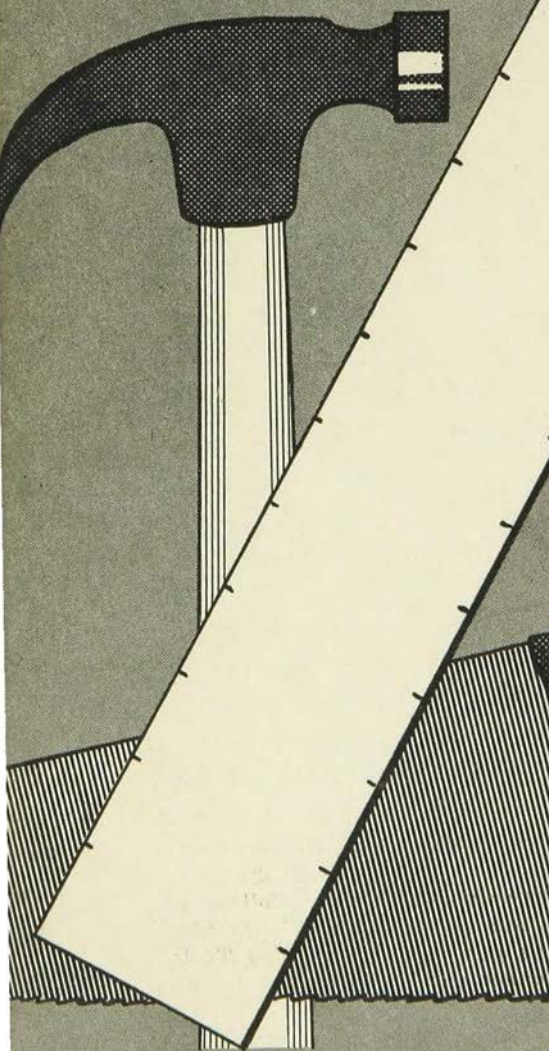


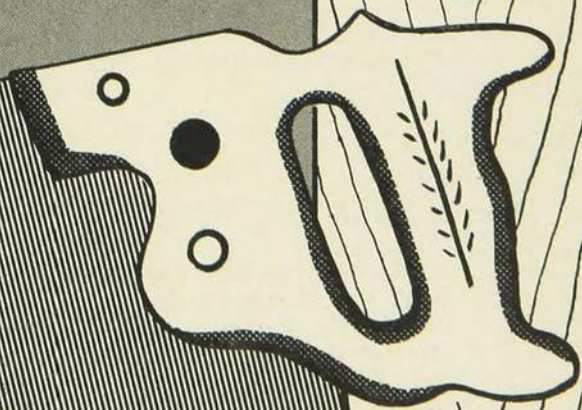
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*Shop*



**Woodworking**



UNIVERSITY OF MINNESOTA  
*Agricultural Extension Service*  
U. S. DEPARTMENT OF AGRICULTURE

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*This publication has been adapted in its entirety from Nebraska circular E. C. 7-11-2 (Revised), "4-H Woodworking," through the courtesy of the Extension Service, University of Nebraska College of Agriculture, Lincoln. All copyrighted illustrations from "The Stanley Tool Guide" are reproduced with the permission of Stanley Tools, New Britain, Connecticut.*

# 4 - H Shop

**T**HE 4-H mechanics project was revised in 1956 and given the name "4-H Shop Project." One of the fastest growing projects in 4-H, it is well suited to 4-H members both on the farm and in town.

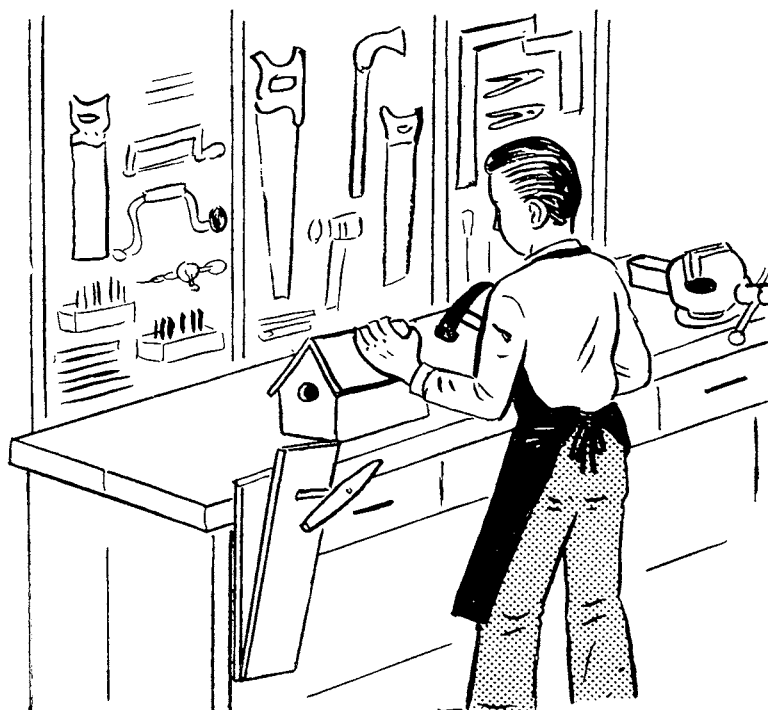
Its purpose is to help 4-H Club members learn the care and use of common tools, make useful articles, and keep farm and home equipment in good repair.

Use this bulletin (1) as a reference on use of tools, and (2) as source material in developing demonstrations on tool use and care.

Those enrolled in the junior phase of the project will find most of the plans in the bulletin suitable for their use.

Members in advanced woodworking may wish to contact local lumber yards, check libraries, or refer to magazines for plans on more advanced projects to build.

**Note to project leaders:** You will find the instruction sheet very helpful in developing a woodworking project meeting. The materials and tools needed are listed. The construction steps are indicated in a step-by-step process suitable for group teaching.



## TOOLS:

Good tools make good work easy. Take care of your tools. See that they are dry, keep them sharp, and keep them in order. The best of tools can do you no good if you can't find them.

Rust and careless handling are the greatest enemies of hand tools. A good, clean place to work will help you to take care of them.

The following tools should be in every farm shop:

1. Claw hammer
2. Cross cut saw (8 point)
3. Rip saw (5½ point)
4. Folding rule or steel tape
5. Screwdrivers
6. Brace and bits
7. Jack plane
8. Wood chisels
9. Ripping bar

10. Framing square
11. Try square
12. Nail set

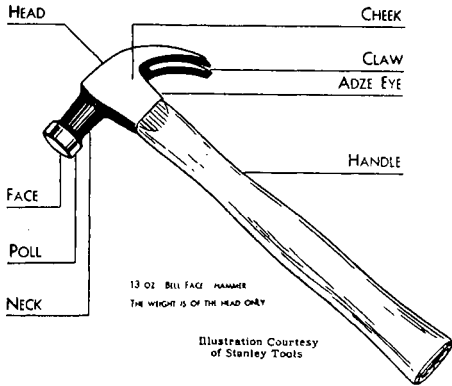
After the user of the shop becomes skillful in handling tools, he may find that he needs additions to his set. The following are suggestions:

1. Combination square
2. Coping saw
3. Marking gauge
4. Keyhole (compass) saw
5. Mallet (wood or plastic)
6. Hand drill and bits
7. Carpenter's level
8. Countersink
9. Bench vice
10. Back saw
11. Draw knife
12. Block plane
13. Hand scraper



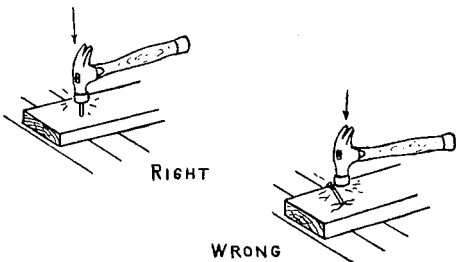
Careless handling ruins tools quickly. Don't do it. Protect cutting edges; keep tools out where you can see the one that's needed.

**THE CLAW HAMMER** is perhaps the most used and the most abused tool. To use it safely and well, remember a few simple rules.



Parts of the claw hammer.

To start a nail, hold the nail high, just under the head, with the thumb and forefinger of the left hand. This method will save bruised fingers—if the hammer slips off the nail head, fingers will be knocked out of the way rather than being mashed between the hammer and the board. If necessary for control, you may hold the hammer near the head while starting the nail.

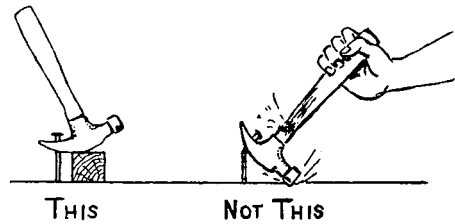


Drive the nail with full, strong blows. Learn to use wrist action and hold the handle near the end. Keep the handle parallel to the work at

the point of impact. Hit the nail squarely. This will prevent bending the nail and leaving marks on the wood. Practice will help.

To pull a nail, insert the claws under the nail head. Do not pull the handle past a straight up and down position. When the handle has reached the vertical, place a block of wood under the head before the nail is pulled farther.

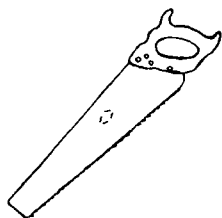
A wedge cut from a piece of 2 x 4 is often handy for pulling nails.



There are some things that should be avoided. Let's list a few:

- ✓ Don't use a hammer that is "loose on the handle," or that has a split or broken handle. Someone may be hurt.
- ✓ Don't use the side of the hammer to pound with. The cheek is the weakest part of the hammer head, and may be broken. (See illustration showing parts of the hammer.)
- ✓ Don't use a claw hammer to pound a cold chisel or other hard metal objects.

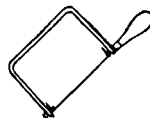
Use your hammer well, and it will serve you well. Awkwardness will disappear with practice. Remember to hold the hammer near the end of the handle when driving larger nails. For starting nails and driving small nails, hold the hammer closer to the head if necessary.



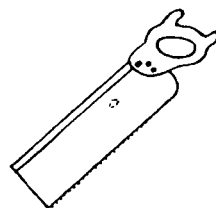
CROSSCUT SAW



KEYHOLE SAW

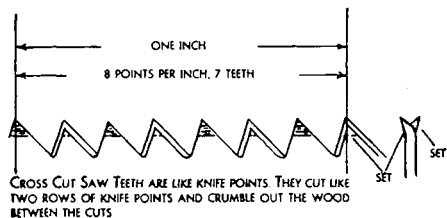


COPING SAW

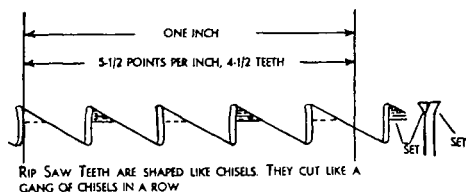


BACK SAW

**THE HAND SAW** is the next tool that we will consider. The two types most used are (1) the **cross cut saw**, and, (2) the **rip saw**. The cross cut saw is used to cut across the grain of the wood, the rip saw to cut with the grain. The most obvious difference is in the size of teeth—the rip saw has large teeth, the cross-cut has smaller teeth.



CROSS CUT SAW TEETH ARE LIKE KNIFE POINTS. THEY CUT LIKE TWO ROWS OF KNIFE POINTS AND CRUMBLE OUT THE WOOD BETWEEN THE CUTS



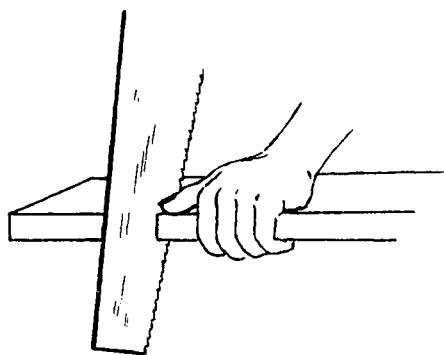
RIP SAW TEETH ARE SHAPED LIKE CHISELS. THEY CUT LIKE A GANG OF CHISELS IN A ROW

Saws are designated by the number of tooth points to the inch—a cross cut may have 8, 10, or 11; a rip saw will have only 5, 5½, or 6. Usually this number will be found stamped on the blade near the handle.

In the use of the hand saw, remember these points:

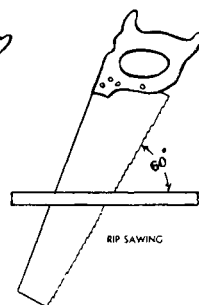
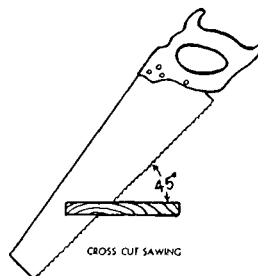
1. Start the cut by drawing the saw toward yourself. Guide it with the

thumb of your left hand until the cut (kerf) is deep enough to hold the saw steady.



Be careful—the saw is designed to cut through hard wood. Remember that your thumb is much softer.

2. Saw with steady, long strokes, taking care not to “kink” the blade. It is much easier to keep a saw straight than it is to straighten a crooked one.



3. If ripping, hold the saw at 60 degrees to the work. If cutting across the grain, the angle should be 45 degrees.

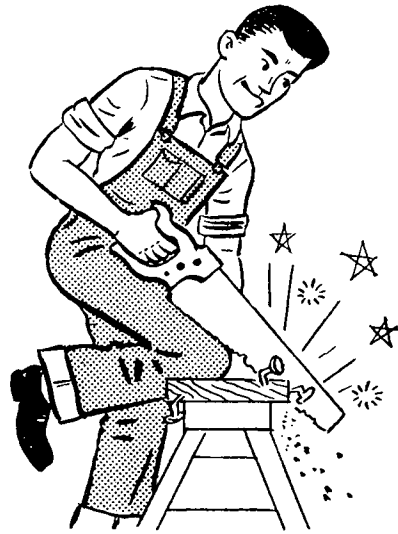
4. It takes practice to keep the cut vertical. While learning, you can use the try square to check. The side of your saw should be square with the board.

5. Keep the kerf on the waste side of the line, not on the line, and not on the inside of the line. You can guide the saw to some extent by twisting it in the desired direction. (Kerf is the term carpenters use to describe the cut left by the saw.)

6. Finish the cut with gentle strokes, holding the waste end of the work in position. If you just let it fall, it probably will split or splinter your work.

