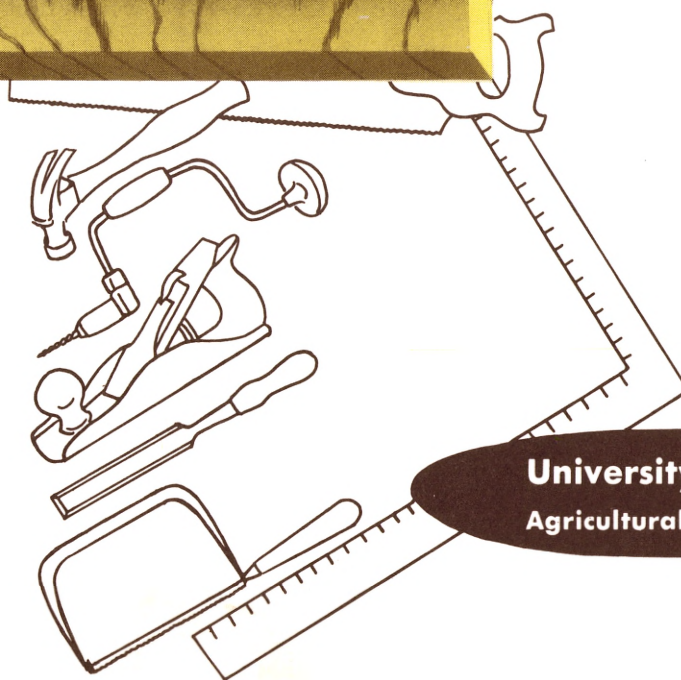
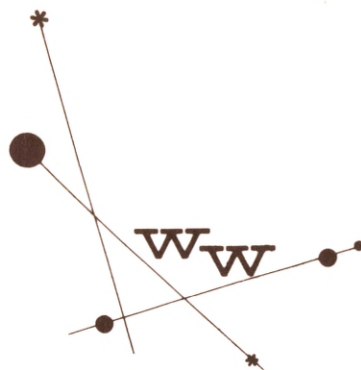


WOODWORKING



4-H-Ag142



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Subject material used in this manual has been adapted and compiled by George Shambrook, Farm Advisor, Santa Clara County, from material in Marin County 4-H Woodworking Project Outline, and Oregon State College 4-H Woodworking Bulletin.
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Woodworking Project

In this project, you will learn how to use tools to build simple wooden articles for use on the farm and around the home. The skills you learn in this project will be useful to all members with projects in livestock or crops, home furnishing, and home grounds beautification.

You will learn to select the proper kind of wood for articles you build. You will learn to practice safety in working with tools. Many good demonstrations can be developed from this project. Look at your project outline to find out what you will have to do to complete this project.

PROJECT REQUIREMENTS

1. Club members must be between 10 and 21 years of age as of January 1 of the club year.
2. Each member shall agree to follow carefully the directions of the project leader.
3. Each member shall keep complete and accurate records of his project in the 4-H Club Record Book.
4. Each member must furnish his own tools and material for the items he makes.
5. Each member will fulfill the requirements for the unit in which he is participating.
6. Each member will practice at home the instruction given at the regular project meetings.
7. No power tools will be used in this club unless in the fourth year unit, and then only under competent supervision.

SAFETY IN WOODWORK

Keep your safety rating high. Prevent accidents to yourself and fellow workers. In the handicraft project, remember these two important rules:

- Develop skillful, efficient and safe work habits.
- Use these habits when making all articles—from the plan to the finished article.

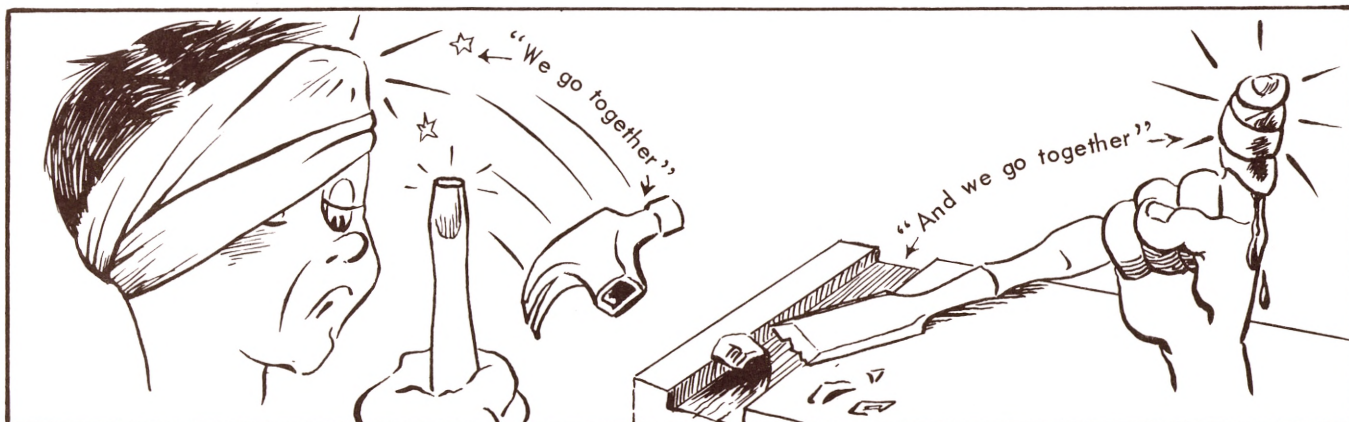
Think about the tools you'll work with. What do you expect of them? Each has a special job to do. Learn what it should do, then use it correctly.

If you had to earn the money to buy all your tools, you'd certainly learn how to use and care for

them properly. Many men, who earn their living with just such tools as are found in the farm shop, learn early in life that tools should be treated as friends for best results. Correct use prevents injuries to the worker and others, and lessens breakage and damage.

Keep your tools sharp. Dull tools are hard to use, do unsatisfactory work, and are usually the ones that cause accidents.

Your first work in this project calls for the use of only a few tools. As you advance to jobs which require more skill, you will use other tools.



* MORE SAFETY TIPS *

CLOTHES TO WEAR. Loose collars are comfortable. For safety, don't wear a tie while working. Sleeves should be rolled to the elbows, using an inside roll so the cuffs won't catch. Clothing should be loose, but never bulging or flying.

TO PROTECT YOUR EYES. Your eyes cannot be replaced. Do not expose them to unnecessary danger. Wear goggles when you use a high speed power grinder. Metal particles, abrasives, nails, sawdust, and shavings may cause eye injury. Keep them cleaned up.

HOUSEKEEPING. A good workman has a place for everything and keeps everything in its place. He keeps his bench and tools clean and ready for use. The work area is kept in order. You'll take pride in working in a clean and orderly shop, and also be able to find your tools and materials easily.

TREATMENT OF INJURIES. It is important that all injuries be treated, however slight. Even a scratch may start infection. A slight injury treated at once is not likely to develop into serious trouble.

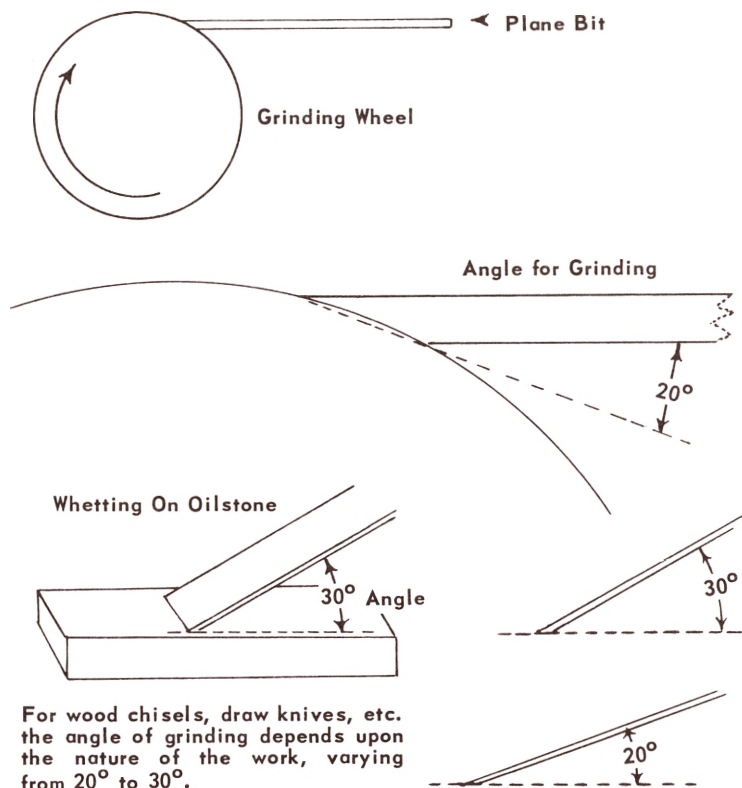
Every workshop should have a handy first aid kit for treating injuries and wounds immediately.

care of tools

Have a clean, dry place for your tools and return each one to its proper place after using. Tools may be kept in a cabinet over the bench, in drawers in the bench, or in a tool box. Oil keeps tools from rusting, but should be used very sparingly. If tools become rusty, remove the rust by rubbing with pulverized pumice stone, then oil thoroughly.

