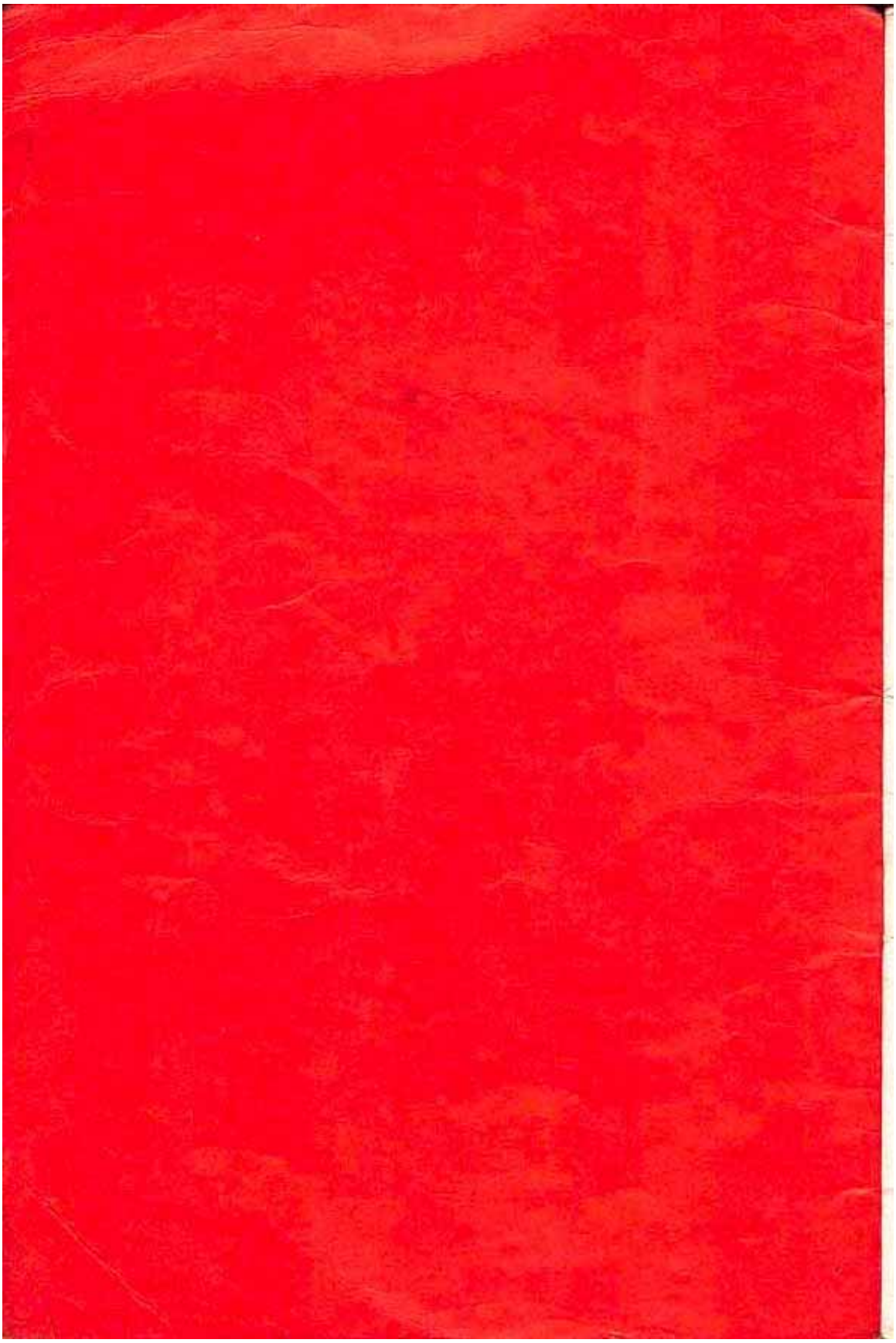
GETTING THE MOST OUT OF YOUR CIRCULAR SAW AND JOINTER

• A Complete Shop Manual on Modern Saw and Jointer Practice

Published by DELTA



GETTING THE MOST
OUT OF YOUR

CIRCULAR SAW AND JOINTER

Ninth Edition

A DELTA-CRAFT PUBLICATION

Edited by
SAM BROWN

A Complete Handbook Describing Circular Saw and Jointer Operation in the Home Workshop with Over Two Hundred Photographic Illustrations and Line Drawings.

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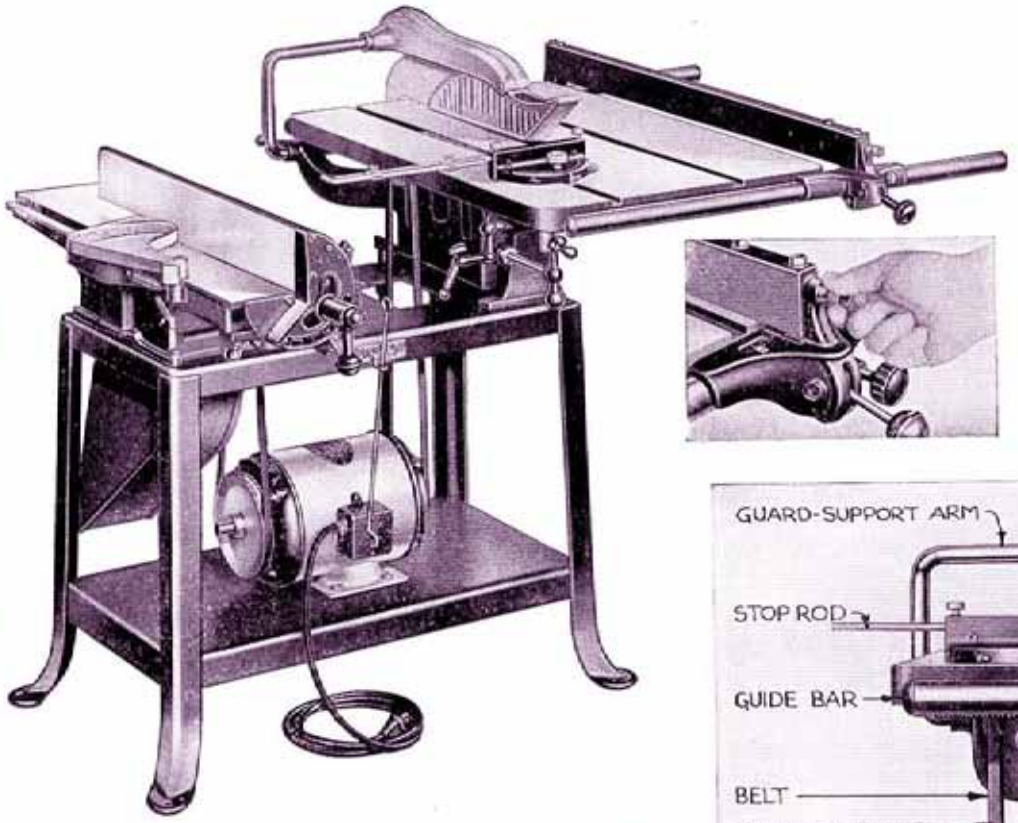
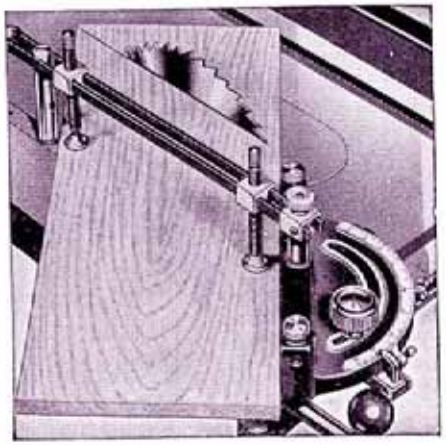
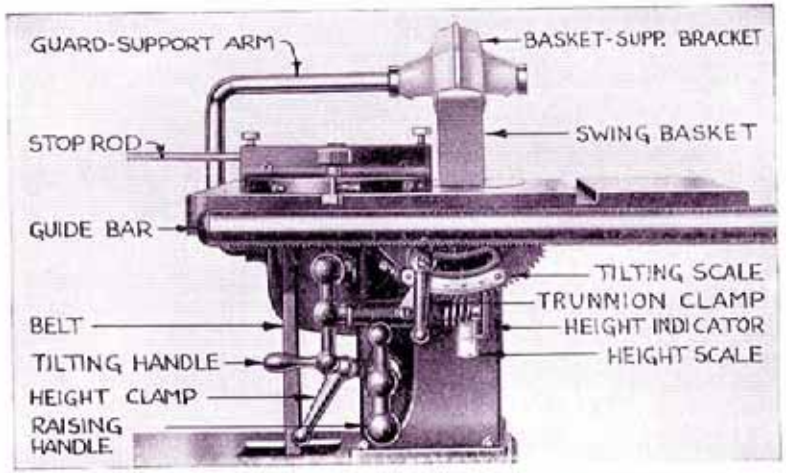
THE CIRCULAR SAW

THE JOINTER

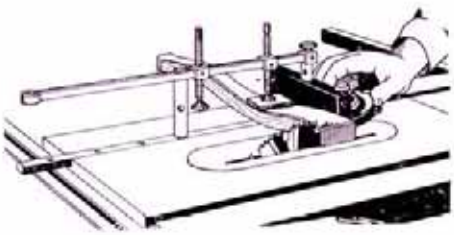
The Circular Saw . . . Basic machine in the home or professional woodworking shop. The illustration shows a modern tilting-arbor circular saw with fully enclosed motor and extension tables.





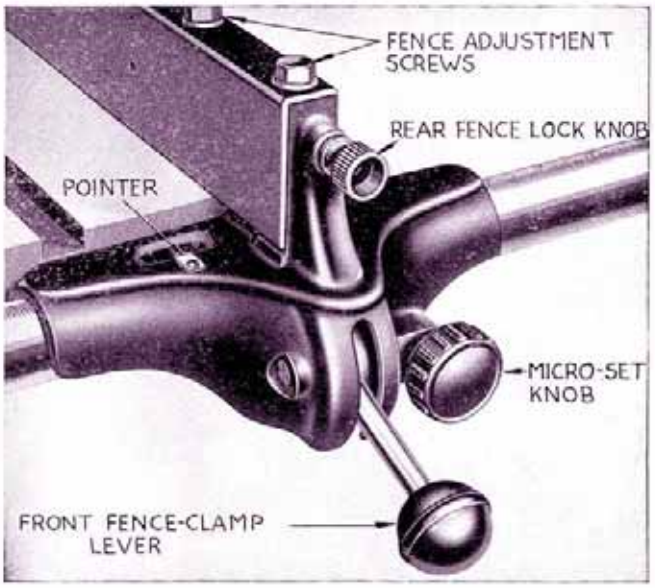


Above, a typical home or production shop unit, consisting of a 6 inch jointer and 10 inch circular saw mounted on a steel stand and powered with a ¾ H. P. motor. Right, the essential parts of a 10-inch saw. Top, miter gage clamp attachment, one of the most useful of many circular saw accessories.



CHAPTER ONE
THE CIRCULAR SAW and its ADJUSTMENTS

Construction.—The circular saw consists of a base casting in which is mounted the saw arbor. One end of the arbor is fitted with a pulley, while the opposite end carries the saw blade or other cutter. Above the base is mounted the saw table. In the conventional saw design, this is carried on two trunnions, with adjustments for tilting the table to a 45 degree position. In the tilting arbor type of construction, the table is fixed in a stationary, level position, tilt positions being obtained by tilting the saw blade. The table of both saws is fitted with a fence which can be set at any distance from the saw blade. The fence is used as a guide when cutting boards lengthwise, the operation being known as **ripping.** The table also has two grooves, these to accommodate a miter gage which is used as a guide when sawing across a board, the operation being known as **crosscutting.** The named size of any circular saw is based on the diameter of the saw blade which it will swing. Thus, a saw fitted with an 8 inch diameter blade is called an 8-inch saw. The various essential parts of a typical circular saw are shown in the photos.



The fence of a 10-inch saw. Clamps are provided at both front and rear. Micro-set knob permits close adjustments.

Table Extensions.—The average 8-inch saw has a table measuring about 15 by 18 inches. The size of the table can be increased by adding extra sections of table which bolt to the front or sides of the original table. Increased capacity across the table can be gained by using longer fence guide bars so the fence can be set farther from the blade.

Power and Speed.—An 8-inch circular saw requires a ½ H. P. motor for average work, although ⅓ H. P. will suffice if only thin stock is to be cut. A saw of this size is made to operate at a speed of about 3,400 R. P. M., giving a cutting speed of 7,100 feet per minute. A 10-inch saw requires at least ½ H. P. and preferably ¾ H. P. if the full 3¼ inch capacity of the saw is to be used. This saw runs at about 3,100 R. P. M., which gives a cutting speed of 8,100 F. P. M. It is a mistake to run any saw faster or slower than the manufacturer recommends. Saw blades are tensioned to run at a certain speed, and they give the best results at this speed.

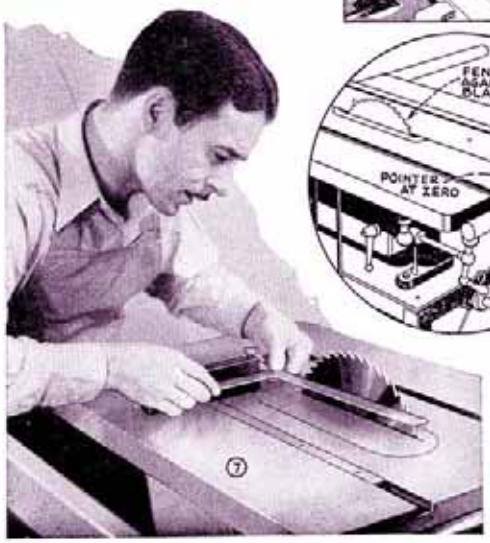
Installation. — The circular saw can be mounted on a bench or on a suitable steel stand, the steel stand mounting being preferable. The saw is often mounted on the same stand with the jointer, as shown on page 4, since operations on these two machines are more or less related. Saws of the tilting arbor type are commonly mounted in a cabinet type housing which extends to the floor and is a complete installation in itself.

Guard and Splitter. — The circular saw guard is a metal basket which is arranged to fall over the saw blade. A splitter is a metal plate mounted directly behind the saw blade. Its purpose is to hold the saw kerf open so that the wood will not rub against the saw to cause burning and binding. The splitter is commonly fitted with anti-kickback fingers which effectively grip the work and prevent it from being thrown back at the operator. The use of a guard is optional and depends on the preference of the operator. The splitter, as an actual aid to better work and safety, should always be used in ripping operations.

Saw Adjustments. — The principal adjustment of the circular saw has to do with the relation between the saw blade, the saw table and the fence. The fence must be square with the table, and the table must be square with the blade. The manner of making this adjustment on a typical 8-inch saw is shown in the diagram at the top of the page. While mechanical features may vary slightly, the same adjustment is made in much the same manner on any kind of saw. The fence is first aligned square with the table, as shown in Fig. 1. The fence should then be square with the blade when checked in the manner shown in Fig. 2. If it is not, the table must be adjusted, Figs. 3 and 4, or, if the table cannot be adjusted, the fence should be adjusted square with the blade.

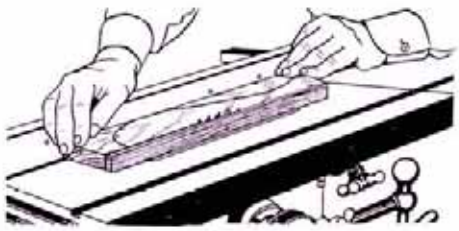
Other adjustments consist of setting the various scales so that they will read properly. The table should be checked square with the blade, as shown in Fig. 5, after which the pointer on the tilt scale should be set at zero. The depth-of-cut pointer should be set so that it will show the exact projection of the blade. The pointer on the fence is set by running the fence over

Proper adjustment of the saw blade in relation to the fence and table is necessary for good work.



until it lightly touches the blade, as shown in Fig. 6, and then setting the pointer to zero on the graduated front bar. The miter gage is likewise checked for squareness, as shown in Fig. 7. Lock the gage at the "square" position indicated by the try square, and then make a trial cut on a fairly wide board. Check the board with the square, and if it is accurate, set the pointer on the miter gage to the 90-degree mark on the scale. If the miter gage is fitted with automatic stop links, adjust these to the right settings.

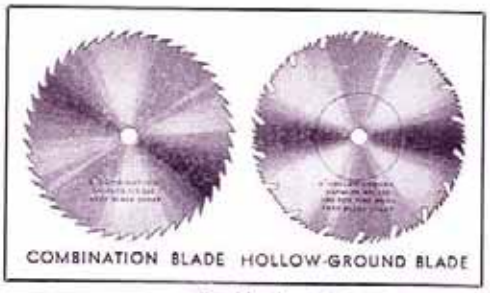
Accessories.—Circular saw accessories include such items as the tenoning jig and miter gage clamp attachment. The use of these is shown elsewhere in this book.



CHAPTER TWO

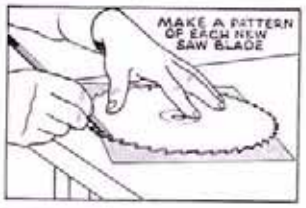
SAW BLADES and CUTTERS

Saw Blades. — The average homeshop owner is concerned with two kinds of saw blades: (1) the combination blade, (2) the hollow-ground planer blade. Both of these saws rip, crosscut and miter equally well, hence their adaptability to homeshop needs. Where production work is being done, two other common saw blades—the crosscut saw and the rip saw—are useful, but each can be used only for the one operation for which it is intended. Other than these four blades, there are hundreds of specialized saw styles, each designed to work best under certain conditions.

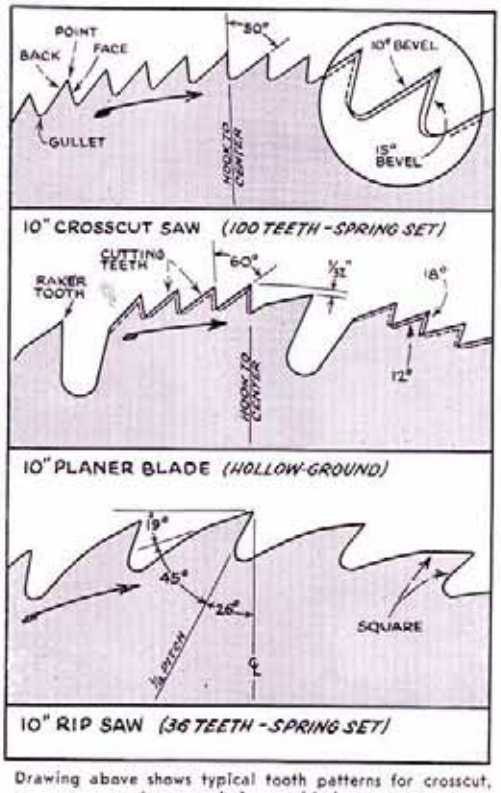


Combination blades which both rip and crosscut are most popular in the homeshop.

Paper Patterns. — The best guide for maintaining any saw in good condition is the saw itself. To this end, it is advisable to make a paper pattern of every new saw which is

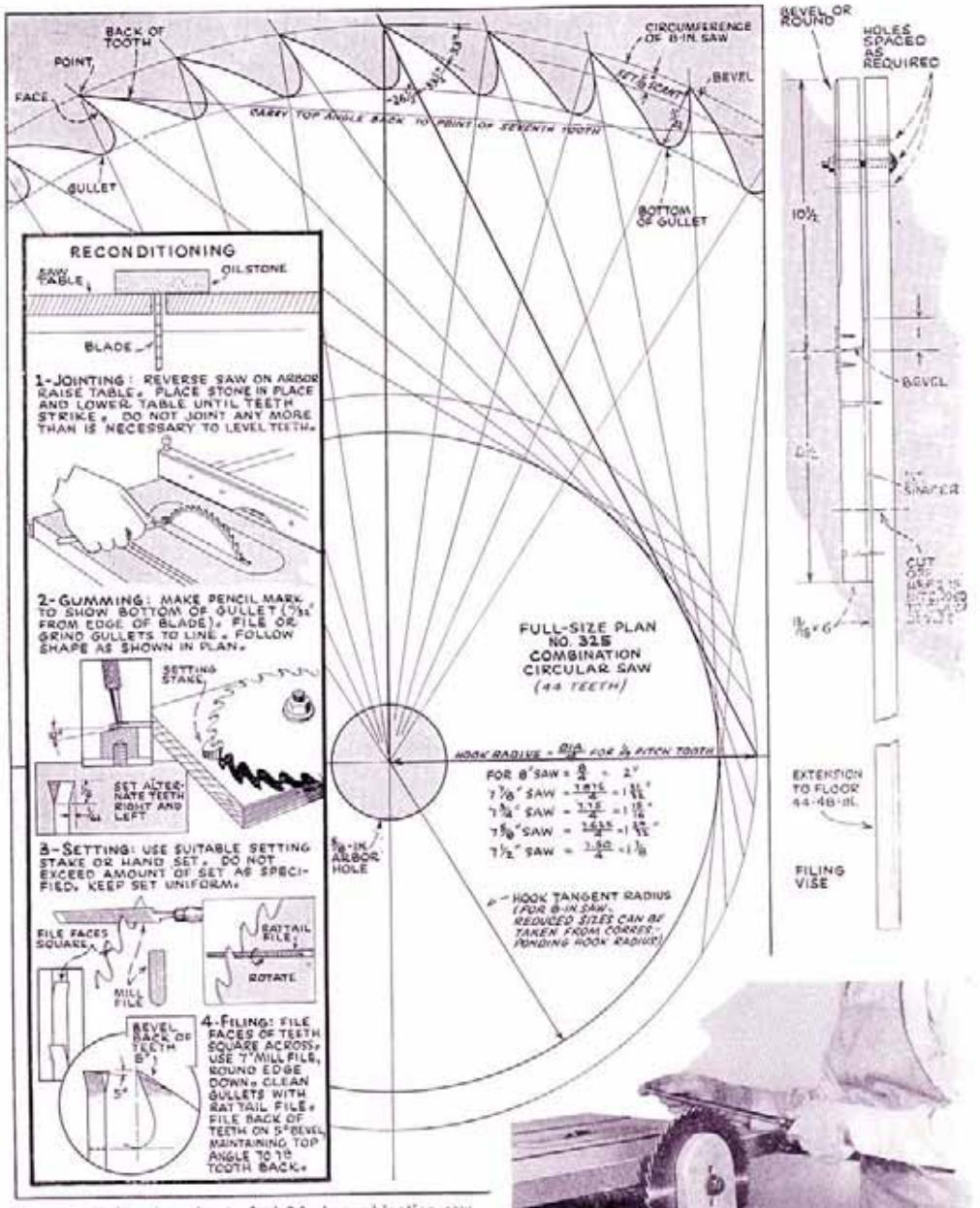


acquired. In addition to showing the tooth shape, the pattern should also contain such information as the degree of set, the filing angles, etc. Great exactitude is not usually required, since a slight variation in the tooth shape or bevel will not ordinarily effect the working of the saw. What is important, however, is that each tooth must be exactly the same. One long tooth or one poorly-filed tooth can easily throw the whole saw out of balance.

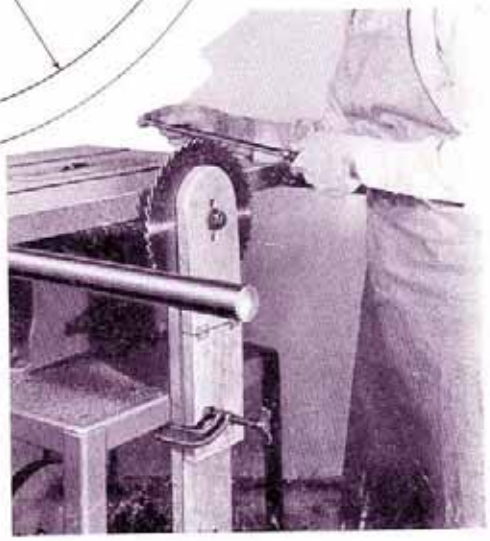


Drawing above shows typical tooth patterns for crosscut, planer, and rip saw blades.

