case-hardened and this will eventually lead to breakage of the saw.

The guide adjustments, as described, are the same for both upper and lower guide. Summarized, the various steps are as follows: (1) Open up guide pins on both upper and lower guides. (2) Run blade support back. (3) Center blade on wheels by tilting upper wheel as required. (4) Set blade to correct tension. (5) Revolve band saw to check blade tracking. (6) Set guide pins inward to thickness of blade, with correct clearance. See that pins do not push blade sidewise. Lock guide pins. (7) Set guide pin bracket so pins come to bottom of blade teeth. (8) Set blade supports with 1/64 inch clearance. (9) Check settings by revolving saw by hand.

The final step is to replace the table insert, alignment pin and pulley guards, after which the saw is ready for operation. The alignment pin should be gently tapped in with a hammer, as shown in Fig. 9. This must be done cautiously—too vigorous action can easily fracture the table.

Adjusting Table.—The table must be at right angles to the blade when it is in a normal level position. Check should be made with an accurate try square, as shown in Fig. 10 on the previous page. Adjustments are made by means of the stop screw under the table, turning this up or down until the table, when it rests against the screw, is at right angles to the blade. Recheck by sawing a piece of wood, checking the cut with the try square. After the table has been checked level, the pointer should be set to zero on the graduated scale, so that it will accurately indicate every degree of tilt.

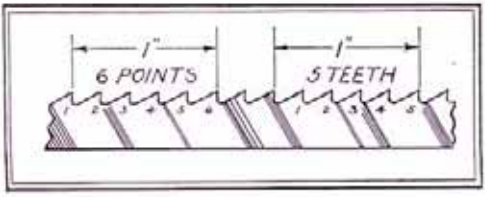


Common Faults.—Smooth band saw operation is largely dependent upon proper adjustment of the guides. The two most common faults are diagrammed on this page. Excessive tilt, as shown in the upper diagram, is usually the result of setting the blade support hard against the back of the blade. It then becomes necessary to tilt the upper wheel to make the blade track properly. The operator can guard against this by tracking the blade independent of the guides, and then setting the guides. The second fault, as shown in the center diagram, is not likely to happen if the operator makes blade adjustments carefully.

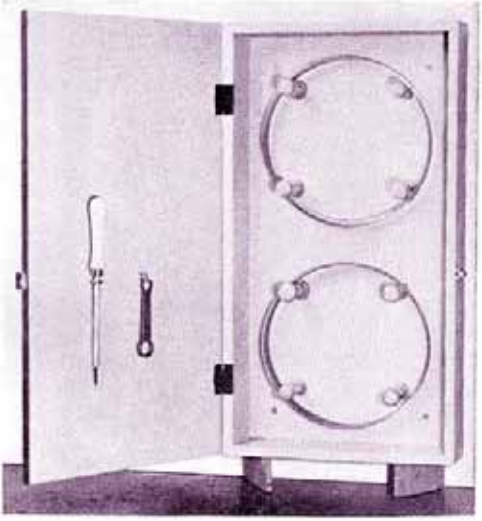
CHAPTER TWO

BAND SAW BLADES

Dimensions.—Common sizes usually supplied include blades from ⅛ to ¾-inch wide, all of which are known collectively as narrow band saws. The thickness of the blade varies somewhat depending upon the quality of steel which is used, but generally averages about .001 inch thick for each inch diameter of the wheels on which it is to run. Thus, a 14-inch band saw would take blades .014 inch thick. At the same time, it must be pointed out that both thicker and thinner blades can be used successfully. The set of the narrow blade averages about .005 inch on a side for ¼ inch blades, this being increased .001 inch for each size larger to give a ¾ inch blade a set of about .010 inch. Narrow band saws will run four to seven teeth per inch. A four-tooth saw will give a fairly smooth cut, while having the advantage of fast cutting. Where a smoother cut is desired, a six or seven-tooth saw will do better work with a slight loss in cutting speed. It will be noted, in the upper drawing, that there is a difference between **points** per inch and **teeth** per inch. There is always one more point than teeth; that is, a five-tooth blade would have six points per inch.

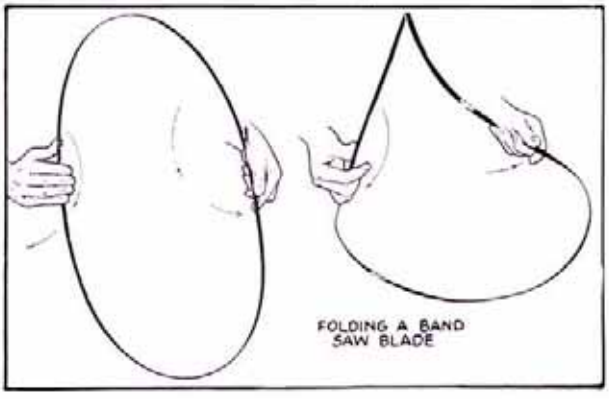


Above, method of designating number of teeth or points to the inch. Below, a simple band saw storage cabinet.

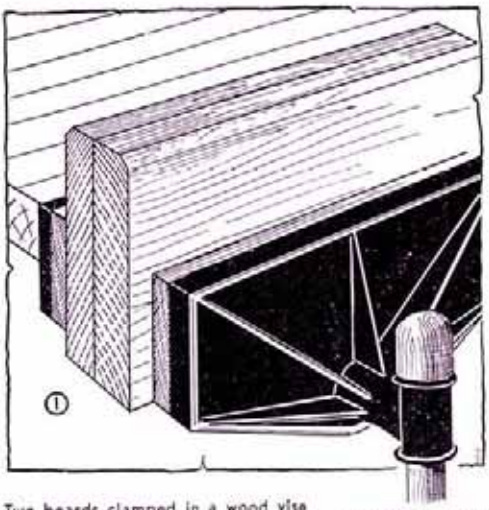


Storage.—Band saw blades not in use should be wiped with an oily rag and stored in a dry place. The oil, however, must be removed when the saw is again used. A suitable storage cabinet is shown in the photo. Some workers prefer pegs or a notched board upon which the blades are hung. Blades should always be tied with soft metal straps at at least two points to prevent accidental unfolding.

Band saw blades are folded in thirds. The starting position of the hands should be carefully noted, as this is the whole secret of folding.



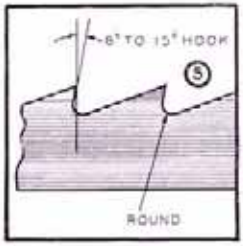
How to Fold. — Band saw blades are folded in thirds. This is done by grasping the blade tightly as shown in the left hand drawing. Note carefully the original position of the hands, as this is the whole secret of folding. From a starting position, the right hand is revolved away from the body and the left towards the body. The grip on the blade should be maintained. If this is done, the blade will automatically form itself into three loops.



Two boards clamped in a wood vise can be used for occasional band saw filing work. For more extensive filing, a regular vise of the style shown at right or below should be used.

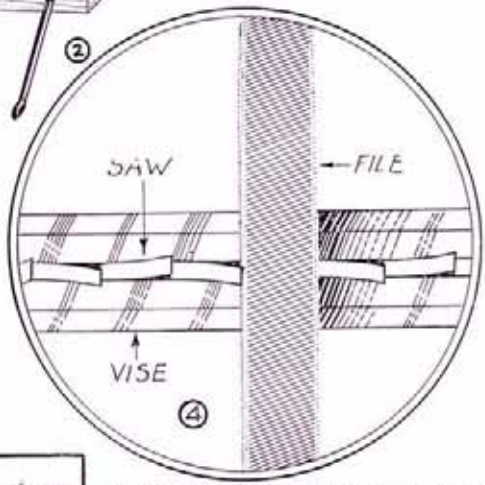
Filing.—The user of narrow band saw blades should know something of the filing and setting of the teeth of his blades in order to get the most out of them. Nothing will break a blade so quickly as to keep on forcing it to work after it has become dull, and the matter of touching up the blade to keep it sharp is a very simple one, demanding no more equipment than a vise and a saw file of the proper size, and slightly more patience than is required to file a hand saw.

A good enough emergency vise for the occasional user is made simply by clamping two boards about 10 inches wide in the woodworkers vise, the boards being high enough to bring the saw to a comfortable height for filing. The boards may be hinged together if desired. The saw is gripped between the upper edges of the boards with the body of the teeth projecting as shown in Fig. 1. For those who expect to do considerable sharpening of their own blades, a better type is shown in Fig. 2. Fig. 3 shows a pair of fitting wheels (which may be homemade) used in connection with the vise.



When touching up a saw, the teeth should be filed straight across as shown in Fig. 4; they must not be beveled as when filing a cross-cut hand saw. The best guide to the shape of the teeth is a new saw, or to follow the shape of the teeth in the saw being sharpened, provided the latter are not too much worn. The band saw should never be allowed to get into this condition, of course. A good shape of tooth for all around work is shown in Fig. 5. The angle between the face of one tooth and the back of the next is 60 degrees, to suit the saw file used for sharpening, and this shape should be maintained. An even number of strokes should be made across each of the teeth, in order to keep the saw of equal width throughout its length.

A very important point to observe is that the bottom of the gullet or valley between teeth, should always be rounded. This is done automatically on narrower saws and those with fine teeth by the rounded edge of the file. For widely spaced teeth the gullets should always be carefully rounded out with a rat-tail file, all sharp corners left by the triangular saw file being taken out.



Teeth should be filed square across, with a hook from 6 to 15 degrees.

Occasional touch-up filing can be done quite well while the blade is mounted on the machine, as shown in Fig. 1 on the opposite page. Best results can be obtained, however, if the blade is turned inside out and remounted so that the teeth point up instead of down.

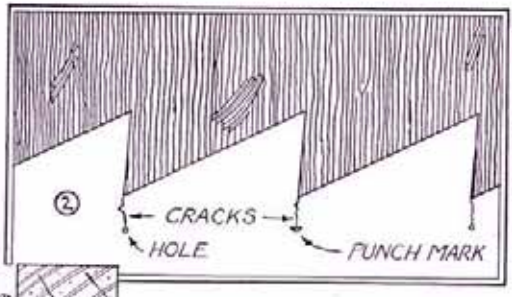
Cracks.—Cracks will sometimes develop at the bottom of a gullet, especially if the

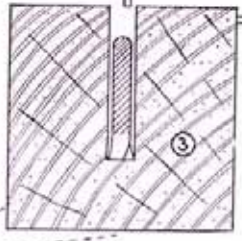
gullet has not been properly rounded. The remedy for this is to drill a fine hole at the bottom of the crack, as shown in Fig. 2, **provided that the crack does not extend across more than one-sixth the width of the blade.** If it is longer than this it is better to have the saw rebrazed. Some filers make a crescent-shaped punch at the end of the crack, on each side of the blade, and this prevents the crack from extending just as effectively as drilling a hole. A very small hole—about No. 60 drill—is all that is required to prevent the crack from extending further. On very narrow band saws the blade should be broken and re-brazed.

Setting.—The teeth of the saw may be touched up several times before it is necessary to reset them, but eventually setting will be necessary. Setting consists of bending the points of alternate teeth to right and left, so that the teeth will cut a kerf wider than the body of the blade, and so provide clearance for it, as shown in Fig. 3. A number of different machines are made for setting band saw blades; the occasional worker can also set his blades with an ordinary hand set such as is used for setting hand saws, the only difference being that the job consumes more time.

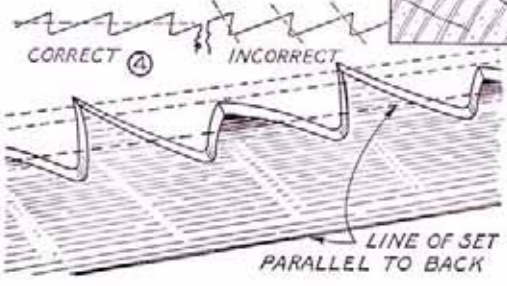
When setting, do not set the tooth more than half-way down the tooth; avoid setting so deeply that the body of the tooth is distorted. Also, keep the line of the set parallel to the back of the blade, as shown in Fig. 4, and not at an angle to the back.

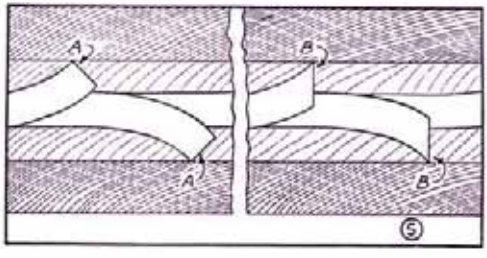
Touch-up filing can be done with the blade mounted. Best results are obtained by turning the blade inside out.





Set is required for blade clearance. Setting, if necessary, should be done BEFORE filing.



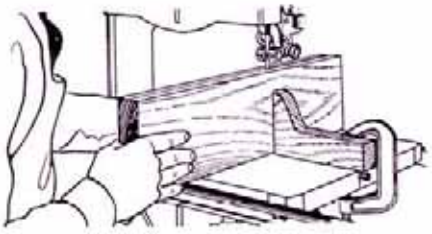


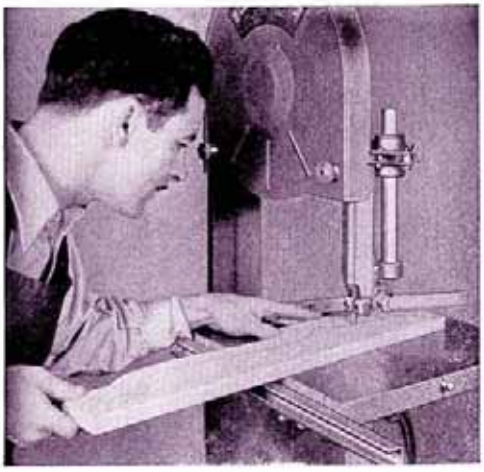
The teeth of the band saw should be filed **after** setting. If the teeth are filed square across first, and then set, the angle of the front of the teeth will be as at A in Fig. 5. It is obvious that these teeth will scrape instead of cutting cleanly, and while the saw will operate, it will tend to vibrate in the cut. It the teeth are filed after setting, the front of the tooth will be as at B, Fig. 5, and the teeth will cut clean and smooth.

Brazing.—When the narrow band saw breaks, regardless of the cause, it may be joined together again either by brazing or silver-soldering. Blades as they come from the maker are often welded electrically, but the repairman is not usually equipped for welding, and either brazes or silver-solders the joint. The occasional saw user is recommended either to return his broken blade to the maker for repair, or else take it to a local saw filer, since it is not worth while for him either to invest in the equipment necessary for brazing, and not worth while running the risk of ruining the saw.

CHAPTER THREE

METHODS OF WORKING

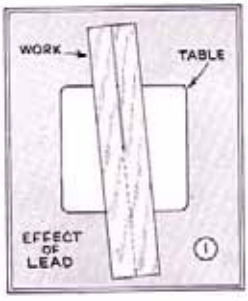




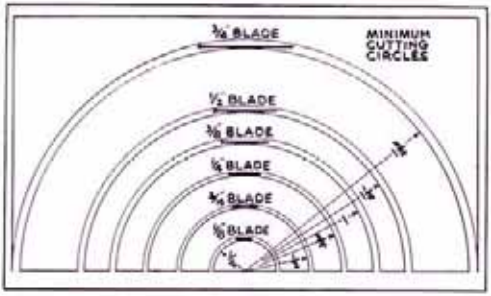
Fundamentals of Cutting.—Certain fundamentals of cutting, as pictured and described on the opposite page, must be thoroughly learned by the operator. The application of these elementary principles should be almost second nature—as much a part of the operator's mental processes as the fact that he should not stick his finger into the revolving blade.

Effect of Lead.—If a piece of wood is pushed squarely into the saw blade, it should under normal conditions, be cut in a straight line at right angles to the blade. Often, however, the blade will pull to one side or the other (lead), making it necessary for the operator to adjust the feed accordingly. Thus, in Fig. 1, the blade leads to the right, making it necessary to swing the feed hand to the right in order to follow a straight line. Lead is caused mainly by two things: (1) Improper setting of guides, (2) Improper set of saw blade. After checking No. 1, the fault can be reasonably laid to No. 2. Sawing along the side of a nail, riding one side of the blade deep and tight in the guides, or poor filing will result in a saw blade which is dull and poorly set on one side while the opposite side is sharp and fully set. Cutting with this blade, the sharp side does not cut in a straight line but leads off. Where the lead is slight, it can be remedied by lightly honing the side of the blade with a fine stone, as shown in Fig. 2. Honing is done only on the sharp side of the blade (the side that leads away from the line). The result, of course, is to make the set of the

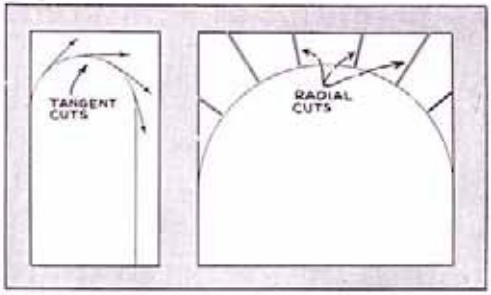
Position of Operator. — If the operator is right-handed, he will naturally take a position directly behind the left side of the table, as shown in the photo above. He will use his right hand to feed the work to the saw blade, while the left hand will be placed alongside the work to act as a guide. This position is not arbitrary—it can be varied to suit the work and the operator's natural style. The hand alongside the work more or less guides the work by means of side pressure. Side pressure against the blade should always be gentle. The feed hand should not jam the work forcibly against the blade, but should be fed lightly. The pressure of a single finger on the end of the work will cause the blade to cut; when more pressure than this is required, it is a sign that the blade is dull. The feed hand should not choke the work, but should be held at a reasonable distance from the blade. This gives much better control of the cut and will result in smoother operation than when the work is held close up and fed in a niggling manner. The operator's eyes should be fixed on the line a little ahead of the saw blade.



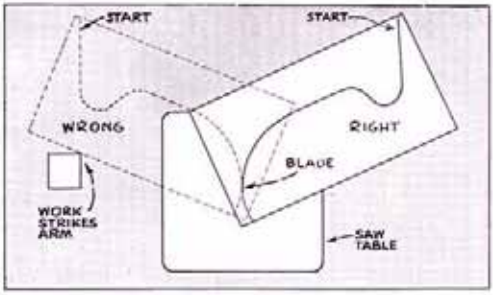
Left, proper working position. Below, effect of lead and how it can be remedied.



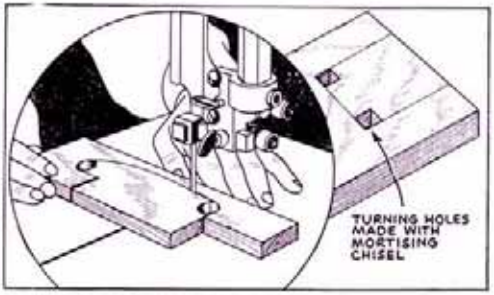
USE A BLADE TO SUIT THE WORK. Use this table. For example, a ¾-inch blade cannot cut a circle less than 1¾-inch radius. In actual work, it is best to work one size smaller.



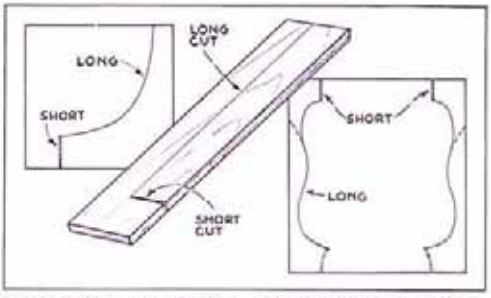
BREAK UP SHORT CURVES. When it is necessary to make a wide blade go around a short curve, break the cut into a number of shorter tangent cuts, or, eliminate twisting strain by the use of radial cuts to the curved line.



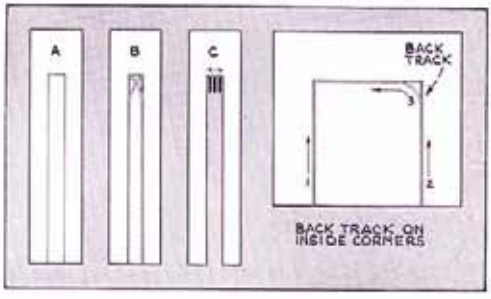
WATCH FEED DIRECTION. Mentally follow the path of the cut before actually cutting the work. Many pieces of work will swing in such a fashion as to bind against the upper arm if not started properly.



