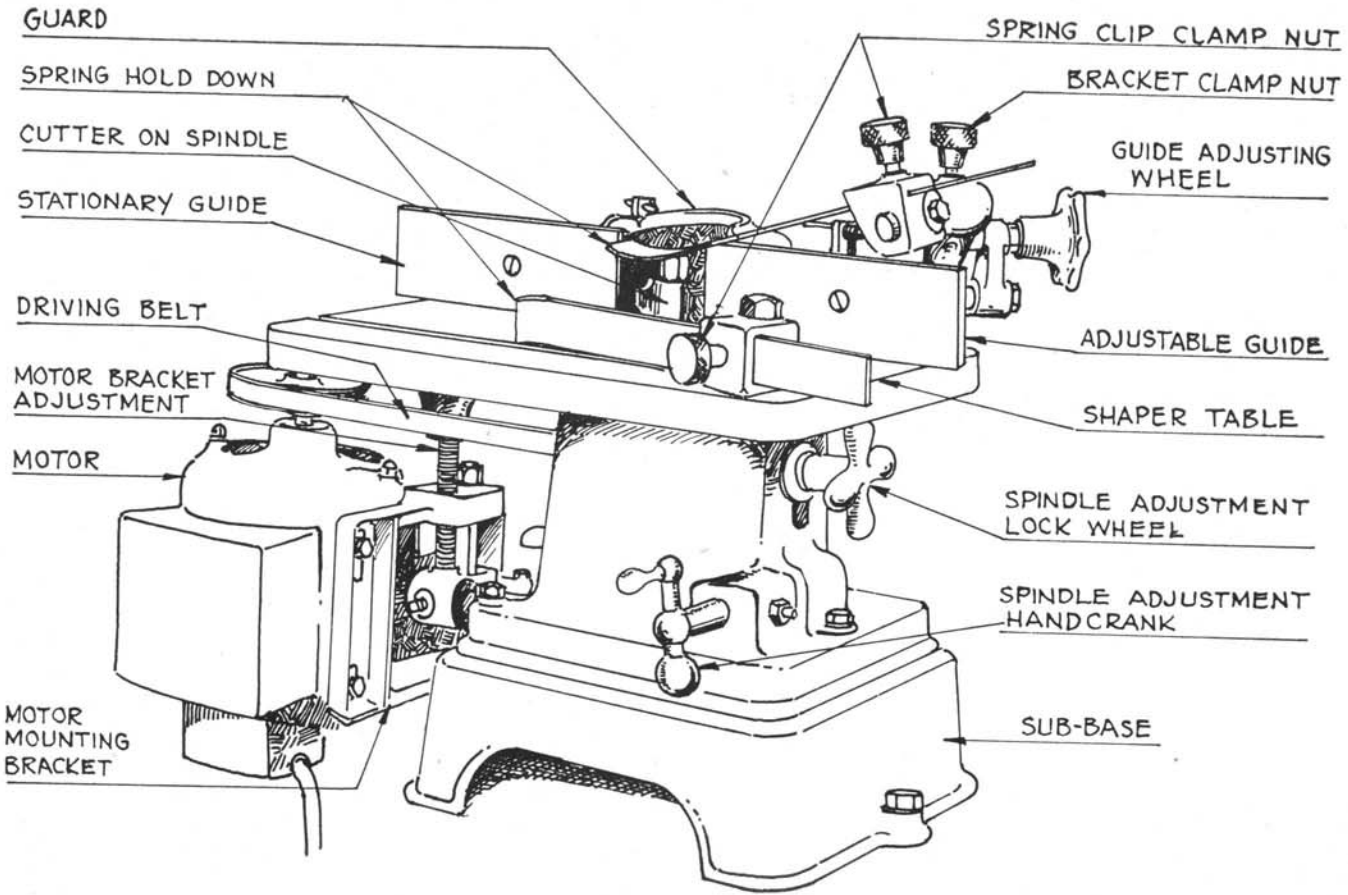

GUARD
SPRING HOLD DOWN
CUTTER ON SPINDLE
STATIONARY GUIDE
DRIVING BELT
MOTOR BRACKET ADJUSTMENT
MOTOR
MOTOR MOUNTING BRACKET
SPRING CLIP CLAMP NUT
BRACKET CLAMP NUT
GUIDE ADJUSTING WHEEL
ADJUSTABLE GUIDE
SHAPER TABLE
SPINDLE ADJUSTMENT LOCK WHEEL
SPINDLE ADJUSTMENT HANDCRANK
SUB-BASE

BOOK THREE
The
Vertical Spindle Shaper

HE shaper is usually the last to be added of all the machines that are available for the home workshop. This is probably because the functions of a shaper are not understood as well as the other machines. While it may at first appear to be somewhat of a "luxury," once we have one we are surprised at the number of times we can fit it into our scheme of things and make the project under construction more beautiful and professional looking. There is a certain fascination about shaper work that takes hold of the operator, and before long he begins to plan ways and means of using it on almost all types of projects that he tackles.

While many "home-made" shapers are doing a creditable job, usually the amount of tinkering and time-wasting adjustments necessary to keep it in working condition is wasteful to the owner both in time and lumber spoilage. The improvement in the work, the saving in time and the elimination of annoyance afforded by better grade machines well justifies the modest investment ordinarily required for them. With a good shaper one can make adjustments with facility and turn out excellent work quickly. And, when the machine is not in use as a shaper primarily, it makes an ideal sanding machine with a vertical drum, working on projects that require sanding of curves both inside and outside; and it does a far better job and gives a smoother finish than could be accomplished by hand in a greater time.

Points of Construction

There are on the market at the present time many different types of shapers. Some have the table movable and the spindle stationary, the different depths of cuts being taken care of by the table being moved up or down in relation to the cutter. On others the table is stationary or fastened firmly to the base and the cutter is movable up or down, either by means of a rack and pinion, or by spiral gears, or by bevel gears and a screw mecha-

nism. Still others have the shaft of a motor mounted in such a way that the entire motor and shaft may be swung to various degrees to adapt the contours of cutters to the different contours and curvatures of the moulding under construction. Most kinds do the same type of work.

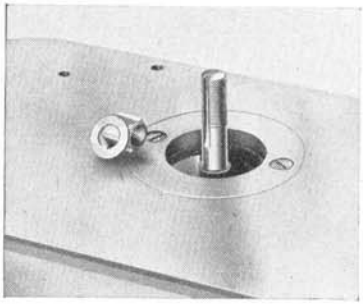
Good Bearings Essential

In any type of shaper the bearings and bearing support are the most important units of the machine, and it is wise to look over the bearings carefully before purchasing any shaper. In a machine where the bearings are of the sleeve type be sure and examine them closely to determine whether a suitable thrust bearing to take care of the up and down thrust of the spindle has been installed. This quite often is taken eare of by putting the pulley operating the spindle between the two arms of the yoke which is perfectly suitable, but in time will develop end play and under heavy cuts there will be a definite variation of depth in the moulding being cut showing up in the form of a ripple on the moulding. In the other type of machine which has ball bearings as its spindle mounting, the bearing is usually of the pre-loaded thrust annular type ball bearing, in which the bearing has been pre-loaded with an initial thrust to take care of end play, and these bearings will, of course, with proper lubrication last almost indefinitely, at the speed at which a shaper is supposed to run. These bearings are usually packed with grease and sealed against dust at the factory where the machine is assembled, and with ordinary care should last five or more years without further attention. These bearings have been known to wear without any attention whatever, for over ten years.

Reversible Spindle is an Asset

Another important item in the design and construction of a shaper is the spindle itself. This should be of ample diameter to withstand constant hammering which is occasioned by the cutter striking the wood a terrific number of blows per minute, and it is obvious that a light spindle in a shaper using a cutter of fairly large diameter will soon cause the spindle to develop side play.

