GETTING THE MOST OUT OF YOUR SHAPER

- A COMPLETE SHOP MANUAL ON MODERN SHAPER PRACTICE

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GETTING THE MOST OUT OF YOUR SHAPER

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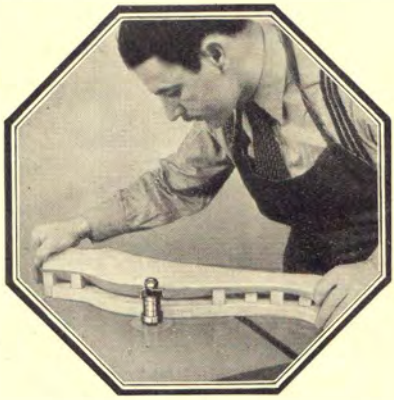

Edited by
SAM BROWN

A Complete Handbook Covering all Branches of Shaper Operation in the Home Workshop with Over Two Hundred Photographic Illustrations and Line Drawings.

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MAIN CONTENTS

• GETTING THE MOST OUT OF YOUR SHAPER

The Shaper... Top Ranking Production Tool for the Small Shop and Capable of a Score of Different Operations, Some of Which are Impossible in Any Other Manner. Photo Above Illustrates Cabinet Model with ¾ Inch Spindle. The Machine Should be Located in an Unobstructed Working Space.

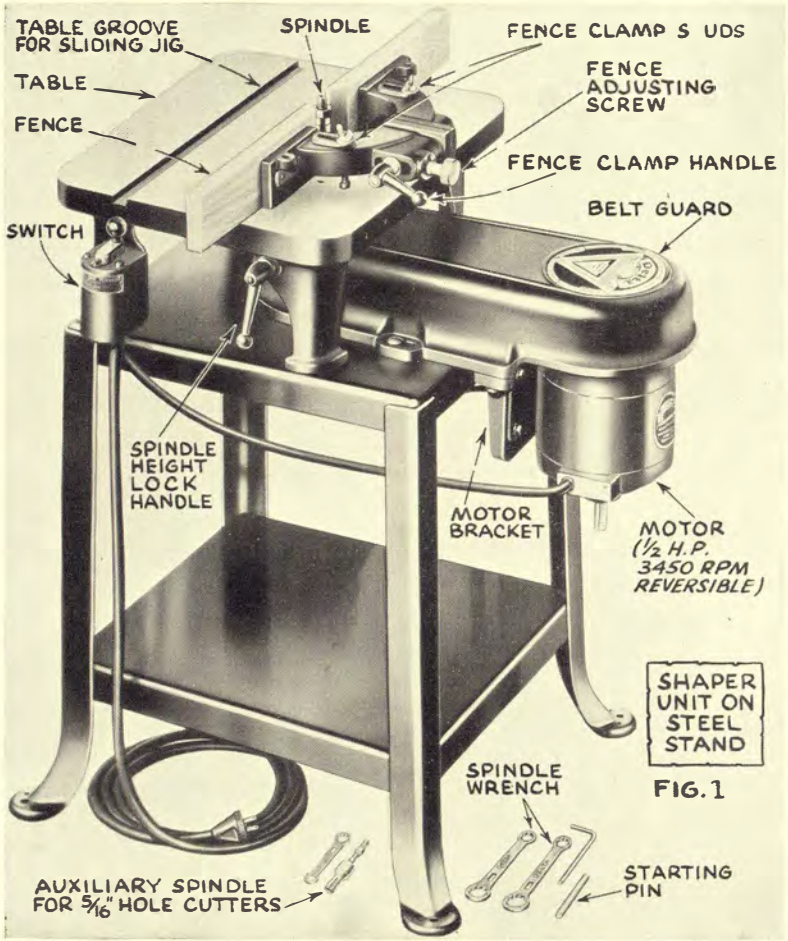


FIG. 1

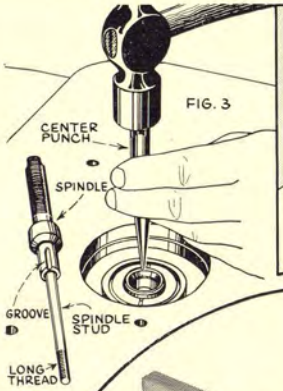


FIG. 3

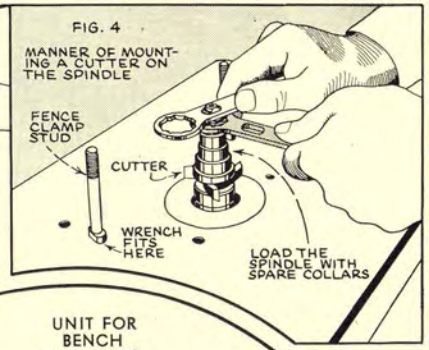


FIG. 4

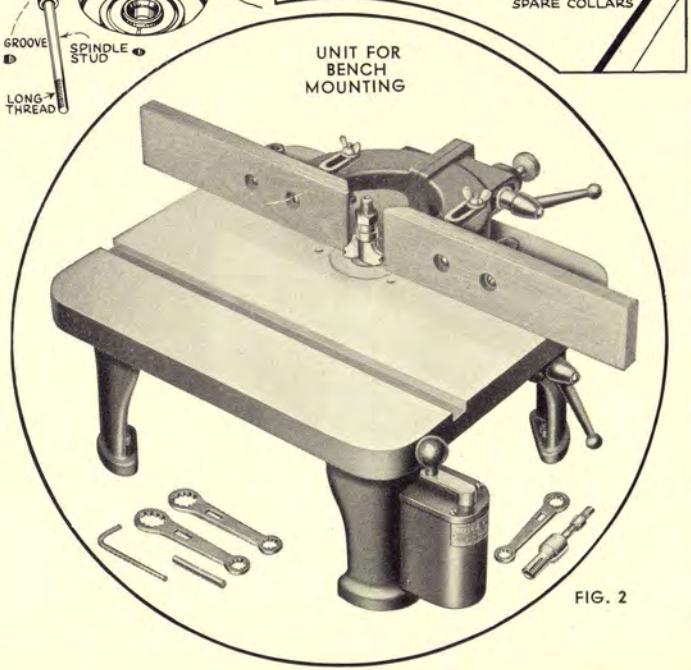


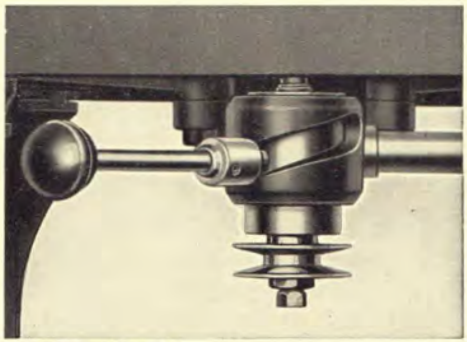
FIG. 2

CHAPTER ONE

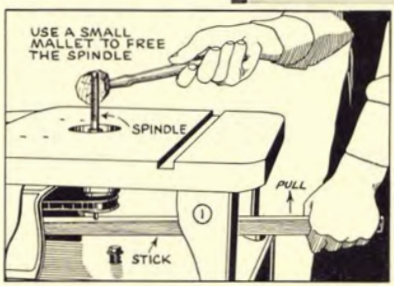
THE SHAPER and its ADJUSTMENTS

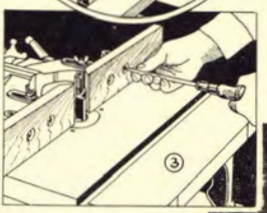
The Shaper.—The shaper is a vertical spindle, differing from the drill press in that it is built primarily to withstand side thrust. The spindle is generally hollow so that auxiliary spindles can be fitted to it, much the same as drills are fitted in a drill chuck. An adjustment is provided so that the spindle can be raised or lowered, and a second adjustment locks the spindle at any desired height above the table.

Power and Speed.—The medium-size shaper using ½ inch hole cutters works nicely with a ½ h.p. motor. Where large knives mounted between slotted collars are used, ¾ to 1-h.p. will give best results. The motor must be a 3450 r.p.m. type in order to give the shaper spindle the required speed. Pulleys are generally about a 3 to 1 ratio, so that the actual spindle speed runs slightly over or under 10,000 r.p.m. The motor should be reversible since an opposite direction of rotation may often be required. In some units the motor is reversed by means of a lever fitted directly to the motor; other units employ a reversing switch fitted to the side of the shaper stand and wired to the motor.



Above, spiral spindle-raising mechanism of light-duty shaper.

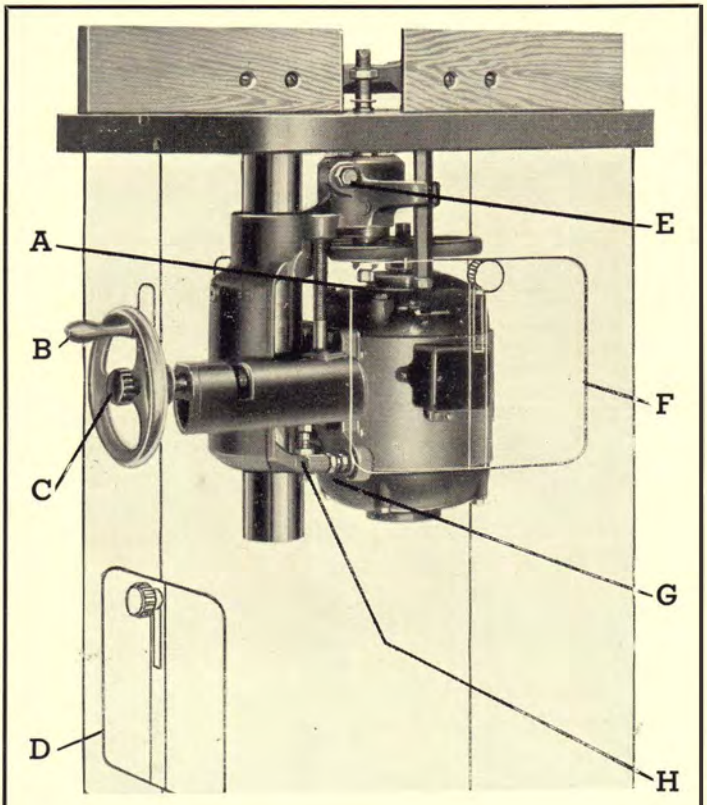




Auxiliary Spindles.—There are four auxiliary spindles—the stub spindle for cope cutters, the 5/16 inch diameter spindle for cutters having this size hole, the ½ inch diameter spindle for ½ inch hole cutters and the ¾ inch spindle for ¾ inch hole cutters. The latter can be used only on the heavy-duty cabinet model shaper. Each spindle is fitted with a tie-rod, threaded at both ends. One end of the rod is fitted to the spindle while the opposite end is capped with a tapered nut after passing through the hollow main spindle. The shank of each spindle is fitted with a keyway. This engages a ball or key inside the main spindle to prevent it from turning. A light punch mark on the rim of the main spindle, as shown in Fig. 3 on the opposite page, is an aid to locating the auxiliary spindle. Once in place, the spindle can be fitted with the necessary collars and cutters, as shown in Fig. 4 on opposite page. Because of accurate fitting, it may be necessary to use the method shown in Fig. 1 on this page to remove the auxiliary spindle.

The Adjustable Fence.—The fence is fitted to the shaper table by means of two studs and wingnuts. Adjustment of either half of the fence can be made when required. For most work, the two halves of the fence should be in line. A punch mark across the two parts, as shown in Fig. 2, is a useful index in re-setting.

The Circular Guard Should Be Used Whenever Possible When Shaping Directly Against Guide Collars.



MECHANISM OF HEAVY-DUTY SHAPER

A—Spindle Tie-Rod Nut
B—Spindle Height Handwheel
C—Spindle Lock Knob
D—Cleanout Door
E—Bearing Clamp Screw
F—Removable Panel
G—Belt Tension Adjustment
H—Spindle Stop Screw

returning mouldings across the ends of narrow strips.

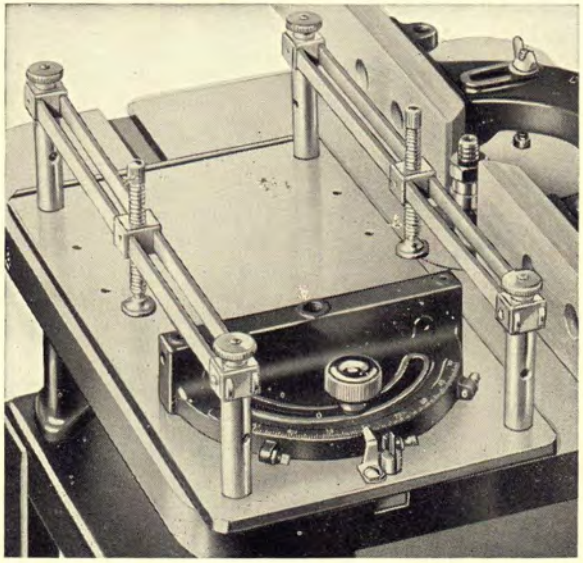
Heavy-Duty Shaper.— A phantom view of a typical heavy-duty cabinet type shaper is shown at left. A machine of this size, swinging a ¾ inch diameter spindle, should be powered with a ¾ to 1½ h.p. motor. The construction of this machine differs from the lighter model previously described, the main points of departure being the spindle raising mechanism and mounting of motor, as shown in photo at left. The standard spindle for this machine is ¾ inches in diameter and has a travel of 3 inches. The spindle is fitted inside the main spindle, as previously described, and this method of mounting permits the use of ½ inch diameter and other auxiliary spindles. The table size is 27 by 28-inches, which can be increased to 27 by 36-inches by the addition of a back wing.

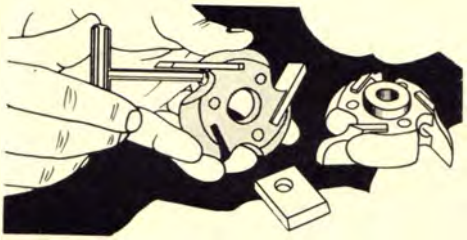
Left, phantom view of heavy-duty shaper. Below, the sliding jig.

The wood face pieces of the fence are adjustable in or out to accommodate various sizes of cutters. The opening should never be any more than is required to clear the cutter. Changes in the setting are made by loosening the bolts, pushing the wood facings to the required position, and retightening, as shown in Fig. 3 on the previous page.

Ring Guard. — The ring guard should always be used when shaping curved work directly against collars. Besides offering protection, the guard provides a hold-down, pressing the work down on the table surface.

Sliding Jig. — The sliding jig shown in the lower photo is an essential part of any shaper. Its purpose is to clamp the work securely so that it can be advanced to the cutter. It is used chiefly in

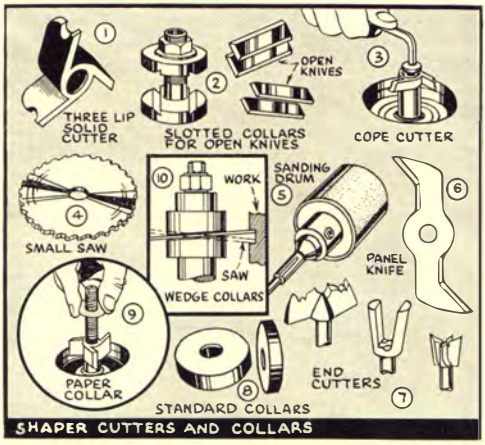




CHAPTER TWO

CUTTERS and COLLARS

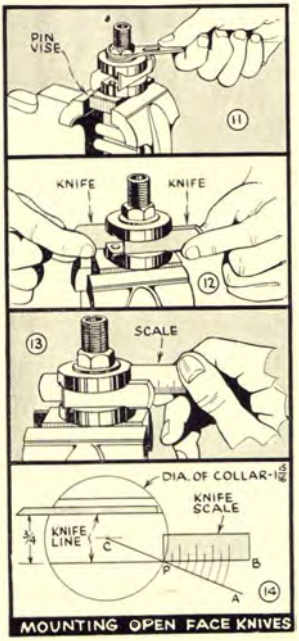
Shaper Cutters and Collars.—A wide variety of knives, saws, collars, etc., are used in shaper operation, a typical group being as shown in the drawing at the right. Fig. 1 shows the standard three-lip cutter with ½ in. spindle hole. These are available in a wide variety of shapes and are undoubtedly the safest and most practical type of knife for average work in the small shop. Similar cutters with 5/16 in. hole can also be used by substituting an auxiliary spindle of the proper diameter. A second type of commonly used cutter is the open face knife clamped between two slotted collars, as shown in Fig. 2. The blank knives are easily ground to any required shape. The drawing in heading shows a three-knife cutterhead. A variety of ready-machined knives can be obtained, any set of which can be mounted in this head. The center hole is ¾ inch, but a bushing permits mounting on a ½ inch spindle.



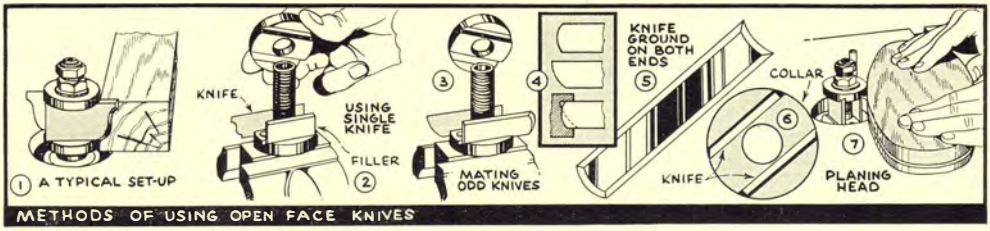
Above, Examples of Shaper Cutters. Left, Stationary Collars and Manner of Mounting Open Knives.

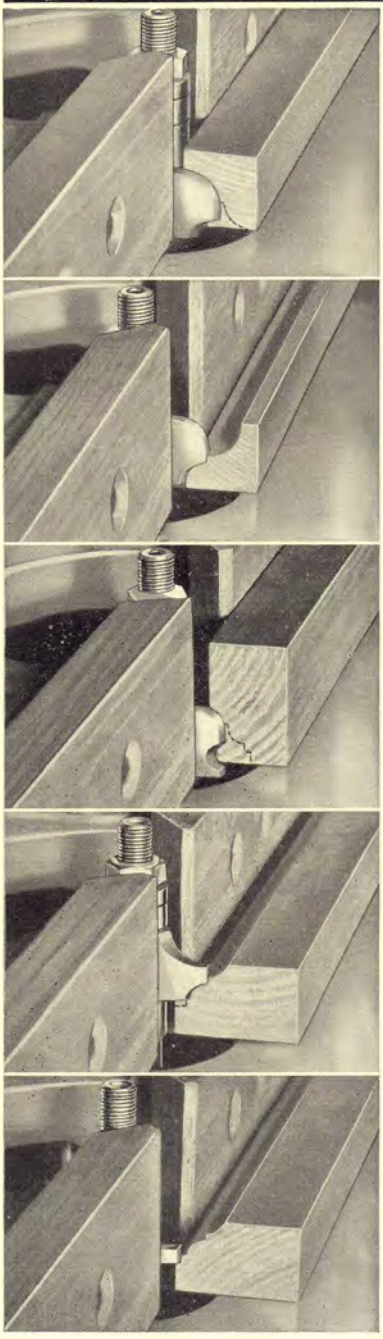
Fig. 3 shows a cope cutter and the special spindle on which it is carried. A small saw, Fig. 4, is a useful accessory for grooving and rough cutting. No. 5 is the familiar sanding drum. Fig. 6 shows a wing cutter, used for making raised panels and similar work. A group of end cutters are pictured in Fig. 7. These, as the name implies, travel vertically and make an end cut.

Standard shaper collars, Fig. 8, are from ⅛ to ½-in. thick and of various diameters to permit control over the depth of cut. Paper collars are often used as shims to build up a standard collar to some required exact size, as shown in Fig. 9. Collars of special size or construction are often made up to suit the work, a common example being the wedge collars shown in Fig. 10. A saw clamped between these collars (they can be made from hardwood) will cut a more or less wider groove than the saw thickness depending on the wedge angle of the collars. Stationary collars, which fit into the table opening, as shown in the photo, and ball-bearing collars (these are simply ball races which fit over the spindle) are often used instead of standard collars to eliminate scoring, especially in production work.



Mounting Open Face Knives.—Open face knives are perfectly safe to use, but only when they are properly mounted. The first step in mounting a set of knives is shown in Fig. 11. The cutter head is placed on the pin vise, and the nut is turned down to lightly clamp both knives. The ends of the two knives are then gripped between the fingers and pulled outwards. Both knives should slide with an equal



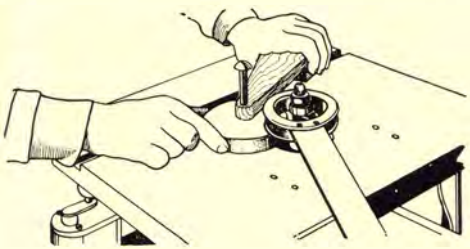


Above, Various Methods of Using Open Knives Between Slotted Collars. Left, How Cuts Are Combined to Produce Moulded Shapes.

tension—if one pulls more readily than the other, it is an indication that the knives are not of the same width, and *knives of unequal width should never be used together between slotted collars.* It can readily be seen that if one knife is a trifle narrower than the other, the wider of the two will be clamped firmly while the other will be loose and apt to fly out when the machine is set in motion. However, providing both knives are clamped evenly, the knife projection can then be measured, setting both knives to project exactly equal, as shown in Fig. 13, after which the nut is turned down tight. An ordinary thin steel rule can be used as a gauge, but the dimensions will read about 1/32 in. off. If a knife scale for exact measuring is required, it can be made as shown in Fig. 14. First draw a circle of the same diameter as the collar—$1\frac{15}{16}$ in. On this, lay out the knife lines. Project one of the knife lines to the point B. From the center of the circle, draw a line through point P to point A. On line PA, lay off $\frac{1}{8}$ in. marks from a common rule, starting at P. With C as a center, extend these marks to line PB, these marks being the exact dimensions for the knife scale.

Methods of Using Open Face Knives.—Open face knives can be used in a number of different manners, as shown in the drawing above. Fig. 1 shows a standard set-up, two blank knives ground to the required contour being held between the collars. For light cutting, or where the run is not long, one knife alone is often used, as shown in Fig. 2, a short blank piece of steel being used in the other slot as a filler. It is important, of course, that the filler be the same exact width as the knife. Odd knives of the same width but of different shapes are sometimes mated, as shown in Fig. 3. The moulding which would be cut in the example is shown in Fig. 4. Mating is often useful, but should not be practiced unless both knives are approximately of the same weight. Grinding knives at both ends, Fig. 5, is widely practiced, and is especially good for cuts requiring a male and female joint. Straight knives ground to the same diameter as the cutterhead, as shown in Fig. 6 and Fig. 7, are often used for outline planing.