Crosscut Saw.—The crosscut or cutoff saw is intended for cutting across the grain and is useless for ripping. A typical tooth pattern is shown at the top of the drawing at the left. This drawing also gives the names of the different parts of the saw tooth, these names applying equally well to any other kind of saw blade. The gullets of the crosscut saw are quite sharp, yet they should have a slight round in order to prevent cracking. The front or face of the tooth is on a line with the center of the saw, and is filed to a 15-degree bevel. Where fine, smooth work is to be done, the face bevel can be increased to 20 to 25-degrees. The back of the tooth is filed on a 10-degree bevel, this being increased to 15 degrees for fine cutting. This saw is usually spring set. Setting consists of bending successive teeth in opposite directions to secure clearance as the saw cuts through wood. Setting is done after filing, using a setting stake or suitable hand set. The set is alternately right and left on successive teeth. Only the tips of the teeth are set. The set should not exceed 1/64 inch.



Above, full-size plan of a typical 8-inch combination saw. Right, filing a circular saw.



Planer Saw.—The planer saw is a hollow-ground blade, the cutting edge of which is shaped as shown. This same tooth pattern is also used for flat-ground saws. In this case, the teeth are set to give the necessary clearance. The hollow-ground blade does not require set since it is tapered from the edge to the center for clearance. The planer saw has two kinds of teeth—cutting teeth and raker teeth. The cutting teeth sever the wood fibers on either side

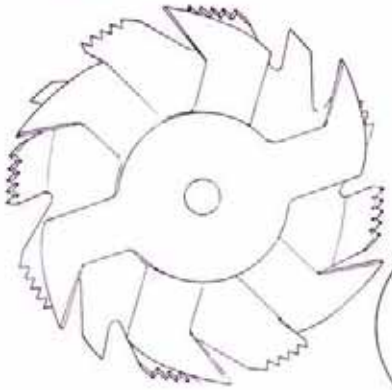
of the cut, while the raker teeth clean out the wood fibers. Raker teeth should be 1/32 to 1/64-inch shorter than cutting teeth. The cutting teeth are beveled alternately right and left, as shown. The raker teeth are filed square across, front and back.

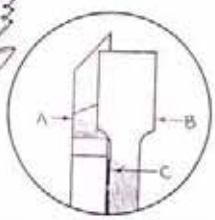
Rip Saw.—Rip saw teeth are filed to many different patterns. The face of the tooth is on a line tangent to a circle one-third to one-fourth the diameter of the saw. The point of the tooth must be strong; usually not less than 40 degrees in view of the rough work for which this saw is intended. The teeth are filed square across to give a true chisel point.

Combination Saw.—The drawing on the opposite page shows a full-size plan of a typical combination saw. This saw is somewhat similar to the rip saw except that the teeth are finer and beveled on the back so that the saw will cut across the grain as well as with it. The various steps in sharpening a blade of this kind are shown in the sketch. Where jointing removes a considerable portion of the tooth point, the blade is first filed and then set. When it is not necessary to joint the saw or where jointing does not materially effect the tooth shape, it is usually better to set the teeth first and then file.

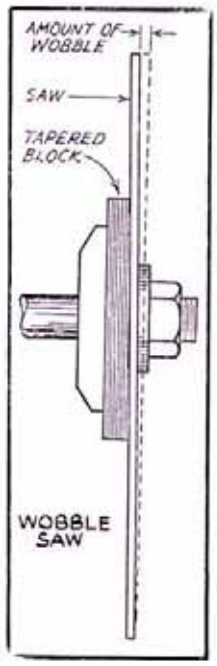
Filing Vise.—A suitable vise for filing saws in the home workshop is shown on the opposite page. This can be made up to clamp in a vise, or, by making the lower arm sufficiently long, the vise can be clamped to the side of any upright object. File equipment should include a 6 or 7-inch taper file for crosscut saws, a 7-inch mill file with one round edge for rip and combination saws, and a round taper file for cleaning out gullets.

The Dado Head.—A dado head is made up of two outside cutters and three or four inside cutters, as shown in the photo above. Grooves varying in width from ⅛ to ¹³⁄₁₆ inch can be made by using different combinations of cutters. The dado head cuts cleanly in any direction. For grooves ⅛ inch wide, one of the outside cutters is used. Grooves ¼ inch wide are cut by using both outside cutters, placing these side by side so that the teeth are in line like one thick saw. Grooves ⅜ inch wide are cut by placing a ⅛ inch inside cutter between the two outside cutters. By adding to the outside cutters in this manner, any groove up to ¹³⁄₁₆ inch wide can be cut.





Above, the various members of a dado head. Diagram at left shows how the cutters are assembled. Paper washers are used for fractional expansions, as at C below.



In arranging inside cutters, care must be exercised so that the swaged portion of the inside cutters will be in line with the gullets of the outside cutters. The sketch shows the arrangement, one of the outside cutters being removed to show the inside ones clearly. For tight or loose fits in standard width grooves, paper washers are added to the various assemblies as required. This is shown in the small circle inset, in which A is the outside cutter, B the inside cutter, and C the paper washer.

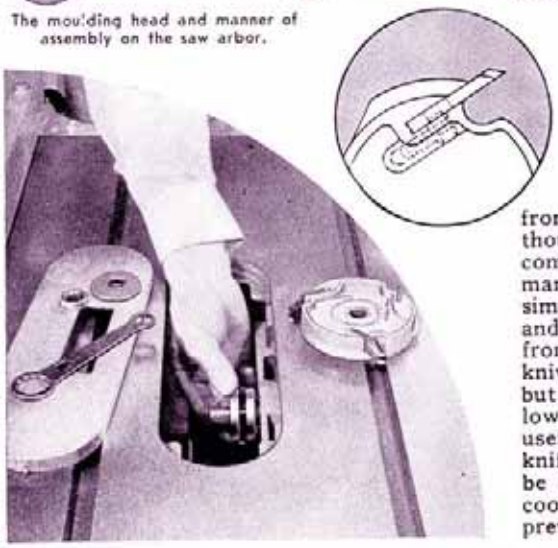
The outside cutters of a dado head are filed very much like the combination hollow-ground blade already described. The raker teeth are filed square across, front and back, and are from 1/64 to 1/32 inch shorter than the cutting teeth. The cutting teeth are beveled, all of the teeth in one group being beveled from one side, while the next group is beveled from the other side. The inside cutters are swaged quite a distance down from the rim and will not require reswaging. These cutters are not beveled, but are filed square across. Sharpening is done by filing the top of the tooth only. This will turn over a burr on the front of the tooth. Removal of the burr with a light touch of the file will leave the cutter sharp. File strokes must be counted and all cutters in the head treated exactly the same in order to keep the set balanced properly. Dado heads can usually be re-

turned to the factory for resharpening at a nominal price, and this procedure is advisable in most cases.

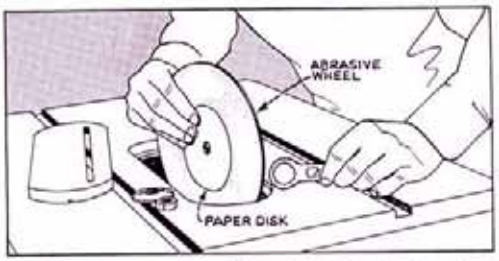
Wobble Saw.—Grooves are sometimes cut with an ordinary saw, this being mounted on the saw arbor in such a manner that it will wobble and cut a groove more or less wider than its own thickness. The drawing shows the arrangement. A thin disk of wood, slightly tapered, is first fitted over the saw arbor, and the saw blade is seated against this tapered disk. Cutting with the saw thus thrown out of alignment will produce a groove wider than the saw blade, the exact width depending upon the taper of the disk. Where cuts over ¼ inch wide are to be made in this manner, a tapered disk should be on both sides of the blade.

Abrasive Wheels.—Abrasive wheels for use on the circular saw arbor can be obtained in a number of different grades, thicknesses and diameters. For average homeshop use, 8 inch diameter, 3/32 inch thick resinous-bonded wheels are the most satisfactory. Almost any material can be cut with abrasive wheels. Aluminum-oxide wheels are used for cutting steel and nonferrous metals, while silicon-carbide wheels work best for glass, porcelain, plastics, hard rubber and similar materials. Cutting operations are performed dry and at the regular saw speed of about 6500 surface feet per minute. For production work, the speed can be increased to 16,000 feet, but this has no particular advantages beyond prolonging the life of the wheel. Wheels are mounted on the circular saw arbor the same as any saw blade, with the addition of heavy paper washers on either side, as shown in the drawing below. These washers act as shock absorbers. A guard should always be used to guard the operator against accidental wheel breakage. This, however, is not likely to happen if the work is properly guided with the rip fence or miter gage.

The moulding head and manner of assembly on the saw arbor.

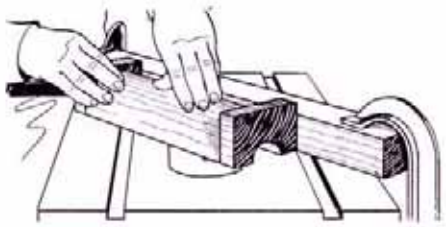


The Moulding Head.—The moulding head consists of a cutterhead in which can be mounted various shapes of flat steel knives. A special fence is required when using moulding cutters, this being cut out at the center to give clearance to the head when the knives are raised to their highest point. Each knife is held in the cutterhead by means of a screw, as shown in the inset. When this screw is turned down tight, it not only locks the knife securely in place, but also aligns it square with the head and at the proper projection. The knife grooves should be kept free of sawdust which would prevent the cutter from seating properly. The cutterhead is mounted on the saw arbor the same as a saw blade, except that a thick metal washer is used behind the head, as shown in the photo, this washer being necessary for clearance.



Thick paper washers on either side of the abrasive wheel act as shock absorbers.

Moulding head knives are made from high-speed steel and will cut many thousands of feet of moulding before becoming dull. They are ground in such a manner that sharpening is accomplished by simply whetting the flat side of the knife, and then removing the burr thus formed from the beveled edge. Extremely dull knives can also be ground on the bevel, but this is seldom worthwhile in view of the low cost of new knives. Grinding is often useful, however, in reshaping a straight knife to some particular pattern which may be needed. Grinding should be done dry, cooling the knife frequently in water to prevent burning.



CHAPTER THREE

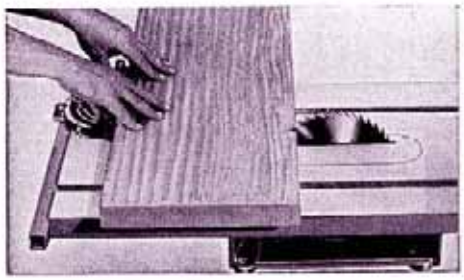
CIRCULAR SAW OPERATIONS

Ripping.—The simplest and most useful operation on the circular saw is ripping stock to required widths. The fence is set to the graduated scale at the front of the table to cut the required width, then the work is placed against the fence and pushed into the saw. A smooth uniform speed of feed should be used, avoiding jerky movements and jamming the work through too quickly. The operator should not stand directly behind the saw blade, but should take a position a little to either side, as shown in Fig. 1. This keeps the operator's face clear of the sawdust which is sometimes thrown back by the saw; also, in the event of a kickback (wood thrown back by the saw), the operator will be in the clear. A guard should be used to insure safe operation. In feeding the work, most operators prefer to hook the little finger over the top of the saw fence, as shown in the picture. Thus, if anything should go wrong, the feed hand will have an anchor to prevent it from being pulled into the saw. Do not talk while you saw. Do not rip work which has not a fairly straight edge to go against the fence. Always stop the machine to make adjustments. The period of greatest danger in any circular saw operation is when the hand is passing the blade and when the hand is behind the blade. As far as possible, the operator should keep his hand in front of the blade. Any object, whether a piece of wood or a hand, if thrown into the saw on the front side, will be pushed away by the saw. Conversely, any object caught on the back side of the saw will be pulled into the blade.

Ripping on the circular saw. The operator should stand a little to one side rather than directly behind blade.

Saw Projection.—The height of the saw above the table should be such as to expose several full teeth. Both scant and extreme projections should be avoided. When the blade barely projects through the work, the cut will often become clogged with sawdust; also, the saw makes harder work of cutting in this position. One good point about a low projection, however, is that it has the least tendency to kick back the work. A high blade cuts fast and free, throws more sawdust, and kicks back the instant work is slightly twisted in the cut.

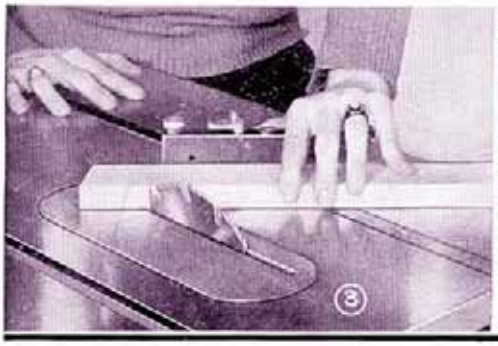
Where short thin material is to be ripped with the use of a moulding fence, the fence should be faced with wood to insure safe operation.

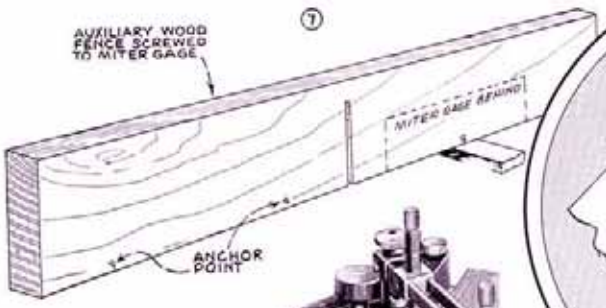


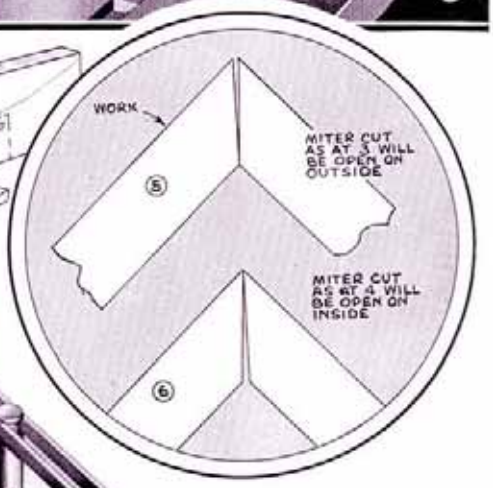
possibilities of injury to the operator. When such work is to be ripped with a moulding fence, the fence should be faced with a wood strip, as shown, and a push stick should be used to project the work into the saw. Regardless of the fence style, a push stick (see page 48) should always be used where the work being ripped is less than 3 inches wide. Do not attempt to run your hand between the saw blade and fence when the clearance is not over 3 inches.

Crosscutting. — Square crosscutting is done by placing the work against the miter gage and then advancing both the gage and the work toward the saw blade. The gage may be used in either table groove, most operators preferring the left-hand groove for average work. Where the work is so wide that it completely covers the table in front of the saw, the gage should be reversed, as shown in Fig. 2. It is essential at all times that the edge of the work which

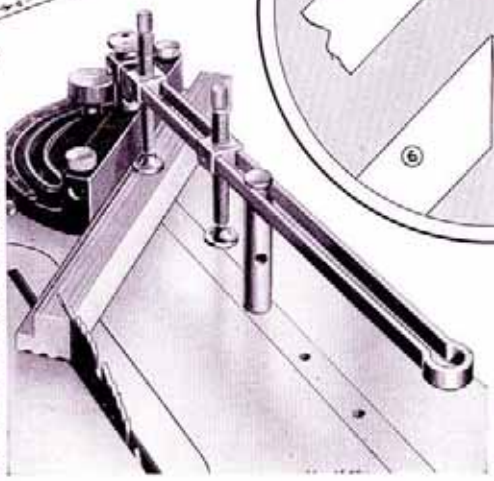
Above, using the miter gage in crosscutting. Right, the miter gage is reversed for very wide stock. Figs. 3 and 4 picture the miter cut. The gage can be turned either way from the central position. Effects of creeping and methods to prevent it are shown in the lower diagrams and photo.

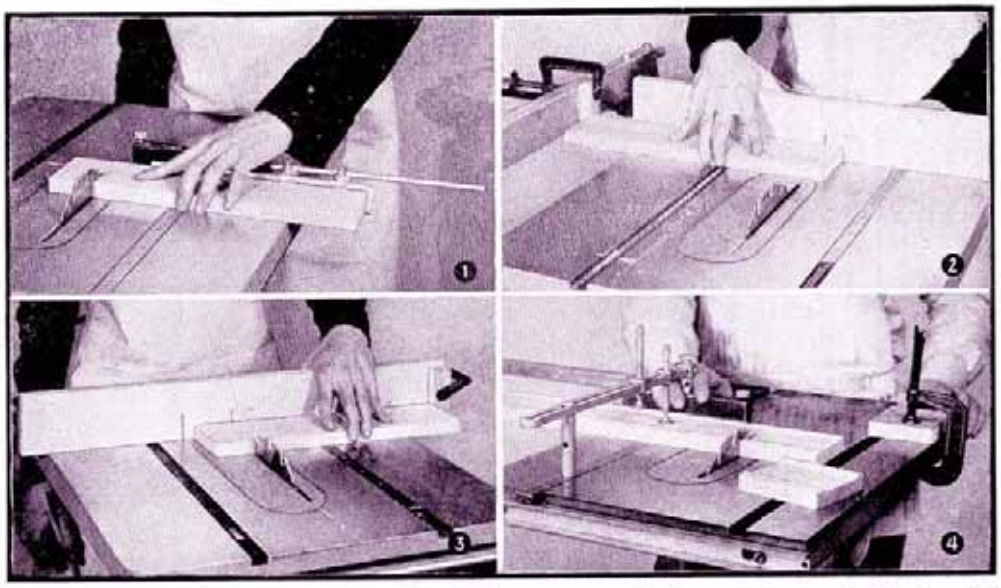






Use of Moulding Fence. — A moulding fence with cut-out center is standard equipment on some saws. This fence can be used successfully for the ripping of all but short, thin pieces of wood. It can be seen in the photo that work of this nature will have a tendency to slip into the opening at the end of the cut, with the resulting





Four standard methods commonly used in cutting off stock to exact lengths. The methods shown in Figs. 1 and 3 are the most accurate since the stop is at all times in place at the end of the work.

goes against the gage be straight, otherwise the work may twist and kick back as it is advanced to the saw.

Miters.—Miters are cut by setting the miter gage at the required degree setting. Here, again, the gage may be used in either table groove, also, the gage may be set on either side of the center position, as shown in Figs. 3 and 4 on the opposite page. Miter cuts, unless very tightly held, will creep ever so slightly as the cut is being made. This creep is ***into*** the saw blade; not away from it, and is equal to the set of the blade or the amount of taper on hollow-ground blades. Figs. 5 and 6 show an exaggeration of this creep when the gage is used in the two positions shown in the photos.

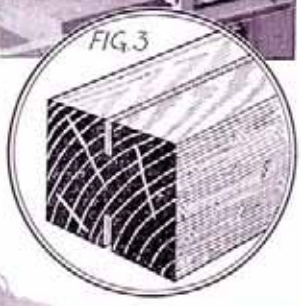
Creep is eliminated when anchor points are used in the face of an auxiliary fence which is screw-fastened to the miter gage, as shown in Fig. 7. The anchor points can be phonograph needles and should project about $\frac{1}{8}$ inch, sufficient to hold the work but not enough to mar the wood. The auxiliary fence without anchor points can be used to advantage for almost any kind of crosscutting, giving a much firmer support than the short length of the miter gage. Where great accuracy is required on miter cuts, the miter gage clamp attachment should be used. This not only insures precision cutting but greatly simplifies the work of cutting.

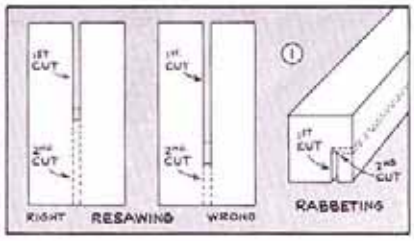
Cutting to Length.—Cutting work to exact length can be done in a number of different ways, as shown in the photographs above. One of the simplest methods is to use the stop rod which is furnished as standard equipment on most saws. This is set to stop the work at the required length, as shown in Fig. 1 above, after which the cut is made in the usual manner. In using metal stop rods, care should be exercised to avoid against accidentally pushing the rod into the saw blade. Thus, in Fig. 1, the rod must be removed if the miter gage is used in the opposite table groove.

A common and useful method of cutting to length is shown in Fig. 2. Here, a small block is clamped to the regular fence, somewhat in front of the saw blade. The fence is then set so that the distance from the face of the block to the saw blade is the length of the required cut. The work is placed against the miter gage, butted against the block, and then advanced to the blade. The fence alone should never be used as a stop since it provides no clearance. Fig. 3 shows a somewhat similar method, except in this case the stop block is clamped directly to the auxiliary wood fence. The method shown in Fig. 4 is practically the same as Fig. 2 except that the stop block is clamped to the saw table. The methods shown in Figs. 1 and 3 are the most accurate since they provide a positive end stop while the cut is being made. The other two methods set the position before the cut is made, after which the operator's hand or the miter gage clamp attachment is relied on to hold this position.

Resawing.—Resawing, or the cutting of thick boards into thinner ones, is a ripping operation. Boards up to $4\frac{1}{2}$ inches wide can be completely resawed with an 8 inch blade, while work up to $6\frac{1}{2}$ inches wide can be sawed with a 10 inch blade. The rip fence should be set so that it will cut the board to the required thickness, then the

Below, the work should be below the blade in tilt table operations.





Above, order of cuts in resawing and rabbeting. Left, resawing on the band saw.

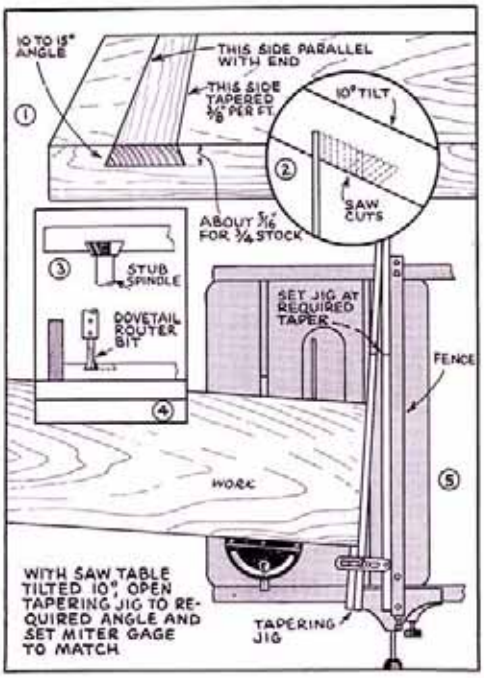
work is run through on edge. After making the cut on one edge, the stock is turned end for end and the second edge is cut. It is important that the same face side of the work be against the fence for both cuts. The two cuts should be fairly evenly distributed. That is, if the stock is 4 inches wide, the saw would be set to cut about 2¼ inches on each of the two cuts, as shown at the left in Fig. 1. If the first cut is made excessively deep, as shown in the center diagram, Fig. 1, the second cut will bind the saw. Where very wide stock is to be resawed, a cut to full capacity is made on either edge, as shown in Fig. 3, after which the uncut section may be cut on the band saw. This method is usually better than using the band saw to make the entire cut, as the band saw has a tendency to weave on heavy cuts of this kind. When, however, a large part of the cut is made with the circular saw, the band saw blade tracks accurately in the original saw groove.

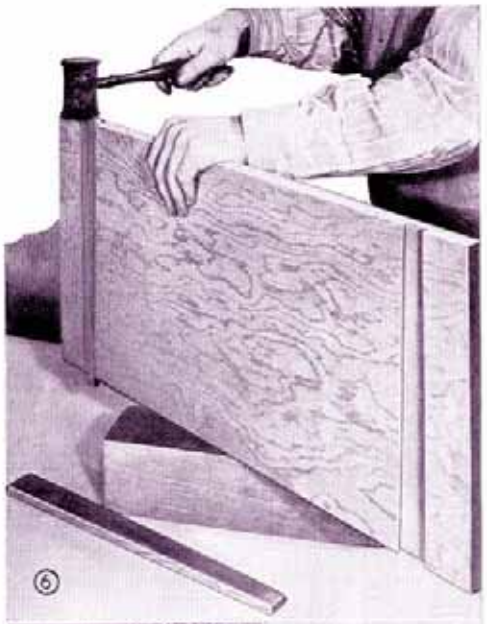
Rabbeting.—The sawing of a rabbet is somewhat akin to resawing inasmuch as one of the cuts must be made with the work on edge. As shown at the right in Fig. 1, the first cut is made shallow, after which the second cut is made to completely clean out the corner and finish the rabbet.