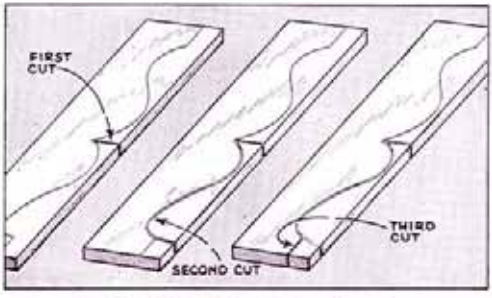
MAKE USE OF TURNING HOLES. Time can be saved if round turning holes are drilled and square turning holes mortised into the work before band sawing. Use this method for short curves with a wide blade.



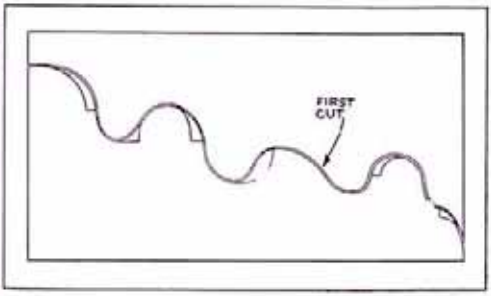
MAKE SHORT CUTS FIRST. Where choice of starting points is offered, make the shortest cut first. Backtracking out of the short cut can be done much more quickly than backing out of a long cut.



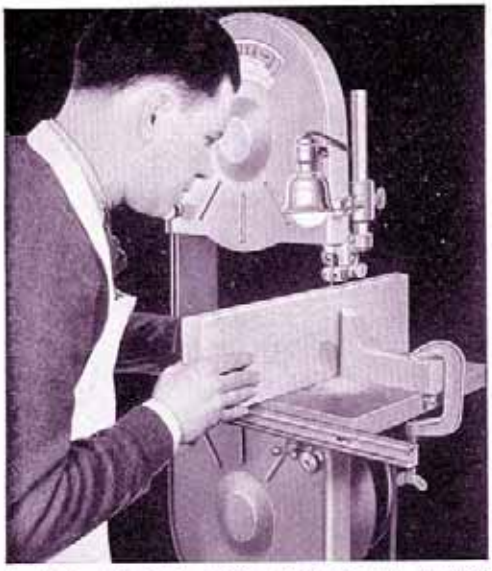
BACKTRACK ON INSIDE CORNERS. Very narrow grooves must be "nibbled," as shown at A, B, C. On other inside corners, cut to the corner and then backtrack sufficiently to lead the blade over to the second line.



BREAK UP COMBINATION CUTS. Combination cuts should be broken into a number of smaller cuts. The diagram shows a typical example. Study each piece of work to determine the simplest method of cutting.



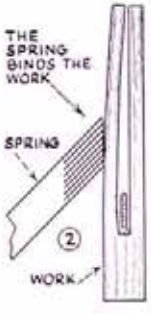
ROUGH OUT COMPLEX CUTS. Where cuts are of a complex nature, start at one end and follow as much of the line as possible on the first cut, then go back over the work and complete the smaller cuts.

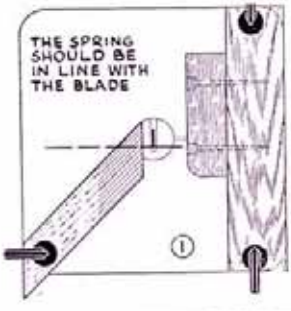


A blade with slight leading tendencies can be used successfully with the pivot style of ripping fence shown in the photograph above.

teeth equal on both sides of the blade. It can be seen that if the lead is excessive, it cannot be remedied by honing since this simply makes the sharp side as dull as the dull side. Where lead is excessive, the blade must be completely reset and sharpened before it will cut properly.

Ripping and Re-Sawing.—Ripping and re-sawing require straight-line cutting. When the stock is worked flat on the table, the operation is generally known as **ripping**; when the board is worked on edge, the operation is known as **re-sawing.** Cuts of this nature are best made with some form of guide or fence to keep the work in proper relation to the saw. One of the simplest guides is the pivot block, as shown in the upper photo. The guide is set opposite the blade and at the proper distance from it to cut the thickness required. A pencil mark on the work is an aid to cutting but is not essential. The work is held tight against the pivot block with the left hand, while the right hand feeds the work to the blade. This style of guide is particularly useful when working with a blade which leads slightly since the work can be shifted slightly as required to follow a straight line.



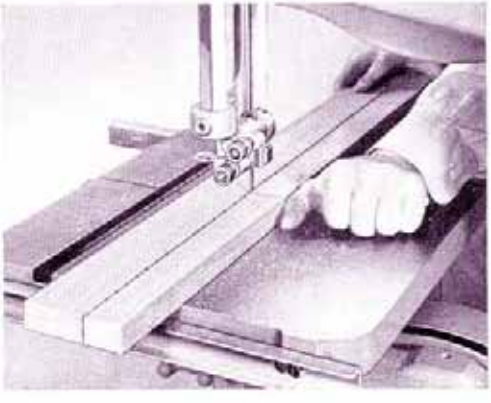


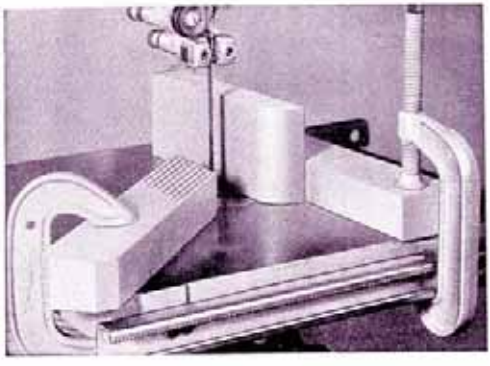
Above, using a thumb pivot as a guide when ripping. Diagram and photo below show simple style of ripping fence. A wood or metal spring is useful as a hold-in when ripping with any style of fence.

Where the work is to be ripped flat, the same idea of a pivot block can be applied by holding one hand firmly on the table so that the side of the thumb acts as a pivot, as shown in the photo below. Here, again, the thickness of the cut is controlled by the fixed pivot point (in this case the thumb), while a straight line is followed by guiding the work with the feed hand.

A simple form of guide fence, which can be used for either ripping or re-sawing is shown in the diagram and in the lower photo. The spring shown at the side is made by sawing a number of saw kerfs in a piece of hardwood, and then clamping this so it will press the work against the fence.

Use of Standard Fence. — The regular ripping fence, if the saw is so equipped, is the logical unit to use for all ripping and

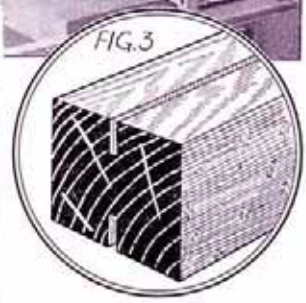


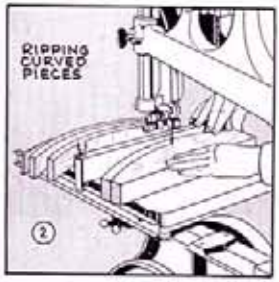


re-sawing operations. It possesses the advantages of always being ready for use, while permitting accurate settings for ripping to any width. This style of fence requires a blade in proper condition since nothing can be done to compensate lead after the cut has been started. A typical re-sawing operation with the standard fence is shown in the upper photo on this page. In this case, auxiliary cuts have been run in on the circular saw on either side of the work, as shown in Fig. 3. These cuts are not always necessary, yet they insure straight cutting.

The Ripping Blade. — When re-sawing or ripping lumber, the widest blade in the shop should be used. It can be easily seen that a wide blade has much more "rudder" to follow a straight line than a narrow blade. Where extensive re-sawing is being done, blades specially suited for this work should be used. Ripping blades should have coarse teeth, generous set, and a hook of from 20 to 30-degrees. In ripping pine and other soft woods, a maximum of hook is required, while harder woods such as oak and maple require less hook.

Above, resawing with standard rip fence. Diagram shows work prepared on circular saw.





Ripping Curves.—Curves can be successfully cut by using the standard fence in the manner shown in Fig. 2. A contact point is first marked on the fence, directly opposite the teeth of the blade. With one edge of the work carefully cut to the required curve, the opposite edge can be cut to the same curve by advancing it to the saw, keeping the first-cut edge in contact with the pencil mark on the fence.

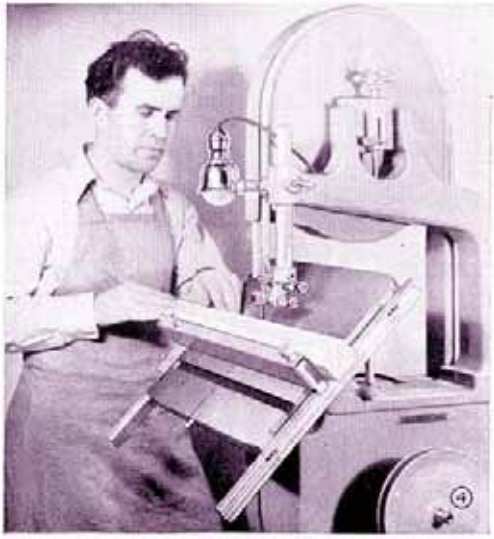


Fig. 2, using the fence for ripping slow curves to exact width. Photo above shows fence used for bevel ripping.

Tilt Table Operations.—When the fence is used for bevel cutting, it should be carried on the lower side of the table so that both work and fence are below the blade, as shown in Fig. 4. The particular operation shown here is the trimming of square stock preparatory to turning, the band saw being ideal for making cuts of this kind.

Cutting-off with Fence and Gage. — Both fence and gage can be used for cutting work to exact length, as shown in Fig. 1, the gage presenting the work squarely to the blade while the fence acts as a stop. Unlike the same operation on the circular saw, there is no danger of a kickback caused by the work binding between blade and fence.

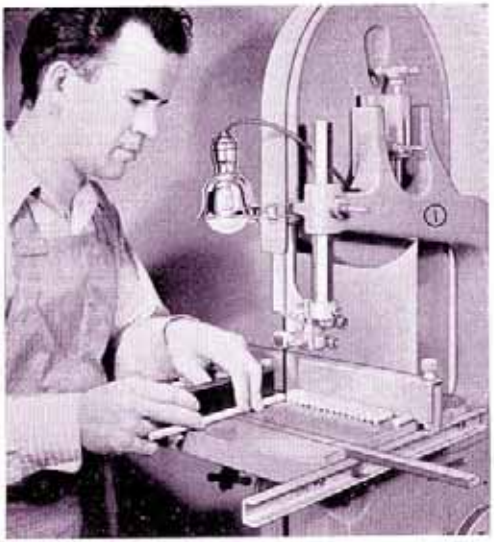


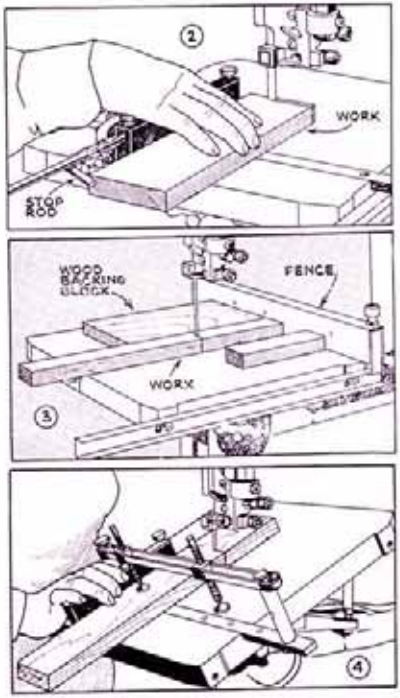
Photo and drawings show various methods of cutting-off on the band saw.

Use of Stop Rod.—Cutting to length can also be done with the use of the stop rod, as shown in Fig. 2. The rod should be carried on the outer end of the miter gage. When required, it can be carried on the side next to the blade, but care must be exercised to prevent the blade from cutting into it at the end of the cut.

Cut - off Block. — When the saw is fitted with a fence but does not have a miter gage, cutting off can be done by using a backing block behind the work, as shown in Fig. 3. This block should be perfectly square, so that with any side riding the fence, the adjacent side will be at right angles to the blade. Similar blocks for cutting 45-degree miters and other angle cuts can be easily made up as required.

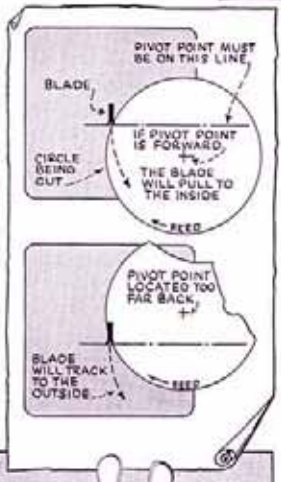
Using Clamp Attachment.—The miter gage clamp attachment can be used to advantage in many crosscutting operations, and is particularly useful when cutting-off with the table tilted, as shown in Fig. 4. The use of the clamp attachment eliminates any possibility of creep, and greatly simplifies the job of holding short lengths of wood against the gage. The clamp can be used to good advantage for all work of unusual shape, which is ordinarily difficult to handle.

Crosscutting Wide Stock.—The use of the miter gage in crosscutting wide stock follows the same method as used for similar work on the circular saw. When the work is so wide that it cannot be loaded in front of the gage, the gage is reversed and the work fed from the back side, as shown in Fig. 5. Work this large is best handled on the circular saw, but where the shop is not fully equipped, the band saw is a satisfactory machine for this and other straight-line cutting. The use of an auxiliary wood fence screw-fastened to the gage will facilitate the handling of wide boards and will result in more accurate work. Unlike the auxiliary circular saw fence, the wood fence for the band saw should be kept low (the same height as the gage) so that it will work under the guides. In length, the wood fence can be cut off at the blade cutting line, or, by using a little heavier stock, it can be extended across the table. The increase in thickness of the stock is necessary to offset the depth of the band saw cut which will be gradually cut in the face of the fence. For general work, the fence should be cut off even with the blade.



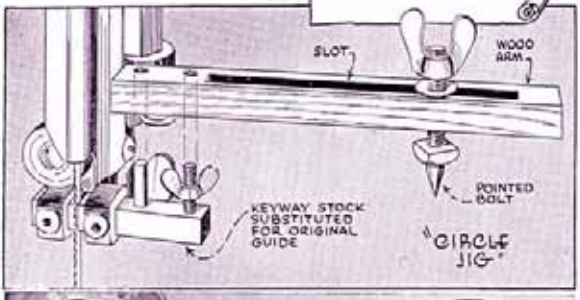
Below, the miter gage is reversed in the table groove when cutting-off wide stock.

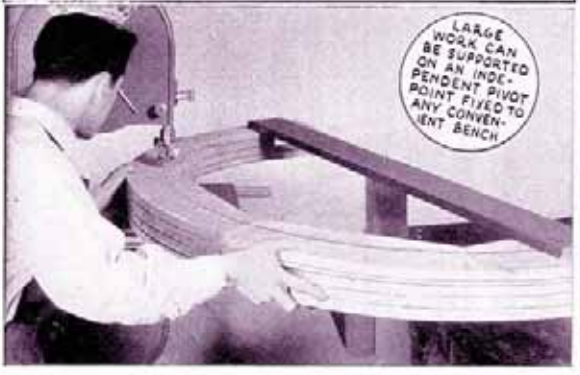
Cutting Circles.—The cutting of circles on the band saw can be done freehand in the same manner as cutting any other curved line. More often, however, a pivot jig is used to obtain both speed and accuracy. All circle-cutting jigs for the band saw or scroll saw feature a pivot point around which the work revolves as it is advanced to the blade. A feature which some workers fail to realize is the importance of the pivot point position in relation to the blade. In order to get perfect circles, this pivot point must be at an exact right angle with the blade, and on a line with the cutting edge or teeth. What happens when this basic rule is not followed is shown in an exaggerated form in the diagram. It can be seen that a forward pivot point will cause the blade to track to the inside of the circle being cut, while a pivot point behind the cutting edge of the blade will result in tracking to the outside. A $\frac{1}{16}$-inch variation is enough to cause the blade to track, especially if the deviation is back of the blade, as shown in the lower example in the diagram.

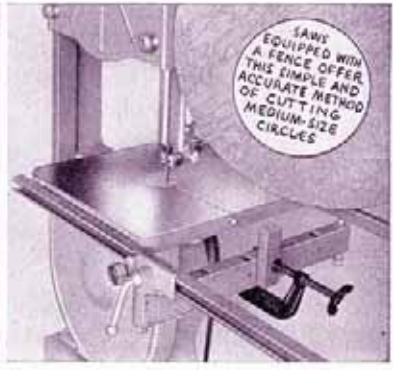


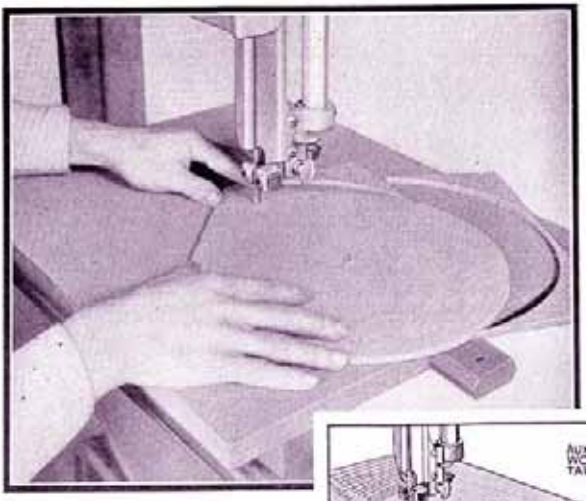
Above, using a circle-cutting jig. Diagram at left explains mechanics of cutting.

Jig Construction. — Bearing the basic rule well in mind, any number of jigs can be made to more or less conveniently carry the pivot point. Naturally enough, this point should be adjustable so that a wide variety of circle sizes can be cut. A typical jig is shown in the top photo and in the drawing. In this case, the right-hand guide pin is removed, and a longer guide pin of suitable keyway stock substituted. Most band saws have standard ½-inch square guides, making the substitution of ½-inch keyway stock as perfect as the original set-up. The new guide carries two short studs and one wing nut, as shown, and this portion of the circle-cutting jig can become a permanent part of the band saw. The rest of the jig is simply a

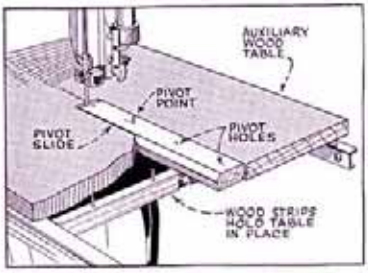








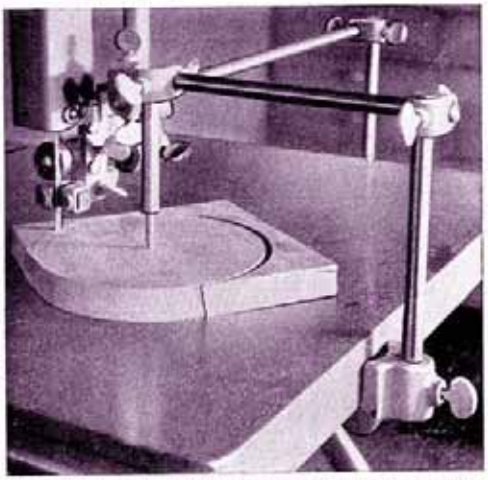
Above, auxiliary wood table circle jig with sliding pivot bar.



The auxiliary table, as shown at left, is the commonest of the circle-cutting jigs. The basic idea is readily apparent from the sketch. The table should be fitted with wood strips or angles on the underside so that it will fit snugly over the original band saw table. The pivot is located on a wooden strip in the manner shown. Any form of joint can be used so long as it holds the pivot bar snugly in place. The sliding pivot bar is sometimes eliminated entirely by simply boring a series of holes in the table top. Any of these holes can be used to take the pivot pin in making circles to certain set diameters. In another form, the space occupied by the pivot bar is cut out, and a fixed pivot pin located at the outermost edge of the auxiliary table. In hardwood or metal arm which is slotted to take the pivot point. This, the pivot point, can be readily made by cutting off the head of an ordinary bolt and shaping by filing, grinding or turning to a sharp point. A scale can be marked on the slotted arm to instantly show the right setting for any diameter. A careful check should be made before slotting the bar to establish the slot at the right position in relation to the blade. With this or any other circle-cutting jig, slight tendencies to track to the inside or outside can be corrected by adjusting the position of the blade to the near or far edge of the bandsaw wheels. Once the perfect set-up is obtained, there should be little need for further re-adjustment.