Combining Cuts.—Knives are sometimes made to cut a required moulding in one pass of the work. More often, however, two or three passes are required, using standard shapes. The photos at the left show typical examples of how cuts are combined to shape moulded edges.



CHAPTER THREE

METHODS of OPERATION

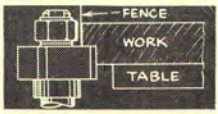
Four Main Methods.—There are four main methods used in shaper operation: (1) shaping with guides, (2) shaping against collars, (3) shaping with an outline pattern, (4) shaping with forms. Each of these methods is widely used, and each is adapted for a particular type of work. In the brief description of each method which follows, and in the illustrations, the same cut is shown for each, but this would not, of course, apply in actual work.

Shaping with Guides.—Guides are fastened to the shaper table and form a support for the work as it is advanced to the cutter. The most common type of guide is the standard fence, as shown in Fig. 1. In addition to this, there are a great number of other straight fences, also concave and convex fences for curved work and special fences for odd shapes. Shaping with a guide is the safest and most satisfactory method of working, and this method should always be used when the work permits. As can be seen in the diagram, the fence is the controlling factor in limiting the depth of cut.

Shaping Against Collars. — Work which cannot be shaped against a guide is usually shaped against a collar. In this method of working, the rim of the collar rides against the work and limits the depth of cut. This is one of the most useful methods used in shaping, its only drawback being that the revolving collar will slightly score or burn the work. This fault is not a serious objection since the scoring is usually light when the work is handled properly.

Shaping with an Outline Pattern.—This is similar to shaping against collars, except that a pattern and not the work rides against the collar. Scoring is thus eliminated, and the same pattern can be used for any number of like pieces. This latter feature makes this method preferable for many shaping jobs where pieces must be produced in quantity.

Shaping with Forms.—A form is any devise in which the work is held so that it can be advanced to the cutter. The most common form is the sliding jig, and it is this form which is shown in the picture,



SHAPING WITH GUIDES

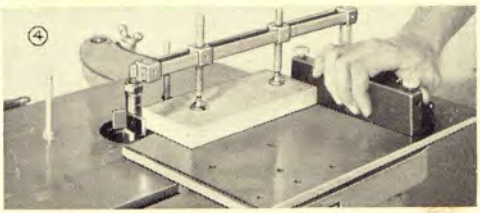
This method is most used for straight work, the guide limiting the depth of cut.

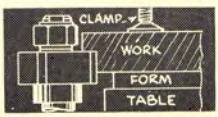
SHAPING AGAINST COLLARS

In this method of working, the diameter of the collar controls the cut.

SHAPING WITH PATTERN

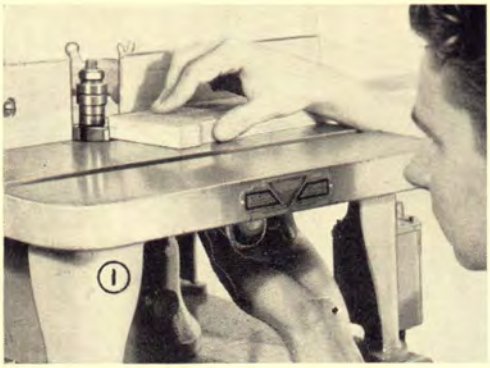
The pattern rides against the collar to limit the depth of cut.

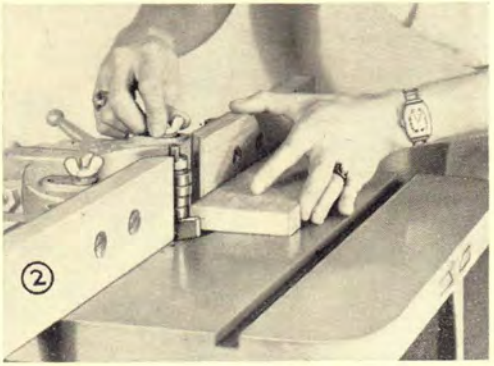




SHAPING WITH FORM

The form holds the work in position so that it can be advanced to the cutter.





The Work is Held Against the Cutter so That Proper Spindle Height and Fence Settings Can Be Made.

Fig. 4. (The supporting arm has been painted out to show the cut more plainly.)

Setting the Cutter. — In making any moulded edge, the pattern is usually marked on the end of the work. The proper cutter is then mounted on the spindle, after which the spindle is raised or lowered to the proper height. This is done with either the spiral adjustment, Fig. 1, or with the spindle-raising handwheel, Fig. A, depending on the machine. The fence is then located to give the right depth of cut, as shown in Fig. 2. Where collars are used, the collar is checked against the work in a similar manner.

Rotation and Feed. — The recommended spindle speed for small cutters is 10,000 r.p.m. The shaper is usually fitted with a reversing switch so that the cutter can rotate in either direction. Whatever the direction, the work must be advanced INTO and AGAINST the cutter. Feeding from the right side of the machine is preferred by most workers, the rotation of the cutter being counter-clockwise, as shown in Fig. 3. When the work is fed from the left side, the cutter rotates in a clockwise direction, as shown in Fig. 4.

When returning mouldings or cutting all edges of a piece, the first cut should be made on end grain, each edge being taken in turn so that the final cut is with the grain, as shown in Fig. 5.

The direction of feed should be such that the cutter will cut with the grain, as shown by the two examples at the top of Fig. 6. This is of minor importance if the

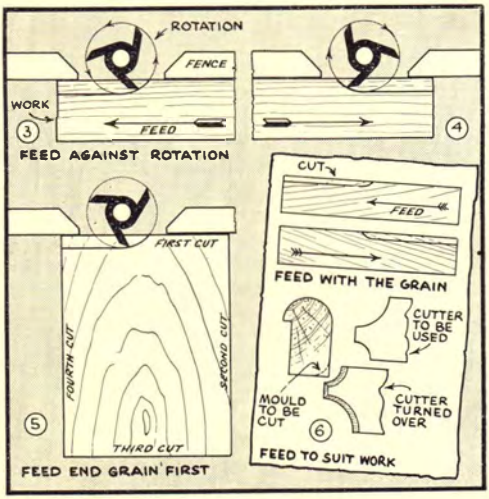
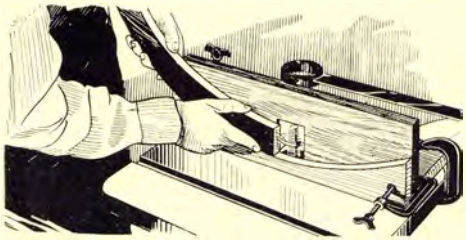


Diagram Above Shows Fundamentals of Feed in Relation to Rotation of Cutter.

shaper is a high-speed machine, but of increasing importance with slower speed spindles.

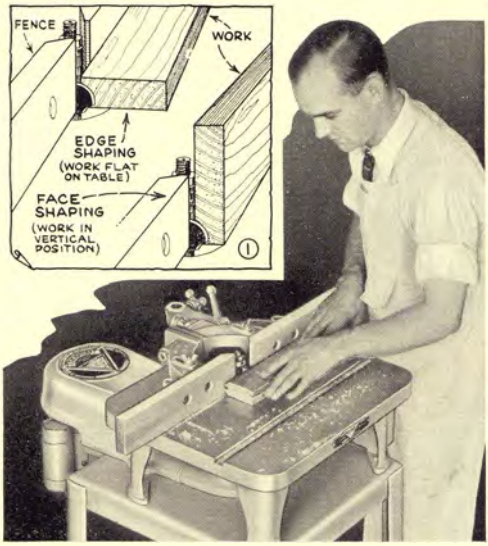
The feed is often fixed by the nature of the work. That is, in planing a straight edge, the worker could feed from either the left or right side of the machine. On some shapes, however, the cut can only be made in one direction. An example is shown in Fig. 6. Here we have a moulding on which it is required to make the cut shown by the dotted line. The cutter to be used and its position on the spindle as viewed from the right side of the machine is shown at the top of the diagram. It is apparent that the work cannot be fed from the right. Now, by turning the cutter over, and feeding from the left side of the machine, the required mould can be cut. Many cuts of this nature make it apparent why the shaper must have a reversing switch for satisfactory operation.



CHAPTER FOUR

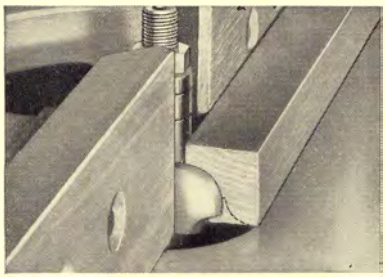
SHAPING with GUIDES

Definition.—A shaper guide is any wood or metal fixture or fence which can be clamped or otherwise fastened to the shaper table in such a position as to form a guide for the work. The most common guide is the straight fence. It can be adjustable or non-adjustable, and varies considerably in construction, as will be seen in the following paragraphs. Curved fences are also used extensively as guides for circular and segment work. In every case, the guide is fixed, the work sliding along it to meet the cutter. When the work is advanced with its edge against the fence, the operation is known as *edge shaping;* when the work is advanced with its face against the fence, the operation is called *face shaping,* as shown in Fig. 1. Edge shaping is always preferred because of the better bearing surface thus afforded.



Above, Using the Standard Adjustable Guide for Straight Shaping.

The Adjustable Fence.—The small shaper is usually fitted with an adjustable fence of the type pictured and described in Chapter I. The whole fence is readily adjusted in relation to the spindle to expose the cutter to the proper depth for the moulding required, as can be seen in the center photo. A second adjustment permits either half of the fence to be advanced or retracted. For average work where a portion of the original edge of the work is not touched by the cutter, as shown by the examples at the top of Fig. 3, both the front and rear fences are in a straight line. The distance which the fence is set back from the cutting circle is the *depth of cut,* as shown in the diagram.



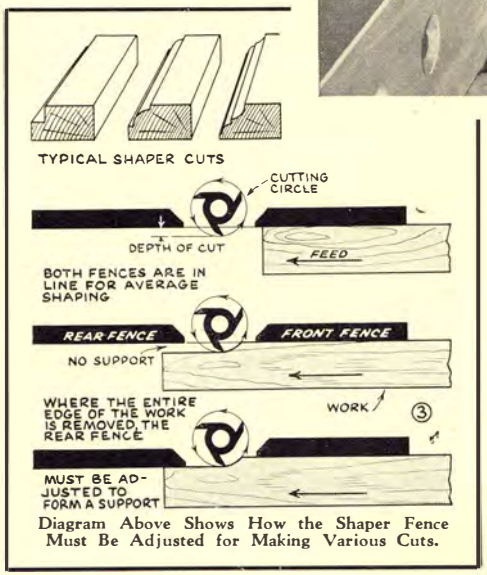
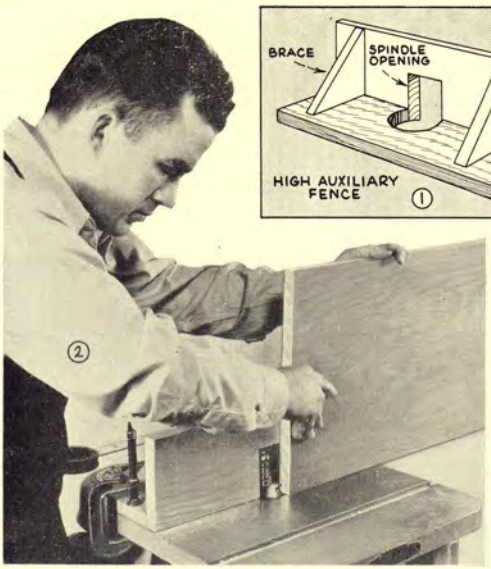


Diagram Above Shows How the Shaper Fence Must Be Adjusted for Making Various Cuts.

Where the shaping operation removes the entire edge of the wood, as, for examples, in jointing or making a full bead, it can readily be seen that the shaped edge will not be supported by the fence when both fences are in line. In this case, the work is advanced to the approximate position shown in the center diagram, Fig. 3, after which the shaper is stopped and the rear fence advanced to lightly contact the



The High Fence Simplifies Face Shaping of Wide Stock; Center, Construction of Long and Miter Fences.

wood. It can be seen that the rear fence is thus in line with the cutting circle, and this adjustment can be made, if desired, before the actual shaping operation begins.

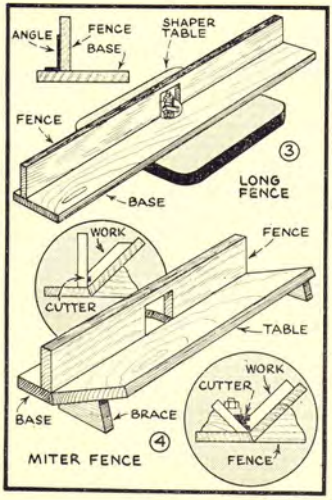
The High Fence.—Wide stock which must be face shaped is sometimes difficult to guide along the comparatively low standard fence, and to secure a better bearing surface most operators prefer the high auxiliary wood fence shown in Figs. 1 and 2 above. The construction is quite simple, as shown in the diagram, the base affording a landing so that the fence can be clamped to the shaper table.

The Long Fence.—The long fence is somewhat similar, as shown in Fig. 3, except that the base forms a table for the work. This fence makes a better support for long work, and also allows the fastening of stop blocks for fluting, reeding, etc., which the shorter standard fence does not always permit. Long work in a "one-man" shop should always be handled in this manner.

The Miter Fence.—Work to be mitered or beveled on the shaper is advanced past the cutter on a suitable miter fence, a typical form of construction being shown in Fig. 4. Where the edge of the work is already beveled, the fence is constructed with the fence proper in a vertical position, as shown in the top circle inset. Where the edge of the work is square, the fence is vertical in relation to the table of the complete unit. Made in this manner, the fence supports the work both before and after leaving the cutter. An adjustable jig for beveling is shown on page 25.

The Rip Fence.—Where the shaper is fitted with a rip fence of the type commonly used on the circular saw, many operations in planing, grooving, etc., can be done. ***Important—Always use the adjustable fence in connection with the rip fence and the hold-down, otherwise work is liable to be drawn into the cutter with serious damage.*** The rip fence should be used on the side of the cutter opposite the adjustable fence. The fence is particularly useful when boards must be planed to exact width. Fig. 5 shows the operation.

The Segment Fence.—The segment or circular fence is a useful guide in shaping segment or circular work. The work must be a true circle or a segment of a true circle, the fence being useless for curved work which is not circular. Fig. 1 on the opposite page shows the set-up of a segment fence for making an inside cut. The guide is simply a flat piece of stock clamped to the shaper table. The radius of the fence and the work must be exactly the same. The work is advanced to the cutter in the same manner used for straight work.



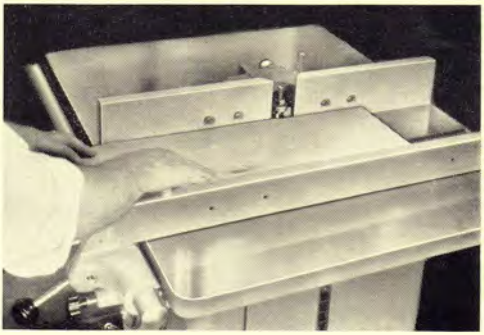
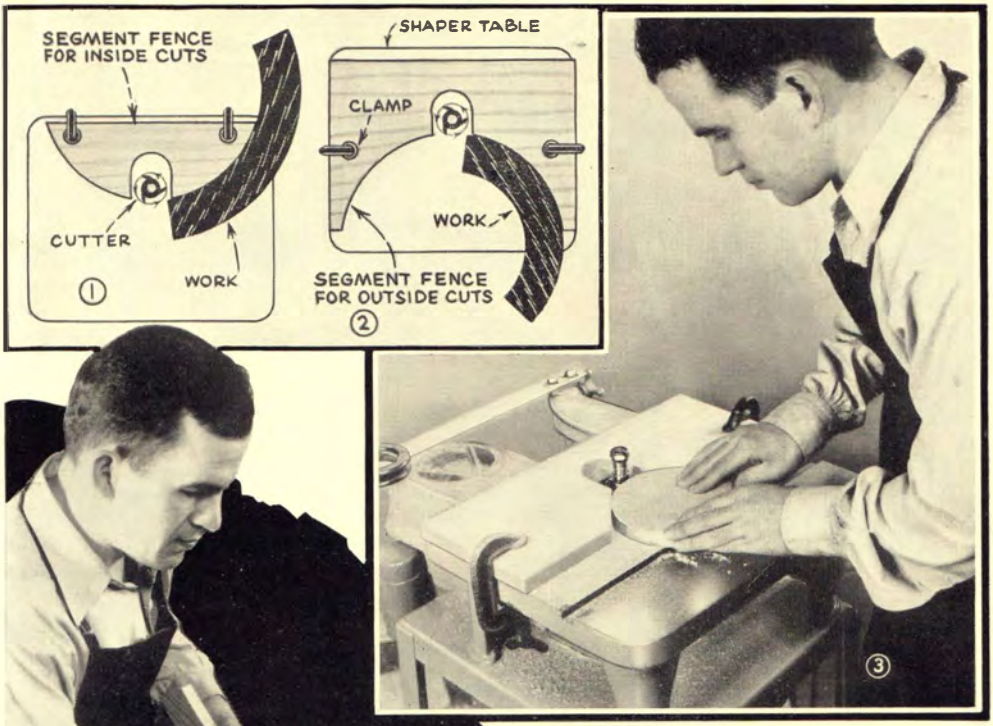


Fig. No. 5—Planing to exact width is a simple operation when the shaper is fitted with a rip fence.



Construction and Manner of Using Segment Guides for Curved and Circular Work.

Where the whole edge of the work is removed, the after portion of the guide must be made the required distance fuller to contact the work.

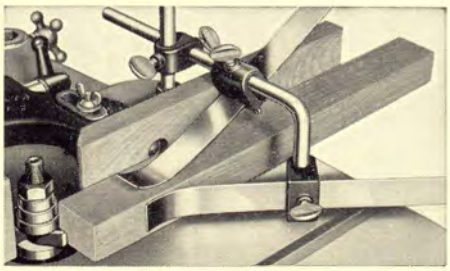
A segment fence for outside cuts is shown in Fig. 2. It can be seen that both fences can be cut from a single board. It must be remembered, however, that a new fence is necessary for every new-diameter work, and that the fence must be cut to the same radius as the work. Smoothness of both guide and work is required for satisfactory operation.

An excellent guide which can be used for a wide variety of different-diameter circles is shown in Fig. 3. This consists of a flat guide with a 90° vee opening cut in the center. A little consideration will show that the sides of this opening will afford two contact points for circular work of any size up to the capacity of the guide. This guide cannot be used for segment work, since the cut at the beginning and end would not be supported.

Fig. 4 shows a segment guide being used for face shaping. The method of working is the same as before, except that the segment is clamped upright to the high fence. The photo shows the end of the cut, the worker having gradually changed his position from the side to the rear of the machine to permit readier handling of the stock, such body movements being necessary in many shaper operations.

Other Guides.—Other guides, fences, shoot-boards, etc., can be made up as the need for them arises. For general work, the standard adjustable fence serves every purpose. For faster production work or increased safety in operation, the auxiliary fence will often work out to better advantage. The few examples shown here do not exhaust the subject, but are simply intended to illustrate the general principles of design to serve as a basis for making other guides. Many of the guides become permanent fixtures and should be

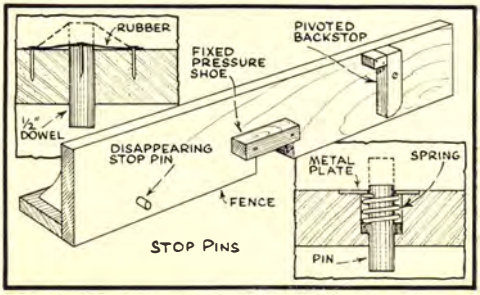
Strip Jig Above and Photo to Right Show How Hold-downs Are Used in Shaper Work.



saved; others may be discarded after the job for which they were made has been completed. Permanent jigs should be well-made, sanded and varnished. Instead of being clamped to the table, they can be readily constructed to fasten with the same studs which are used to hold the standard fence in position.

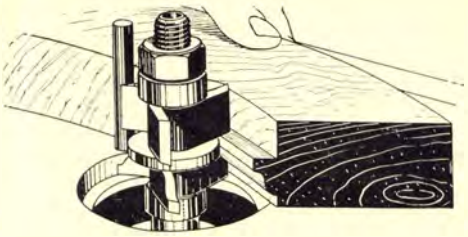
Hold-downs.—Any device which holds the work against the fence or the shaper table is known as a *hold-down*. There are many different styles of hold-downs—wheels, weighted arms, spring tensioners, etc.—all of which serve the same general purpose of keeping the work in close contact with the table or fence. Very often the hold-down is built into and is a part of the guide, a typical example being the guide shown at the top of the page. This shows a jig for narrow mouldings, commonly called *strip mouldings*, which is so constructed that the work is at all times supported against the impact of the cutter, the wood spring holding the work *in* while the top piece of the jig holds it *down*. The same effect is secured through the use of standard shaper hold-downs—thin, steel springs which can be readily adjusted to fit any size of average work. Any hold-down is more effective when it supports the work at a point slightly behind the point of cutting, as shown in the center photo. Suitable mountings on the standard shaper fence permits the hold-down to be used at either end to correspond with the direction of feed. Mountings for the standard hold-downs can be readily fitted to most auxiliary guides, or these guides can be fitted with wood springs or the simpler fixed pressure shoe, as shown in the lower drawing. Some form of hold-down should be used whenever possible.

Stops.—Stops must be used to control the travel of the work in doing such operations as grooving, fluting and reeding, where the cut does not extend the full length of the work. The simplest method is to use scrap pieces of wood, clamping these to the fence at the required positions. Where production work is being done, a more permanent set-up is usually desirable, something on the order of the guide shown in the drawing. The stop or stops on the front or infeed portion of



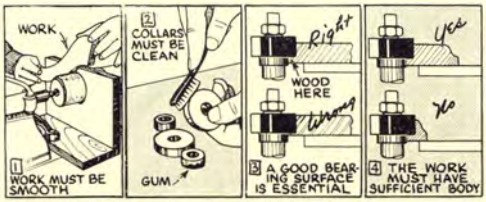
Above, Production Guide Fitted With Pressure Shoe and Stops; Two Styles of Disappearing Stops Are Shown.

the guide are usually of the disappearing type, since this style does not interfere with ordinary straight shaping when the stop is not used. Two styles of disappearing stops are shown in the diagram, one using a rubber band and the other a spring to project the stop forward through the fence. The backstop is usually pivoted or hinged so that it can be swung out of the way when not in use. It is evident that each set of stops is used for just one particular operation, and is of no use for anything else.