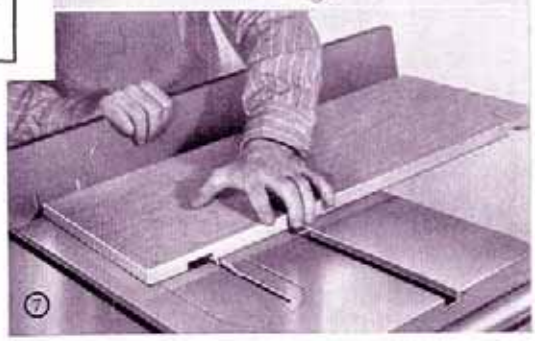
Tilt Operations.—Bevel cuts up to 45 degrees are made by tilting the saw blade or table, depending on the type of saw. Ripping cuts are made in the same manner as in straight sawing. Bevel operations using the miter gage on a tilt table saw should be done with the gage in right hand groove and the main portion of work below the blade, as shown in Fig. 4. It is necessary to use the right hand groove since the gage will strike the blade if used in the left hand groove. On the level table of the tilting arbor saw it is immaterial whether the work is done on the right or left hand side of the blade.

Taper Ripping. — Work which is to be ripped on a taper cannot be guided against the fence but must be held in some form of tapering jig. A typical tapering jig is shown on page 46, together with the method of setting and using it for taper ripping. In production work, many operators prefer a solid jig cut from a single piece of wood. The set-up remains the same, the solid jig being cut to the same shape as the adjustable jig would be when opened to cut the taper being worked.

Dovetail Tapers. — Wide pieces of solid lumber are often fitted with dovetail keys to prevent warping. Fig. 1 shows the general detail of the joint. The operation of cut-



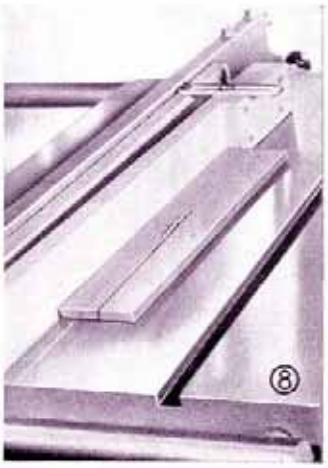


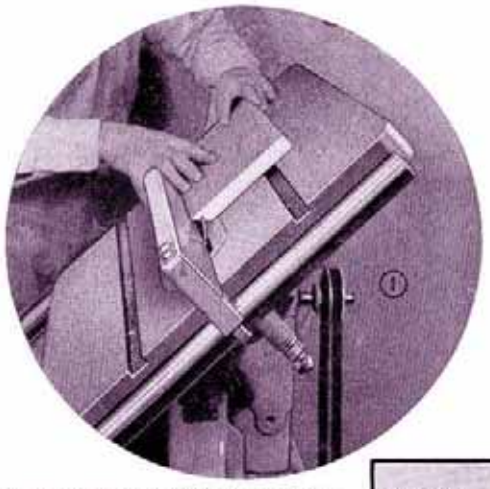


Dovetail keys are good insurance against warping on wide boards. Both keys and keyways are cut on the circular saw at the same setting to secure a perfect fit.

ting both groove and key can be done by using a tapering jig on the circular saw. The taper should be about 3/8 inch per foot, or, as little as 1/4 inch per foot if appearance is important. Some measure of taper is always required since it is impossible to drive a straight key for any distance. The cutting of the groove is done by tilting the saw blade, as shown in Fig. 2. Other methods of cutting the keyway are shown in Figs. 3 and 4, Fig. 3 showing the work as done on the shaper while Fig. 4 shows the use of a dovetail router bit on the drill press. Both these methods give a clean cut in the keyway, but requiring rematching of the taper when keys are cut on the saw. If both groove and key are cut with the saw, the same setting is used for both operations, thus insuring a good fit. A disadvantage of cutting the keyway on the saw is the slight roughness made by the saw blade in the tilt position. This, however, is usually of no consequence as regards appearance and makes a good glueing surface.

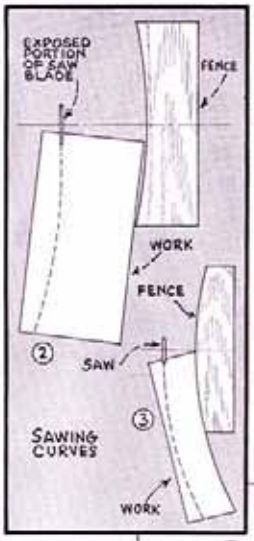
The set-up as done on the circular saw is pictured in Fig. 5. The tapering jig is opening to the required taper and the saw table is tilted about 10 degrees. By placing the end of the work against the tapering jig, the miter gage can be set at the same angle to cut the tapered side of the keyway. Successive cuts across the work cleans the slot on one side, the opposite, untapered edge having been previously cleaned with the miter gage at the zero position. Fig. 8 shows the operation. The keys are cut without any change in the table tilt, using the tapering jig at the angle previously set, as shown in Fig. 8. The keys should be made a little longer than necessary, cutting off flush after the key has been fitted, Fig. 6. A heavy driving fit should be avoided since this in itself will cause warping.





Spline grooves on beveled edges are cut by tilting the table.

Spline Grooves. — Spline grooves in beveled or mitered edges are run in by tilting the saw table so that the blade is at right angles to the edge of the wood, as shown in Fig. 1. Where the bevel is 45 degrees, the table would be tilted 45 degrees. The fence is then set so that it just clears the saw blade. In this position the saw will cut a groove in the center of the beveled edge, as shown. Spline grooves are usually cut with the dado head, since the width of the saw blade is not sufficient to make a groove in stock over ⅜ inch thick. For average work, the width of the spline should be about one-third the thickness of the stock, favoring the scant side. That is, for ½ inch stock, the spline groove would be ¼ inch wide. For further details on spline grooves, see page 30.

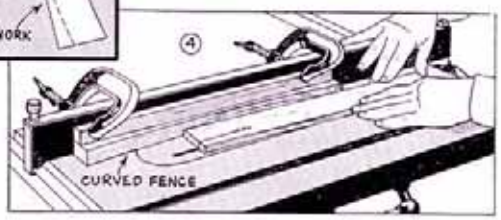


Cutting Curves.—While the circular saw is intended for straight-line sawing only, it can, where the work demands, be made to cut slow curves. There are certain limits to this practice, and workable results cannot be obtained where the curve is excessive. Fig. 2 shows the general arrangement. An auxiliary wood fence cut to the required curve is fastened to the saw table or to the saw fence, as can be seen in Fig. 4. This fence should be the same length as the work which is to be cut, and the center of the curved fence must be in line with the center of the saw blade. The saw blade is exposed to minimum projection, just sufficient to project through the work. The work is advanced to the saw blade along the curved fence, maintaining a two point contact at all times, as can be seen in Fig. 2. The resulting cut will be a duplicate of the curved fence.

If it is desired to shape the opposite side of the work to the same curve, another fence is made up, as shown in Fig. 3. The first-cut edge is guided along this second fence, the saw making a cut to the same curve as the fence.

Curve cutting in the manner described demands a stiff blade with good set. The operation is essentially one of cove cutting (see page 20) except that the cut is carried completely through the work. The amount of curve should not exceed 1 inch in two feet, with the possible exception of very thin stock. Wood or metal springs to hold the work tightly against the fence should be used, since there is a natural tendency for the work to creep away from the blade.

Production Work. — Production work on the circular saw is no different from the single operations described except that full use is made of stop blocks, special fences and other accessories to enable operator to run through a number of pieces with a minimum loss of time. The time element in circular saw operation is largely concerned with the initial setting of the fence, stop block, etc. to set the required cut. Once this adjustment has been made, the various pieces can be pushed through as quickly as the cutting capacity of the saw permits. Unlike band and scroll saw cutting, very little is gained by multiple sawing. The speed of the saw is so great that several pieces can be cut separately much faster than the same seven pieces could be made into a pad for a one-cut operation. It is poor practice to pile several pieces on top of each other and then attempt to cut the entire bundle in one pass. Saying that the operation is cutting to length, each piece must be against the miter gage and each piece must be butted against the stop block. Results show that it is almost impossible to stack pieces in this manner accurately. Multiple

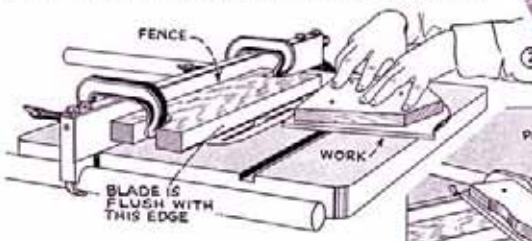


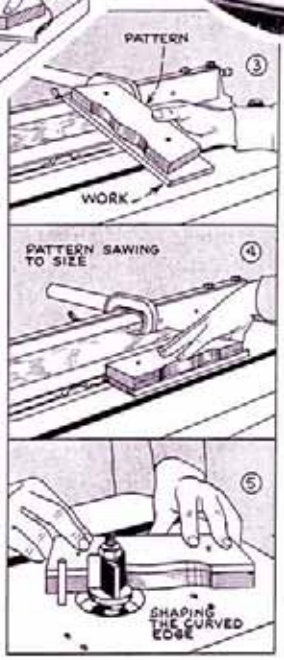
Slow curves not exceeding 1 inch in two feet can be cut on the circular saw by the method shown above.

sawing on the circular saw is only practical when (1) the jig can be quickly loaded, and, (2) when the jig furnishes a positive stop for the work in every direction.

Pattern Sawing.—Pattern sawing on the circular saw can be used to good advantage in production work in cutting any shape comprised of straight lines, such as shown in Fig. 1. It is extremely fast, and has the great advantage that short pieces of waste stock can be quickly worked to size.

The general set-up is shown in Fig. 2. There is an auxiliary wood fence, which





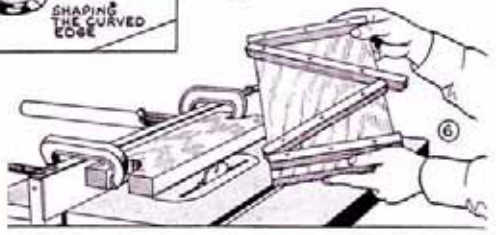
Above, pattern sawing. Drawings show various applications of this useful method of shape-cutting.

is clamped onto the regular saw fence. This auxiliary fence clears the table sufficiently so that the work can slip below it. The fence has a small rabbet cut on the lower side of the outer edge to take the saw blade. The outer face of the blade must be exactly flush with the outer face of the fence. A pattern cut to the shape desired is necessary. This is fitted with any style of anchor point (nails or phonograph needles are the simplest) so that it can be temporarily fastened to the work, as shown in Fig. 2. After the pattern is fastened to the work, it is a simple matter to guide each edge of the pattern along the fence, and thus cut the work to the same exact shape as the pattern.

A typical set-up is shown in Figs. 3, 4, and 5. Fig. 3 shows the pattern fastened to the work. Fig. 4 shows the work being pattern sawed. Fig 5 shows how the curved portion of the work can now be completely cut with the shaper. It can be seen that any piece of work can be cut to shape in this manner, and then, using the same pattern, it can be taken to the shaper and moulded with any selected cutter by riding the pattern against the shaper collar.

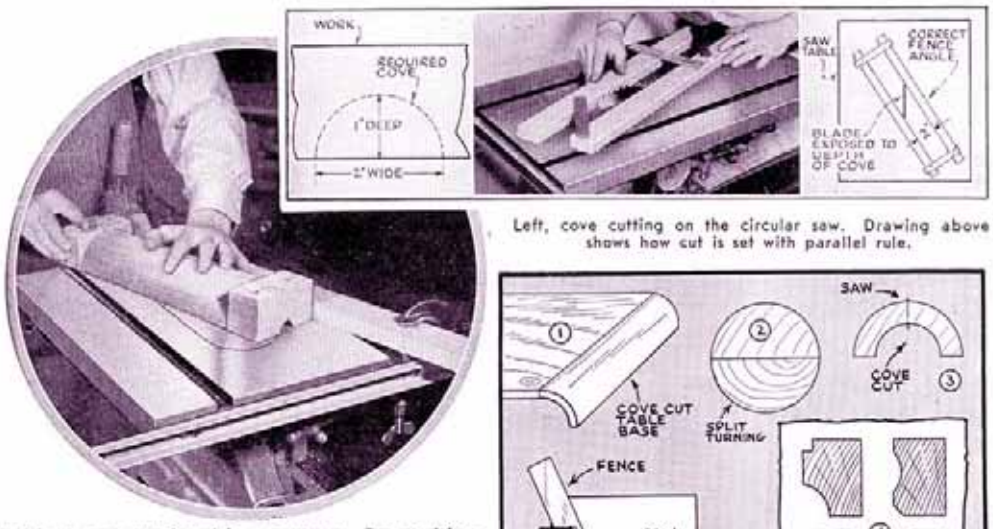
Fig. 6 shows another common application of pattern sawing. In this particular case, no pattern is necessary since the work itself is the pattern. The job is to cut off the cleats flush with the edges of the work. The cutting is done easily and quickly by simply running each edge of the work in turn along the fence. The same general method applies to trimming veneer edges flush with the main body of wood to which it is applied. The veneer is first applied to the work, slightly overlapping the edges. After the glue has set, the edges of the veneer can be trimmed exactly flush with the body piece by pattern sawing as described.

A variation of pattern sawing is also useful for cutting off projecting lugs on screen door frames, windows, etc. In this case, the auxiliary fence is shifted to the rear of the saw blade, extending as far as necessary to furnish a support for the frame be-



ing cut. No pattern is used, the set-up being simply a fence mounted behind and directly in line with the saw blade.

Cove Cutting.—Cove cutting is done by clamping a straight guide fence to the saw table, out of parallel with the blade, and then running the stock against this fence, taking a number of light cuts. A typical example of the application of the cove cut is shown in Fig. 1, which shows a curved



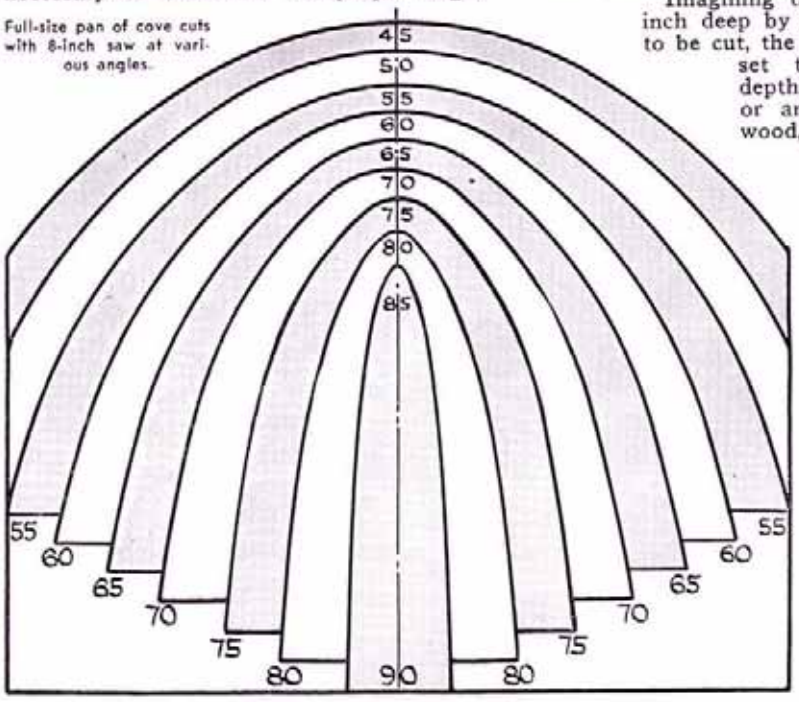
Left, cove cutting on the circular saw. Drawing above shows how cut is set with parallel rule.

table base cut in this manner. In making this piece, the outer curved portion is first worked as a split turning on the lathe, as shown in Fig. 2, after which the piece is cove cut, Fig. 3, and sawed apart to form two quarter sections. Other examples of cove cuts in combination with straight cuts are shown in Fig. 4. Where the cut is made with the dado head instead of a saw blade, the curve will be more or less flat in the center, depending on the width cutter selected.

To set up for cove cutting, it is first necessary to determine the proper angle setting of the auxiliary wood fence. One method of doing this is shown at the top of the page.

Imagining that a cove cut 1 inch deep by 2 inches wide is to be cut, the saw table is first set to the specified depth. A parallel rule, or any two strips of wood, is now set to the specified width of the cut — 2 inches. The rule is placed over the saw blade, and gently turned until the arms touch both the front and the rear tooth of the exposed blade. Care should be exercised that the rule does not slip between the saw teeth. That is, the contact point must be on the line which the tips of the teeth make in motion. The saw can be turned to check

Full-size pan of cove cuts with 8-inch saw at various angles.

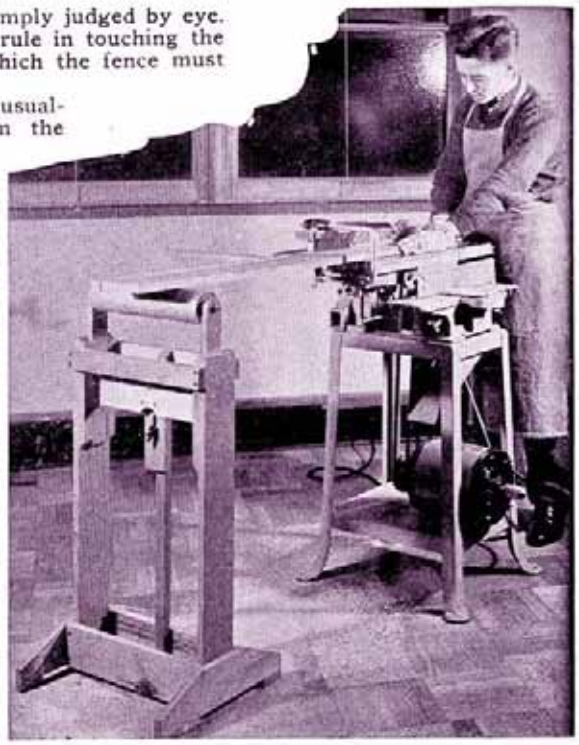


this position, or the setting can be simply judged by eye. In any case, the angle made by the rule in touching the front and rear tooth is the angle which the fence must take for the cut.

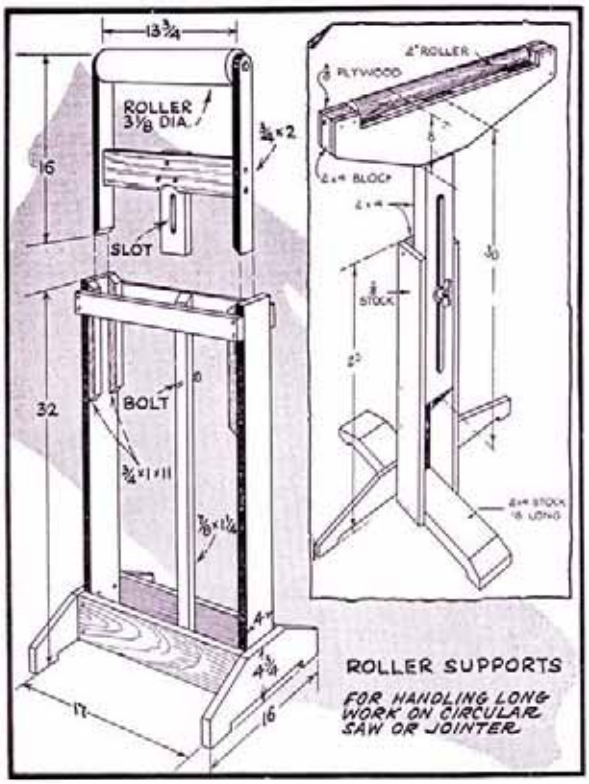
The actual position of the fence is usually somewhat further removed from the rule, but on the same angle, the determining factor being the width of the stock which is to be cut. Once the right angle is found, it is easy to place the fence at the required distance so that the centerline of the work will intersect the centerline of the saw blade; as shown in Fig. 5.

In cutting the cove shape, the blade is set so that it projects about $\frac{1}{8}$ inch above the table, and the first cut is made at this projection. The saw is then raised about $\frac{1}{8}$ inch and a second cut is made. Repeated cuts are made in this manner until the cove is cut to full depth. Time can generally be saved if, after marking the approximate cove shape on the end of the work, the waste wood inside the mark is removed with the dado head or by successive cuts with a single saw blade.

Instead of using the parallel rule method, the shape of the cove cut can be obtained from the diagram shown at the bottom of page 20.

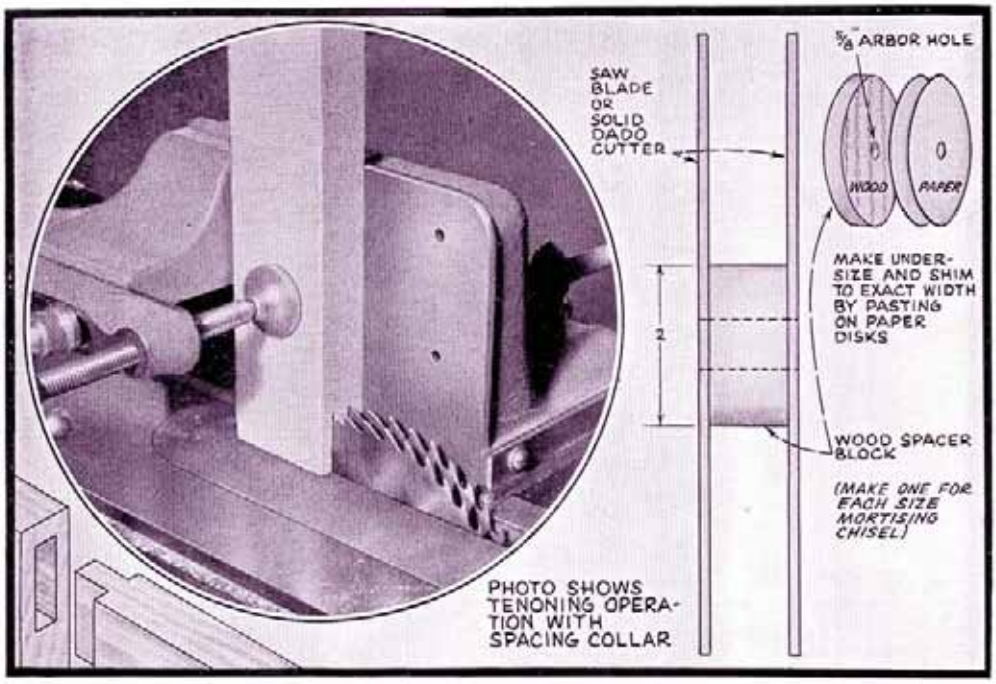


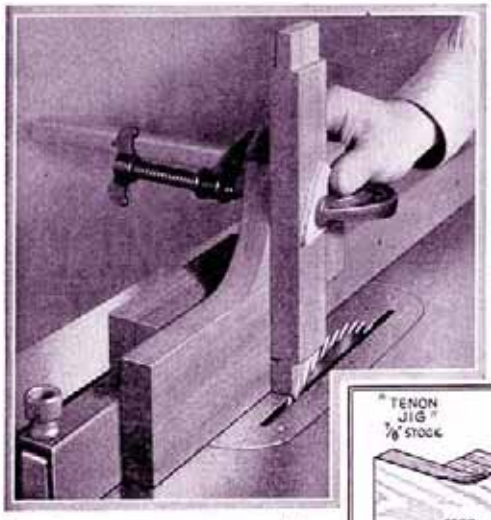
Some form of roller support should be used when ripping long work.