7. Oil the saw lightly after using. Keep it in a dry place. Rust can ruin a saw—or any cutting tool—very quickly. If rust is present, it can be removed by careful polishing with pumice stone or brick powder.

There are also “hand saws” designed for special purposes. Three of



**Remove all nails from used lumber: they can ruin your saw.**

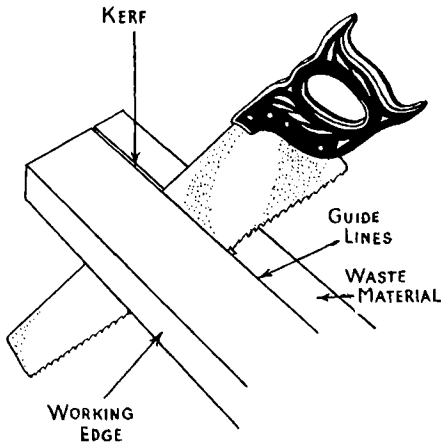
them which you may find very useful will be briefly described:

The **keyhole saw**, pictured on page 6, is often used to start a cut in the center of a piece of work. A hole is drilled and the slender blade inserted. It can also be used to cut large circles or gentle curves.

The **coping saw** is used to cut figures from thin stock. It can be turned on a very short radius.

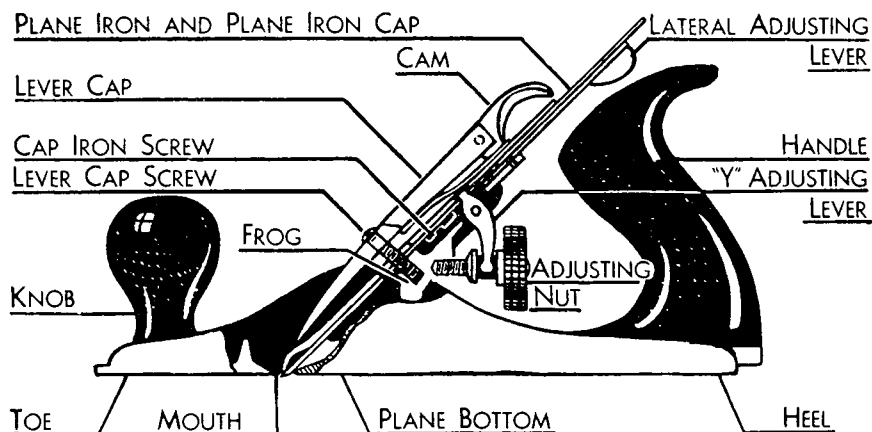
The **back saw** is used for cabinet work and in mitre boxes. Its thin blade and fine teeth make precise work possible. The reinforcement of the blade gives the saw its name.

**A word of caution:** You may work with used lumber a good deal in these projects. Be careful of hidden nails. They will break or dull teeth, ruining your saw. So examine used lumber very carefully, and remove all nails before you try to cut it.





## PARTS OF THE COMMON HAND PLANE



TO ADJUST FOR THE THICKNESS OF THE SHAVING SIGHT ALONG THE BOTTOM OF THE PLANE AND TURN THE ADJUSTING NUT UNTIL THE CUTTING EDGE PROJECTS ABOUT THE THICKNESS OF A HAIR.

Illustration Courtesy  
of Stanley Tools

**THE PLANE** is the tool that removes the rough and ridged surface left by sawing. It helps you in bringing stock down to size when a fraction of an inch is all that needs removing.

To adjust the plane, bring the cutting edge just below the plane. (Note the illustration). If one side of the cutting edge is lower than the other, use the lateral adjusting lever to even it up. Try the plane. If the shaving is too thick or too thin, readjust until a satisfactory thickness of cut is reached.

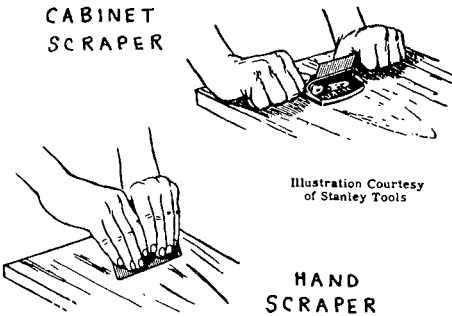
When using a plane, take precautions to protect the cutting edge. Lay the plane on one side—not in an upright position—when it is not in use.

Store it carefully. If it cannot be stored so that the cutting edge is protected, use the adjusting nut to bring the cutting edge above the plane bottom before you put it away.

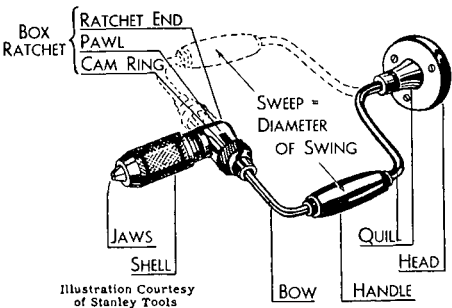
When using the plane, push it straight ahead, keeping it square with the work. Press down on the toe at the start of a stroke; press on the heel at the end of the stroke. This prevents rounding the work. Always plane with the grain, if possible.

A **HAND SCRAPER** or cabinet scraper may be used if the grain is rough and cannot be smoothed with a plane. The hand scraper is a flat, steel blade, one edge of which is sharpened by drawing a file along the edge. To use, the scraper is grasped by the top with both hands and pushed or pulled in the direction of the grain. It is sloped about 75 degrees to the work, leaning toward the direction of travel.

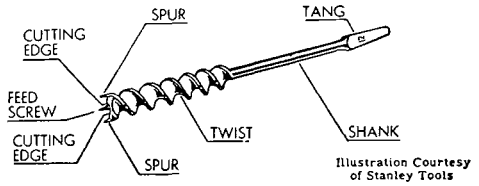
The **CABINET SCRAPER** has a frame to hold the blade and handles for the user.



The familiar **BIT BRACE** is another tool that the woodpecker uses often. Pictured is the ratchet type which has the advantage of being usable in corners and tight quarters.



**THE AUGER BIT**, as shown here, is sized by 16ths of an inch, measuring the diameter. Bits vary in length from seven to ten inches.

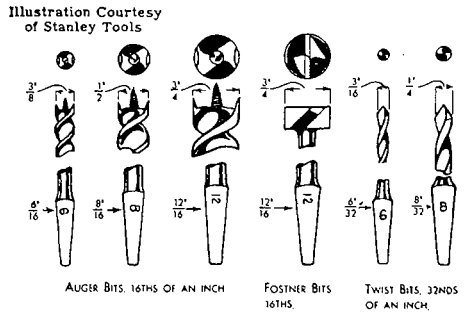


Parts of the auger bit.

Dowel bits are the same, but shorter.

Bits are marked for size by a single number. The numerator of the fraction stands for the diameter of the bit. Auger and fostner bits are marked by 16ths—as No. 8 meaning  $8/16''$  or  $1/2''$ .

Twist bits for wood are usually marked in the same way, by 32nds of an inch. No. 8 here would mean  $8/32''$  or  $1/4''$ .

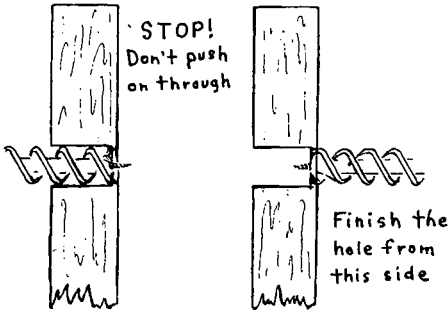


Practice drilling a few holes in scrap lumber. Check with the try square to see that the hole is straight.

To avoid splitting and splintering, drill from the opposite side as soon as the lead screw has pushed through. (See illustration, page 10.)

Take care to place the bit accurately when starting a hole. The location

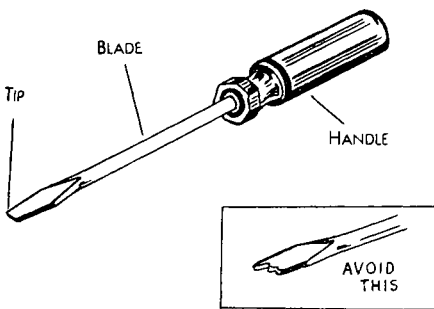
should be clearly marked on the wood.



Correct way of drilling through a board without splintering it.

Store the bits so that the cutting edges, spur, and lead screw are protected. One good method of doing this is to drill a block of wood and keep the bits in the holes.

**THE SCREWDRIVER** is another useful tool that gets more than its share of abuse. It is easy—but not smart—to ruin a good screwdriver by failing to observe the following points:



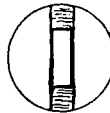
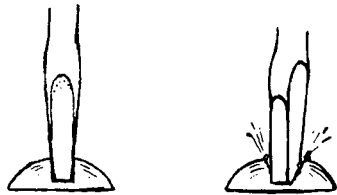
1. The blade should fit the slot snugly. Don't use a screwdriver that is too large or too small.

2. Hold the screwdriver square with the work. Keep a firm down-

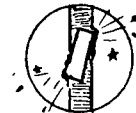
ward pressure as the twisting motion is applied. You will find a long screwdriver easier to hold.

3. Avoid hammering on a screwdriver. It is not a substitute for a cold chisel.

4. Never sharpen the tip to a point. If it is too thin, it will break. A tip that is rounded on the corners will ruin screw slots. (Note the illustration at the lower left.)



THIS



NOT THIS

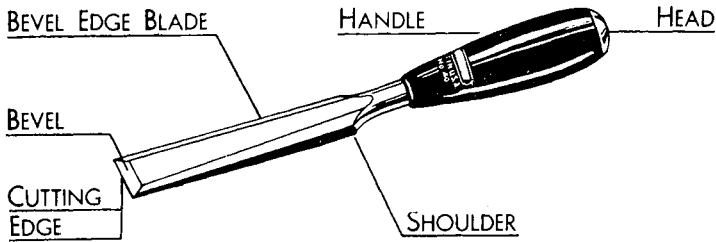
The blade of the screwdriver should fit snugly in the slot of the screw.

5. Never use pliers on the blade to give greater turning force.

6. Choose a plastic handle or a good wooden handle. Cheaper wooden handled screwdrivers often become loose and useless.

**THE WOOD CHISEL** may be regarded as a more primitive plane. Because its blade is unprotected, it can be used in routing (cutting grooves) and gouging. **Be careful.** The chisel is the most dangerous of hand working tools. **Always keep both hands on the chisel.** (See the illustrations.)

## KEEP YOUR CHISEL SHARP



THE CHISEL IS CONTROLLED WITH THE LEFT HAND, PRESSING FIRMLY ON THE CHISEL AND THE WOOD. THE POWER IS APPLIED WITH THE RIGHT HAND. THE CHISEL IS HELD SLIGHTLY TURNED SO THE EDGE SLIDES ACROSS THE WORK OR THE CHISEL IS MOVED TO THE RIGHT AND LEFT AS IT IS ADVANCED, TO GIVE A SLIDING ACTION TO THE CUTTING EDGE. THIS IS EASIER THAN A STRAIGHT THRUST AND LEAVES A SMOOTHER SURFACE ON THE WORK.

AT ALL TIMES KEEP BOTH HANDS BACK OF THE CUTTING EDGE.

Illustration Courtesy  
of Stanley Tools

As with the plane, work with the grain whenever possible. Angle the blade a little, or move it from side to side as it moves forward. You will find that it will cut more smoothly and evenly.

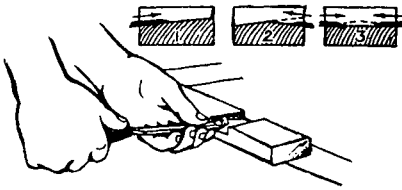
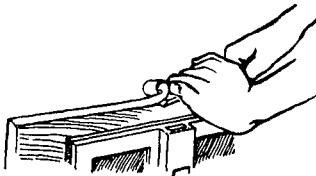


Illustration Courtesy  
of Stanley Tools



Using the wood chisel.

For most work, the bevel is held up. For rough gouging, the bevel may be held down.

Protect the blade during storage. A wall rack is one of the best storage methods.

**SANDPAPER** is used to give a final, smooth finish to your work. Don't use it until you are certain that edged tools are no longer necessary. Sand left in the pores of the wood will dull a plane or a saw used afterward.

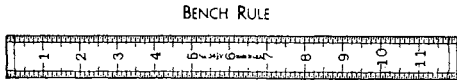
Use a moderately coarse sandpaper and work with the grain. Very coarse sandpaper may leave deep and hard-to-remove scratches in the surface. For a smooth job, use a sanding block. Then you will cut off the high spots and will not "drag" the corners.

Finish with fine sandpaper.

Sometimes it is desirable to use very fine sandpaper on paint, before applying the last coat. A "wet" type sandpaper which can be used with water proves useful in work of this type.

**LAYING OUT YOUR PROJECT** is the most important single step. Study the drawings. Know what you want to do. Then use your rule and square to mark the necessary cuts. Don't saw until you are sure. Accurate measurement is essential for good work.

There are many kinds of rules—your familiar school ruler; the yard stick; folding, zig-zag, and bench rules; the flexible tape, and others. Most of these are marked off in eighths or sixteenths of an inch. They may be made of metal, wood, or plastic. Use them well and you will have taken a big stride towards craftsmanship. When laying out measurements, double check each one. Lay the rule so that the graduations touch the work. Then your eye cannot mislead you.



BENCH RULE  
Illustration Courtesy of Stanley Tools

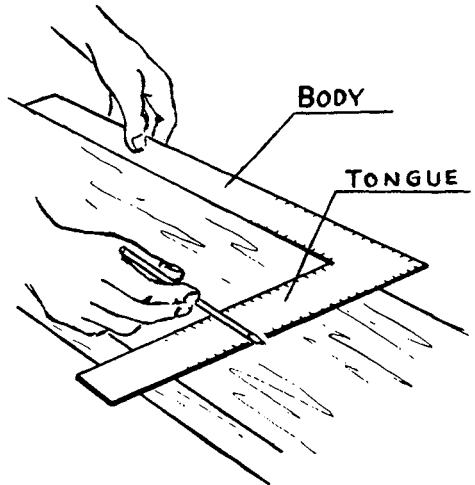
Use a square to mark boards before cutting them to length. Mark across the top and at least one edge. The mark on the edge will help you to judge whether or not your saw is straight up and down.

