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A Young Teacher looks at His Job

David Morgan Hannah

A NINE WEEK COURSE SYLLABUS FOR WOOD WORKING IN NINTH GRADE

by

Dane C. Henderson

Submitted as partial fulfillment toward the

Master's Degree

Approved by [redacted]

Dr. Sonderman. July 7, 1958

Approved by Walter A. Klehm

Dr. Klehm.

Eastern Illinois University
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"Books are keys to wisdom's treasure;
Books are gates to lands of pleasure;
Books are paths that upward lead;
Books are friends. Come, let us read."

-By Perry S. Graffam.

CLASS SCHEDULE

The class periods are 55 minutes in length. The class meets five times a week. Two class periods of about twenty minutes each will be used for discussion periods. This will give the student approximately four hours of laboratory time per week.

A NINE WEEK COURSE SYLLABUS FOR WOOD WORKING
FOR NINTH GRADE

Section I

INTRODUCTION

A. Purpose

B. How To Use The Syllabus

C. General Objectives Of Industrial Arts

D. Specific Areas Of Development

E. Summary Of Work To Be Covered

F. Suggestions To The Student

Purpose--This syllabus has been assembled as an aid for both the teacher and pupil. This is a detailed outline of what is to be studied, the laboratory assignments to be covered, and the various tool procedures and other related material which are required in most hand tool wood working activities.

HOW TO USE THE SYLLABUS

This syllabus has been written primarily for the student in the woodworking courses. It includes basic information on the many tools and gives a procedure for tool operations. It is intended to help the reader to develop an understanding and appreciation of the tools and processes involved in woodworking.

Section I is the introduction to the subject which states the purpose of the course. There is an outline of the material which will be covered in the study during this term. A list of what each student should know how to do has been entered as a guide for both the teacher and student. This section should be read by each student so he knows what is expected of him.

Section II lists the laboratory assignments. These assignments have been selected so the many tool operations may be learned. Each assignment will have new operations and a review of several tool operations from previous laboratory projects.

Section III is devoted to the study assignments. The assignments will be discussed at the time appointed by the instructor. The study assignments are written in the form of an outline about the unit to be discussed. The references listed are the location which all the information will be obtained in order to answer all the questions in each study assignment.

Section IV describes many of the practical and useful hand-

tool processes which develop craftsmanship in hand-tool skills with yard and shop lumber. This section will be referred to for many of the hand-tool operations throughout the term.

Section V contains information on the hand-tools. The description and use of each tool is discussed. Also this section will be referred to for information needed for the study assignments.

GENERAL OBJECTIVES OF INDUSTRIAL ARTS [1]

1. Shop Skills and Knowledge--to develop in each pupil a measure of skill in the use of common tools and machines, and an understanding of the problems involved in common types of construction and repair.

2. Drawing and Design--to develop in each pupil an understanding of drawings and the ability to express ideas by means of drawing.

3. Interest in Achievement--to develop in each pupil a feeling of pride in his ability to do useful things and to develop worthy leisure-time interests.

4. Appreciation and Use--to develop in each pupil the appreciation of good design and workmanship, and the ability to select, care for, and use industrial products wisely.

5. Orderly Performance--to develop in each pupil the habit or an orderly, complete and efficient performance of any task.

6. Self-Discipline and Initiative--to develop in each pupil the habits of self-reliance, self-discipline and resourcefulness in meeting practical situations.

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[1] Duncan, Glenn S., Recreational Craft Work, Eastern Illinois State College, Charleston, Illinois. 1951, p.4.

7. Cooperative Attitudes--to develop in each pupil a readiness to assist others and to join happily in group undertakings.

8. Interest in Industry--to develop in each pupil an active interest in industrial life and in the methods and problems of production and exchange.

9. Health and Safety--to develop in each pupil desirable attitudes and practives with respect to health and safety.

SPECIFIC AREAS OF DEVELOPMENT [1]

1. Tool Technique and Skills--to develop in each individual some measure of skill in the manipulation of woodworking tools and materials.

2. Subject Matter Information--to develop in each individual some understanding concerning information basic to woodworking.

3. Habits, Traits, and Attitudes--to develop in each individual desirable personal habits, traits, and attitudes.

4. Appreciation and Use--to develop in each individual some appreciation of design, craftsmanship, and products made or wood.

5. Health and Safety--to develop in each individual an interest and some understanding concerning individual and group health and safety in the use of woodworking tools and materials.