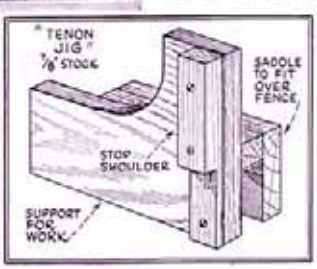
This shows approximate full-size shapes cut by an 8 inch saw at various fence settings. Calling a line parallel with the saw blade 90 degrees, the angles departing from this "zero" position will give the curves shown. It can be seen that the cove is not perfectly circular in shape, but is an ellipse of the blade at various angles.

Long Work.—Work over 5 feet in length should be carried on some form of support after leaving the saw table. Two simple units are shown. No. 1, as shown at the left of the drawing, is made up from various widths of ¾ inch stock. The roller is turned to the specified size, the ¾ inch tenons at either end being made a part of the turning or dowelled in place later as desired. The dimensions as given are standard for the 8-inch saw only, and if desired to handle jointer work also should be varied to suit. Unit No. 2 embodies the same general ideas as to usage, but varies somewhat in construction. The dimensions as given apply to work on either the 8 and 10-inch saw or 4 or 6-inch jointer. A ⅜ inch bolt is driven





Top, two or more saws ganged together are useful for cutting tenons and doing similar work.

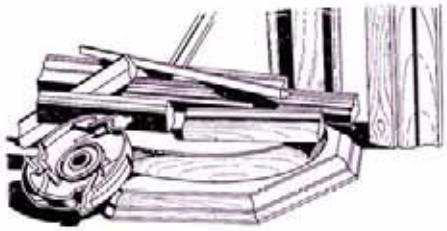


Above, a simple jig which can be used when the saw is not equipped with a tenoning jig.

into either end of the roller to fit corresponding holes drilled in the 2 by 4-inch end pieces. Either unit, while intended for ripping, can be used to advantage as a support when crosscutting long pieces.

Gang Saws.—Saws ganged together with wood or metal spacing collars between can be used to advantage for certain kinds of work. An example is the cutting of tenons, as shown in the photo above. Two saws are used, these being separated by a collar to the width of the desired tenon. The work is carried in the tenoning jig, one pass making both cuts in the end of the work. Three or four saws ganged together are sometimes useful in grooving or in ripping narrow strips. This comes more under the head of large scale production work and has little application to jobs done in the homeshop.

Simple Tenoning Jig.—Where the saw is not equipped with a regular tenoning jig, the simple homemade device shown in the photo and diagram can be used. As can be seen, this consists of a wooden form which straddles the regular fence. Work to be tenoned is placed against the stop shoulder and clamped in place. The work can then be advanced to the saw blade with perfect safety. Cutting tenons freehand with the fence alone as a guide is not recommended because of the danger involved, and should never, under any circumstance, be attempted when the work is less than 4 inches wide. If the tenon is being cut freehand, a suitable backing block should be used to give the work a rear as well as a side support. For all work, however, the use of the regular tenoning jig or the homemade jig shown is advisable.

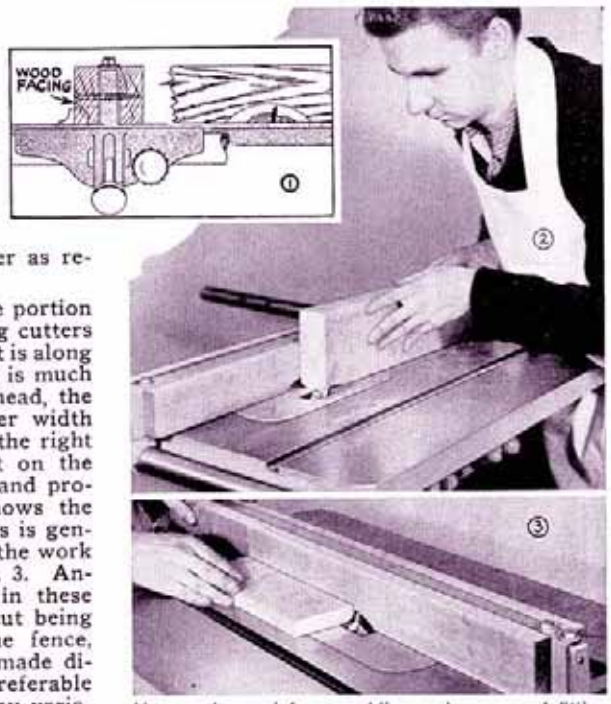


CHAPTER FOUR

THE MOULDING HEAD

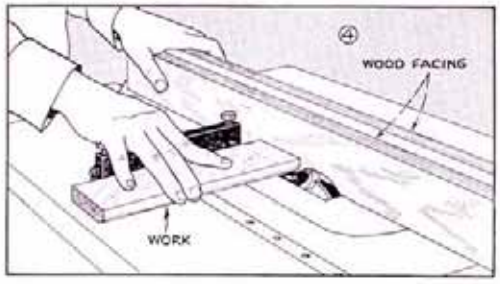
Auxiliary Fence. — Where the saw is not equipped with a cut-out moulding fence, it will be necessary to add wood facings to either side of the regular rip fence, as shown in Fig. 1, to permit the free passage of the knives. Naturally, only one face of the fence will be used at a time, so a single piece can be used for occasional work, switching this from one side to the other as required.

Moulding Straight Edges.—A large portion of all work done with the moulding cutters is straight line work. Where the cut is along the side of the work, the operation is much the same as using a saw or dado head, the fence being adjusted to the proper width while the saw table is adjusted to the right height. Work can be shaped flat on the table, or it can be stood on edge and projected into the cutter. Fig. 2 shows the work being moulded on edge. This is generally less preferable than running the work flat on the table, as shown in Fig. 3. Another point which will be noted in these pictures is that Fig 2 shows the cut being made on the side away from the fence, while Fig. 3 shows the cut being made directly along the fence. Fig. 3 is preferable since the cut is not then effected by variations in the width of the stock.



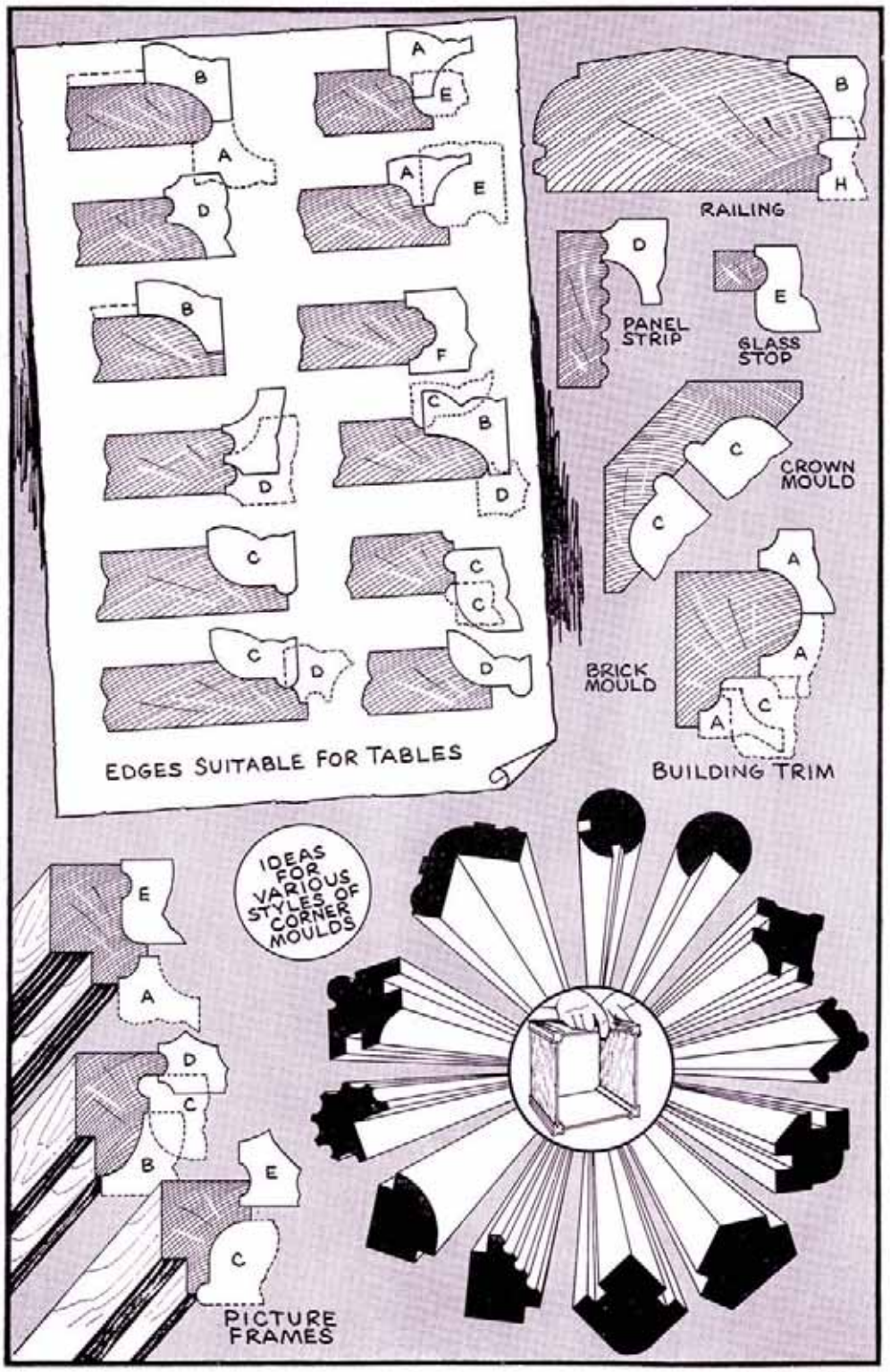
Above, edge and face moulding and manner of fitting wood facings. Below, moulding end grain.

Moulding End Grain.—When moulding end grain, use is made of the miter gage, as shown in Fig. 4. As in crosscutting with the shaper or jointer, the feed should be slowed up at the end of the cut to prevent splintering. Where the mould is completely around the piece, the ends should be worked first so that the final, with-the-grain cuts will remove any splintered edges. In all cuts, attention should be given the grain, making the cut at all times whenever possible in the same direction as the grain of the wood, and not against it.



Application of Cutters.—A few of the hundreds of shapes which can be cut with moulding cutters are shown on the following page. Since the moulding cutters are identical with standard shaper cutters, with the exception of knife B, any mould made with the same-shape cutter on the shaper can be duplicated on the circular saw. This is mentioned so that the operator can consult "Getting the Most Out of your Shaper," for further applications of moulding cutters.

Strip Mouldings.—The term "strip moulding" is applied generally to any moulding whose body is a thin strip of wood. The usual manner of working these is to mould the edge of a wider board, and then rip off the moulded portion. Another method of working is to use a strip jig, as shown at the top of page 25. The jig is made according to the sketch, the channel opening being of the required height and width to accommodate the work. The piece which

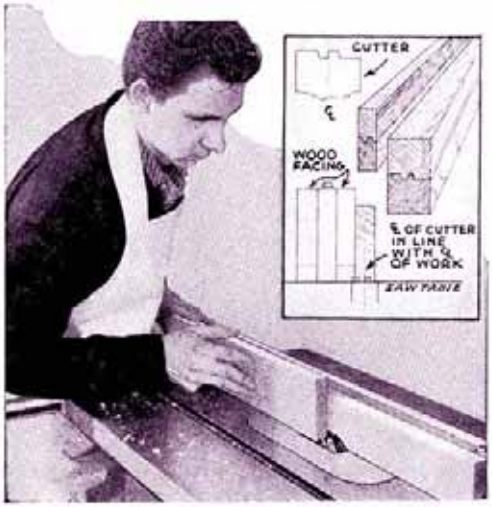


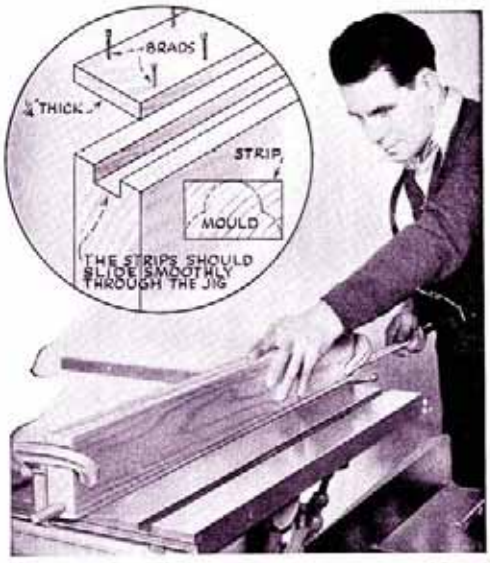
One-Half Full Size.

is bradded to the main body of the jig is cut away at the center to permit the passage of the knives. In use, the jig is clamped against the saw fence, and the strips are run through. A clover leaf moulding, such as used on screen doors, can be cut with one pass of the work with style F knives. Mouldings which require combination cuts are run through the jig as often as necessary to produce the required shape.

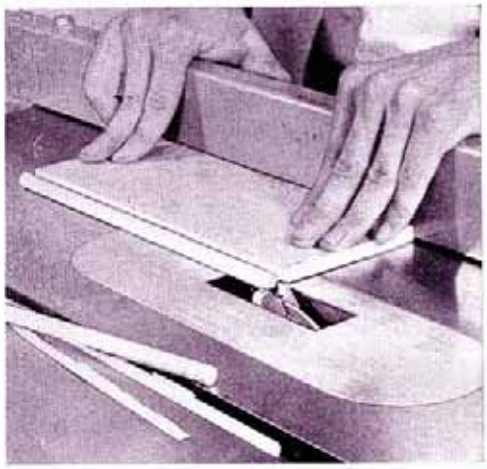
Cutting Dowels.—Dowels ⅜ and ¼ inch in diameter can be cut with standard moulding cutters, as shown in the center photo. This picture shows the ⅜ inch size being cut. The stock should be about 1/32 inch over ⅜ inch thick. A cut is first made on one side of the piece, after which the work is turned over for the final cut on the opposite side. A light edge will be left connecting the dowel with the main body of the work. This is easily broken off with the fingers.

Glue Joints.—Glue joints are made with the knife shown in the diagram below. This knife makes both cuts for the joint, the shape of the cutter being such that the tongue and groove fit perfectly by reversing the stock. To get good results, the set-up must be very accurate. The guide fence must be set so that the centerline of the work is exactly in line with the centerline of the knives. The table must be adjusted so that the lowest cutting part of the knives will just touch the stock lightly. After these adjustments have been made, two pieces of scrap stock which are the same thickness should be run over the knives. After cutting, one piece is reversed end for end and fitted over the other piece. The joint should fit perfectly. If one side projects more than the other, make the necessary adjustments to center the joint. Do not make any glue joint in this manner without first checking the set-up on scrap stock. If not properly adjusted, one piece





A strip jig is used when getting out larger quantities of any particular moulding, especially a clover-leaf mould.



Above, cutting dowels. Left, accurate setting of the fence is essential for the making of good glue joints.

will be offset from the other, necessitating an irksome job of resurfacing.

Table Inserts. — When cutting certain mouldings which require only a small portion of the knives to project above the table, it is best to make a special wooden table insert piece which fits up close to the knives. Such an insert is usually necessary when moulding thin curved work on edge to prevent the stock from dropping into the opening around the cutterhead. Inserts are made from plywood to the required shape to fit the table opening. With the wooden insert in place, the machine is started and the table gradually lowered so that the knives will cut their own opening in the insert. The table should be lowered

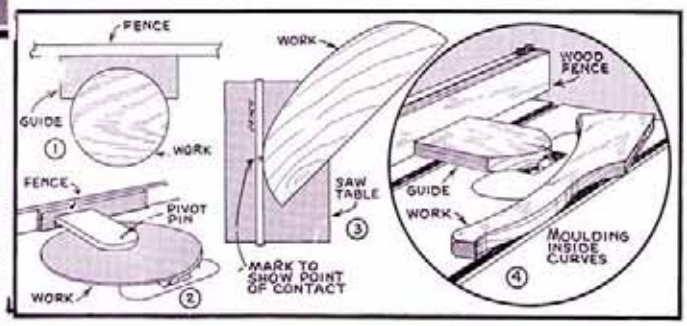
Below, a simple jig for moulding circular work. The vee blocks will furnish a two-point contact for work of almost any size.

a scant fraction of an inch farther than necessary in order to give the cutter clearance, after which the table is again raised to the level required for the work.

Circular Work. — Work which is perfectly circular in shape is best moulded with the use of some simple jig. A typical set-up is shown at the top of page. It can be seen than any circle will make a two-point contact against the vee blocks so that the edge will at all times maintain a fixed position in relation to the cutter. This jig is particularly useful in that it can be used for a wide variety of sizes. The set-up should be made carefully so that the centerline of the work and the centerline of the jig are in line. The cut proceeds in the usual manner, the work being pushed into the cutter and against the jig and then rotated. A somewhat similar form of guide is shown in Fig. 1. In this case, the scrap cutting which is left after band sawing the circle is clamped to the fence to form a guide for the work. Another method of moulding circular work is shown in Fig. 2. This makes use of a pivot pin which fit through the jig and into a corresponding hole in the work. This jig can be used for a wide variety of sizes.

Outside Curves. — Outside curves which are not circular cannot be guided by a jig but must be worked more or less freehand. The fence is first set so that when the work butts against it, the knives will cut the required mould. A mark must be made on the fence to show the centerline of the cutterhead. The work is then fed to the knives, maintaining a point of contact at the mark on the fence, as shown in Fig. 3. Since it is not possible to keep the work moving and still keep it tangent to the fence at all times, it will be necessary to go around the work two or three times in order to get a full shape. Overcutting is impossible since the knives can only cut as wide as the fence is set.

Inside Curves.—Slow inside curves can be moulded successfully when the mould is not too complicated. A guide block is used, this being fastened to the wood fence, as shown in Fig. 4. Work to be moulded is guided against the wood block in much the same manner as moulding an outside curve. Here, again, a mark should be made on the guide to show the centerline of the cutterhead, and the work must be kept in contact with this mark.



Various methods of moulding round and curved work are shown in the diagram, Below, straight knives offer a clean and fast method of cutting tenons.

Tenons.—Straight knives in the moulding head offer a quick and clean method of cutting tenons, as shown in the lower photo. Tenons up to 1 inch wide can be made in one pass of the work, while longer tenons are cut by simply walking across the work to the width desired. Where more than one cut is to be made, the first cut

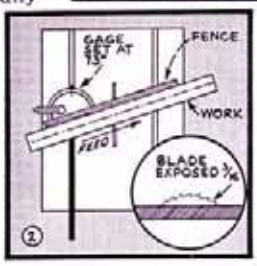
should be on the inside to form the shoulder.

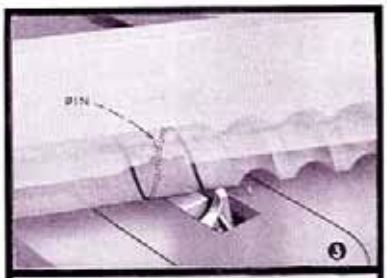
Panel Raising.—With the saw table slightly tilted, the same application of straight knives as for tenoning will enable the operator to do panel raising. One, two or three cuts can be made entirely around the work in order to make up any required panel. As in other cuts where the work is moulded all around, the end cuts should be run in first so that the final cuts with the grain will clean up the work.

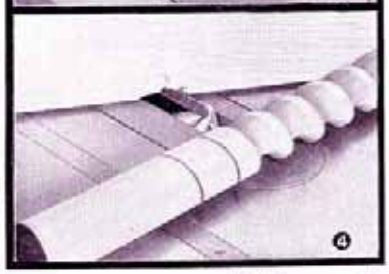
Spiral Turnings.—Spiral turnings, ordinarily produced by a slow lathe method, can be greatly simplified by the machine method of making them on the circular saw. Figs. 1 and 2 show the first operation. An auxiliary fence is screw-fastened to the miter gage, after which the fence is clamped to the saw table, as shown in Fig. 2. The blade is exposed to a depth of $\frac{1}{16}$ inch, and the center of the blade should be in line with the center of the work. The work, when pushed along the fence, will both turn and feed itself, cutting a perfect spiral groove which will not vary over 1/32 inch from any one spiral to the next in line. A fairly stiff blade is necessary, such as the hollow-ground saw or a single dado cutter.

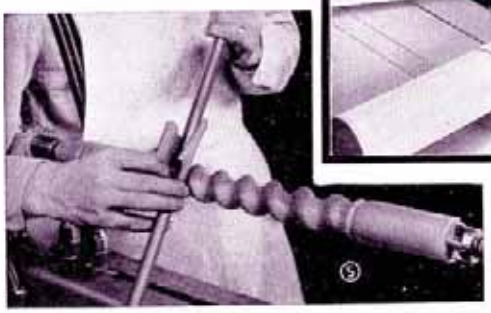
After cutting the spiral groove, the fence is swung completely around to a position about 60° on the opposite side, as can be seen in Fig. 3. The fence is fitted with a guide pin, as shown in the phantom view, Fig. 3, the pin being located so that, engaged in the spiral groove, the bottom of the groove will be immediately over the style B moulding cutter, which is used for the second operation. With the pin guiding the work, the stock is fed to the cutter. The cut produced is not the true shape of the cutter, but is a perfect cove cut, as can be seen in Fig. 4. The cut will be quite smooth if the work is fed slowly, and of course, it will be just as perfect as the guiding spiral groove.

Perfect spirals in round stock are easily cut with the circular saw method of working.









The work is now mounted in the lathe and the sharp corners of the cove-cut spiral are rounded over. This part of the work is done with a rasp file in the usual manner of making spiral turnings. Finishing can be done with sandpaper held around a dowel stick as shown in Fig. 5, chasing up the spiral as the work rotates at slow speed. It can be seen that by grinding special cutters, the full round of spiral can be cut instead of the cove shape. On the average home workshop job, however, this extra labor is not worth while. On the other hand, any job calling for four spiral turnings can be speeded up considerably by using the style B knife in the manner described. The stock shown in the pictures is about 1½ inch diameter, but any other size can be worked equally well. The specified setting of the miter gage in cutting the guiding spiral will give a pleasing pitch, but can be varied to suit. In every case, the spiral-turned portion should be worked first, after which the work can be placed in the lathe for turning operations.

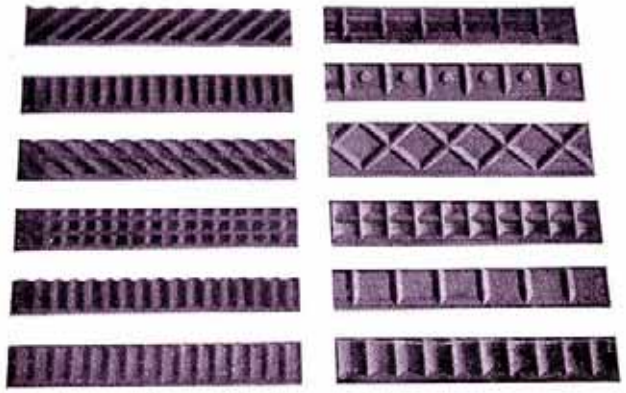


Photo shows a number of different ornamental mouldings made with moulding cutters on the circular saw.

Ornamental Mouldings. — A wide variety of ornamental mouldings giving the appearance of hand carved work can be made with moulding cutters. Typical examples are shown in the photo at the top of the page. The work is simply a repetition of any suitable moulding cut, the cut being spaced at regular intervals by means of a guide pin. To make the moulding shown in Fig. 1 (this is also shown in the photo, right column, fourth from top), a set of style D cutters are placed in the cutterhead. The saw table is then adjusted to the position shown in Fig. 2. A strip of wood is fastened to the miter gage, and a brad or small nail is driven into the wood to serve as a guide, as can be seen in Fig. 3. The exact location of the pin must be determined by experiment. This is done by making three cuts at the required spacing. With the final cut over the moulding head, the first cut will mark the location of the pin. Now, if the second cut is engaged with the pin, the work will be properly set for making the fourth cut; the third cut will space the fifth cut, and so on as far as the operator cares to go. The cut for this particular moulding, is on the edge of a piece of ¾ inch stock, the cut being directly across the grain. After making as many cross cuts as desired, the piece is fluted lengthwise, running in a full flute in the center and two half flutes, one at either side. The work can then be ripped on the saw to any thickness desired.