One of the very important items that is found in only one of the different types of shapers on the market is the reversible



The keyed washer permits operation of cutter in either direction, without loosening nut.

spindle, with a keyed washer and a keyed shaft to prevent the cutter coming loose under the impact of the cut being made. The operator will find that there are numerous cases where it will be necessary to reverse the cutter to prevent cutting into the grain and thereby tearing out the wood. In commercial work it is usual to have two spindle shapers setting side by side or a double spindle shaper, wherein the two spindles run in opposite directions and necessitate a pair of cutters or a reverse type cutter so that the same cut may be continued from one piece to the next. This, of course, is out of the question for the average home workshop user and also in small shops. Therefore the ability to reverse the spindle of a single spindle shaper and do this quickly with only a very slight loss of time is a boon to the man who has only a short time at his disposal.

The actual use of the reversible spindle will be taken up later on.

Reversing Switch Helpful in Shaping

The ability to reverse the direction of the spindle in a shaper is a decided help in doing good work. Frequently when shaping crosswise of the grain, the wood splits off at the end of the cut. While easing up on the feed will sometimes avoid this difficulty only by reversing the direction of rotation of the spindle and starting the cut from the other end, can one be sure that this trouble will not occur.

Typical motor reversing switch. used only with split phase motors.

There is available a motor reversing switch which permits the direction of rotation of motor and shaper spindle to be reversed at will. This working in conjunction with a keyed spindle shaper will assure utmost in convenience.

Speed an Important Factor

Smooth, even shaping requires comparatively high spindle speed. While 4000 to 5000 R.P.M. will do fair work the best work requires speeds of from 7000 to 8000 R.P.M. This is especially true when cutters of small diameter (1½" or less) are used. Coping heads and larger diameter shaper cutters can be operated at relatively slower speeds.

The ideal power unit for the average shaper is a 3500 R.P.M. motor of around ½ H.P. With this type motor and a motor pulley twice the diameter of the spindle pulley a spindle speed of 7000 R.P.M. will be provided. If the motor is the 1750 R.P.M. type it will be necessary to use a motor pulley more than three times the diameter of the spindle pulley to obtain a speed of 6000 R.P.M. Naturally this step-up throws considerable load on the motor to start and it should be "favored" somewhat on this account.

The direct motor drive is recommended for all high speed machines and the shaper is no exception. If it is necessary to drive through a countershaft allowance should be made for loss of speed at hanger bearings.

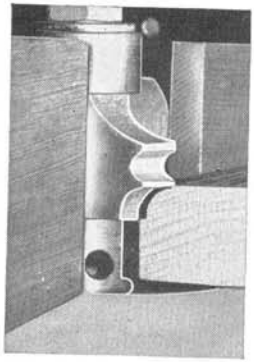
Types of Cutters

There are two different type of cutters; namely, the loose cutter type, on a safety head and the small solid tool steel cutter which is milled from a solid piece.

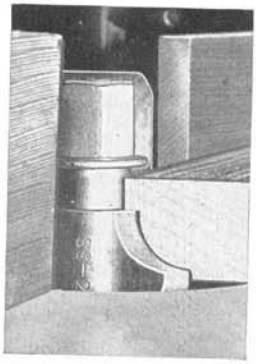
The first or loose type of knife is in the nature of a cutterhead to which the cutters themselves are fastened by means of screws or lock studs and in the hands of an expert are fairly safe. But they are not recommended for the man who has had little experience with the shaper.

The second type, milled from a solid bar of tool steel and ground to the shape of the moulding, or a portion of the moulding for which the cutter is intended, is the type generally in use. It is, without doubt, the safest type to use.

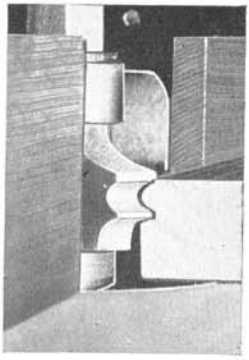
As before stated, it is not at all necessary to have a large array of cutters of different shapes and contours in order to do a large variety of work with the spindle shaper. On the contrary it is surprising how many different types of mouldings can be made with only a very few cutters. A representative group of cutters with which quite a large array of mouldings may be made is shown on the page opposite.



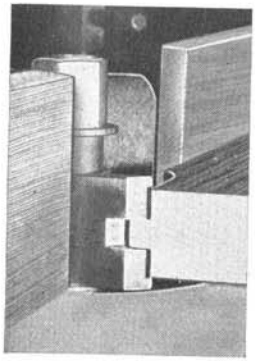
A simple edge cut using only one section of a cutter.



A moulding of popular design. The collar above cutter restricts depth of cut.



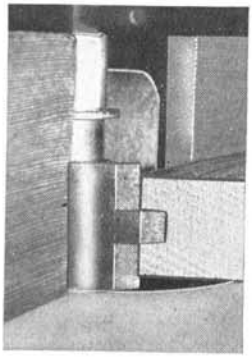
Cut being made by another section of cutter shown in upper left hand corner.



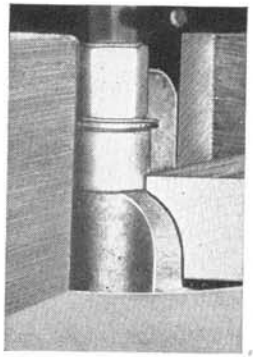
Shaping the male member of a glue-joint. Depth restricted by guide.

WITH a little ingenuity and experimenting almost innumerable moulding designs of outstanding beauty can be shaped with a very small assortment of cutters.

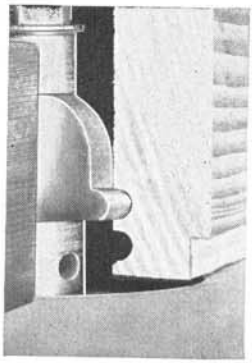
Using cutters in various combinations, two at a time, opens up entirely new possibilities in variety and attractiveness of design.



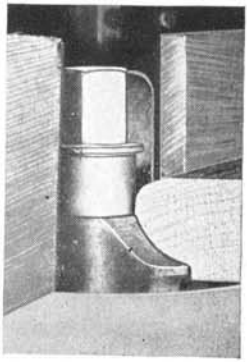
Female section of glue-joint. Depth restricted by guide.



A simple design using the collar above cutter to restrict depth of cut.



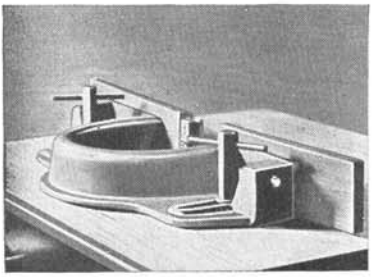
Flute effect is easily obtained by using only one section of cutter.



Second cut being made on a piece with one section already shaped.

Guides and Guards

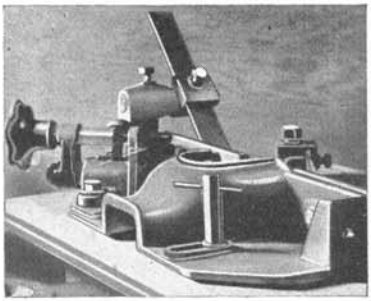
While the standard guards and guides which are usually found on the shaper table are really not part of the construction of the shaper, yet they claim a very important part in the operation of the machine. One can, of course, through the medium of jig sawed or band sawed strips of wood, clamped to the table with wood clamps or metal "C" clamps, do quite a variety of work, but if the shaper is equipped with a properly designed set of guides and guards, it is not necessary to stop in the middle of an operation to hunt around the workshop for small pieces of wood to strengthen the make-shift arrangement, but can continue with the cut once it is started with the assurance that the entire strip of moulding will be the same through the positive action of the guide.