The jig just described will take circles up to about 15 inches in diameter. Larger work follows the same basic rule, with the pivot point sometimes entirely apart from the saw when very large work is being done, as shown in one of the pictures. This photo also shows the method used in cutting half-circles, a length of scrap stock being nailed in place to take the pivot point.

The lower right-hand photo on the preceding page pictures an excellent circle-cutting method which can be used when the band saw is fitted with a fence. In this case, a block of wood carrying the pivot point is clamped to the fence, which has been inverted. A mark on the fence will accurately relocate the pivot point for later work.



Stock circular saw hold-down parts are used to make the substantial circle-cutting jig shown above.

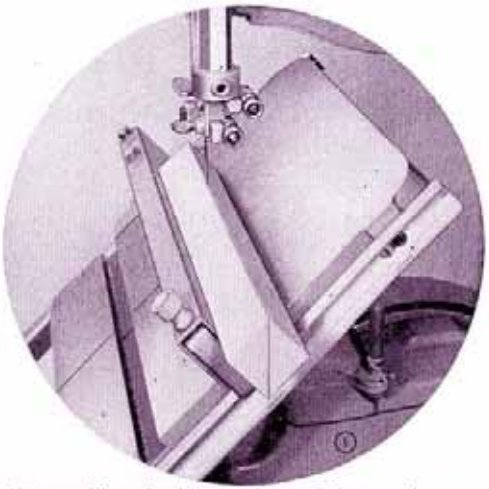
use, the table is moved over to bring the pin to the proper diameter. Another form of overhead jig can be made up from stock hold-down units, as shown in the lower photo. The manner of assembly is readily apparent from the picture.

All of the jigs described make a hole in the center of the work at the pivotal point. With the overhead jig, this is readily eliminated by glueing a small block of wood to the work to take the pivot point. Where the pivot point is on the underside of the

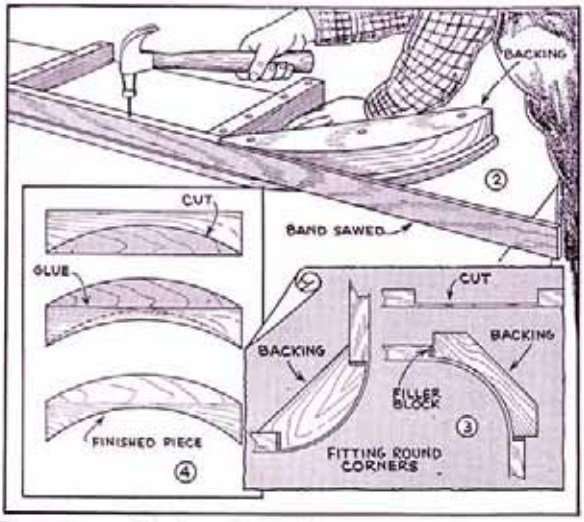
work, a slightly larger block must be glued in place in order to give the work sufficient bearings. With a finely-ground pivot point, the glue block is seldom necessary.

Cutting Glue Blocks.—With the band saw table tilted to 45 degrees, square stock can be ripped exactly on the diagonal to produce glue blocks or any other work requiring a similar triangular section. Fig. 1 shows how the work is done, using the standard ripping fence. Because of the slight clearance under the fence, the fence may be set at such a position to exactly halve the stock, and this without coming in contact with the blade.

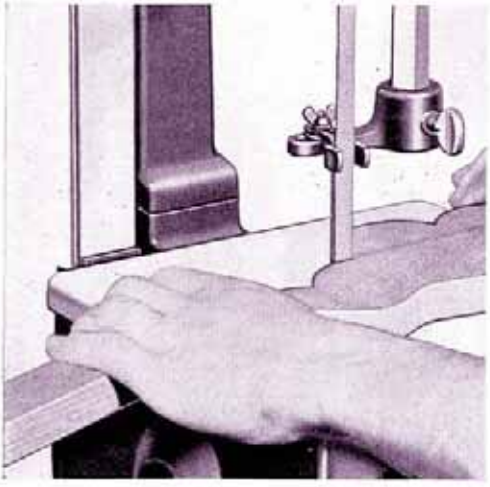
Fitting Round Corners.—In cabinet work it is frequently necessary to run a facing strip around curved work. This can be done without steaming if the facing strip is first ripped to a thin section on the band saw, and then applied to a suitable backing block. Fig. 2, which shows a facing strip being applied to the top of a mantel, will make the idea clear. Fig. 3 shows the application of this idea to both inside and outside corners. The distance between the shoulders of the facing strip is made about ½ inch greater than the distance between the shoulders on the backing pieces so that wedges can be driven between the ends to make a solid joint when glued. For average work, the thinned portion of the facing strip should be about ¼ inch thick, but it can be made thinner if the curve of the work is of short radius or if the facing strip is wide.



Above, cutting glue blocks. Below, fitting round corners and manner of cutting circular arcs from narrow stock.

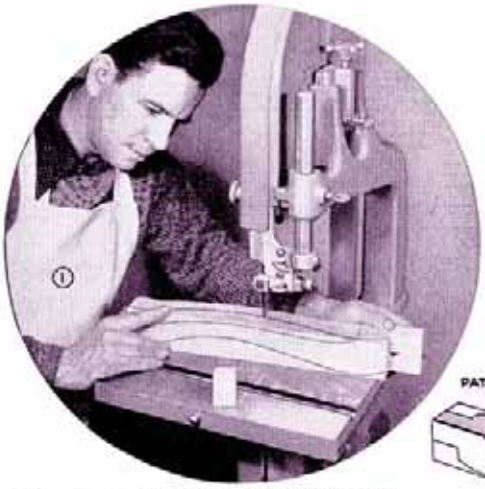


Both curved and straight work can be quickly sanded smooth with the sanding attachment.



Circular Rails.—Fig. 4 shows a stock-saving method of sawing a circular rail or arch. The required curve is cut through any part of the original narrow board, as shown in the upper diagram. The two pieces are then glued edge to edge, after which the inner radius is set off and cut. A similar application on production work is shown on page 48.

Sanding.—The belt guide for sanding on both 10 and 14-inch band saws is easily fitted to the guide post. The belt is tracked on the wheels in the same manner as a band saw blade. Tension should be just sufficient to prevent slipping. Two guides are supplied, one flat for straight edges, and the other curved for sanding curved work. Fast cutting without belt glazing can be done at the standard band saw speed.



Above, compound sawing on the band saw. Drawings at left show various steps in compound-sawing the cabriole leg.

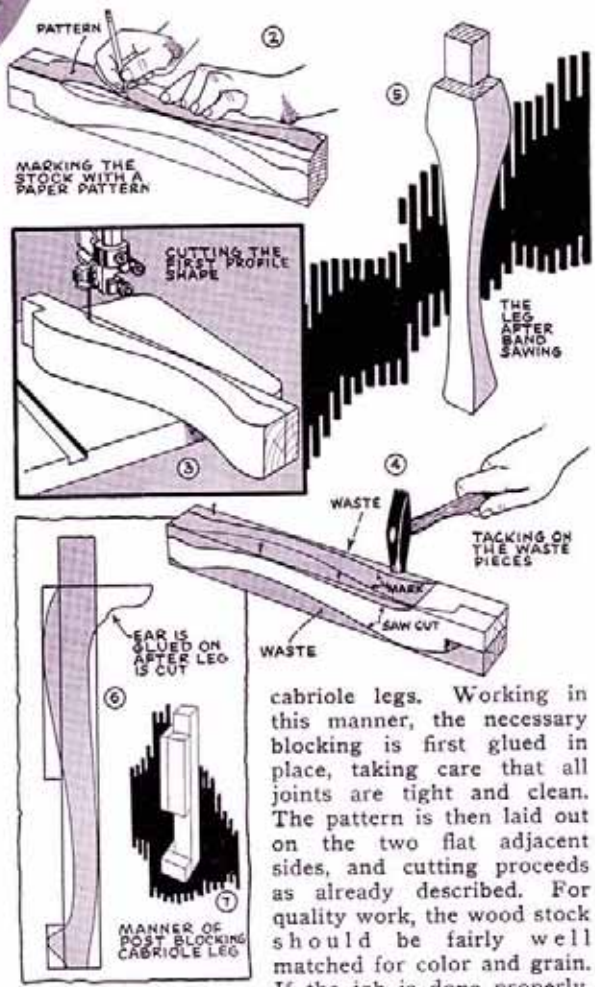
Compound Band Sawing.—When work is sawed from two or more sides, the operation is known as compound band sawing. Cuts of this nature are used in many kinds of work, one of the most common examples being:

The Cabriole Leg.—The stock for the leg must first be jointed perfectly square. It can be seen that if the original square of lumber is not true, neither will the band saw cuts be true. After jointing the leg pattern is laid out on two adjoining sides of the wood, as shown in Fig. 2. A cardboard pattern is usually used to trace the outline.

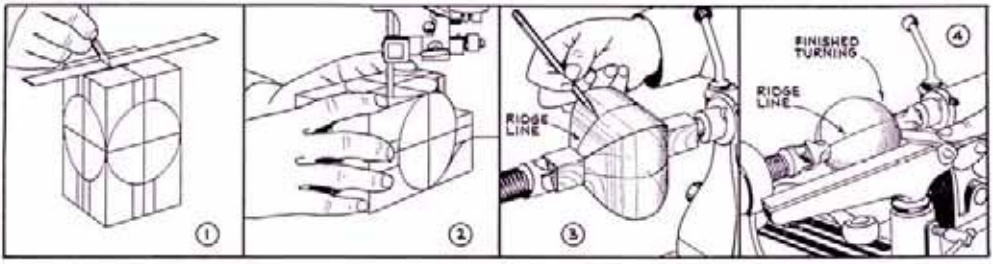
The work can now be taken to the band saw where the two cuts necessary to form one of the complete profile shapes are made, as shown in Fig. 3. After this has been done, the waste cuttings are tacked back in place, as shown in Fig. 4, in order to give the work a base and to restore the pattern markings. The nails used to fasten the waste cuttings should be placed in such a position that they will not mar the leg. The second profile shape is now cut, after which the leg will appear somewhat as shown in Fig. 5, depending, of course, on the original design. From this stage the leg is finished by modeling the front and rear corners. This can be done on the shaper, but for the average homeshop job is usually done with a spokeshave or other hand tool.

Ears are sometimes added to each side of the leg. While these can be fitted in place and cut at the same time as the leg the best practice is to cut the leg first and then fit the ears. The ear is first cut to the required profile shape, after which it is glued in place and rounded to the same curve as the facing side of the leg.

Figs. 6 and 7 shows the manner of post blocking stock for cabriole legs. This method of working is frequently used, since it is often difficult to secure a piece of fine cabinet wood sufficiently large to take in the full shape of many styles of



cabriole legs. Working in this manner, the necessary blocking is first glued in place, taking care that all joints are tight and clean. The pattern is then laid out on the two flat adjacent sides, and cutting proceeds as already described. For quality work, the wood stock should be fairly well matched for color and grain. If the job is done properly, the post blocked cabriole leg has every appearance of being cut from solid stock. In fastening the leg to the framework for which it is intended, any common joint may be used. As in all other forms of cabinet work, the mortise-tenon joint is the strongest, but equally good results can be ob-

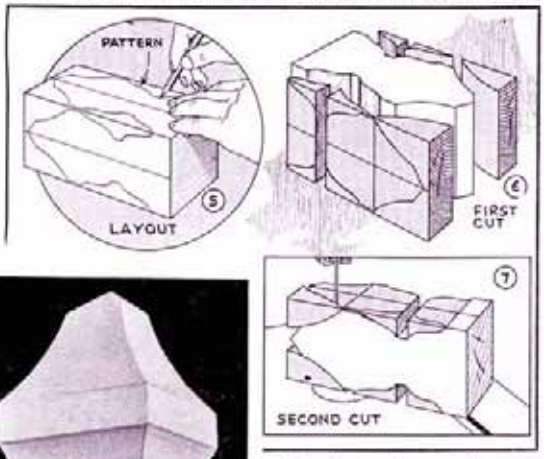


Accurate turning of balls and similar spherical objects can be done if the work is first compound-sawed to the required shape.

tained with dowelled or glued-and-screwed butted joints. Typical joint construction and leg designs are shown in the drawing on page 46.

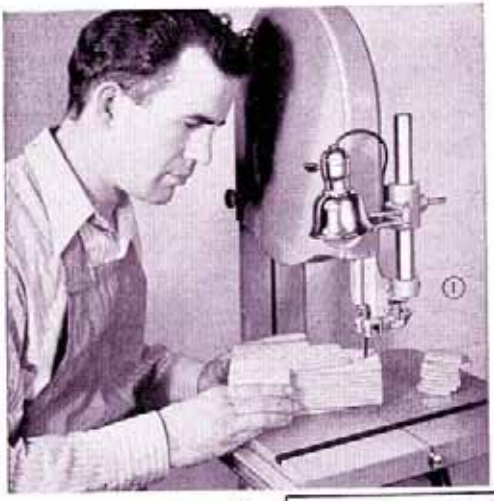
Compound-Sawed Turnings. — Good use can be made of compound sawing in preparing stock for turning. This applies especially to the turning of balls and similar work which must be worked to an exact spherical shape. Fig. 1 shows the start of the operation. The required shape, in this case a ball, is laid out on two adjacent sides of the stock. The stock must be previously prepared by jointing the opposite two sides perfectly square; also, the sides upon which the markings are made must be approximately square and smooth enough to take the pencil marks. Care must be exercised in laying out so that all centerlines will match. Sufficient stock must be left at each end of the ball shape to permit mounting in the lathe.

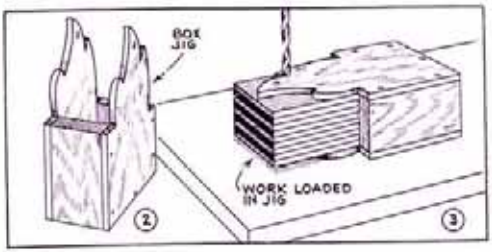
Fig. 2 shows the ball being compound sawed on the band saw. Fig. 3 shows how the ball looks after sawing. This picture shows the ridge lines of the intended ball turning being marked with pencil. These marks need not be centered but are simply very broad pencil marks blackened in on each of the four sides of the work. Turning is then carried on as usual, stopping the work frequently for examination. It is only necessary to watch the ridge lines. When the turning has progressed to the point where the ridge lines are almost removed, the turning will be practically complete, and the ball shape will be just as perfect as the original band sawed shape. Final trimming of the ball is done in a cup chuck in the usual manner employed for such work.



Drawings above show how square-cut finial at left is cut.

Ornamental Work.—A wide variety of compound-sawed ornaments can be made for finials, especially for outdoor work for post tops, rail ends, etc. Figs. 5 to 8 inclusive show successive steps in making an ornament of this kind. Fig. 5 shows the work being laid out, using a thin cardboard pattern to mark the two sides of the stock. Fig. 6 shows the work after the first two cuts have been made on the band saw. It will be noted here that the cut cannot be made in one continuous operation, yet the broken pieces are sufficient to form the base and to restore the markings for making the second pair of cuts. Fig. 7 shows the pieces bradded back in place to permit the second side being cut. After this has been done, the ornament is complete and will appear as shown in Fig. 8. Only a very light sanding should be necessary to complete the work. Where a turning of this same shape is desired, it can be seen that the square cut finial could readily be mounted in the lathe, marked with ridge lines, and turned down in the same manner as the ball already described. Where very large turnings are to be made, this is one of the best methods of working since the band saw cuts both remove waste stock and mark the turning outline.



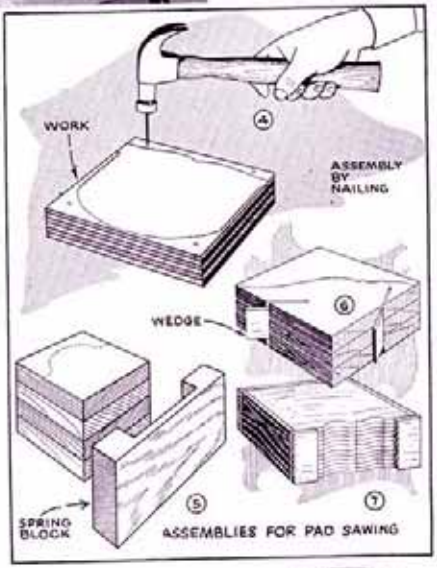


Above and right, various methods used in sawing work in multiple units.

Sawing in Multiple.— In order to save time in production work, and often as a means toward accuracy in cutting duplicate parts, wood parts are frequently sawed in multiple. The general method consists of making a pad of the work by stacking layers of lumber on top of each other. Eight or ten designs in, say ¼-inch plywood, can thus be cut in one operation.

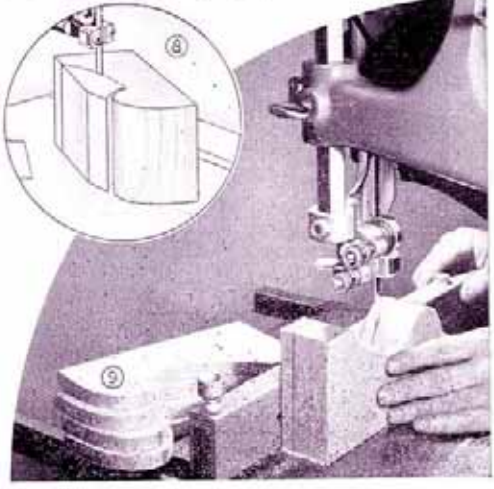
Various methods are used to hold the pad securely in place while cutting is being done. One of the best methods for production work is the box jig, as shown in Figs. 1, 2, and 3. Fig. 2 shows the jig, while Fig. 3 shows the jig loaded and the work being drilled to facilitate turning of the band saw blade. Fig. 1 shows the work being cut, the edges of the jig serving as a pattern. Fig. 7 shows another type of box jig. In this case the pattern can be a previously-cut wood template which is dropped into the box on top of the work. In another manner of working, the pattern is drawn on the top board of the pad.

For occasional work, assembly by nailing, as shown in Fig. 4, is the most convenient method of working, the nails being driven into the waste portions of the design. Fig 5 shows the manner of making up a pad with a spring block, the opening in the block being cut to such a size that it can be sprung over the work to hold the various pieces secure. Fig. 6 shows work which has been held by hand while straight saw kerfs are made. Wedges inserted in these kerfs hold the pieces secure for more intricate cutting. This method is only useful when the design has considerable waste in which the wedges can be set.

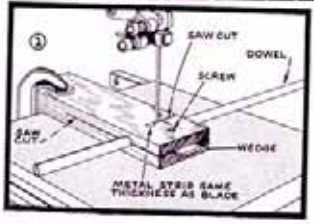


Ripping Thick Stock. — Closely related to the pad method of sawing is the "rip apart" system of sawing, as shown in Figs. 8 and 9. This is just the reverse of pad sawing. the block first being cut to shape and then ripped to thickness, producing a number of thinner duplicate parts. A light sanding is then required in order to bring the band sawed faces to a smooth surface.

The pad method is reversed when the work is first cut to shape and then ripped apart.

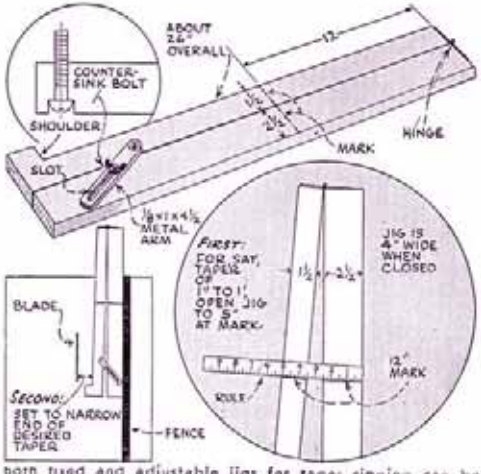


Split Dowels.—Small half-round mouldings can be made by splitting dowel rod with the set-up shown in the photo and diagram at the right. A block of wood is made up according to the sketch, being drilled with a hole the same size as the dowel stock. The block is slotted with a saw cut both ways, one cut being to control the exact size of the dowel hole, while the other admits the band saw blade. The important feature of the jig is a thin strip of metal of the same thickness as the band saw blade which is inserted through the block behind the saw blade. This strip of metal acts as a splitter. It engages the saw kerf of the dowel and guides it in a straight line, preventing the rod from spiraling, while the cut is being made. For good work, the dowel should be a neat sliding fit through the block. The drilled hole can be readily made a trifle larger by inserting a wedge in the saw kerf, or made smaller by turning down the screw. This adjustment is not to take different diameters of dowels, but simply to compensate for slight variations in any single standard size.