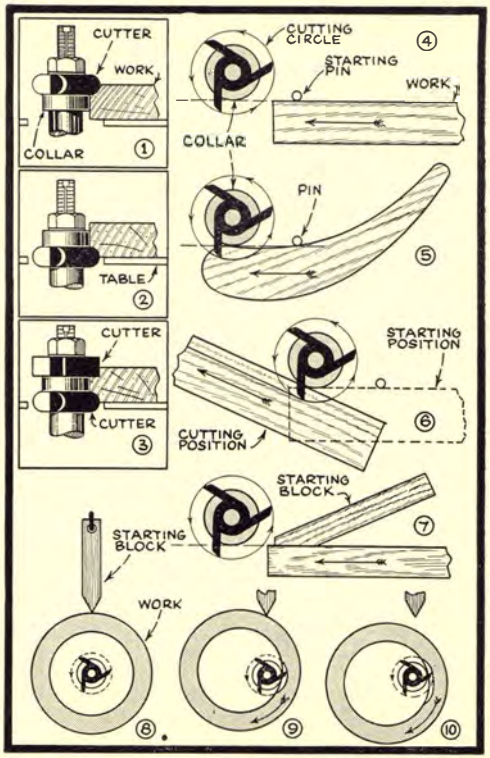


CHAPTER FIVE

SHAPING with COLLARS

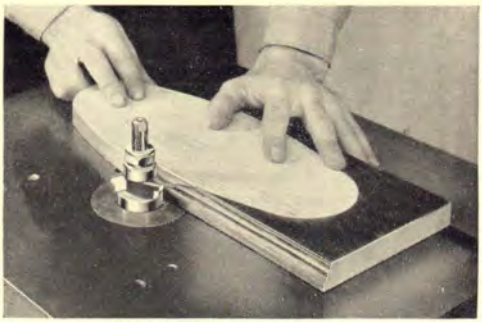


Working Conditions. — Certain conditions must always prevail when work is shaped directly against guide collars: (1) Collars must be smooth and true, free from all gum or other substances. They should be inspected frequently during long runs since some woods will deposit a layer of hard pitch on the rim of the collar as thick as 1/16 in., and this in a very few hours. The gum is easily removed with a stiff bristle brush and benzine or gasoline. (2) The edge of the work to be shaped must be smoothed to net size. It can be seen that any irregularity in the surface which rides against the collar will be duplicated on the moulded surface. (3) A portion of the edge of the work must remain untouched by the cutters in order that the collar will have a sufficient bearing surface. (4) The work must be fairly heavy in proportion to the cut being made. Under no circumstances should short work of light body be shaped against collars. These four rules—smooth work, clean collars, riding edge, and body of the work—are shown in the diagram, and it is important for good work and for safety in operation that they be strictly observed when doing shaper work of this nature.



Position of Collar.—The collar may be used either above, below, or between two cutters, as shown in Figs. 1, 2, and 3. The advantage in having the cutter uppermost, Fig. 1, lies mainly in the fact that the progress of the cut can thus be observed at all times. Where the collar is uppermost, Fig. 2, the cut cannot be seen, yet this method offers some advantage in that the cut is not effected by slight variations in the thickness of the stock; also, accidental lifting of the work will not gouge the wood as would be the case in the first method described. The collar-between-cutters is a method frequently used where both edges of the work are to be moulded.

Starting the Cut.—Practically all shapers are fitted with a steel fulcrum or starting pin, and this pin must be used as a support when starting the cut. If the work were to be advanced to the cutter without this side support, it would invariably be kicked back. It is important that the cut be started right, that is, the wood must be advanced



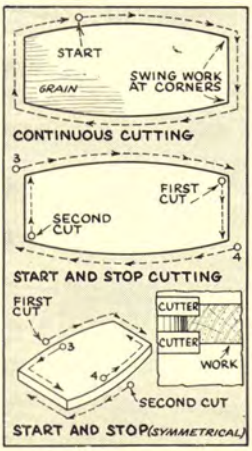
Above, using a sliding starting block. Right, path of shaper cutter.

along an imaginary line running from the edge of the collar to the side of the starting pin, as shown in Figs. 4 and 5. After the cut has been started, the work is swung free of the starting pin and rides only against the collar. Besides the regular steel starting pin, many workers use wood starting blocks, Fig. 7 on the previous page being an example. Figs. 8, 9 and 10 show a wood starting block set up for running an inside cut.

Sliding Start Block.—A wood form having the moulding previously cut on it can be used instead of a starting pin, as shown in photo above. After the cut is started on the work, the block may be pushed aside.

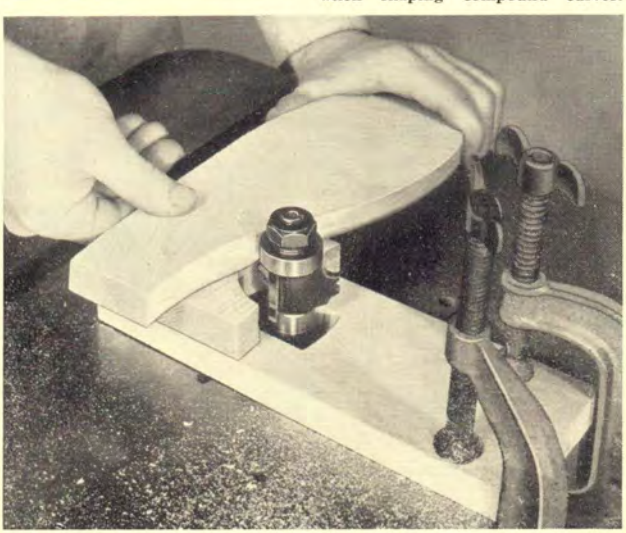
Path of Cutting.—Shaping is usually done with one continuous cut, the work being manipulated to turn corners, etc. Start and stop cutting is also used, the order of the cuts being as shown in the center diagram. Where the moulding is symmetrical, the method shown at bottom of diagram can be used. Cuts 1 and 2 are made in the directions shown, after which the work is turned over for cuts 3 and 4. This method eliminates running off the end grain.

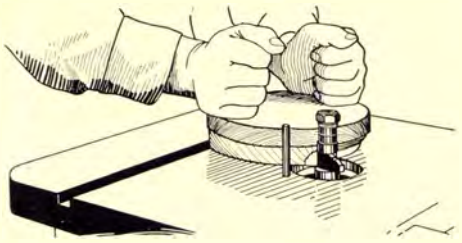
Compound Curves. — Work with compound curves must sometimes be shaped, an example being the head rail on a chair. The small photo shows the set-up. This is simply a block of wood, with the top surface cut to a curve a little sharper than the curve of the work. This guide block is nailed to a second block, the under block being clamped to the shaper table. The crown of the guide block should be in line with the center of the spindle. The spindle is usually raised as far as it will go for work of this kind, and the cutter is mounted high, with just room enough above for the guide collar and nut. The height is necessary, of course, in order that the ends of the piece being shaped will clear the table.



Shaping is done much the same as if the work were a flat piece of wood. The top of the guide block limits the face cut, while the spindle collar limits the edge cut. The work is pushed straight across the table, being tilted slightly so that the work at the cutting point is always approximately level with the table. Overcutting is impossible. On some curves it may be necessary to go over the work twice in order to get a full shape. Notice that the knife is set to cut on the underside of the work. Do not attempt freehand shaping with overhaning cutters as this is both dangerous and liable to produce inaccurate work. Operated as described, that is with the cutter under the work, the cut is always accurate and the operation safe.

A wood guide block is necessary when shaping compound curves.





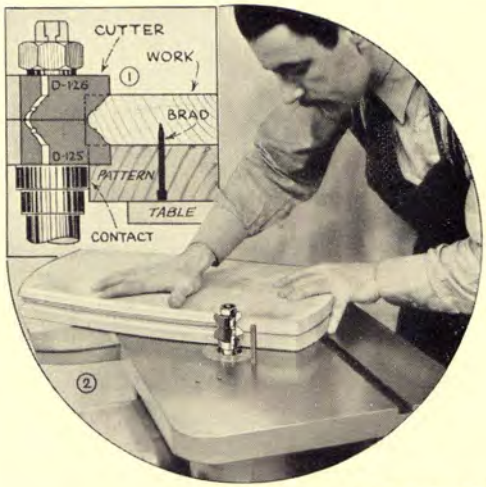
CHAPTER SIX

SHAPING with PATTERNS

Advantages.—Shaping with the use of patterns offers two outstanding advantages: (1) It permits the working of the entire edge of irregular curved objects, an operation which is impossible in any other manner. (2) It provides one of the cleanest and fastest methods of doing production work possible on any machine.

The Pattern.—The average pattern is made from wood, the usual stock being ¾ or ⅞ in. thick. Small patterns are usually cut from solid stock; larger ones are best built up from suitable pieces of hardwood. Production patterns are often made from fiber in order to better withstand the continual riding against the guide collar, but for average work hardwood serves nicely. The shape of the pattern is the exact outline of the work which is to be moulded. The edges must be smooth and clean, and should be oiled to permit smooth running. Softwood patterns for production work should be edged with strip fiber, as shown in Fig. 3.

The work which is to be shaped is roughly sawn about $\frac{1}{16}$ to ⅛-in. oversize, and is fastened to the pattern by means of anchor



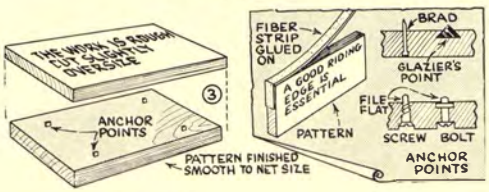
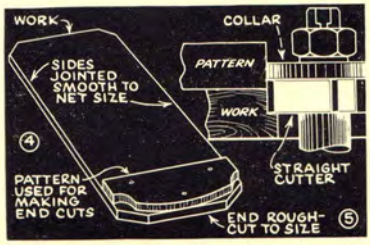


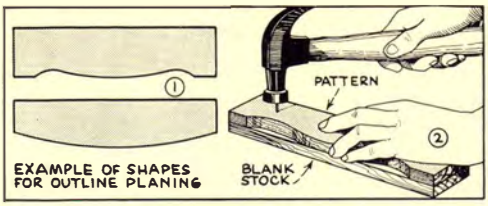
Photo Above Shows Outline Pattern in Use; Diagram Shows Manner of Assembly to Work.

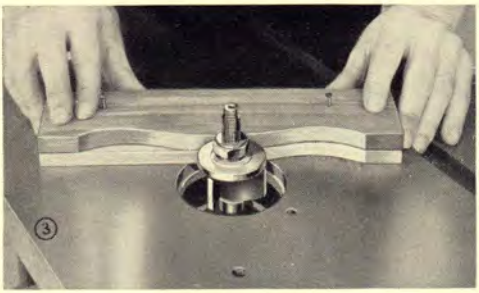


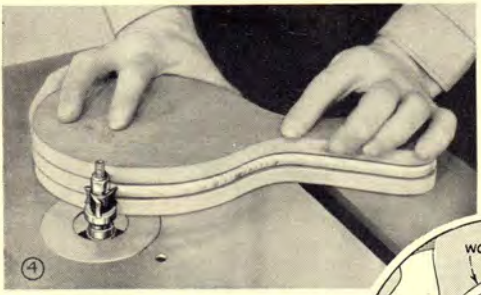
Above, Using a Built-up Outline Pattern for Shaping the Edge of a Small Table Top.

points. The simplest anchor point is the brad or nail — others are made from glazier's points, screws or bolts, as shown in the sketch. A flat point is preferable to a round point. Flat points should be inserted in the pattern in such a manner that they will fit lengthwise with the grain.

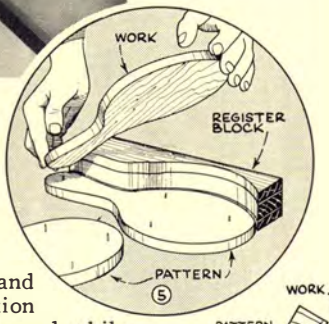
Examples of Work.—A typical example of work done with an outline pattern is shown in Figs. 1 and 2 above. The pattern in this case is a solid piece of ¾ in. stock, carefully smoothed to net size. The pattern, with the work attached, is advanced to the cutter the same as for shaping against guide collars. The pattern rides a suitable-diameter collar to control the cut to the proper depth, the surplus wood on the work being removed as the moulding is







Photos Above Show Outline Planing and Use of Double Form; Diagram at Right Explains Register Blocks.



used with a smaller collar would then be used to cut the moulding.

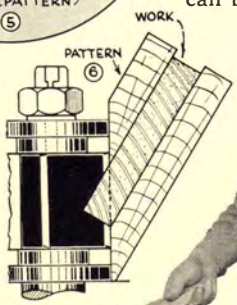
Outline Planing.—It can be seen from the foregoing description that outline planing can be readily done on the shaper. That is, certain shapes can be planed directly from square-sawed stock, examples being the shapes shown in Fig. 1. The pattern of the required outline is fitted to a suitable piece of blank stock, as shown in Fig. 2. Then, using a large straight cutter in connection with a collar of the same size, the blank stock can be planed to the same shape as the pattern, as shown in Fig. 3. Excessively deep cuts are, of course, to be avoided in view of possible spindle strain, but ½ in. cuts in ¾ in. stock and deeper cuts in lighter work can be made quite easily.

Double Patterns. — Where symmetrical mouldings are being cut, a double pattern with the work sandwiched between is sometimes useful, as shown in Fig. 4. The advantage lies in the fact that the work can be turned over at any time in order to favor the grain. While it is true that a high spindle speed makes grain of little importance, reversing in this manner is sometimes useful.

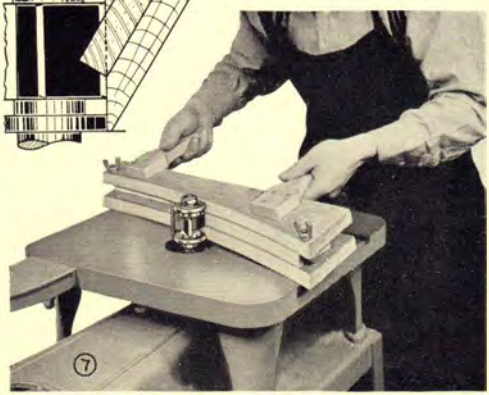
Register Blocks.—Register blocks are used for production work, their purpose being to afford a quick and simple means of fitting the work to the pattern or patterns in the proper position, as shown in Fig. 5. Quite often, a hole in the work or a projecting lug can be used to good advantage.

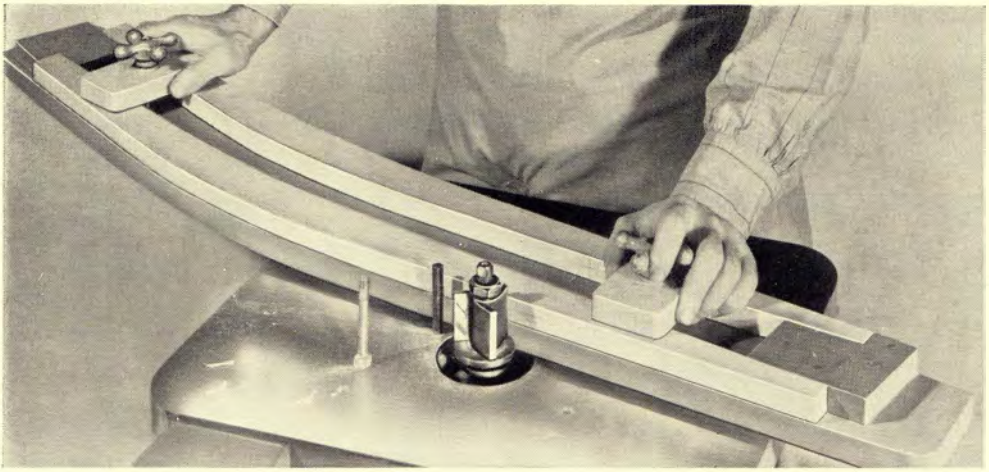
cut. Fig 1 shows the set-up being used in the photo. The dotted lines indicate the original size of both the pattern and the work. Notice that a portion of the pattern edge is also removed while the moulding is being cut. This, of course, is not always the case, but simply so happens for this particular cut.

Fig. 6 on the previous page shows a larger table top being shaped with the use of a built-up pattern. It will be apparent that for symmetrical shapes such as this that only a portion of a full pattern need be used if the run does not justify the making of a whole pattern. Fig. 4 makes this point clear. It can be seen that the partial pattern can be used for both ends of the table top, while the sides can be shaped against the regular straight fence. The cut being made in the photograph is diagrammed in Fig. 5, a collar the same diameter as the cutter being used to dress a portion of the edge of the work to the same size as the pattern. A shaped cutter



Below, Bevel Planing the Edge of a Boat Frame Part by Using a Double Pattern With the Work Clamped Between; the Diagram Shows the Action of the Cutter.





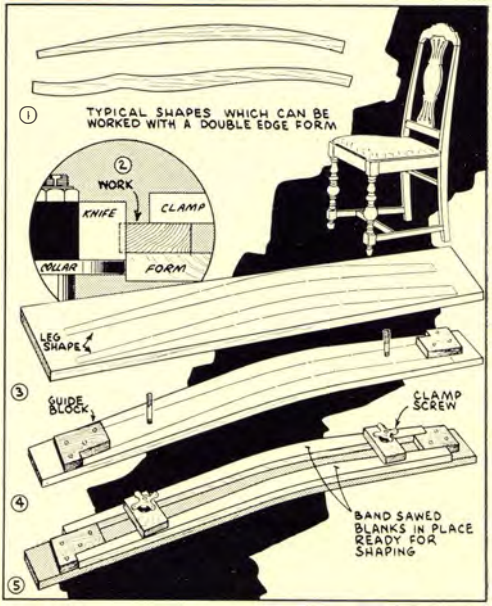
tage to get the pattern in proper register.

Bevel Planing.—Some classes of work, the frames for vee-bottom boats being a typical example, require the beveling of an edge which often varies, being at a greater angle at one end than the other. Where production work of this nature must be done, a great savings in time as well as perfection in results can be effected by making a double pattern to the required shape and bevel. The work is clamped between the two patterns and the whole unit fed to a straight cutter, the patterns riding collars of the same diameter as the cutter, as shown in Figs. 6 and 7 on the opposite page.

Double Edge Patterns.—Where long, narrow shapes are to be planed to size, the use of a conventional form becomes more or less unsatisfactory. The main drawback to the use of a regular form for such work is the safety factor—it can be seen that such shapes as those shown in Fig. 1, offer little room for anchor points and must necessarily pass the feed hand very close to the knife.

A better type of pattern for such work is made from a wide board carrying the outline of the work on opposite edges. The typical example illustrated in the drawing shows how a double-edge pattern for a chair leg is made and used. A board 6 or 8-inches wide and slightly longer than the work is required. On opposite edges of this is penciled the full shape of the work, as shown in Fig. 3. This should be done from an accurate wood or metal pattern. The outer line of each leg shape is then band sawed and the edges carefully smoothed and lightly sponged with oil. These are the edges which will ride against the guide collar. Guide blocks are made to fit the

A pattern with double edges affords a safe, accurate method of handling narrow pieces.



ends of the inside lines., and are nailed or screwed in place, as shown in Fig. 4. Fig. 5 shows two of the band sawed blanks in place ready for shaping. One edge of each is shaped in the position shown, then the legs are reversed from side to side and the opposite edges cut to size.

In band sawing the blanks, the saw cut should be made carefully for a distance of about two inches from each end, while the rest of the cut can run up to ⅛ inch wide of the mark. It can be seen that a fairly accurate end cut is necessary in order that the blanks will be located at the proper positions when fitted against the guide blocks.

CHAPTER SEVEN

THE USE of FORMS

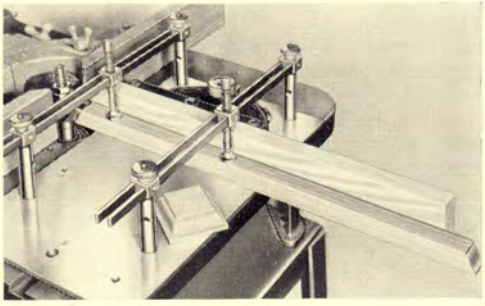
The Circular Saw Tenoning Jig can be Used to Good Advantage for Many Shaper Operations.

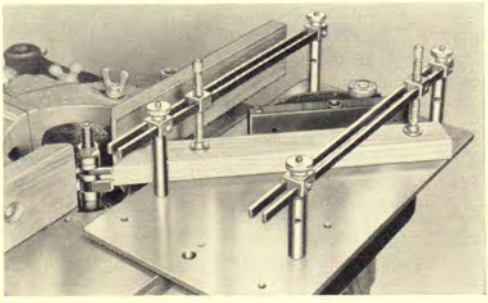
Definition.—A form is any device or jig in or upon which the work is securely fastened by means of clamps, screws or wedges so that it can be advanced to the cutter. In this classification are included the sliding jig and the tenoning jig, but the term is more truly applied to special forms which *must* be used to support odd-shaped work. Since the construction of the latter type of form requires both a money and time expenditure in making, it is used only when the work cannot be shaped by other methods. It can be seen that this condition does not apply to the various all-purpose forms, such as the sliding and tenoning jigs, the fluting jig, etc. Indeed, in this case, the jig offers the simplest and least inexpensive method of working.

The Tenoning Jig. — This fixture, made especially for making tenons on the circular saw, can be used to good advantage in various shaper operations, especially where narrow stock must be face shaped. A typical example of the work is shown in the top photo where the jig is being used to hold a drawer side for grooving. A backing block, as shown in the inset, is

used in order to set the work within range of the cutter. The block is easily fastened to the face of the jig by means of screws inserted through holes provided for this purpose. Another example of the tenon jig in use is shown in Fig. 1 on the opposite page. The backing block is not necessary in this case. It can easily be seen that the tenoning jig offers the most satisfactory set-up for making the particular type of cut shown.