The illustration shows the use of a **FRAMING SQUARE** in marking a board. On page 13 is a picture of a **TRY SQUARE**. It is very handy for laying out projects as well as checking stock during squaring.

A **COMBINATION SQUARE** will lay off ninety or forty-five degree angles. The **SLIDING T BEVEL** can be set for any angle and is used much as the try square on page 13.

Framing squares are used in cutting rafters, squaring ends of boards,

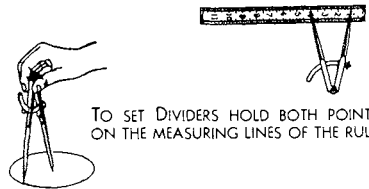
and laying out various angles. (See pages 33 and 37.)



FRAMING SQUARE

The **MARKING GAUGE** is very useful in marking stock to size after the working face and the working edge are squared and true.

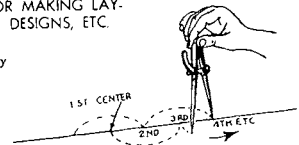
**DIVIDERS** may be used as shown. Your school compass can substitute for dividers in the laying out of circles and arcs.



TO SET DIVIDERS HOLD BOTH POINTS ON THE MEASURING LINES OF THE RULE

DIVIDERS ARE USED FOR SCRIBING CIRCLES OR AN ARC. ALSO FOR COMBINATIONS OF CIRCLES AND ARCS FOR MAKING LAYOUTS FOR CURVED DESIGNS, ETC.

Illustration Courtesy of Stanley Tools



DIVIDERS ARE USED TO STEP OFF A MEASUREMENT SEVERAL TIMES ACCURATELY

Remember that tools for measurement are precision instruments. Wipe squares, rules, and steel tapes with an oily rag after using to protect the steel from rusting.

Never use a try square as a hammer! If the blade is loosened in the handle, the try square is useless.

**AFTER SELECTING YOUR PROJECT,** study the working drawings until you know about what you are going to do. If you choose a project from this manual, you will find the steps of construction outlined for you.

- Select the material.
- Lay out the work. Double check your measurements. If you do not understand the drawing, ask your leader to help you. Don't saw until sure.

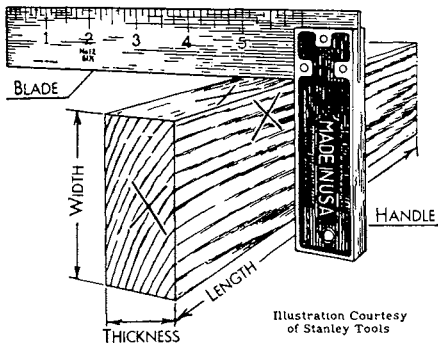


Illustration Courtesy of Stanley Tools

Hold handle of the try square tight against the stock when testing ends, edges, or scribing lines.

- Work carefully. Remember that you can cut a board down with a plane, but you can't stretch it.
- Do your best. A neat, well-fitted project is worth the extra effort.

In order to avoid confusion, you should know a few terms used in carpentry and woodworking.

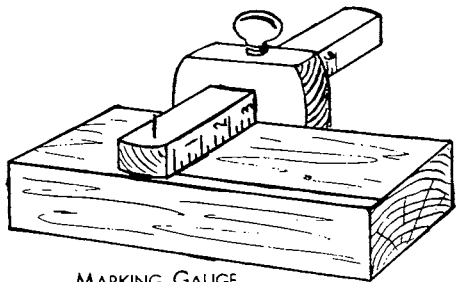
**Length** is always measured **with** the grain, even though the board may

be shorter than it is wide. Width and thickness are measured as shown at the left (try square illustration).



**WHEN SQUARING STOCK,** this procedure should be followed:

1. Select a **working face**. For accurate work, this face should be planed true and smooth. Don't depend on your eye—check for high spots with a bench rule or the blade of your try square. When you have it true, mark with a pencil.
2. Select a **working edge**. Plane this true, using your try square to square it with the working face. Mark this edge.
3. Square and mark a **working end**.
4. Measure the desired length from the working end. Saw to length. Remember to saw on the waste side of the line, leaving part of the line on the work. (See page 7.)



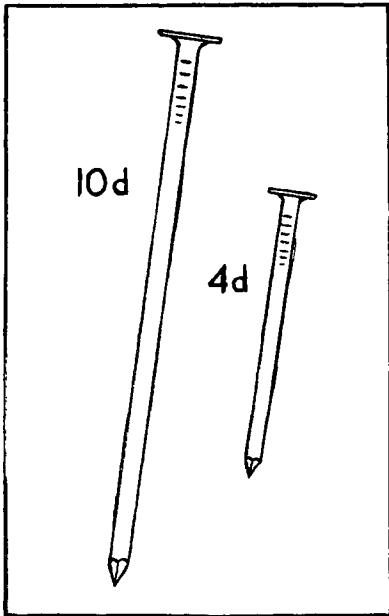
5. Mark the stock to proper width, measuring from the working edge. A marking gauge will help you here. Saw and/or plane to width.

6. Measure the thickness from the working face. Plane to line.

## WOOD FASTENERS:

**NAILS** are the most widely used method of joining wood. They are handy and fast. Use them where you can, but remember their limitations.

Size is designated by the "penny" system. The symbol for penny is the letter "d". Larger nails have bigger numbers. Sizes range from 2 penny to 60 penny. The illustration below shows you a 10 penny and a 4 penny nail, actual size.



There are a number of special types of nails for special jobs. Some of the more common are listed below.

1. **Common nails** are used for general purpose — sheathing, flooring, framing, etc. The nails shown at the left are common nails.

2. **Box nails** are lighter than commons, and are less apt to cause splitting. They are used with light or easily split lumber.

3. The **finishing nail** is preferred

when it is desirable to have no nail heads showing. It can be sunk below the surface of the wood with a **nail set**. (A nail set is a sort of a punch.) The heads are covered with putty or plastic wood before the finish is applied.

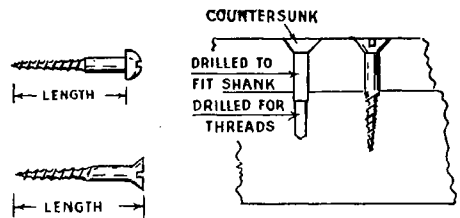
4. **Common brads** are similar to finishing nails. The small sizes are frequently used in fine assembly work, such as model making.

5. **Shingle nails** are used for putting on roofing materials. They are usually coated with zinc for resistance to corrosion.

6. **Corrugated fasteners** are used in joining the edges of boards together. Sometimes you will find them used in fastening corners of screen frames. More often they are used for repair work. Corrugated fasteners are made with plain edges for hard wood and saw edges for soft wood. They can be purchased in different sizes.

**SCREWS** are second only to nails as fasteners of wood joints. They have the advantage of making a much stronger joint than nails, but they require more time and work.

There are two common types of wood screws; the **flat head** and the **round head**. The flat head screw can be countersunk to leave a smooth surface, as shown in the illustration to the left.



Most screws are steel. If you are making a project that will be exposed to severe conditions, you may want

to use a plated screw to avoid rusting. Zinc, cadmium, and nickel are used for coating steel screws. Brass screws are used to resist corrosion by salt water, and for decorative effects.

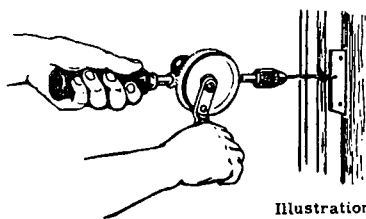


Illustration Courtesy of Stanley Tools

In joining two pieces of wood with screws, a hand drill is a great help. Use the following procedure:

1. Select a bit equal in size to the shank of the screw. (See table for size.) Drill a hole equal in depth to the length of the shank.
2. Using a bit slightly smaller than the diameter of the screw as meas-

ured between threads, make the hole equal in depth to the length of the screw. (See illustration at bottom of page 14.) The bit size for each size screw is shown in the table.

3. If you are using flat head screws, countersink for the heads. In soft wood, you may find that countersinking is not necessary.

If you have many screws to drive, you will find some sort of depth gauge handy. One method that may be used is to drill a hole through a dowel, so that it fits over the bit to be used. This dowel is cut off so that when you slide it over the bit and against the chuck of the drill, only enough bit is left exposed to make a hole of the depth wanted.

Soap applied to the threads of a screw make it much easier to drive in hard wood.

Remember the rules for proper use of the screwdriver.

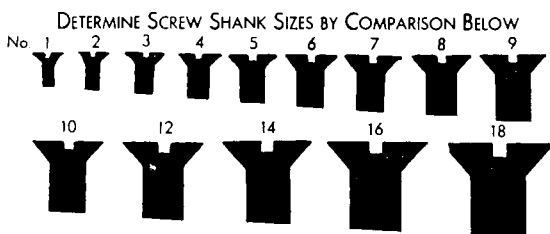


Table Courtesy of Stanley Tools

### SIZES OF BITS OR DRILLS TO BORE HOLES FOR WOOD SCREWS

NUMBER OF SCREW	1	2	3	4	5	6	7	8	9	10	12	14	16	18			
BODY DIAMETER OF SCREW	.073	.086	.099	.112	.125	.138	.151	.164	.177	.190	.216	.242	.268	.294			
	$\frac{5}{64}$	$\frac{3}{32}$	$\frac{3}{32}$	$\frac{7}{64}$	$\frac{1}{8}$	$\frac{9}{64}$	$\frac{5}{32}$	$\frac{11}{64}$	$\frac{11}{64}$	$\frac{3}{16}$	$\frac{7}{32}$	$\frac{15}{64}$	$\frac{17}{64}$	$\frac{19}{64}$			
FIRST HOLE	TWIST DRILL SIZE		$\frac{5}{64}$	$\frac{3}{32}$	$\frac{7}{64}$	$\frac{7}{64}$	$\frac{1}{8}$	$\frac{9}{64}$	$\frac{5}{32}$	$\frac{11}{64}$	$\frac{3}{16}$	$\frac{3}{16}$	$\frac{7}{32}$	$\frac{1}{4}$	$\frac{17}{64}$	$\frac{19}{64}$	
	AUGER BIT NUMBER							3	3	3	3	4	4	4	5	5	
SECOND HOLE	TWIST DRILL SIZE			$\frac{1}{16}$	$\frac{1}{16}$	$\frac{5}{64}$	$\frac{5}{64}$		$\frac{3}{32}$	$\frac{7}{64}$	$\frac{7}{64}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{9}{64}$	$\frac{5}{32}$	$\frac{3}{16}$	$\frac{13}{64}$
	AUGER BIT NUMBER													3	3	4	

EXACT SIZES CANNOT BE GIVEN FOR THE HOLES FOR WOOD SCREWS. THE ABOVE ARE APPROXIMATELY RIGHT FOR AVERAGE NEEDS. VARIATIONS IN HARD AND SOFT WOOD, MOISTURE CONTENT AND SNUG OR LOOSE FITS, IF DESIRED, SHOULD BE CONSIDERED. NUMBER AND LETTER SIZES OF DRILLS ARE AVAILABLE, IF MORE EXACT SIZES ARE WANTED. A TRIAL FIT IN SCRAP WOOD IS PRACTICAL.



# DOOR STOP

With this wedge type door stop, a door may be held open as desired. Very little material is needed and the construction is simple. This is a good project for practice.

## MATERIALS NEEDED

Stock: Soft wood free of knots  
1 piece, 1" x 1'2"  
2—1½" No. 8 flathead  
2—½" No. 8 flathead screws

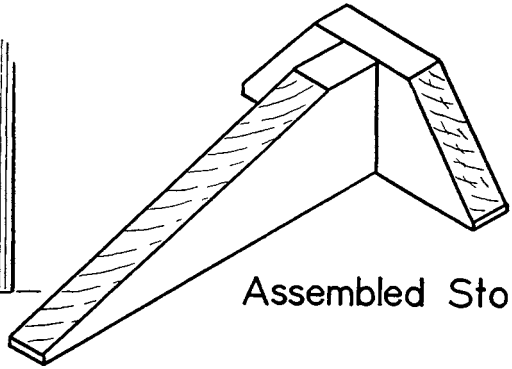
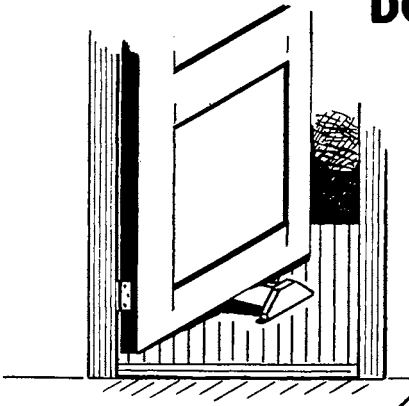
## TOOLS NEEDED

Try square            Rule  
Screwdriver        Plane  
Cross cut saw      Pencil  
Brace and bit      Rip Saw  
Marking gauge (if available)

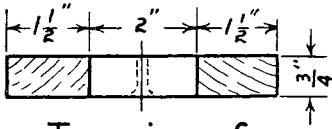
## CONSTRUCTION STEPS:

1. Square the stock
  - a. Select best face—plane smooth if necessary.
  - b. Select best edge—plane square with face—check with try square as illustrated on page 13.
  - c. Mark to correct width and rip about ⅛" outside of this line. (Use marking gauge if one is available.)
  - d. Reduce to correct width by planing and squaring with other edge.
  - e. Square one end being careful not to splinter edges.
2. Mark to correct length for back block. Saw about 1/16" outside of this line.
3. Plane and square block to correct length.
4. Square one end of remaining stock being careful not to splinter edges.
5. Mark to correct length for wedge. Saw as accurately as possible.
6. Mark for correct shape of wedge. Saw slightly outside of this line. Caution: This wedge must have an edge approximately ⅛" thick as shown to prevent splintering.
7. Reduce to correct size by planing and squaring.
8. Assemble with No. 8 screws, countersinking as shown. Refer to the table on page 15 when making selection of correct sizes of bits for holes and countersinking.
9. Sandpaper all surfaces.
10. Finish with either paint or stain, depending upon finish of other wood-work where stop is to be used.