Small half-round mouldings can be made by splitting dowel rod as shown above and at left.

Tapering Jigs.—Jigs for taper ripping on the band saw are similar to jigs used for the same purpose on the circular saw. Jigs for individual jobs are laid out full-size on paper and then cut from wood. In use, the work is placed against the shoulder of the jig, and the jig is then pushed along the fence. An adjustable jig for cutting any degree of taper is shown in the lower drawing. This consists of two arms, hinged together at one end. A slotted metal arm permits the two wood parts to be adjusted to various openings. The wooden arms should be from 26 to 28 inches long, and the combined width of the two should equal some even dimension. Thus, in the sketch, the combined width is shown to be 4 inches. It can be seen that when the jig is opened to, say, 5 inches at the 12-inch mark, it is set for a taper of 1 inch per foot. After setting the jig,

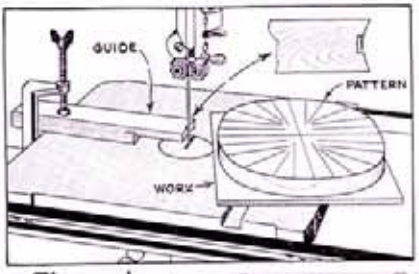


both fixed and adjustable jigs for taper ripping can be used successfully on the band saw.

Above, centering turning squares by means of diagonal band saw cuts.

upper photo. Two diagonal cuts, about ⅛-inch deep, are made, the intersection marking the center of the work while the cuts permit ready entry of the spurs of the live center.

Pattern Sawing.—Pattern sawing on the band saw, while requiring some degree of skill, is a fast and accurate method of making duplicate pieces where the curves of the work are not too abrupt. The set-up, as shown in the center diagram, consists of a wooden arm which is clamped to the saw table. This arm is cut away on the underside so that the work will be free to slip below it. The end of the arm is cut away in a hollow curve, the radius of the curve being approximately the same as the slowest curve on the work being cut. The end of the arm is also nicked with a shallow cut to take the saw blade. A pattern cut to the required shape is necessary. This is fitted with anchor points so that it can be fastened to the piece of wood which is to be cut. The pattern is then pushed into the saw until it comes to rest on the end of the wood arm. It is kept in continuous contact with the arm while the various movements to feed the work to the blade are being made. Properly done by this method, the work is cut to the same exact shape as the pattern. Even in unskilled hands, this method gives very good results. There is no danger of cutting too deep. The only miscue that can be made is to cut the work too large, necessitating back tracking to get back on the line. For perfect work, the pattern must be kept tangent to the arm at all times. As an aid to doing this, some workers mark radial lines on the pattern. As the work is swung around, each of these lines is



the regular band saw fence is adjusted so that the distance between the jig, measuring from the inside of the shoulder, is equal to the narrow end of the desired taper. The work is then placed in the jig and advanced to the saw.

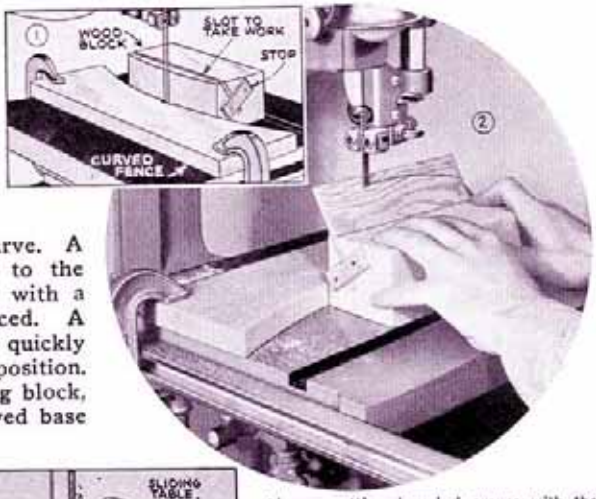
In cutting legs and similar work where the taper is on all four sides, the jig is first set for the required taper as before. Two adjacent sides of the leg are then tapered. The jig is then opened to twice the required taper to compensate for the two sides already tapered, and these sides are then placed against the jig and the remaining two sides are cut.

Pattern sawing on the band saw offers a quick and accurate method of cutting duplicate parts. The drawing shows the set-up.

Marking Squares for Turning.—Turning squares can be conveniently marked on the band saw by making up a suitable vee block, running a saw cut down through the center to permit the blade to work exactly in the center of the vee cut. The width of the block should be such that when the fence is placed at some even dimension on the guide bars, the vee block will be centered with the blade. Work to be center-marked is placed on the vee block and advanced to the blade, as shown in the

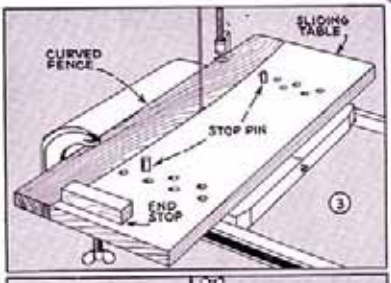
brought in line with the wood arm, thus maintaining the proper point of contact.

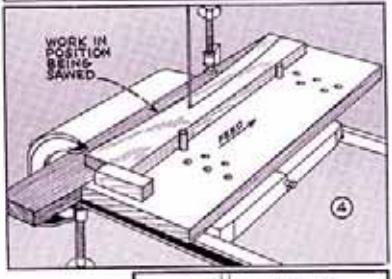
Production Jig for Beveled Curves.—Figs. 1 and 2 show a useful and accurate jig for cutting beveled curves, such as are required in making chair panels. The jig consists of a base, which is cut to the radius of the desired curve. A sliding block, with one edge cut to the same radius as the base, is fitted with a slot into which the work is placed. A stop block nailed to the block quickly locates the work at the required position. With the work loaded in the sliding block, the block is pushed along the curved base to make the cut.



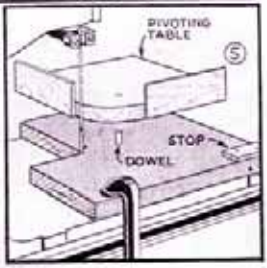
Above, cutting beveled curves with the aid of a sliding jig.

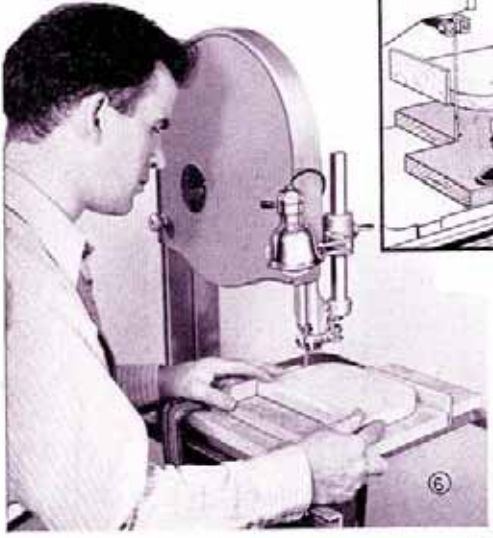
Jig for Circular Arcs. — Where the work is to be cut on a curve but is not to be beveled, a somewhat similar jig to the one just described can be used. As shown in Fig. 3, the base piece or guide is cut to the radius required. The sliding portion of the jig is cut to the same radius, and is fitted with stops to quickly locate the work in the proper position. Work to be cut is simply loaded in the jig and pushed forward to the blade. Working with wide stock, the stop pins are set over for each succeeding cut until the stock is used up.





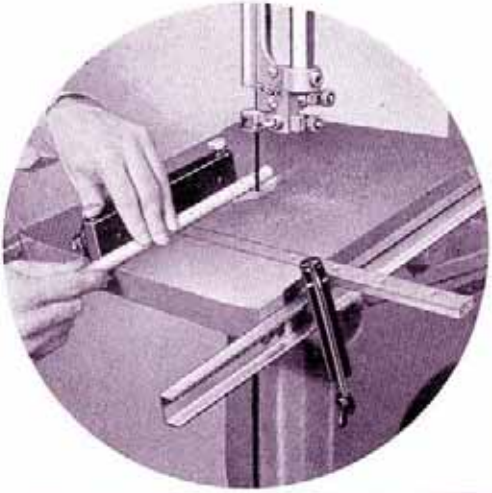
Corners can be band sawed to any radius with the simple jig shown below.





Corner-Rounding Jig. — Corners can be quickly rounded with the simple jig shown in Figs. 5 and 6. This consists of an auxiliary wood table upon which is pivoted a second and smaller table. Work is loaded into the jig and rotated into the saw blade to cut the corner to a perfect round. Any desired round can be cut by adjusting the pivot pin at the proper distance from the band saw blade.

Spiral Dowels. — Spiral dowels, which are preferred by many craftsmen for their superior holding power in glued dowelled joints, can be readily made on the band saw, as shown in the upper photo on the following page. The table is tilted fifteen or twenty-degrees, and the miter gage is clamped securely in position. The position of the miter gage should be set at such a distance from the band saw blade as to cut the required depth of groove. The work is then placed against the gage. The rod should be held firmly in the hand. It will feed itself in a perfect spiral, but the feed must be controlled to prevent the rod from being twisted along the gage faster

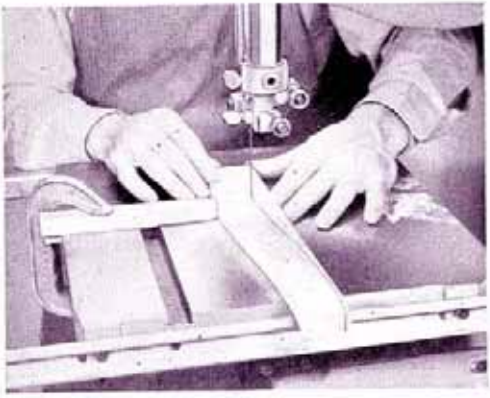


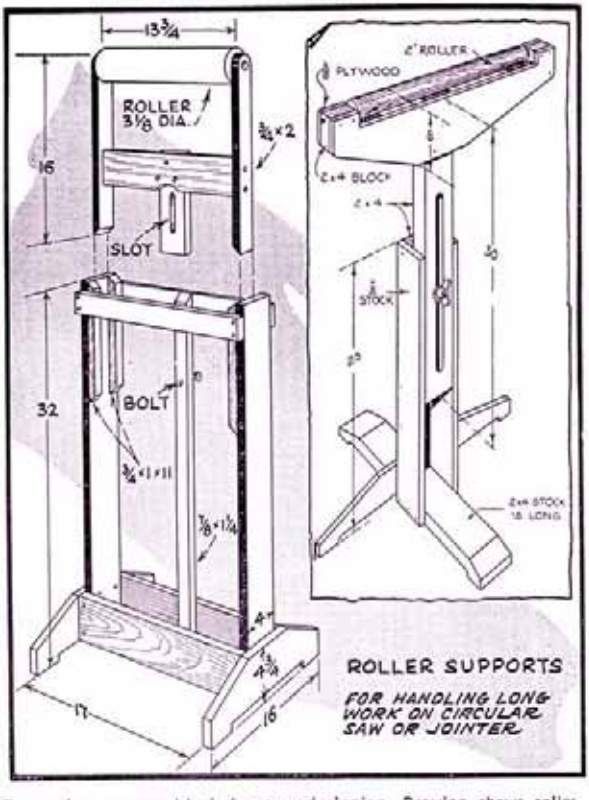
Spiral dowels, useful for glue work, can be cut by tilting the table and running the rod against the miter gage.

than the blade can make the cut. This same idea can be used successfully for spiral turnings in marking the spiral and cutting the bottom of the groove. Where production warrants, proper table settings for cutting full vee-grooves could readily be determined. In this case, of course, the second and third cuts would be made with a guide pin engaging the first cut, the method of working being much the same as described in the circular saw handbook.

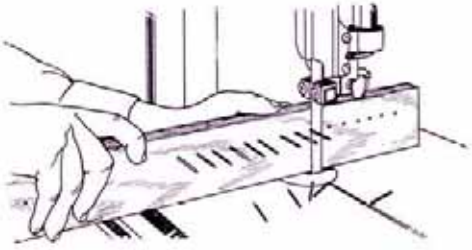
Ripping Pin.—Curved work which is to be ripped to an equal width throughout its length can be cut with the aid of a ripping pin in much the same manner as used for straight ripping. The set-up is shown in the center photo. One edge of the work is first cut to a pencilled line. The ripping pin or block is then set at a distance from the blade equal to the required width of the work. If the work is guided against this pin and kept at right angles to it, the other edge of the work can be ripped to the same curve and at a uniform distance from the first edge. This is particularly useful for some classes of work where perfect accuracy is not required.

Roller Supports.—Roller supports, commonly used in circular saw and jointer work, are frequently useful in the handling of long work on the band saw. The two units shown can be made up from standard sizes of wood stock. Adjustments should be provided so that the roller can be extended to 42 or 44-inches, whatever the height of the saw table happens to be. This is about the highest table in the shop. A full range of adjustments, down to the low table of the shaper, should be provided for if the support is to be used for all machines. A support of this kind is almost a necessity for handling long work in the one-man shop.





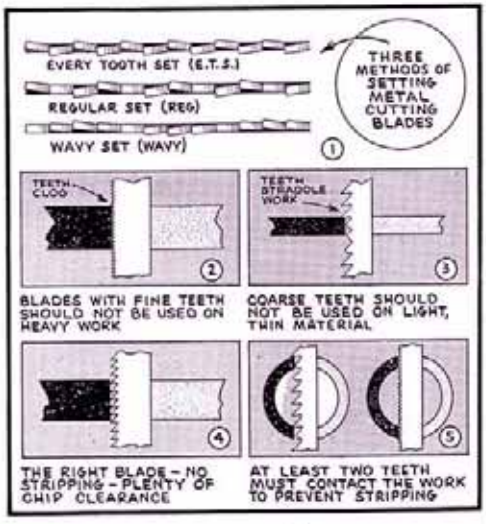
Top, using a gage block for curved ripping. Drawing shows roller supports which are often useful in handling long work.



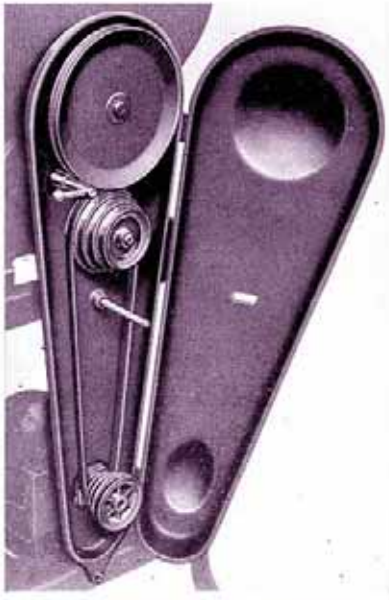
CHAPTER FOUR

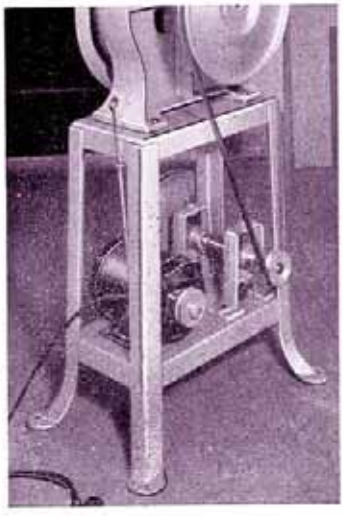
METAL CUTTING

Metal Cutting Blades.—Blades for metal-cutting are much finer-toothed than blades for cutting wood. A good selection for the small shop would be saws with 14, 18 and 24 teeth (not points) to the inch. The coarser toothed blades are excellent for the softer metals, such as copper, brass, aluminum, etc., while the 24-tooth blade is better for cutting thin sheet stock in any metal. Most metal blades are hardened and tempered, making it impossible to resharpen them with any equipment within the reach of the small shop. The life of a new blade, however, is quite long. When dull, the blade should be discarded.



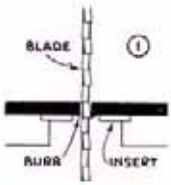
Three different styles of set, as shown in Fig. 1, are commonly used for metal cutting blades. Blades with every tooth set, alternating right and left, are similar to wood-cutting blades. This style of set is used for cutting all of the softer metals. "Regular" set blades have one unset raker tooth to each pair of set teeth, the raker tooth serving to keep the cut clean. This style of set is used for cast iron, cold rolled steel, monel metal, etc. The "wavy" set blade has teeth set in groups, one set of teeth forming a wave to the right, while the next set forms a wave to the left. This style of blade is extensively used for cutting thin metals, such as pipe, metal tubing, radiator cores, etc. For average work, regular set blades should be used. A blade intended for cutting soft metals cannot be used for sawing high speed steel, while the blade intended for sawing high speed steel will do very good work in soft metals.





Above, proper use of metal cutting blades. Photos show slow speed units for metal cutting.

The most important consideration in blade selection is the number of teeth per inch. As diagrammed in Fig. 2, a fine-tooth blade will clog and refuse to cut heavy materials. Exactly opposite to this, a coarse-



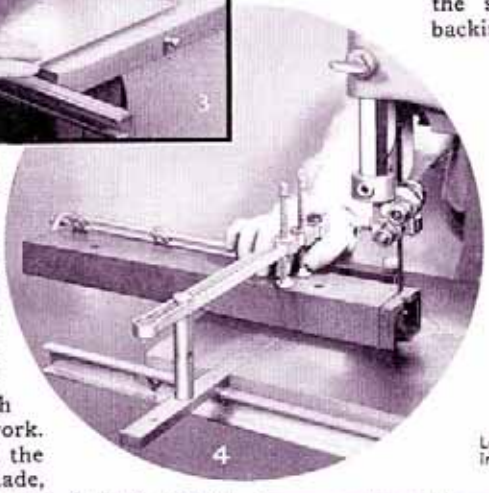
Above, using an auxiliary wood table to prevent burring of thin metal.

tooth blade will straddle thin material, with the result that the teeth are broken out and the blade ruined in a short time. The right blade should have from 8 to 12 teeth in contact with the work. The coarser the teeth, the faster the cut can be made, but at least two teeth, Fig. 5, must contact the work in order to prevent stripping.

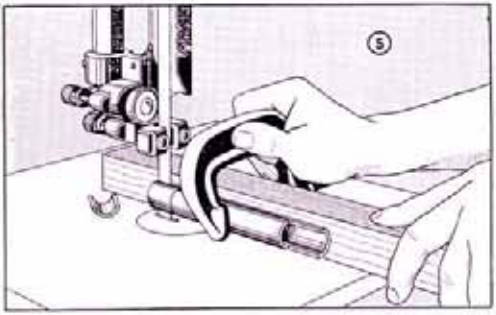
Slow Speed Essential.—While the wood-cutting band saw blade can turn at a speed up to 2,200 feet per minute, the metal blade on the same machine should not be operated at speeds in excess of 330 F. P. M. Operated at high speed, the teeth of the metal saw are simply burned away through friction with the metal. The necessary slow speed for metal cutting can be obtained by either of two standard methods of speed reduction — back-gearing and countershaft. The countershaft unit, as shown in the lower photo on the previous page, can be fitted to almost any standard band saw, and is so arranged as to retain the required high speed for wood cutting while offering the necessary slow speed of 90 revolutions per minute for metal cutting. The back-geared band saw is especially designed for cutting metals, with built-in gearing which permits of a range of four slow speeds—125, 175, 250 and 340 feet per minute—while a simple change of belts gives a 2,200 F. P. M. speed for wood.

Cutting Thin Metal.—Despite the use of a fine-tooth blade, thin metals will invariably burr on the underside of the cut, as shown in Fig. 1. This is especially noticeable when the softer metals are being cut, and is caused by the light body of metal being improperly supported at the point of cutting. This burring can be avoided and clean cuts made if an auxiliary wood table, through which a saw cut is run, as shown in Fig. 2, is used. When the metal is cut on this table, as shown in Fig. 3, it is fully supported at the point of cutting and the underside of the work shows a clean edge.

The principle is very much the same as that used in backing up holes in drilling with the drill press. Other methods are employed to the same end. The metal can be glued to a wood base or sandwiched between two boards to obtain the necessary support. This method of backing is impossible when thin-wall tubing is being cut, and in this case it becomes necessary to plug the tubing



Left and below, simple clamping methods simplify task of feeding work to saw.



with dowel rod if clean cutting is required. It is usually simpler, however, to let the work burr and then clean out the opening with a reamer.