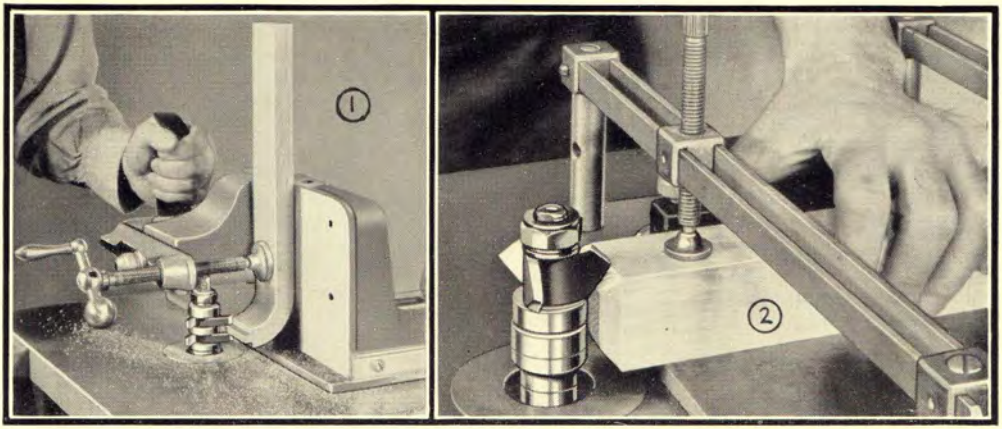
The Sliding Jig.—The sliding jig is a standard shaper accessory, and is indispensable for various kinds of work, espe-





Top, Using the Sliding Jig in Returning a Moulding. Bottom, the Jig Being Used to Cut a 45° Miter Joint.

cially for returning a moulding on narrow stock, as shown in the photo. It is also useful for making joints, either straight or at any specified angle, as can be seen in the lower photo. Fig. 2, page 21, shows the sliding jig being used with a 45° cutter, the operation being the beveling of a square post. The sliding jig is to the shaper what the miter gage is to the cir-

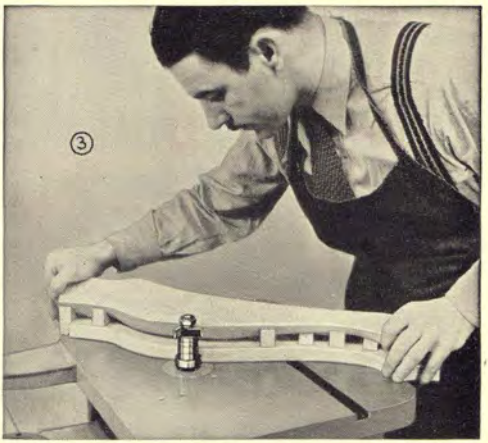


Typical Examples of Shaper Work Using the Tenoning and Sliding Jigs.

cular saw, and its application to a hundred-and-one jobs will readily become apparent under actual working conditions. It should always be used when end working narrow stock.

A Typical Form.—Figs. 3 and 4 picture the operation and set-up for a job requiring the use of a form. The work is a cabriole leg which has been band sawed and sanded to the proper shape. The final touch is to round the outside corner, and it is this operation which is being done on the shaper. It can be seen that the work cannot be advanced along the fence, neither can it be shaped against collars or by the use of the sliding or tenoning jigs. Hence, the need of a form to properly support the work. The edge to be shaped forms a straight line, so all that is necessary is a means of blocking the leg so that this edge will be level with the shaper table. The base of the form is shaped to the required outline, much the same as for flat pattern work. With the leg firmly blocked in place, the form is advanced to the cutter, the form riding a suitable collar. The cutter is special, being ground to the concave shape required from a straight cutter.

While on the subject of the cabriole leg, it may be pointed out that the full shape of the leg could be readily worked with straight knives in the same manner as described for outline planing, Chapter Six. The work would be roughly band sawed to remove excess wood, and then planed smooth to net size with an outline pattern. The work might or might not require blocking, depending upon the nature of the leg shape. A leg with shallow curves could be advanced to the cutter directly on the table surface; deeper curves would need blocking in order to give the work sufficient support.



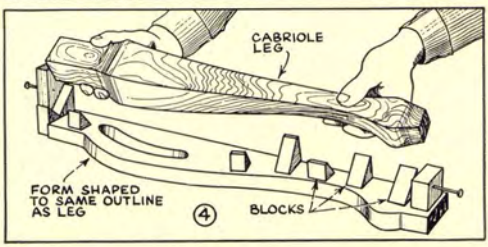


Photo and Diagram Above Show Application of Form in Shaping Odd-Shaped Work.

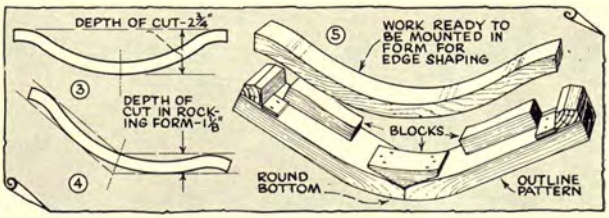
Rocking Forms.—Curved work which is to be planed to an outline is often beyond the capacity of the cutters. An example is shown in Fig. 2, page 22—a rail in a chair back. The flat sides have been previously shaped to the required curve, either by steaming or by bandsawing. It remains to shape one edge of the piece, the curve being shown in Fig. 2, this being a picture of the finished job. Referring to Fig. 3, it can be seen that if the work is blocked in the conventional position, the cut required will be 2¾ in.—greater than any straight cutting edge which can be carried on the

spindle. If, however, half the work is advanced on one plane and the remaining half on another plane, as shown in Fig. 4, the depth of cut will be only 1⅛ in., well within the capacity of the spindle.

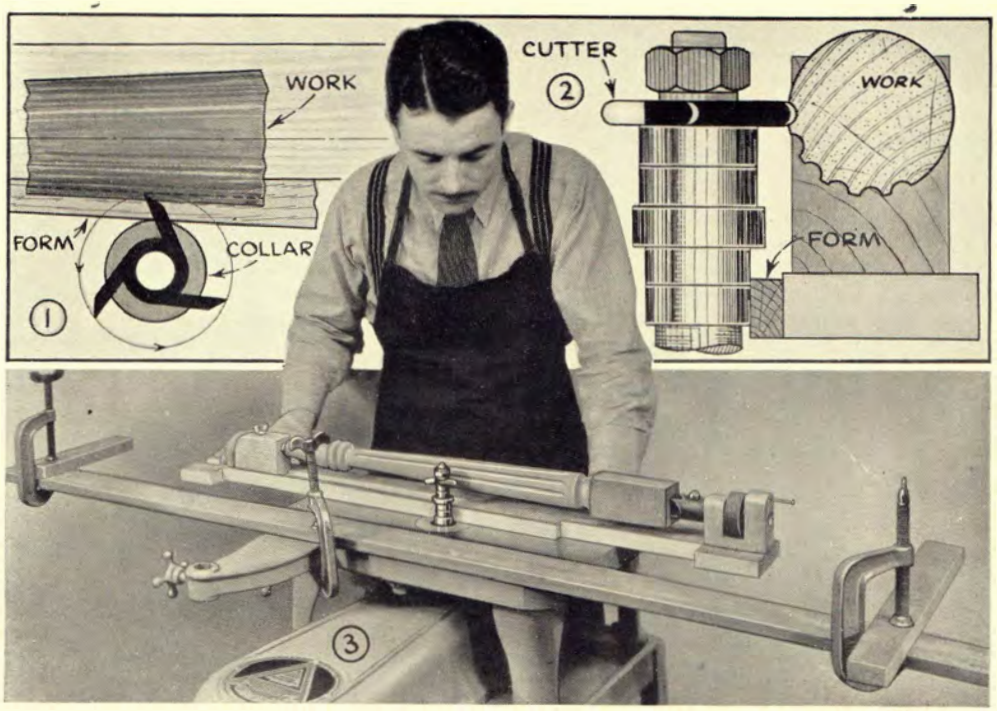
Hence, the need of a rocking form. In every respect except one, this is the same as a flat form, the base carrying the outline pattern on its edge and the required blocking on its flat surface. The difference lies in the fact that the bottom is in two planes, joined by a slow curve so that the form can be rocked from one plane to the other, as shown in Fig. 5. Fig. 6 shows the work securely clamped in the form, ready for the shaping operation. The photo at the top of the page shows the cut in progress. The outline pattern is net size. Consequently, a collar the same diameter as the cutter is used to ride the outline pattern. The work is started against the starting pin in the usual manner and advanced to the cutter with the base of the form flat on the table. As the work nears the center of the cut, the form must be evenly and smoothly rolled from the starting flat plane to the finishing flat plane. On concave shapes, the roll can be done quite easily; on convex curves, such as in this particular example, the roll must be made fairly evenly in order to keep the work at right angles to the cutter. As an aid to making an even roll, radial lines are drawn on the upper portion of the form, each successive line being kept vertical as that portion of the cut is pushed past the cutter.

Edge Shaping a Chair-Back Rail With the Use of a Rocking Form.

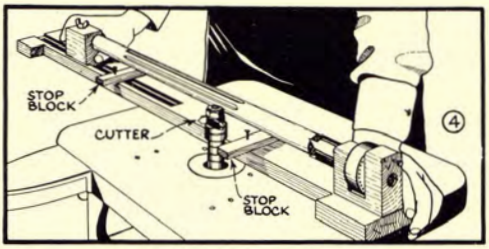
The Fluting Jig. — The fluting jig is a form familiar to most workers. It is essentially a small lathe, in which the work is held for shaper operations. A common and simple type of construction is shown in Chapter Eight. The fluting jig is mostly used for fluting, hence its name. This operation is shown in Figs. 1, 2, and 3. A form of the same contour as the leg is fastened to the jig, the form riding a depth collar in the same manner as for other shaping operations. In the example shown, the flutes are being cut on a tapered surface, hence, the form is simply a straight tapered piece of wood. Where the fluting is being done on a curved surface, the form or pattern would, of course, be of the same shape as the contour of the leg. The upper photo shows outside stops being used to limit the starting and stopping position of the cut. In Fig. 4, which shows a reeding cutter being used, inside stops set the limits of the cut. These stops, as will be evident, start and finish against a collar to set the length of the cut. The work, in this case, is a round cylinder, so that no form is necessary, the depth collar simply riding the straight edge of the jig. Stops are also worked directly on the form itself, the pattern curving out to limit the cut. Some workers ride the work directly against the collar to limit the cut, but this method is not recommended because of its tendency to score the work.

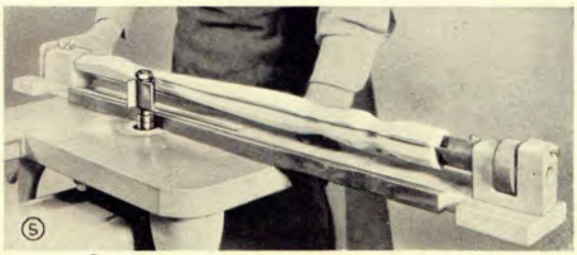


Photos and Drawing Show Construction of Rocking Form and Its Application.



Square Turnings.—Fig. 5 shows the fluting jig being used to work a square turning. This type of leg has eight or more planes shaped to a specified contour. The shape is worked directly from square stock with the use of an outline pattern fastened to the base of the jig. The example shown is a twelve-sided square turning, the cut being the next to the last to complete the leg. Square turnings are easily and quickly fashioned on the shaper in this manner, and, despite the fact that the contour is limited to a series of slow curves, the leg readily lends itself to many projects in furniture construction. It is one of the fastest methods of making legs, requiring only that the stock be sawed square and to length, after which the necessary cuts can be made on the shaper. It can be seen that it is impossible to make any concave cut of less diameter than the cutting circle of the cutter, and this should be borne in mind when planning the design. Some pleasing variations can be made by using slightly curved cutters instead of straight knives.



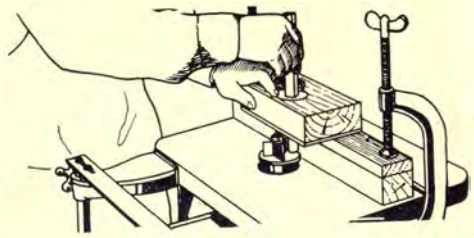


Above, the Fluting Jig Being Used to Make Flutes in a Table Leg; the Insets Show How the Form Rides the Collar to Limit the Depth of Cut. Left, the Jig Being Used With a Reeding Cutter and Inside Stops to Limit the Cut. Below, the Fluting Jig Being Used to Hold Work for Square Turning.

Caution.—It is important that any form used in shaper work be well made. It must hold the work securely and have a firm base on which to slide. Never use a makeshift form in an attempt to speed up the job—do it right or not at all. This is especially important in the construction and use of rocking forms, where the proper manipulation of the form is hazardous enough in itself without adding extra dangers through poor construction of the form.

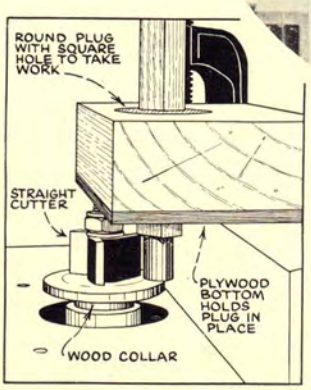
CHAPTER EIGHT

JIGS and FIXTURES



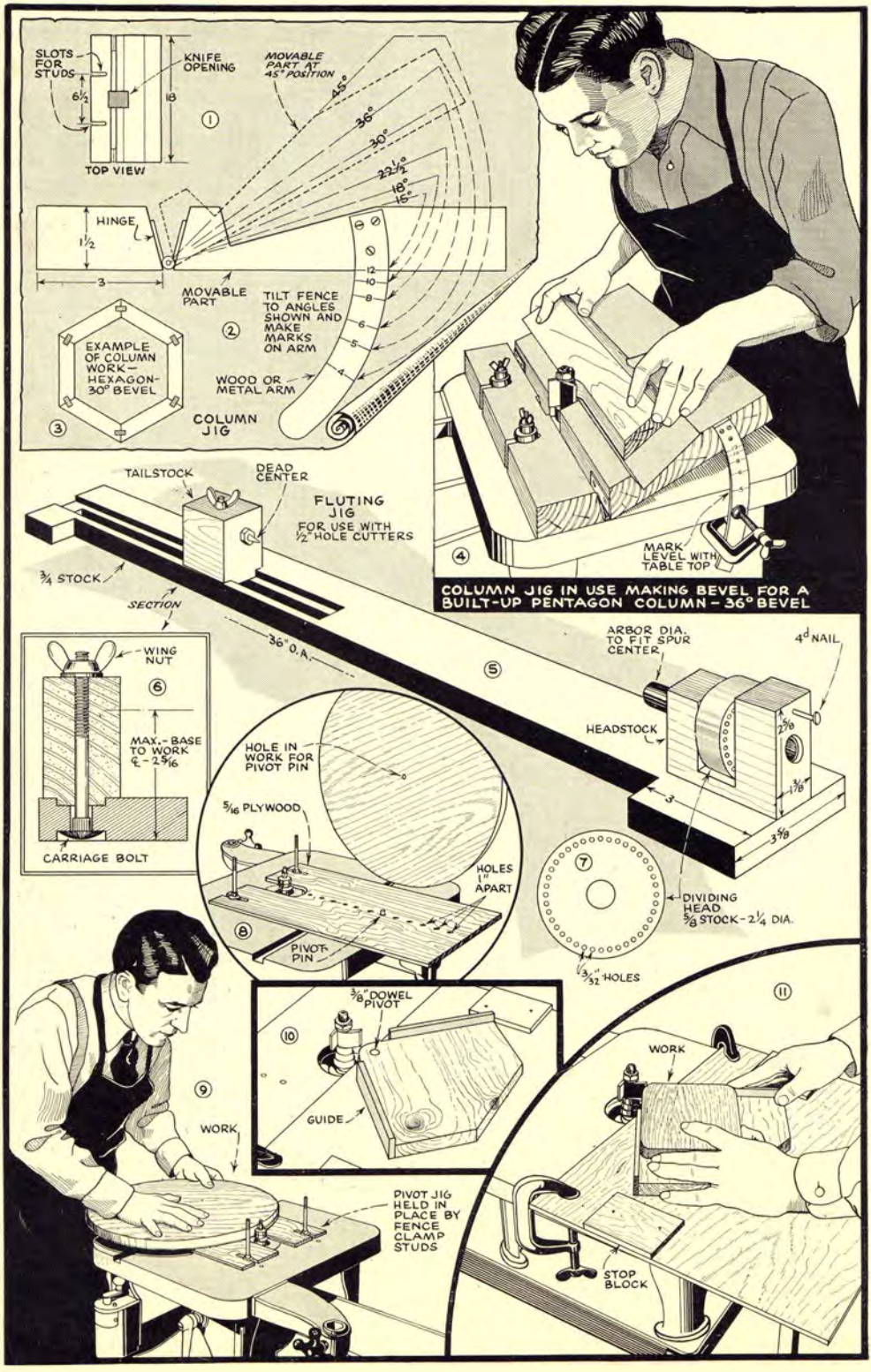
Tenons. — Round tenons are frequently necessary on the ends of square stock, and, barring a comparatively long lathe operation, the job presents considerable difficulties. However, the shaper offers an easy solution, and once the jig has been made, the stock can be tenoned quickly and safely. The jig, as shown in the drawing, consists of a heavy block of wood mounted over the cutter. In this block is fitted a round plug, the plug in turn having a square hole to take the work. A piece of plywood on the underside of the block allows the work to pass through but keeps the plug in place. Work to be tenoned is inserted through the square hole and into contact with the revolving cutter. A method of cutting tenons on round stock is shown in the lower photo. This has one advantage in that the tenon can be tapered, often necessary as in rake and hoe handles and similar work.

Tapering Jig.—Where the shaper is fitted with a rip fence, use can be made of any style of tapering jig commonly used on the circular saw. The method of setting and running the cut or cuts is exactly the same. The photo in circle shows the operation. In actual work, the ring guard would, of course, be in place over the cutterhead. In this respect, it should be mentioned that the ring and other guards and safety devices should be used whenever possible. ***The adjustable fence should be used on the opposite side of the cutter, for the above operation.***



Above, using tapering jig in connection with rip fence. Left, two methods of cutting tenons.

Column Work.—Column work demands an adjustable bevel jig, one which can be quickly and accurately set to the proper bevel for any particular type of column. A jig of this type is shown at the top of page 25. Its general construction and use should be apparent. In making the various marks on the wood or metal arm, the table portion of the jig is set to the required angle and a corresponding mark is made on the arm, level with the top of the shaper


SLOTS FOR STUDS
KNIFE OPENING
6½
18
TOP VIEW
MOVABLE PART AT 45° POSITION
45°
36°
30°
22½°
18°
15°
HINGE
1½
3
MOVABLE PART
TILT FENCE TO ANGLES SHOWN AND MAKE MARKS ON ARM
EXAMPLE OF COLUMN WORK— HEXAGON- 30° BEVEL
WOOD OR METAL ARM
COLUMN JIG
MARK LEVEL WITH TABLE TOP
COLUMN JIG IN USE MAKING BEVEL FOR A BUILT-UP PENTAGON COLUMN – 36° BEVEL
TAILSTOCK
DEAD CENTER
FLUTING JIG
FOR USE WITH ½" HOLE CUTTERS
¾ STOCK
SECTION
36" O.A.
WING NUT
MAX.- BASE TO WORK ℄ - 2 5/16
CARRIAGE BOLT
ARBOR DIA. TO FIT SPUR CENTER
4d NAIL
HEADSTOCK
HOLE IN WORK FOR PIVOT PIN
5/16 PLYWOOD
HOLES 1" APART
PIVOT PIN
DIVIDING HEAD
⅝ STOCK - 2¼ DIA.
3/32" HOLES
⅜" DOWEL PIVOT
GUIDE
WORK
PIVOT JIG HELD IN PLACE BY FENCE CLAMP STUDS
STOP BLOCK

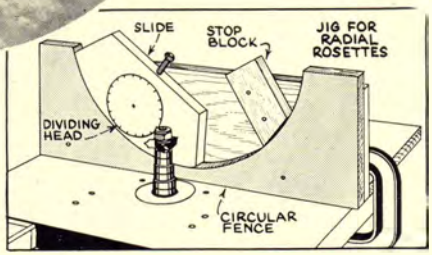
Ornamental Radial Rosettes in a Wide Variety of Patterns Can Be Made With the Simple Jig Shown.

table. To reset the jig to any particular angle, it is only necessary to set the mark on the arm level with the top of the shaper table. The angles shown are for 4, 5, 6, 8, 10, and 12-sided figures, but markings for other shapes can be easily interposed.

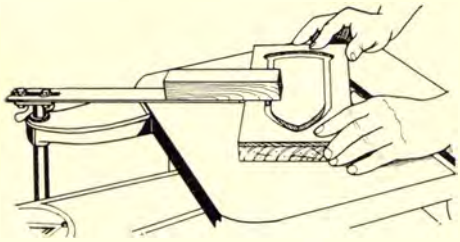
Fluting Jig.—The construction of a simple fluting jig is shown in Figs. 5, 6, and 7. The dividing head is drilled with a suitable number of holes, and is fastened to the arbor by means of a pin inserted through the head and engaging the arbor. The dead center is simply a bolt turned to a 60° point. Adjustments to suit various lengths of work can be made by means of the slotted base arrangement, as shown in Fig. 6. This jig is for use with ½ in. hole cutters. The distance from the lower side of the base to the centerline of the work must not exceed $2\frac{5}{16}$ in.—this being the highest position which it is possible to raise the cutter. A smaller jig for use with $\frac{5}{16}$ in. hole cutters can be made up if desired. Larger work of any nature will require the use of a special extension spindle.

Pivot Jig.—Round and semi-circular work can be shaped easier and more uniformly if a pivot jig is used. A simple form of construction is shown in Fig. 8. The jig consists of a piece of plywood, in which is drilled a series of holes 1 in. apart, these holes being about $\frac{5}{16}$ in. diameter to take a corresponding pivot pin. Slots at one end of the jig permits of ready mounting to the shaper table, and also allows for proper setting where the work is not an even-inch diameter. The jig in use is shown in Fig. 9. A hole is drilled in the underside of the work to take the pivot pin. The cut is started by leaving the clamp studs loose so that the work can be pushed into the cutter tc the required depth, after which the studs are tightened and work rotated into cutter with the pivot pin as a center. Work need only be rough sawed for this operation.

Rounding Corners. — A handy jig for rounding corners is shown in Figs. 10 and 11. It consists of an auxiliary wood base, on which is mounted a pivoted carriage. In use, as shown in Fig. 11, the work is placed on the carriage and tight against the guides. The carriage is then swung from the starting stop block to the finishing stop block to neatly and uniformly round the corner of the work.



