4-H Woodworking : Extension Circular 7-11-2 1951

D. A. Kitchen
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OBJECTIVES:

This is a "learn by doing" club. You will learn the value of good tools. You will learn to use them and care for them. When you have finished the work in this manual, you will appreciate the need of a shop on the farm, and you will have completed some useful articles as well.

REQUIREMENTS:

1. Club members must be between 10 and 21 years of age as of January 1 of the club year.

2. Five problems must be completed.

3. No power tools will be used in this club.

4. The first problem for each member will be sorting and listing available tools.

5. The second problem will be to lay out and square a sanding block. Use the saw, plane, and try square to reduce a soft wood block to 3/4" x 3" x 5 1/4", following the steps for squaring stock given on page 11. This block can be used with a sheet of sandpaper cut or folded into quarters.

6. Three articles must be constructed. At least one of the three must be a class II problem.

If a member wishes to build more than one of the same article, the second can be counted as 1/2 a problem. In other words, if a member builds two birdhouses, he has completed one and one-half of the six required problems.

A member may, with the approval of his leader, choose problems from other sources. They should be of equal or greater difficulty than the class of problems for which they are substituted.
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 (5 1/2 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

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. Key hole (compass) saw
5. Mallet (wood or plastic)
6. Hand drill and bits
7. Carpenter's level
8. Counter sink
9. Bench vice
10. Back saw
11. Draw knife
12. Block plane
13. Hand scraper
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.

The Claw Hammer is perhaps the most used and 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 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 two by four is often handy for pulling nails.

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

Do not use a hammer that is "loose on the handle", or that has a split or broken handle. Someone may be hurt.

Do not 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, page 3.)

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 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.
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 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.

Saws are designated by the number of tooth points to the inch—a cross cut may have 8, 10, or 11, while a rip saw will have only 5, 5 1/2, 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:

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.

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.
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.)

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. If rust is present, it can be removed by careful polishing with pumice stone or brick powder.

The keyhole saw, pictured on page 4, 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.
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.

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The auger bit, as shown at the 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.

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—no. 8 meaning 8/16" or 1/2".

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

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.
4-H WOODWORKING

Avoid hammering on a screwdriver. It 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 at the left.)

Pliers should not be used on the blade to give greater turning force.

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

Keep your chisel sharp

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 the chisel. See illustrations below.

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.

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 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 eights 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. On page 1 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 11.

Framing squares are used in cutting rafters, squaring ends of boards, and laying out various angles. See pages 33 and 37.

The marking gauge is very useful in marking stock to size after the working face and the working edge are squared and true. See page 12.

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

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, 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 at the left.

When squaring stock, the following 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 6.
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 at the left 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 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 number.

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.

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 measured between threads, make the hole equal in depth to the length of the screw. See the illustration at the top of the page. 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 softwood, 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 is slipped 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.
With this wedge type doorstop, 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 - 1-1/2" #8 flathead

TOOLS NEEDED

Rip Saw
Rule
Try square
Cross cut saw
Plane
Screwdriver

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 chart.
   c. Mark to correct width and rip about 1/8" 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 1/8" thick as shown to prevent splintering.

7. Reduce to correct size by planing and squaring.

8. Assemble with #8 screws, countersinking as shown. Refer to the table on page 13 when making selection of correct sizes of bits for holes and countersinking.


10. Finish with either paint or stain, depending upon finish of other woodwork 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
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 - 1 1/2" #8 flathead screws

TOOLS NEEDED

Rule
Try square
Cross cut saw
Plane
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 13, for #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 #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

Assembly

Backboard

Holes for 1 1/2" No. 8 Screws
C'SK

Holder
NECKTIE RACK - CLASS I
Instruction Sheet

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 #9 1 1/2" screws

TOOLS

Saw
Plane
Hand drill and bit
Coping saw
Wood rasp
Screwdriver

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 13 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

Construction:

1. Cut four pieces of wood to the following dimensions:
   - 3 1/2" long
   - 1 1/16" wide
   - 1/2" thick

2. Drill a 1/4" hole 1 1/4" from one end of each piece.

3. Assemble the rack by inserting the 12" rod through the holes in the pieces.

Materials:

- 4 pieces of wood (3 1/2" x 1 1/16" x 1/2"
- 1 piece of 1/4" rod

Tools:

- Saw
- Drill
- Screwdriver

Instructions:

1. Mark and cut the pieces to the dimensions given.
2. Drill the holes and assemble the rack.
3. Use the rack to hang your neckties.
KNIFE RACK - CLASS I
Instruction Sheet

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 1/4" x 8" x 15" plywood - back
1 piece 1/4" 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
1/4 pound 3d nails

TOOLS

Rip and crosscut saws
Marking gauge
Rule
Try square
Mitre box
Plane
Hammer

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 11 1/4" long.

4. Mark and cut knife slots in top piece.

5. Fasten this piece to the back, three inches 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 much 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.
FILE CABINET - CLASS I
Instruction Sheet

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 pieces 1/2" x 6" x 8' 0".
1 piece 1' 1" x 1' 6" 1/4" plywood or Presdwood.

Nails: 8 2d finish

Screws: 38 1" #6 flathead

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.
A chick feeder of this sort is useful as a starting trough. It is inexpensive and very easy to make.

**MATERIALS NEEDED**

Old orange, lemon or lettuce crates provide satisfactory material for such feeders. There may be some slight variation in the thickness of the thin material found in some crates. Such material will be satisfactory if it is not less than 3/16" thick.

- 2 pieces - 5/8" x 2" x 4" ends
- 3 pieces - 1/4" x 2" x 2'-0" sides and bottom
- 1 piece - 1/4" x 2" x 2'-0" division board

**TOOLS NEEDED**

- Rule
- Try square
- Cross cut saw
- Plane
- Marking gauge
- Rip saw
- Hammer
- Pencil
- Nails: 16 - 5/8" #17 gauge wire nails for sides
- 4 - 3/4" #17 gauge wire nails for bottom

**CONSTRUCTION STEPS:**

The material is light. Work with care to assure correct sizes and to prevent splitting.

If you wish, you may make more than one feeder. One crate provides enough material for several of them. You can get credit for half a project with the second.

1. Square the stock
   a. Select best end of crate - plane smooth if necessary.
   b. Select best edge - plane square with face - check with try square as illustrated on chart.
   c. Square one end being careful not to splinter edges.
   d. Mark off correct width for ends of feeder. Be sure grain of wood runs the right way. (Use marking gauge if one is available).
   e. Rip off this piece cutting is slightly wider than it is marked.
   f. Reduce to correct width by planing.
   g. Cut to correct lengths and square being careful not to splinter ends. See Cross Cut Saw and Plane Charts.

2. Select best thin stock and cut to size the bottom, side pieces and division board. Planing of these pieces is not required.

3. Saw slots in end pieces for division board.
CHICK FEEDER

End view

Completed feeder

End construction
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" #8 screws
- 3 - 1 1/4" #8 screws

**TOOLS NEEDED**

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

**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 7 1/2".
   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 - 7 1/2". The length of this piece must equal the width of the 7 1/2" 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 13 for #8 screws.**

7. Bore a 1/2" 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 1 1/2" space would be at the other end of it.
BENCH HOOK

C'SK 2" No. 8 Wood screw

1/4" No. 8 Wood screw C'SK
HOME BENCH VISE - CLASS I
Instruction Sheet

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

<table>
<thead>
<tr>
<th>Stock: Oak or other hardwood</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 piece of 2&quot; x 10&quot; x 10&quot;</td>
</tr>
<tr>
<td>or</td>
</tr>
<tr>
<td>1 piece of 2&quot; x 8&quot; x 10&quot;</td>
</tr>
<tr>
<td>1 piece of 2&quot; x 2&quot; x 10&quot;</td>
</tr>
<tr>
<td>10 - 3&quot; #12 flathead screws</td>
</tr>
</tbody>
</table>

TOOLS NEEDED

<table>
<thead>
<tr>
<th>Rip saw</th>
</tr>
</thead>
<tbody>
<tr>
<td>Try square</td>
</tr>
<tr>
<td>Plane</td>
</tr>
<tr>
<td>Rule</td>
</tr>
<tr>
<td>Pencil</td>
</tr>
<tr>
<td>Screwdriver</td>
</tr>
</tbody>
</table>

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 #12 flathead screw.