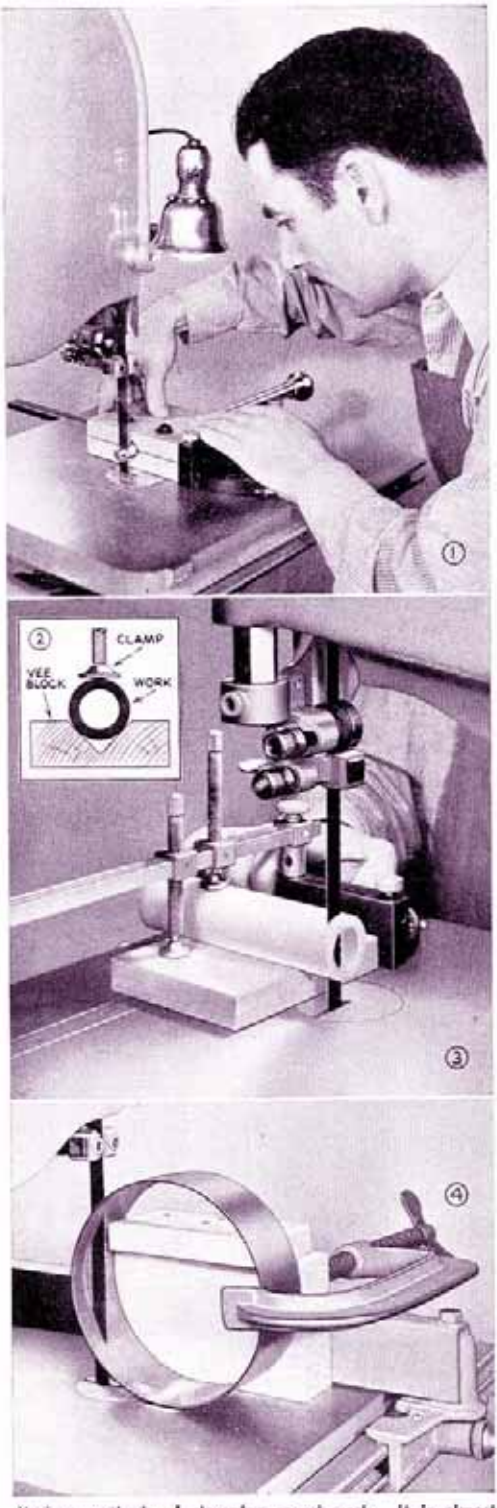
Methods of Clamping.—Clamping is used extensively in cutting metal. This is sometimes absolutely necessary, such as in cutting tubing or pipe, while in other cases clamping is employed only to simplify the work. Metal cutting is comparatively slow work, and very often a simple clamping device will eliminate the strain of holding the work for freehand cutting. As in cutting wood, good use can be made of both the ripping fence and miter gage, together

with the stop rod and miter gage clamp attachment. Fig. 4 on the opposite page shows a typical operation where a length of channel iron is being cut to exact size. The stop rod sets the length, while the use of the clamp attachment relieves all operating strain as the cut is being made. Another example of simple clamping is shown in Fig. 5 where a section is being cut out of the end of a piece of pipe.

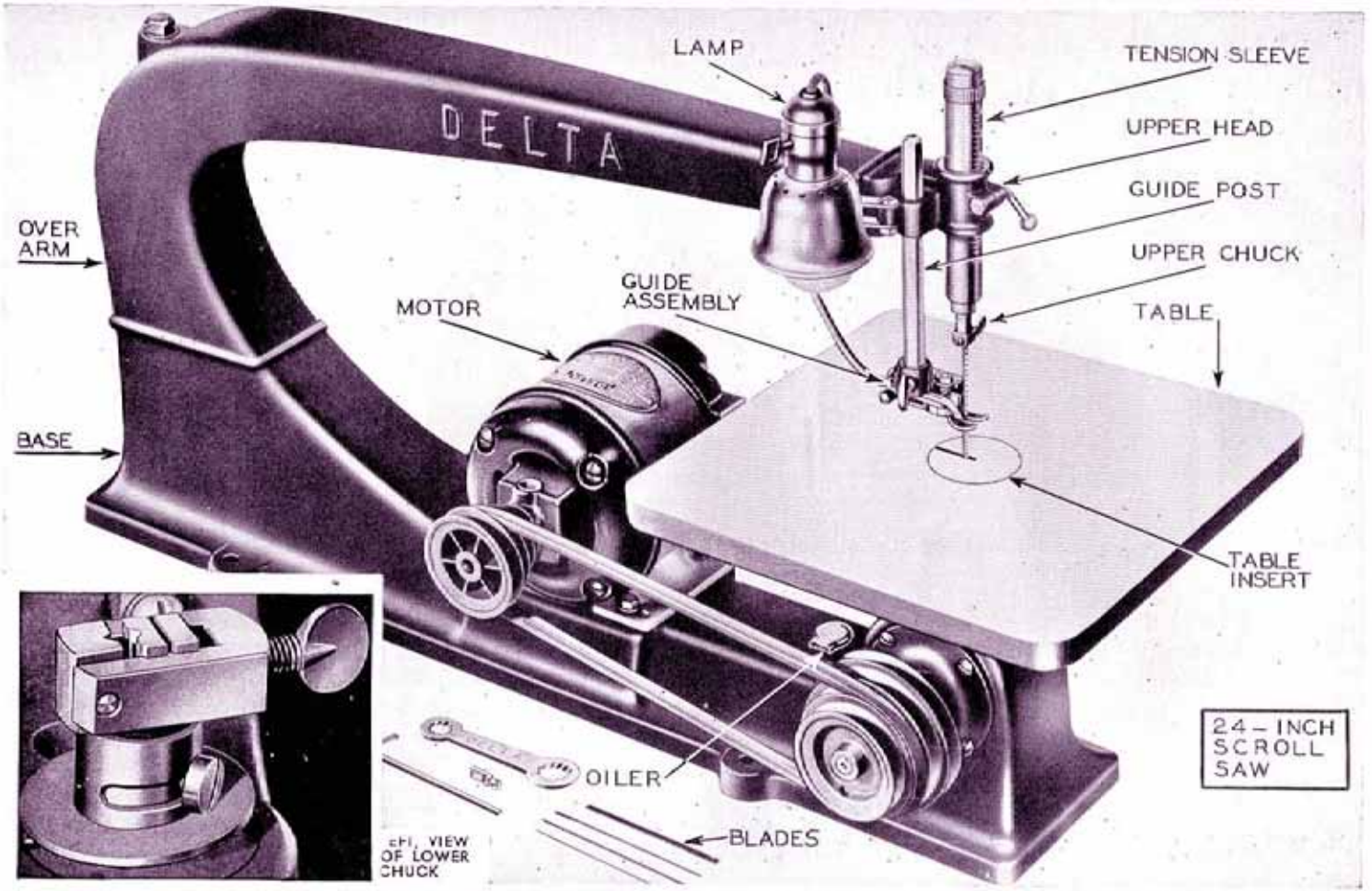
Cutting Round Material.—Round material, both solid and tubular, including plastics, pipe, thin tubing, etc., should always be clamped securely for sawing. This applies especially to tubing, which is almost impossible to hold freehand against the constant drag of the saw. A simple vee block, in some form or other, is the most commonly used clamping device. Fig. 1 shows a double vee block provided with through bolts for clamping the work in place. This style of block can be made up to accommodate a wide variety of sizes, and it possesses the advantage of permitting a freehand feed which is sometimes necessary because of the shape of the work. A single vee block used in combination with the miter gage clamp attachment is shown in Fig. 3 and diagrammed in Fig. 2.

Special clamping is necessary for larger sizes of tubing. This need not be complicated, but must securely clamp and support the work. Fig. 4 shows how a large brass cylinder can be clamped for sawing. The work is clamped securely to a length of wood, the clamp being located at the rear end where its pressure will not cause the saw to bind in the cut. To prevent the work from turning and to offer a support to keep the cylinder from being crushed out of shape, a piece of wood is fitted tightly inside the cylinder, this supporting block being nailed to the other piece of wood. The whole unit is held against the regular band saw fence and advanced to the blade. These methods are not production shop set-ups, but are simply the makeshift set-ups used in occasional homeshop work.

Sawing in Multiple.—Metal pieces can be sawed in multiple by using the same general methods as described for wood cutting (see page 22). In some special cases where these methods are not practical, the various blank pieces can be soldered together, either by tacking or sweating. The assembled pad can then be sawed, drilled, ground, etc. as one unit, the pieces being finally separated by the application of heat. This method is especially useful for precision work where a number of exact duplicates must be made.



Various methods of clamping round work. It is almost impossible to feed metal cylinders without clamping.

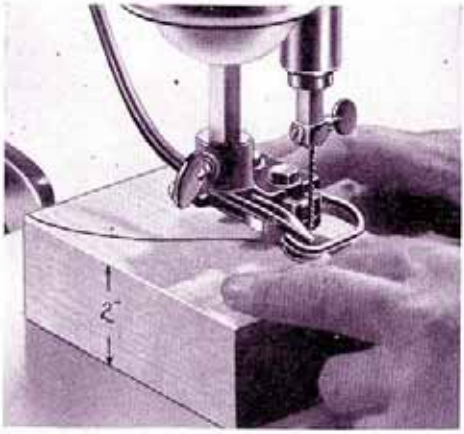

DELTA
LAMP
TENSION SLEEVE
UPPER HEAD
GUIDE POST
UPPER CHUCK
TABLE
OVER ARM
MOTOR
GUIDE ASSEMBLY
BASE
TABLE INSERT
OILER
BLADES
24 – INCH SCROLL SAW
CH, VIEW OF LOWER CHUCK

CHAPTER FIVE

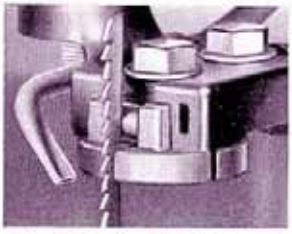
THE SCROLL SAW

Construction.—The heart of the scroll saw is the crankshaft—an ingenious mechanical arrangement that converts "round-and-round" into "up-and-down." This part of the machine must be precision-balanced if the machine is to run at high speed without excessive vibration. Apart from the driving mechanism, the scroll saw resolves itself into a quite simple machine by simply attaching a blade to the moving plunger and fitting a table around the blade upon which the work can be supported.

Size.—The name size of the scroll saw is generally expressed in terms of the throat opening, that is, the distance between the blade and the support for the upper arm. Thus, 24-inch scroll saws, a common size, measure 24 inches from the blade to the front edge of the upper supporting arm. A machine with 24-inch throat capacity will cut to the center of a 48-inch circle, while provisions are made on some saws for extension arms which permit the handling of much larger work. Another important index to size is the cutting capacity—the thickness of stock which can be cut on the machine. This generally averages about 2 inches, which is as heavy as the mechanical structure of the saw can cut successfully.



Two inches is the cutting capacity of the average scroll saw, which is ample for most work.



The guide offers both side and back support for the blade.

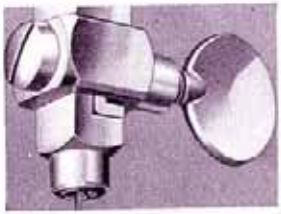
A convenient star wheel is turned to permit tilting the table.

The spring hold-down can be adjusted to match tilt-table settings

Power and Speed. — Very little power is required to operate the scroll saw. A good ¼ H. P. motor is ample for average cutting, while ⅓ H. P. will give plenty of power for heavy, continuous duty. In either case, the motor should be constant speed, 1725 R.P.M. Properly coupled with cone-pulleys, the saw will have four speeds approximating 650, 1,000, 1,300, and 1,750 R. P. M.

Universal Guide.—The scroll saw guide serves the purpose of guiding and supporting the blade during the course of cutting. Since a wide variety of blades and attachments are used on the machine, the guide is generally of the universal type, as shown in the center upper photo, which permits of a wide range of adjustments to accommodate various blades sizes. A full description of proper guide setting is given on page 34.

Table Adjustments. — The table of the modern scroll saw has two main adjustments — it can be tilted to permit bevel cutting, and, it can be rotated to give clearance space when handling large work. The most-used of these adjustments is the tilt, usually controlled by a knob under the table, as shown in the center photo, which is loosened to permit the table to swing on trunnion mountings. A scale is usually provided, which, after once setting at zero with the table perfectly square with the blade, will accurately register any degree of tilt up to 45 degrees either right or left. This same picture shows in the foreground one of the two capscrews which are loosened to permit the entire table mounting to be swivelled



Above, self-centering chucks are convenient for mounting fine blades. Right, individual guides for the scroll saw.

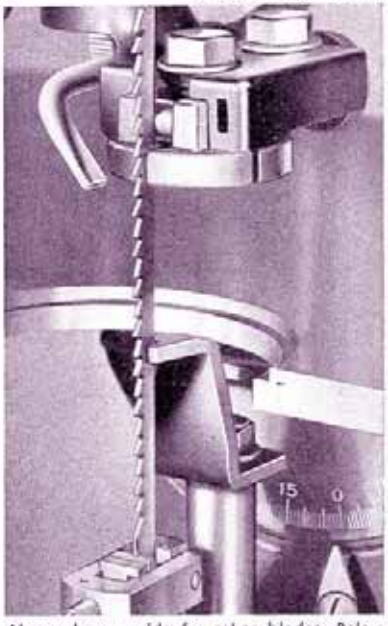
through 90 degrees. No arrangement is made for tilting the guide to match the tilt of the table, but an adjustment is provided, as shown in the lower photo on the previous page, for tilting the spring hold-down so that it will contact the work evenly.

Special Chucks. — The chuck is the small vise which is attached to the plunger, its purpose being to clamp the blade in position. The average machine has two chucks, one on the end of the driven plunger, and another on the end of the upper plunger. Some blades are held at either end in both chucks, others are held by the lower chuck only. In addition to the standard chucks, self-centering chucks for both upper and lower plungers are frequently useful where fine blades are used extensively.

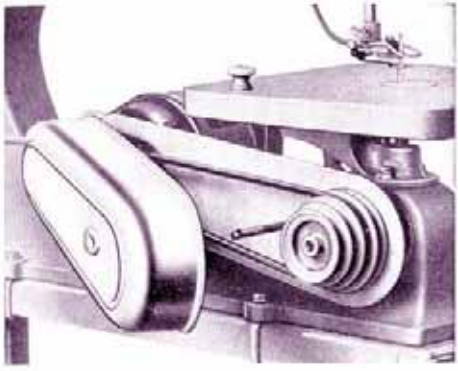
Special Guides.—While the universal guide will successfully handle practically any blade, special guides designed to fit one particular blade are often useful. Complete sets of these guides, as shown in the center drawing, are available for most saws and are preferred by many workers. Another special guide is shown in the photo at the right. This guide is fitted below the saw table, its purpose being to support saber blades. Used in conjunction with the upper guide, it enables perfect straight-line work to be done, as there is no opportunity for the blade to spring. In some special cases, but only where an extremely stiff blade is used, the lower guide can be used alone as a support for the blade. This is often useful in cutting odd-shaped work which will not fit below the upper guide. It will be apparent, however, that the top of the blade will have a tendency to weave in the cut if heavy cuts are attempted. The best use for this method of working is where the cut is thin but the body of the work heavy, as, for example, a wood or metal tube. This may be of such a size that it cannot be worked below the guide, yet the cut can be made by sawing around the cylinder with the blade supported by the lower guide only.

Belt Guard.—Worthwhile accident protection is afforded by the belt guard shown in the lower photo. This is a metal casing which completely surrounds the pulleys and belt. The outer casing is hinged at the rear so that it can be instantly swung out to permit belt changing. Belt guards for all machines, while adding immeasurably to the safety of operation, also give a more finished appearance to the machine.

Scroll Saw Seat.—Many operations in scroll sawing can be done more conveniently if the operator is seated. The simple unit shown answers the purpose fully, yet it can be readily swung out of the way when not necessary. Looking at the construction, the most important thing is the "break" in the supporting arm.

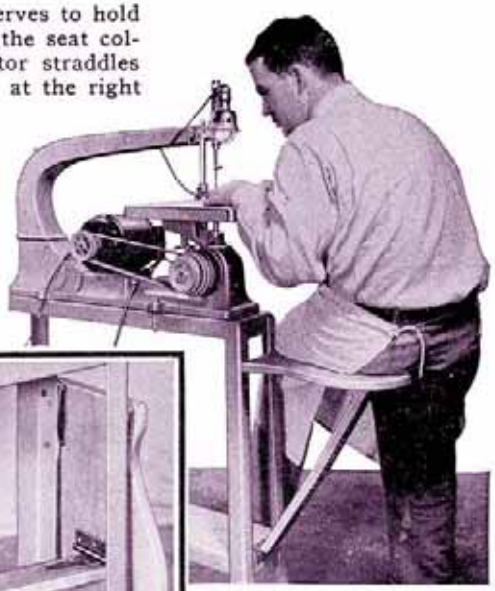


Above, lower guide for saber blades. Below, a belt guard is good safety insurance.

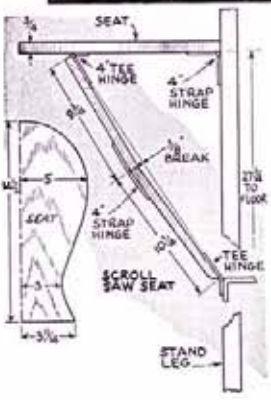


about ⅜ inch, as shown in diagram. This serves to hold the seat rigid, eliminating any possibility of the seat collapsing when in use. Ordinarily the operator straddles the seat. The "side saddle" position shown at the right is intended simply to better show the seat in use.

The seat itself is made from ¾-inch stock, with the upper corner neatly rounded all around on the shaper or drill press. If desired, the edge can be simply rounded over with sandpaper. Some operators will prefer to use a rubber seat pad, and, in this case it will not be necessary to machine the edges of the seat. All hinges are standard strap and tee, easily procured at any hardware store. Fastenings can be either bolts or rivets. If bolts are used, the nuts should be tightened over lock washer so that they will "stay put." Besides being useful on the scroll saw, the same type of seat can be readily adapted to many other machines where the nature of the work permits the operator sitting down.

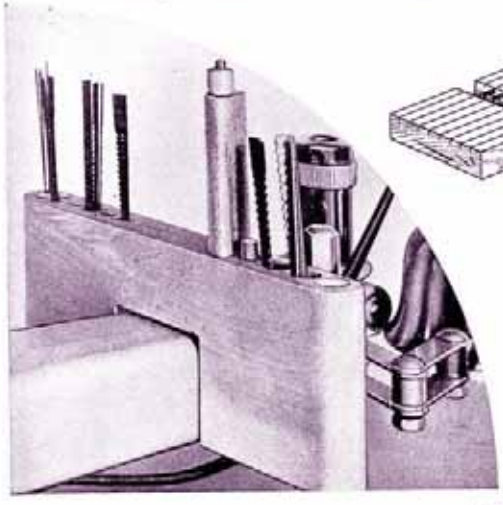


This simple scroll saw seat can be easily swung out of the way when not in use.



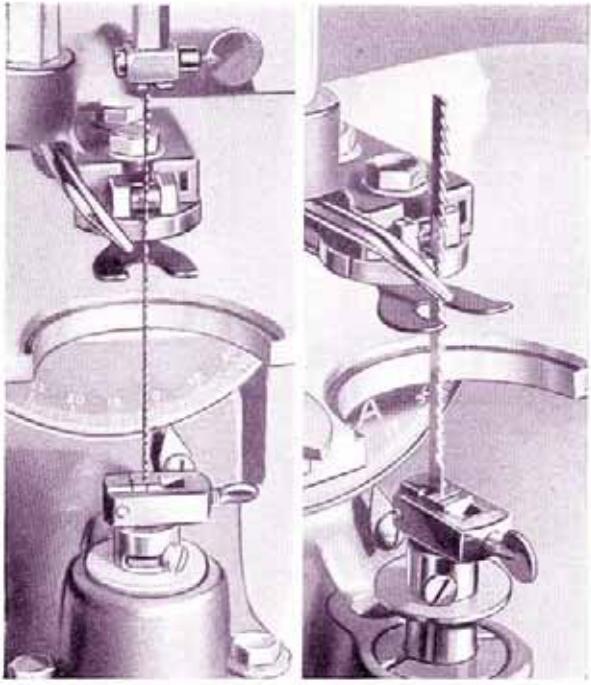
Blades. — Many different sizes and styles of blades are supplied for the scroll saw. All blades, however, readily classify themselves into one of two main divisions — (1) blades which are gripped by both upper and lower chuck, commonly known as jeweler's blades, and (2) blades which are held in the lower chuck only, known as saber blades. The jeweler's blades are useful for all fine work where short curves predominate, while the saber blades are faster-cutting tools for heavier materials where curves are not too abrupt. Jeweler's blades can, of course, be used successfully in heavy material up to the full capacity of the saw. The larger sizes of jeweler's blades are very near to the same dimensions, in both gage and width, as the smaller sizes of saber blades.