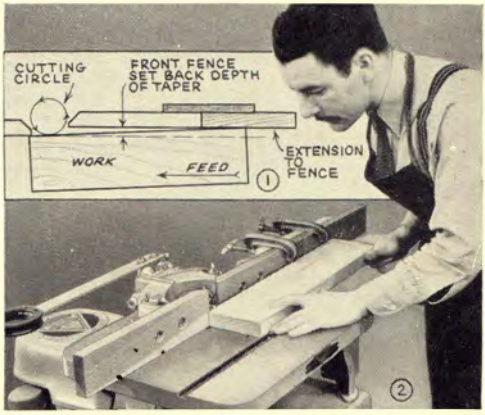
Radial Rosettes.—An unusual type of jig for making radial rosettes is shown in the photo and drawing above. The jig consists of a circular fence, on which is a sliding block. A dividing head is fitted into a round hole cut in the sliding block, the setting of the dividing head being controlled by a push pin in the block. In use, the work is fastened by brads or screws to the dividing head, and, at the various settings, pushed past the cutter. A stop block on the fence stops the cut at the required limit. The cutter is usually of the same form as used for reeding and must be very sharp in order to prevent tearing the wood. Rosettes of this kind are useful in decorating furniture and can be made up to about 5 in. square. They make up best if the center is first recessed, this opening to be later fitted with a round, turned button projecting slightly above the face of the work. The photo shows a rosette with creases radiating from the center, but other forms radiating from the center of an edge or from a corner can be readily made by setting the fence accordingly. In doing production work of this nature, it is advisable to secure special cutters which are constructed and ground for this type of work. For the occasional job, standard cutters will work satisfactorily, but they must be very sharp and the feed must be made slowly to prevent tearing in those cuts which are directly across the grain. In any case, the jig should be well-constructed and well-guarded in order to eliminate any danger to the operator.



CHAPTER NINE

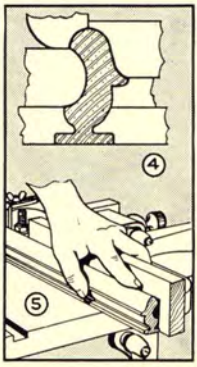
Miscellaneous SHAPER OPERATIONS

Jointing.—Stock up to 1½ in. thick can be edge jointed on the shaper with perfect results. The fences are set much the same as the tables are set on a jointer (see Chapter Four.) The depth of cut is from zero to about 2 in., the deeper cuts requiring the fence to be mounted with the clamping studs in the rear set of holes. Extremely heavy cuts, as shown in Fig. 3, are not recommended for the average run of work, but the operation is sometimes useful, as, for example, in forming the handles of wooden paddles.



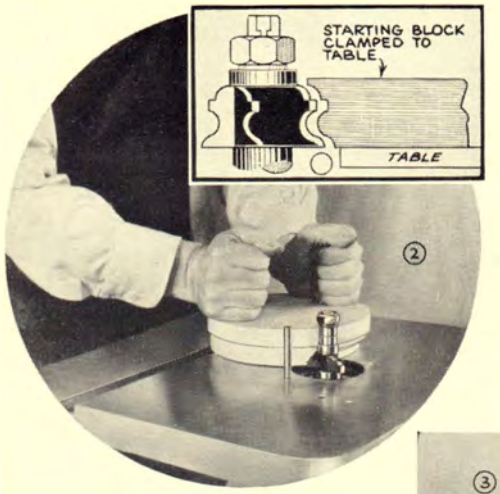
Above, Taper Jointing on the Shaper. At Left, Making a Heavy Cut.

Tapering.—Similar to the same operation as performed on the jointer, the front fence is set back the distance of the required taper, and, from a starting position as shown in Figs. 1 and 2, the work is pushed forward to make the cut. Tapering on the shaper has two advantages: (1) A greater depth of cut is possible than on the jointer; (2) A fence extension for long work is easily attached to the standard fence. Where the work is to be both tapered and moulded, the whole operation can be done in one pass by using the required shaped knife instead of a straight cutter.



Speed in the Production of Small Shaped Figures Is Made Possible With the Shaper.

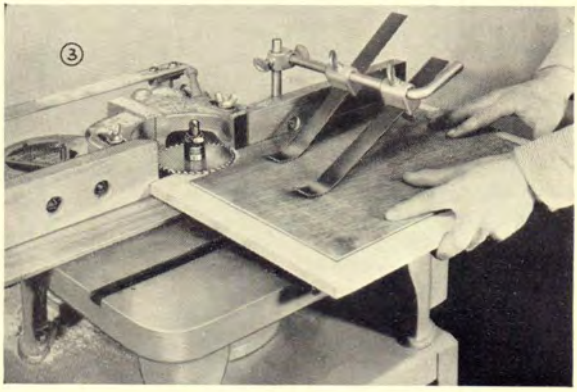
Shaping Figures.—Very frequently shaped figures are necessary for games and toys. Again, the job might entail the making of several hundred alphabets of wooden letters. This class of work is often done by comparatively slow scroll saw methods, whereas a much quicker solution is to work the mould in long strips on the shaper as shown in Figs. 4 and 5 and then saw off the design to the required thickness, as shown in Fig. 6. Several runs may be necessary to produce the required figure, and special cutters ground to the required outline are sometimes worthwhile in order to speed up the cutting operation by reducing the number of passes required. Fig. 4 shows specially-shaped knives for forming a toy duck. The cut can be across the grain so that the later separation of the block into strips will give a surface instead of an end grain. Where the end grain is permissible, as it often is, it is usually better to shape the work with the grain as in Fig. 5, since cleaner cutting is possible in this manner.



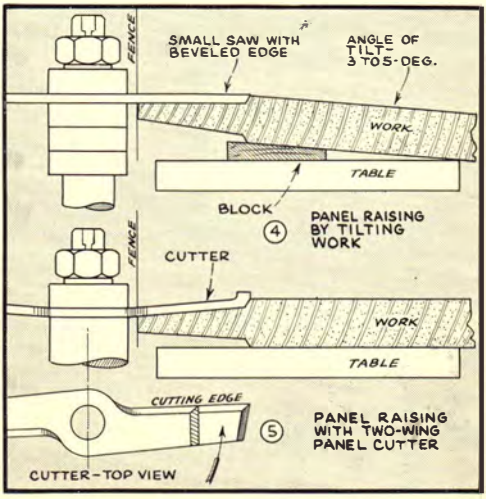
Above, Using a Pattern for a Turning Operation. The Inset Shows a Formed Starting Block.

Turnings.—This is another example of production work on the shaper, especially useful in getting out porch column bases, wall rosettes for stair rails, and also smaller pieces such as drawer knobs, small turned pediments, etc. Large work is usually shaped with a round pattern; smaller work is best swung from a pivot or worked in a jig (see Chapter 8). A typical set-up using a pattern is shown in Fig. 2. The pattern is used above the work, and has handles to permit easy and safe manipulation. Regular cutters can often be used, while some classes of work will demand knives ground to the required contour. Where heavy cuts are being made, a starting block instead of a starting pin should be used. The block is cut to the same contour as the knife and mounted close to it, as shown in Fig. 1. In this position, it permits easy and safe starting of the cut and also serves as a chipbreaker while the cut is in progress.

Panel Raising.—Raised panels are featured in both casework and furniture construction, the essential feature of the work comprising a heavy panel which is reduced in thickness at all edges to fit a corresponding groove in the frame for which it is intended. Fig. 3 pictures a typical job in operation. There are two general methods of raising panels: (1) Using a small saw and tilting the work to suit, (2) Using a regular two-wing panel cutter, with the work flat on the table. The set-up for the first method of operation is shown in Fig. 4. A small saw with the teeth slightly beveled, is mounted on the shaper spindle. A strip of wood is then fitted to the shaper table or nailed to the shaper fence, this block, together with the edge of the shaper table, forming an angle of from 3 to 5 degrees. The work rides the block and the edge of the shaper table to get the angle required, while the edge rides the fence to keep the cut straight. The cut may or may not be made in one pass depending upon how much wood is to be removed. Generally speaking, one or two fairly heavy roughing cuts followed by a light finishing cut will give better work at a speed comparable with a one-cut operation with its consequent slow feed. Heavy cutting in any kind of work is to be avoided unless



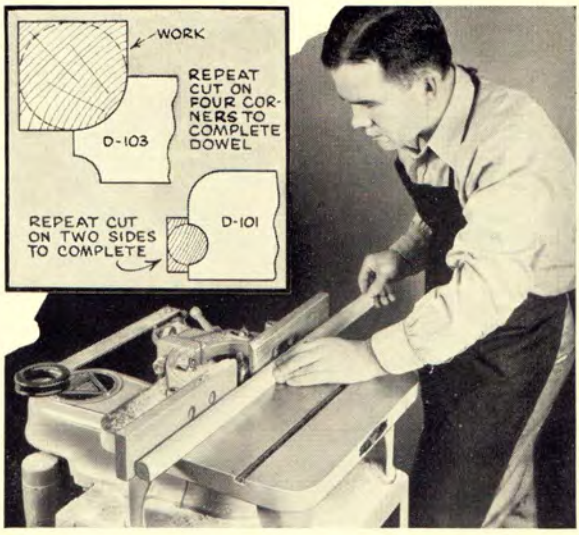
Panel Raising Can Be Done by Two Different Methods as in the Photo Above and Diagram Below.



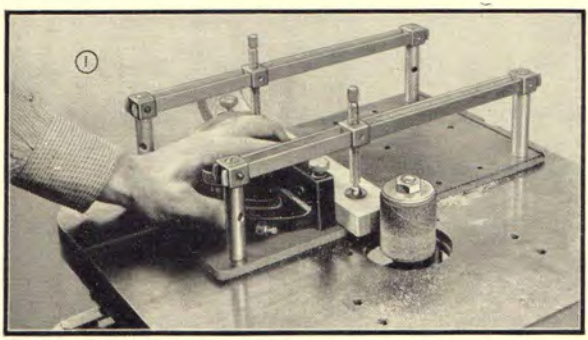
special equipment is used.

The set-up for raising panels with a two-wing panel cutter is shown in Fig. 5. Here, the required tilt is incorporated in the construction of the knife so that the work is carried flat on the shaper table.

Making Dowels.—Perfect dowels, especially the larger sizes, can be made by using various cutters on the shaper. The largest size which can be made with standard knives is 1 in. diameter, this being done with D-103 cutter in the manner shown. Four cuts are necessary, one on each corner, to reduce the square stock to cylindrical form. The finished work is a full round, smooth, and superior to ordinary hand turning. Other sizes which can be made with the four-cut method comprise ¼, ⅝, and ¾-in., the larger sizes being the most practical. Smaller dowels are best made with the second method shown in the sketch at the top of the page. This requires but two cuts, one on either side of the stock, to complete the full dowel

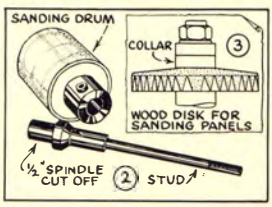


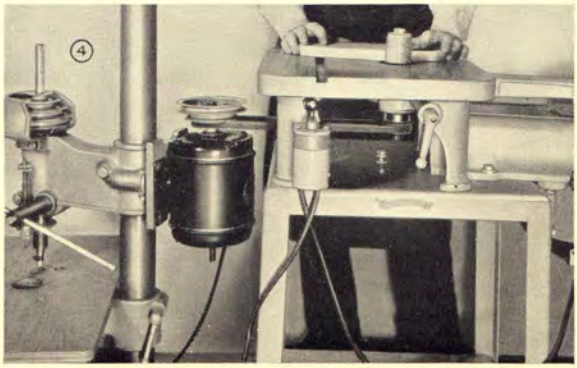
Perfect Dowels in a Wide Variety of Sizes Can Be Made on the Shaper With Standard Cutters.



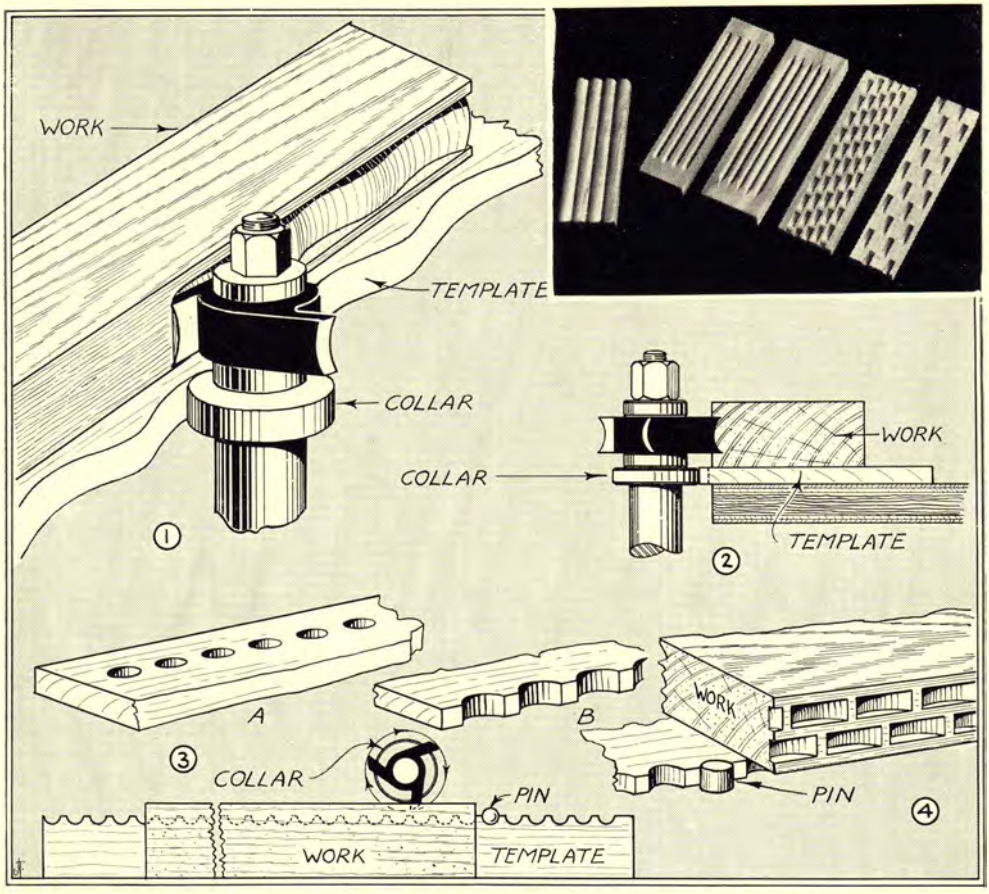
shape. D-102 cutter produces a dowel ¼ in. in diameter, while D-101 cutter makes a dowel ⅜ in. in diameter. Either method demands a little care in setting the cutter to the right depth and aligning the fence, hence the advisability of making a stock quantity after the necessary adjustments have been made.

Sanding.—The shaper makes an excellent spindle sander, a typical operation being shown in Fig. 1. Fig. 2 shows one method of adapting a standard spindle and sanding drum, the spindle being cut off to fit the hole in the sanding drum. Other methods of mounting drums can be readily figured out by the operator to fit existing equipment. Fig. 3 shows a wooden disk for sanding panels. This type of sanding equipment is readily carried on the shaper spindle. One fault of the shaper as a spindle sander is that the machine, except for the smallest spindles, runs at excessive speed. This high speed tends to glaze the sandpaper, resulting in burned work which is generally unsatisfactory. The obvious solution is to reduce the spindle speed to about 2000 r.p.m.. This can be easily done by removing the front belt guard to permit access to the spindle pulley. Any motor can then be belted direct, a simple set-up being shown in Fig. 4 which utilizes the drill press for this purpose. The slow-speed set-up is useful for a number of varied operations, and is sometimes necessary to free the shaper spindle





Sanding Operations Demand Slow Speed—a Satisfactory Manner of Drive Being From the Drill Press as Shown Above.



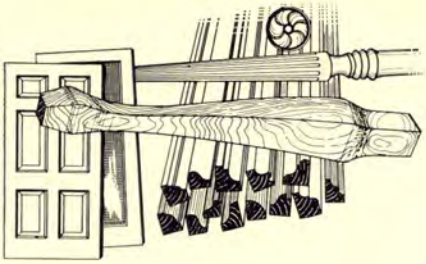
Ornamental Mouldings Are Easily Made on the Shaper With 5/16 in. Hole Cutters by Using the Simple Methods Shown in the Drawing Above.

after long disuse in extremely cold weather. Grinding with 3 or 4-inch cup or straight wheels can be done at the low speed, while smaller wheels can utilize the full shaper speed.

Routing.—With a special chuck made to fit the main shaper spindle, all routing operations can be done on the shaper. Where pattern work is being done, the guide pin is located on the arm of the ring guard. All operations are similar to routing as done on the drill press except that the router bit points up instead of down. This is a useful method for doing pierced work since the pattern is always visible.

Ornamental Work.—Small shaper cutters are especially suitable for making fancy mouldings and a wide variety of forms can be cut with a minimum of setting-up. A typical example is shown in Figs. 1 and 2.

Another method capable of wide variation is shown in Figs. 3 and 4. The template in this case has a regular series of notches along its edge, the simplest way to form these being to drill a row of holes as at A, Fig. 3, and then saw through them as at B. A short pin, a trifle less in height above the table than the thickness of the template, is set in the starting-pin hole in the table, and the cutter and two depth collars of the same diameter are placed on the spindle. The collar diameter limits the cuts to the proper depth, which should not be over 3/16 inch in most cases, using the small cutters. The work is bradded to the template, parallel to the notched edge, one notch is set against the pin and the work is swung carefully into the cutter and against the collar. As soon as it touches the collar it is swung back, the template is advanced to another notch and the process is repeated. This is continued for the entire length of the piece. The spindle may then be raised higher, the work moved forward on the template a distance equal to half a space and a second row of cuts made.



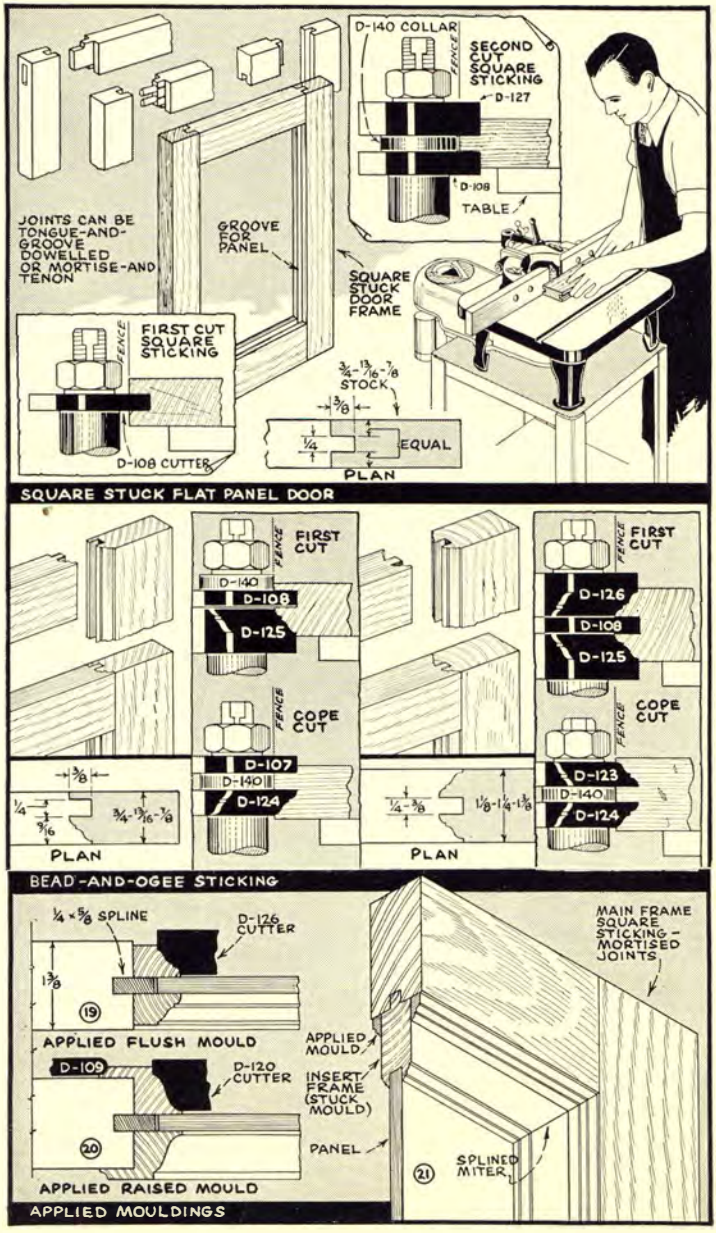
CHAPTER TEN

Application of SHAPER CUTTERS

Square Stuck Doors.—Use the shaper set-up shown in Fig. 5 to groove the inside edge of all pieces. Cope both ends of both rails with the set-up shown in Fig. 6. Assemble the door as shown in Fig. 1. For light cabinet doors, the tongue-and-groove formed by sticking makes a sufficiently stiff joint when well glued. For sturdier construction, the joints can be doweled, Fig. 3, or tenoned, Fig. 4.

Bead-and-Ogee Sticking.—Figs. 9 and 10 show the assembly of a cabinet door, bead-and-ogee stuck on one side. The operations are the same as before, using the set-up shown in Fig. 12 for the sticking, and the set-up in Fig. 13 to cope the ends of the rails. See also page 39. Figs. 14 and 15 show the assembly of a door stuck on both sides. This sticking is standard for 1⅛ in. closet doors. The joints are dowelled.

Applied Mouldings.—Doors are frequently made up with applied mouldings, as shown in Figs. 19 and 20. The main frame is square stuck, after which the panels and moulded strips are fitted in place. A somewhat similar form of construction is shown in Fig. 21. This is good for



Above, Application of Shaper Cutters in Cabinet and Interior Door Construction. All Doors Use ¼ in. Flat Panels, Although Raised Panels with the Same Edge Thickness Could be Substituted if Desired.