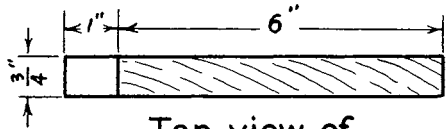
# DOOR STOP



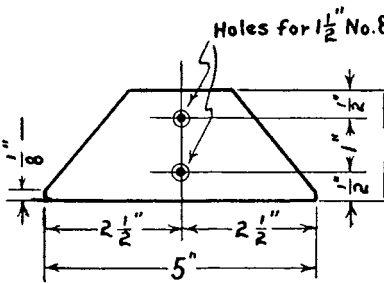
Assembled Stop



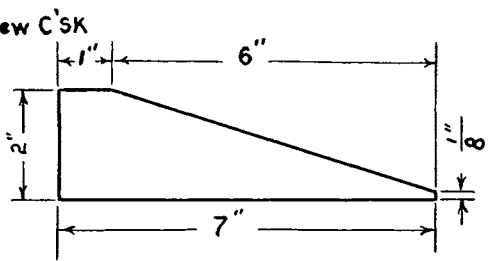
Top view of back block



Top view of wedge block



Front view of back block



Side view of wedge block

# BROOM HOLDER

A broom will last longer if hung with the bristles up. Here is a holder that will do the job.

## MATERIALS NEEDED

Stock: White pine or some other soft wood  
1 piece—1" x 6" x 12"  
1 piece—1" x 4" x 8"  
4—1½" No. 8 flathead screws

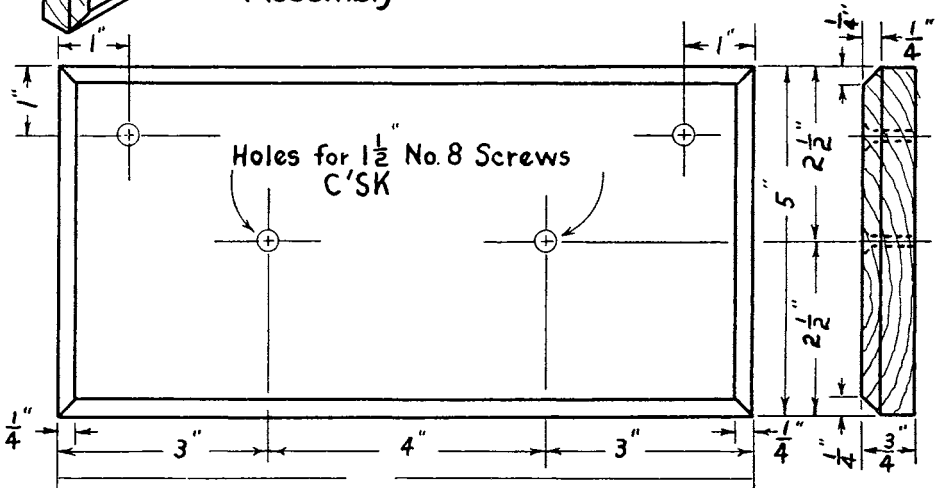
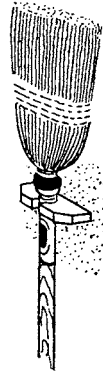
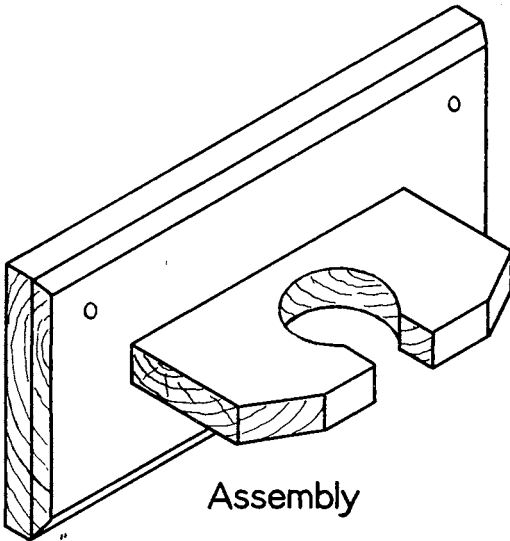
## TOOLS NEEDED

Try square      Rule  
Screwdriver      Plane  
Cross cut saw      Pencil  
Brace and bits      Wood rasp

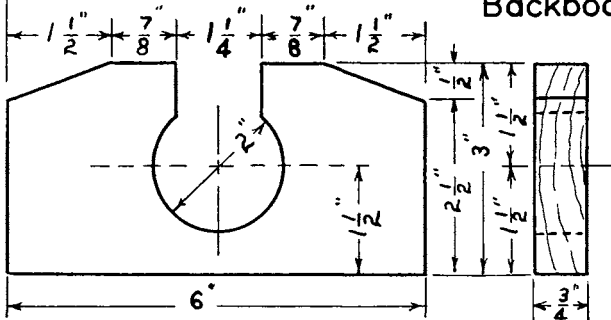
## CONSTRUCTION STEPS:

1. Square the stock for backboard.
  - a. Select best face—plane smooth if necessary.
  - b. Select best edge—plane square with working face—check with try square as illustrated on chart.
  - c. Reduce to correct width by planing and squaring other edge.
  - d. Square one end, being careful not to splinter edges.
  - e. Mark to correct length and saw about 1/16" outside of this line.
  - f. Plane and square to correct length.
2. Chamfer (plane at an angle) the top edges as shown in the drawing.
3. Make holes for the screws using correct size bit, as shown on page 15, for No. 8 screws.
4. Square the stock for the holder.
5. Cut off front corners as shown in drawing.
6. Drill hold for handle with either a 2" or an expansive bit. (A coping saw can be used.)
7. Cut entrance to this hole.
8. Smooth top edge of the hole and entrance with a rasp or coarse sandpaper.
9. Assemble with No. 8 screws, countersinking as shown.
10. Sandpaper all surfaces.
11. Finish to match the woodwork where the holder is to be used.
12. Fasten in place with nails or screws being careful not to mark finished surface.

# BROOM HOLDER



Backboard



Holder

# NECKTIE RACK

Keep them neat. Here is a necktie or towel rack that can be put to good use.

## STOCK

- 1 piece, 1/2" x 4" x 12" soft wood
- 2 pieces, 3/4" x 2" x 2" soft wood
- 1 piece, 1/2" dowel, 12" long
- 2 No. 9 1 1/2" screws

## TOOLS

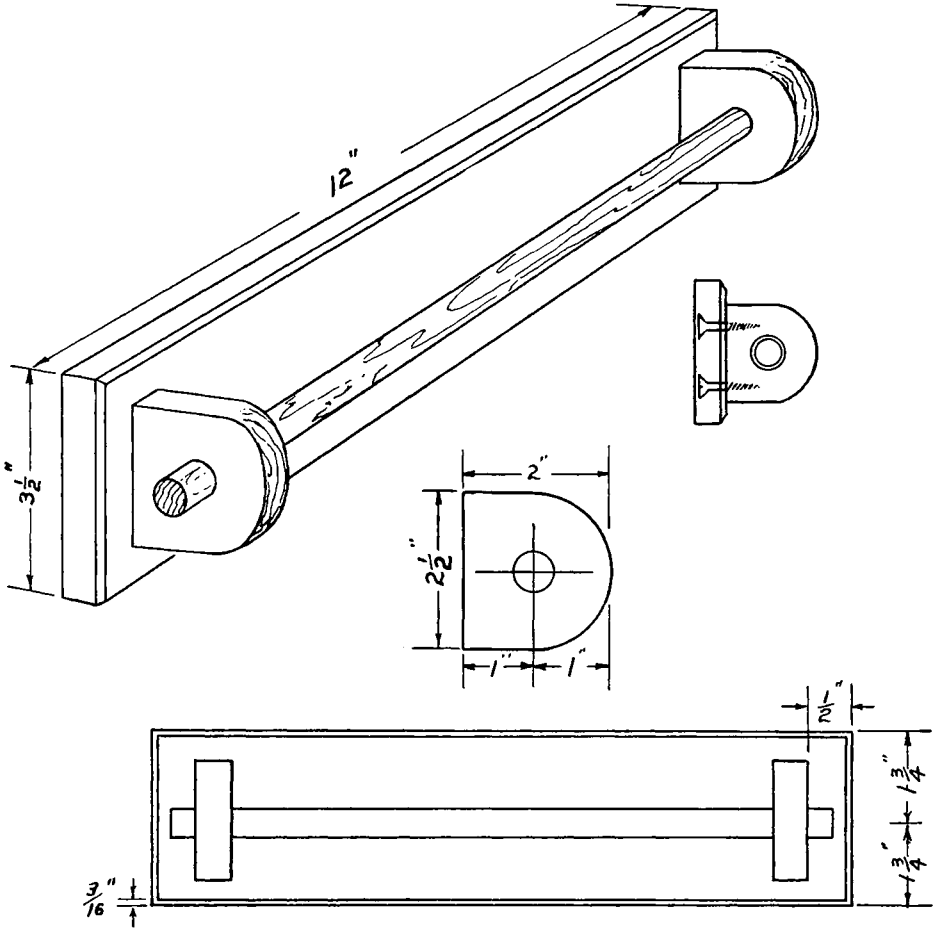
- Wood rasp
- Coping saw
- Screwdriver
- Hand drill and bit
- Saw
- Plane

## CONSTRUCTION STEPS:

1. Mark and cut the 12" x 4" back to size. Use the plane to put a 3/16" bevel around the board.
2. Lay out the brackets on 3/4" wood. Cut to approximate shape with a saw. (You can use the coping saw on this.) Smooth to line with a block plane or a wood rasp.
3. Drill 1/2 inch holes in bracket. Use care in centering the bit. Be sure that it is the same size as the dowel.
4. Cut the dowel 11 1/2" long. Round ends slightly with a wood rasp.
5. Assemble as shown. Refer to page 15 for information on screws.
6. Finish to match wood work.

**Note:** Use dividers to lay out bracket: Mark exact center and set the dividers for 1" radius. The 1/2" hole for the dowel will be drilled in the center of the block.

# NECKTIE RACK



# KNIFE RACK

A knife rack hung in the kitchen provides a safe and neat storage for kitchen knives. This rack, as shown, provides space for five knives up to 12" long. You can shorten or lengthen it if you wish to fit the longest knife that you use. The width also can be varied for any number of knives.

## STOCK

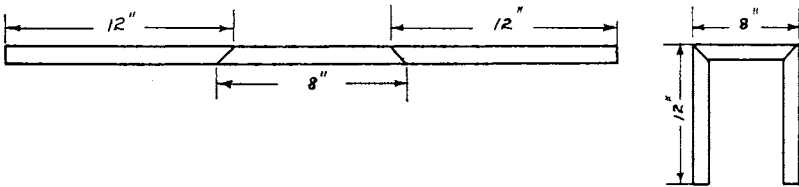
- 1 piece, ¼" x 8" x 15" plywood—back
- 1 piece, ¼" x 8" x 12" plywood—front
- 1 piece, 1" x 3" x 8" soft wood—top
- 2 pieces, 1" x 3" x 12" soft wood—sides
- ¼ pound 3d nails

## TOOLS

- Hammer
- Mitre box
- Try square
- Marking gauge
- Rip and cross cut saw
- Rule
- Plane

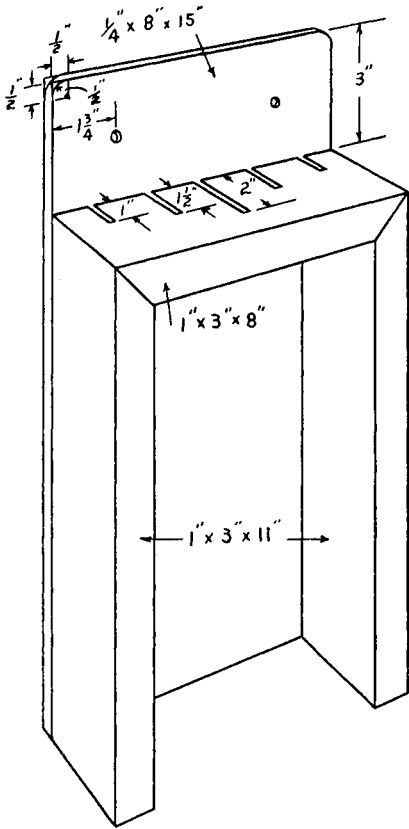
## CONSTRUCTION STEPS:

1. Reduce the stock to width. Since this is to be used in the house, take special care to see that all joints fit.
2. Cut back, 8" x 15". Use an ordinary compass or dividers to lay out rounded corners. A coping saw can be used to cut the rounded corners, or a wood file and ordinary saw may be used.
3. Cut the top and sides as shown below. If you do not have a mitre box, you may use butt joints. In that case, cut the top 8" long and the sides 11¼" long.

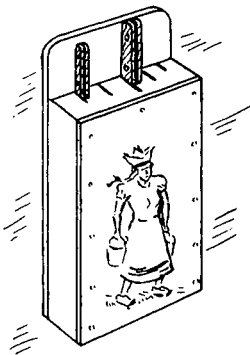
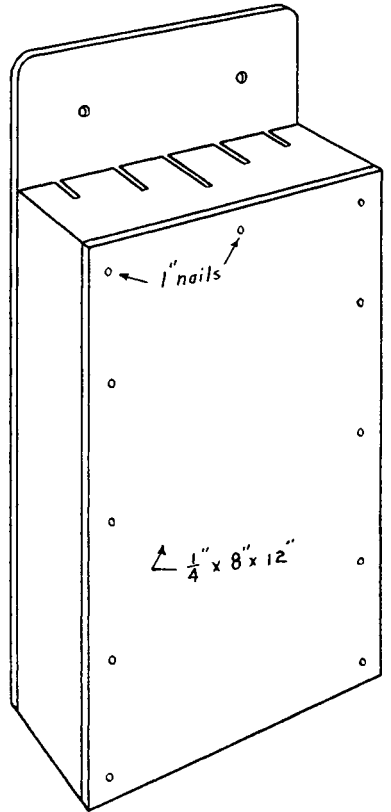


4. Mark and cut knife slots in top piece.
5. Fasten this piece to the back, 3" from the top.
6. Fasten the side pieces to the plywood back, being sure that the points are tight where they join the top piece.
7. Nail the front piece to the sides and top.
8. Sand and paint to match the kitchen woodwork. A decal may be used for added decoration.