Semi-adjustable type guide arranged for spring hold-down clips.

The quality of the work turned out with a machine that is fully equipped is in most respects of a superior nature to that turned out by a make-shift arrangement. In the hands of an expert a make-shift arrangement may turn out very creditable work, but with some of the small bench type shapers that are now on the market the expert can turn out no better work than the novice, once the novice has attained a little experience in the operation of the shaper. And most of these bench type shapers are priced low enough to be available to the novice and amateur as well as the expert.

There is one other very important point in the system of guides that is decidedly worth mentioning. In some types of mouldings it is necessary to cut away the entire face of the wood that rests against the guide, and due to this type of cut it is necessary that the guide be made in two sections, so that one sec-



Fully adjustable type guide equipped with spring hold-downs.

tion may be advanced or retreated to take care of variation in the face of the wood so that both faces of the wood, that is, before and after the cut, may rest against the guide. It is, of course, very handy to have one section of the guide adjustable by means of a hand nut so that this adjustment may be taken care of very quickly and easily.

In the other type of cut where only a small portion of the face of the wood going past the cutter is cut away, it is not necessary to have a difference in the plane of the guides, so that the guides before and after the cutter should lay in the same plane and be in an exactly straight line. This particular point will be pointed out more definitely while describing some of the mouldings being cut.

The Sharpening of Cutters

With shaper cutters as with hand tools it is absolutely necessary that they be kept as sharp as it is possible to have them. The actual sharpening of the knives is a simple matter, but it is necessary to have some special sharpening stones with which to reach into the curves and crevices of the cutting edge of the cutter. Suggested equipment for sharpening shaper knives comprises a small rat tail file or Arkansas oil stone, a slip stone type of the same material, whereon one edge is about ⅛″ thick and tapers to about ⅜″ thick on the other edge, the stone being about 4″ long. Both edges of this stone are rounded.

Another stone is ¼″ square and about 4″ long, while still another is 2″ wide, ½″ thick and about 4″ long.

In addition, a small stone, triangular in section with each face 3/16″ wide and 3″ long is a very convenient stone to have. With this equipment one is able to sharpen almost any or all of the different cutters that he might have.

The action of cutting wood with the knife has a tendency to turn over the edge or wear it away and it is only necessary to renew the cutting edge in order to continue work so that a great amount of metal need not be removed from the cutting edge, and it is very important that the cutting angle of the cutting edge be not changed any more than is absolutely necessary.

The first procedure is to select a stone that will fit the shape or curve of the cutter and rub the stone lightly on the back of the cutting edge first, holding the stone almost flat on the back of the edge.

This will turn a wire edge over to the cutting face of the cutter and it is then necessary to remove this by laying the cutter flat on a flat stone and rubbing it with a back and forth motion until this wire edge has been removed. The cutter can then be considered as sharp.

Grinding Cutters to Various Shapes

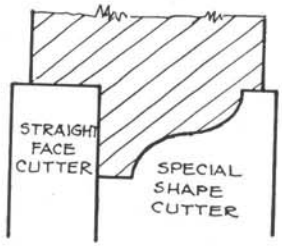
The grinding of a cutter to a pre-determined shape is an entirely different proposition, and calls for some degree of skill. This skill, of course, can only be acquired through experience, and experience means grinding cutters. At first the new operator should only attempt the grinding of the simpler forms of cutters such as the quarter round, quarter cove, half round and simple concave or convex shapes, until he becomes proficient and gains confidence in his ability.

In order to grind cutters to special shapes, it is necessary to have a grinding head or an emery wheel stand. Or one may invest a little more money and obtain one of the motor grinders which are available at the present time, and mount it in a place that is convenient to the shaper, if one intends to do considerable cutter grinding. Grindstone equipment for this machine requires at least two stones which are ¼" thick, at least two stones ½" thick and at least two stones ¾" thick, all of a medium soft grit. A hard stone glazes over quickly and burns the cutter. In addition one should have an emery wheel dresser which may be in the nature of the star wheel type, or of the carborundum stick type or the more expensive commercial black diamond type. The carborundum stick type of dresser is recommended for the average small shop, where it is necessary to shape a wheel closely to a given shape. One each of the three different types of stones mentioned should be kept faced with an absolutely square edge. The other three types or sizes may be used for various shapes by rounding off the corners or by tapering them to fit into the different types of cuts which you may desire to grind.

In addition to this is needed a small rat-tail file, a small square file, a half round file and a flat file for the making of templets to which to grind the cutters. For the actual making of the templets small scraps of zinc are usually the best material with which to work.

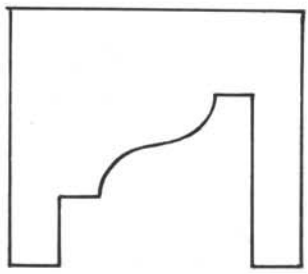
Forming a Sash Cutter

Probably the best and most convenient way of describing the grinding of a cutter would be to actually go through the procedure in a step by step description. Let us choose as our example a much used type of cutter which is known as a sash tool. One of the most popular of the sash tools consists of an ogee type on one side or one edge of the same, and, of course the rabbet for the glass on the other side. As shown by the sketch, we will assume that the finished moulding is to be 1" wide and the depth of cut is to be 3/8". You will find in this type of cutter and in others of similar type that it is far easier to make the cutter of two separate cutters than to attempt to grind down into a deep recess and acquire sharp corners. For this reason we will choose as the cutter blanks, a 1" straight face type cutter and a 1/2" straight face type of cutter. The 1/2" straight face cutter will remain as is, that is, without any grinding. This cutter will take care of the rabbet on the underside of the moulding. We now have left the ogee shape and the flat face on the 1" straight face cutter to grind. Our next step is the making of the zinc templet, which is a means of gauging the grinding of the three legs of the cutter to the same shape.



A MOULDED EDGE AND THE CUTTERS REQUIRED TO MAKE IT.

The sketch opposite shows the shape that the templet should be made. You will note that there are two legs at the side of the templet, and these legs are the guiding or gauging edges by which to determine that the three cutting edges are being ground alike. Care should be taken to make the templet as accurate as possible.

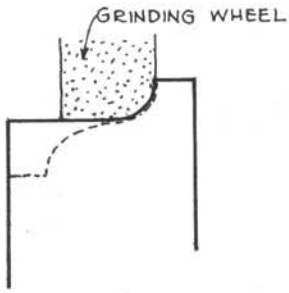


THE ZINC TEMPLATE

Cutter Must Be Annealed Before Filing

It is now necessary to draw the temper of the cutter in order to allow for filing by hand at a later period. This is accomplished by putting the cutter on a piece of iron wire or by holding it with a pair of pliers in the flame of the kitchen gas range. Hold it so that the hole in the cutter is in a vertical position, and so that all three of the cutters may be in the flame at the same time and each receive the same degree of heat. Hold the cutter in the flame until it becomes a deep cherry red and then remove it and lay it to one side to cool. Do not plunge it in water or oil.

After the cutter has cooled we will now make use of the templet, the outline of the shape for grinding is marked on the leg of the cutters by holding the templet on the face of the cutter and scratching the line on the darkened face of the cutter itself. With the grindstone dresser round off the right hand edge of one of the 3/4" grinding wheels.