All tools bearing an edge should be kept well-sharpened. It is not easy to use dull tools.

grinding tools



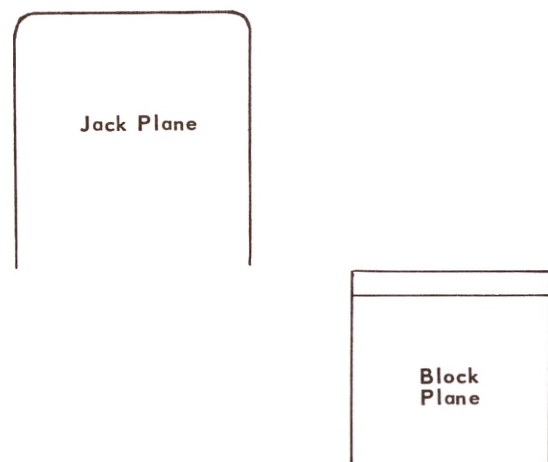
sharpening tools

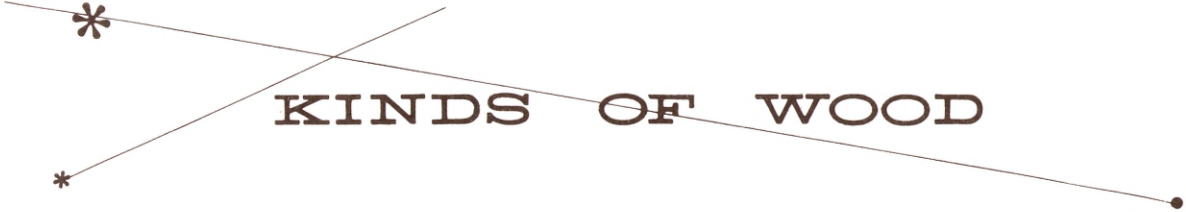
Tools must be kept in good condition and sharp. When you use the grindstone, you will notice that it leaves a coarse, feathery edge. This must be removed on an oilstone. Take care to keep the correct bevel while sharpening a tool.

For sharpening, you'll need a grindstone, an oil or carborundum stone, a three-cornered file, a flat file, a saw jointer and a saw set. Saws and auger bits are sharpened with files. Unless you have all the equipment, don't try to sharpen a saw; send it to a saw filer instead.

A common oilstone of coarse grit on one side and a fine grit on the other is used to sharpen a chisel. Plane blades are sharpened by first grinding on a wheel, then whittling on an oilstone. Sometimes grinding is not necessary. The diagram on the left shows the proper way to sharpen the blades and the angles to hold the chisel to the stone.

For wood chisels, draw knives, etc. the angle of grinding depends upon the nature of the work, varying from 20° to 30°.





KINDS OF WOOD

Wood is probably the most commonly used material in the world today. Lumber is more than just a piece of wood. It has taken years to grow and skill to shape. Unwise logging and the ravages of insects, fire, and storm, have caused the great virgin forests of America to dwindle until only very small areas of original timberland now remain.

Today trees are grown as a crop to furnish wood. There are two general classes of wood—softwood and hardwood. Wood is also graded according to quality, with grades of select and common. The select grades are “B” and “Better,” “C” and “D.” Common lumber is graded as No. 1-2-3-4, and is distinguished from the select by its coarseness of appearance, and one or a combination of defects.

Some hardwoods are oak, hickory, black walnut, and maple. They are used for flooring, furniture, interior finishes and cabinetwork.

Some softwoods are fir, white pine and redwood. Softwoods are used for framing, foundations, siding and other general construction uses.

CEDARS are fragrantly-scented soft woods. They include eastern red cedar, northern white cedar, western red and yellow cedar. Eastern red cedar is a popular wood for lining closets and chests because moths dislike its odor. The heartwood, or center, of cedar is dark red in color. The sapwood, or outside, is white. Cedar’s many knots add beauty to the wood, but make it difficult to plane. Cedar is best dressed with the cabinet scraper. The wood seasons rapidly. It shrinks and checks very little and the heartwood is very durable for outside use. It is used like soft pine, but because of its great durability it is preferred for shingles. The smaller trees are used for fence posts and railroad ties.

DOUGLAS FIR is one of the largest trees native to North America. It is the most cut of any wood of commercial importance. Although it is distinctly a western species, it is also used in many parts of the middle-west and east for structural timbers, railway ties, rough and finished lumber, flooring, plywood, furniture, lath, tanks, and many other articles. The sapwood is white and the freshly-cut heartwood is light reddish yellow in color. When exposed to light and air it becomes distinctly reddish. Sometimes it turns cherry red or brown. The average fir lumber from the west coast is strong, moderately hard, moderately heavy, and very stiff. It splits easily and is

rather difficult to work with hand tools.

REDWOOD, one of the largest trees known, grows only in the extreme western part of the United States. Redwood is very durable in contact with soil and is widely used for flower boxes, fence posts, water pipes, railway ties, and water tanks. It is used also for siding and shingles in house construction. Both the bark and the wood are cinnamon brown. The wood is light, soft, moderately strong, and easily worked with tools.

WHITE OAK is grayish brown, with a reddish tinge and has an open grain. The medullary rays of the oak, running out from the center of the log, are very prominent. When the log is quartersawed, these rays produce an attractive flaky-looking surface. Oak is used for interior finish, cabinet work, furniture, flooring, implement parts, and for heavy construction such as bridges and railroad ties. White oak is strong, hard, tough, elastic, durable, beautiful in grain, and rather easy to work. Oak furniture is never out of style and modern methods of finishing have increased the demand for it.

WHITE PINE is perhaps more in demand for carpentry and building than any other kind of wood. It is nearly white in color, light in weight, works easily, and when properly seasoned, it warps little. It is used in building and for door and window frames. The heartwood is moderately durable in contact with soil and moisture. The heavier the wood, the darker, stronger, and harder it is, and the more it shrinks and checks. The cheaper grades of white pine are used for general carpentry.

YELLOW PINE grows in the southern part of the United States. It is used largely for building construction. From the Longleaf and Slash pines comes most of the commercial resin and turpentine of the United States. Yellow pine is hard and the summerwood portion of the annual rings is dark colored. It warps little and the heartwood is moderately durable. The grain is usually straight. There is a tendency to split during nailing. Yellow pine is used for heavy structures such as bridges, trestles, wharves, piling, ship frames, and docks. It is used for house sills, foundation timbers, and for concrete forms.

LUMBER

* some symbols and sizes *

Lumber comes in standard sizes. Softwood comes in thicknesses of 1 to 3 inches, widths of 1 to 12 inches, and 8 to 20-foot lengths, in multiples of 2 feet. Lumber is either rough or surfaced. If it is surfaced on two sides, it is known as S2S. If all sides are surfaced, it is S4S.

SYMBOLS

- " means inches
- ' means feet
- x means by

A mark such as 2"x1'-8" is read "two inches by one foot and eight inches."

SIZE. Most lumber is sold by board measure. The unit of board measure is a board foot, which is equal to a board 1"x12"x12". When ordering lumber, each size is listed separately, giving the number of pieces, the thickness, width, and length. For example—6 pieces 2"x4"x12' equals 48 board feet. If the cost is \$110 per M (thousand board feet), the cost of the 2"x4"s would be \$5.28.

Be sure to get lumber that is not warped. It is in the interest of conservation and economy to use lower grades of lumber and shorter lengths whenever possible without affecting your project.

Keep in mind, when ordering, that you don't get all the lumber you bargain for. For example, when you buy a one-inch finished board, you'll find it measures only 7/8 inches in thickness. The board was one inch thick when it came from the saw mill. But it was planed to take off the saw marks and make it smooth on both sides, reducing it to 7/8 inches in thickness. Width is also reduced by planing. Length, however, will be the same as or a little more than you order. Some materials, such as plywood and pressed board, will have the same thickness, width, and length you order.

abbreviations and equivalents

Sq. ft. = square foot
Bd. ft. = board foot
pcs. = pieces
1" = one inch
1' = one foot

lb. = pound
qt. = quart
gal. = gallon
4 qts. = 1 gal.

M = one thousand
s2s = surface 2 sides
s4s = surface 4 sides

useful facts and formulas

Number of pieces x inches
Board feet = $\frac{\text{thick x inches wide x feet long}}{12}$

$$1 \text{ board foot} = \frac{1" \times 12" \times 1'}{12}$$

$$= 1" \text{ thick } 12" \text{ wide } 1' \text{ long}$$

$$= 144 \text{ square inches}$$

Square foot measure = $\frac{\text{width in feet x length in feet}}{\text{feet}}$

One square (roof) = 100 square feet (10'x10')

Lumber is usually purchased —

1. Per thousand (M) board feet
2. Per running foot
3. Per square foot
4. Per bundle (shingles, lath, etc.)

Lumber usually comes in even lengths —

8' 10' 12' 14' 16'

Lumber may be purchased rough or smooth. In ordering lumber, list pieces, dimensions, kind of wood, and finish.