You may want to do this after you make the mitre box on page 32.



# KNIFE RACK





# FILE CABINET

This will be handy in the farm shop or office for the filing of records and plans. It may be used on a table or desk, or it may be fastened to the wall above your work bench.

## MATERIALS NEEDED

Stock: Good quality fir or pine  
1 piece,  $\frac{1}{2}$ " x 6" x 8'0"  
1 piece, 1'1" x 1'6",  $\frac{1}{4}$ " plywood or Presdwood  
Nails: 8 2d finish  
Screws: 38 1" No. 6 flathead

## TOOLS NEEDED

Saw  
Hammer  
Try square  
Screwdriver  
Brace and bits  
Rule  
Pencil

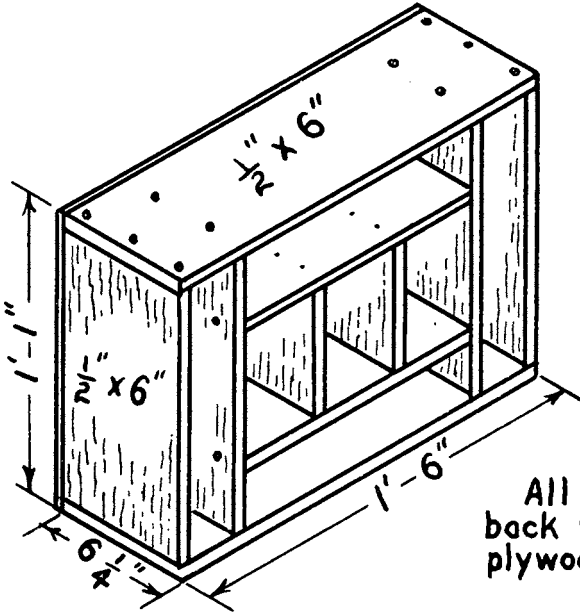
## HOW TO MAKE IT:

1. Cut all pieces to sizes indicated on the drawing.
2. Assemble top, bottom, sides, and back with screws.
3. Assemble shelves and partitions with screws and nails as shown before placing these in the cabinet.
4. Fasten shelf and partition assembly in cabinet with screws.

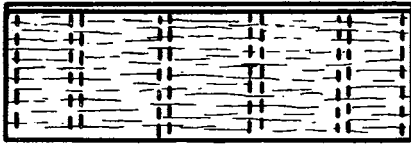
## FINISH:

Finish the cabinet to match the desk or table on which it will stand. If it is to be fastened to a wall, paint or varnish to match the woodwork.

# FILE CABINET

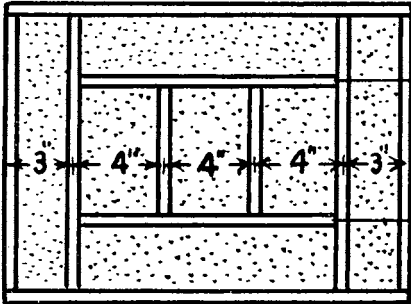


All  $\frac{1}{2}'' \times 6''$  material except back which is 3 thickness plywood or presdwood.

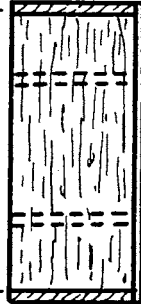


Top

$1'-6''$



Front



Side

# BENCH HOOK

A bench hook is handy for holding your work while sawing, planing, chiseling, etc. Make one now—it will save time on later projects.

## MATERIALS NEEDED

Stock: Pine or Fir  
1 piece of 1" x 8" x 10"  
1 piece of 1" x 2" x 8"  
1 piece of 2" x 2" x 7"  
2—2" No. 8 screws  
3—1¼" No. 8 screws

## TOOLS NEEDED

Plane  
Try square  
Screwdriver  
Cross cut saw  
Marking gauge—if available  
Brace and bits or hand drill  
Rule  
Pencil

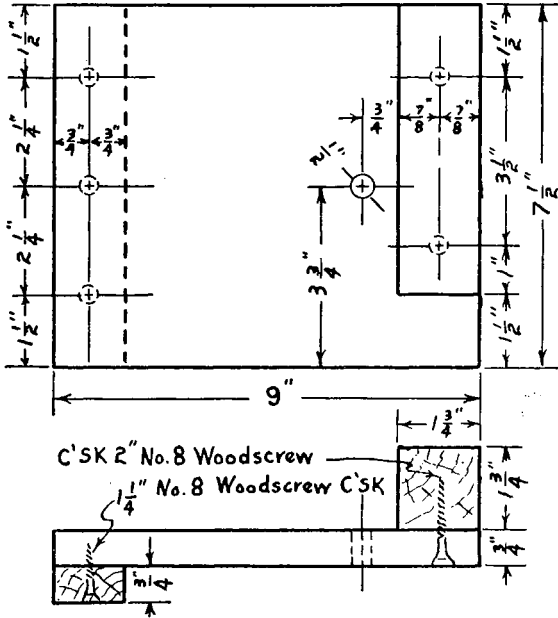
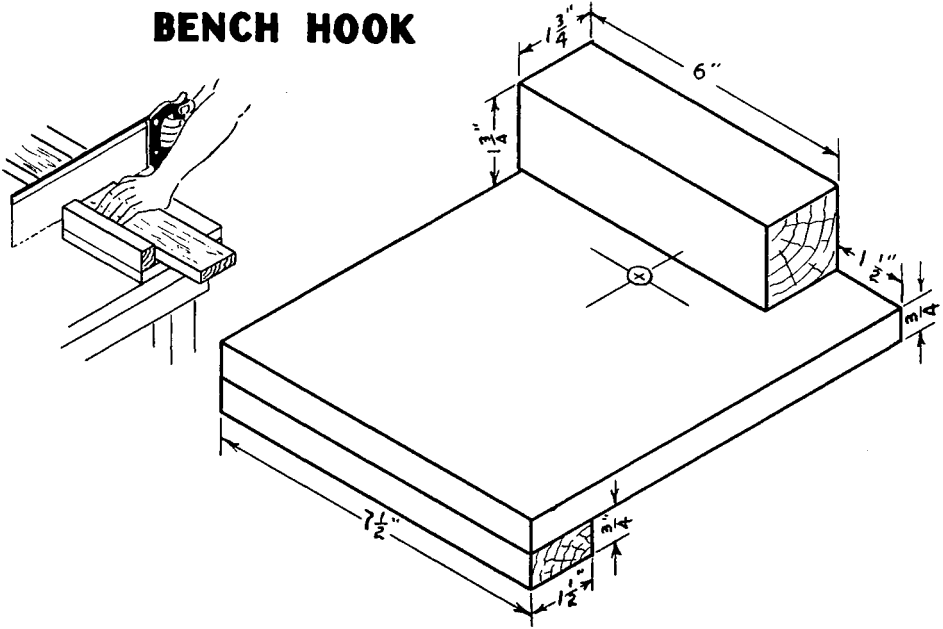
## CONSTRUCTION STEPS:

1. Square the stock
  - a. Select the best face—plane smooth if needed.
  - b. Select best edge—plane square with working face—check with try square.
  - c. Mark to correct length (9")
  - d. Saw or plane to correct length.
  - e. Square and plane ends, if necessary, being careful not to splinter edges.
  - f. Mark to correct width of 7½".
  - g. Reduce to correct width either by planing or sawing. Rip saw needed if the latter method is used.
2. Plane 1" x 2" x 8" smooth if necessary.
3. Mark and cut to correct length—7½". The length of this piece must equal the width of the 7½" x 9" board.
4. Plane the 2" x 2" x 7" smooth, if necessary.
5. Mark and cut to the correct length (6") being sure the ends are square. One method is to square one end and then mark and saw about 1/16" outside the line for the other end. Square the second with a plane, cutting it down to the mark.
6. Assemble with screws, using the bits as indicated on page 15 for No. 8 screws.
7. Bore a ½" hole in the board as indicated so bench hook may be hung up when not in use.

## THIS ARTICLE NEEDS NO FINISH.

**Note:** Should the bench hook be made for a left-handed person, the large cleat should be fastened so that the 1½" space would be at the other end of it.

# BENCH HOOK



# HOME BENCH VISE

This vise will hold material for planing. It depends on the wedging action of the free block (B). The other two parts are fastened to the surface of a work bench.

## MATERIALS NEEDED

Stock: Oak or other hardwood  
1 piece of 2" x 10" x 10"  
or  
1 piece of 2" x 8" x 10" and  
1 piece of 2" x 2" x 10"  
10—3" No. 12 flathead screws

## TOOLS NEEDED

Rip saw  
Try square  
Plane  
Rule  
Pencil  
Screwdriver

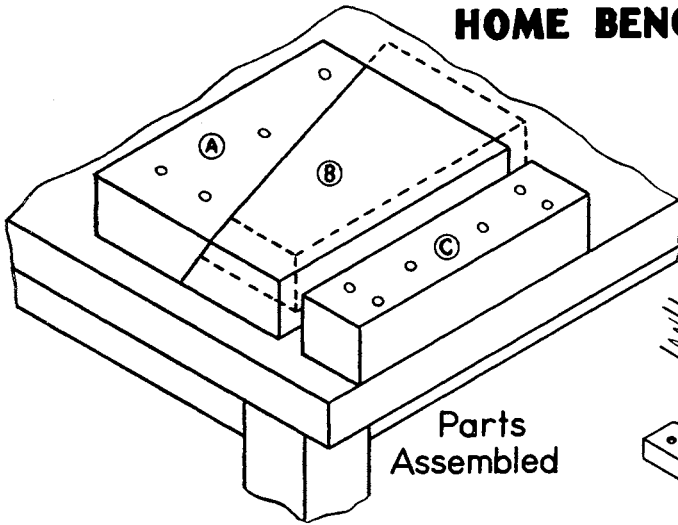
## CONSTRUCTION STEPS:

1. Rip a piece 2" x 2" x 10" from the original stock if it is 2" x 10".
2. Square the stock—both pieces
  - a. Select best face, plane smooth.
  - b. Select best edge—plane square with working face—check with try square.
  - c. Square the other edge.
  - d. Square the ends—plane if necessary being careful not to split the ends.
3. Mark "B" and "A" as shown. Have the leader check your layout. Care must be used. The wedging effect depends on accurate layout and sawing.
4. Fasten "C" to bench as shown in drawing with 6 No. 12 flathead screws.
5. Fasten "A" to bench so that when "B" is in place a  $\frac{3}{4}$ " space will be left between "B" and "C".

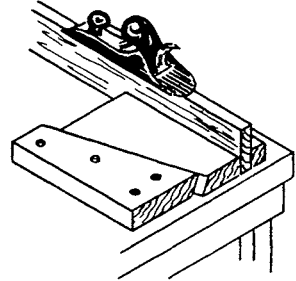
## THIS ARTICLE NEEDS NO FINISH.

**Note:** Should the bench vise be made for a left-handed person, the end measurements of "A" and "B" should be changed end for end. Have your leader check your layout before you do any cutting, if you are in doubt. See page 15 for information on screws.

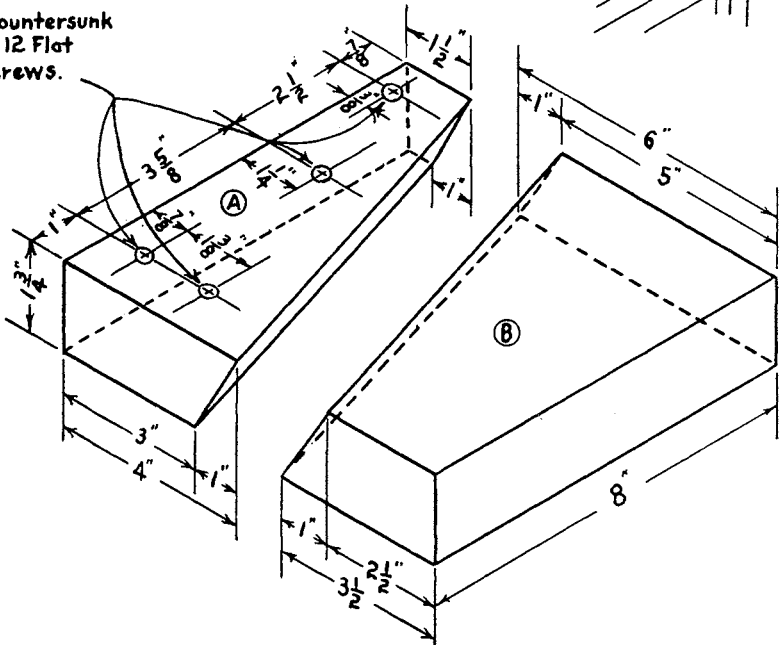
# HOME BENCH VISE



Parts  
Assembled



Holes Countersunk  
for 3" #12 Flat  
Head screws.



# BIRD HOUSE (WREN)

Here is a home for your friend, the wren. The smallest of our song birds, the wren likes a snug house with a small opening. Build this one for him. Place it from 6 to 10 feet **above** the ground. Do not let the opening face the prevailing winds.