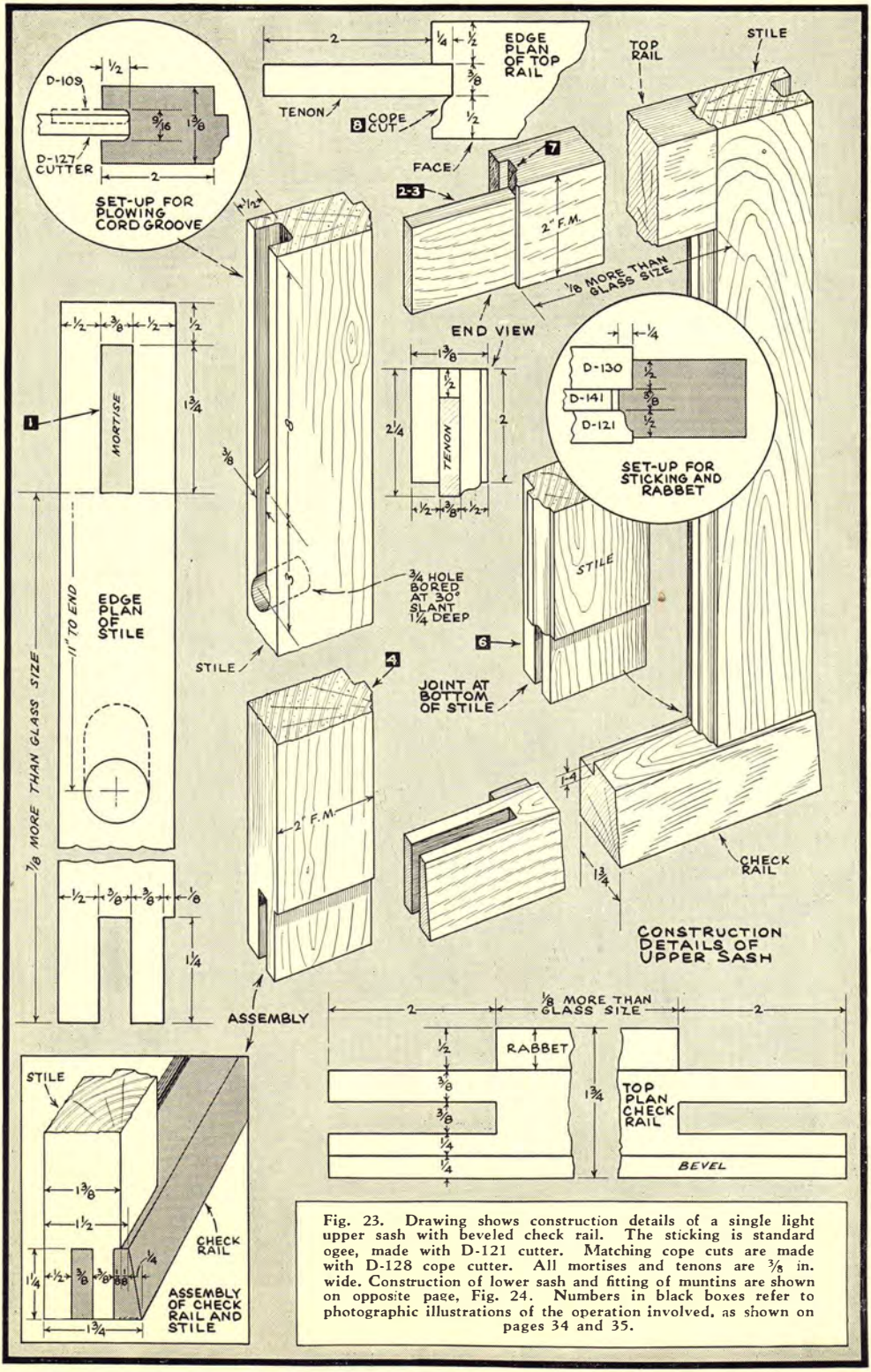


Fig. 23. Drawing shows construction details of a single light upper sash with beveled check rail. The sticking is standard ogee, made with D-121 cutter. Matching cope cuts are made with D-128 cope cutter. All mortises and tenons are 3/8 in. wide. Construction of lower sash and fitting of muntins are shown on opposite page, Fig. 24. Numbers in black boxes refer to photographic illustrations of the operation involved, as shown on pages 34 and 35.

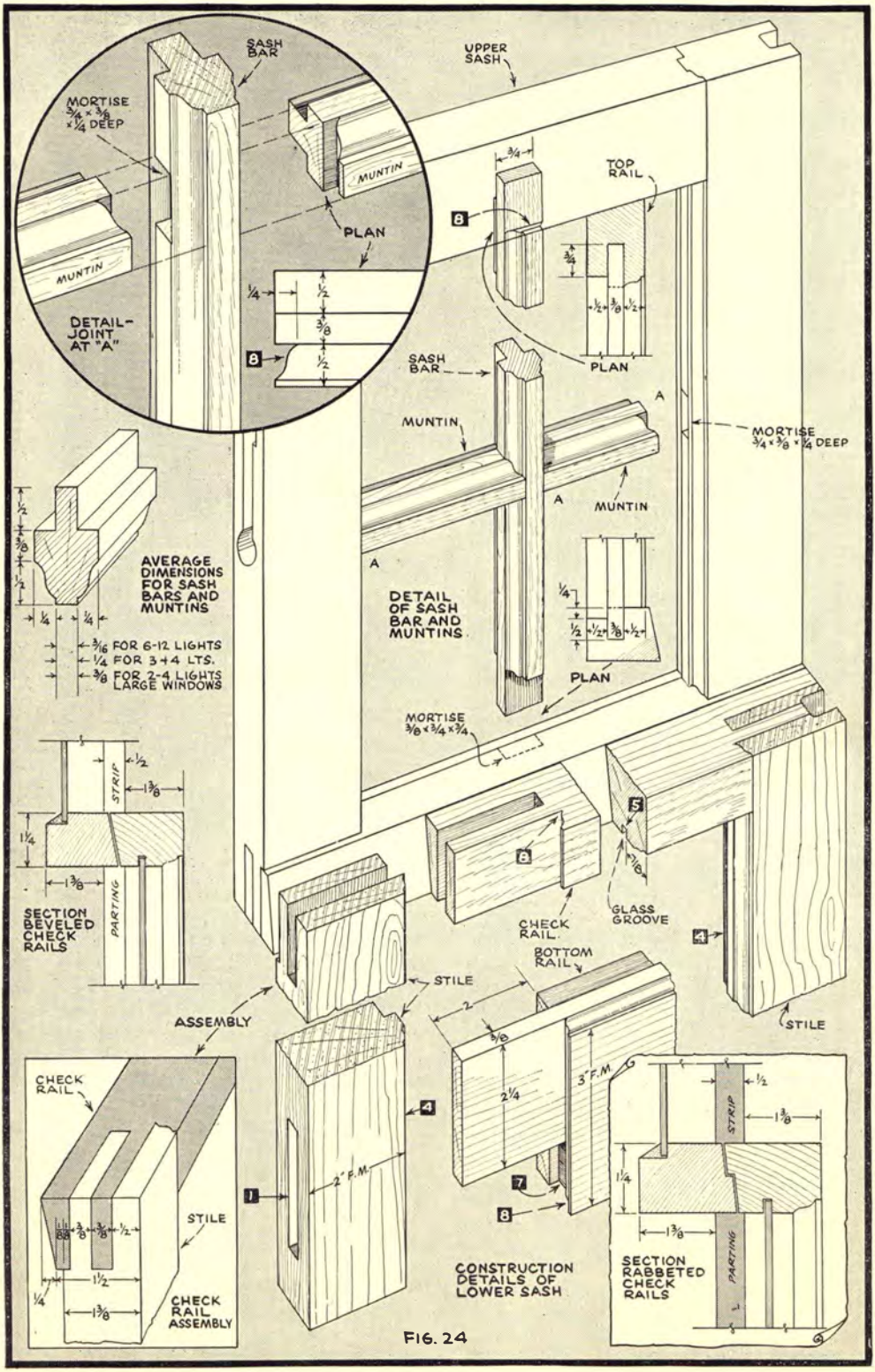
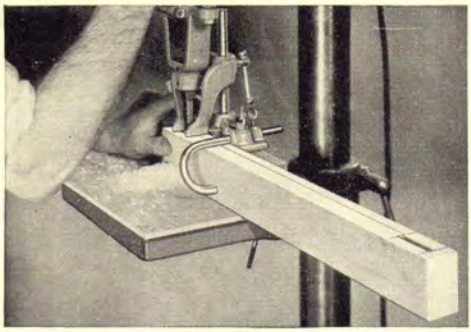
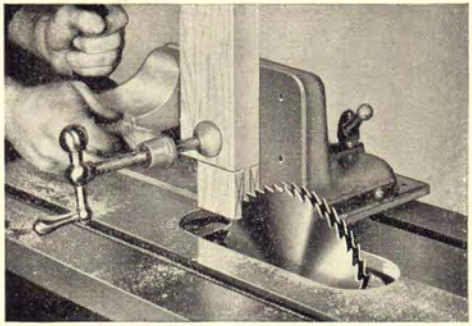

SASH BAR
MORTISE 3/4 x 3/8 x 1/4 DEEP
MUNTIN
MUNTIN
PLAN
DETAIL - JOINT AT "A"
UPPER SASH
TOP RAIL
PLAN
SASH BAR
MUNTIN
MUNTIN
MORTISE 3/4 x 3/8 x 1/4 DEEP
DETAIL OF SASH BAR AND MUNTINS
PLAN
AVERAGE DIMENSIONS FOR SASH BARS AND MUNTINS
3/16 FOR 6-12 LIGHTS
1/4 FOR 3+4 LTS.
3/8 FOR 2-4 LIGHTS LARGE WINDOWS
MORTISE 3/8 x 3/4 x 3/4
STRIP
PARTING
SECTION BEVELED CHECK RAILS
CHECK RAIL
GLASS GROOVE
BOTTOM RAIL
STILE
STILE
ASSEMBLY
CHECK RAIL
STILE
CHECK RAIL ASSEMBLY
2" F.M.
3" F.M.
CONSTRUCTION DETAILS OF LOWER SASH
STRIP
PARTING
SECTION RABBETED CHECK RAILS

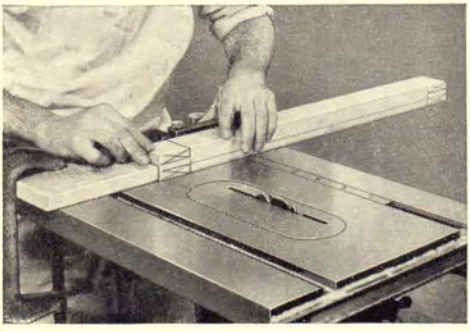
FIG. 24



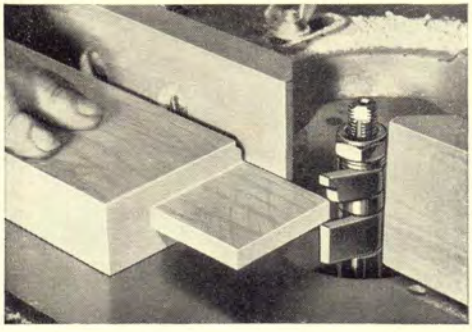
1 Cutting the mortises in one of the stiles. The wood area to be removed should be carefully marked, centering the cut ½ in. from each edge of the 1⅜ in. stock. The face side of the wood should be towards the operator.



3 A double saw with ⅜ in. spacing collar is used to make the tenon cheek cuts. The cut should be carefully centered, and the thickness of the tenon checked for a snug fit in a ⅜ in. mortise. A single saw can be used if desired.



2 Making the shoulder cuts on the ends of the top rail. Notice the stop block to accurately set each cut to the required length. Set the saw blade shallow, cleaning out the corner of the shoulder with the cheek cut shown at 3.

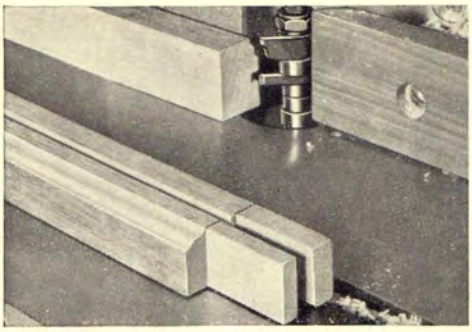


4 Sticking the edges of the stiles and rails, using D-121 cutter. The rabbet is cut at the same time. The fence should be set to cut a rabbet ¼ in. deep. The ogee cutter will then take a corresponding bite. Use D-141 collar.

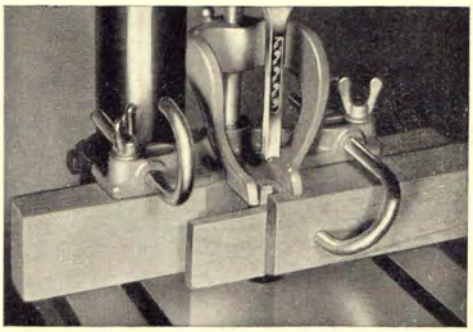
very heavy doors, the main frame being square stuck with tenoned joints, while the insert frame is stuck for ¼ in. panels.

Windows.—Fig. 23 shows the construction of the upper sash of a double-hung, check-rail window. The top rail and stiles are 2 in. wide, face measure, which is a fair standard, while the check rail is 1¾ in. wide by 1¼ in. thick. The first step in construction involves a careful layout of the wood stock. The size of the window must be determined, the basic dimensions being the glass size or the size of the opening into which the window must fit. All mortises and tenons should be carefully marked. Wood to be removed should be pencilled with a heavy "x." The name of each piece should be plainly written on the best side of the wood, this side to be known thereafter as the face side. Since wood stock will often vary a little in thickness, it is important to keep the face side in the same position for all pieces.

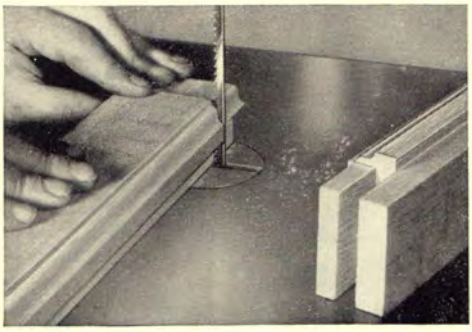
The first machine operation after jointing and trimming the stock consists of cutting the mortises, as shown at 1 above. The rails are then taken to the circular saw and the shoulder cuts for the tenons are made, as at 2. Some form of stop should be used in order to keep the dimension uniform. The tenon cheek cuts are then made, using the two saws with a spacing collar, as shown in Operation No. 3, or one saw and making cuts on either side. The top rail and stiles are next conveyed to the shaper where they are stuck with the setup shown, Operation No. 4. The check rail is not stuck, but is rabbeted only. The sticking on the lower end of the stiles for the length of the tenon is now cut away on the band saw, as at 6. Operation No. 7 consists of mortising the top rail in line with the tenon and in ¼ in. Finally, the top rail is coped at both ends, Operation No. 8, after which the assembly of the sash can be made. After checking the joints, the check rail is removed for beveling. The plowed groove for the cord is not run in until the sash is permanently fitted to-



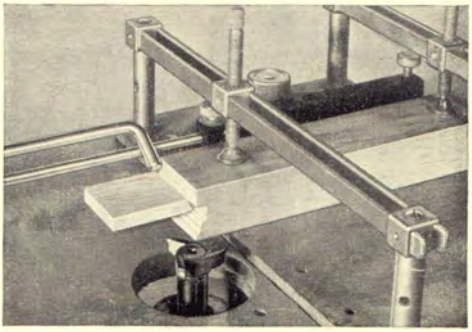
5 Sticking the bottom edge of the lower sash check rail. The glass groove is cut at the same time or can be made in a separate operation (see text). The appearance of the cut when finished is as shown in the foreground.



7 Mortising the upper rail so that it will fit the corresponding shoulder on the stile. The cut should be in line with the tenon, and should extend in ¼ in. The same operation is necessary on the underside of the bottom rail.



6 Trimming the ogee mould at the bottom of the upper sash stiles to permit a neat joint with the check rail. The operation is done on the band saw. Piece in foreground shows finished appearance.



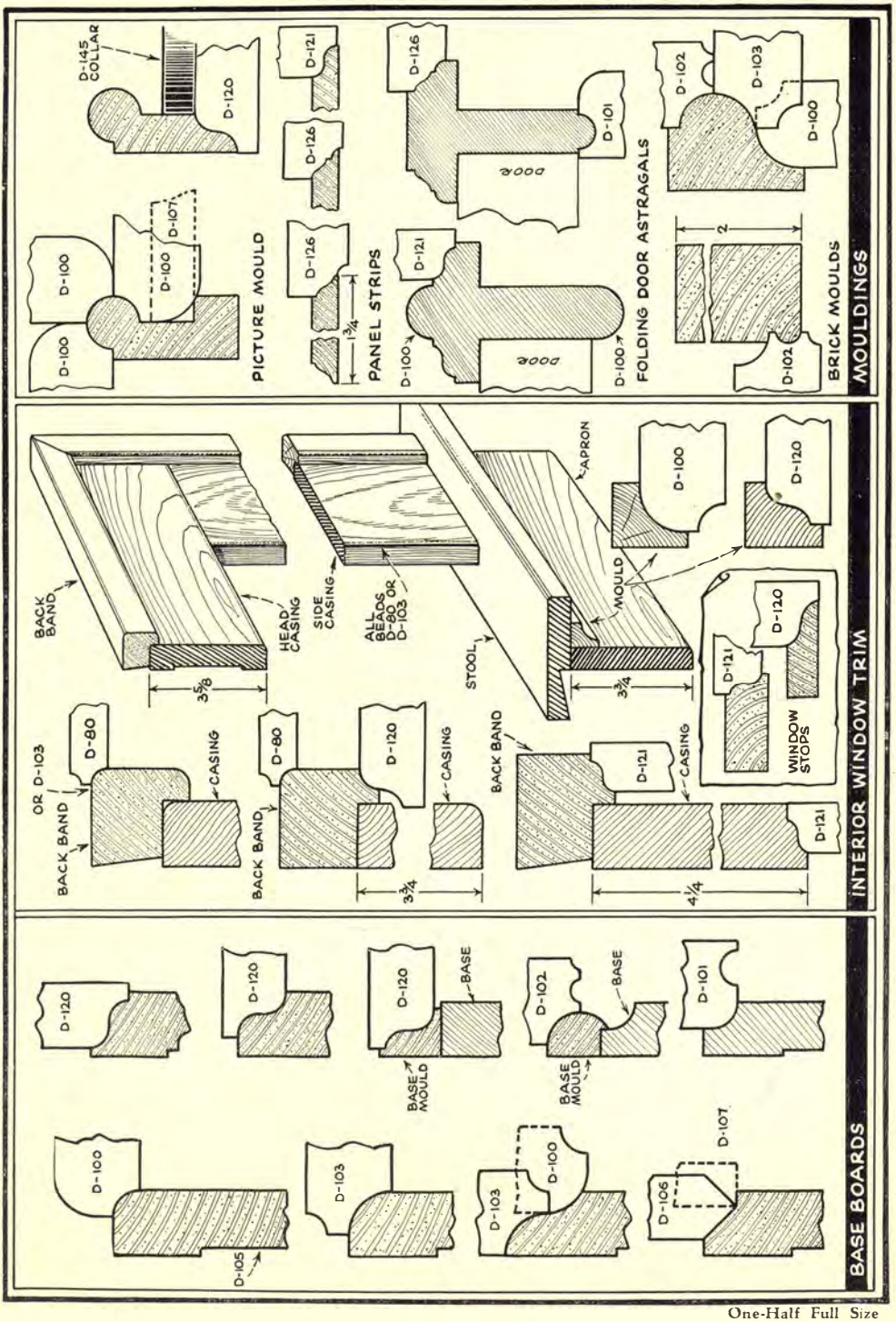
8 Cope cutting the rails, using D-128 cutter. The wood is held in the shaper sliding jig, the depth of the cut being controlled by the stop rod. This cut should be checked carefully for proper height and depth setting.

gether. Similar operations in the construction of the lower sash are, of course, done at the same time as the upper sash.

Sash Bars and Muntins.—Very frequently, the sash, especially the upper one, is divided into a number of smaller lights. Vertical uprights which separate the panes of glass are called *sash bars*, while the shorter horizontal strips are called *muntins*. All of the light wood inside a sash is often referred to as muntins or munts. The manner of fitting sash bars and muntins is shown at the top of Fig. 24. The necessary marking and cutting of the mortises in the main frame would be made at the same time as other previous operations. The muntins are 1⅜ in. thick to match the thickness of the sash, but vary somewhat in width, being narrower where the sash has many lights. Approximate average dimensions are given in the drawing and will be found suitable for most work. The stock for all of the sash bars necessary should be in block form. In this shape, it is cut to exact length and coped at the end which is to fit the top rail. The end which fits to the check rail is simply square-cut to the tenon dimensions shown. After this cutting to length, the wood stock is ripped into pieces of the required width. Each piece is then stuck on both sides with the same set-up as used for the main frame.

Muntins are made in the same manner as sash bars, with the exception that the tenons are flush with the ends, as can be seen in the circle inset, Fig. 24. Mortises to receive the munts are thus the same depth as the glass rabbet, or ¼ in. The joint between muntin and sash bar is the same as muntin to stile, as shown in the detail drawing joint at "A." The wood stock should be cope-cut in block form before being ripped to width for sticking. This will insure uniform length.

Construction of Lower Sash.—With a few minor variations, the construction of the lower sash is the same as the upper sash, as shown at the bottom of Figure 24. The bottom rail is fitted exactly the same



One-Half Full Size

as the top rail. The check rail shows two variations. One of these concerns the joint between the rail and stile, the rail being cope-cut to match the sticking on the stile. Variation number two is that the under edge of the rail is stuck, and is not left square as for the upper sash. A glass groove substitutes for the glass rabbet as

shown at 5, page 35.

Building Trim.—The drawing on page opposite shows various mouldings used in building trim.

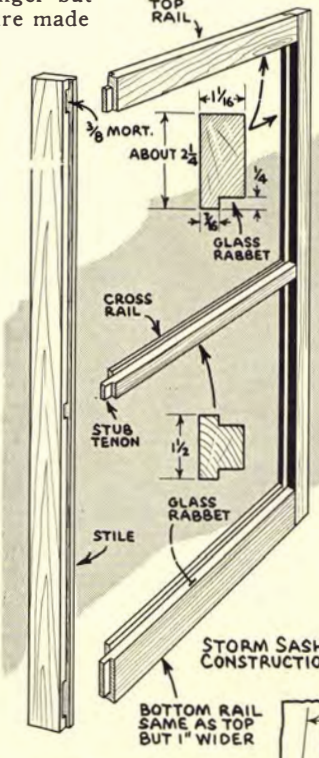
Storm Sash. — The stock used is generally 1⅛ inches thick. Typical window frame construction can be used. A simpler style with square sticking is shown on this page. The main feature of the construction is the tenon with long and short shoulders cut with straight cutters. 13/16 inch stock is sometimes used. In this case, tenons would be ¼ inch thick, using the same shaper set-up but with a ¼x¾ spacing collar instead of the ⅜x¾ collar. The stub tenon can be set in either a slot or mortise as desired, the mortise being stronger but the slot easier to cut. Both are made stronger by pinning.