Below, blade holders for both machine and bench use are easily made to hold a variety of blades



Blade Racks. — Because of frequent change of blades, some form of rack to hold the commonly used sizes is a great convenience in scroll saw operation. A suitable blade holder for bench use can be easily made by running a number of saw kerfs through a suitable piece of ¾-inch stock, as shown in the drawing. Another form of rack consists of a length of ¾-inch stock, notched to fit over the upper arm, and drilled with a number of holes to receive the various blades and accessories.

Fitting Blades.—Jeweler's blades are held between the **flat** jaws of both upper and lower chuck; saber blades are held between the **vee** jaws of the lower chuck only. The exact method of mounting should be appar-

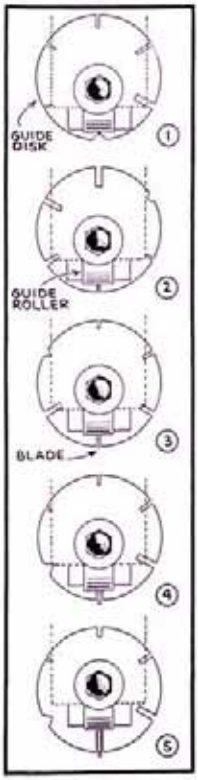


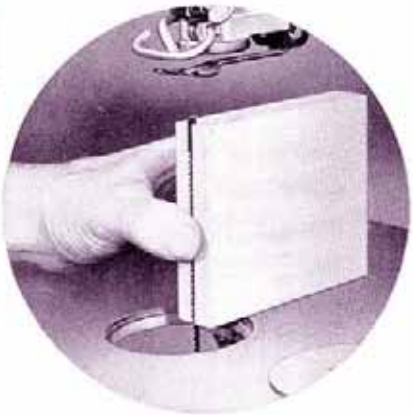
Jewelers blades are held in both upper and lower chucks while saber blades are held in the lower chuck only and always between the vee jaws of the chuck.

ent from the photos shown at the top of the page. It will be noted that when saber blades are used, the lower chuck must be turned around. This is easily done by loosening the set screw which holds the chuck, swinging the chuck over, and then retightening. The saber blade will naturally align itself in relation to both table and guide, but there is some chance of mis-alignment in mounting jeweler's blade. This, while never serious, can be avoided and the blade mounted quickly if a guide block is used, as shown in the photo in circle. This consists of a wood block in which is cut one or more saw kerfs. With the block held on the scroll saw table and the blade held in the kerf, proper alignment in both upper and lower chucks is assured.

Adjusting Guide. — The universal guide consists of two parts: (1) a disk which guides the blade, and, (2) a roller which supports it. Both of these parts can be seen in the two upper photos. The disk has a number of slots around its rim, these being of different widths to fit various blades. The slot selected should be neither too loose nor too tight. The disk is adjusted to bring any slot to the front by loosening the screw which holds it in place and turning the disk to the required position. In regards to the width of the blade, the guide is set so that the forward edge of the disk is just behind the bottom of the blade teeth. The roller support is worked independently, and should be moved forward until is just **lightly** touches the back of the blade.

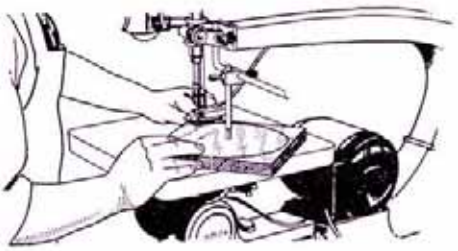
No matter what the thickness or the width of the blade, a slot and a roller position can be found that will guide it correctly. Figs.





Above, a simple device for aligning blades. Left, various settings of disk guide and roller to accommodate different blade sizes.

1 to 5 illustrate this point clearly. The vee notch on the rim of the disk is used for very fine blades, as shown in Fig. 1. Blades of such small size work just as well without a guide, and the guide is often removed entirely, the tension of the blade itself being sufficient to guide it. The vee notch, if used, is not really a guide but simply a back support since the very fine blade is not wide enough to afford any appreciable rudder. Fine blades have a tendency to drift in the cut, and must be worked slowly, both as regards the speed of the machine and rate of feed.

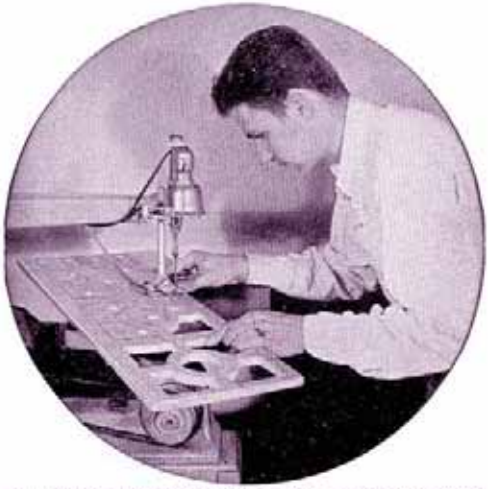


CHAPTER SIX

SCROLL SAW OPERATIONS

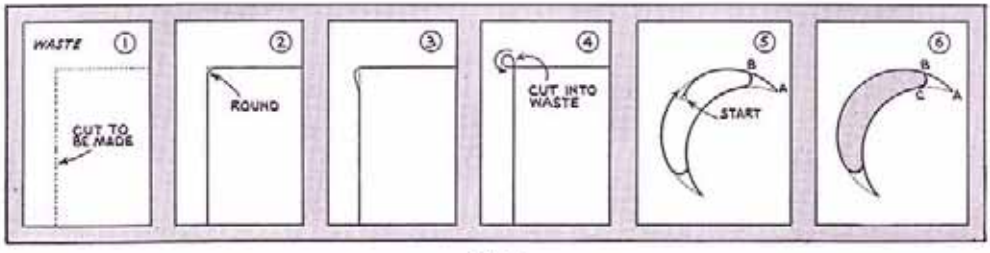
Position of Operator.—In average work, the operator takes a natural position, either standing or sitting, at the front of the table, with the blade facing toward him, as shown in the upper photo. Where the work is of such a length that it will strike the upper arm before the cut is completed, cutting from the side is necessary. Side cutting requires that both the upper and lower chuck be turned around, this being easily done by simple adjustments on most machines. On some machines, the table must be rotated so that the groove in the table insert will center around the blade. For occasional work, however, the insert is usually laid aside and the table used in its regular position.

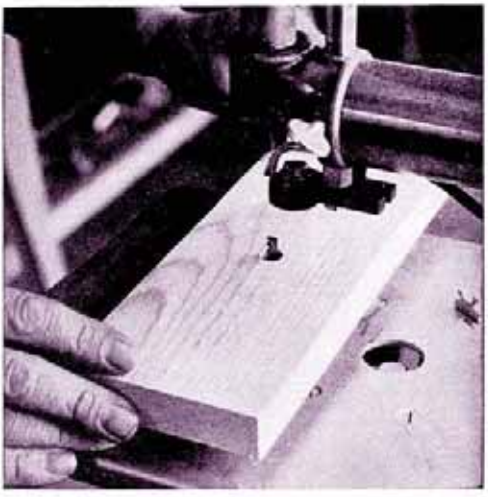
Technique of Cutting.—The technique of cutting with scroll saw blades follows much the same practice as used on the band saw. Because of the fine blades used, however, there are a few additional points worth noting. The first of these concerns the cutting of an inside square corner, as shown in Fig. 1. In one method of cutting, the fine blade is turned directly at the corner, as shown in Fig. 2. This gives a very slight round to the corner, the degree of rounding depending upon the size of blade used. Turning in this manner is often necessary in some work, and the slight round is usually no detriment to the work. In another method of cutting, the cut is slightly jogged at the corner, as shown in Fig. 3. This permits a perfectly square corner, but has the disadvantage that the bulge must be later smoothed by sanding or filing. Fig. 4 shows yet another method, where the blade is run out into the waste stock and turned completely around so that the blade can enter at right



For average work the operator takes a sitting or standing position at the front of the table, with the teeth of the blade pointing towards him.

Above, using a side feed for long work. Drawing below shows technique of cutting inside corners.





Pierced work is readily slipped over the saber blade, which is held in the lower chuck only.

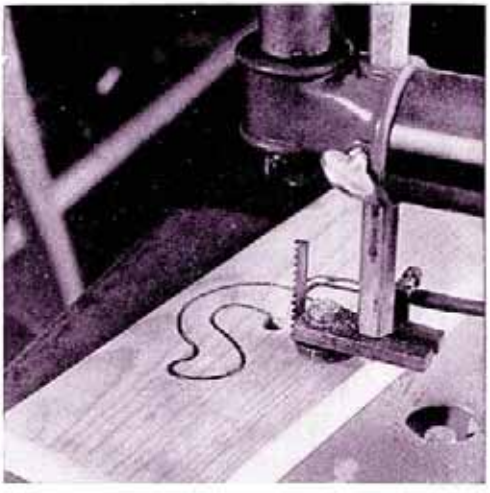
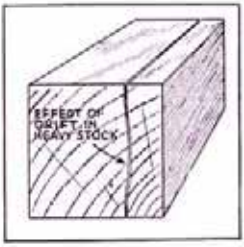


Photo above shows cutting with a saber blade, and is a fair index of the cut radius of the average blade.

angles to the first cut. All of these methods are good, the selection depending upon the nature of the work.

Fig. 5 shows a variation in scroll saw technique in the cutting of acute corners. The cut is started at any inside point, as shown in Fig. 5, and proceeds to point A. The blade is then backtracked to B to permit running over to the other line, this being the same technique used in band saw cutting. The difference comes in cleaning out the corners, as shown in Fig. 6. Where the band saw worker would clean the corner by cutting directly from C to A, the scroll saw worker often prefers to **back** into the cut from B to A, until the back of the blade comes to A, and then cut from A to C. This gives a perfectly clean corner, whereas the meeting of two cuts often shows a ragged point.



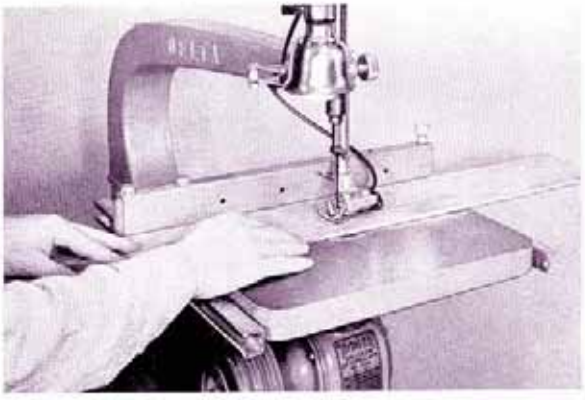
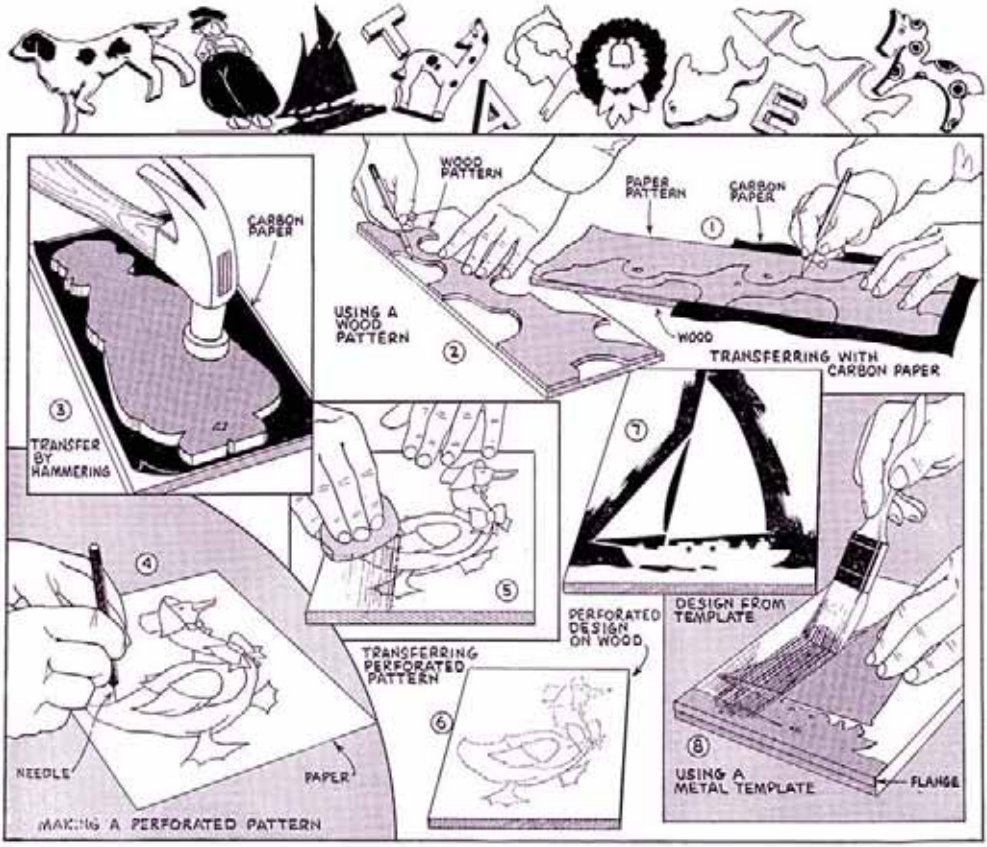


Diagram shows effect of drift when cutting heavy stock with a fine blade. Photo above shows saw fitted with ripping fence.

Using Saber Blades. — Saber blades can be used for a large portion of all scroll saw work, and should be used where possible because of their faster-cutting action and simplicity of jumping from one opening to another in pierced work. Where the cut is inside, a starting hole must be drilled, as shown in the left photo above. The guide is then lowered and the work cut as required, the right photo giving a fair idea of the turning radius of such blades. It should be noted that saber blades are mounted between the vee jaws of the lower chuck; not the flat jaws. Wide saber blades and not thin jeweler's blades should be used in cutting heavy stock. The thin blade, even at full tension, will often drift when making the cut, giving an effect similar to that shown in the diagram. If jeweler's blade must be used on heavy stock, select a blade of generous body.

Ripping Fence.—While intended primarily for curve-cutting, the scroll saw can be used successfully for ripping when the shop is not fully equipped. The photo at left shows how the standard band saw fence can be fitted for such work. Holes must be drilled in the table, of course, to permit mounting the guide bars.

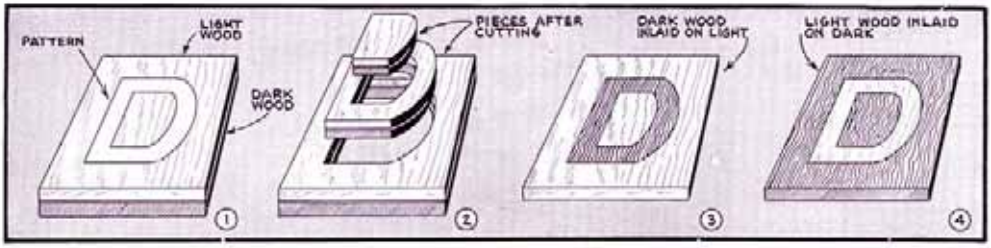


A number of different methods can be used in transferring any required pattern to the wood stock. Carbon paper and wood patterns are used for short runs, while perforated patterns and metal templates are best for production work.

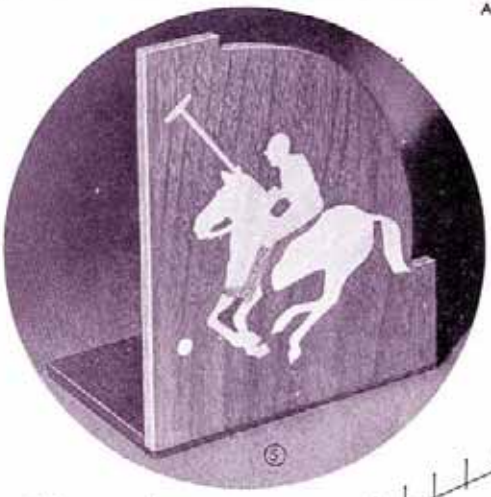
Transferring Patterns. The first and one of the most important steps in cutting any shape from wood is the job of marking the pattern shape on the wood stock. In any method of working, it is first necessary to make a full-size paper pattern of the work, either by the common method of enlarged squares or by the use of a projector. This paper pattern can sometimes be mounted directly on the wood as a guide. Where this is not practical, the simplest method of transferring is with carbon paper, as shown in Fig. 1. After the first piece has been cut, it can be used as a pattern in marking other pieces, as in Fig. 2. Where the work is small, the transfer can be quickly made by hammering a wood pattern over the work, with a sheet of carbon paper between, as shown in Fig. 3. This gives a clean outline, but is only useful for small work.

Where many similar pieces must be cut, tracing each piece becomes too slow and some faster method, such as the perforated pattern, must be used. A perforated pattern is made by first pencilling the design on a sheet of thin, tough paper, and then going over the entire design with a fine needle, punching holes at intervals of from $\frac{1}{16}$ to $\frac{1}{8}$ inch as required, as shown in Fig. 4. The pattern is then placed on the wood stock and the transfer made by rubbing with transfer ink on a cloth pad or sponge, as shown in Fig. 5. Another stain which can be used is asphaltum paint. This should be quite thick, being picked up and diluted as required with a sponge dampened with benzine. Transferring can also be done with a powder composed of two parts of powdered rosin to one part of dry lamp black. This is beaten through the perforations in the pattern by patting with a piece of hard felt. Application of heat is necessary to melt the rosin and thus fix the pattern. This method is used extensively for making up a number of duplicate paper patterns, which are, in turn, gummed directly to the work. Fig. 6 shows how a perforated design looks after transferring.

Another production method is the use of



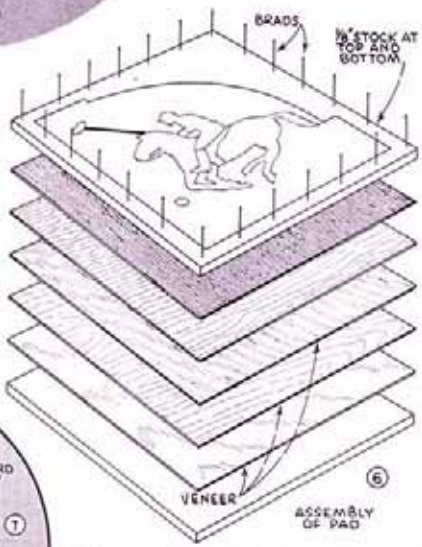
Above, principle of inlaying. Photo at left shows how inlay work looks when finished.

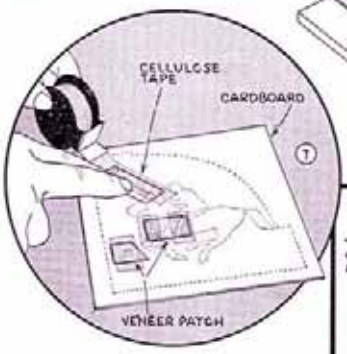


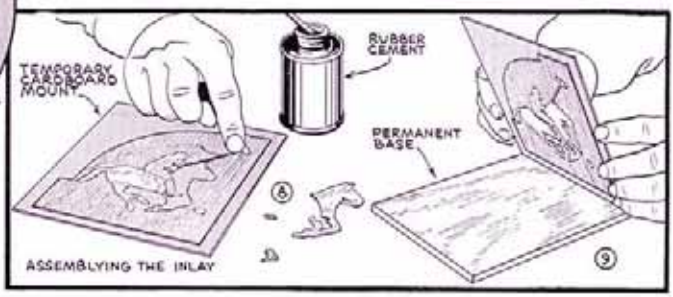
enough color to do the marking. Fig. 8 on the previous page shows the pattern after transferring. The black areas, of course, represent the portion of the work which is to be cut away.