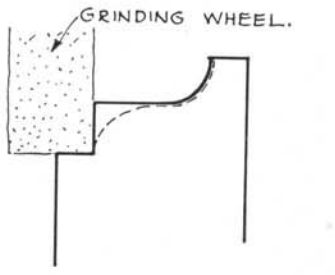


THE FIRST OPERATION

The first step which is taken in the grinding of this cutter is to grind away the portion as shown with a solid line in the drawing on the left, the grinding being taken down within about 1/32" of the scratch line, which is represented by the dotted line.

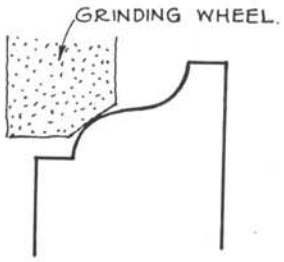
The next stage in grinding is to grind down the step as shown in the sketch below. This may be accomplished with either one of the 1/2" wheels or one of the 3/4" wheels with a straight face.

Since the accuracy of the cut to be made will depend to a great extent on how accurately the grinding wheel has been shaped it is of utmost importance that "dressing" the wheel be done carefully. If you expect to make various shaped cutters from time to time it may pay you to keep certain grinding wheels in stock particularly for this sort of work. The added convenience will warrant the small investment.



THE SECOND OPERATION.

Then with one edge of the wheel grind away the remainder of the cutter as shown in the drawing to the right. After which a retouch of all the edges with the stone to bring it down to the scratch line, as necessary. As one gets nearer to the line, a lighter touch becomes necessary, and this is accomplished by holding it with much less pressure against the stone.



THE FINISHED CUTTER.

Back Clearance Must Be Provided

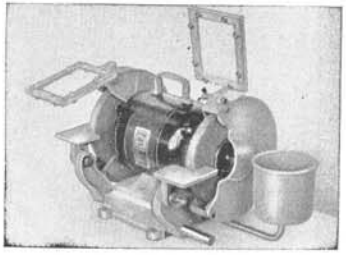
In a properly ground cutter there should be from two to four degrees of clearance on the back of the cutting edge. There is, however, considerable allowance for deviation permissible in this angle of clearance so that one need not worry about getting them exact. If you will examine a stock cutter, and by holding it against the face of the grinding wheel determine at just about what angle it is necessary to hold the cutter in order to attain the proper angle of clearance, you will have no difficulty in maintaining this angle. The angle should, of course, be maintained throughout the grinding of the entire face.

We have now ground our cutters roughly to the shape determined by the templet, and it is only necessary to clean up the edges and to sharpen up the corners which were impossible to get with the grind stone itself. Clamp the cutter in a vise with the cutting edge towards you, and the back of the cutting edge on top, so that in filing you file against the cutting edge. In this particular cutter either the flat or the square file may be used for sharpening up the corners. Check the cutter with the zinc templet as you go and try carefully to get all three of the cutting legs of the cutter to the same shape. Should you inadvertently get one of the cutting legs a little out of line with the others, it is nothing to worry about since the other two cutters or cutting edges will maintain the proper contour. After you get the cutter to this stage of grinding it is wise to make a trial cut on a piece of wood on the shaper to determine how near you have come to the desired moulding shape.

Rehardening the Cutter

After making a trial piece of moulding you can determine which of the legs of the cutter are not according to the templet and make slight remedies here and there until you get exactly the proper contour which will check up with the templet. When the grinding and filing of the cutter have been completed it is necessary to reharden the cutter. Take the cutter back to the kitchen gas range and reheat it to a deep cherry red. When this point is reached and the cutter is plunged in and taken out of cold water as quickly as possible, and then three seconds later, plunged back into the water and held there until cool it will have just about the right amount of hardness, and a long wearing cutting edge. If the cutter is plunged into water right from the fire and held there until cool, there is a liability that the cutting edge will become too hard and brittle and break off under the action of cutting hard wood. If the cutter is allowed to become too cool before the second plunge, there will not be sufficient hardness in the cutting edge, and the wearing qualities of the cutting edge will be impaired. Ordinarily a cutter on which the temper has been drawn and then not rehardened, will give about ten hours of continued service before needing resharpening. This would tend to denote that considerable variation in the hardening of the cutting edge is permissible.

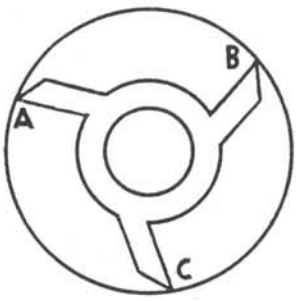
In the grinding of cutter shapes wherein it is not necessary to do any filing, it is not essential to draw the temper on the cutter. These may be ground on the grindstone as they are. While grinding a cutter on the stone, plunge it frequently into cold water to prevent drawing the temper.



An ideal set-up of a bench grinder with cooling cup for holding water, conveniently located, is shown at the left. Attention is also called to the non-shatterable glass shields which protect the operator.

As evidenced by the manner in which this particular cutter was made the reader will learn that in the more intricate types of cutters, it is easier to make the cutters of two or three individual

cutters rather than to attempt to grind them from one solid cutter. The important point to remember in this grouping of cutters is to be sure that all the cutters are of the same outside diameter, or rather the same outside cutting diameter. This point can most readily be determined by grouping the bank cutters on the spindle shaper and running through a piece of wood,

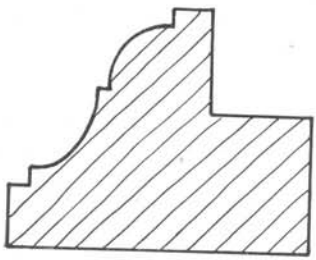


If the reader will grind a cutter of this type and follow through the different operations in the grinding, step by step, as they have been described, he will find that the grinding of a cutter is not the terribly hard proposition that he has been led to believe. One can, of course, if he has a machine lathe, put the cutter on a mandrel in the lathe and turn it to the shape desired, and later grind off the cutting angle on the back of the cutter.

Straight Shaping

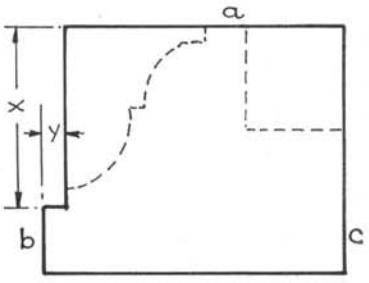
Shaper work which is in the form of long strips of moulding, the straight edges of table tops, bench tops, or other similar types of cabinet work, is considered as straight shaping. This type of shaper work is accomplished through the medium and help of the straight guide on the shaper table.

The best method possible of explaining just how straight shaping is done is to take a definite piece of moulding, and go through the operations just as they are done on the shaper. Let us choose for this explanation a piece of moulding which is to be used for a deep picture frame. This moulding is shown on the left.



The first step is the cutting of a rabbet on the face side of the piece of moulding. We find that the diameter of the cutter will not allow us to use the

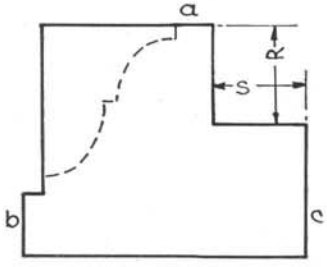
face A against the guide while cutting, since the maximum depth which our cutter will cut is about 5/8", so that for the first cut it is necessary to rest face A on the table. and use face B against the guide. We use a 1" straight face cutter for the first rabbet. The cutter is so adjusted that a portion of it sticks above the table which is equal to the distance X on the sketch to the right. After this has been accomplished the guide is so adjusted as to allow only a portion of the cutter to project beyond the guide and this distance would be equal to the distance Y on the sketch. Use a scrap piece of wood and make a trial cut, then take measurements and check to see that it is accurate to size desired.



FIRST CUT.