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[1] "Class discussion and notes", Dr. Klehm, History of Vocational Education, April 25, 1958.

SUMMARY OF WORK TO BE COVERED

The work which is to be covered in this course is divided into two areas:

1. Manipulative activities[1]
2. Informational content

During the progress of the course the students will have an opportunity to experience the following type of activities.

How to:

1. Read a working drawing.
2. Develop a bill of material.
3. Get out stock.
4. Plan an orderly procedure for doing a job.
5. Take pattern from source material.
6. Transfer pattern to stock.
7. Check materials when received.
8. Lay-off measurements with a rule.
9. Lay-off pattern on stock.
10. Gage with a marking gauge.
11. Test for straightness with a try-square.
12. Test for squareness and trueness with a try-square.
13. Hold stock with a woodworker's vise.
14. Assemble and adjust a jack-plane or smooth plane.

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[1]Compiled from: Dr. Klemn's list of General Wood Work Hand Tool Processes, Eastern Illinois University, Charleston, Illinois.

15. Plane a surface true and smooth.
16. Plane an edge square with face.
17. Plane an end square with face and edge.
18. Sharpen a plane iron.
19. Proceed properly in squaring stock.
20. Insert a coping saw blade in frame and adjust it.
21. Cut along a line with a coping saw.
22. Hold stock on a saw jack.
23. Cut along a line with a coping saw and saw jack.
24. Saw outside curves with a coping saw.
25. Saw to a line with a cross-cut saw.
26. Smooth edges with a file.
27. Smooth a surface with sandpaper.
28. Trim with a chisel.
29. Cut countersink with a chisel.
30. Pare with a chisel.
31. Cut a groove using a chisel.
32. Score and notch to aid in chiseling.
33. Saw to a line with a back saw.
34. Use a bench hook.
35. Layout curves with dividers.
36. Lay out arcs using a compass.
37. Saw to a line with a rip-saw.
38. Attach and adjust auger bit depth gauge.
39. Bore holes with a auger bit.
40. Finish outside curves with sandpaper.
41. Finish inside curves with sandpaper.
42. Fill holes using plastic wood.

43. Apply show card paint.

44. Hold stock using "C" clamp.

45. Clean and care for a show card paint brush.

46. Apply wax.

47. Apply wood filler or other sealers.

48. Drive and draw nails.

49. Set nail or brad.

50. Lay out duplicate parts.

51. Gauge with marking gauge.

52. Layout and cut a regular chamfer with a plane.

53. Layout and cut a stop chamfer.

54. Make holes for small screws or nails using a brad awl.

55. Adjust and secure sliding T-bevel.

56. Layout bevel-cut with a T-bevel.

57. Test bevel cut with a T-bevel.

58. Prepare and apply casco or cascomite or weldwood glue.

59. Make an edge to edge glue joint.

60. Glue up stock.

61. Drill holes using a brace-drill.

62. Countersink for screws.

63. Drill holes using a hand drill.

64. Fasten with screws.

65. Drive screws with common screw driver.

66. Mix oil stain and apply it with a brush.

67. Clean and care for a stain brush.

68. Layout and cut tapers.

69. Round edges using sandpaper.

70. Round edges using plane.

71. Assemble and adjust a block-plane.

72. Shape edges and ends of a board with a block-plane.

73. Shape an edge or end with a file.

74. Apply enamel with a brush.

75. Clean and care for enamel brush.

76. Sharpen a scraper.

77. Smooth a surface with a scraper.

78. Layout and cut a dado-point.

79. Apply filler using a brush.

80. Clamp up stock using bar-clamp.

81. Layout irregular design by means of squares.

82. Apply varnish.

83. Clean and care for a varnish brush.

84. Rub a finish with pumice stone and oil.

85. Apply lacquer with a brush.

86. Clean and care for a lacquer brush.

87. Hold stock using a hand-screw clamp.

88. Apply paint with a brush.

89. Clean and care for a paint brush.

90. Drill holes for a dowel pin using a doweling jig.

91. Make a dowel joint.

92. Layout and cut a blind mortise and tenon joint.

93. Sharpen a screwdriver.

94. Apply linseed oil to stock.

95. Remove liquid from a full container.

96. Open a paint can with a screwdriver.

The information units listed below will help give the students added knowledge of the details of woodworking.