The whole operation of making a length of carved moulding of this kind can be done very rapidly after the spacer pin is once set. The work is very similar to making box joints with the dado head (see page 32) excepting that a moulding cutter is used instead of a dado head. Practically any cutter can be used. Even straight knives will give an attractive variety of patterns by tilting the table to 45 degrees which will permit the knives to cut a full vee groove. Some good effects are possible by making the cuts at an angle across the edge of the work instead of directly across it. In this case, the guide pin would be driven at the same angle, as can be seen in Fig. 4, so as to be parallel with the cut. Fig. 5 shows the second cut being made in the work.

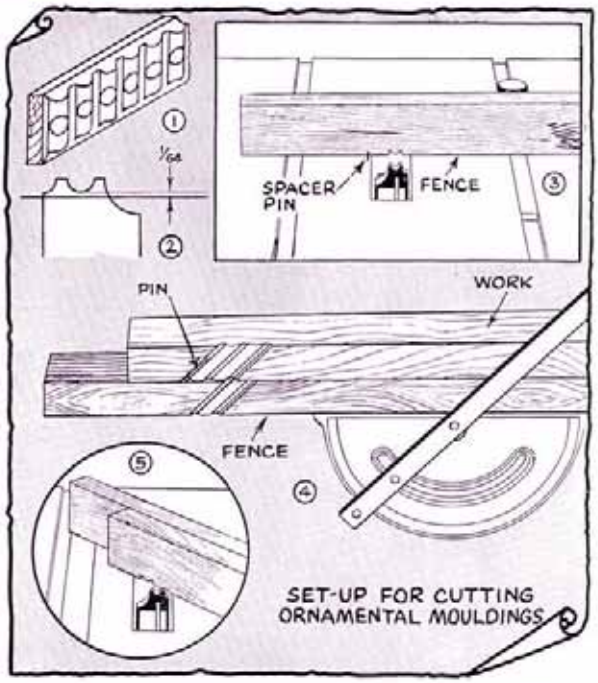
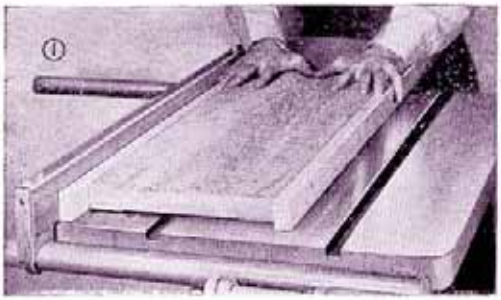
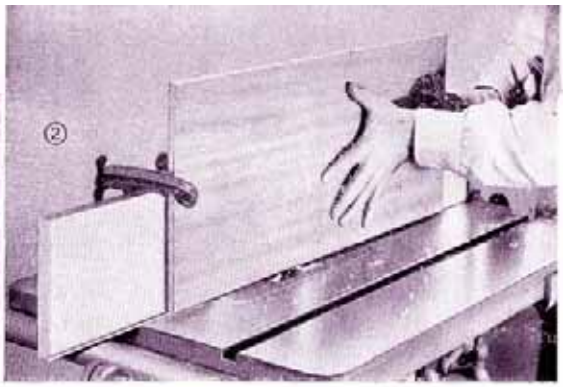


Diagram shows the spacer pin method which is used to quickly and accurately space the various cuts at the proper distance.

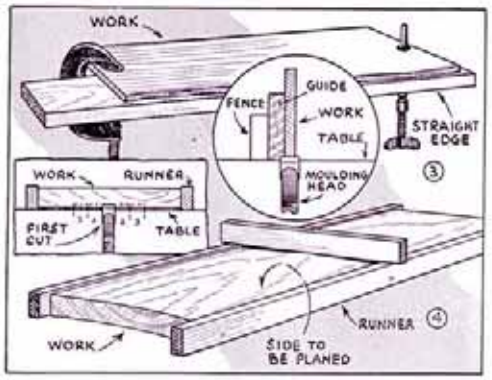
The first cut setting over the guide pin. Cutting diagonally across the board is usually productive of smoother work than when the cut is squarely across the grain. As in all other operations where the cut is across grain, there will be a slight amount of tearing of the wood fibers at the end of the cut. This can be eliminated if the feed is made very slowly at the end of the cut so that the knives will have a chance to cut instead of tearing the last few fibers of wood. As well as making mouldings, the same general methods described can be used for working up imitation carved panel effects, the only major difference being the size of the work.



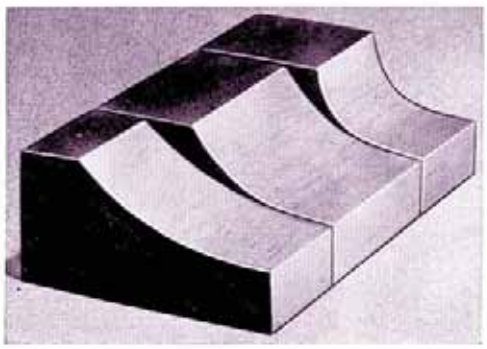


When other equipment is not available, good jointing and planing can be done with straight moulding head knives, as shown in photos above.

Jointing and Planing. — Where better equipment is not available, good jointing and planing can be done with straight knives in the moulding head. To joint an edge, clamp the work to a guide board known to have a true edge. The work should be entirely inside the straight edge, as shown in Fig. 3. The work is advanced to the knives, as in Fig. 2. It can be seen that the straight edge serves as a guide and insures an accurate edge on the work. The cutterhead should be set so that a small rabbet is cut in the guide board at the same time as the operation is being done. In the planing operation, runners are nailed to each edge of the work, as in Fig. 4. As in the jointing operation, the work surface must be entirely inside the projection of the runners, as indicated by the straight edge across the work in Fig. 4. The first cut is made at the center of the work, then successive cuts are taken on either side by setting the fence over 1 inch for each new cut. When the surface being planed is true and smooth, the runners are not required, since a narrow strip of uncut wood at either side will serve the same purpose. If the board is evenly warped, it can be worked without runners. However, if there is a twist in the work or unequal warping, the runners must be nailed in place. In fitting these, check should be made to see that a flat plane is established, free from twist.



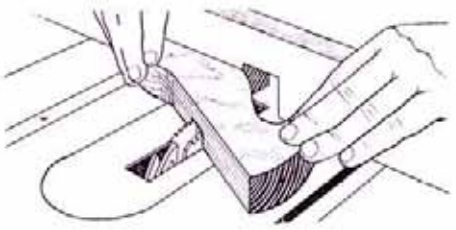
Cutting Coves.—Oblique feed with moulding head knives produces large cove mouldings of exceptional smoothness. The maximum depth of cut is about 11/16 inch. The width of the cove is controlled by the angle of feed. In the example below, the smallest cove was cut with style P knife in the usual position, that is, straight into the cutter. The mould is 1 inch wide—the full width of the cutter used. The middle sample was cut with a 30-degree feed. The depth is the same as before, but the width of cut is increased to about 1¼ inches. With a 60-degree feed, the width of the cove increases to about 1⅝ inches. This is the maximum width It is practical to use direct cross feed but there is no increase in cove width. Direct cross feed produces a perfectly circular mould, making this operation useful for certain work. All cuts can be made in one pass, although two passes would be preferable if working dense cabinet woods. After cove cutting, the moulded portion can be ripped on the saw to any desired width.



Large coves are cut with maximum smoothness and minimum labor by using oblique feed with the moulding head.

CHAPTER FIVE

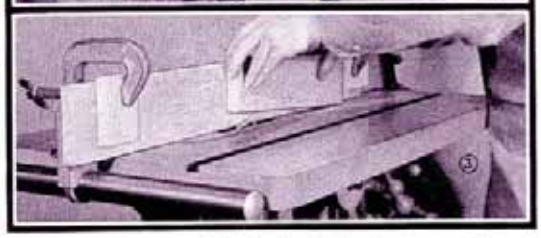
Using the DADO HEAD



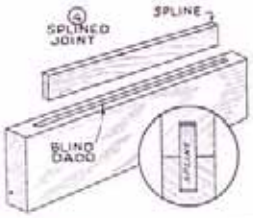
Application.—The application of the dado head is easy to understand—it is simply a thick saw used for making various widths of grooves and rabbets. Fig. 1 is an example. In this operation, a series of grooves are being cut at regular intervals on the surface of a board, the stop rod being used to engage the previous cut in setting the next cut, and so on. Fig. 2 shows a similar operation except that the grooves are not cut at regular intervals. You will note in this picture, the use of the yardstick as a convenience in measuring. Some workers use a rule in this manner for all circular saw work.

Blind Dadoing. — Where the groove is not a through groove, but stops short of one or both edges, it is called a blind dado. A common use of the blind dado is in the making of the splined joint, as shown in Fig. 4. An auxiliary wood fence and stop blocks to start and stop the cut are necessary for this operation. Where the work is very short, the stops can, of course, be clamped directly to the saw fence.

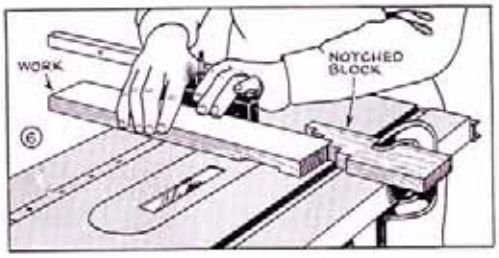
Tenons.—Tenons are easily and quickly made with the dado head. The widest combination is usually used, this being wide enough to cut the average stub tenon in one pass of the work, as shown in Fig. 5. Where the tenon is longer than the width of the dado head, the inside cut should be made first, then the work is stepped over to make the necessary extra cuts.

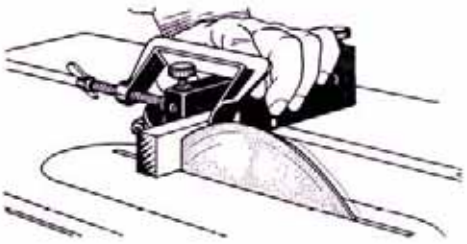


The dado head offers a quick and convenient method of cutting grooves and rabbets of various widths.



Wide Grooves.—Where a number of wide grooves or tenons are to be made, it is convenient to use a gage block, as shown in Fig. 6, to set the various cuts.



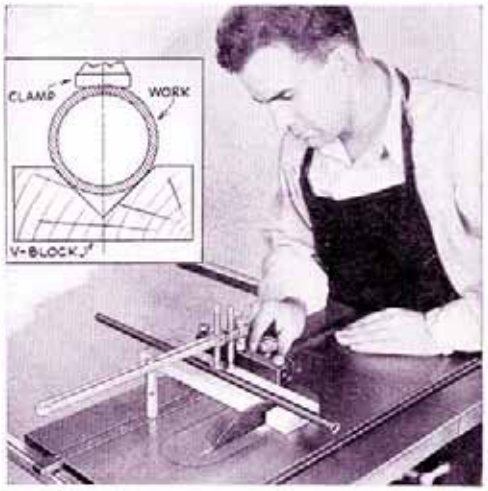


CHAPTER SIX

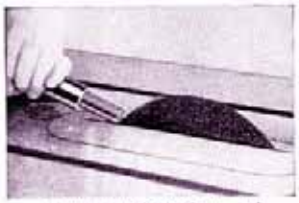
USE OF ABRASIVE WHEELS

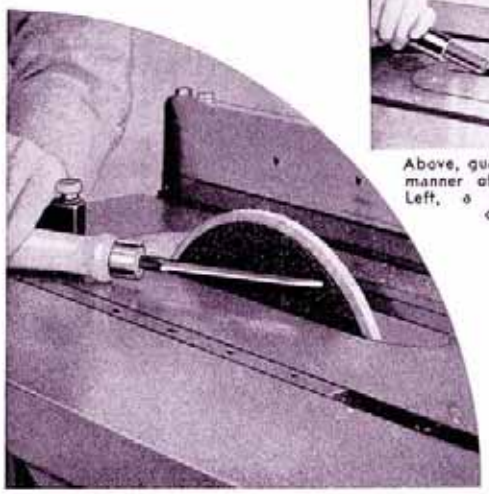
Cutting Thin-Wall Tubing.—One of the most common uses of abrasive cutting-off wheels on the circular saw is the cutting of thin-wall tubing to exact lengths. In this operation, it is advisable to hold the tubing in a suitable vee block, the block being held to the miter gage by means of the miter gage clamp attachment, as shown in the top photo and diagram. The tubing can project beyond the block, or the block may be partially cut away to permit the passage of the wheel. As in similar operations in cutting wood, various stop blocks and stop rods can be used to accurately gage the exact length of the piece.

Cutting Solid Stock.—Solid metal or other stock in bars or sheets are cut to size with abrasive wheels in much the same manner as wood is cut with the circular saw. Some form of guide is always necessary. Also, since heavy material will become quite hot some distance from the point of cutting, it is frequently necessary to use clamps or other devices to hold and feed the work. A suitable guard should be used whenever possible. At the same time, it may be pointed out that abrasive wheels, while brittle, are well-bonded and not likely to break or chip in use. The feed should be firm and with sufficient pressure. A slow feed permits the wheel to glaze,



Above, cutting thin-wall steel tubing with an abrasive wheel.





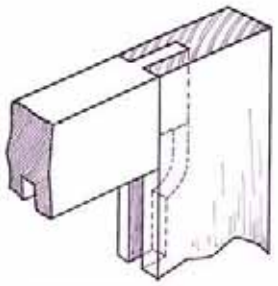
Above, guard in place and manner of trueing wheel. Left, a typical surface operation.

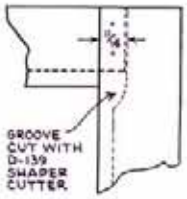
and glazing is the prime cause of wheel breakage. On the other hand, the work should not be forced too strongly against the wheel since this will greatly shorten the life of the wheel by tearing the abrasive grains from the bond before they have accomplished their full duty of cutting.

True Wheels Essential.—A balanced wheel with a clean edge is necessary for successful cutting. If the wheel should get a little out-of-round, it will start to vibrate. While this is not particularly dangerous, it results in a cut considerably wider than the thickness of the wheel. Wheel life is shortened, and precision cutting-off is impossible. If the wheel should get out-of-round or chip, it should be brought to a true edge with the use of a suitable abrasive stick.

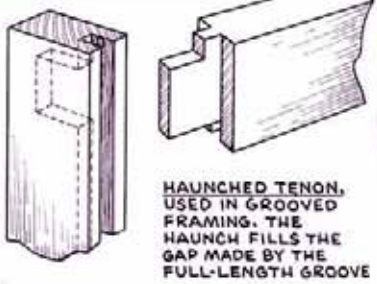
Surfacing.—A wheel used for surfacing should be glued to a disk of ply-wood to give it the necessary stiffness. Sanding disks can be mounted in the same manner, and are useful for a variety of work.

Various applications of the mortise-and-tenon joint. The tenon portion of the joint is cut on the circular saw, as described and shown on the opposite page, while the mortised part is cut with the use of a mortising chisel on the drill press. The best general practice is to cut the tenon first, although the order can be reversed if desired.

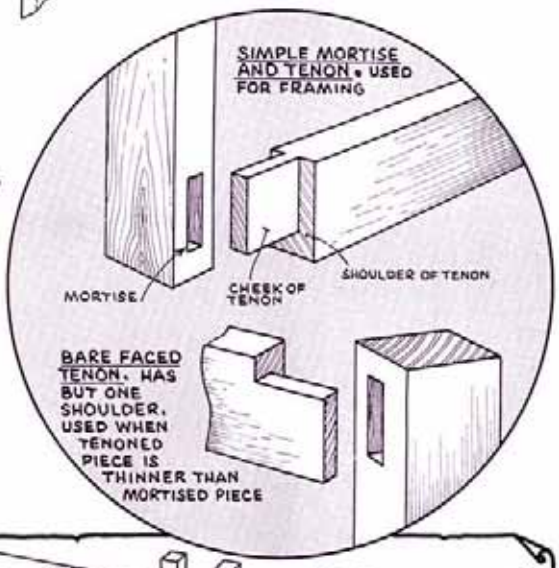


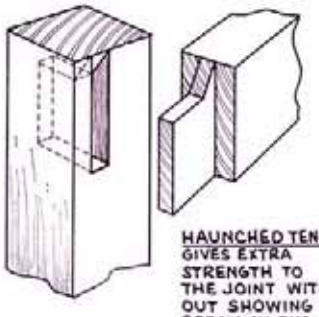


STUB TENON IN SLOT. NOT A TRUE MORTISE-TENON BUT EASILY MADE AND USEFUL FOR LIGHT FRAMING

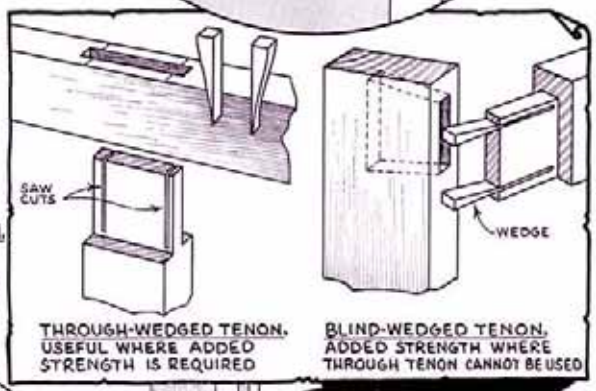


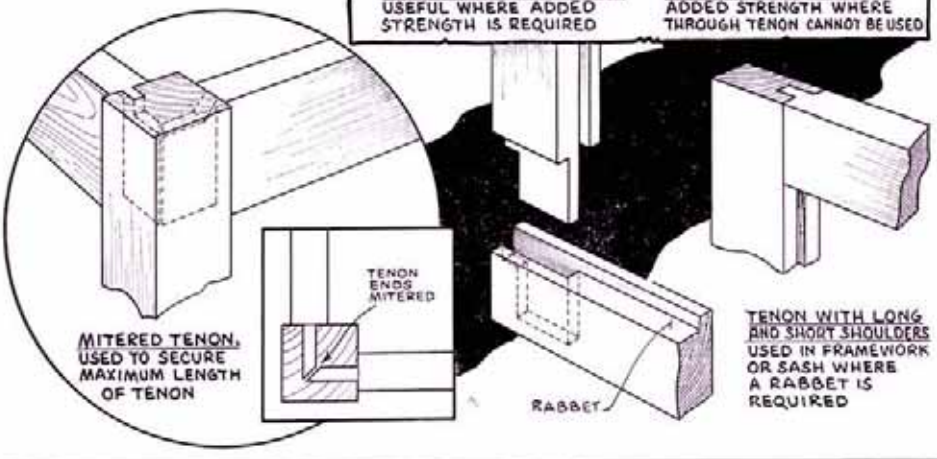
HAUNCHED TENON, USED IN GROOVED FRAMING. THE HAUNCH FILLS THE GAP MADE BY THE FULL-LENGTH GROOVE

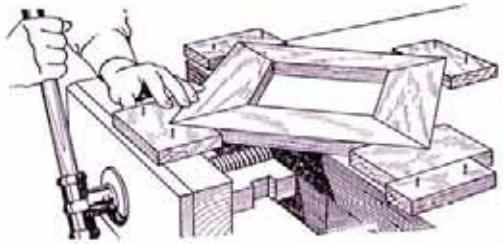




HAUNCHED TENON, GIVES EXTRA STRENGTH TO THE JOINT WITHOUT SHOWING A BREAK AT END







CHAPTER SEVEN

Common WOOD JOINTS

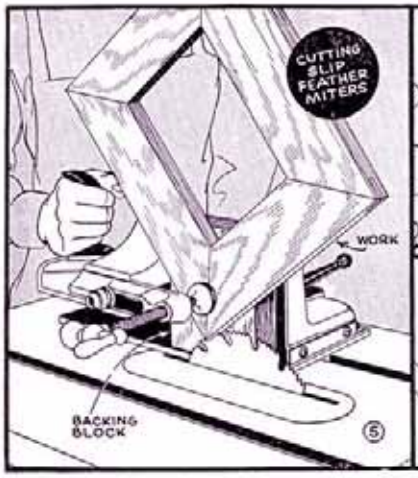
Use of Tenoning Jig.—Fig. 1 shows the tenoning jig being used to cut a spline groove in a mitered joint. Note stop block clamped to the saw table to stop the cut at the proper position, a little short of the full length of miter.

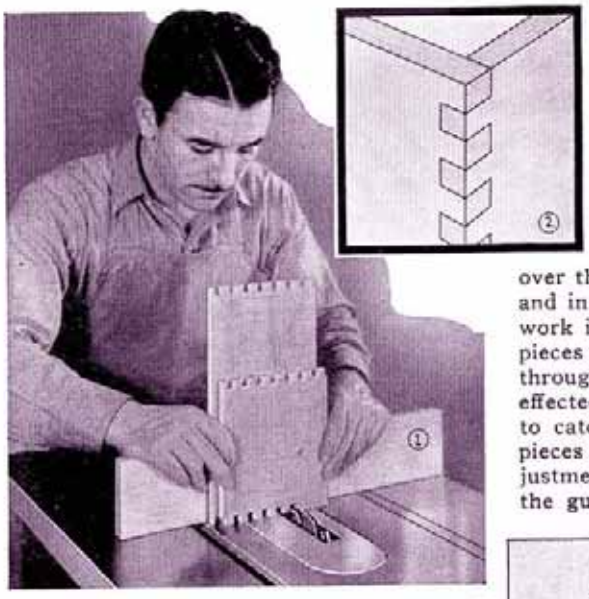
Figs. 2, 3, and 4 show the various steps in cutting a tenon with a single saw. The shoulder cuts are made first, as shown in Fig. 2, the length being set by means of a stop block. The work must be exactly right in overall length. The first cheek cut is then made, as shown in Fig. 3. In making this cut, a backing block is used behind the work, this block being of a thickness equal to the width of the desired tenon, plus the thickness of the saw blade. After making the first cheek cut, the backing block is removed and the second cheek cut is made, keeping the same face side of the work against the jig. Notice in Figs. 3 and 4 that a stop block is clamped to the saw table. This should

Drawings and photos show the application of the tenoning jig in making various joints.

be the same thickness as the base plate of the tenoning jig. It should be kept as a standard accessory, since the work cannot always be stopped against the base plate. An equally useful method is shown in Fig. 7, where the length is stopped with a stop rod inserted in the hole in the top of the jig.

Grooving a miter joint for a slip feather is shown in Fig. 5. A heavy backing block is used behind the work so that it will clear the rear of the jig. Fig





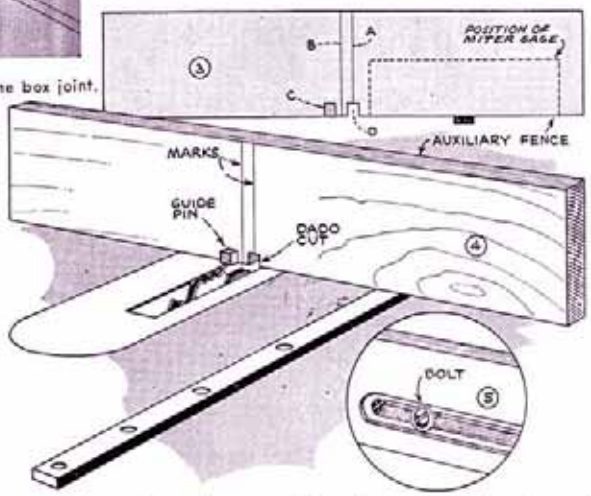
Any width dado cutter can be used in making the box joint.

6 shows the tenoning jig being used to hold the work in making an open mortise.

Box Joints. — This familiar joint, seen on many varieties of small boxes, can be used to advantage for much of the work that falls within the scope of the home or production shop. The joint presents lots of glueing surface, besides being neat in appearance, as can be seen in Fig. 2. This joint, in any suitable size, can be easily made on the circular saw fitted with dado head.

To set up for the work, it is necessary to have an auxiliary wood fence which can be screw-fastened to the standard miter gage. After sawing this piece, remove the saw from the arbor and mount a dado cutter of the thickness selected for the joint. In most cases, the width of the cut is equal to or slightly less than the thickness of the stock. Hold the fence firmly against the miter gage and run it across the dado head somewhere near the center. Remove the fence, and mark the position of a second cut, D, Fig. 3, spacing this from the first cut, C, the same width as the groove. At the same time, mark the lines A and B, centering them as shown. Nail a little square of wood in the first dado cut, as can be seen in Fig. 4, and then make the second dado cut, D, with the fence screw-fastened to the miter gage. You are now ready to make the box joint.