## MATERIALS NEEDED

Stock: An easily workable wood such as pine or yellow poplar  
1 piece,  $\frac{1}{2}$ " x 8" x 5'0"  
Heavy waterproof roofing  
1 piece, 2" x 8"  
Screws: 14—1" No. 8 flathead screws  
Tacks: 8 small carpet tacks  
Nails: 6 to 12 needed

## TOOLS NEEDED

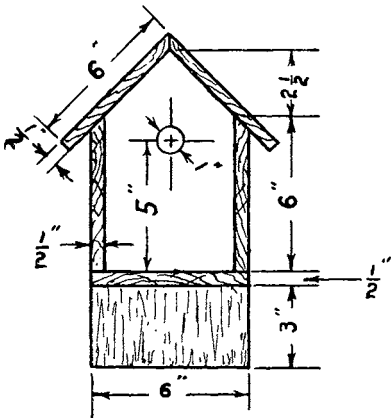
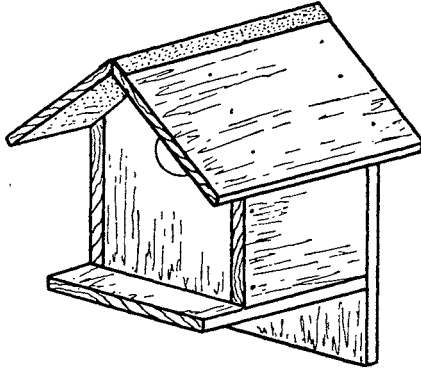
Screwdriver  
Hammer  
Cross cut saw  
Rip saw  
Marking gauge  
Carpenter's square  
Plane  
Brace and bit  
Pencil

## CONSTRUCTION STEPS:

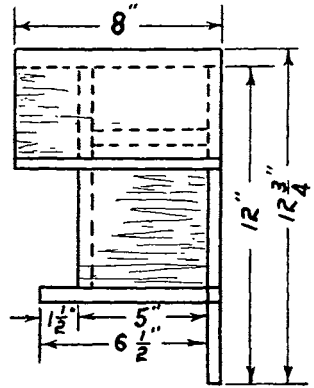
1. Reduce the stock to 6" width.
  - a. Mark for correct width of 6" with marking gauge.
  - b. Rip about  $\frac{1}{8}$ " outside this line.
  - c. Reduce to line with plane.
2. Cut two pieces 5" long for sides.
3. Cut one piece 6 $\frac{1}{2}$ " long for floor.
4. Cut one piece 12" long for back. Cut to correct gable for roof.
5. Cut two pieces 8" long for roof.
6. Cut one piece 8 $\frac{1}{2}$ " long x 5" wide for front.
  - a. Cut to correct gable for roof. (Check with back piece.)
  - b. Bore 1" hole for entrance. ( $\frac{15}{16}$ " is better.)
7. Fasten side pieces to front and back piece to them with screws.
8. Plane the top edge of the sides to conform with the slope of the gable ends.
9. Tack one roof board in place as shown at "A" on working drawing and mark for ridge bevel.
10. Remove and place to correct bevel.
11. Repeat steps 10 and 11 for other roof board.
12. Fasten roof boards in place with 6d nails.
13. Cover ridge with roofing paper as shown.
14. Fasten floor board in place with screws.

**FINISH:** This article may be left without finish or may be stained some dark color. Birds do not like fresh paint. Fill the house half full of rags, and you will find the wrens more likely to move in.

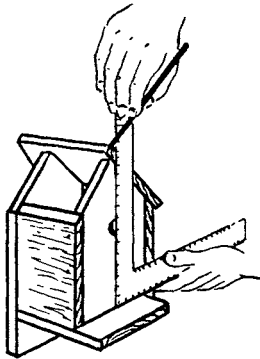
# BIRD HOUSE



Front view



Side view





# MITRE BOX

A mitre box will help you do many jobs. It will assure square ends and accurate 45° cuts if properly constructed and properly used.

## MATERIALS NEEDED

Stock: Oak and fir  
2 pieces,  $\frac{3}{4}$ " x  $5\frac{1}{2}$ " x 2'0"—oak  
1 piece,  $1\frac{3}{4}$ " x  $5\frac{1}{4}$ " x 2'0"—fir  
Screws: 8 No. 8  $1\frac{1}{2}$ " flathead screws

## TOOLS NEEDED

Brace and bit	Rule
Cross cut saw	Plane
Marking gauge	Pencil
Carpenter's square	Rip saw

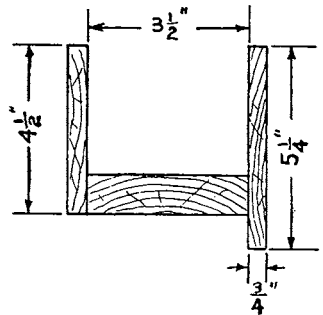
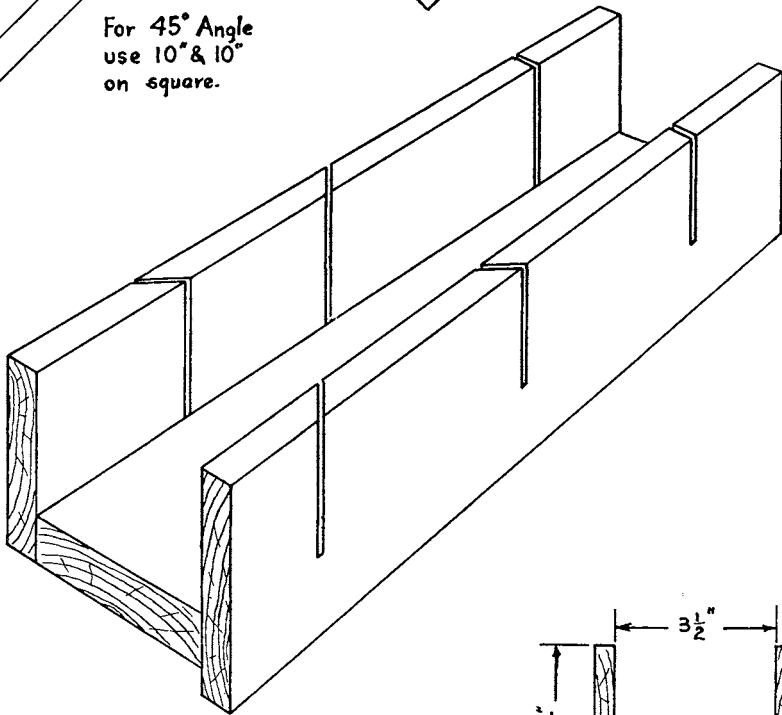
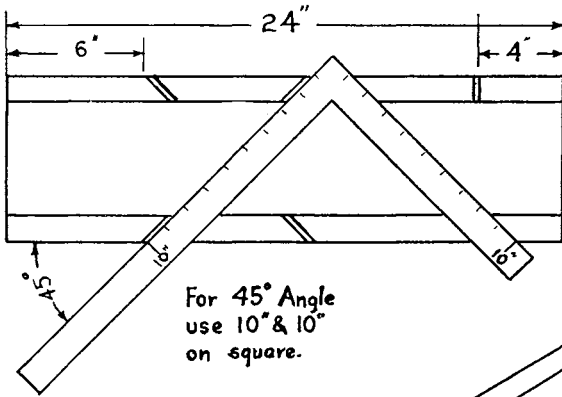
## CONSTRUCTION HINTS:

1. Cut bottom to correct size.
2. Cut sides to correct width and length.  
Caution: One side is  $\frac{1}{2}$ " wider than the other.
3. Fasten sides to bottom with screws being sure that the wider side projects below the bottom  $\frac{1}{2}$ " so it may be held against bench more securely when used.
4. Mark for the cuts at the correct places.
  - a. Use a large square so marks on both sides will be in a straight line.
  - b. Vertical lines on the inside of the back piece and the outside of the front piece will help greatly in making straight saw cuts.

**FINISH:** This article needs no finish.

**Note:** If you wish, you can make the sides equal in width and have a flat bottomed box, which can be held against a block while sawing.

# MITRE BOX



# NAIL BOX

You will find this just the thing for those little jobs where you need a few small tools and some nails and screws. It will come in handy for fixing fence too. There is plenty of room for hammers, pliers, and staples.

## MATERIALS NEEDED

Stock: Good quality soft wood  
1 piece, 1" x 4" x 5'0"—sides and partitions  
1 piece, 1" x 8" x 1'6"—ends  
1 piece, 1" x 10" x 1'3"—bottom  
33 5d finish nails (for partitions and bottom)  
2—2" No. 10 flathead screws (for handle)  
6—2" No. 7 flathead screws (for ends)

## TOOLS NEEDED

Plane                    Rule  
Square                  Pencil  
Hammer  
Screwdriver  
Brace and bits  
Marking gauge  
Cross cut and rip saws

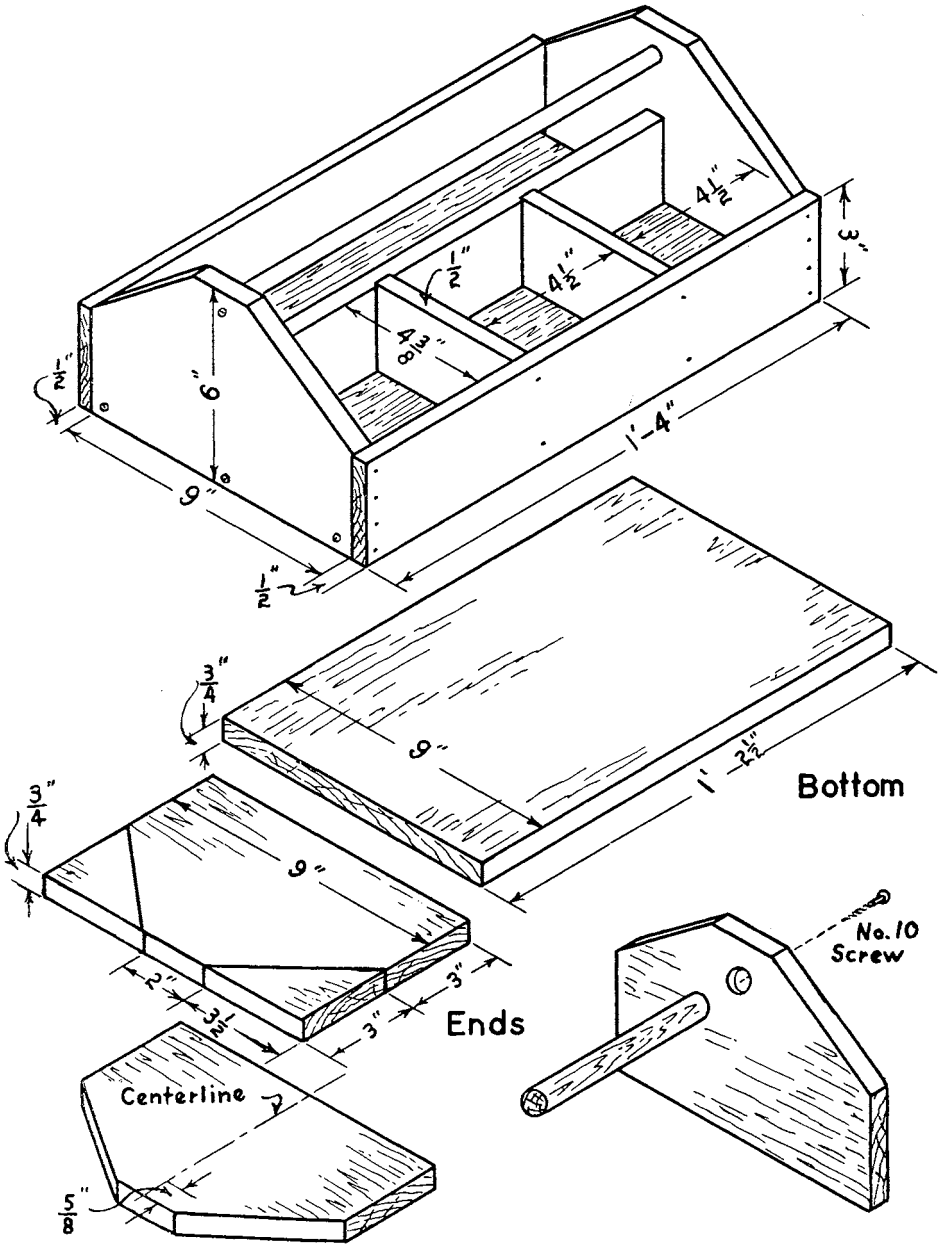
## HOW TO MAKE IT:

Study the drawing. All dimensions are noted. Lay out the work on your material.

1. Make the bottom. Because the bottom goes inside of the sides and ends, special care should be taken to see that it is square.
2. Make the sides.
3. Make the ends.
4. Make the handle. You can use an old broom stick for this. Choose a piece that is sound and that has straight grain.
5. Make the partitions.
6. Assemble the box.

If you wish, you may make vertical cleats to strengthen the ends. Or you can cut them from a 1" x 10" board, with the grain running up and down, rather than length-wise. If you have any heavy scraps of plywood ( $\frac{1}{2}$ " or thicker) you can make the ends that will not split.

# NAIL BOX



# SAW HORSE

A pair of these will be handy, and it takes less work if they are made at the same time. The second will count as  $\frac{1}{2}$  an article.

## MATERIALS NEEDED

Stock: Fir  
1 piece, 2" x 6" x 4'0" (length may be varied as desired)  
1 piece, 1" x 6" x 12'0"  
1 piece, 1" x 10" x 4'0"  
Nails: 16—8d common  
16—6d box

## TOOLS NEEDED

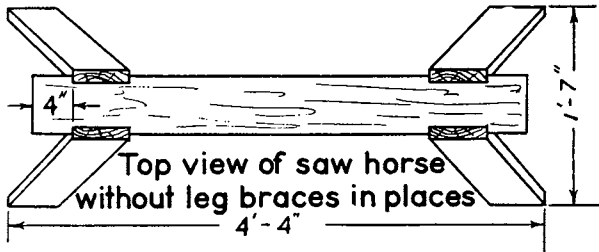
Hammer                      Rule  
Rip saw                      Pencil  
Cross cut saw  
Carpenter's square  
Try square (if available)  
1" Wood chisel (if available)

## CONSTRUCTION HINTS:

1. Study the plan carefully and understand all dimensions before cutting any of the pieces.
2. Cut the top 2" x 6" to required length.
3. Cut the four legs to required length. Note use of the square.
4. Notch the top pieces to receive the legs. (This is the hardest part of the whole job, as the slope of the notch governs the angle at which the legs stand.) Use your chisel carefully. Read instructions on page 11.
5. Set the legs in the notches in the top pieces. Nail as shown, using 8d nails.
6. Cut the leg braces and fit them into the legs. Nail as shown, using 6d box nails.

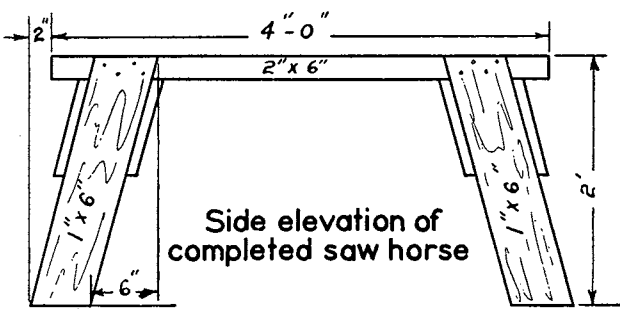
## FINISH:

These may be finished or not, as desired. Finish will add to the appearance. Sand smooth before finish is applied.