WIDTH. Below on the left, are "nominal" or rough-lumber widths; on the right is the width the finished lumber will be.

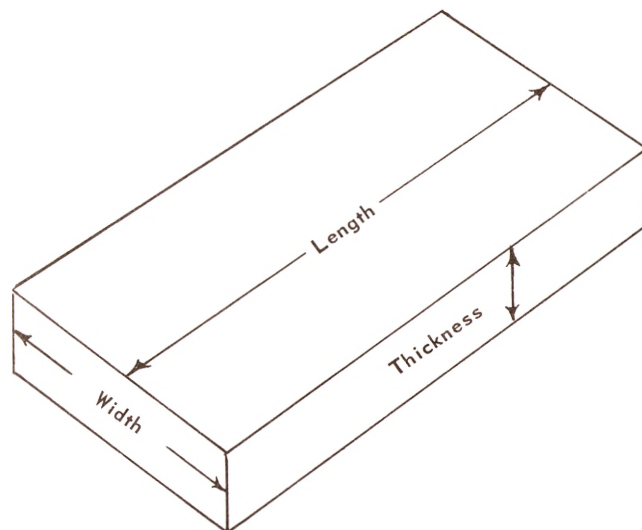
2" dressed to 1-5/8"
4" dressed to 3-5/8"
6" dressed to 5-5/8"
8" dressed to 7-1/2"
10" dressed to 9-1/2"
12" dressed to 11-1/2"

THICKNESS. Below on the left, are "nominal" or rough-lumber sizes. On the right is the thickness the finished lumber will be.

3/8" dressed to	1/4"
5/8" dressed to	1/2"
3/4" dressed to	5/8"
1" dressed to	7/8"
1-1/4" dressed to	1-1/8"
1-1/2" dressed to	1-3/8"
2" dressed to	1-7/8"

Lumber from some mills will be thinner than these measurements.

Notice here that in the smaller widths the finished size is 3/8 inch less than the nominal size; in larger widths, it is 1/2 inch less. Softwood lumber comes in even-numbered widths, such as 2, 4, 6 inches. Hardwood lumber may come in various other widths.

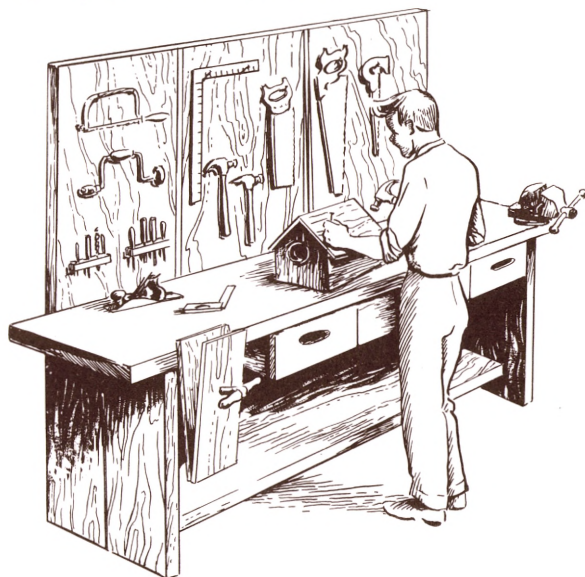


TOOLS

Good tools make good work. Take care of your tools. Keep them dry, sharp, and in order. The best tool is no good if you can't find it when you need it.

Rust and careless handling are great enemies of hand tools. A good, clean place to work helps you give your tools proper care.

Learn to use the tools necessary to make the articles listed in this project outline. Then learn to identify and use other tools.



Every home shop should have these tools –

1. Claw hammer
2. Cross cut saw (8 point)
3. Rip saw (5½ point)
4. Folding rule or steel tape
5. Screw drivers
6. Brace and bits
7. Jack plane
8. Wood chisels
9. Ripping bar
10. Framing square
11. Try square
12. Nail set

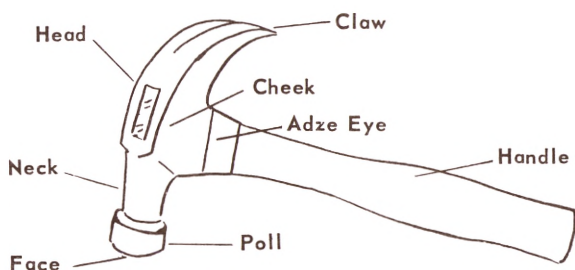
The more experienced woodworker will use more tools, including –

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

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

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

This kind of careless handling ruins tools quickly. Don't do it. Protect cutting edges; keep tools out where you can see the one that is needed. ➡



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 to prevent bending the nail and leaving marks on the wood. Practice helps.

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.



This

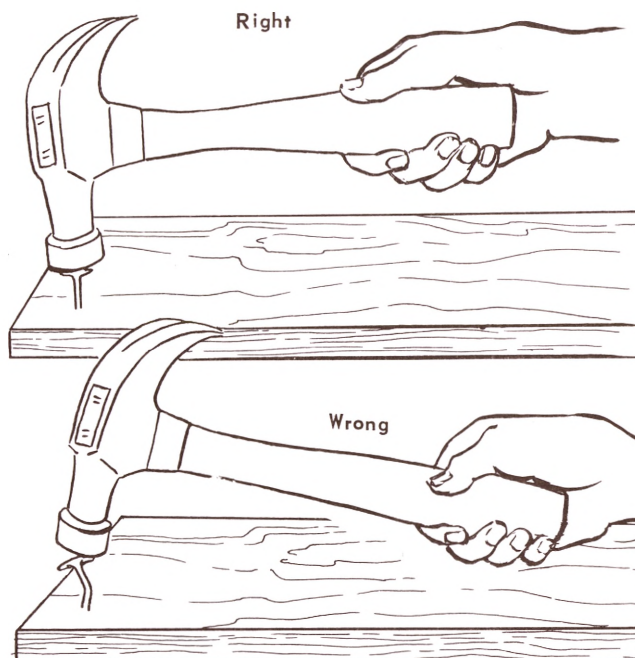


Not This

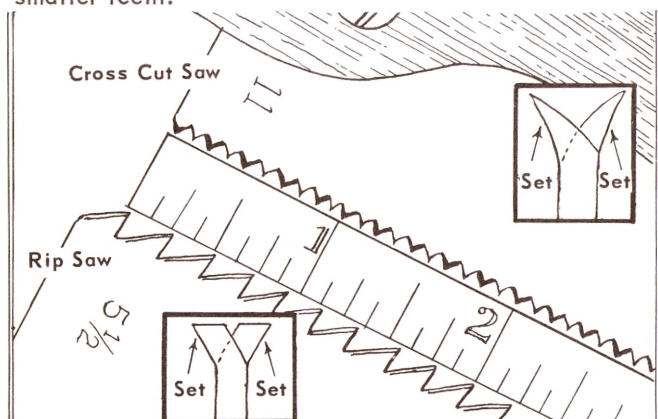
- Do not use a hammer that is "loose on the handle." Someone may be hurt.
- Do not use the side of the hammer to pound with. The cheek (see illustration) is the weakest part of the hammer head and may be broken.
- Do not use a claw hammer to pound a cold chisel or other hard metal objects.



Use your hammer well and it will serve you well. Awkwardness disappears 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.



THE HAND SAW is the next tool to consider. The two most used types are the cross cut saw and the rip saw. The cross cut saw is used to cut across the grain of the wood. The rip saw is used 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.