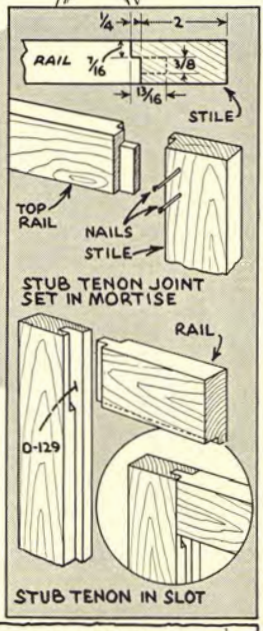
The glass rabbet can be cut in a number of different ways. As good a method as any is the "two pass" cut with a single saw blade, as shown.

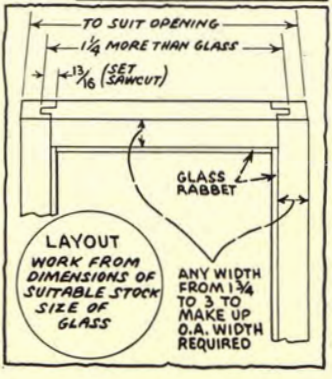
To secure the required ¼ inch offset, the shoulder on the long side of the tenon is cut on the circular saw, ⅛ inch from the end and level with rabbet.

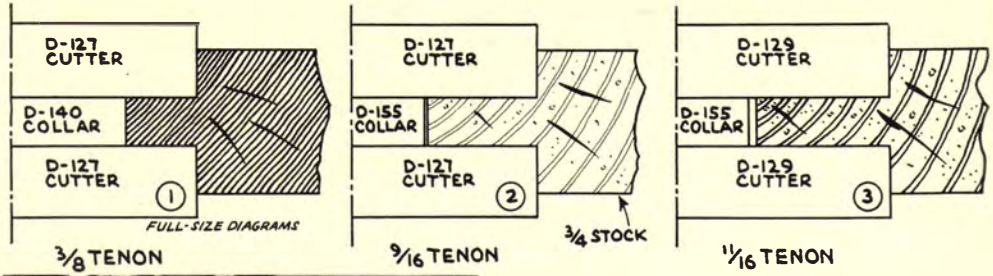
The two stock sizes of Delta straight shaper cutters combine with the saw cut to produce the ¼ inch offset tenon.

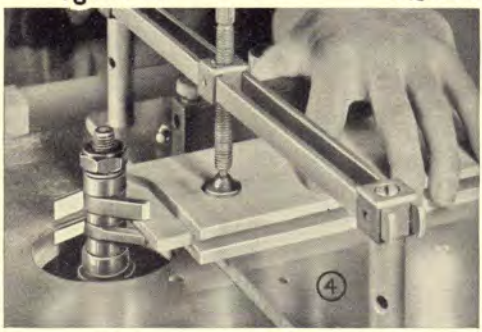
The haunch on top and bottom rails can be easily cut on the band saw, using the stop rod as a guide.











Short tenons up to 11/16 inch long can be cut on the shaper and are useful in frame construction.

Paneled Frames. — The full-size diagram above shows tenon lengths which can be cut with standard cutters. The longest of these makes an ideal joint for paneled frames. Fig. 4 shows the tenon being cut, while Figs. 5, 6 and 7 illustrate methods of making the joint.

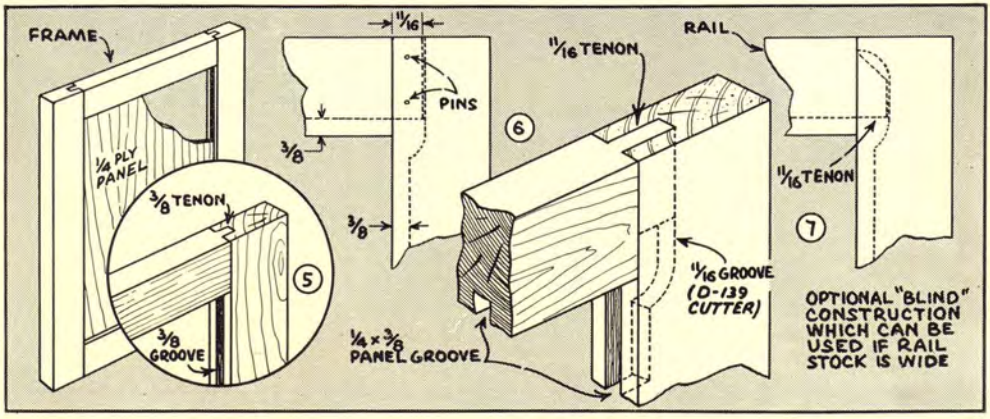
Casework.—Casework includes such jobs as china cabinets, kitchen cupboards, etc. A partial description of this work has already been given. Further examples are shown in the drawing on the opposite page. Fig. 1 shows the standard method of drawer construction, and Figs. 2, 3 and 4 show how the various cuts are made on the shaper. Figs. 5 and 6 shows two variations of the joint between the drawer front and the sides. The projecting lip style is usually cut with a dado head on the circular saw since the depth of cut is somewhat deeper than is possible with standard cutters.

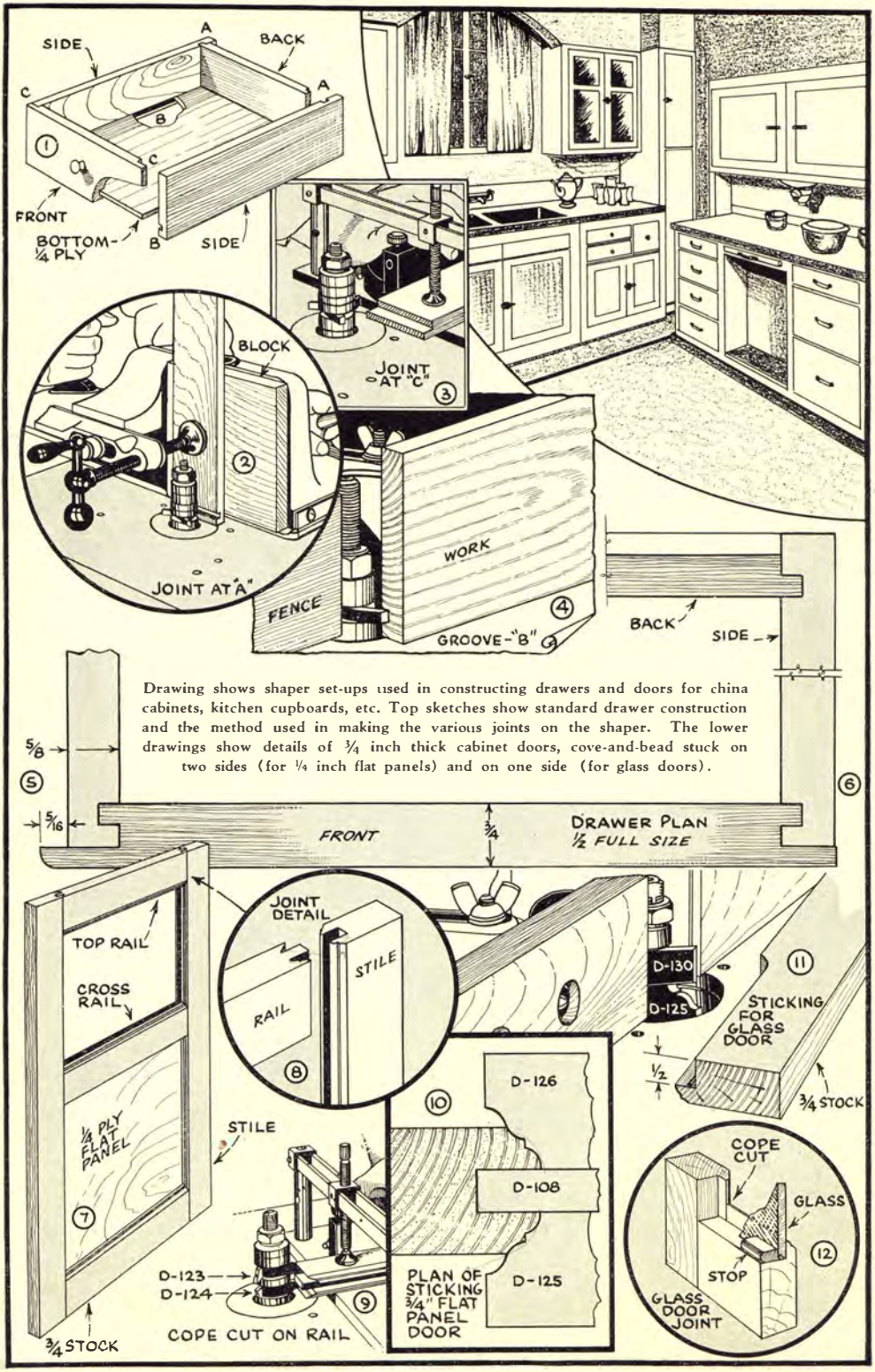
The construction of a ¾ inch thick cabinet door, cove-and-bead stuck on both sides, is shown at (7). The shaper set-up for the sticking is shown full-size at (10). The rails are cope cut in the usual manner, the set-up being as shown at (9). Panels are ¼ inch plywood. The joint is simply glue-fastened (8) although dowels can be used if additional stiffness is required. Where matching glass doors are to be made, the stiles and rails are stuck with the set-up shown at (11). The cope cut in this case would simply be one of the cutters shown at (9) instead of two. (12) shows the assembly of the glass door, using a wood stop to hold the glass.

Miscellaneous Mouldings. — Several miscellaneous mouldings made with ½ inch hole cutters are shown at the top of page 40. The crown mouldings are fashioned from flat stock, the bevels being cut on the circular saw after the shaping is finished.

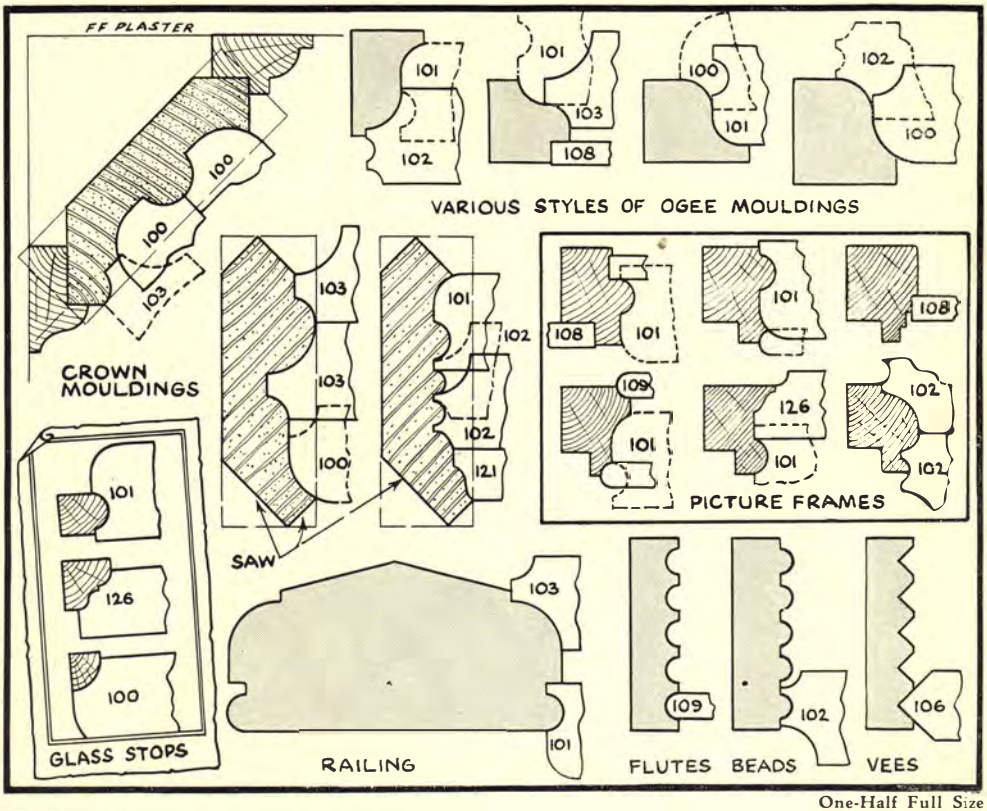
Wood Joints.—The lower drawing on page 40 pictures various edge-to-edge and corner joints which can be cut on the shaper. The drawing is self-explanatory, and the cutters required should be obvious.

Table Tops.—Shaped edges suitable for table tops are shown in the full-page draw-



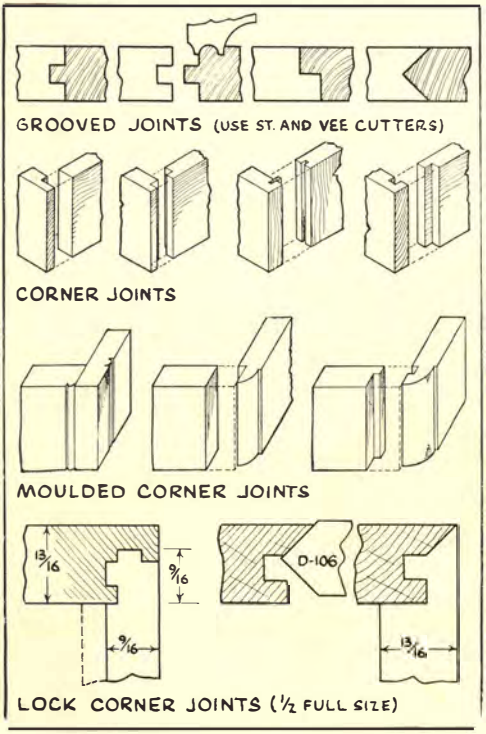


Drawing shows shaper set-ups used in constructing drawers and doors for china cabinets, kitchen cupboards, etc. Top sketches show standard drawer construction and the method used in making the various joints on the shaper. The lower drawings show details of ¾ inch thick cabinet doors, cove-and-bead stuck on two sides (for ¼ inch flat panels) and on one side (for glass doors).



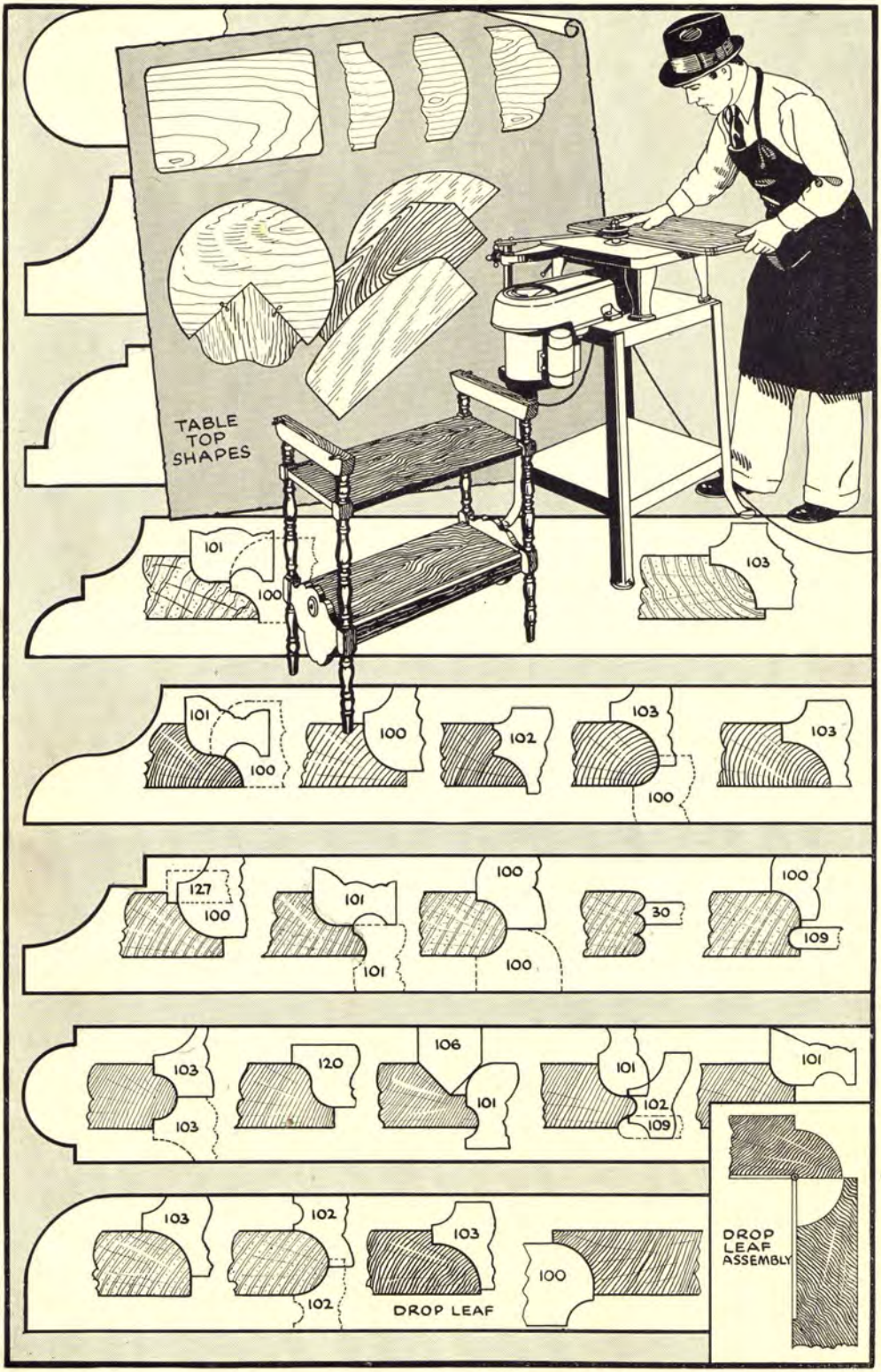
One-Half Full Size

Above, one-half full size drawings of miscellaneous mouldings. Left, various edge and corner joints.



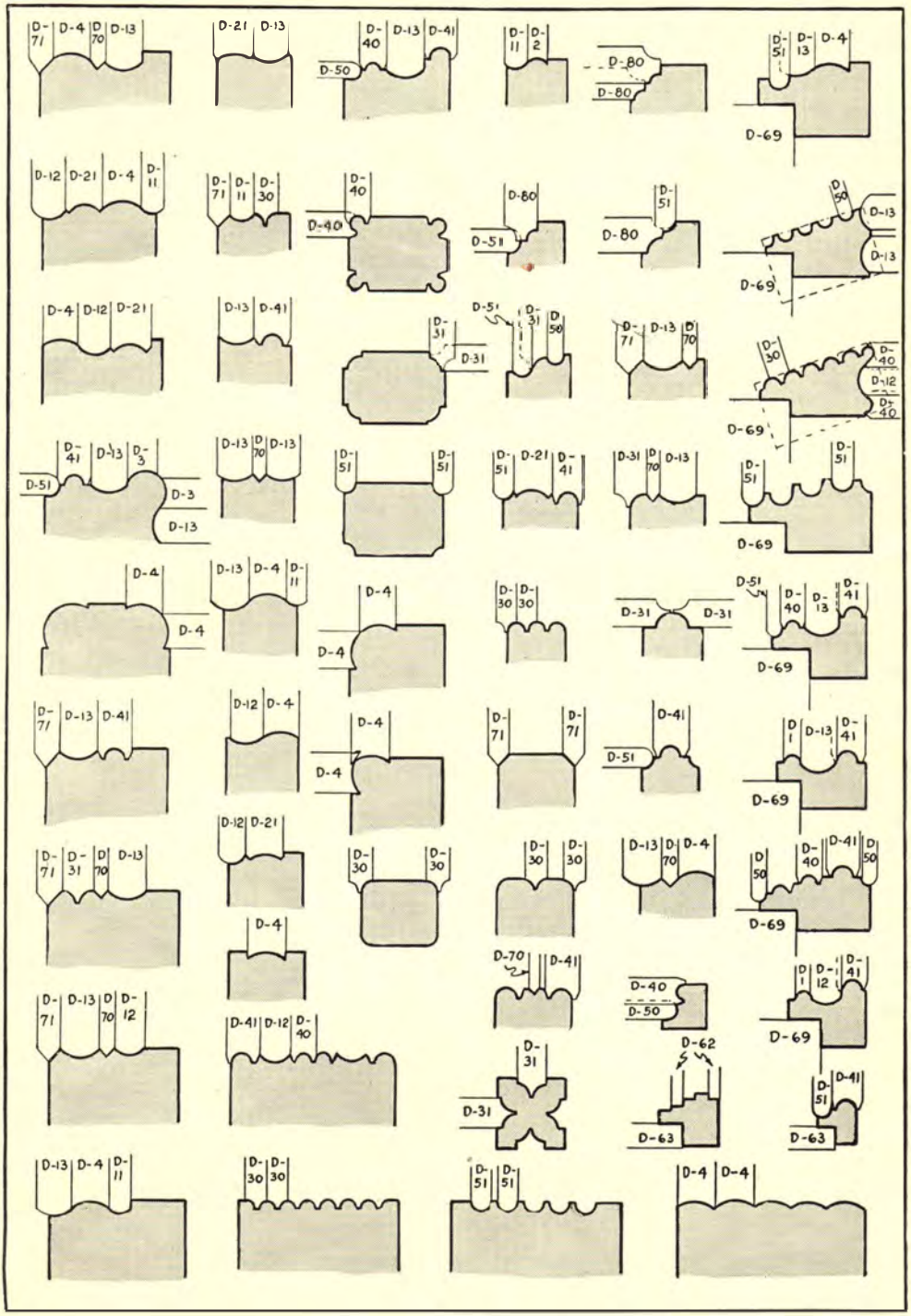
ing on the opposite page. These shapes can often be used to advantage as strip mouldings or in some other capacity. Similarly, many of the moulded edges shown in the building trim drawings can be adapted for furniture work. For this reason it is advisable to study all of the shapes in this chapter, even though you may not be interested in the particular classification under which the shapes are listed as shown in some of the examples. Three or four cutters of the same pattern are often useful, especially for reeding or fluting flat work. With but the one cutter in the standard set, jobs of this nature must be reset for each new cut, whereas with three or four cutters mounted together on the spindle, the whole operation can be done in one pass of the work, an important saving in time, especially on production work.