5. Fasten "A" to bench so that when "B" is in place a 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 13 for information on screws.
HOME BENCH VISE

Holes Countersunk for 3" #12 Flat Head screws.

Parts Assembled
BIRD HOUSE (Wren) - CLASS I
Instruction Sheet

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 - 1/2" x 8" x 5'-0"

Heavy waterproof roofing
1 piece - 2" x 8"

Screws: 14 - 1" #8 flat head screws

Tacks: 8 small carpet tacks

Nails: 6 to 12 needed

TOOLS NEEDED

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

CONSTRUCTION STEPS:

1. Reduce the stock to 6" width.
   a. Mark for correct width of 6" with marking gauge.
   b. Rip about 1/8" outside this line.
   c. Reduce to line with plane.

2. Cut two pieces 5" long for sides.

3. Cut one piece 6 1/2" long for floor.


5. Cut two pieces 8" long for roof.

6. Cut one piece 8 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. (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 - CLASS II
Instruction Sheet

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 3/4" x 5 1/2" x 2'-0" - oak
- 1 piece 1 3/4" x 5 1/4" x 2'-0" - fir

Screws: 8 #8 - 1 1/2" flat head screws

TOOLS NEEDED

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

CONSTRUCTION HINTS:

1. Cut bottom to correct size.

2. Cut sides to correct width and length.
   Caution: One side is 1/2" wider than the other.

3. Fasten sides to bottom with screws being sure that the wider side projects below the bottom 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

For 45° Angle use 10" & 10" on square.
You will find this just the thing for those little jobs were 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**

- Crosscut and rip saws
- Square
- Rule
- Plane
- Hammer
- Screwdriver
- Brace and bits
- Marking gauge
- Pencil

**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 lengthwise. If you have any heavy scraps of plywood (1/2" or thicker) you can make the ends that will not split.
SAW HORSE - CLASS II
Instruction Sheet

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

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 8.

5. Set the legs in the notches in the top pieces. Nail as shown, using 8 d nails.

6. Cut the leg braces and fit them into the legs. Nail as shown, using 6 d box nails.

FINISH

These may be finished or not, as desired. Finish will add to the appearance. Sand smooth before finish is applied.
Top view of saw horse without leg braces in places

SAW HORSE

Side elevation of completed saw horse

End elevation

Notching 2'' x 6''

Cutting Leg
CHICK FEEDER - CLASS II
Instruction Sheet

This feeder is suitable for chicks up to about six weeks of age. It will hold more than the flat bottom feeder. There will be less waste and feed will stay cleaner.

MATERIALS NEEDED

Use old orange, lemon or lettuce crates. A full 1/4" thickness is not necessary. The material should be at least 3/16" thick.
2 - 5/8" x 3" x 6" ends
2 - trough ends as shown in cutting diagram
1 - 1/4" x 3" x 2'-0" trough bottom
1 - 1/4" x 3 1/4" x 2'-0" trough bottom
2 - 1/4" x 1 1/4" x 2'-0" lips
3 - 1" x 1" x 2" reel cores
4 - 1/4" x 3/4" x 3'-10" reel slats

TOOLS NEEDED

Rule
Try square
Cross cut saw
Rip saw
Plane
Brace and 1/4" bit
Hammer
Pencil
36 - 3/4" #17 gauge wire nails for trough lips, bottom and reel
6 - 1" barbed berry box nails for fastening trough ends to feeder ends
2 - 6d common nails for reel.

CONSTRUCTION STEPS:

1. Square the stock.
   a. Select best face of one end of crate - plane smooth if necessary.
   b. Reduce to size - 11 1/2" x 11 1/2" if necessary.
   c. Mark off as shown and cut out trough ends.
      Caution: Be sure grain runs right way.
   d. Select best face of one end of crate - plane smooth if necessary.
   e. Select best edge - plane square with face - check with try square.
   f. Square one end being careful not to splinter edges.
   g. Mark off for rectangular ends and saw out.
      Caution: Be sure grain runs right way.
   h. Square other edges and ends.