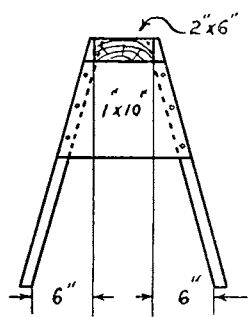


# SAW HORSE

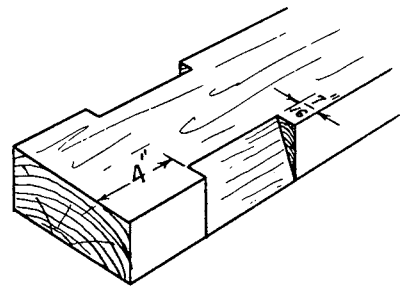
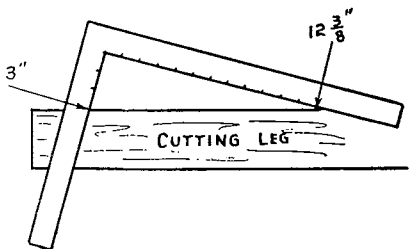
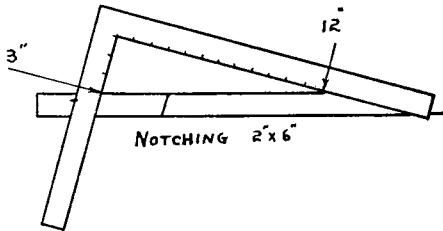
Top view of saw horse  
without leg braces in places



Side elevation of  
completed saw horse



End elevation



# HANDY BENCH

## MATERIALS NEEDED

Stock: Knot-free pine or fir  
1 piece, 1" x 12" x 4'0"—pine  
2 pieces, 1" x 8" x 4'0"  
1 piece, 1" x 10" x 3'0"  
Screws:  
6 No. 8 2" flathead  
12—4d common nails  
10—5d finishing nails

## TOOLS NEEDED

Hammer  
Cross cut saw  
Rule  
Carpenter's square  
Nail set  
Brace and bit

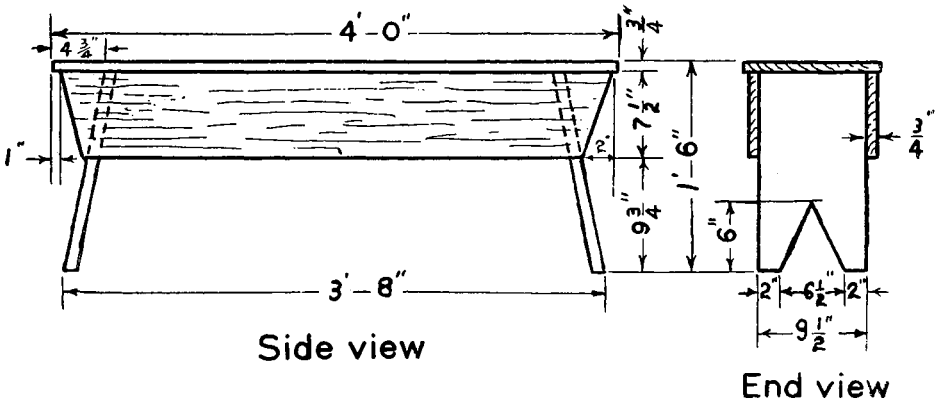
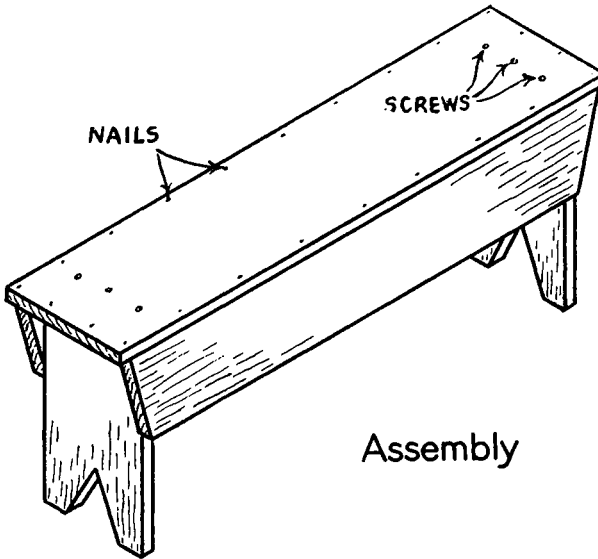
## CONSTRUCTION HINTS:

1. Cut top to size.
2. Cut side boards to correct length and angle.
3. Cut and notch legs. To find correct angle for top and bottom of the legs use  $17\frac{1}{4}''$  and  $3\frac{3}{4}''$  on your square. (See page 37 for illustration.)
4. Mark location of legs on top piece and bore holes for screws.
5. Fasten legs to top with screws.
6. Nail sides to legs and top to sides.

## FINISH:

Sand smooth and paint. Follow instructions as given on the paint can.

# BENCH





# WALL DESK

This desk will be handy in your shop or in your room. It takes little space and affords storage for papers and plans.

## MATERIALS NEEDED

Stock: Knot-free pine or fir

Bottom: 1 piece, 1" x 8" x 2'0"

Top, sides, and partitions: 1 piece, ½" x 8" x 10'0".

Drawer: 1 piece, ½" x 6" x 3'0"

Back: 1 piece, ¼" x 1'6" x 2'0" plywood or Presdwood

Lid: 1 piece, ¼" x 1'4" x 2'0" plywood or Presdwood

1 piece, 1" x 2" x 7'0"

Optional lid: 1 piece, ½" x 1'4" x 2'0" plywood. (No 1" x 2" reinforcement is needed with the heavier plywood)

Drawer bottom: 1 piece, ¼" x 8" x 12" plywood

Cleats: 1 piece, ½" x ½" x 4'0". (You might prefer ripping this from a wider ½" board)

Screws: 12—1¾" No. 10 flathead screws for sides

20—1" No. 6 flathead screws for lid and back

Nails: 18—6d finish nails for partitions

12—3d extra-fine No. 16 nails for cleats

16—¾" wire brads for lid frame

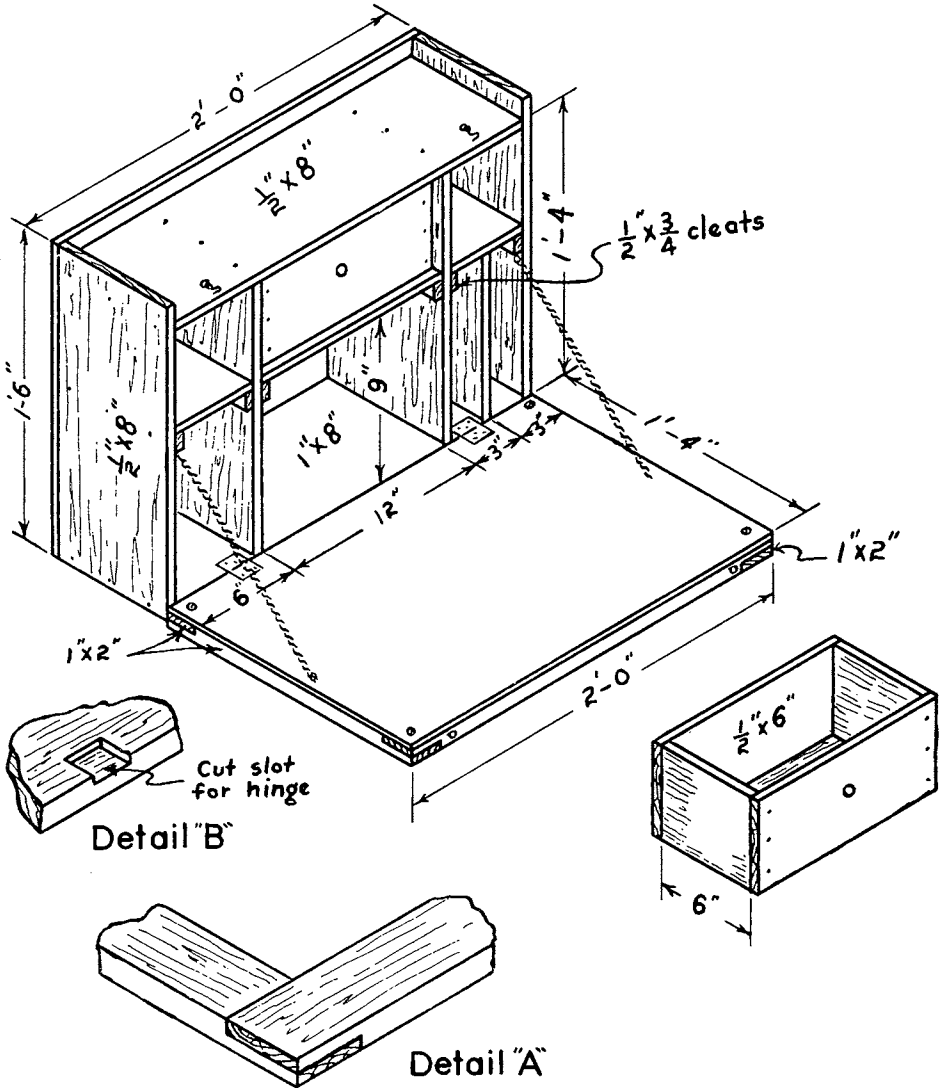
Glue may be used for added strength when fastening the cleats and lid frame.

## HOW TO MAKE IT:

1. Cut bottom, sides, top, and partitions to size.
2. Cut drawer parts to size. Assemble drawer.
3. Mark position of the two long partitions, using the drawer as a guide for the distance between them.
4. Cut shelf material to size.
5. Mark for cleat positions using drawer and shelf material as a guide for the distance between top of cleat and bottom of top.
6. Make cleats and nail in position on sides and partitions.
7. Assemble sides, back, top, bottom, and partitions.
8. Make frame for lid. Note detail "A". If you use ½" plywood for the lid, the frame will not be needed.
9. Fasten plywood or Presdwood to lid frame with screws. Glue may be used if desired.
10. Fasten lid to desk. If you use a chisel to set the hinges in, be careful. Read the material on the use of chisels on pages 10-11.

FINISH: Stain and varnish, or paint to match other furniture or woodwork.

# WALL DESK



# TOOL BOX

A tool box which can be locked is handy where tools are moved from one job to another. This box is large enough for the tools of most club members. It will help you to keep your tools dry, clean, and in order.

Perhaps you have need of a larger box. You can add to the dimensions of this—make it deeper, wider, or longer. It could be designed to hold the equipment that you need for showing livestock.

## MATERIALS NEEDED

Stock: Pine or fir  
2 pieces,  $\frac{1}{2}$ " x 14" x 32" plywood—top and bottom  
1 piece,  $\frac{3}{4}$ " x 6" x 7'0" sides and ends  
1 piece,  $\frac{1}{2}$ " x 13 $\frac{1}{4}$ " x 7'6" sides, ends, partitions for tray  
1 piece,  $\frac{1}{4}$ " x 5" x 30 $\frac{1}{2}$ " plywood—tray bottom  
1 piece,  $\frac{3}{4}$ " x 2" x 4'0" top cleats  
1 piece,  $\frac{1}{2}$ " x 1" x 2'0" cleats for tray  
3 pieces—cleats, and button to hold saw  
Screws:  
1 doz. 1 $\frac{1}{2}$ " No. 9 flathead wood screws (for sides and bottom)  
1 doz. 1" No. 8 flathead wood screws (for cleats)  
Nails: 1 box 1" No. 16 wire brads (for tray and cleats)  
3 steel chest hinges and screws  
2 drawer pulls (steel) and screws  
1 hinge hasp and screws

## TOOLS NEEDED

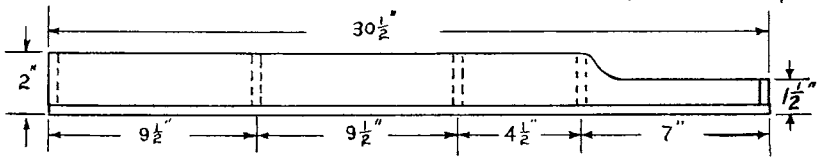
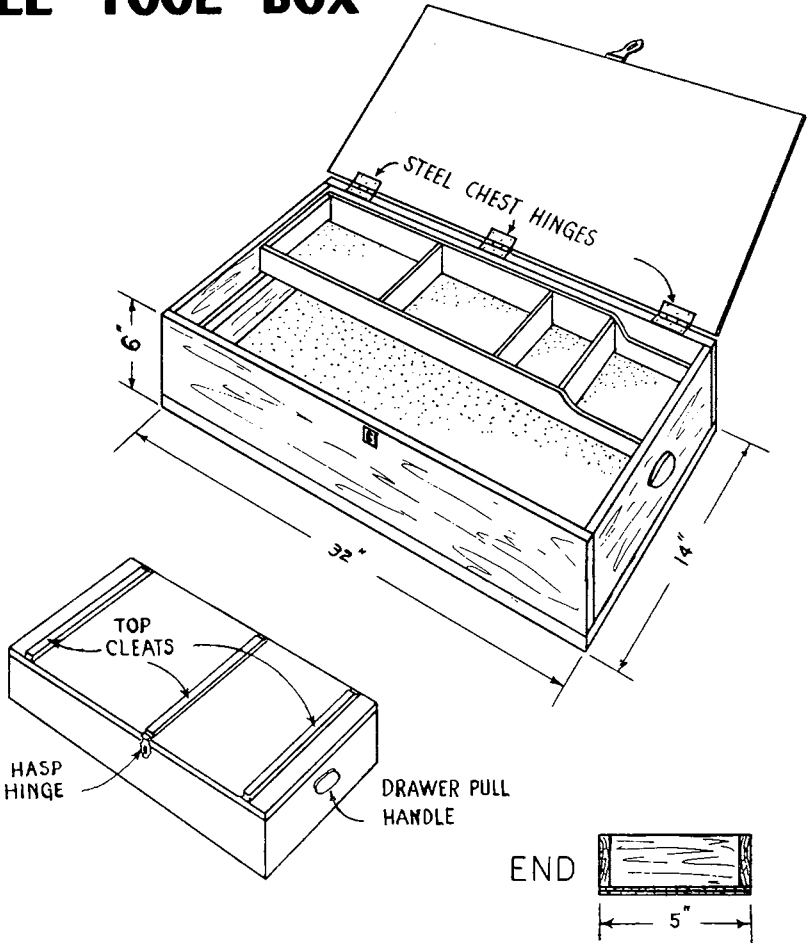
Brace and bits  
Hammer  
Cross cut saw  
Square  
Pencil  
Screwdriver  
Plane  
Wood file  
Rule

## HOW TO MAKE IT:

1. Mark and cut  $\frac{1}{2}$ " plywood for top and bottom. (If you do not have plywood,  $\frac{1}{2}$ " lumber may be used. Add three nailing cleats to bottom for added strength.)
2. Mark and cut sides and ends from 1" x 6" board. The sides will be 32" long, the ends 12 $\frac{1}{2}$ " long.
3. Assemble sides, ends, and bottom.
4. Cut tray sides 30 $\frac{1}{2}$ " long from the  $\frac{1}{2}$ " x 2" board. Check the inside length of the box. The tray should be slightly shorter than the box for easy removal. Cut notches in sides as shown.
5. Cut ends and dividers. Cut tray bottom from  $\frac{1}{4}$ " plywood. Assemble tray.
6. Cut the  $\frac{1}{2}$ " x 1" x 12 $\frac{1}{2}$ " cleats to support tray. Nail these in place so that the top of the tray is  $\frac{1}{4}$ " below the top of the box. Fasten the cleats with two 1" screws.
7. Place top cleats on lid, 3" from each end and one in the center. Fasten with wire brads and two screws.
8. Attach hinges, hasp, and handles. Smooth sharp corners with wood file. Sand smooth and paint.