Small Cutters.—Small cutters with 5/16 inch spindle hole are useful for a wide variety of work, a few of the many shapes possible being shown on page 42. These cutters can be used on the drill press as well as the shaper and are frequently essential for small shapes.



Large Shapes Full Size

Small Shapes One-Half Full Size



One-Half Full Size

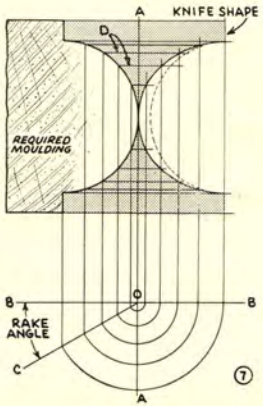
Combination Spindle Cuts.—Many of the more delicate and intricate mouldings are made by combining cuts made with both the 5/16 and ½-in. spindles. None of these shapes have been shown in this chapter, but it can be easily seen that the number of mouldings which could be cut by thus combining the small and large cutters is limited only by the imagination of the craftsman.

CHAPTER ELEVEN

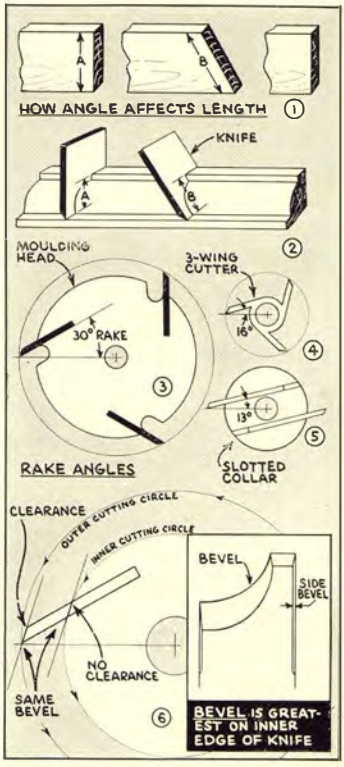
GRINDING SHAPER CUTTERS

Rake Angle.—The rake angle of any cutter determines its shape and other characteristics. As shown in Fig. 1, a slanting line across a piece of wood is necessarily longer than a straight one. Applied to shaper cutters, it can be seen, Fig. 2, that the length of the cutter working on an angle, B, must be greater than if the cutter worked straight across the work, as at A. This rake angle is present in all shaper cutters and is greatest when knives are mounted in a moulding head, as shown in Fig. 3, where the angle is approximately 30 degrees. It is obvious that the greater the rake angle, the greater the difference between the shape of the knife and the moulding it cuts.

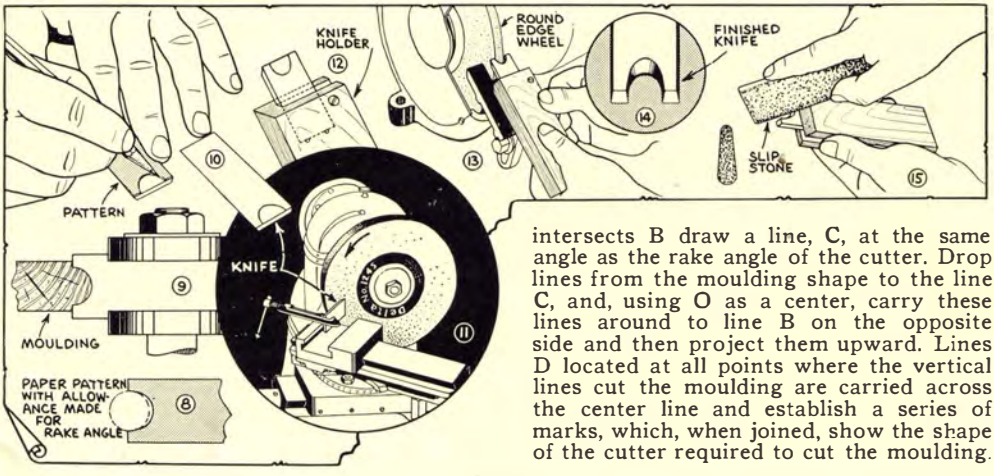
Amount of Bevel.—Knives are beveled at an angle between 30 and 45-degrees. It can be seen, Fig. 6, that a bevel which will provide clearance at the outer cutting circle may not be enough to give clearance at the inner cutting circle. Examination of a factory-sharpened cutter will show that the bevel is greatest at the inner edges of the knife, thus maintaining the same amount of clearance. Portions of the knife parallel with the line of travel, such as the sides, demand only a minimum amount of bevel to provide clearance.

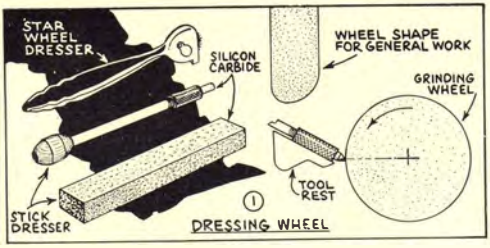


Projected Shape. — The required shape of any cutter to produce a certain shape can be obtained by drawing the moulding full size on a piece of paper, as shown in Fig. 7. Along the edge of the moulding erect a vertical line, A. Below the moulding, draw a horizontal line, B, and where A intersects B draw a line, C, at the same angle as the rake angle of the cutter. Drop lines from the moulding shape to the line C, and, using O as a center, carry these lines around to line B on the opposite side and then project them upward. Lines D located at all points where the vertical lines cut the moulding are carried across the center line and establish a series of marks, which, when joined, show the shape of the cutter required to cut the moulding.



Above, factors governing the knife shape. Left, a knife projection. Drawing below shows knife making.

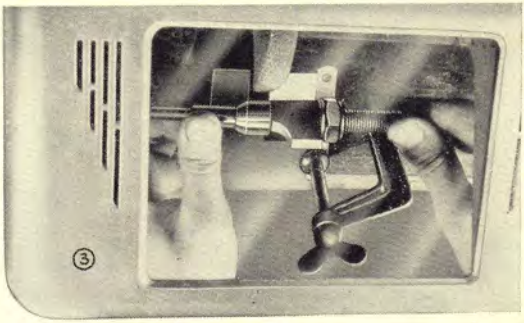


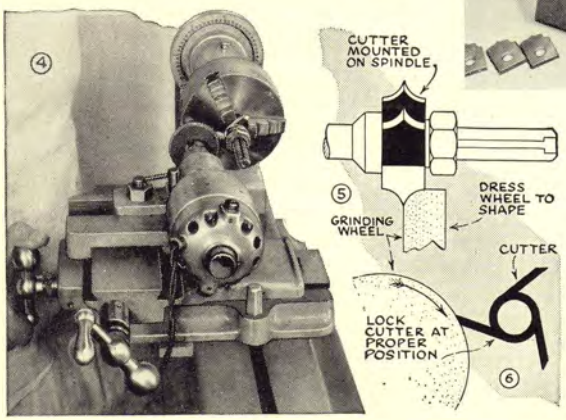


A star wheel dresser is fast-cutting while stick and diamond dressers provide for precision work.

The difference amounts to about 1/16 inch in depth where moulding head cutters are being plotted and about half of this for three-wing cutters and slotted collars. For average work, the projected shape can be judged with fair accuracy without drawing. The basic rules to remember are (1) knives for cutting beads must be ground deeper, and (2) knives for cutting coves must be ground fuller.

Making a Knife.—Figs. 8 to 15 on the previous page show the various steps in making a pair of knives for use with slotted collars. The required shape is a full half-circle, as shown in Fig. 9. A paper or metal pattern is made, as shown in Fig. 8, and, following the basic rule, this is cut slightly deeper than the shape of a true circle. Fig. 10 shows the pattern shape being transferred to the knife blanks. The outer straight bevel is then ground, a suitable method being as shown in Fig. 11 which uses the lathe slide rest to set the required angle. The curved portion of the knife is then ground on a round edge wheel, as shown in Fig. 13, the tool rest being adjusted to provide the proper bevel. After grinding both knives, the shape is compared and checked, readjustments made as required, after which the bevel is lightly honed, as in Fig. 15, to remove any burr left by the grinding. On certain shapes, good use can be made of a cut-off wheel to remove excess knife stock, thereby eliminating tedious grinding.





Use of Shaped Wheels.—Wheels can be fashioned to any required shape by using a suitable dresser. The revolving wheel type is the fastest cutting but does not permit the precision which is possible with the silicon carbide stick type or the diamond dresser. The wheel type should be pushed straight into the wheel, while the stick or diamond work best at a drag angle, as can be seen in Fig. 1. With a wheel properly shaped, it is a simple matter to grind any cutter to the same contour. Fig. 3 shows a three-wing cutter being ground. Stops and guides insures all wings being ground exactly the same. The use of a shaped wheel in a tool post grinder used on the lathe is shown in Figs. 4, 5 and 6. The cutter is turned to the required position for the bevel, as in Fig. 6, and is then locked in this position by means of the index pin, after which the cut can be made.

Sharpening Knifes. — Factory - ground shaper knives with involute bevels should be sharpened by honing the flat side of the cutting edge, as shown in Fig. 7. The involute bevel will retain the same shape regardless of metal removed from the back side. Knives ground in the homeshop with a straight bevel can be resharpened in the same way, or, the bevel itself can be honed. Where the knife has an involute or curved bevel, however, no grinding or honing should be done on the bevel.

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			
5/64 = .078125	5/16 = .3125	9/16 = .5626	13/16 = .8125
3/32 = .09375	21/64 = .328125	37/64 = .578125	53/64 = .828125
7/64 = .109375	11/32 = .34375	19/32 = .59375	27/32 = .84375
	23/64 = .359375	39/64 = .609375	55/64 = .859375
1/8 = .125			
9/64 = .140625	3/8 = .375	5/8 = .625	7/8 = .875
5/32 = .15625	25/64 = .390625	41/64 = .640625	57/64 = .890625
11/64 = .171875	13/32 = .40625	21/32 = .65625	29/32 = .90625
	27/64 = .421875	43/64 = .671875	59/64 = .921875
3/16 = .1875			
13/64 = .203125	7/16 = .4375	11/16 = .6875	15/16 = .9375
7/32 = .21875	29/64 = .453125	45/64 = .703125	61/64 = .953125
15/64 = .234375	15/32 = .46875	23/32 = .71875	31/32 = .96875
	31/64 = .484375	47/64 = .734374	63/64 = .984375

GLASS TABLE

Kind of Glass	Thickness		Weight in Ounces Per Square Foot
	Min.	Max.	
Single Strength	.08	.10	18.5
Double Strength	.111	.125	24.5
26 oz. Glass	.125	.135	26.0
29 oz. Glass	.135	.148	29.0
34 oz. Glass	.150	.175	34.0
39 oz. Glass	.176	.205	39.0

SHAPER SPEEDS

Operation	Min. RPM	Max. RPM	Average RPM
Shaping	5,000	15,000	10,000
Routing	5,000	20,000	10,000
Sanding (drums)	1,200	3,000	2,000
Grinding (3 in. wheels)	5,000	10,000	7,500
Sawing	3,000	7,000	5,000

N. B. For method of reducing shaper speed for sanding and grinding operations, see page 29.

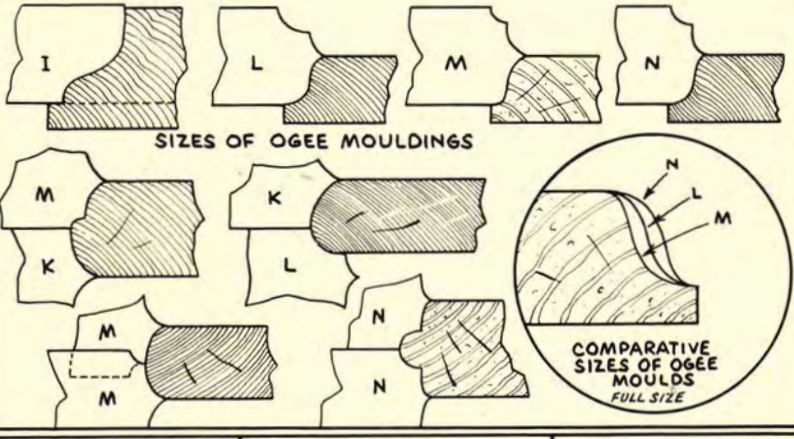
BOARD MEASURE

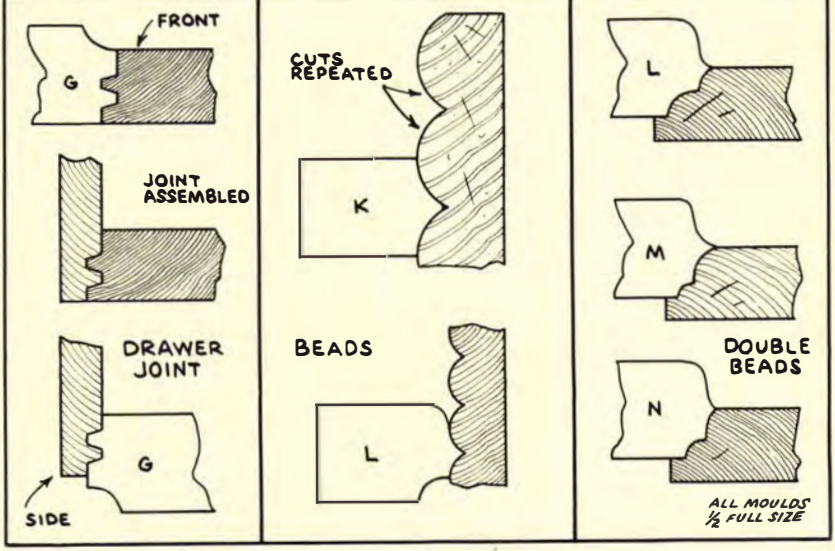
Width in Inches	Length in Feet														
	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
2	0-8	0-10	1-0	1-2	1-4	1-6	1-8	1-10	2-0	2-2	2-4	2-6	2-8	2-10	3-0
3	1-0	1-3	1-6	1-9	2-0	2-3	2-6	2-9	3-0	3-3	3-6	3-9	4-0	4-3	4-6
4	1-4	1-8	2-0	2-4	2-8	3-0	3-4	3-8	4-0	4-4	4-8	5-0	5-4	5-8	6-0
5	1-8	2-1	2-6	2-11	3-4	3-9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

Explanation: Board measure applies to 1 in. thick boards or any finished size less than 1 in. A board foot measures 1 in. (or less) thick by 12 in. wide by 12 in. long, or its equivalent. Boards are usually sold at a certain price per board foot. To find the number of board feet in any board, find the length of the board in feet at the head of the table. Follow down this column until the width in inches is reached to get the board footage. Example: A board 9 ft. long and 10 in. wide contains 7-6 board ft., the right hand figure expressing a portion of a full board foot in twelfths—in this case 7 6/12 board feet, or, 7½ board feet.

DELTA CRAFTSHEET No. S-7

APPLICATION of 3-KNIFE CUTTERHEAD

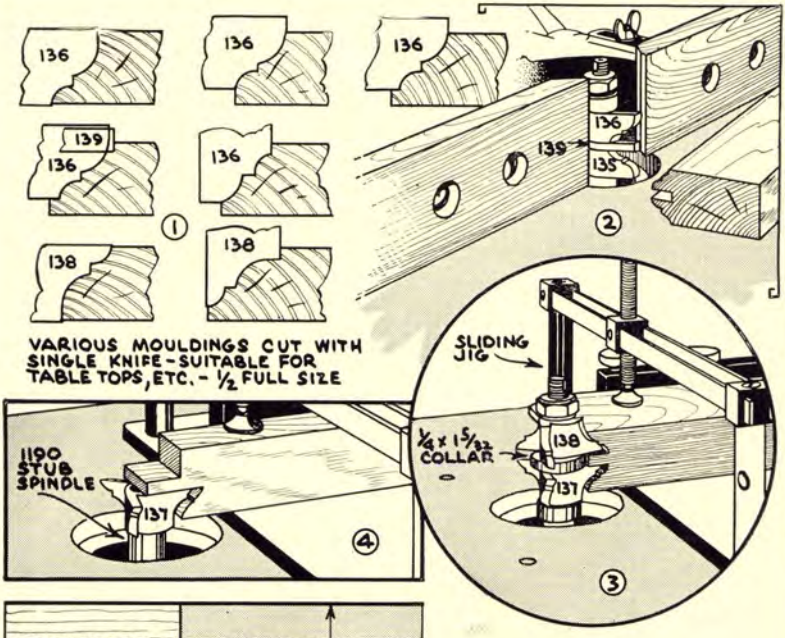


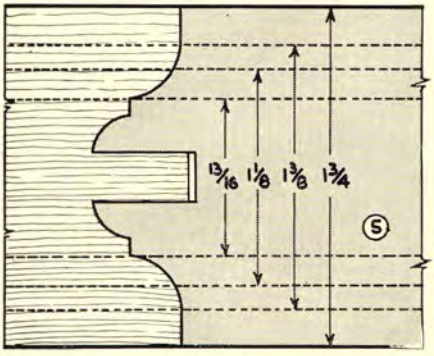


Delta Craftsheet

No. S3
Cove-and-Bead Shaper Cutters

The Deltagram—Nov., 1937





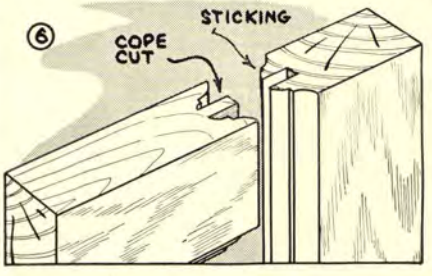


FIG. 1—Various applications of single knives in cutting mouldings suitable for table tops, etc. Either knife of the matched set can be used.

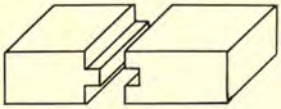
FIG. 2—Set-up for cove-and-bead sticking. Straight knife shown is No. 139, cutting a groove ¼ in. wide to take ¼ in. plywood panels. No. 129 straight knife (⅜ in. wide) would be used for ⅜ in. panels.

FIG. 3 — Cope cutting. Collar should be same thickness as straight knife used for sticking, and should be $1\frac{5}{32}$ in. diameter. Paper washers can be used on either side of the collar if a tight tenon is desired.

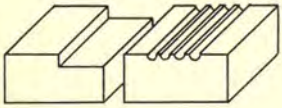
FIG. 4—Cope cutting. Single knife set-up required for tenons over ½ in. long. Tenons up to about 1¼ in. long can be completely cut with the shaper knife. Tenons longer than this are preferably roughed cut on the circular saw before coping.

FIG. 5—Full-size plan of cove-and-bead sticking as applied to various thicknesses of wood.

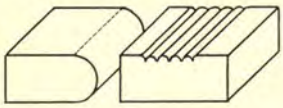
FIG. 6—Sketch showing cove-and-bead sticking applied to 1⅜ in. stock (standard for interior and exterior doors.)



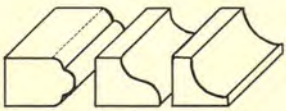
TONGUE GROOVE



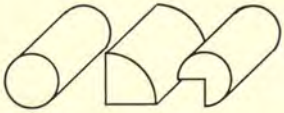
RABBET FLUTES



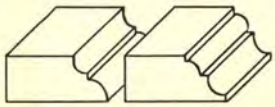
BEAD BEADS (OR REEDS)



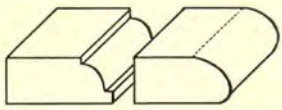
CLOVER LEAF OGEE COVE



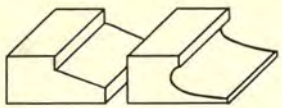
ROUND QUAR. RD. ¾ ROUND



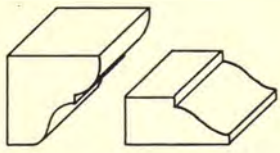
COVE AND BEAD-BEAD & COVE



OVOLO THUMB



PGEE SCOTIA



BEAD & OGEE REVERSE OGEE

COMMON MOULDINGS

GLOSSARY OF MILL TERMS

GENERAL:—

SOLID MOULD OR STICKING—A moulding which is worked on and is a part of the article itself.

APPLIED MOULD—A separate moulding applied or attached to any part of an article.

FLUSH MOULD—An applied moulding which finishes flush or below the face of an article to which it is attached.

RAISED MOULD—An applied moulding which partly covers or which extends above the face or surface of the article to which it is attached.

FACE MEASURE—The face dimension of an article exclusive of any solid mould or rabbet.

FINISHED SIZE—The measurement of any article including the solid mould or rabbet.

RAIL—The cross or horizontal pieces of the framework of a sash, door or blind.

STILE—The upright or vertical outside pieces of a sash, door or blind.

COVE-AND-BEAD—A mould which is a combination of a cove and quarter-round with a small fillet between.

BEAD-AND-COVE—A mould which is a combination of a quarter-round and cove with a small fillet between and on each side.

BEAD AND OGEE—A mould which is a combination of an ogee and bead with a small fillet between.

OGEE or O-G—A mould which is a combination of a cove and quarter-round with no fillet between.

OVOLO—A mould which is a combination of a small fillet on either side of a quarter round.

APPLYING TO DOORS:—

PANELED DOORS—Doors containing one or more panels of lighter wood inside a framework.

GLASS DOORS—Doors containing one or more glass panels.

DOWELLED DOORS—Doors assembled with dowels, as differing from the standard method of mortise-and-tenon.

FLAT PANEL—A wood panel of the same thickness throughout, usually ¼, 5/16 or ⅜-in.

RAISED PANEL—A panel which is heavy at the center and tapered to a smaller dimension on all four edges.

MULLIONS—Long vertical members of a door between panels.

LOCK RAIL—The central horizontal rail of a paneled door.

APPLYING TO WINDOWS:—

SASH—A single wood frame to be filled with glass.

WINDOW—Two sash, upper and lower.

CASEMENT SASH—A sash or pair of sash which are hinged, generally at the sides, to swing.

FULL BOUND—Indicates same amount of wood in stiles and rails, often described as "same rail all around."

MEETING RAILS—The rails of a window which meet when the window is hung and closed.

PLAIN RAIL—Meeting rails of the same thickness as the rest of the frame.

CHECK RAILS—Meeting rails made thicker than the rest of the frame to fill the opening between the upper and lower sash made by the parting strip of the frame.

SASH BARS—Vertical members which separate the glass in a sash.

MUNTIN—Short or light bars in a sash, either vertical or horizontal, which do not extend the full width or length of the frame.

MUNTS—Common term applied to all of the light wood inside the main frame of the sash.

LIGHTS—Term applied to the glass in a window—a two-light window, eight-light window, etc.