2. Select best thin material - cut out trough bottoms and lips.
   Caution: Notice that one bottom piece is wider than the other by the thickness of the material.

3. Bore 1/4" holes in trough ends so 6d nails which support reel will turn without binding.

4. Assemble feeder.

5. Cut reel cores out of extra end material.

6. Cut slats from extra thin material.

7. Bore holes in the end reel cores so 6d nails will fit snugly but may be placed or removed by hand. These holes should not go entirely through the cores.

8. Fasten slats onto reel cores.

9. Put reel in place, being careful not to push 6d nails in so far that the heads bind on trough ends and prevent reel from turning easily.
POULTRY FEEDER FOR CHICKENS 6-10 WEEKS OLD - CLASS II
Instruction Sheet

Feed will stay cleaner in this feeder, because it is up off of the floor.

MATERIALS NEEDED

Stock: Old orange crates may be used for part of material. Use fir for legs.
1 end of orange crate - Trough ends
2 - 1/4" x 6" x 3'-0" - Trough bottoms
2 - 1/4" x 2" x 3'-2" - Trough lips
4 - 1" x 2" x 1'-5" - Legs
2 - 1" x 2" x 1'-3" - Cross arms
2 - 1/2" x 2" x 3'-0" - Perches
3 - 2" x 2" x 3" - Reel cores
4 - 1/4" x 1" x 2'-10" - Reel slats

Nails: 8 - 3d light lath - perches to cross arms
12 - 3d common - legs to trough ends
8 - 4d common - legs to cross arms
42 - 3/4" #17 gauge wire - trough bottom and lips, and reel slats
2 - 6d common - reel supports

TOOLS NEEDED

Hammer
Cross cut saw
Rule
Square
Brace and bits
Pencil
Rip saw

Note: Since this material is small scale, the lengths and widths given are approximately as they will be used. A few pieces may have to be cut slightly shorter and the trough bottoms must be planed to a narrower dimension.

CONSTRUCTION HINTS:

1. Cut trough ends from end of old orange crates as shown.
2. Bore holes in ends as shown. Two holes are needed in each end so reel may be raised as chickens grow.
3. Cut trough bottoms to correct width and length.
4. Nail bottoms onto ends.
5. Cut legs to correct length and angle. (See detail "A")
6. Cut cross arms to correct length and notch for trough. (See detail "B")
7. Cut perches to correct length.
8. Nail perches to cross arms.
9. Nail legs, trough and cross arms together.
10. Cut trough lips to correct length.
11. Nail trough lips to trough and legs.
12. Cut reel cores and reel slats to correct sizes.
13. Bore holes in the two end reel cores so 6d nails will fit snugly but may be placed or removed by hand.
14. Fasten slats onto reel cores.
15. Put reel in place being careful not to push 6d nails in so far that the heads bind on trough ends and prevent reel from turning easily.

FINISH: This article needs no finish.
POULTRY FEEDER
for chickens 6-10 weeks old

Detail A

Detail B

2" Reel

1" x 2" x 1'-3"

1/2" x 2"

1' x 2" x 3'-2"

4 1/4" x 2" x 3'-0"

3/8" x R" x 3'-0"

1'-3 3/4"

11 1/2"
POULTRY FEEDER FOR HENS - CLASS II
Instruction Sheet

Here is a heavier and larger feeder for hens.

MATERIALS NEEDED

Stock: Scrap lumber and crates can provide most of the material here. Select knot free, straight grained stock for legs.