Keep Hand Pressure Constant

We now adjust the cutter to a height above the table which is equal to the distance S in the sketch below. The guide is then readjusted so that a portion of the cutter projecting beyond the guide is equal to the distance R. In this case we will use face A against the guide, and face C resting on the table. The cut is then run through. You will note that in both of these cuts the cutter is below the piece of wood being cut. There is a definite purpose in cutting the wood this way rather than having the cutter above the piece of wood.



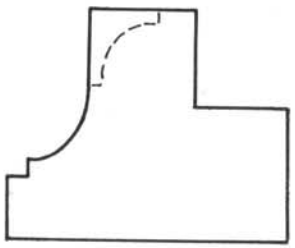
SECOND CUT.

There might be a variable pressure of the hand on the piece of wood as it is being fed through, which would allow the wood to be raised or lowered during the operation, thus causing a variation in the cut. This variation sometimes shows up in the form of a decided ripple. There is also a possibility of the hand slipping

and allowing the wood to jump, and in this case the piece of moulding would be practically ruined. By having the cutter below the wood, should an accident or release of pressure occur the piece of wood simply rises away from the cutter, and this can be recut at a later time, thus saving the piece of moulding.

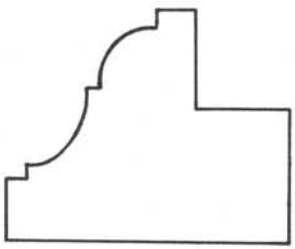
Spring Hold-Down Clips Helpful

At this point it might be well to mention that a pair of spring hold-down clips attached to the guide are a very great help in this type of work, in that they maintain a constant uniform pressure on the wood, holding it against the table for the entire length of cut. One of these guides is installed in such a position as to be on the top of the wood. The other guide is bolted to the table in such a manner as to press against the side of the wood, holding it firmly against the guide.



THIRD CUT.

The next step in the cutting of this moulding is the cove which is shown in the sketch to the right, and in this case we rest face A on the table and use face B against the guide. Again we so arrange our cutter that the wood will be above the cutter. The same system of adjustment is used as before in that the type of cutter above the table will regulate the width of the cut and the distance the cutter projects beyond the guide will regulate the depth of the cut.



FOURTH CUT.

The next step is the cutting of the quarter round as shown in the sketch to the left, and in this case we use face C, or face B resting on the table and face A resting against the guide. So arrange your cutter that the wood will again be above the cutter as it is being run through.

Always Make Trial Cut Before Proceeding

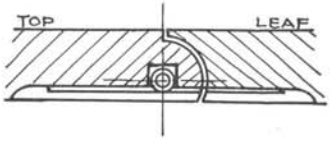
In making all the various cuts as described in the preceding paragraphs, after the cutter has been adjusted to what one imagines is the proper setting, it is wise to make a trial cut on the scrap piece of wood and check this cut before actually going ahead with the piece of good lumber. So far as is known there is no shaper on the market at the present time in which these adjustments of the cutter and guide are done by means of any sort of gauge, the setting being done by the trial and error method.

In the moulding just described we have kept one face, that is face A uncut, throughout the entire number of operations, and the guide therefore should be in an exactly straight line, and in the same plane, so that a bearing may be had on this surface before and after the cut is made.

It is sometimes possible to group a number of cuts on the spindle shaper at the same time, thus making a complete cut in one operation. Where this is impossible due to the length of the spindle of the shaper, and inability to get the complete group of cutters on, the group of cutters may be divided into two or more individual groups, and these run as successive cuts to make the completed moulding.

All straight shaper work is run along practically the same line of procedure as has just been described for the moulding just cut.

Drop Leaf Hinge Joint



THE CORRECTLY CUT "RULE JOINT" OR DROP LEAF TABLE JOINT.

One type of straight shaper work that seems to give considerable trouble to a great number of operators, is the joint known as the rule joint, or the joint which is used on a drop leaf table. We feel that it would be advantageous to describe the operation in the making of the joint, and why the mouldings are made in the manner they are.

First examine the drawing of the hinged, and cut joint as shown in the sketch. We will assume that the table top thick-

ness is ¾". You will note that a radius 7/16" is given on the male or table top portion of the joint. It is a usual procedure to allow a ⅛" drop from the top for a square face for the joint between the top and the leaf. You will also find that the hinge pin or rather the center of the hinge pin is exactly in a vertical line, below this joint of the table top. You will also note that due to the fact that a 7/16" radius has been used, that we have 3/16" left of the thickness of the top, that is we have used ⅛" for the straight edge drop, 7/16" for the radius, which leaves 3/16". This is the distance that the center of the hinge pin must be set in from the under surface of the table top. The table top is run through, cutting the moulding as shown by the dimensions. For the female portion of the joint we have a cutter which is ground to a ½" quarter round radius. The square shoulder on the upper face of the lead is in this case only 3/32" and with the ½" radius and the cut made so that the bottom surface of the table meets this radius at exactly ½" from its original square edge, we must maintain a 1/32" clearance between the top of the table and the leaf of the table to prevent the wood from rubbing together as the table leaf is dropped, thus wearing away the finish and leaving unsightly light wood showing.

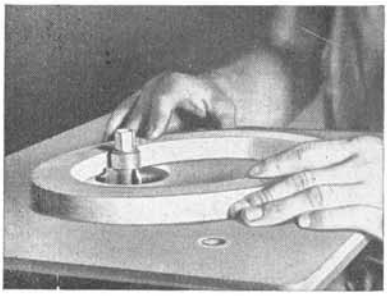
Irregular Shaping

Oval shaped table tops, curved legs, stretchers and similar objects come under the head of irregular shaping, and in this case the guides of the shaper are dispensed with. In their place we use a varied assortment of depth collars; these collars being placed on the spindle above or below the cutter as required. The collar prevents the cutter from cutting beyond a certain depth, that is when the wood is cut in for a certain distance, until the edge of the wood strikes the collar, the collar prevents the wood from going any further, and, as will be seen, the difference in diameter between the cutter and the collar regulates the width of cut. It is true therefore that with a stock cutter of 1¾" diameter, cut from solid tool steel, it would be impossible to make any adjustment of the cutting edge, so that any variation in the depth of cut must be taken care of by the difference in diameter of the shaper collar, and it is necessary therefore to have an

assortment of different diameter shaper collars. The thickness of these shaper collars is unimportant and can vary from ¼" up to 1". They must, however, have a square edge for the entire thickness.

As before, the simplest method of describing the use of a shaper collar in conjunction with the shaper cutter, is by going through an actual operation of shaping a curved piece of work. Let us choose for this description, an oval frame.

The first step in the making of this table top is to prepare the pattern and transfer it to wood. The edge is then bandsawed or jigsawed to the pattern and all parts of this edge are sanded to exactly the shape that they will assume for the finished piece. We will choose for the shaping of this edge a plain roll type such as is commonly found on frames of this kind.



Inside shaping without a form. The shape is determined by the contour of the stock itself.

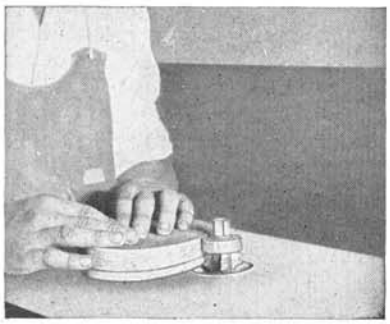
Put the cutter on the shaper with the collar above the shaper cutter and adjust the cutter for the required width of cut. This adjustment and setting is shown in the photo to the left, and you will note that a shaper collar has been chosen, that is enough smaller than the diameter of the cutters to give the required depth of cut. It happens in this case that the shaper collar is exactly the same diameter as the smaller diameter of the cutter.