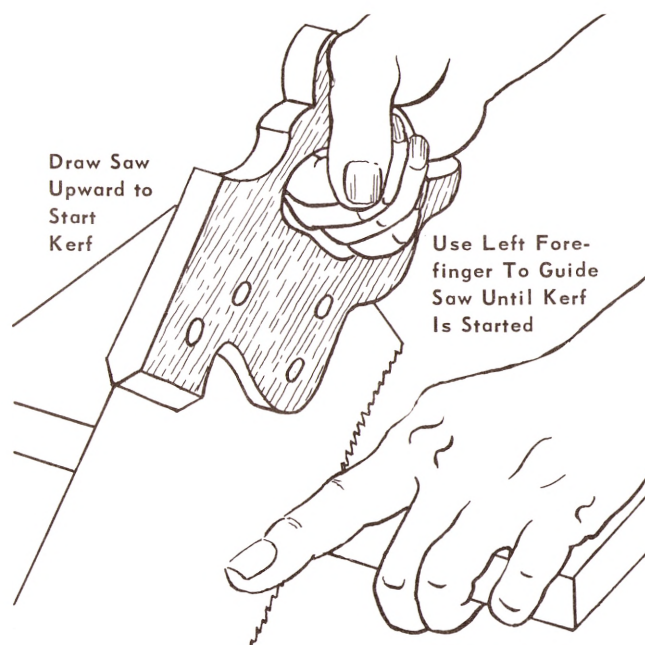
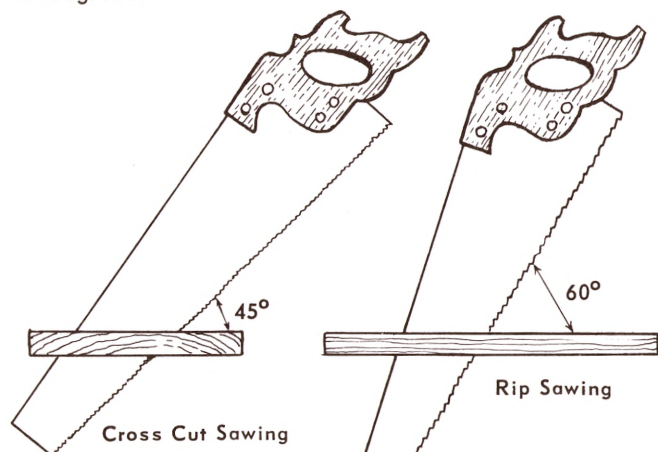
Saws are designated by the number of tooth points to the inch. A cross cut may have 8, 10, or 11. A rip saw will have only 5, 5½, or 6. Usually this number will be found stamped on the blade near the handle.

Start the cut by drawing the saw toward yourself. Guide it with the thumb of your left hand until the cut is deep enough to hold the saw steady.

BE CAREFUL. The saw is designed to cut through hard wood. Your thumb is much softer.

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.

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



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.

STARTING THE KERF. Kerf is the term carpenters use to describe the cut left by the saw.

Keep the kerf on the waste side of the line—not on the line—nor on the inside of the line. You can guide the saw to some extent by twisting it in the desired direction. 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.

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

THE KEYHOLE SAW 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.

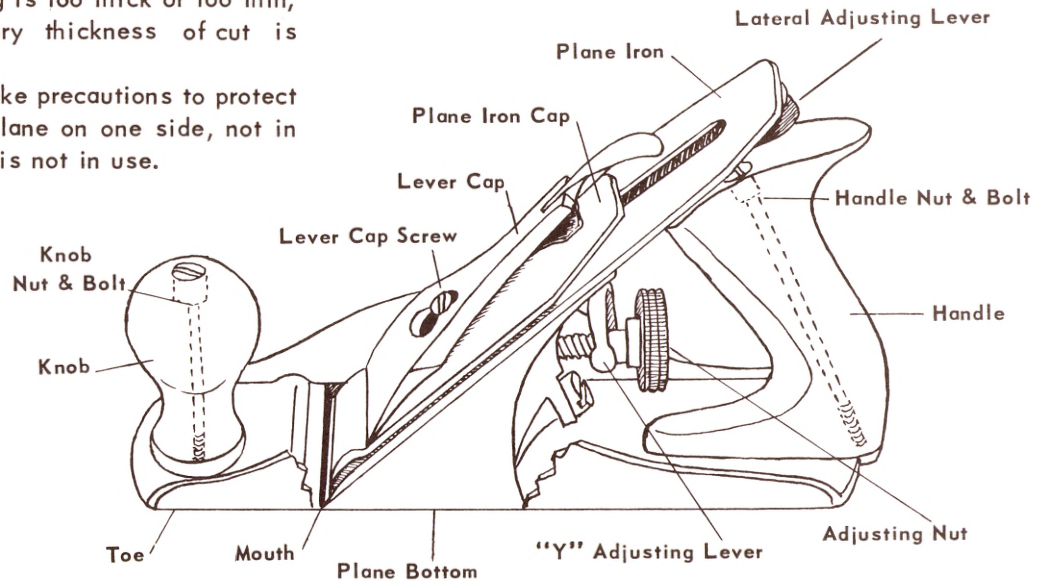
A WORD OF CAUTION. You may work with used lumber in these projects. Be careful of hidden nails. They will break or dull teeth, ruining your saw. Examine used lumber carefully and remove all nails before you try to cut it.

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.

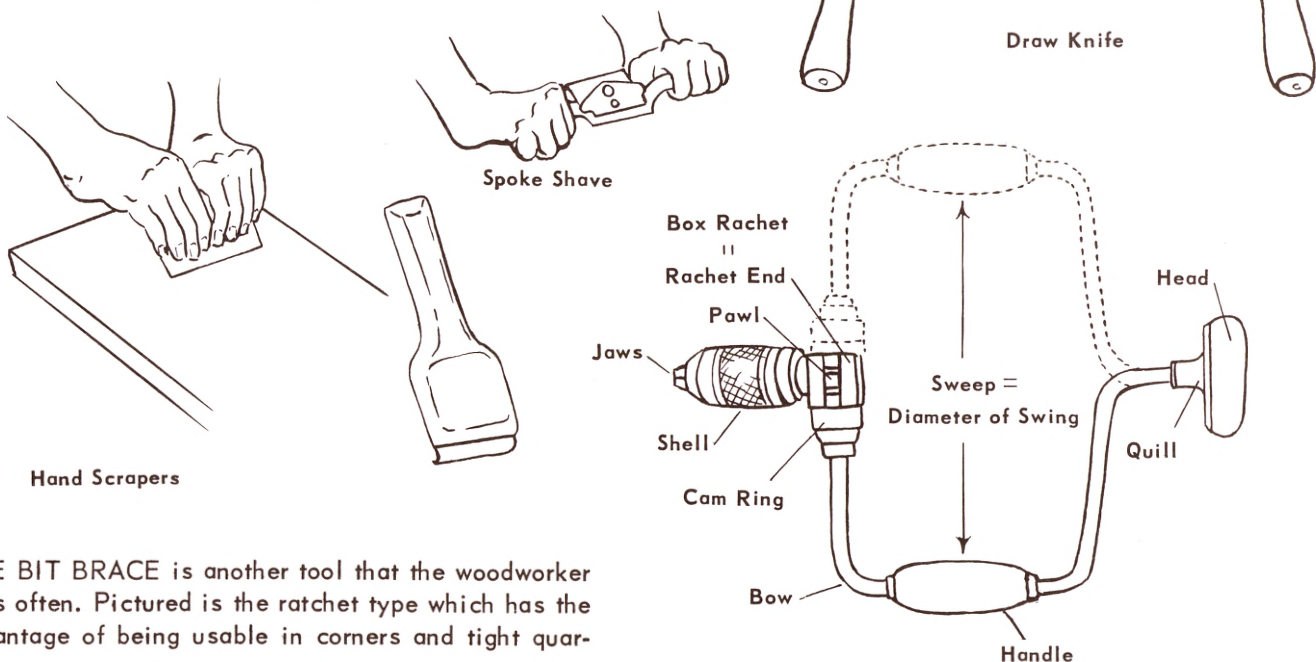
Store your plane carefully. If it cannot be stored so that the cutting edge is protected, use the adjusting nut to bring the cutting edge above the plane bottom before you put it away.

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 a stroke. This prevents rounding the work. Always plane with the grain.



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 scraper edge. To use grasp by the top with both hand and push or pull in the direction of the grain. It is sloped about 75 degrees to the work, leaning toward the direction of travel.

THE DRAW KNIFE and SPOKE SHAVE are other smoothing tools.



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

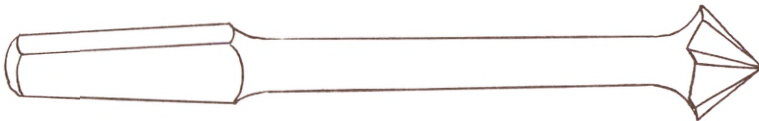
THE AUGER BIT, shown at right, is sized by 16ths of an inch, measuring the diameter. Bits vary in length from seven to ten inches. Dowel bits are the same, but shorter.

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. Take care to place the bit accurately when starting a hole. The location should be clearly marked on the wood.

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.

Bits are marked for size by a single number. The numerator of the fraction stands for the diameter of the bit. Auger and forstner bits are marked by 16ths. No. 8 means $8/16"$ or $1/2"$. Twist bits for wood are usually marked in the same way by 32nds of an inch. No. 8 means $8/32"$ or $1/4"$.