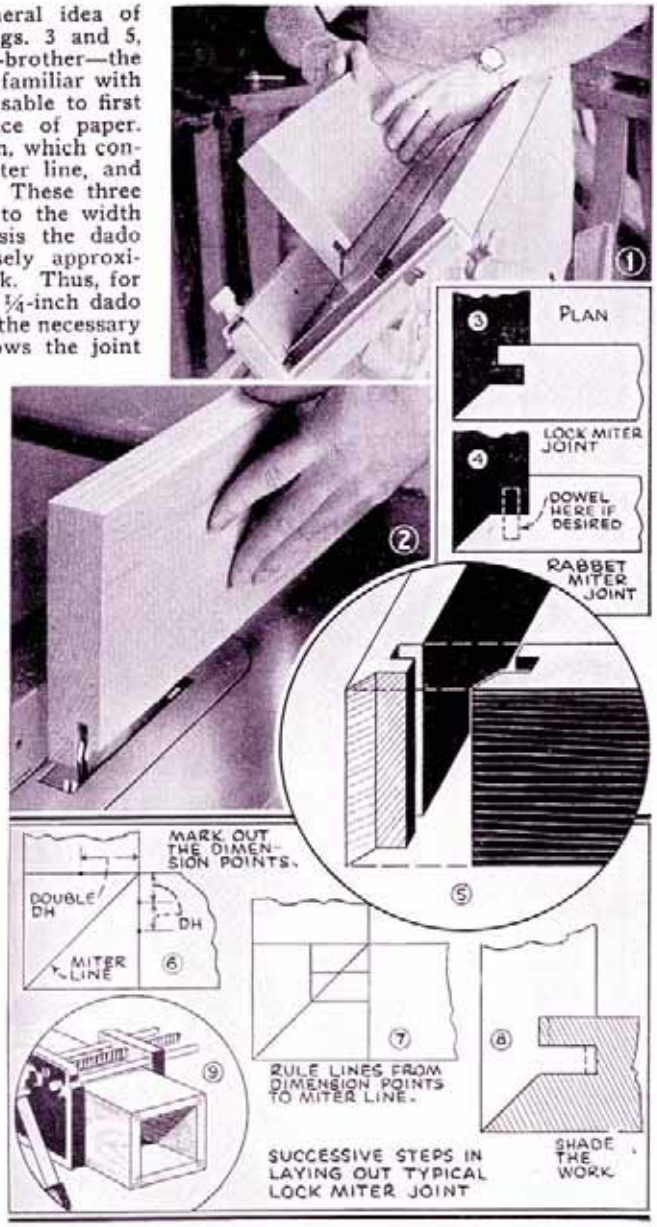
To make the joint, two pieces of stock that are to be joined are set against the fence, the edge of one piece being set even with line A, while the edge of the other piece is set even with line B. The work is then pushed across the cutter. The work is then shifted, so that the groove just cut sits over the locating pin, and the second cut is made. The second groove is then placed over the locating pin and a third cut made, and in this manner the whole width of the work is cut. It is important that the two pieces of stock maintain the same position throughout the operation. This is easily effected if the guide pin is made long enough to catch both pieces. If desired, the two pieces can be lightly nailed together. Adjustments can be made by moving either the guide or the fence itself.



In order to make adjustments simple and to accommodate a wide variety of work, many craftsmen prefer the arrangement shown in Fig. 5, or something on the same order. In this case, the fence is held to the miter gage by means of bolts inserted through a long slot. After selecting the cutter to be used, the fence is set so that the distance between the side of the cutter and the side of the guide pin is the same as the width of the cutter. A small guide pin serves for all sizes of cuts, each groove being set tight against the side of the pin nearest the cutter. This type of fence is recommended for all-around work, since it permits any width of dado cutter to be used. Another worthy feature is that any box joint thus made can be made either a driven or loose fit by simply setting the fence a fraction of an inch one way or the other.

Lock Miter Joint.—The general idea of this joint can be seen in Figs. 3 and 5, while Fig. 4 shows its near-brother—the rabbeted miter. In becoming familiar with the lock miter joint, it is advisable to first draw the markings on a piece of paper. Fig. 6 shows the first operation, which consists of marking the true miter line, and setting off three dimensions. These three dimensions are in proportion to the width of the stock, taking as a basis the dado combination which most closely approximates ¼ the width of the stock. Thus, for 1-inch stock, you would use a ¼-inch dado combination, etc. Fig. 7 shows the necessary lines ruled in, and Fig. 8 shows the joint shaded to picture how it will make up in wood.

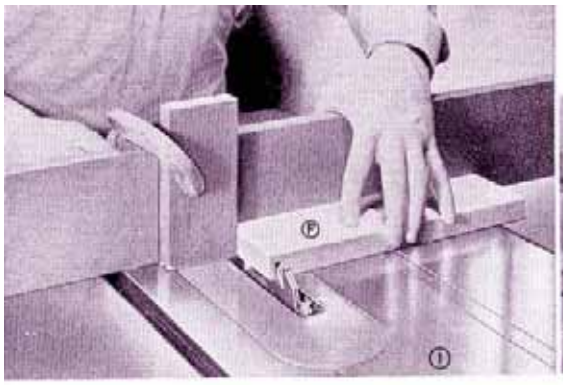
In making the actual joint, similar markings are penciled on the wood stock; then, the wood is cut away to these lines. The photograph in the center pictures the dado cuts being run in on one of the pieces, while the top photo shows how the table must be tilted to 45° to cut that portion of the joint which is a true miter. A few sample joints will quickly point out the exact method of procedure. It will be found that the width and depth of the dado cuts can be varied considerably while still maintaining the general features of the joint. Thus, in working ¾-inch stock you would still use a ¼-inch dado combination, with a resulting shorter portion of true miter. Again, the projecting ears of the joint can be made shorter than the specified "double dado head combination" as shown by the dotted lines in Fig. 8. Note, Fig. 9, that the same cut is used on both edges of any single board to permit one-way clamping.

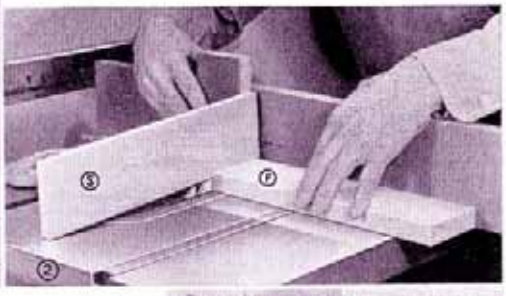


Drawings and photographs above show how the lock miter joint is cut with the dado head. The saw table is tilted to 45 degrees for the miter cut.

Rabbeted Joint.—This simple joint, extensively used in drawer construction, is pictured in Fig. 4 on the following page. A fair standard with ¾ inch front stock is to allow ¼ inch for the lip. It can be seen that all of the work is concerned with the rabbet on the front. There is no work on the side of the drawer. To cut the rabbet, mount the ¼ inch dado combination on the saw. Set the depth of cut at ½ inch. Place the front stock tight against the side of the dado head, as shown in Fig. 2, and then use the side stock as shown to determine the position of the stop block. Clamp the stop in place and make the cut, Fig. 1. Clean out surplus stock by moving the work over, as shown in Fig. 3. The same dado combination is then used to cut the box corner rear joint and groove the sides and front for the bottom.

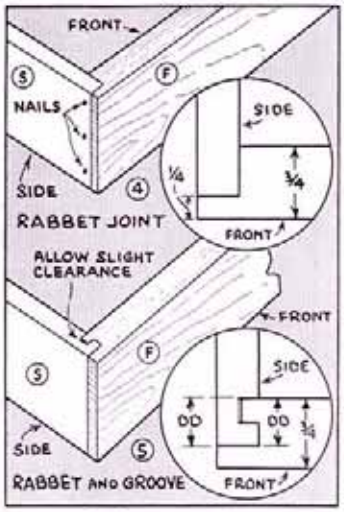
Rabbet and Groove Joint.—Neater and stronger construction than the plain rabbeted joint, the rabbet-and-groove or milled joint is popular for drawer construction.



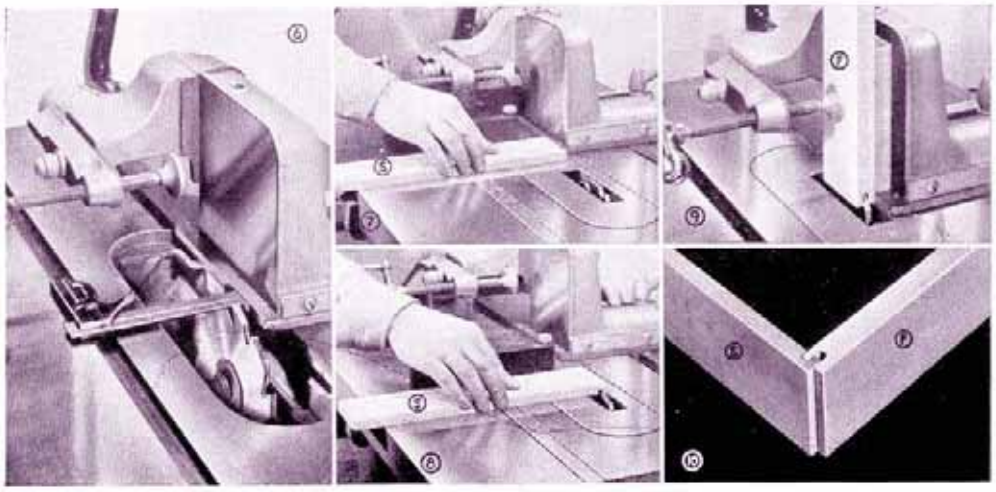


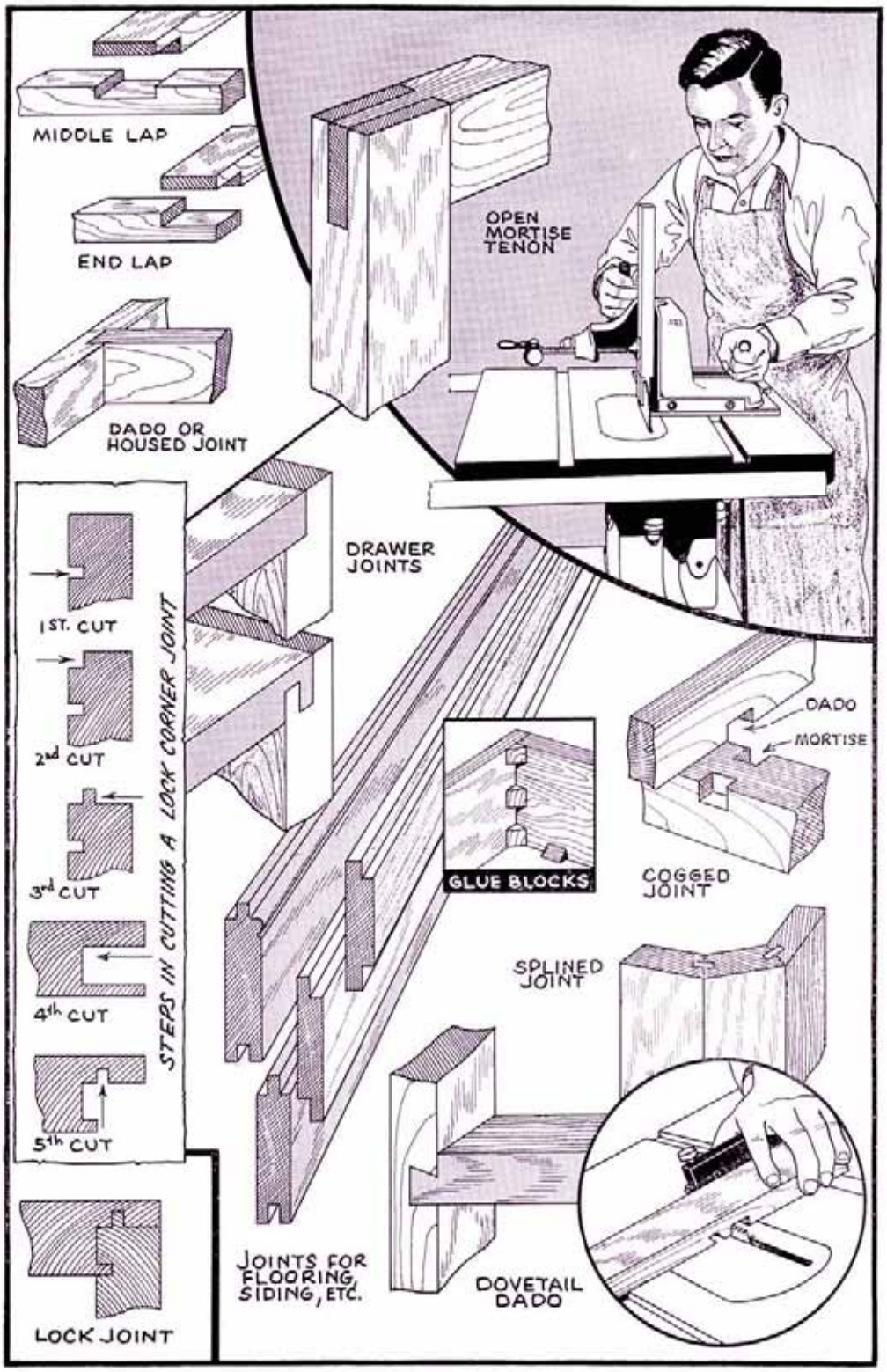
Photos and drawing on this page show the construction and operations in making two simple forms of drawer joints.

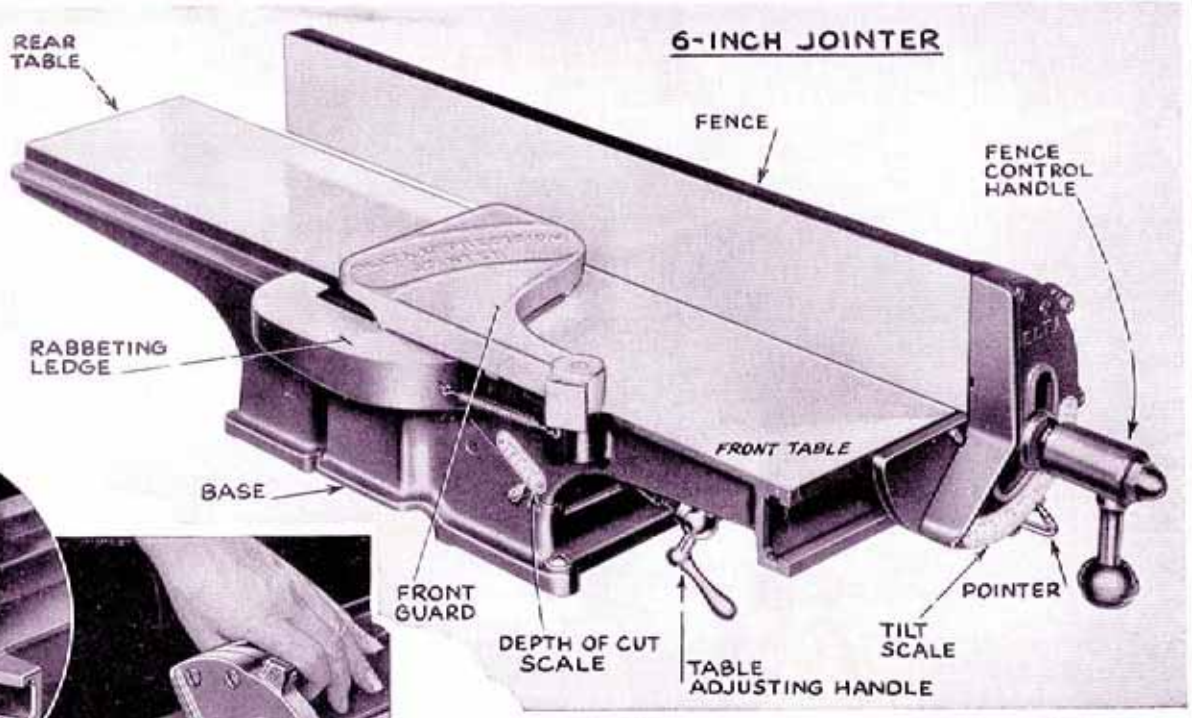
The joint with average dimensions is shown in Fig. 5. The dimension DD means "double dado," and represents a distance equal to twice the width of the dado combination being used. The ¼ inch dado combination is commonly used, making DD equal to approximately ½ inch (dado saws are usually a trifle scant on their named size). The fit of the joint depends on getting the dado groove exactly DD distance from the inner face of the front, and the same DD distance from the end of the side. This is best accomplished by using the same stop block for both cuts. Start by mounting the ¼ inch dado combination in place. Use a thin metal collar or several paper collars behind the innermost saw so that the outer edge of the combination will be DD distance from the edge of the tenoning jig base plate, as shown in Fig. 6. Set the depth of cut to a trifle less than one-half the thickness of side stock. Using the edge of tenoning jig base plate as a stop, Fig. 7, cut the groove in the side piece, as shown in Fig. 8. This completes the side. Reset depth of cut to the same depth as thickness of side stock. Mount the front stock in the tenoning jig, with the inner side of front against the base plate, Fig. 9, and cut the groove in front. The joint will now assemble as shown in Fig. 10 and needs only the cutting-off of the tenon to bring it to a perfect fit.

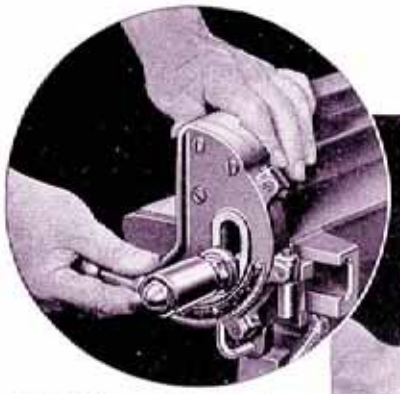


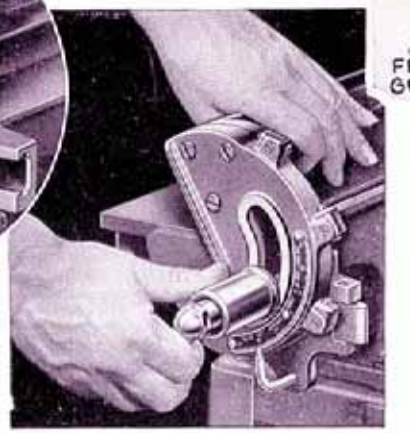
Other Joints.—Various joints which are typical of work done on the circular saw are shown in the drawing on the opposite page. The lock corner joint is excellent construction for cedar chests. It is cut with a single saw, following the order of operations as shown.



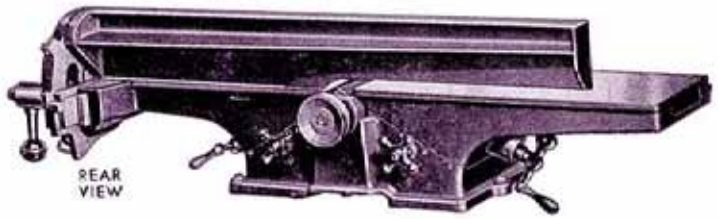

MIDDLE LAP
END LAP
DADO OR HOUSED JOINT
OPEN MORTISE TENON
DRAWER JOINTS
STEPS IN CUTTING A LOCK CORNER JOINT
1ST. CUT
2nd CUT
3rd CUT
4th CUT
5th CUT
LOCK JOINT
GLUE BLOCKS
DADO
MORTISE
COGGED JOINT
SPLINED JOINT
JOINTS FOR FLOORING, SIDING, ETC.
DOVETAIL DADO







Right, the essential parts of a modern 6-inch jointer. Photos above show how the dual control handle is pulled out to control the fence cross slide, and pushed in to tilt the fence to any required degree setting.



CHAPTER EIGHT

THE JOINTER and its ADJUSTMENTS

Mechanical Features.—The working portion of a jointer consists of a cutterhead housing three high-speed steel knives. The cutterhead is housed between two tables, the front or infeed table, and the rear or outfeed table. Both tables are adjustable up and down to regulate the depth of cut. A scale on the jointer shows the depth of cut. A 4-inch jointer will cut to a depth of ¼ inch, while a 6-inch jointer will cut to depth of ½ inch. The terms 4 and 6-inch indicate the length of the knives carried in the cutterhead. A guide fence is provided against which the work is held as it is advanced to the knives. This fence is so constructed that it can be tilted 45 degrees each way from a vertical position; also, it can be moved bodily across the jointer table. A front knife guard to cover the cutterhead is usually furnished as standard equipment, while a similar guard for the rear of the knife is available for most models.

Setting Up.—The jointer may be mounted on a bench or on a steel stand, the stand mounting being preferable. The motor must revolve in such a direction as to cause the cutterhead to revolve towards the front table. If the jointer is mounted on a bench with other machines, care should be taken that there is nothing in line with the rear table that will interfere with the jointing of long pieces.

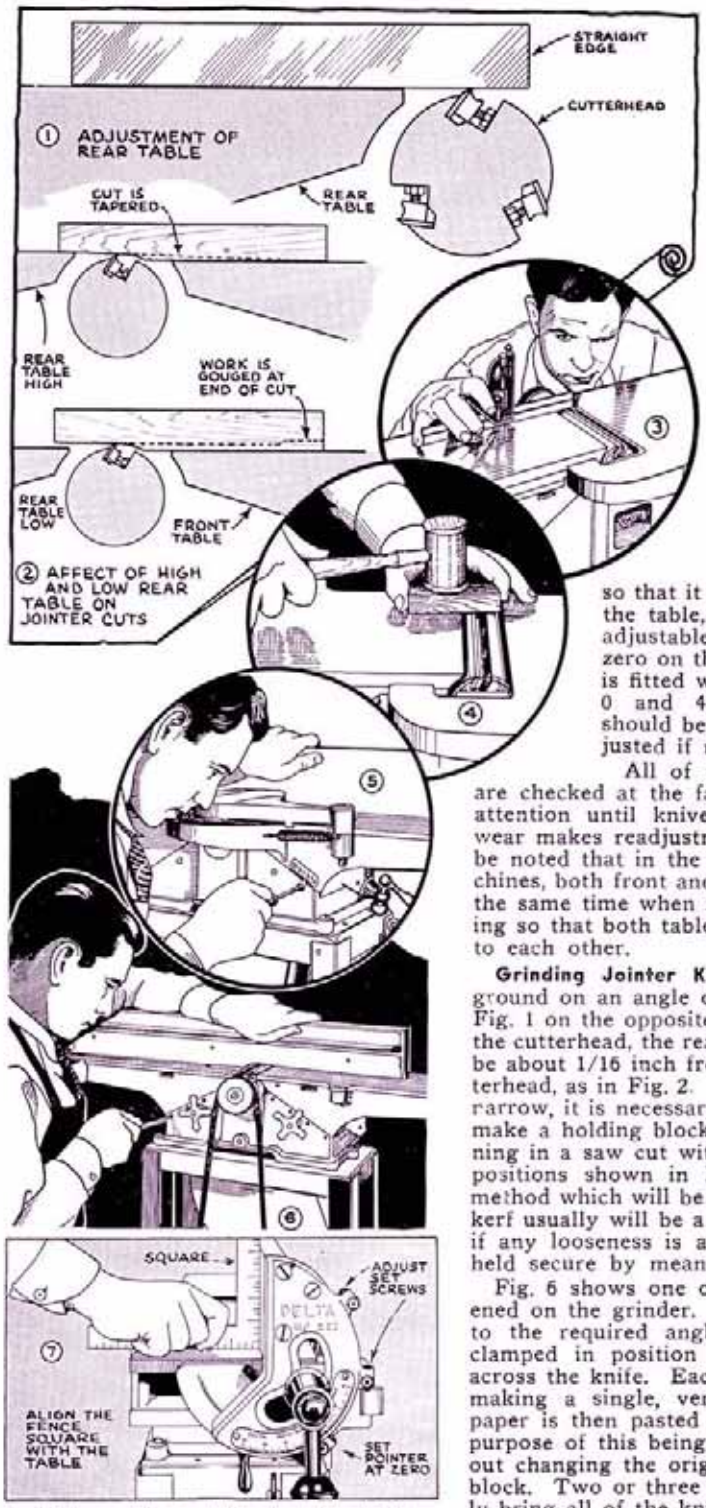
Power and Speed.—Jointers are operated at speeds from 4000 to 8000 revolutions per minute. For average work, a speed of 4200 revolutions will give satisfactory results. The jointer is usually purchased with a pulley attached to it, so, in order to determine the correct size of motor pulley it is only necessary to apply a simple formula:

$$\frac{4200 \times 2.75}{1750} = 6.6 \text{ inch diameter}$$

In this formula, 4200 is the desired speed of the cutterhead; 2.75 is the 2¾ inch pulley which we will say is supplied with the jointer; 1750 is the speed of the motor. The result, 6.6 inch is the required diameter of the motor pulley to get a cutterhead speed of 4200 R.P.M. Since a 6.6 inch pulley is not usually available, the motor would be fitted with the next larger, 7 inch. The motor itself can be any ½ H.P. repulsion induction motor. The belt is preferably a vee belt, properly tensioned to drive without whip.