With a shaper running at 8000 R.P.M. or better it is unnecessary to reverse the direction of cut since clean cutting may be done, both against the grain as well as with the grain, provided, of course, the cutter is kept very sharp. It is well to keep in mind, however, that when cutting against the grain one should take the cutting much more slowly than when cutting with the grain in order to get a clean smooth surface. You will see that the cut is made on the bottom with the frame upside down, resting on the surface of the shaper table.

The foregoing description is what is known as irregular shaping to a finished edge. If one has a series or a number of these frames to run through at the same time, the operation is somewhat different, in that a templet is used to give the required

shape instead of using the finished edge of the table top. In this case it would also be wise to provide oneself with a shaper cutter that will cut the entire moulding on the frame at one time. This cutter may be ground as you see fit.

There is one big advantage in irregular shaping from a templet in that you need not have a great array of different size shaper collars, since you can take up any discrepancy in the difference in size of collars by adding or subtracting from the size of the templet. Suppose, for example, we find that in order to make a certain cut we require a shaper collar which is 11/16" in diameter, and we find that the nearest collar we have is only 5/8" in diameter. We can use this 5/8" diameter collar by the simple expedient of making our templet 1/16" larger all around than it would be with the 11/16" diameter collar.



Shaping an oval with a form. The form bears against the collar restricting depth of cut.

Using a Templet in Shaping

It is preferable that this templet be made of a hard wood such as maple or birch plywood or something of the sort, and it is very important that all edges be sanded perfectly smooth to exactly the finished shape desired. Any discrepancy or any mistakes or nicks that are left in the edge of the templet will be reproduced by the cutter in the finished work so you will see that it is very important that the edge of the templet be perfectly smooth if you wish to turn out very nice work. A little paraffin wax rubbed on the finished edge of the templet will greatly facilitate its functioning.

Let us take for our example an oval pie crust table top. In this particular case, that is, using a templet, the table top is placed upside down on the shaper table and the templet is placed on the upper side of this top. Several small nails driven through the templet to project about 1/32" or 11/16" on the face side, that

is the side to come in contact with the table top, will prevent the templet from slipping on the table top. The cutter and collar on the shaper spindle are so adjusted that the cutter will make its cuts at the desired points on the table top, and the shaper collar will rest against the finished edge of the templet. Thus you see that the shaper cutter will cut in only so far as the templet will allow it to go before the templet comes in contact with the shaper collar. Moving the templet around its entire circumference with its edge in contact with the collar at all points, will therefore reproduce the exact outside shape of the templet on the table top, through the medium of the cutter. It is therefore unnecessary to put a finished edge on the table top before shaping, it being only necessary to band saw or jig saw the table top roughly to its required shape, leaving a little excess stock on the table which will be removed by the cutter, thus assuring a perfectly smooth finish cut.

Use Fiber for Production Templets

If a templet is required that will withstand long and hard usage and stand up under this usage, the templet had best be made of ¼" fiber. A little paraffin wax rubbed on the edge of this fiber templet will cause it to attain a very hard and durable polish, which seems to get harder as the friction of the collar rubbing against it causes it to burn or glaze over.

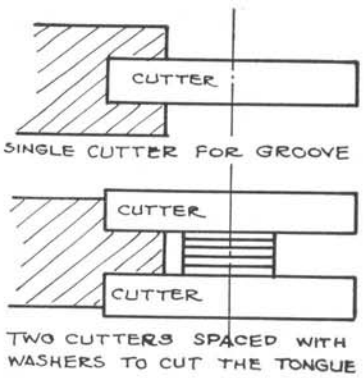
All irregular shaping is done along the same line of operation; that is, regardless of its peculiar shape or of its contour, so long as it has a flat surface to rest on the table. Whether you do it with the collar and the work alone, or whether it is done with the aid of a templet, is entirely up to the operator, and it is for you to decide whether or not the making of a templet is worthwhile. It is generally considered that the work turned out with the aid of a templet is superior to that turned out where the work actually rubs against the shaper collar. It is difficult to see any difference if the same amount of care is used in one method as is used in the other. When using the shaper collar, with the wood itself coming in contact with it, there will be a polished line along the edge of the moulding, where the wood rubbed against the collar, but this can easily be sanded away so that it will not be noticeable. For such items as the curved leg of a

pedestal table or the curved leg of a chair and similar articles, where there are at least four or more matched pieces in the finished project, it would be advisable to make a templet, the templet insuring that the four pieces will be exactly alike.

Matched Shaping—Tongueing and Grooving

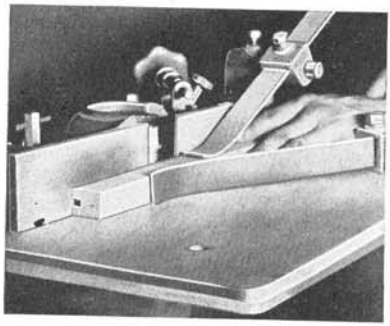
Anyone who has torn apart a door such as is used in the interior of a house or on a cabinet, will have noticed that there is a male and female type of moulding which to the commercial world is known as a coped joint. This type of shaper work requires a pair of matched cutters; that is, a cutter to cut the female portion of the moulding and another cutter to cut the male portion of the moulding. In running this type of moulding it is usually wise to cut the female portion of the moulding first, and fit the male portion to it later on. This particular type of shaping calls for a fair degree of skill and should not be attempted by the novice until he is more conversant with the methods of shaping.

For tongued and grooved jointing a pair of cutters is necessary. The female portion of the joint or the board with the female portion, is cut with a single cutter which ranges from 1/8" to 3/8" or 1/2" in width of face, this width or thickness of cutter is entirely a matter of choice with the operator and is dependent mainly on the thickness of wood being jointed. There are two methods of making the male portion of this joint. One is to have a cutter in which is ground a square recess which will cut a tongue; that is, a fairly close fit in the female portion of the joint. Another method is to have two cutters of the same outside diameter, and at least a 1/2" face on each one, and a collar or spacer washer of such thickness as to separate these two cutters to a point where they will cut a tongue which will be a close fit in the groove cut in the female portion of the joint.



The latter method of cutting the tongue on the male portion

of the joint is preferred to that of using the solid cutter, since the fit of the tongue into the groove may be controlled to some extent by varying the thickness of the spacer washer. This may be accomplished by inserting thin shim washers between the cutter and the spacer washer.

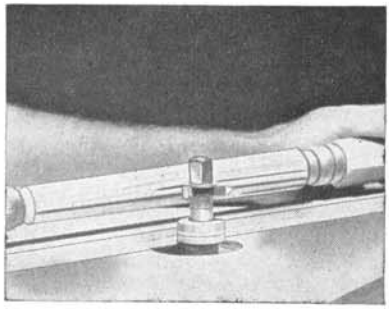


Spring clips hold work down on table and against cutter. A great convenience on long cuts.

Grooving or dadoing such as is used in the side, front and back of a drawer into which the bottom of a drawer fits, comes under the head of straight shaping and is accomplished in the same manner as the groove cut in the tongue and groove joint.

Reeding and Fluting

For reeding or fluting straight or curved irregular work it is necessary only to have reeding or fluting cutters. A reeding cutter is a cutter in which the cutting edge consists of two coves coming together in the center of the cutting face; while a fluting cutter is just the reverse, being rounded off on its cutting edge. For reeding or fluting flat faces it is sometimes advisable to use more than one cutter ganged up on the spindle of the shaper, thus saving considerable time and also turning out more uniform work. The actual cutting, however, is done exactly the same as any other straight or irregular type of shaper work.