- 4 - 1" x 2" x 2'-4" - Legs
- 4 - 1" x 2" x 4'-0" - Perches
- 2 - 1" x 2" x 2'-0" - Cross arms
- 2 - 1" x 10" x 12" - Trough ends
- 2 - 1/2" x 8" x 4'-0" - Trough bottoms
- 2 - 1" x 3" x 4'-0" - Trough lips
- 6 - 1" x 2" x 2" - Reel cores
- 4 - 1/2" x 1/2" x 4'-0" - Reel slats

Nails: 2 - 6d common - reel support
- 24 - 4d common - legs
- 16 - 5d finish - perches & reel cores
- 30 - 2d light lath - trough bottoms & lips
- 24 - 2d extra fine #17 wire - reel slats

TOOLS NEEDED

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

CONSTRUCTION HINTS:

1. Cut trough ends and bore holes for reel support. (Detail "A")
2. Cut trough bottoms and nail in place.
3. Cut legs and cross arms. (Detail "B").
4. Nail legs to cross arms and trough ends.
5. Cut perches to correct length and notch two inside ones so they fit snugly against legs.
6. Cut and nail trough lips in place.
7. Bore holes in the two and reel cores so 6d nails will fit snugly but be placed or removed by hand.
8. Fasten slats onto reel cores. (Detail "C").
9. Put reel in place, being careful not to push 6d nails in so hard that the heads bind on trough ends and prevent reel from turning easily.

FINISH: This article needs no finish.
POULTRY FEEDER FOR HENS

**Detail A**

- Holes 1" Apart
- 1" Hole used 4 to adjust height of Reel
- $\frac{1}{2}" \times 3"$
- $1" \times 2"$
- $\frac{1}{2}" \times 5$
- $\frac{1}{2}" \times 2$
- $2' \times 6"$
- $2' \times 0"$
- $12"$

**Detail B**

- 2 - $1" \times 3" \times 3"$
- $\frac{1}{2}"$ Material
- Nail Pulls Out

**Detail C**

- 2.34" X 2.34"
- 3.56" X 3.56"
- 2.0" X 0.0"
- 4.5" X 4.5"
If you have hogs around the place, you can use one or more of these. A hog trough must be sturdy, heavy enough to resist overturning, and protected to keep the hogs from laying down in their water or feed. Joints must fit snugly.

This trough will fill the bill, if you use care in construction.

**MATERIALS NEEDED**

- The wood used should be strong, and resistant to decay. Fir is a good choice.
- 1 - 2" x 10" x 6' side
- 1 - 2" x 12" x 10' side and ends
- 3 dozen 16d nails
- 2 dozen 8d nails
- 1 - 1" x 2 1/2" x 4' braces

**TOOLS NEEDED**

- Hammer
- Saw
- Square
- Plane

**CONSTRUCTION STEPS:**

1. Mark and cut sides 6' long. One side is a 2 x 10, the other a 2 x 12. Be sure that these are cut to exactly the same length, and that the ends are square.

2. Check the edge of the 2" x 10" that is to be joined to the 2" x 12", is square and straight. Remove any high spots with a plane if necessary.

3. Nail sides together. Use 16d nails. Be sure that ends are even.

4. Cut ends, 2" x 12" x 2'. Nail ends in place, using 16d nails.

5. Notch top edges of the sides to receive the divider braces.

6. Cut braces 3/4" x 2" x 1'-4". Nail in place with 8d nails.

Use no finish.

1" x 2" cleats may be nailed to the end pieces, tight under the sides, if desired. This will add to the strength and the trough will not be as likely to leak.
HOG TROUGH

DIVIDER BRACES

$\frac{3}{4}'' \times 2\frac{1}{2}'' \times 16''$

ENDS

$2'' \times 11\frac{1}{2}'' \times 24''$

SECTION

$11\frac{1}{2}''$

$2'' \times 12''$

$2'' \times 10''$

$24''$
WASH BENCH - CLASS II
Instruction Sheet

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 - #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 1/4" and 3 3/4" on your square. See page 36 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.
WASH BENCH

Assembly

NAILS

SCREWS

Side view

End view

Dimensions:
- 4' 0" long
- 3' 8" wide
- 1" high
- 2" deep
- 6" deep
- 9 1/2" deep
- 2 1/2" deep
- 3/4" thick
WALL DESK - CLASS II
Instruction Sheet

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
1/2" x 8" x 10' 0"
Drawer: 1 piece 1/2" x 6" x 3' 0"
Back: 1 piece 1/4" x 1' 6" x 2' 0" plywood or Presdwood
Lid: 1 piece 1/4" x 1' 4" x 2' 0" plywood or Presdwood
1 piece 1" x 2" x 7' 0"
Optional lid: 1 piece 1/2" x 1' 4" x 2' 0" plywood. (No 1" x 2" re-enforcement is needed with the heavier plywood.)
Drawer bottom: 1 piece 1/4" x 8" x 12" plywood
Cleats: 1 piece 1/2" x 1/2" x 4' 0". (You might prefer ripping this from a wider 1/2" board)
Screws: 12 1-3/4" 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 #16 nails for cleats
16 3/4" wire brads for lid frame.