Inlays.—Inlays are made on the scroll saw by pad sawing. Figs. 1 to 4 inclusive show the simple principle involved. Fig. 1 shows a pad made of two pieces of wood, light and dark. Any design cut out of this pad, such as the letter D in Fig. 2, can be reassembled as shown in Fig. 3. Since both pieces of wood were cut at the same time, any piece out of one will fit the corresponding hole in the other. This principle can be applied to any picture, design or sketch, a typical example being the inlaid book end shown in Fig. 5. In making this inlay, the pattern is first transferred with carbon to a suitable piece of ⅛-inch thick plywood. Another piece of ⅜-inch plywood makes the bottom of the pad. Bradded securely between these two pieces are the various layers of veneers, each layer being 1/28-inch thick.

a thin metal template. This is usually fitted with flanges or tabs so that it can be easily located on the work. Transferring is done by blacklead or graphite, either dry or wet. The color is spread or rubbed into a piece of soft wood, a rub of the brush over this lifting



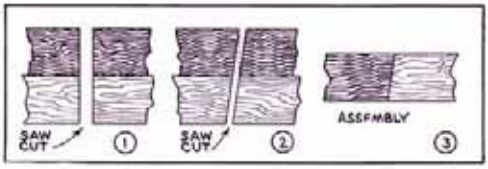




Drawings above show various steps in making the pad and assembling the pieces for the inlaid picture shown in Fig. 5.

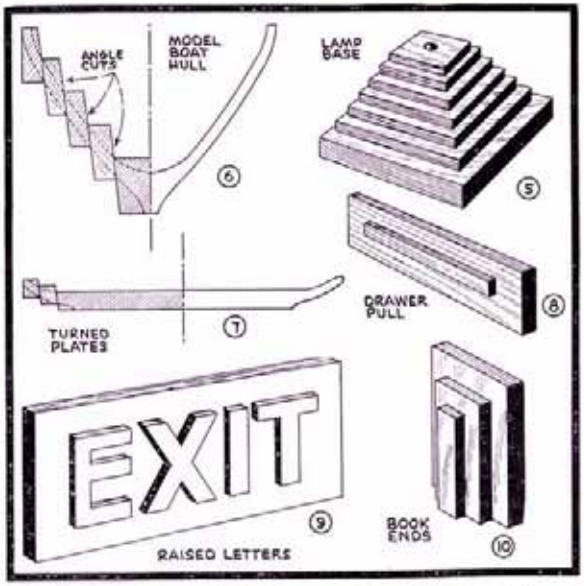
Different colors and grains in the veneer stock supply the contrast to make the picture effective. Since a separate layer for each detail in the picture might make the pad too heavy while being rather expensive, patching is used for all small pieces, as shown in Fig. 7. A sheet of cardboard calipering close to 1/28-inch thick is used as a base. Areas are cut out of this sheet where details are wanted in the picture, and the required veneers are mounted in these holes with gummed tape. Fig. 7 shows the mallet, boot and ball being patched in place.

The assembled pad is cut in the usual manner, using a very fine blade. After cutting, all pieces are discarded except those required for the picture. These are mounted face down with rubber cement on a sheet of cardboard, as shown in Fig. 8. The permanent mount is then made by glueing the assembled inlay to the wood base, as shown in Fig. 9, after which the cardboard can be easily stripped off to reveal the finished picture.



Above, angle cutting eliminates the seam formed by the saw kerf. Photo shows angle-cut lamp base.

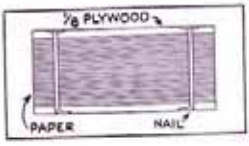
Left, various applications of angle sawing.



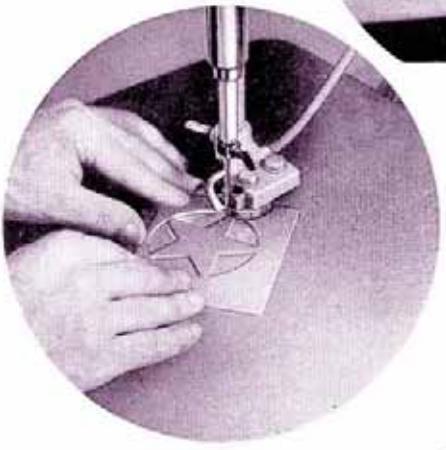
Angle Sawing.—Inlays are often cut with the table tilted at an angle of from 1 to 10-degrees. This is done so that the pieces, when assembled, will not show the saw cut opening at the joints but will fit tightly together. This is clearly shown in Figs. 1, 2 and 3. When cutting on an angle, the work must at all times be kept on one side of the blade. If the work is swung completely around the blade, the bevel will change directions and the pieces will not fit.

With a little experimenting, angle cuts can be made in heavy stock so that any piece cut out of a larger piece will jam tight when pushed through the larger piece. Fig. 4 shows a single piece of ¾-inch stock which has been angle cut into a number of rings of decreasing diameter. Each ring jams tightly inside the next larger one to make a neat lamp base. This simple principle can be used to good advantage in the making of model boat hulls, wood dishes, book ends, raised letters, etc. A few typical applications are shown in the drawing above. Fig. 6 shows a model boat hull which has been so cut that the various pieces pull out to form the complete rough shape of the boat. Fig. 7 shows how angle sawing can be used to advantage when making deep turned plates or bowls, at the same time removing a lot of the waste stock. Raised letter, as shown in Fig. 9, are very effective when angle cut so that the letters project above the surface of the base piece. The letters can be readily dropped out of the base to permit painting for color contrast.

Fifty to one hundred paper cut-outs can be perfect'y cut at one time by using the pad method.



Paper Cut-outs.—Paper cut-outs, an example of which is shown in the upper photo, can be perfectly cut on the scroll saw by using the pad method of sawing. The whole secret of this work is to clamp the paper sheets tightly between outside boards of ⅛ or ¼-inch plywood, as shown in the diagram. The various sheets of paper thus become equivalent to one solid block and can be cut without the slightest fraying of the edges. This work is frequently useful in making greeting cards, signs, or decorations, also for making standard forms of file cards and cardboard shapes used in office work. The blade used should be of a size to make the necessary curves, and teeth should not be too coarse. On the other hand, a very fine blade will quickly become clogged with the paper particles and will burn the work.



Above, pad sawing cloth patterns. Left, both saber and jeweler's blades can be used for metal work.

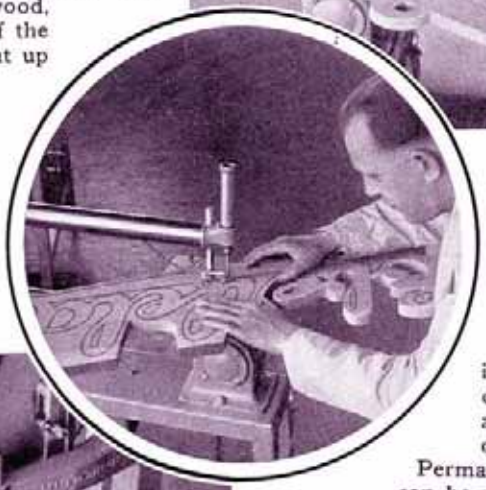
Cutting Cloth.—Cloth can be cut on the scroll saw in pad form, much the same as paper. Here, again, it is exceedingly important that the cloth pieces be tightly clinched between supporting boards on each side. Cloth demands a somewhat finer tooth blade than paper. For production work on some materials, better results can be obtained by using knives instead of toothed blades. An instance where knives are necessary is in the cutting of oilcloth patterns. Because of the combination of oil paint on cloth, this material does not cut satisfactorily with a toothed blade, showing tearing to some degree. Perfect work can be obtained when the work is cut with a knife blade instead of being sawed with a tooth blade.

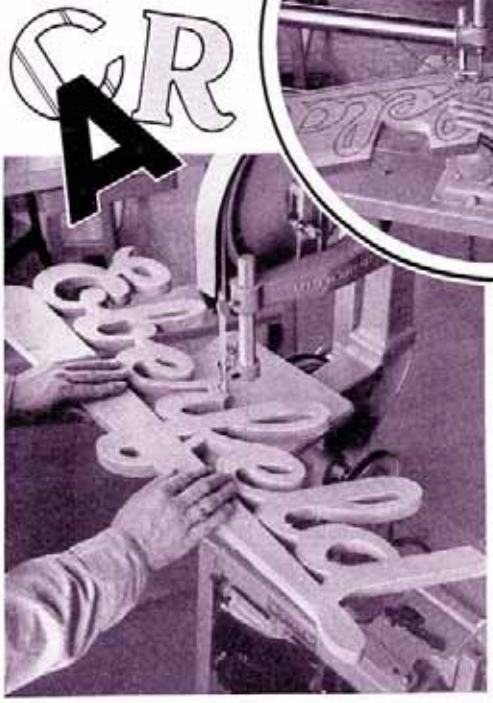
Cutting Metal.—Metal cutting blades, both saber and jeweler's, can be obtained for most scroll saws. Consult the table in the appendix for the proper blade to use. In general, metal cutting on the scroll saw follows the same technique as used on the band saw. Fine teeth are necessary in order to prevent stripping. Special table inserts should be made, with a slot which will just take the thickness of the blade with minimum clearance. This is necessary in order to support the work directly at the cutting point and thus prevent burring. The insert is unnecessary, of course, where an auxiliary table is used or where the work is first shellacked to a wood base.

Cutting Plastics.—Plastics can be cut with either wood or metal blades, and thickness for thickness offer very much the same conditions as sawing hardwood plywood. The feed should be somewhat slower, especially when cutting light-colored stock, which will discolor through burning if pushed too strongly against the blade. Where sheet stock is being cut into small pieces, the work should be polished before cutting.

Letters and Signs.—A wide variety of cut-out letters and signs in wood, metal, plastic and other materials can be cut and sanded on the scroll saw. This kind of work demands some degree of skill in laying out the original patterns. On the other hand, almost any crafter can make up the simpler block styles. Two simple alphabets are shown on page 47, and others can be found in any good book on commercial lettering or poster work.

Where the letters are to be cut from wood, clear stock must be used. Knots or other imperfections will cause trouble. Whitewood, white pine and some of the varieties of five-ply, put up with waterproof glue, are excellent. Almost any wood other than the highly warpable gum woods can be used if the letters are well protected with paint or glue sizing. A protective coating should be applied to the backs of the letters before they are mounted to the base.



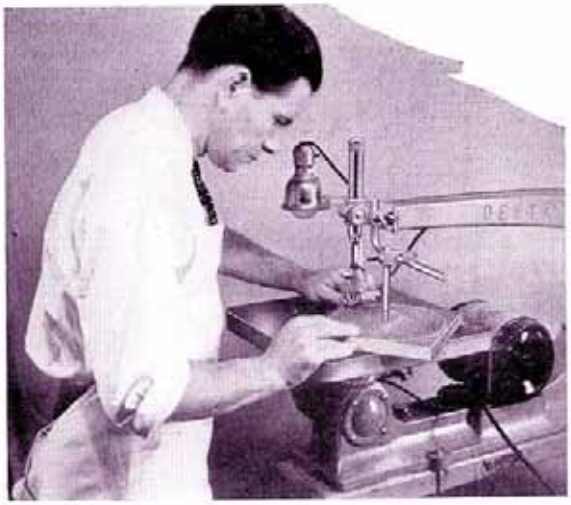


Above, sanding sign on scroll saw. Center, cutting outline on scroll saw. Bottom, sanding on band saw.

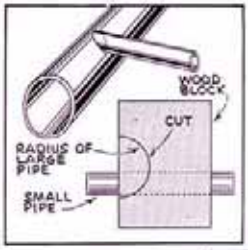
Where letters are to be cut from metal, the usual procedure in metal-cutting is followed. Some very novel effects can be made with metal inlays. Work of this kind is done in the same manner as making a wood inlay, as described on page 38, the metal stock making up a part of the pad. Thin stock is readily worked in this manner, and letters in brass, aluminum or copper inlaid on suitable wood bases are quite effective.

Permanent signs in full color can be made from sheet plastics of various thicknesses. The required letter shapes can be laid out directly on the plastic stock, or the layout can be made on paper, the paper being pasted to the plastic. The sheet stock from which the letters are cut should be polished before the letters are cut out, this being somewhat simpler than polishing each individual letter after cutting. The backs of the letters are, of course, not polished, the original matt surface affording a better glueing surface. Sheet plastic can also be used as a base, but is somewhat expensive in suitable thicknesses. The usual procedure is to cut the letters from plastic about ¼ inch thick, mounting these on a wood base of ¾-inch stock, painted. These general dimensions can be varied considerably to suit different jobs. Effective work can be done in ½-inch sheet plastic by angle sawing, as described on page 39. This has some disadvantage in that the letters and ground are both of the same color, but the raised effect is usually sufficient to make the sign stand out quite clearly.

The mounting of any wood sign to a suitable base should be done with waterproof glue if the work is to be exposed to



Above, useful circle-cutting jig is made from standard shaper hold-down parts.



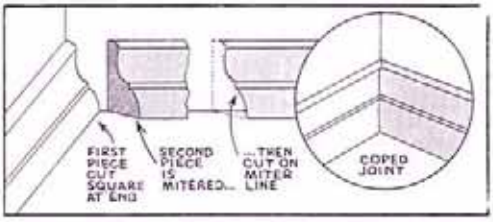
the weather, otherwise any kind of glue will answer the purpose. It is always advisable for good work not to depend upon the glue entirely, but to fasten the letters securely with screws. These should be inserted from the back of the base into the letters. Where this is impossible, brads can be used, driving these from the faces of the letters. The nails should be set and puttied flush for smooth work.

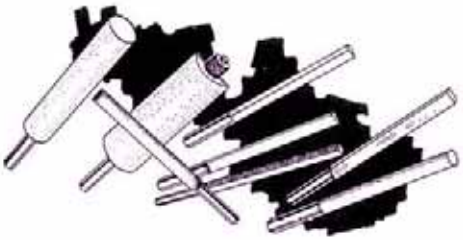
Circle Jig. — A number of the circle-cutting jigs previously described for the band saw can be used equally well on the scroll saw. Another style of jig designed exclusively for the scroll saw is shown in the photo above. This is made up from standard shaper hold-down parts. As can be seen in the picture, the bent post is fitted in the extra hole used for holding the scroll saw guide post. On the bent post is fitted the shaper hold-down post bracket. A length of ½-inch round metal rod, pointed at one end to form a pivot, is fitted through the second hole in the post bracket. Adjustment to any size circle is made by simply sliding the bracket along the bent post.

Tubular Joints.—A useful idea for cutting metal tubing where one pipe is to be brazed or soldered to another at an angle is shown in the center photo and drawing. A block of wood is required. On the top side of this is laid out a circle of the same radius as the size of the tube on which the joint is to be made. Using this pencilled circle as a guide, a hole is drilled through the block, this hole being of the same size as the second piece of tubing and drilled at the same angle as required for the joint. The tube is now placed inside the hole and cut off, using the pencil mark as a guide. If the work has been properly laid out, the tube which has been cut will be a perfect fit against the other. The end of the cut tubing can then be used as a pattern to mark the size and shape of the hole which must be drilled in the first tube to complete the joint.

Coped Joint.—Instead of using a miter joint when fitting moulding to an inside corner, some workers use a coped joint. In this style of joint, one piece of moulding is cut square and butted directly against the corner, while the second piece is sawed away at the end to the same profile shape as the moulding being used. In making this joint, the first piece is cut square at the end and butted tight against the corner. The second piece is then mitered on the circular saw or in a miter box just as if a plain miter joint was being made. The edge of the miter cut now forms an outline for cutting on the scroll saw, the end being cut away to the profile shape of the moulding.

Left, a useful idea for cutting tubular joints. Below, manner of making coped joint for inside corners.





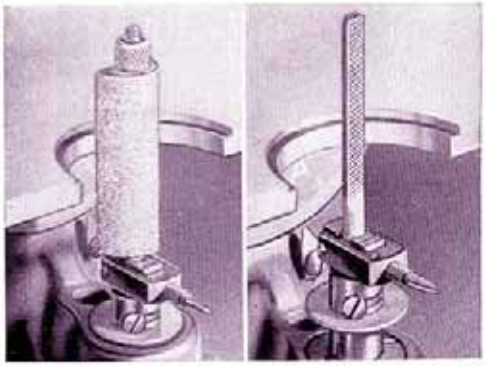
CHAPTER SEVEN

SANDING and FILING

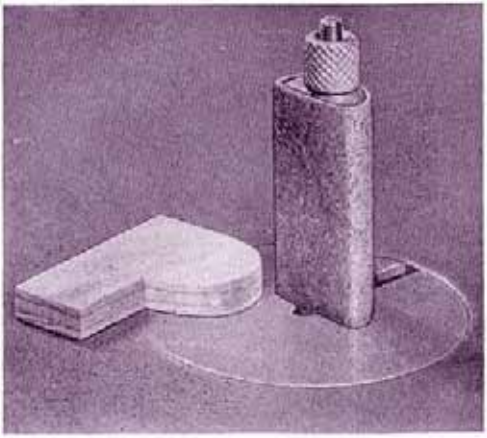
Standard Accessories.—Standard accessories for most scroll saws include a sanding attachment and a variety of machine file shapes. The sanding attachment has a semi-circular body, making it suitable for sanding both curved and flat surfaces. The attachment takes round sleeves of the same size used on the small drill press drum, the shape being easily altered to fit the semi-circular shape of the scroll saw attachment. Machine files are available in both ¼ and ⅛-inch shanks, and in a wide variety of shapes including square, triangular, round, pillar, knife, etc., as shown in the drawing. All files, as well as the sanding attachment, are held between the vee (not the flat) jaws of the lower chuck. The cutaway views at the top of the page show clearly how these accessories are mounted. No guides or supports are used. The work is usually fed from the front, but the chuck can be swung over for side feed if desired. Side feed is often useful since it permits aligning the table exactly square with the file or sanding attachment being used.

Speed of Operation.—Both sanding and filing should be done at low speed. If worked too fast, a machine file will simply scrape the work without cutting, while the sanding sleeve will quickly glaze over and be of no further use. The finer the file is cut or the finer the abrasive particles of the garnet sleeve, the slower the speed should be. Coarser abrasives can be operated faster. Even as cutting with a scroll saw is much slower than cutting with a band saw, so, also, are sanding and filing slower operations as compared with the speed of machines especially designed for this work. These operations on the scroll saw are useful for fine, delicate work. Nothing is gained by speeding up the machine in an effort to get a faster rate of cutting.

Table Inserts.—It is usually necessary to remove the metal table insert when doing sanding and filing in order to permit passage of the abrasive unit being used. This is of no disadvantage on most work, but where the work is small, the supporting area immediately around the file becomes of considerable importance. The required support can be obtained by using an auxiliary wood table, cutting a hole in this of the proper size to admit the file or sanding attachments being used. In the same manner, blank inserts can be cut away to suit, as shown in the photo. Where considerable use is made of filing and sanding equipment, inserts should be made up to fit the various units used.



Above, how sanding attachment and files are held in lower chuck. Below, common file shapes used on the scroll saw.