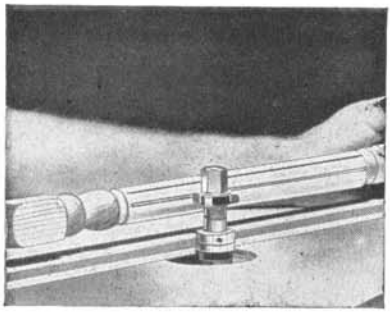


Reeding a table leg on the shaper. Leg is held in special form.

For the reeding or fluting of turnings it is necessary to supply oneself with a special jig, with which the turning may be held. a crude templet or jig with which this type of shaper work may be accomplished, consists of a piece of wood on which two blocks have been fastened, one at each end of the turning and a nail driven through each one of these blocks to act as a center on which

to revolve the turning. The next step in this operation is to divide the turning into the number of flutes or reeds you desire to shape on it.

Two methods of gauging the depth of cut and guiding the turning against the cutter are open to the operator. One is the use of depth collars and the other the use of a templet. The templet in this case is the base board of the jig. Where the turning is tapered or curved such as is shown in the photograph to the right, it is necessary to curve or taper the edge of the base board to conform with this shape of the turning.



Fluting a table leg on the shaper. Leg is held in special form.

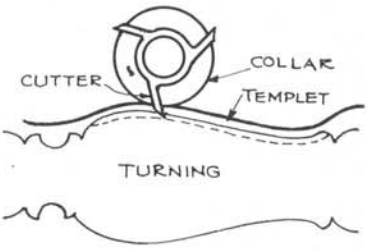
In using the depth collar with the cutter to determine the depth of the cut, be sure that the collars are of the proper diameters and are projecting far enough beyond the cutter to get bearing on the turning.

Ordinarily the templet type of work is preferred in reeding or fluting turnings since it may be more accurately gauged and better work is produced.

To facilitate the handling of the turning when it comes in contact with the cutter and to keep it from "running," a pin should be installed in the shaper table. The exact location of this pin is immaterial so long as it is not directly in line, or close to the shaper spindle. In use this pin acts as a stop pin against which to rest the templet for a jig before it is brought in contact with the shaper cutter. To make clearer the use of this pin, let us assume that we are reeding or turning and we will feed the turning from right to left against the cutter, the cutter revolving in a counter-clockwise direction. The end of the templet nearest the left hand is placed on the table and brought against this stop pin. Then the right hand is moved toward the cutter bringing the turning in contact with it. This gives the right hand a certain amount of leverage to prevent the cutter from drawing the turning into it and causing a bad gash.

Where the reeding or fluting runs the entire length of the surface or a portion of the turning; that is, from a shoulder to another shoulder, it is immaterial whether the templet type of

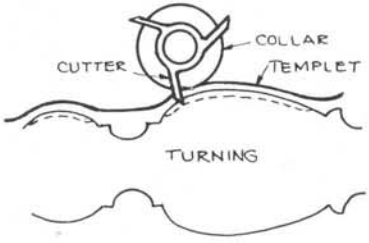
shaping or the collar type of shaping is used. If, however, it is necessary or required that the fluting or reeding begin within a surface of the turning, and should end before it reaches another shoulder, the templet type of shaping is much to be desired. You will see that as the templet rides along on the shaper collar, the depression in the edge of the templet will allow the cutter to drop in and cut into the surface of the turning until a projection in the edge of the templet causes it to move away from the turning, thus preventing it from cutting.



USING A FORM OR TEMPLET FOR REEDING OR FLUTING

Two typical examples of this type of reeding or fluting are shown in the two accompanying sketches on this page.

The diameter of turning that one is enabled to reed or flute on the shaper is, of course, entirely dependent on the height to which the shaper spindle may be adjusted. In all reeding and fluting operations the center of the cutter is exactly on a level with the center of the turning, and the cut is done from the side, not from the top or bottom.



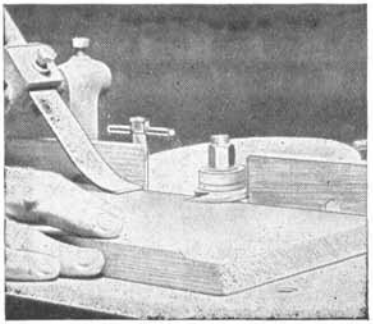
SKIP OR JUMP FLUTING WITH THE AID OF A FORM.

Paneling

This is a type of shaper work which is advantageous in some cases, although it is not often used. For this purpose a special knife is used which may be up to 4″ in diameter, so long as it may be put on the spindle and have sufficient clearance between the guides to revolve without striking them. A photo of this type of cutter is illustrated on the page opposite and its use is as follows. The cutter is so adjusted that its height above the table will give the required depth of cut and the panel is fed to the cutter in successive stages of cuts about ½″ in width. It will be understood that a cut made by a cutter of 4″ or 3″ in diameter, about ¼″ in depth, and taking this cut all in one bite

puts a terrific strain on the spindle and may possibly throw the spindle out of line or spring it out of shape.

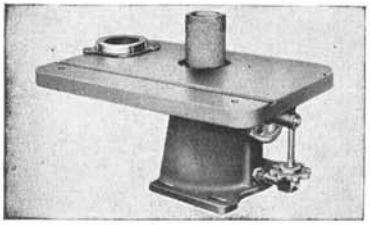
This type of work is usually used where it is desired to install a panel of ½" in thickness, and use a groove in the frame of only ¼" in width, so that it is necessary to cut the thickness of the panel down to ¼" along its edges.



Paneling knife in use on the shaper.

Sanding

One of the very useful purposes to which a shaper may be put is that of sanding with a sanding spindle or sanding drum. For this type of work the guides and guards of the shaper are removed and the sanding drum installed on the spindle. With this drum or spindle irregular shaped pieces of wood may be sanded with great facility, and give a machine-made look to the work turned out, which is almost impossible to attain by hand. For this purpose the sanding spindle or the machine should be run at a fairly slow speed, of not more than 1750 R.P.M. since the action or the heat generated by the sand paper rubbing against the wood would cause a burning of the surface and a glazing of the sand paper, thus using up considerable sand paper and not attaining a very good finish.



By removing table insert and attaching sanding drum the shaper is converted into an excellent sander. Adjustment of the spindle up and down distributes wear on sanding sleeve.

Surface Grinding

Another operation which may be performed with great nicety on the shaper is that of surface grinding. For this purpose a set of stones, possibly 2" to 3" in diameter and with faces of ¼" or ½" should be purchased with the hole of a size necessary to

go over the spindle. For this type of work it is necessary to use the straight guide. After installing the guides and adjusting them so that the edges or faces of the guides are practically flush with the periphery or circumference of the wheel, one should then clamp a board of about ½" to ¾" thick on the surface of the shaper table with its edge resting against the guide. With a wheel of 2" or 3" in diameter it is impossible to drop the wheel below the surface of the table which is necessary in surface grinding. To begin the operation adjust the wheel so that its upper surface is just a slight amount above the surface of the board on the table. Then bring the piece of stock that is to be ground against the side and move it along until the grindstone grinds on its surface, then continue feeding until the entire length of the piece has been ground.

Then adjust the stone up from the table a fraction of an inch at a time and grind successively from one end to the other of the stock until the entire surface has been covered.

With a little practice it is surprising what very creditable surface grinding may be accomplished with the ordinary small bench type of shaper.

It is not necessary as is usually supposed to have a mechanical feed or a true feed to the work in order to do very nice surface grinding of this type.

WOODS COMMONLY USED

Hard Woods

Chestnut. Light in weight, of average strength, hardness and elasticity. Chestnut is sawed, planed, turned and shaped easily, although it splits readily and warps quite badly.