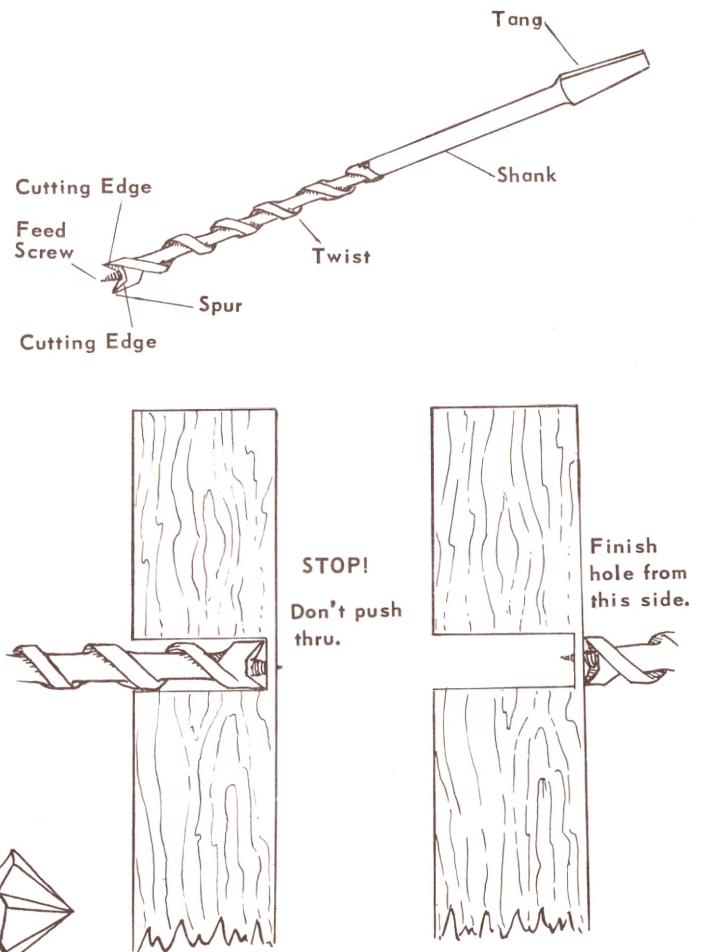
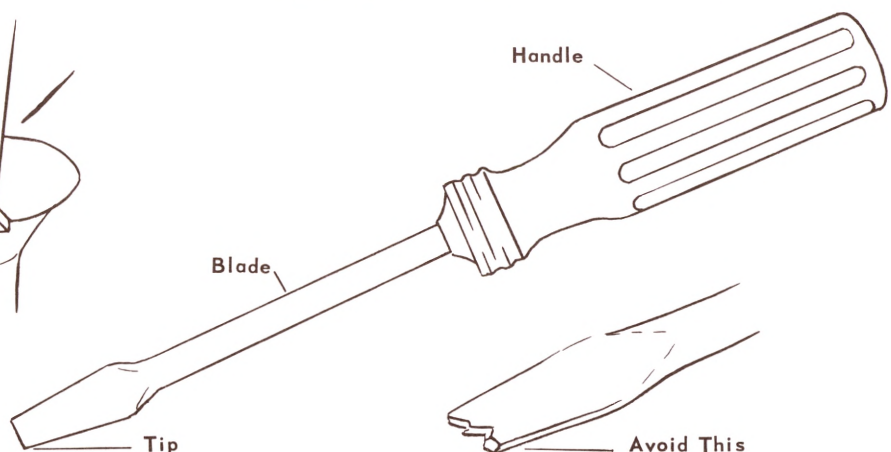
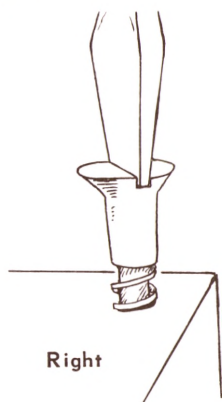
THE COUNTERSINK BIT is a tool used to shape the top of a screw hole so that the head of a flat head screw may be driven flush with or slightly below the surface of the work.



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.

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

Hold the screwdriver square with the work. Keep a firm downward pressure as the twisting motion is applied. You will find a long screwdriver easier to hold.



- Don't hammer on a screwdriver. A screwdriver is not a substitute for a cold chisel.
- Don't 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 below.
- Pliers should not be used on the blade to give greater turning force.

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

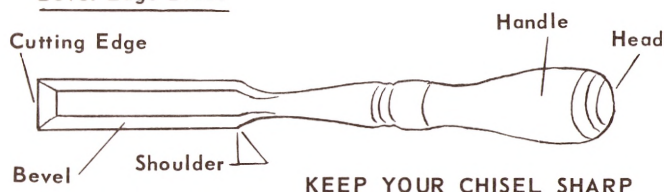
THE WOOD CHISEL may be regarded as a more primitive plane. Because its blade is unprotected, it can be used in routing (cutting grooves) and gouging. Be careful. The chisel is the most dangerous of hand woodworking tools. Always keep both hands on chisel.

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.

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

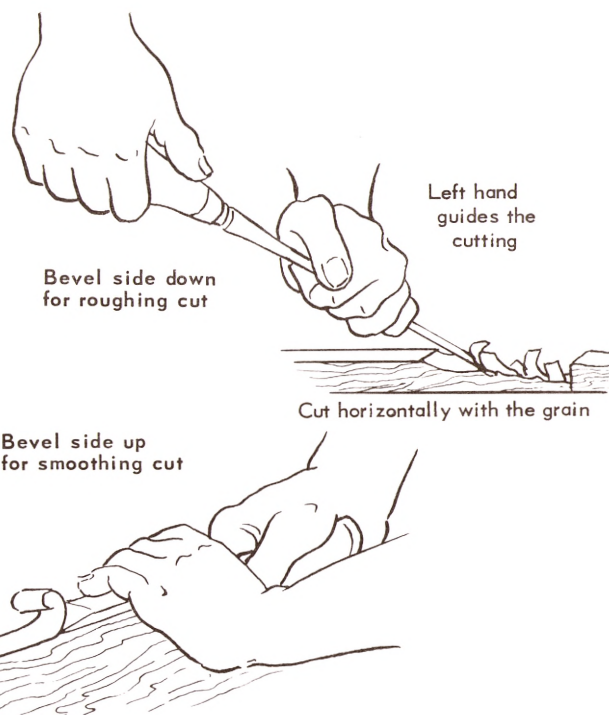
Protect the blade during storage. A wall rack is one of the best storage methods.

Bevel Edge Blade



SANDPAPER is used to give a final, smooth finish to your work. Do not 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

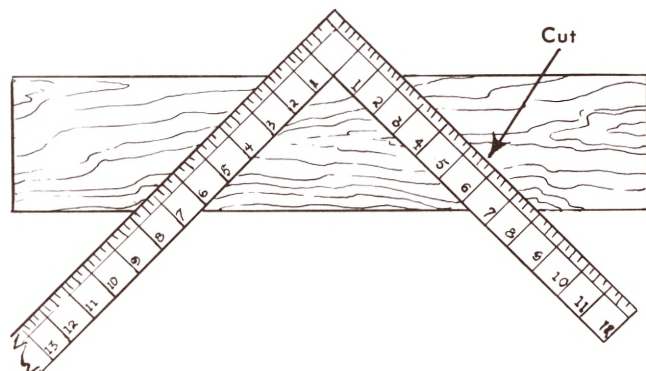


smooth job, use a sanding block. Then you will cut off the high spots and will not "drag" the corners. Finish with fine sandpaper.

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 is useful in work of this type.

* HOW TO LAY OUT THE JOB *

LAYING OUT YOUR PROJECT is the most important 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.

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.

A COMBINATION SQUARE will lay off ninety or forty-five degree angles.

THE SLIDING BEVEL can be set for any angle and is used as much as the try square.

A TRY SQUARE is very handy for laying out projects as well as checking stock during squaring.

THE STEEL SQUARE has two main parts – the blade and the tongue. The blade is the longer, wider part, while the narrow, shorter part is the tongue. Most squares are the same, with the blade being 24 inches long and two inches wide. The tongue is 16 inches long and one and one-half inches wide. The inside corner at which the inside edges meet is called the heel; the side with the manufacturer's label is called the face; the other side is the back.

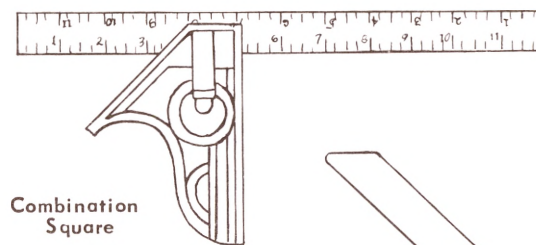
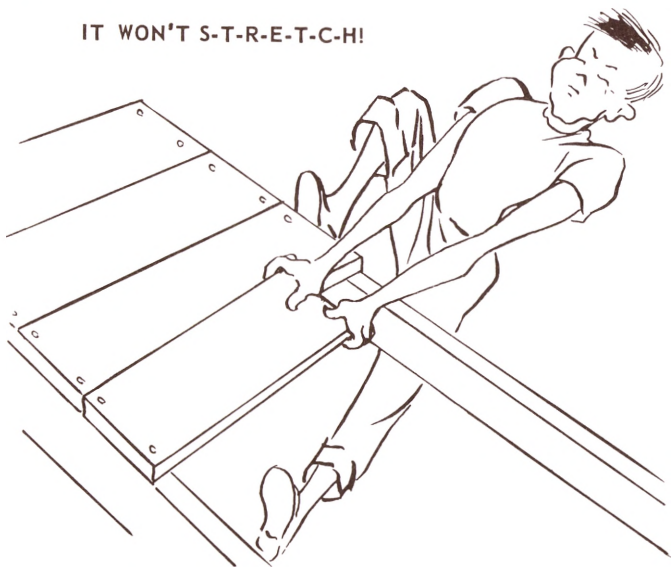
In addition to measuring lengths and determining if the end of a piece of lumber is square, the square can be used to determine angles. A 45° angle is shown being marked in the figure on Page 12 for cutting. Note the same number of inches is shown on both the tongue and blade.