An auxiliary wood table or the use of special cut-out metal inserts become necessary when working small pieces which might fall through the table opening

APPENDIX

DECIMAL EQUIVALENTS

1/64 = .015625	1/4 = .250	1/2 = .500	3/4 = .750
1/32 = .03125	17/64 = .265625	33/64 = .515625	49/64 = .765625
3/64 = .046875	9/32 = .28125	17/32 = .53125	25/32 = .78125
	19/64 = .296875	35/64 = .546875	51/64 = .796875
1/16 = .0625	5/16 = .3125	9/16 = .5625	13/16 = .8125
5/64 = .078125	21/64 = .328125	37/64 = .578125	53/64 = .828125
3/32 = .09375	11/32 = .34375	19/32 = .59375	27/32 = .84375
7/64 = .109375	23/64 = .359375	39/64 = .609375	55/64 = .859375
1/8 = .125	3/8 = .375	5/8 = .625	7/8 = .875
9/64 = .140625	25/64 = .390625	41/64 = .640625	57/64 = .890625
5/32 = .15625	13/32 = .40625	21/32 = .65625	29/32 = .90625
11/64 = .171875	27/64 = .421875	43/64 = .671875	59/64 = .921875
3/16 = .1875	7/16 = .4375	11/16 = .6875	15/16 = .9375
13/64 = .203125	29/64 = .453125	45/64 = .703125	61/64 = .953125
7/32 = .21875	15/32 = .46875	23/32 = .71875	31/32 = .96875
15/64 = .234375	31/64 = .484375	47/64 = .734374	63/64 = .984375

SCROLL SAW BLADES

Material or Operation	General Features of Blade	Blade to Use (Delta Nos.)	Operating Speed (RPM)
HARDWOOD ¾ in. stock	Medium temper, set teeth. Not over 15 teeth per inch.	91. Also 92, 93, 94, 60, 61. Saber 703, 704.	1000 to 1750
HARDWOOD ¾ in. stock	Medium temper. Teeth need not be set.	85. Also 86, 87, 88, 91, 59, 60, 61.	1750
SOFTWOOD ¾ in. stock	Medium temper, set or wide-spaced teeth. Not over 10 teeth per inch.	92. Also 91, 93, 94 Saber 703, 704.	1780
SOFTWOOD ¾ in. stock	Teeth need not be tempered or set.	87. Also 81, 82, 83, 85, 86, 88.	1300 to 1750
PUZZLES, INLAYS, MARQUETRY	Not tempered; not set. Blade must be thin.	84. Also 81, 82, 83.	1300 to 1750
SOFT METALS (over ¼ in.)	Medium hard temper; set teeth.	65, 59, Also 58, 60, 61, 64, 91.	650
SOFT METALS (under ¼ in.)	Medium hard temper set or not set.	96. Also 95, 97, 98.	650 to 1000
IRON AND STEEL	Hard temper set teeth.	59. Also 59, 60, 61, 64, 65.	650
PLASTIC, BONE, IVORY (rough cut)	Medium temper, set teeth.	91. Also 59, 64, 65.	1000 to 1300
PLASTIC, BONE IVORY (finish cut)	Medium temper, with or without set.	85. Also 86, 87, 88, 95, 97, 58.	1000 to 1750

BAND SAW BLADES*

Width	Teeth	Minimum Cut Radius	Working Cut Radius
⅛ inch	6, 7,	¼ inch	⅜ inch
⅛ inch	5, 6, 7	⅜ inch	1¾ inch
¼ inch	5, 6, 7	½ inch	1¾ inch
⅜ inch	4, 5, 6	1 inch	2½ inch
½ inch	4, 5, 6	1¾ inch	3½ inch
⅝ inch	3, 4, 5	1½ inch	5 inch

*For wood

FILE SIZES

Tooth Spacing	File
8-point and finer	6-inch Taper, Extra slim
7-point	7-inch Taper, Extra slim
6-point	7-inch Taper Extra slim
5-point	7-inch Taper, Slim
4-point	8-inch Taper B. S. Reg.
3-point	10-inch Taper B. S. Reg

METAL CUTTING BAND SAW BLADES

Material	Teeth	Set	Material	Teeth	Set
Aluminum-alloy cates	8-10	ETS	High-speed steel	14	Reg.
Aluminum sheets	8-10	ETS	Hose: canvas and rubber	8-10	Wavy
Asbestos sheets	8-10	ETS	Hose: metallic	18-22	Wavy
Babbitt	10-14	Reg.	Iron bars: machine steel	10-14	Reg.
Bakelite	5-10	ETS	Iron sheets	18-22	Wavy
Brass: cast, soft	12-14	ETS	Malleable iron	12-14	Reg.
Brass: cast, hard	18	Wavy	Plymetal	14	ETS
Brass sheets and tubing	14-18	ETS	Mica	10-14	ETS
Bronze: manganese, etc.	10-14	Reg	Monel metal	10-12	Reg.
Bronze mouldings	18-24	ETS	Nickel steel	12-14	Reg.
Builders board	12-14	ETS	Pipe	18-22	Wavy
Brake lining	8-12	ETS	Radiator cores	18-22	Wavy
Carbon tool steel	14	Reg.	Rubber: hard	10-14	ETS
Cast iron	14	Reg.	Slate	10-14	ETS
Cold-rolled steel	14	Reg.	Steel mouldings	18-24	Wavy
Copper	10-12	Reg.	Steel tubing	18-24	Wavy
Drill rod	14	ETS	Transite	14-18	Reg
Fiber	8-10	ETS			

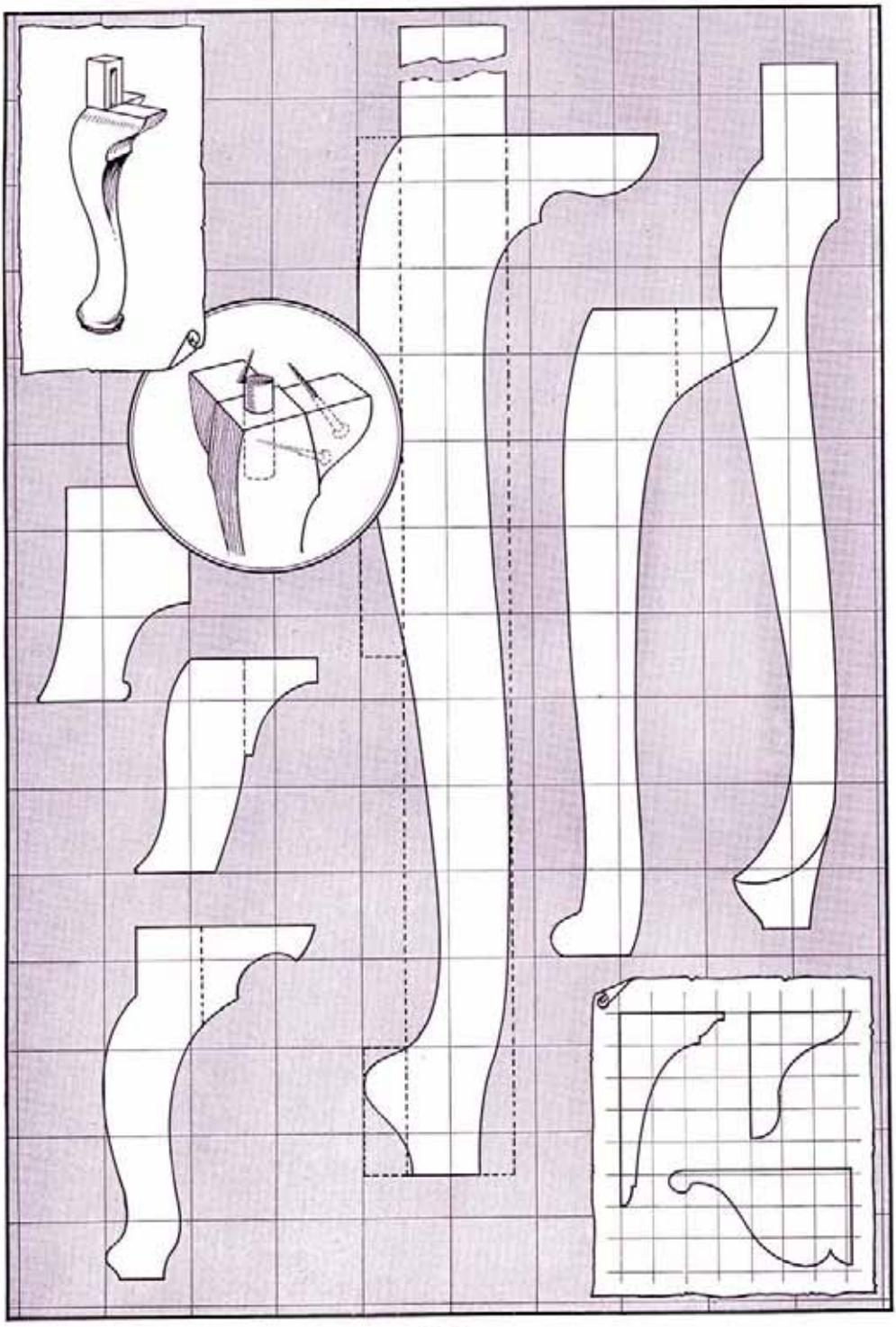
ETS—Every Tooth Set; Reg.—Regular Set; Wavy—Group Set.

BOARD MEASURE

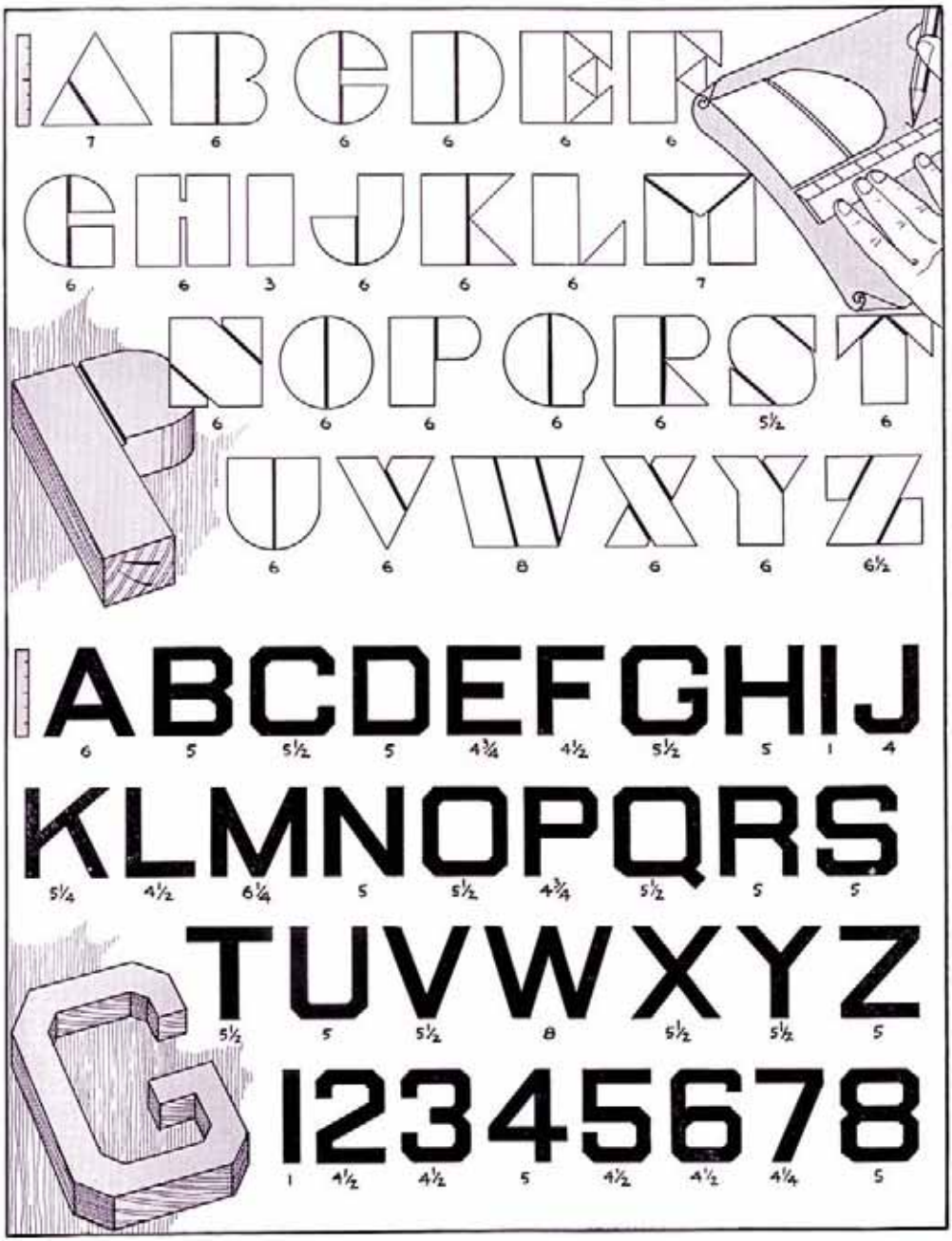
Width in Inches	Length in Feet														
	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
2	0-8	0-10	1-0	1-2	1-4	1-6	1-8	1-10	2-0	2-2	2-4	2-6	2-8	2-10	3-0
3	1-0	1-3	1-6	1-9	2-0	2-3	2-6	2-9	3-0	3-3	3-6	3-9	4-0	4-3	4-6
4	1-4	1-8	2-0	2-4	2-8	3-0	3-4	3-8	4-0	4-4	4-8	5-0	5-4	5-8	6-0
5	1-8	2-1	2-6	2-11	3-4	3-9	4-2	4-7	5-0	5-5	5-10	6-3	6-8	7-1	7-6
6	2-0	2-6	3-0	3-6	4-0	4-6	5-0	5-6	6-0	6-6	7-0	7-6	8-0	8-6	9-0
7	2-4	2-11	3-6	4-1	4-8	5-3	5-10	6-5	7-0	7-7	8-2	8-9	9-4	9-11	10-6
8	2-8	3-4	4-0	4-8	5-4	6-0	6-8	7-4	8-0	8-8	9-4	10-0	10-8	11-4	12-0
9	3-0	3-9	4-6	5-3	6-0	6-9	7-6	8-3	9-0	9-9	10-6	11-3	12-0	12-9	13-6
10	3-4	4-2	5-0	5-10	6-8	7-6	8-4	9-2	10-0	10-10	11-8	12-6	13-4	14-2	15-0
11	3-8	4-7	5-6	6-5	7-4	8-3	9-2	10-1	11-0	11-11	12-10	13-9	14-8	15-7	16-6
12	4-0	5-0	6-0	7-0	8-0	9-0	10-0	11-0	12-0	13-0	14-0	15-0	16-0	17-0	18-0
13	4-4	5-5	6-6	7-7	8-8	9-9	10-10	11-11	13-0	14-1	15-2	16-3	17-4	18-5	19-6
14	4-8	5-10	7-0	8-2	9-4	10-6	11-8	12-10	14-0	15-2	16-4	17-6	18-8	19-10	21-0
15	5-0	6-3	7-6	8-9	10-0	11-3	12-6	13-9	15-0	16-3	17-6	18-9	20-0	21-3	22-6
16	5-4	6-8	8-0	9-4	10-8	12-0	13-4	14-8	16-0	17-4	18-8	20-0	21-4	22-8	24-0
17	5-8	7-1	8-6	9-11	11-4	12-9	14-2	15-7	17-0	18-5	19-10	21-3	22-8	24-1	25-6
18	6-0	7-6	9-0	10-6	12-0	13-6	15-0	16-6	18-0	19-6	21-0	22-6	24-0	25-6	27-0

Explanation: Board measure applies to 1 in. thick boards or any finished size less than 1 in. A board foot measures 1 in. (or less) thick by 12 in. wide by 12 in. long, or its equivalent. Boards are usually sold at a certain price per board foot. To find the number of board feet in any board, find the length of the board in feet at the head of the table. Follow down this column until the width in inches is reached to get the board footage. Example: A board 9 ft. long and 10 in. wide contains 7-6 board feet, the right hand figure expressing a portion of a full board foot in twelfths—in this case 7 6/12 board feet, or 7½ board feet. After determining the number of board feet in the board, multiply by the cost per board foot to arrive at the cost of the board. In this example, if the cost of the lumber was eight cents per board foot, the cost of the board would be (7.5 x .08) sixty cents. Lumber thicker than 1 in. can be computed by multiplying the figures given in the table by 2, 3, or 4, as the case may be. Thus, in the example, a 2 in. thick board would contain 15 board feet.

LEGS AND BRACKETS



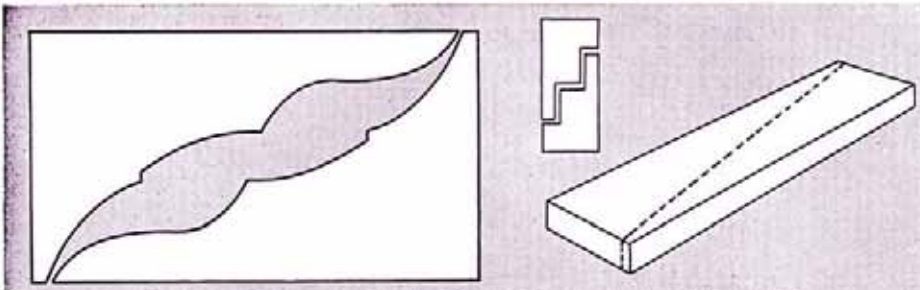
WOOD LETTERS



The width of all letters is indicated in units of one-sixth of the height. In making up any layout, first determine the height which the letters will be. Mark this length on a straight edge and divide the distance into six equal parts; then, lay off three or four additional one-sixth space units. This scale can then be used in laying out the width of any letter. Stem widths can be taken from the letter "I", but can be varied to suit. The upper alphabet is best made from ¾-inch thick material. Black lines indicate grooves cut to a depth of about ⅛ inch. Corners can be rounded in such letters as E and F if the letter is to stand unsupported. This procedure is unnecessary where the letters are mounted on a base. The lower alphabet can be made in any thickness from ⅛ inch up. For other alphabet styles, consult any good book on lettering.

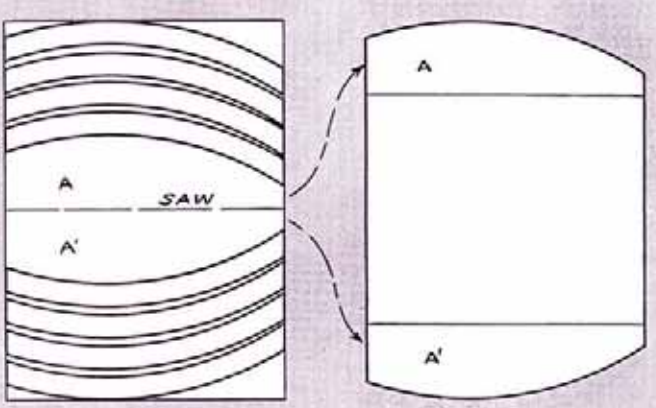
WOOD LAYOUTS

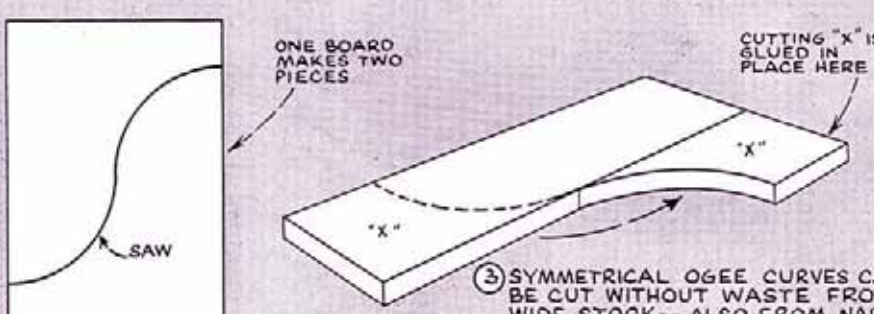
STANDARD METHODS OF CUTTING TO ELIMINATE WASTE



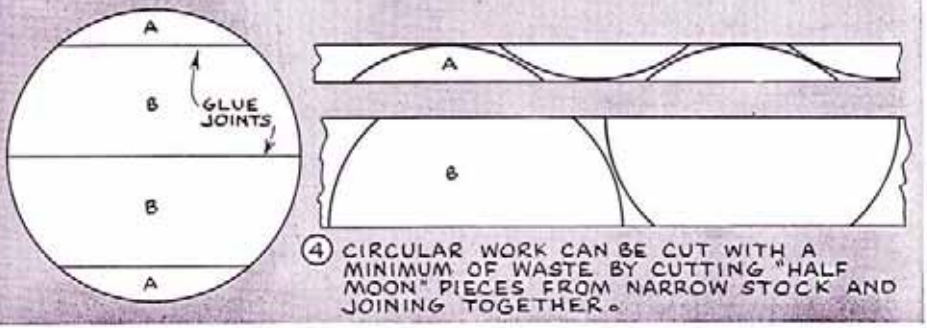
(1) ALL REGULAR OR IRREGULAR WEDGE SHAPES ARE CUT IN PAIRS

(2) CURVED PIECES ARE CUT FROM WIDE STOCK. WASTE PIECE AT "A" IS CUT THROUGH CENTER AND GLUE-JOINED TO SECOND PIECE TO CONTINUE CUTTING. SAME METHOD CAN BE USED TO CUT A SINGLE CURVED PIECE FROM A NARROW BOARD.





(3) SYMMETRICAL OGEE CURVES CAN BE CUT WITHOUT WASTE FROM WIDE STOCK -- ALSO FROM NARROW STOCK BY GLUE-JOINING.



(4) CIRCULAR WORK CAN BE CUT WITH A MINIMUM OF WASTE BY CUTTING "HALF MOON" PIECES FROM NARROW STOCK AND JOINING TOGETHER.

DELTA
MILWAUKEE