Cleats and buttons may be added to the lid to hold one or two saws. Glue will help make a stronger assembly of the tray and cleats.

# SMALL TOOL BOX



SIDE  
MOVABLE TRAY

# SHOE RACK

This shoe rack holds four pairs of shoes. If you wish, you can add 8 inches to the width and it will hold six pairs of shoes.

## MATERIALS NEEDED

Stock—knot-free pine or fir  
 2 pieces, 1" x 8" x 18"—ends  
 2 pieces, 1" x 2" x 16"—back rails  
 2 pieces, 1" x 1" x 16"—front rails  
 16—1½" No. 6 flathead wood screws

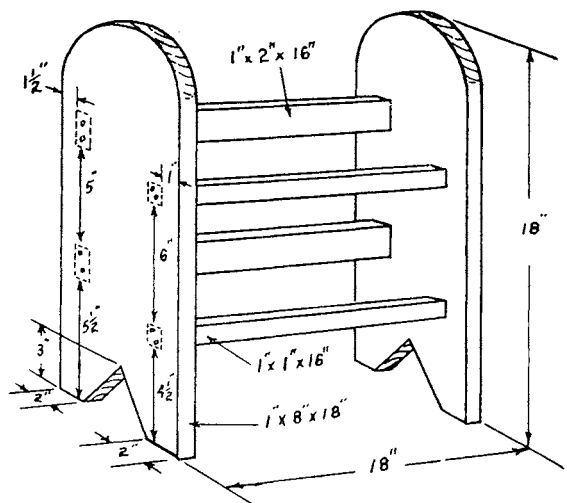
## TOOLS NEEDED

Rip and cross cut saws  
 Rule and square  
 Plane  
 Marking gauge  
 Brace and bits

## HOW TO MAKE IT:

1. Cut the end pieces, 8" x 18". Mark and cut V at the bottom. Set your dividers for half of the width of the board and scribe a half circle so that the line touches the top and sides of the end. Use a coping saw or a turning saw to cut around the outside of this line. Then, with the two ends clamped together in the vice, plane down to the line. Work from the outside toward the center. You may want to use a wood file to finish the curve.
2. Cut two 1" x 2" x 16" pieces for the back rods.
3. Cut two 1" x 1" x 16" pieces for the front rods. These can be made by ripping a 1" by 2" board into two equal pieces.
4. Lay out marks for the shoe rests on the end pieces as shown in the drawing. Use the 1" x 2" support at the back, the 1" x 1" support at the front.
5. Drill screw holes through the end boards as shown on the drawing. (See page 15.)
6. Fasten with screws. You may use glue for added strength if you wish. Countersink the screws so that they are flush with the surface.

FINISH: Sand smooth and paint or stain to match the woodwork or the decorative scheme of the room that the rack is to be used in.

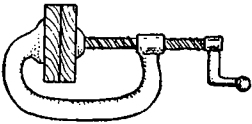


# SHOE RACK

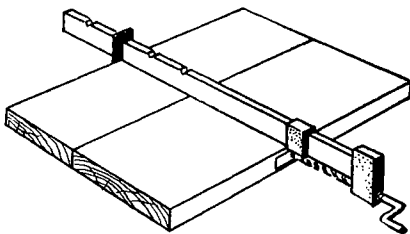
## GLUED JOINTS:

**Glue** holds the entire surface, and if properly used, can make a joint stronger than the original material. A number of glues are available.

**Animal, or hard glue** is most often used in commercial manufacturing of furniture, etc. This glue must be soaked in cold water, then heated to approximately 150 degrees (the glue becomes quite liquid at this temperature). The glue is applied hot to the surface of the wood and the joint clamped together so that there is pressure between the surfaces to be joined. Animal glue is not water-proof.



"C" CLAMP



FURNITURE OR BAR CLAMP

**Casein** is a dry, powdered glue, sold in package form. It can be mixed with cold water, and gives a strong and water-resistant joint. It is especially suitable for home craftwork because no heat is required when it is applied. The joints should be allowed to set under pressure.

There are a number of **liquid glues** on the market in tubes and bottles. The strength of these prepared glues varies widely. They are frequently used in work with model airplanes, toys, etc. Most are not water-proof.

Surfaces to be glued should be smooth and fit snugly. **Dowel** or **mortise and tenon** joints must be tight fitting. Strong joints cannot be made without pressure. Use clamps, if possible. This pressure should not be great enough to distort the joint or crush the wood. Sometimes weights can be used instead of clamps.

Make sure of the following points:

1. Parts should fit properly.
2. Clean parts thoroughly before applying glue.
3. Apply the glue in a thin and even coat.
4. Clamp together tightly, leaving the clamps for at least 4 hours.
5. Allow 24 to 48 hours for the glue to set before handling the article.
6. Remove excess glue by scraping and sanding.

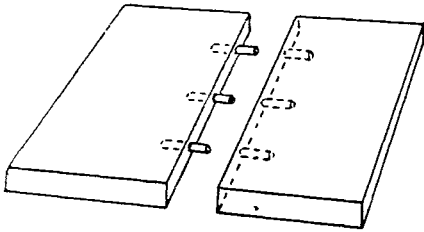
If using hot glue, be sure that everything is ready before starting your work. Have clamps in hand and the work arranged for quick use. Put the pieces together before gluing in order to test the fit.

## DOWELS:

Dowels are wooden pegs, usually made of maple or birch. They can be purchased in diameters of  $\frac{1}{8}$  to  $1\frac{1}{4}$  inches. Cut dowels a trifle shorter than the sum of the depth of the two holes in which they are to be set. In order to check the accuracy of your joint, the work should be clamped together without glue for a trial. If dowel holes are not in line, a dowel should be glued into one or both holes, cut flush, and new holes bored. Check the following points for good work with dowels:

1. Dowels must be dry.
2. Take care in selecting the exact size bit for a snug fit. Brad bits will work better than twist drills.

3. If using hot glue, be sure that the glue remains hot as the dowels are fitted. Apply glue to the dowel holes one at a time, and drive the dowel promptly.



### EDGES JOINED WITH DOWELS

Dowels are used for long edge joints and often substitute for mortise and tenon joints where strength is not too important. Good edge joints can be made without dowels if edges are true and glued with care.

### TYPES OF WOOD:

There are many types of wood available for woodworking. Your selection will be governed by: (1) cost; (2) appearance; (3) strength; (4) ease of working; (5) resistance to warping, rot, etc. Listed below are some of the common woods, with their most important characteristics and uses:

**Ash, White:** Ash is a hard wood with good characteristics as far as strength, shrinkage and warping are concerned. It is susceptible to decay and rather difficult to work. It is generally used for implement handles and vehicle parts.

**Western Cedar** is most commonly used for shingles, siding, posts, etc. It is a soft wood, highly resistant to shrinkage, warping and decay. It is easy to work but not strong.

**Cottonwood** is used in egg cases, boxes, wagon boxes, etc. It is grown locally and, therefore, can be obtained at a low cost. It is moderately

difficult to work and must be rated as poor in the other characteristics.

**Cypress** is used where resistance to decay is of prime importance. It is intermediate in hardness and rates well in most of its characteristics. It is rather expensive.

**Douglas Fir** is widely used in all types of construction. It is of moderate hardness and splits rather easily. Its strength characteristics are good. It is difficult to work.

**Oak** is quite hard and has excellent strength characteristics. It is difficult to work and inclined to shrinkage and warping.

**Pine, Southern Yellow,** is used in construction. It is rather hard, and has good strength characteristics, if there are not too many knots. It is often difficult to finish because of the high resin content.

**Pine, White,** is a soft wood, very easy to work, and has good characteristics as far as shrinkage, warping, etc. is concerned. It is not very strong. It is used in millwork and siding, but has become quite scarce in recent years, and hence is rather expensive.

**Redwood** is of moderate hardness, has good strength characteristics and resistance to decay, warping and shrinkage. It is intermediate in ease of working, and is used for silo and tank construction, etc.

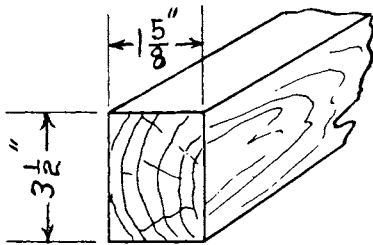
**Walnut** is used mostly for furniture making, is quite hard and strong. Walnut takes a nice finish and hence is prized for use in furniture. It is rather difficult to work and will be used in none of our 4-H projects.

### MEASUREMENT OF LUMBER

Lumber is measured and sold by the board foot. A piece of lumber one foot square and an inch (or less) thick contains one board foot. To find the board feet, use the following:

Thickness (inches) x width (feet) x length (feet). If the width is in inches, divide by 12 for the correct answer. Use the **nominal**, not the **actual** dimension.

**Nominal** size of lumber, as it is sold to you, is greater than actual size. If you ask for a 2 x 4, you will find that it measures about 1 $\frac{5}{8}$ " x 3 $\frac{1}{2}$ "—2" x 4" is the nominal size; 1 $\frac{5}{8}$ " x 3 $\frac{1}{2}$ " is the **actual** size. You will find that an 8-inch board is only 7 $\frac{1}{4}$ " wide. The lumber industry has set these sizes to allow for sawing and surfacing.



A 2 x 4

## FINISHING

Select the finish to provide protection and beauty. There are a great variety of paints, enamels, lacquers, varnishes, and stains on the market. You can choose from an almost unlimited choice of colors and effects.

**Surface preparation** is important, no matter what finish is to be used.

### Painting

1. Have the surface clean and dry. Paint will not stick to waxy, oily, or wet surfaces. Dust will leave a rough "sandpaper" effect.

2. Have the surface smooth. A shiny finish exaggerates imperfections. Use sandpaper, scraper, paint removers, and elbow grease. Fill nail holes with putty **after** the priming coat is applied. Always work **with** the grain.

3. Keep your paint clean. Stir it thoroughly to eliminate lumps and make the color uniform. Using a clean paddle or stick. Strain the paint through wire mesh or cheese cloth if necessary.

4. Dust will stick to wet paint. Paint where dust will not blow on your work. If you are painting in a shop or garage, it may be wise to "wet down" the floors.

5. Let the first coat dry thoroughly before putting on another. Follow the instructions regarding drying time.

6. Spread the paint smoothly, watching for runs and thick spots. When painting wood, brush with the grain. Do not "scrub" with your brush. Try for a smooth, even coat.

7. Buy a good paint. It will go further and require less work. Poor paint costs more in the long run.

8. **Read** and **follow** the directions on the can.

## Natural Finishes

Many woods have attractive colors and grains. A clear finish will preserve their beauty. As when painting, a clean, dry surface is needed.

1. If finishing a coarse grained wood, such as oak, a clear paste filler should be used. Apply with the grain. Cover a small area at a time, then let it dry for a few minutes. Rub off the excess filler with sawdust or a coarse cloth.

2. Clear shellac may be used on finer grained woods. Apply according to the manufacturer's directions.

3. Clear varnish or wax may be used to protect the surface.

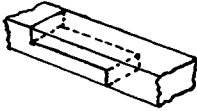
4. If the surface is to be exposed to water, use a spar varnish. They resist both wear and water.

5. Stains may be used to make woods match or to make a low cost wood harmonize with hard woods.

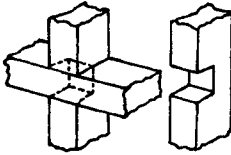




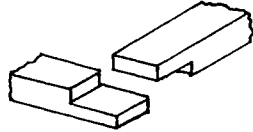
### COMMON WOOD JOINTS



HALF LAP



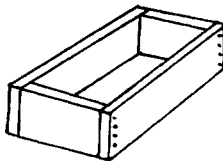
CROSS LAP



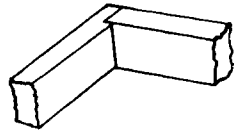
END LAP



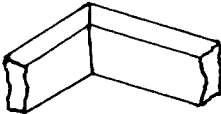
TONGUE & GROOVE



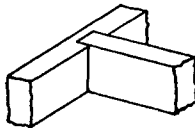
BUTT



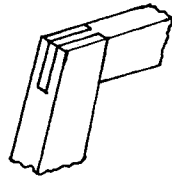
RABBET



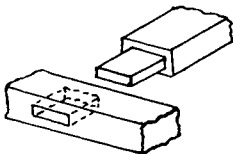
MITRE



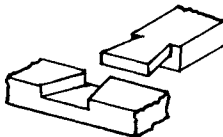
DADO



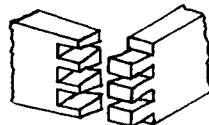
OPEN MORTISE TENON



THRU MORTISE TENON



LAP DOVETAIL



THRU DOVETAIL