Rafter angles can be laid out using the rise and run in feet reduced to inches on the square. Some squares have special markings for angles.

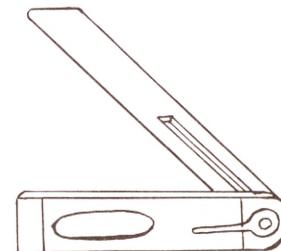
Remember that tools for measurement are precision instruments. Wipe squares, rules, and steel tapes with an oil rag after using to protect the steel from rusting.

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

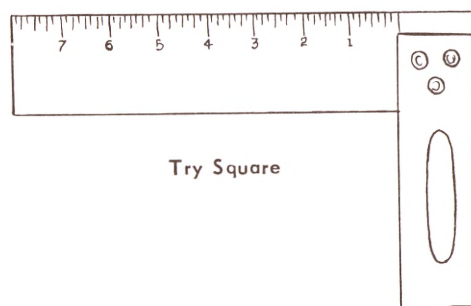
IT WON'T S-T-R-E-T-C-H!



Combination Square

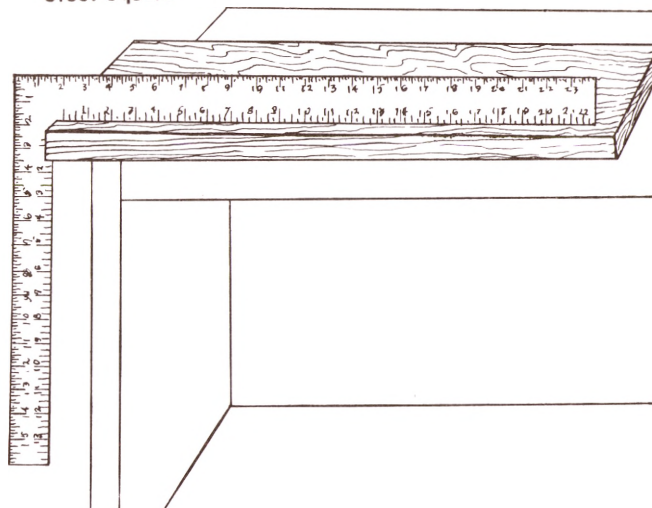


Sliding T-bevel



Try Square

Steel Square



After selecting your project, you should study the working drawings until you know about what you are going to do. If you chose 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.

Work carefully. Remember that you can cut a board down with a plane, but you can't stretch it.

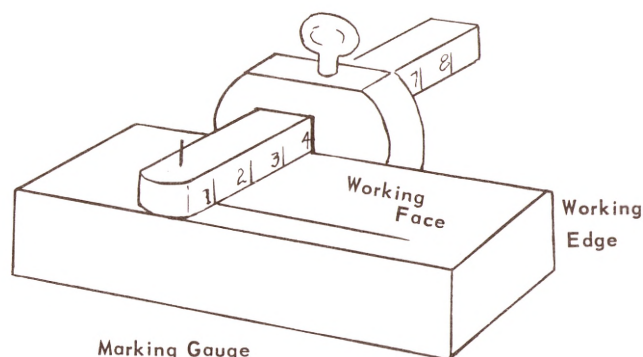
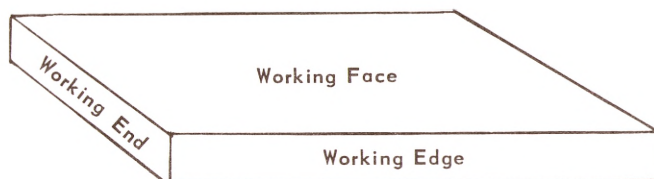
Do your best. A neat, well-fitted project is worth the extra effort.

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 on pages 6 and 7.

WHEN SQUARING STOCK, follow this procedure:

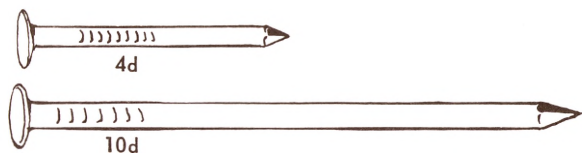
1. Select a WORKING FACE. For accurate work, this face should be planed true and smooth. Don't depend on your eye—check for high spots with a bench rule or the blade of your try square. When you have it true, mark with a pencil.
2. Select a WORKING EDGE. Plane this true, using your try square to square 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.
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.



Much of the quality of your work depends on the care with which you perform the preceding steps. Check often with the try square, and watch the line to which you are planing.

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 shows 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 purposes—sheathing, flooring, framing, etc. The nails shown are common nails.
2. Box nails are lighter than common, 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 to join 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.

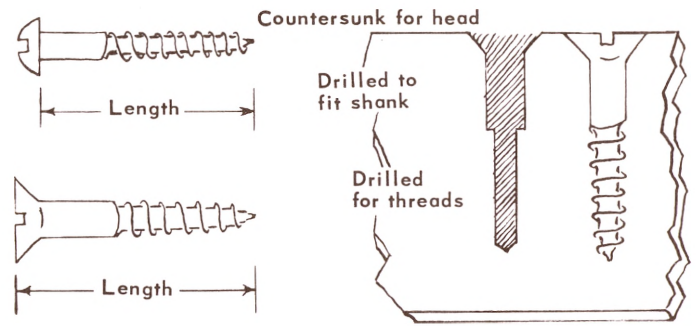
SCREWS are second only to nails as fasteners of wood joints. They have the advantage of making a much stronger joint than nails, but they require more time and work.

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 right.

Most screws are steel. If you are making an item that will be exposed to severe weather or use, 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.

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. 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 measured between threads, make the hole equal in depth to the length of the screw.
3. If you are using flat head screws, countersink for