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

TOOLS NEEDED

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 1/2" 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 page 2.

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

Detail "A"

Cut slot for hinge

Detail "B"

1\(\frac{1}{2}\) x 6"
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

<table>
<thead>
<tr>
<th>Stock</th>
<th>TOOLS NEEDED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pine or fir</td>
<td>Hammer</td>
</tr>
<tr>
<td>2 pieces 1/2&quot; x 14&quot; x 32&quot; plywood--top and bottom</td>
<td>Cross cut saw</td>
</tr>
<tr>
<td>1 piece 3/4&quot; x 6&quot; x 7'-0&quot; sides and ends</td>
<td>Square</td>
</tr>
<tr>
<td>1 piece 1/2&quot; x 1-3/4&quot; x 7'-6&quot; sides, ends, partitions for tray</td>
<td>Pencil</td>
</tr>
<tr>
<td>1 piece 1/4&quot; x 5&quot; x 30 1/2&quot; plywood--tray bottom</td>
<td>Brace and bits</td>
</tr>
<tr>
<td>1 piece 3/4&quot; x 2&quot; x 4'-0&quot; top cleats</td>
<td>Screwdriver</td>
</tr>
<tr>
<td>1 piece 1/2&quot; x 1&quot; x 2'-0&quot; cleats for tray</td>
<td>Plane</td>
</tr>
<tr>
<td>3 pieces--cleats, and button to hold saw</td>
<td>Wood file</td>
</tr>
</tbody>
</table>

### Screws:

1 doz. 1 1/2" #9 flathead wood screws (for sides and bottom)
1 doz. 1" #8 flathead wood screws (for cleats)

### Nails:

1 box 1" #16 wire brads (for tray and cleats)

3 steel chest hinges and screws
2 drawer pulls (Steel) and screws
1 hinge hasp and screws

### HOW TO MAKE IT:

1. Mark and cut 1/2" plywood for top and bottom. (If you do not have plywood, 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 1/2" long.

3. Assemble sides, ends, and bottom.

4. Cut tray sides 30 1/2" long from the 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.


6. Cut the 1/2" x 1" x 12 1/2" cleats to support tray. Nail these in place so that the top of the tray is 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.


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

- STEEL CHEST HINGES
- TOP CLEATS
- HASP HINGE
- DRAWER PULL HANDLE
- END

SIDE

MOVEABLE TRAY
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 1 1/2" no. 6 flathead wood screws

**TOOLS NEEDED**

- Rip and crosscut 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 thru the end boards as shown on the drawing. (See page 13).
6. Fasten with screws. You may use glue for added strength if you wish. Counter-sink 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.
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 waterproof. 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 craft work 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 of them are not waterproof.

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 the 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, and can be purchased in diameters of 1/8 to 1-1/4 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.

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

**COMMON JOINTS:**

Illustrated on the following page are some of the common joints used in woodworking. The choice of joint depends on the use and purpose of the article being made. Sometimes a simple joint, allowing a quick and easy construction, will be preferred. In other cases, appearance will be important. In still other cases, strength will have first consideration. The purposes to which each of these joints can be put are numerous. Many of them are used in furniture and construction around your home.

**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.
Finishing for Protection and Decoration:

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.
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 in a piece, 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 two by four, you will find that it measures about 1 5/8" x 3 1/2". 2" x 4" is the nominal size; 1 5/8" x 3 1/2" is the actual size. You will find that an 8" inch board is only 7 1/4" wide. The lumber industry has set these sizes to allow for sawing and surfacing.

A Two x Four
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 are tough, wear resistant and water resistant.

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

Be neat. Don't dip your brush too deep, and watch for drops. Paint, where you don't want it, is ugly and hard to remove.
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