Maple. It is very hard, strong and elastic. Its close, crooked grain takes an excellent finish.

Oak. Used extensively for furniture and cabinet work. It is heavy, strong, hard and elastic. Very durable but warps and checks considerably.

Ash. Resembles oak somewhat, although ash is coarser grained and less attractive, but easier to work. Used for all kinds of furniture. Straight grained, heavy, hard, strong, stiff and tough, but becomes brittle with age.

Black Walnut. Because of its beautiful chocolate brown color, walnut is in popular demand for furniture, but rapidly becoming scarce. It is heavy, hard, strong, coarse grained and easily worked.

Birch. This wood is hard, tough, straight of grain and able to stand wear and tear. Widely used in cabinet making and for various kinds of furniture. An excellent wood for lathe turning.

Mahogany. There are several varieties, chief of which are Central American, African, Mexican and Philippine. They vary considerably in color, hardness and ease of working. Usual color is rich red. Very desirable if kept dry. Glues exceptionally well.

Soft Woods

Poplar. An excellent wood to work. Light, soft and stiff but not strong. Its fine texture and exceptional working qualities make it very desirable for furniture.

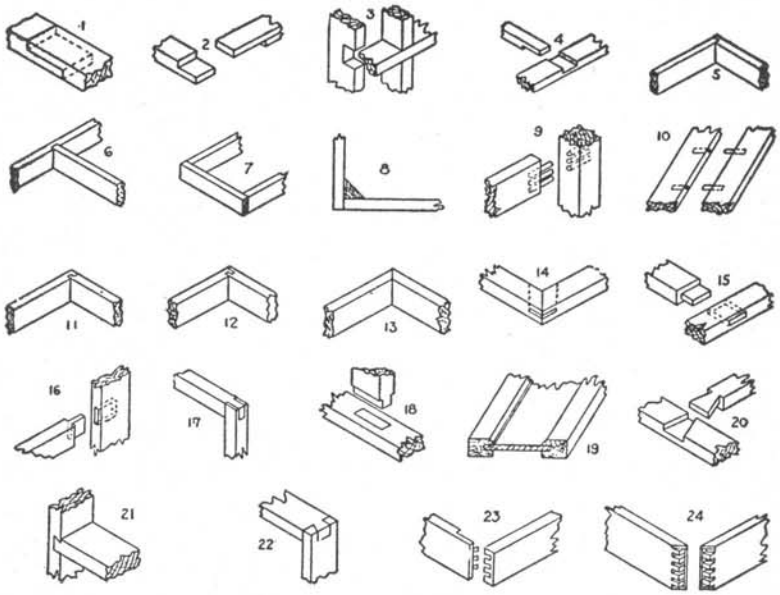
Gum. It has an even texture, is comparatively easy to work, takes a beautiful finish, is an ideal wood for carving, and with a little care can be nailed well.

Cypress. A soft, easily worked wood that does not warp easily, but is likely to contain many fine checks. Nails well and is very durable. Color is reddish brown. It makes beautiful furniture.

Basswood. A light, straight-grained wood which warps very little, is easily worked and nails well. Fairly durable but weak. Picture frames and mouldings are usually made from basswood.

White Pine. A very light wood of average strength and durability. It is used in large quantities for various carpentry purposes. Grain is straight and it is easily worked.

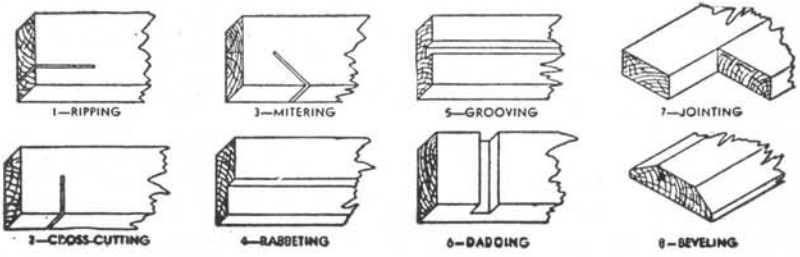
HOW JOINTS ARE MADE



1. Spliced or Halved Joint
2. End Lap or Halved Joint
3. Cross Lap Joint
4. Middle Lap Joint
5. Rabbet Joint
6. Dado Joint
7. Butt Joint
8. Glued and Blocked Butt Joint
9. Dowel Butt Joint
10. Edge to Edge Dowel Joint
11. End Dado or Box Joint
12. Dado Tongue and Rabbet Joint
13. Miter Joint
14. Miter with Spline
15. Through Mortise and Tenon Joint
16. Blind Mortise and Tenon Joint
17. End Mortise and Tenon Joint
18. Stub Mortise and Tenon Joint
19. Panel Construction
20. Half Lap Dovetail Joint
21. Half Dovetail Dado Joint
22. Through Single Dovetail Joint
23. Multiple End Dovetail Joint
24. Blind Miter or Secret Dovetail Joint

Even though you fasten with nail or screw, reinforce every joint with Le Page's Glue

Explanation of Common Terms



HINTS ON GLUING

(By Courtesy of LePage's)

The woodworker is concerned with three kinds of glue—animal, fish and casein. Animal glue, commonly known as "hot glue" is obtained from the hides, skin, bones and sinews of cattle. Fish glue, which we know as a ready-to-use, prepared liquid glue is made from a by-product of the salt fish industry. Casein glue, ordinarily called waterproof glue, is made from the curd of milk.

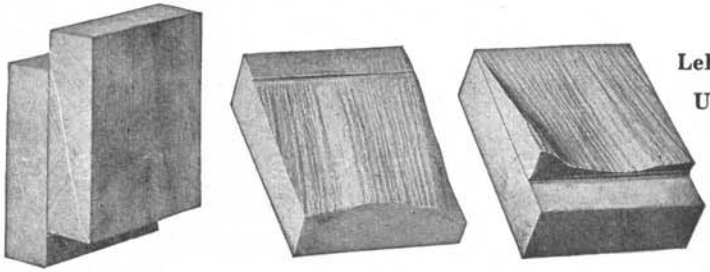
Good Joints Essential

No great skill is needed in using glue but there are a few important directions to follow regardless of what kind you use.

The most vital point is that the two pieces of wood to be joined together must be perfect joints and make perfect contact. The wood must be dry and free from grease, and the glue must be of the proper consistency, spread evenly—and be free from air bubbles. Use enough glue, do not starve the joints. The two pieces to be joined must be held together under pressure, while the glue sets. Always make a trial fitting without glue and mark the various pieces as they are to be put together as No. 1 and No. 1, No. 2 and No. 2, etc. Clean off the excess glue by throwing fine sawdust over that glue which has been squeezed out of the joint. This will facilitate its removal with a chisel

If two pieces of wood are properly glued together, the glue will hold better than the wood itself. The illustration below clearly proves this.

No one kind of glue, whether animal, fish or casein, is the best for all uses. For average use, however, Le Page's Liquid Glue is highly recommended. It requires no soaking, heating or mixing to certain proportions. It is fool proof. It has the advantage of setting slowly, giving the worker ample time to arrange and rearrange the clamps, or to square up the different parts being glued. For many needs, the slow set is indispensable. Makes a joint stronger than the hardest wood.



LePage's Held Under 10,955 Pounds Pressure

The first illustration above shows the side view of one of the blocks of wood used in testing the strength of LePage's. The thin straight line indicates the lepaged joint. The irregular line indicates the line along which the wood finally gave way leaving the lepaged joint unbroken.

Under a pressure of 10,955 pounds, the block was finally broken. Note from the surface of the two halves that it was the wood itself which gave way under the strain and not the LePage's.

REINFORCE EVERY JOINT WITH LePAGE'S GLUE

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