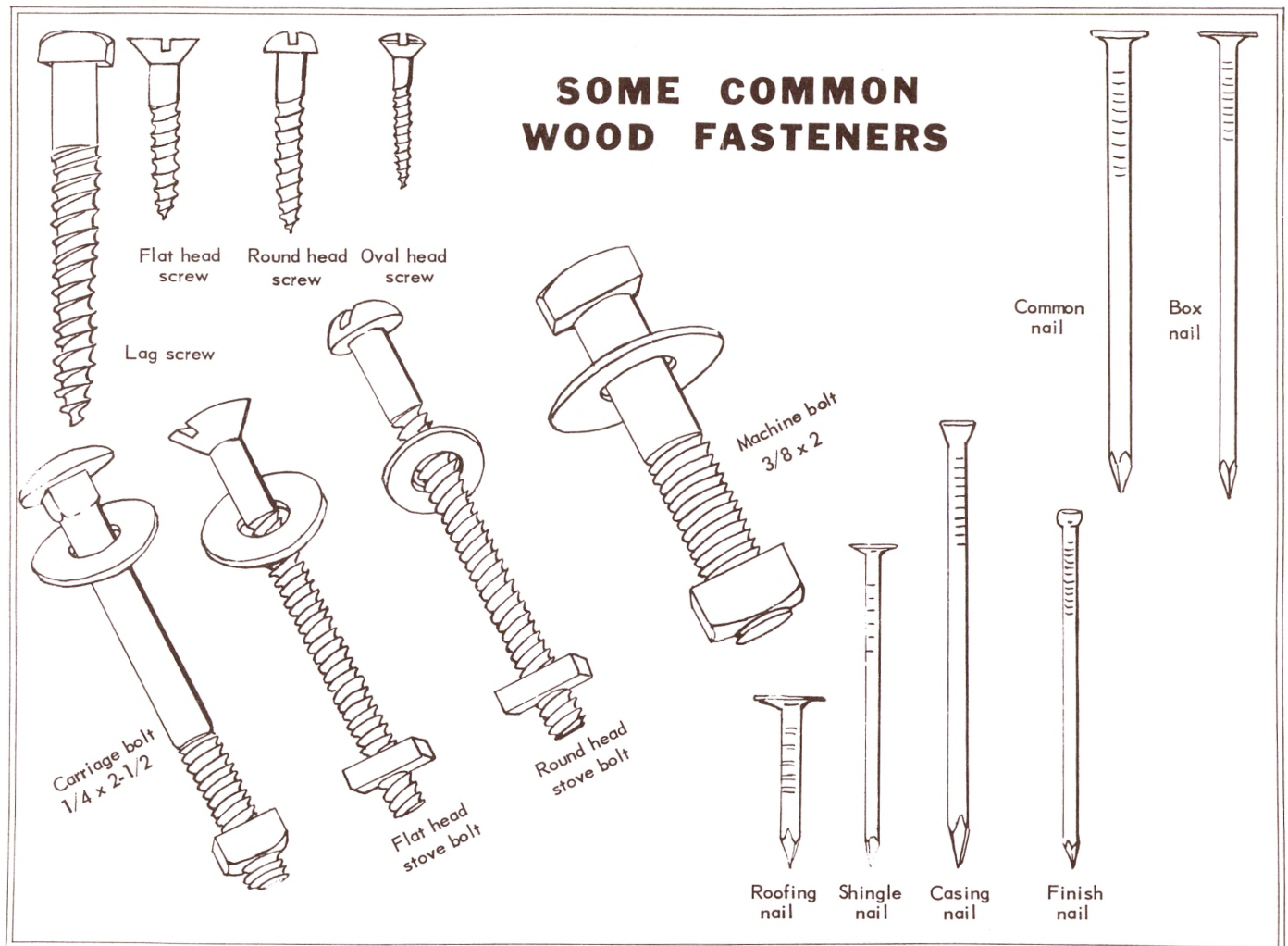


the heads. In soft wood, you may find that countersinking is not necessary.

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 it slides 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 makes it much easier to drive in hardwood.

Remember the rules for proper use of the screwdriver.



HOW TO READ A DRAWING

Each line in a drawing is used for a definite purpose and should not be used for anything else. Outlines and visible edges in a detailed drawing should be fairly thick. Center lines and dimension

lines should be thin. This will give the drawing contrast, and make it easier to read. If all lines are the same thickness, the drawing has a flat appearance and is hard to read.

HERE ARE THE KINDS OF LINES YOU'LL FIND IN WORKING DRAWINGS

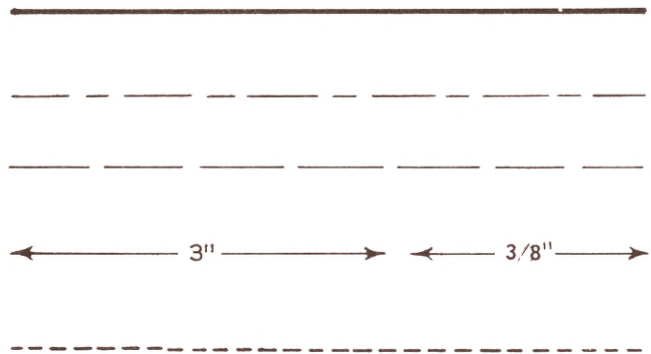
Visible outlines are heavy, solid lines that show the outline of an object and the corners and edges which can be seen.

Center lines are fine lines drawn with long and short dashes. They are used to locate centers.

Extension lines are fine, long-dash lines which extend out from the figure to show the limits of a dimension line.

Dimension lines are fine, solid lines with arrowheads at the end. They are used to show distance between two points.

Invisible lines are short dash lines, showing outlines hidden from view.



HOW TO TELL SIZE

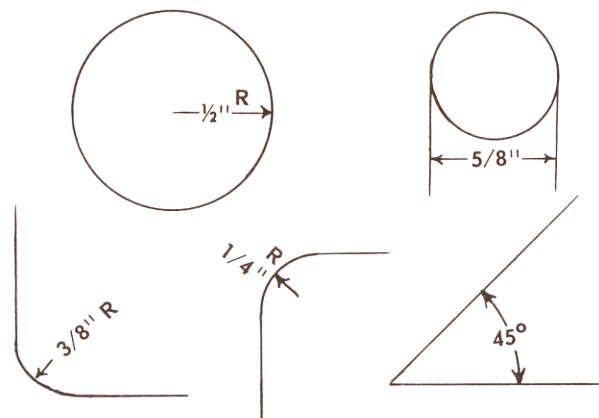
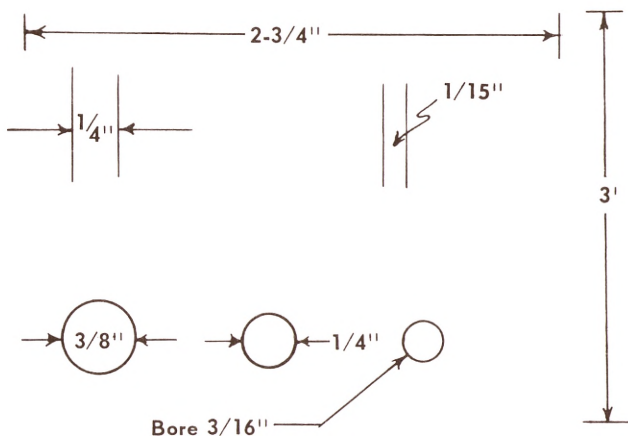
It is usually impossible to make the drawings as large as the full size of the article to be made. Therefore it is necessary to use a scale drawing, smaller than actual size. The plans used with this circular are reduced scale drawings. The full size dimensions are given, even though the drawing has been made smaller.

Dimensions are given in feet, inches, or a combination of the two. For example, 16", as 1 ft. - 4", or as 1' - 4".

The drawings below show the different methods used in dimensioning lines, arcs, and circles. You will find some more symbols:

R equals radius

D equals diameter ° equals degree



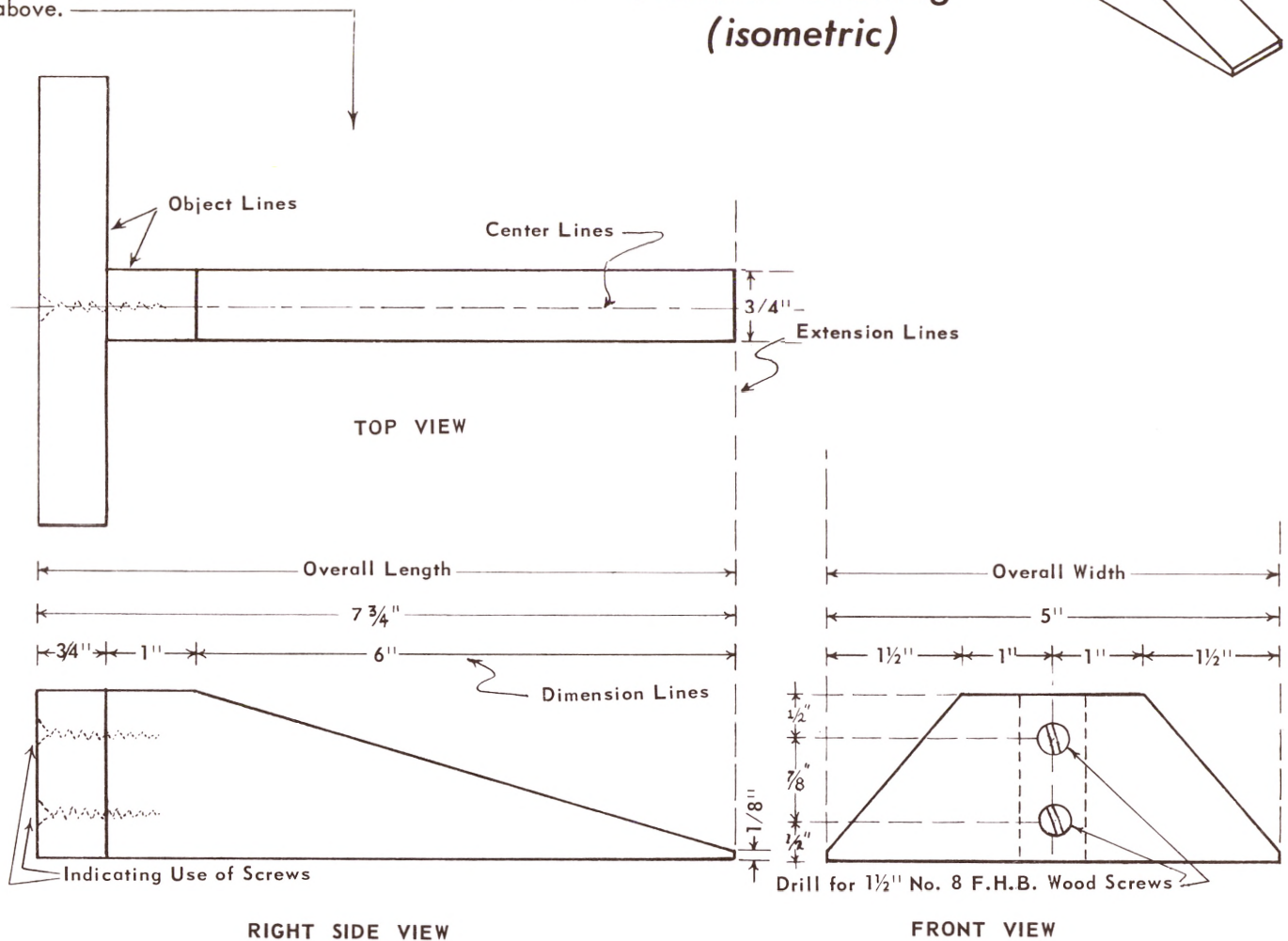
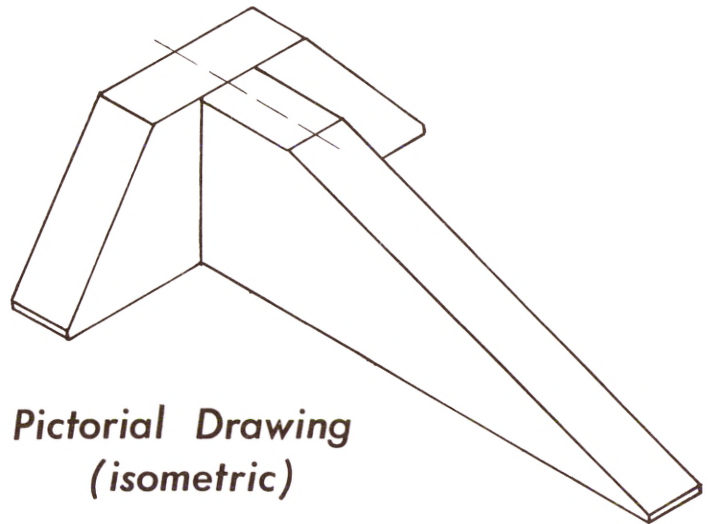
LET'S READ A DRAWING