Rear Table Adjustment.—The most important adjustment on the jointer is the relation of the rear table to the cutterhead. In order to do satisfactory work, the rear table must be exactly level with the knives in the cutterhead, as shown in Fig. 1 on the following page. To make the adjustment, release the lock handle at the back of the jointer and then raise or lower the rear table until it is level with the knives. An accurate straight edge at least 10 inches long should be used, as in Fig. 3. The initial check is made on any one knife, which should be in such a position that its cutting edge is at the highest point of the cutting circle. A similar check should be made on all knives to check the projection of each. The adjustment should be checked at both ends and at the center of each knife in order to determine if any knife is improperly mounted in the cutterhead. If a knife is found out of alignment, the screws which hold it in place should be loosened slightly so that the knife may be tapped down or pried up to the proper position, as shown in Fig. 4. It will be noted that this is a two-fold adjustment. First, the knives must project equally from the cutterhead and be in the same plane as the rear table; second, the rear table must be set exactly level with the knives. Once the rear table has been adjusted perfectly level with the knives, it is locked in place by means of the locking wheel and is not touched again until further adjustment is required after sharpening the knives or after the rear table has been lowered for some special operation, such as chamfering. The effect of an improperly adjusted rear table is shown in Fig. 2. If the rear table is higher than the knives, the work will be cut on a taper; if the rear table is lower than the knives, the work will be gouged at the end of the cut. After setting the rear table with a straight edge, a secondary check can be made by setting the machine in motion and running a piece of wood slowly over the knives for a distance of a few inches. It should slide onto the rear table perfectly, the work neither bumping the table nor being above it as much as a hair.

Other Adjustments. — The depth-of-cut pointer must be set so that it will show the correct cut on the scale. To adjust this, make a test cut of exactly ⅛ inch and then set the pointer to this mark on the scale,



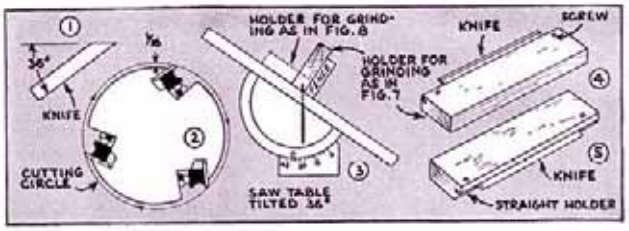
The jointer must be carefully adjusted to hairline perfection in order to do satisfactory work.

as shown in Fig. 5. All other markings will then be correct. The depth-of-cut pointer will require slight adjustment each time the knives are sharpened. An adjustment is provided to take up any wear on the dovetail ways on which each of the tables slide. It is seldom necessary to make this adjustment on the rear table since this remains in a fixed position most of the time and will not show wear in the life of the jointer. On the front table it may be necessary after long use to make the take-up. This is done by turning the gib screws at the back of the jointer, as shown in Fig. 6. The fence should be adjusted so that it is exactly perpendicular to the table, as shown in Fig. 7. The adjustable pointer is then set to zero on the tilt scale. If the jointer is fitted with automatic stops at the 0 and 45-degree positions, these should be carefully checked and adjusted if required.

All of the adjustments described are checked at the factory and will require no attention until knives are sharpened or long wear makes readjustment necessary. It should be noted that in the manufacture of these machines, both front and rear tables are ground at the same time when mounted on the base casting so that both tables are in perfect alignment to each other.

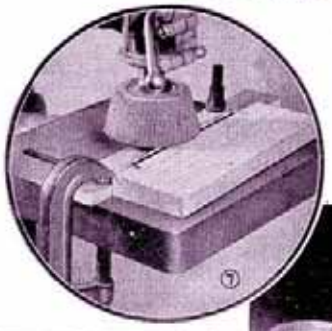
Grinding Jointer Knives.—Jointer knives are ground on an angle of 36 degrees, as shown in Fig. 1 on the opposite page. When mounted in the cutterhead, the rear edge of the bevel should be about 1/16 inch from the surface of the cutterhead, as in Fig. 2. Since the knives are quite narrow, it is necessary for grinding purposes to make a holding block, this being made by running in a saw cut with the block in one of the positions shown in Fig. 3, depending on the method which will be used in grinding. The saw kerf usually will be a snug fit for the knife, but if any looseness is apparent, the knife can be held secure by means of screws.

Fig. 6 shows one of the knives being sharpened on the grinder. The tool rest is adjusted to the required angle, and a guide block is clamped in position to insure a straight cut across the knife. Each knife is worked in turn, making a single, very light cut. A strip of paper is then pasted to the holding block, the purpose of this being to set the next cut without changing the original position of the guide block. Two or three very light cuts will usually bring all of the knives to a perfect edge. It cannot be stated too strongly that abrasive cuts

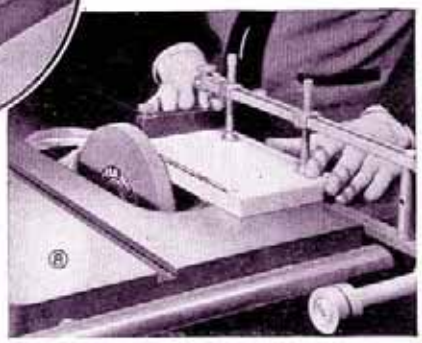


on high speed steel knives must be light; heavy cuts will invariably burn the knife and render it useless.

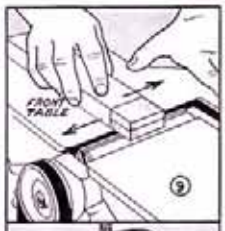
The method of grinding jointer knives on the drill press with a cup wheel is shown in Fig. 7, while Fig. 8 shows the operation as performed on the circular saw. The latter method can also be used in connection with the belt or disk sander. Whatever method is used, best results will be obtained if the grinding is done with successive light cuts, taking each knife in turn until all edges come up sharp.

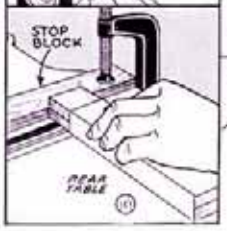


A number of different methods can be used in grinding jointer knives. In each case, grinding is done dry. Very light cuts must be taken to avoid burning. Cuts are made in rotation on all knives until a final cut brings each of the knives to a perfect edge.

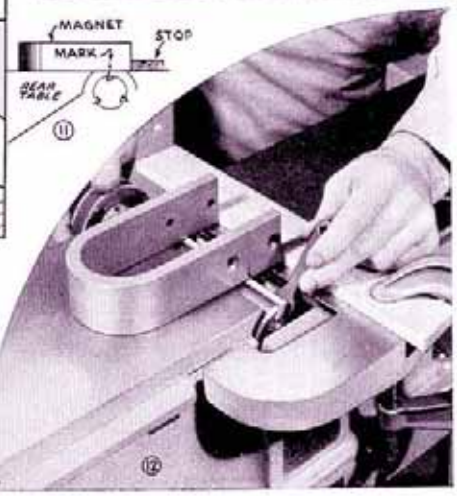


Honing Knives.—Grinding is not always necessary to sharpen the jointer since careful honing at regular intervals will maintain a sharp head for some time. To hone the knives, partly cover a fine carborundum stone with paper so it will not mark the table, and place it on the front table, as shown in Fig. 9. Turn the cutterhead until the stone rests flat on the bevel, and fix the head in this position by clamping the belt to the stand. Whet the knife by stroking the stone lengthwise with the blade, treating each knife with the same number of strokes.





Jointing Knives. — Knives can be sharpened and brought to a true cutting circle by jointing their edges while the head is revolving. In this operation, the stone is placed on the rear table. as shown in Fig. 10, and the table lowered until the stone barely touches the knives.



Setting Jointer Knives. — One of the best methods of setting knives in the cutterhead is with a magnet, as shown in Figs 11 and 12. An index mark should be scribed on the magnet and a stop block should be clamped to the front table at such a position as to bring the index mark in line with the cutting edge of the knife when it is at its highest point. The knife is placed in its slot and is pulled up to the required level by the magnet.

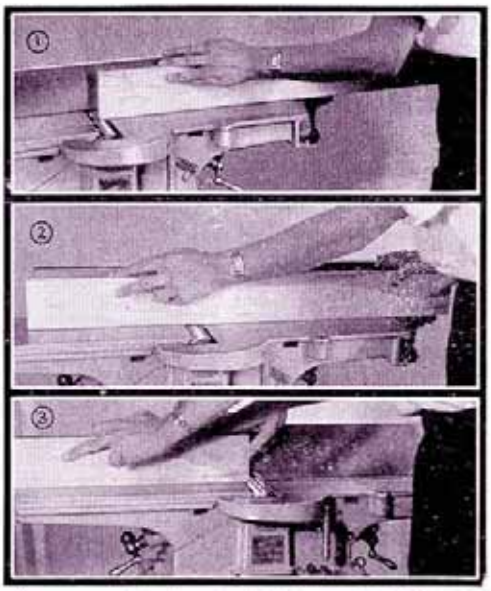
CHAPTER NINE

JOINTER OPERATIONS

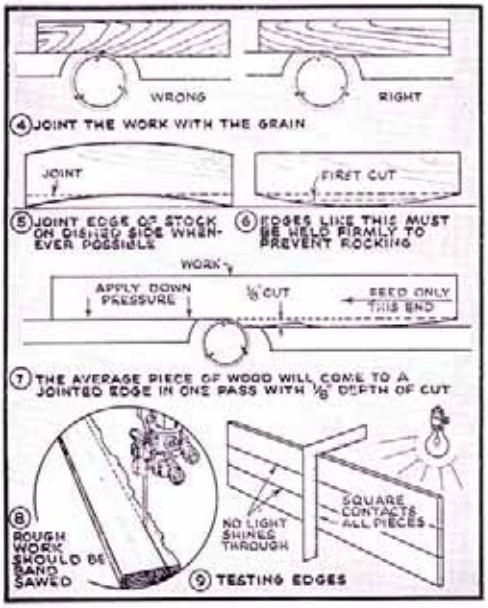
Jointing an Edge.—Jointing an edge is the simplest and most common operation which can be done on the jointer. Fig. 1 shows the start of the cut. The guide fence is square with the table. The depth of cut is approximately ⅛ inch. The best face side of the work is against the fence. Figs. 2 and 3 show successive stages of the cut as the work is pushed over the revolving cutterhead. The hand over the rear table presses the work down so that the newly-formed surface will make perfect contact with the table. The hand over the front table (usually the right hand) exerts no down pressure, but simply advances the work to the knives. Both hands exert side pressure to keep the work in contact with the guide fence.

Placement of Hands During Feed.—Some operators never pass either hand directly over the knives. In working to this end, both hands are over the front table at the start of the cut. As soon as the stock is resting solidly on the rear table, the left hand is lifted and placed on this portion of the stock. As the right hand approaches the cutterhead, the work is held down tightly with the left hand, while the right hand is lifted and placed on the stock over the rear table. Both hands are now over the rear table, and the balance of the cut is completed in this position. Opposite to the teachings of this method, the second method finds both hands on the front table at the start of the cut, and both hands pass over the cutterhead as the feed is made. While there may be some mental hazard in advancing the hands over the cutterhead, actually there is no danger involved providing the feed is made carefully. It is faster and easier to make the feed in this manner. The right hand, always in position at the end of the work, affords positive protection against the most common and most dangerous jointer hazard—the kick-back. The first method is safer when surfacing, especially when the stock is less than 1 inch thick.

Points to Observe.—Figs. 4 to 9 picture important points in jointing an edge. These are self-explanatory with the possible exception of Fig. 6. When it is necessary to joint an edge of this nature, pick out the central portion of the curve, and make the first light cut on this portion of the wood. It can be seen that the stock has no fixed



Above, successive stages in jointing an edge. The guard has been removed to show the cutting action.

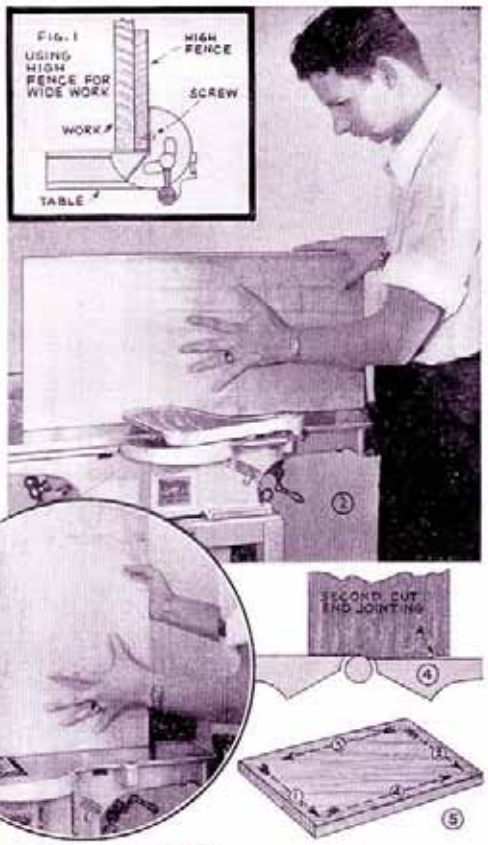


Points to observe in jointing an edge are shown in the diagram above.

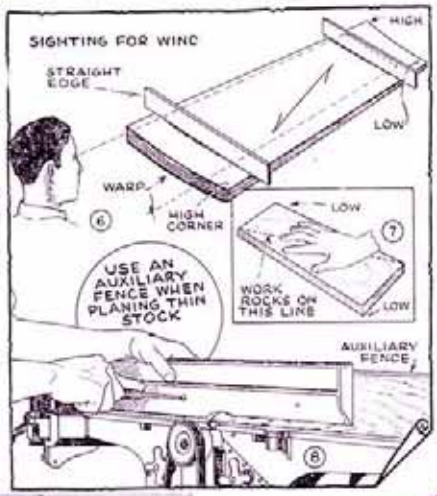
baseline; hence, it must be held firmly for this first cut. With a partial base made in this manner, succeeding cuts can be quickly made to bring the edge to a true surface.

Side Pressure.—Side pressure is always required in order to keep the work in contact with the guide fence, and is very important when jointing wide stock, as shown in Fig. 2. Where a considerable amount of wide work is to be handled, it is advisable to fasten an auxiliary high fence to the regular fence, as shown in Fig. 1, in order to supply a more positive means of support.

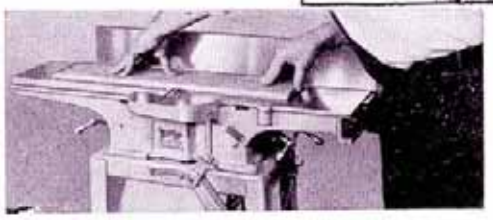
Jointing an End.—Jointing an end can be done in the same manner as jointing with the grain. The one big difference is that the surface should be formed with light cuts. A single heavy cut will invariably tear the grain at the end of the cut unless the knives are very sharp. In a second method of working, a short cut is made at one end, as shown in Fig. 3. The work is then reversed, and fed from the opposite side to blend with the first cut at **A**, as shown in Fig. 4. This method has the disadvantage of a possible poor blend of the two cuts unless the rear table and guide fence are set to hairline perfection. Where the work is to be jointed all around, it can be seen in Fig. 5 that the concluding cuts with the grain will remove any splintered edges formed by the initial cutting across the ends. Stock less than 8 inches wide should not be end jointed unless some form of guide jig is used.

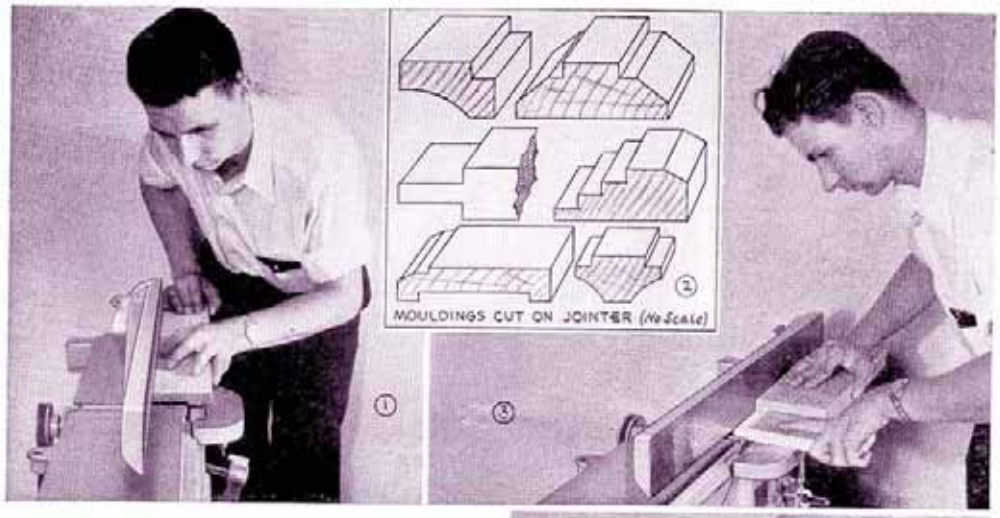


Surfacing. — Surfacing, or planing a working face, is the most difficult standard jointer operation. The work may have two main defects: (1) warp, and, (2) wind. Warped lumber is dished from side to side across the board; lumber in wind is twisted throughout its length. Testing for wind can be done by sighting, Fig. 6, or by rocking the work on a flat surface, Fig. 7. Where the stock is to be dressed out of wind with



Above, jointing wide stock and methods used in jointing an end. The drawing at left and photos below show various points in surfacing stock.





Rabbeting is useful for a wide variety of work as shown in the drawing and photographs above.

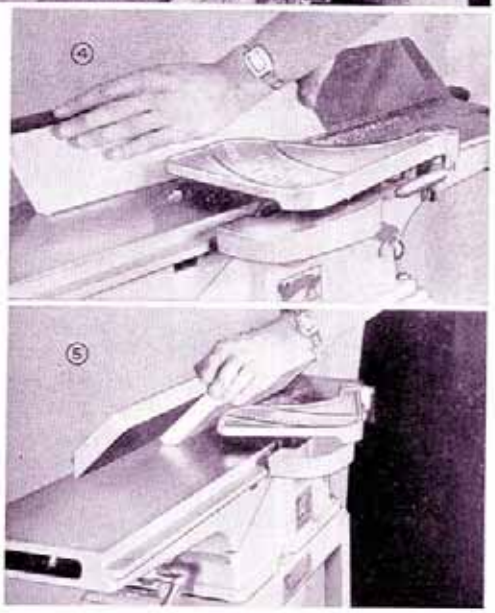
a minimum loss of thickness, it is advisable to mark the work carefully to permit leveling with the least number of cuts. A hold-down block, Fig. 9, is useful in all cases and should always be used when surfacing thin stock. Very thin material requires an auxiliary fence screw-fastened to the standard fence, as shown in Fig. 8. How **not** to surface thin stock is shown in the lower left photo on previous page. Note that the regular fence does not furnish a support for the work over the rear table.

Rabbeting.—Fig. 1 shows the cutting of a rabbet. The fence is set to the width of the cut, while the front table is set to the required depth. The guard must be removed. Two or more passes can be made if required. End rabbets on narrow stock should be done with the aid of a backing block, as shown in Fig. 3.

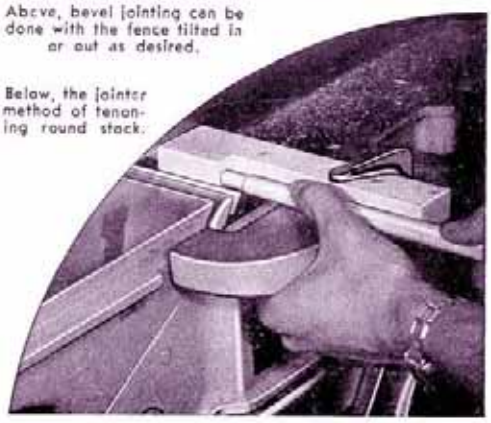
Beveling.—Bevels are cut by tilting the fence to the required position. Several passes are usually required to arrive at a full shape. The fence can be tilted in or out as desired, as shown in Figs. 4 and 5.

Round Tenons.—The lower photo shows the jointer method of making round tenons. A simple wood block guides the work and sets the length of the tenon. The work is pushed into the revolving cutterhead and is then revolved slowly in the same direction as the rotation of cutterhead. It is important in this and other rabbeting operations that the knives project equally from the end of cutterhead for smooth cutting.

Taper Jointing.—Taper jointing is one of the most useful jointer operations, and can be used to good advantage on a wide variety of work. The furniture legs shown in the photo are typical examples. The simplest kind of tapering involves stock which is shorter in length than the length of the



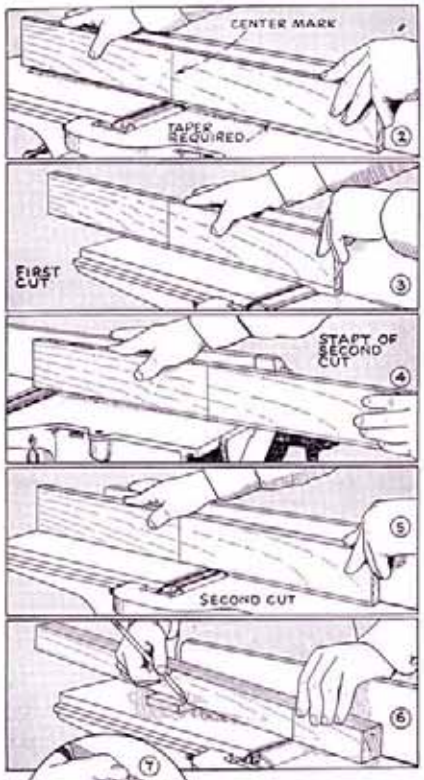
Above, bevel jointing can be done with the fence tilted in or out as desired.

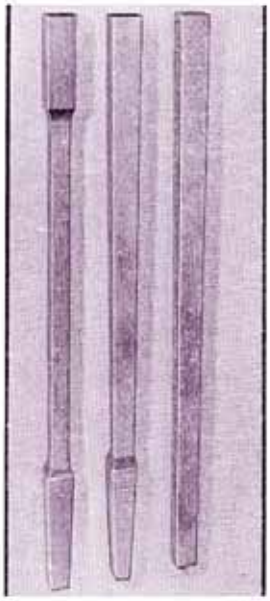


Below, the jointer method of tenoning round stock.

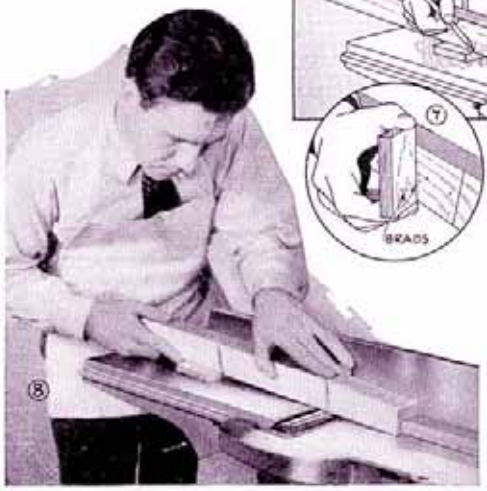
front table. On the six-inch jointer, this takes in stock up to about 14½ inches long. In making the cut, the front table is lowered to the necessary depth of cut. The stock is then placed against the fence. The far end of the board is in such a position that it will land on the rear table at the start of the cut, as shown in Fig. 1. From this position, the board is moved forward to cut the taper. Work longer than the length of the front table can be handled similarly by making a table extension, as shown in Fig. 1-A.