Before starting to build, we must know how to read a drawing or a picture of what we are going to make. A working drawing is a group of views of an object which show you what the object is like. These views also give the dimensions such as widths, length, height, and thickness of the various parts.

Look for a moment at this pictorial drawing of a door stop. It helps you see the relationship of the various parts, how they go together.

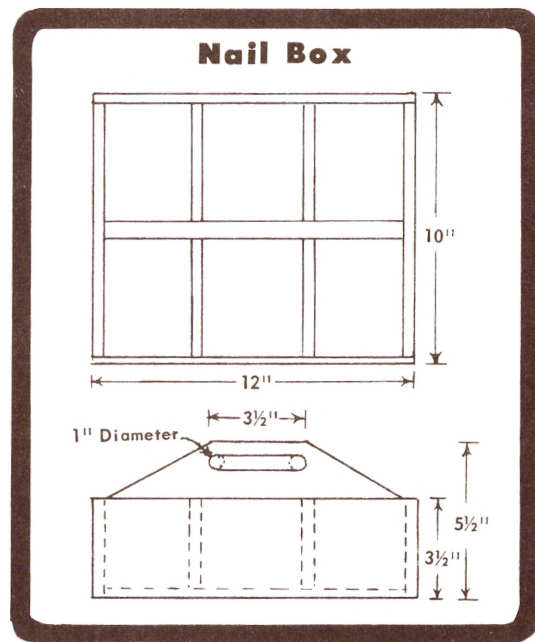
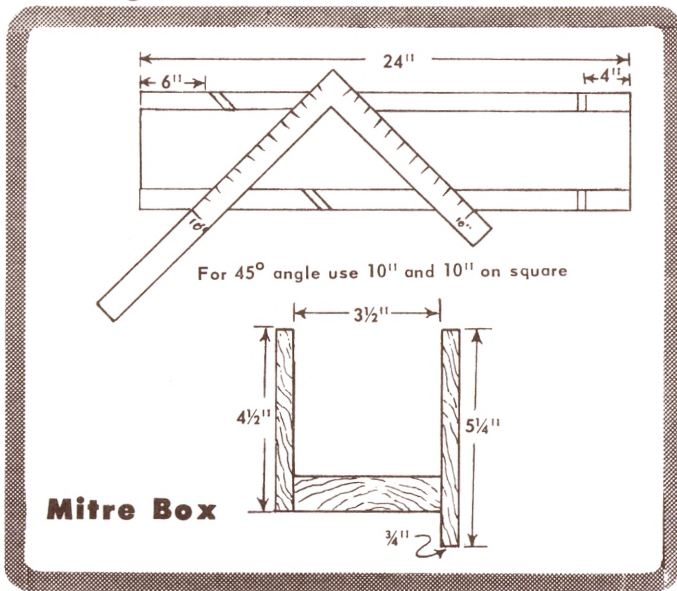
There are times when a drawing of this kind makes it impossible to show all details and it becomes necessary to make two or more separate views of the object.

This is the way it would look from directly above.

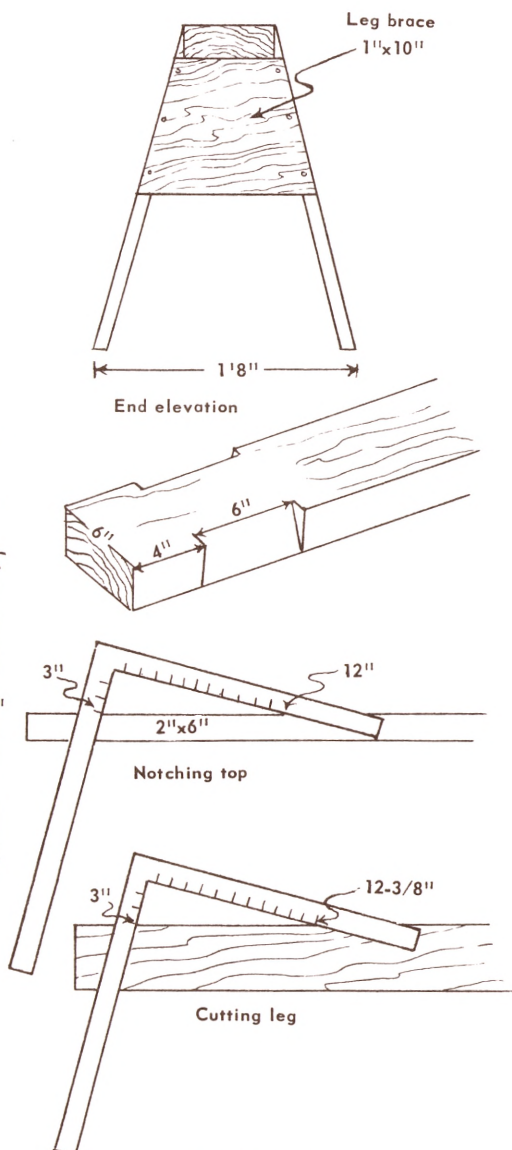
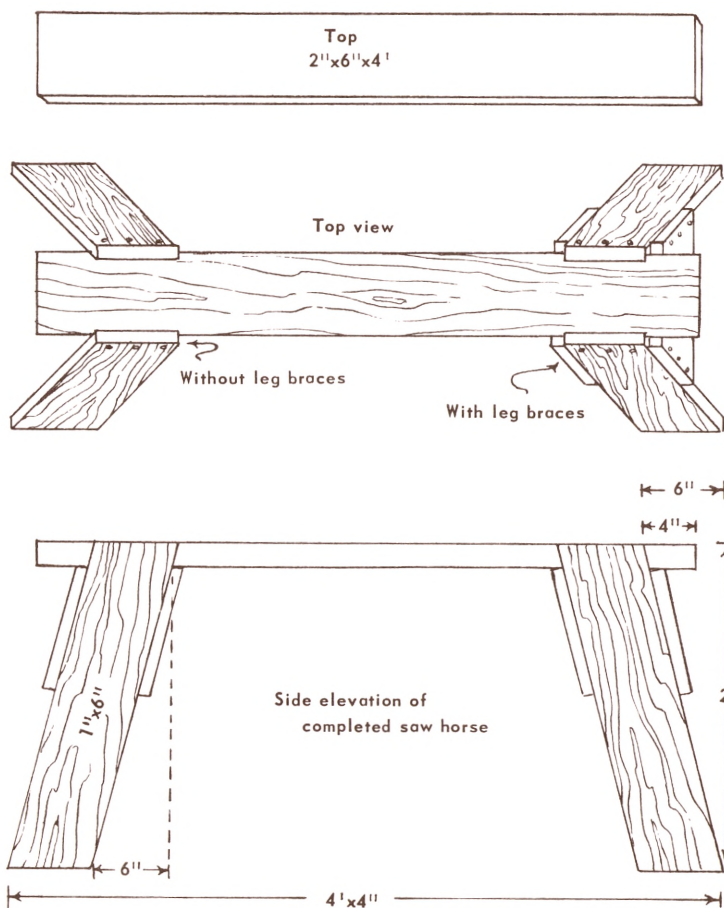


Working Drawing (orthographic)

Project Plans . . .



Saw Horse



Co-operative Extension work in Agriculture and Home Economics, College of Agriculture,
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George B. Alcorn, Director, California Agricultural Extension Service.