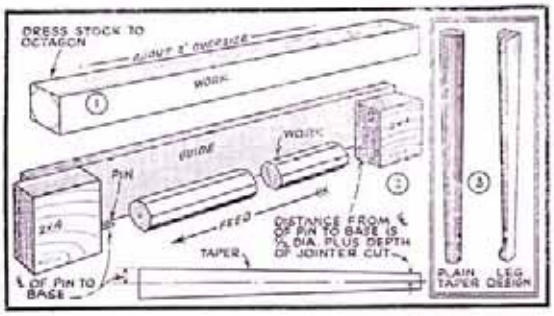
Where long tapers are to be cut without the use of an extension, a slightly different procedure must be followed. The basic rule is that the stock must be divided into a number of equal divisions, each division being slightly less in length than the length of the front table. For example, a 28 inch board would be divided into two divisions. The depth of cut must be divided into a corresponding number of equal parts, which, in this case, would be two. Thus, if a 28 inch board was to be tapered ⅜ inch from end to end, the board would be divided into two equal parts, and the front table would be set to a depth of $\frac{3}{16}$ inch. Two cuts are necessary, the first cut being started by dropping the mark over the knives, as shown in Fig. 2. Fig. 3 shows the completion of this first cut. The second cut is started at the far end of the board, as shown in Fig. 4, and proceeds the full length of the board, Fig. 5, to complete the ⅜ inch taper. Any length of board can be handled in this manner. A 36-inch long board, for example, would be divided

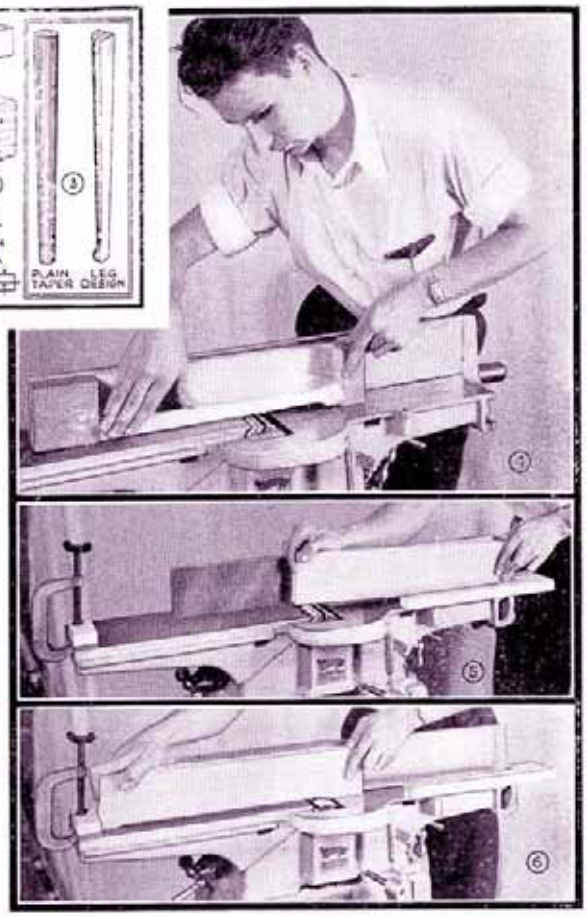




Operations in taper jointing and examples of legs cut in this manner.



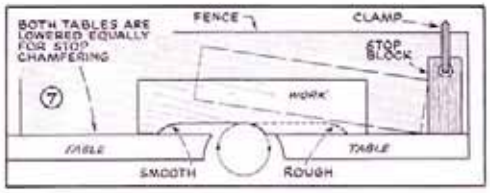




Above, tapering-in-the round. Photos and diagram below show cutting of a stop chamfer.

into 3 spaces of 12 inches each. If the taper required ¾ inch, the front table is set to ⅓ of this or ¼ inch.

Very short and fast tapers are best cut by pulling the work over the knives, as shown in Fig. 8. In setting up for the cut, the front table is lowered to the desired depth. The stock is then placed on the table so that the point at which the taper is to start comes over the knives, as shown in Fig 6. The board is pushed down so that the end contacts the front table, and a suitable block is slipped under the free end of the stock to maintain this position. The position of the block is marked so that it can be lightly bradded in place, as shown in Fig. 7. The start of the cut is shown in Fig. 8, from which position the stock is pulled over the knives to cut the required taper. In a variation of this method, the block is not bradded to the work but is clamped to the rear table, the result being a slightly curved surface throughout the length of the taper. Short tapers demand a stop block against which the work can rest at the beginning of the cut, otherwise the slight bite of the knives in making contact will pull the work.



Tapering-in-the-Round. — Tapering in the round is shown in Fig. 4, and the required set-up is pictured in Figs. 1 and 2. The stock is first dressed to an octagon shape, not tapered, and is then mounted between the two end blocks. The pin in the block which is to rest on the rear table is located at a distance of one-half the diameter of the large end of the required taper, measuring from the base of the 2 by 4 block. The distance of the other pin from the base of the block is one-half the diameter of the small end of the taper, plus the depth of cut, which is quite deep, usually ½ inch. One screw through each end of the guide board holds the two end blocks snugly in place. In operation, the two end blocks are considered as opposite ends of a long board, the cut being made in the same manner as for ordinary tapering. Successive cuts, turning the work about 15° for each new cut, results in a taper which can be readily sanded to a perfect finish.

Stop Chamfering.—Figs. 5 and 6 show the cutting of a stop chamfer, one of the few jointer operations where ***both*** front and rear tables must be lowered. A stop block is necessary to avoid a kick-back, and a stop block on the rear table is useful in setting the correct length. The slight roughness caused by cutting against the grain at the end of the cut can be easily sanded out, or, the cut may be made half-way and then reversed. The true stop chamfer (fence tilted to bevel the work) is made in the same manner as the straight cut shown.

APPENDIX

DECIMAL EQUIVALENTS

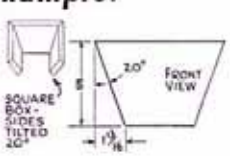
1/64 = .015625	1/4 = .250	1/2 = .500	3/4 = .750
1/32 = 03125	17/64 = .265625	33/64 = .515625	49/64 = 765625
3/64 = 046875	9/32 = .28125	17/32 = .53125	25/32 = .78125
	19/64 = .296875	35/64 = .546875	51/64 = 796875
1/16 = .0625	5/16 = .3125	9/16 = .5626	13/16 = .8125
5/64 = .078125	21/64 = .328125	37/64 = 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

TABLE OF COMPOUND MITERS *

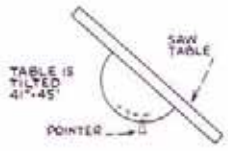
Angle	Equivalent Taper per Inch	SQUARE		HEXAGON		OCTAGON	
		Tilt	Miter Gage	Tilt	Miter Gage	Tilt	Miter Gage
5°	.087	44¼	85¼	29¼	87½	22½	88
10°	.176	44¼	80¼	29½	84½	22	86
15°	.268	43¼	78½	29	81¾	21½	84
20°	.364	41¾	71¾	28¼	79	21	82¾
25°	466	40	67	27¼	76½	20¾	80¾
30°	.577	37¾	63½	25¾	74	19½	78¼
35°	.700	35¼	60¾	24½	71¾	18¾	76¼
40°	.839	32½	57¾	22½	69¾	17	75
45°	1.000	30	54¾	20¾	67¾	15¾	73¾
50°	1.19	27¼	52½	19	66¾	14¾	72¾
55°	1.43	24	50¾	16¾	64¾	12½	71¾
60°	1.73	21	49¼	14½	63½	11	70¾

*To Nearest Quarter-Degree

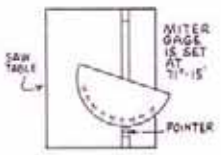
Example:



Required: A mitered joint four-sided box with sides tilted 20°. Read setting under "Square" and opposite 20°. If degree is not given, divide taper by height to get taper per inch.
(1.81 ÷ 5 = .362 = 20°)



Tilt the saw table 41¾° (41° 45'). The fractional part of a degree must be set as closely as possible by eye.



Set the miter gage at 71¼°. With the table tilted and with miter gage set as specified, cut the four pieces to make the box.

N. B. — If the tilt scale uses 90° as a level position, count the number of degrees instead of using a direct scale setting. Hexagon and octagon boxes are cut in a similar manner at the required table and gage settings.

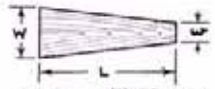
If the top of the box is to be level, the stock should first be bevel ripped with the table tilted to the same degree as the sides of the box are to be tilted.

Delta Craftsheet

TAPER RIPPING

I-DETERMINING TAPER

IN TAPER RIPPING IT IS NECESSARY TO KNOW THE AMOUNT OF TAPER PER FOOT. THE FORMULA USED FOR A TWO-SIDE TAPER IS:



$$\text{TAPER} = \frac{W-W'}{L} \times 6$$

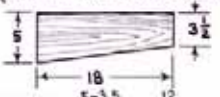
EXAMPLE: TAPER 2 (OR 4) SIDES

$$\text{TAPER} = \frac{5-3.5}{18} \times \frac{6}{1}$$

$$\text{TAPER} = \frac{1.5}{\cancel{18}_{3}} \times \frac{6}{1} = \frac{1.5}{3}$$

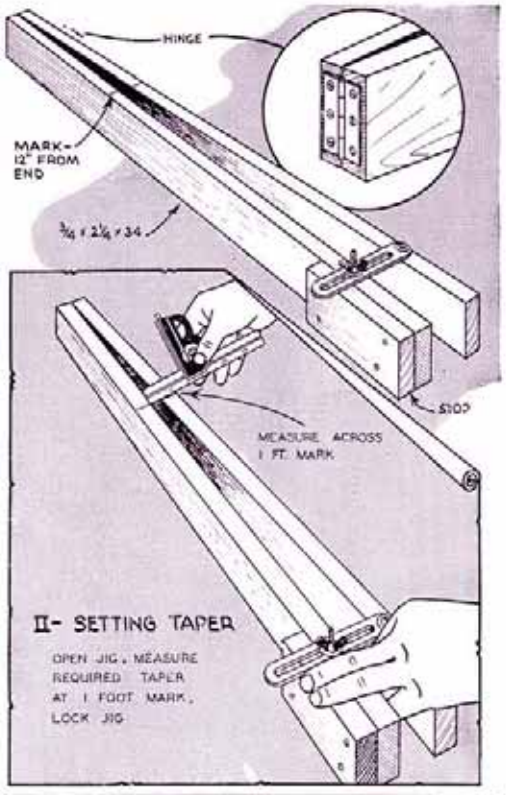
$$\text{TAPER} = \frac{1''}{3} \text{ or } \frac{1''}{2} = \text{TAPER PER FT.}$$

EXAMPLE: TAPER ONE SIDE (MULTIPLY BY 12 INSTEAD OF 6)



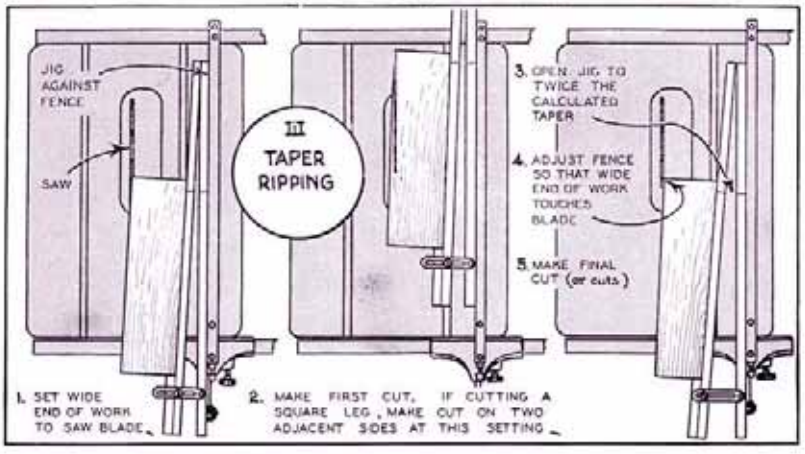
$$\text{TAPER} = \frac{5-3.5}{18} \times \frac{12}{1}$$

$$\text{TAPER} = \frac{1.5}{\cancel{18}_{3}} \times \frac{\cancel{12}^{2}}{1} = \frac{3}{3} = 1'' \text{ TAPER}$$



II- SETTING TAPER

OPEN JIG, MEASURE REQUIRED TAPER AT 1 FOOT MARK, LOCK JIG



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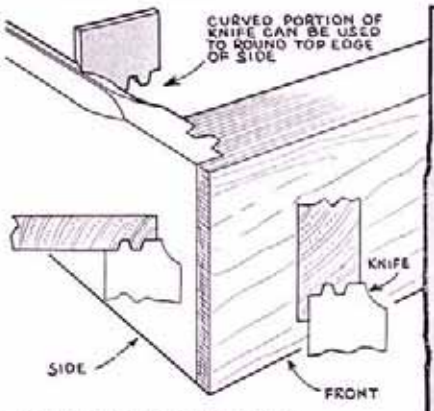
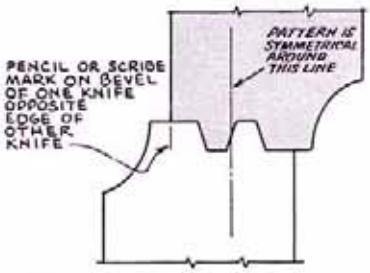
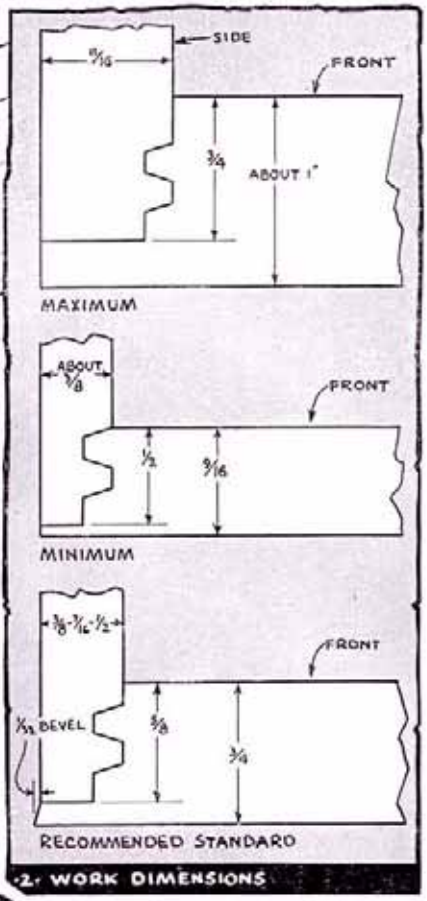
DRAWER JOINT
Style G Moulding Head Knife



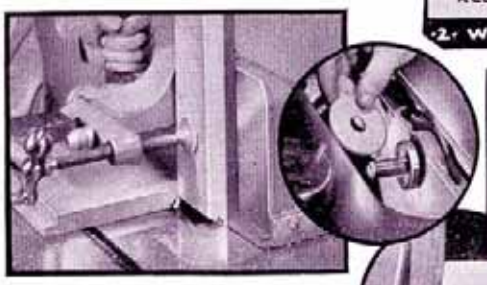
·1· GENERAL CONSTRUCTION



·3· **MATCHING PATTERN:** MATCH TWO KNIVES AS SHOWN AND MAKE MARK ON ONE KNIFE.



·2· WORK DIMENSIONS

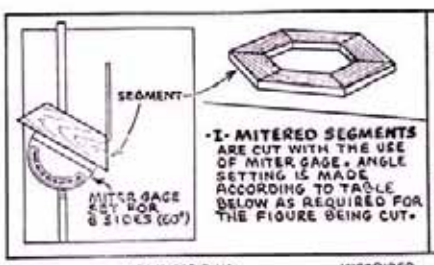


● 4 ● CUTTING FRONT: Mount work in tenoning jig. Set head over with paper washers, so that knives will cut an approximate ⅛ in. lip when work is mounted alongside jig base plate. Use backing block behind work. Set cutting depth to thickness of side stock.

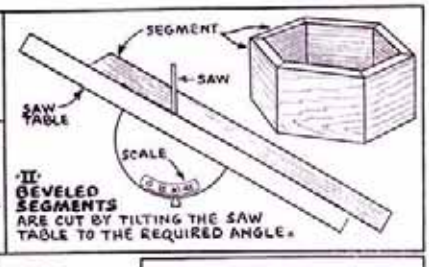
● 5 ● CUTTING SIDE: Set work against stop block so that mark on knife is exactly in line with end of work. Use backing block to prevent tearing. Miter gage must be set at an exact 90-degrees.

Delta Craftsheet

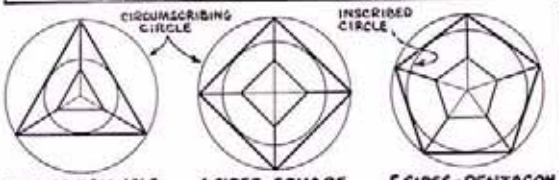
SEGMENTS



·I· MITERED SEGMENTS ARE CUT WITH THE USE OF MITER GAGE. ANGLE SETTING IS MADE ACCORDING TO TABLE BELOW AS REQUIRED FOR THE FIGURE BEING CUT.



·II· BEVELED SEGMENTS ARE CUT BY TILTING THE SAW TABLE TO THE REQUIRED ANGLE.



3 SIDES-TRIANGLE
MITER: 30°
BEVEL: (cannot be cut)
C.C. - 1.732
I. C. - .289

4 SIDES-SQUARE
MITER: 45°
BEVEL: 45°
C.C. - 1.414
I. C. - .5

5 SIDES-PENTAGON
MITER: 54°
BEVEL: 36°
C. C. - 1.176
I. C. - .688

6 SIDES-HEXAGON
MITER: 60°
BEVEL: 30°
C.C. - 1.00
I. C. - .866

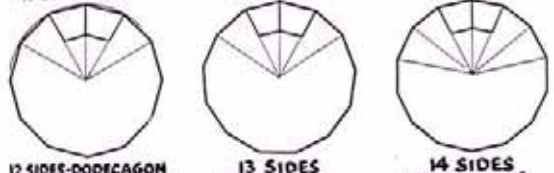
7 SIDES-HEPTAGON
MITER: 64.17°
BEVEL: 25.83°
C.C. - .868
I. C. - 1.038

8 SIDES-OCTAGON
MITER: 67.5°
BEVEL: 22.5°
C.C. - .765
I. C. - 1.207

9 SIDES-NONAGON
MITER: 70°
BEVEL: 20°
C.C. - .684
I. C. - 1.374

10 SIDES-DECAGON
MITER: 72°
BEVEL: 18°
C.C. - .618
I. C. - 1.538

11 SIDES-UNDECAGON
MITER: 73.38°
BEVEL: 16.62°
C.C. - .563
I. C. - 1.702

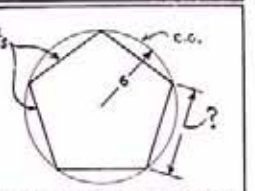


12 SIDES-DODECAGON
MITER: 75°
BEVEL: 15°
C.C. - .518
I. C. - 1.866

13 SIDES
MITER: 76.31°
BEVEL: 13.69°
C.C. - .479
I. C. - 2.028

14 SIDES
MITER: 77.14°
BEVEL: 12.86°
C.C. - .445
I. C. - 2.189

·III· CUTTING ANGLES AND SIZE FACTORS

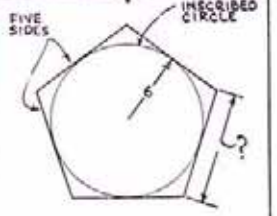


GIVEN: RADIUS OF CIRCUMSCRIBING CIRCLE (CC) AND NUMBER OF SIDES

FIND: LENGTH OF SIDE

RULE: MULTIPLY RADIUS OF CC CIRCLE BY CC FACTOR

EX. - FIVE SIDES, 6" RADIUS
1.176 × 6" = 7.056"
7.056" = 7 1/16" LENGTH OF SIDE



GIVEN: RADIUS OF INSCRIBED CIRCLE AND NUMBER OF SIDES

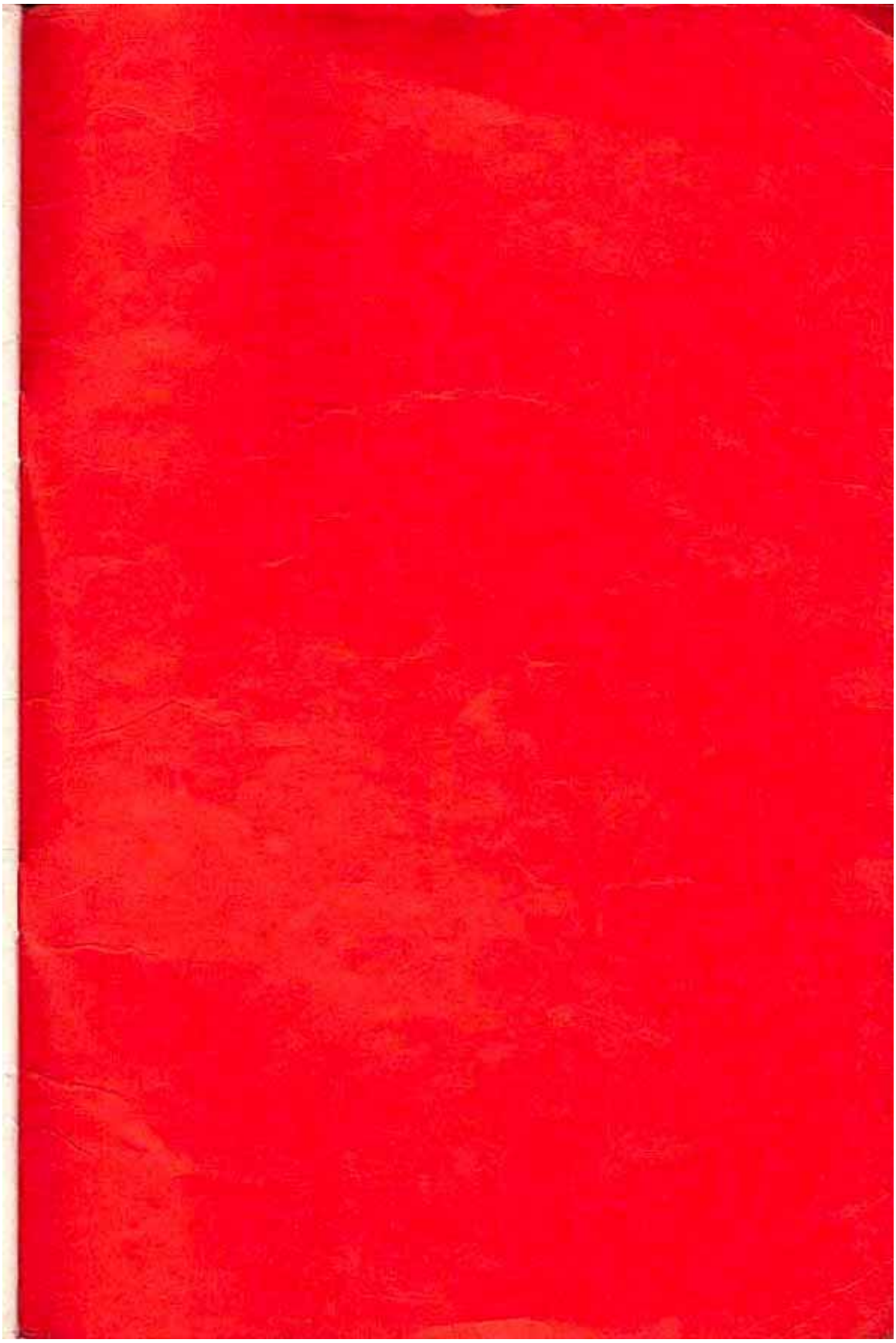
FIND: LENGTH OF SIDE

RULE: DIVIDE THE RADIUS OF INSCRIBED CIRCLE BY THE IC FACTOR

EX. - FIVE SIDES, 6" RADIUS

8.72" = LENGTH OF SIDE
.688) 6000
5504
4960
4816
1440
1376
X

·IV· DETERMINING SIZE



DELTA
MILWAUKEE