1. Planning
2. Layout and measuring tools
3. Woods and plywoods
4. Holding tools
5. Tooth cutting tools
6. Edge cutting tools
7. Boring tools
8. Fastening devices and tools
9. Abrasives
10. Finishes and brushes

SUGGESTIONS TO THE STUDENT

The saying "an ounce of prevention is worth a pound of cure" is applicable to safety in the school industrial arts laboratory, in the individual shop, or in the home workshop. Tools and machinery have been developed to aid in construction of wood projects, but they can be safely used only if they are properly cared for, understood, and respected.

Facts regarding school-shop accidents reveal that more occur in the forenoon around ten o'clock than at any other time of day. We also learn that more accidents happen on Wednesday than on any other day, except on days immediately prior to or following vacation periods. It has been pointed out that the most hazardous area is woodworking; this is possibly owing to the types of hand tools, such as wood chisels, saws, knives, planes, hammers, and files which are used, or misused in woodworking. The wood chisel has been the cause of more injuries than all other hand tools. Hand tool accidents have accounted for twice as many injuries as machine-tool accidents, and most of the injuries have been to the inexperienced person or the beginner because of negligence and improper use of the tools.[1]

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[1]Groneman, Chris H., General Woodworking, McGraw-Hill Book Company, Inc. New York, New York. 1952, p.9.

SAFETY RULES

Physical

1. Test the sharpness of tools on wood or paper, not on your hand.
2. Be careful when using your thumb as a guide in crosscutting and ripping.
3. Always cut away from the body when using a knife.
4. Make sure your hands are not in front of sharp-edged tools while the tools are in use.

Clothing

1. Dress appropriately for work in the shop. You should wear a shop apron or some other protective clothing, such as coveralls.
2. Tuck in your tie and roll up your sleeves so that they are out of the way.

Tools

1. Lay tools to be used in an orderly arrangement on a bench top with the cutting edges away from you and in such positions that they will not rub against each other. Sharp tools should not be allowed to extend over the edges of the bench.
2. Screw-driver points must be kept properly pointed to prevent injury to hands and wood fiber.
3. Fasten handles securely on planes, hammers, and mallets.
4. Make certain that all files have handles.
5. Use tools only for their intended purpose and, then, properly. Do not attempt to pry with a file, screw driver, or wood chisel.

Materials

1. Always fasten material securely in a vise, when practical, before working with it.
2. Store scrap pieces of lumber in the scrap box or in the storage rack so no one will fall or stumble over the pieces.

3. Keep oily rags used for finishing in closed metal containers to prevent fires.

Shop Courtesy

1. Report an accident immediately after it occurs so that first aid can be given.

2. Do not run in the shop, laboratory, or home workshop; it is dangerous.

3. Carry only a few tools at a time.

Section II

LABORATORY ASSIGNMENT

A. Figure Cutout

B. Clip Board

C. Book Ends

D. Book Ends - Incise Carving

E. Book Stand

F. My Shine Box

G. Stand for a Potted Plant

H. Dachshund Tie Rack - Carving

I. Cook Book Shelf

J. Mint Trays - Chase Carving

K. Pen and Letter Rack

L. Solid Figures - Round Sculpturing

FIGURE CUTOUT

Introductory Statement.

These cutouts make very nice decorative articles for the walls in your room.

Job Specifications.

This figure is to be made of 1/4 " wall board. It is to be finished in show card color on the face and in a color that is suitable for the pattern. A small hanger is fastened to the back for hanging on the wall.

Bill Of Material.

1 piece of wall board to fit size of cutout.

1 hanger.

Tools Needed For Job.

Coping saw	File
Sandpaper	Show card paint
Brush	

General Directions.

1. Study the specifications and drawings before beginning work. You may wish to modify the design or create one of your own.

2. Read over entire plan of procedure before beginning work.

3. Check off the steps of procedure as you complete them.

4. Give close attention to all instructions provided by your instructor.

5. Ask the instructor concerning any point you are in doubt about.

Tool Processes Involved in the Job.

To make this project, you will have an opportunity to acquire a degree of skill in the following manipulative processes.

How to:

1. Take pattern from source material.
2. Transfer pattern to stock.
3. Insert a coping saw blade in frame and adjust it.
4. Cut along a line with a coping saw.
5. Hold stock on a saw jack.
6. Cut along a line with a coping saw and saw jack.
7. Smooth edges with a file.
8. Finish outside curves with sandpaper.
9. Finish inside curves with sandpaper.
10. Apply show card paint.
11. Clean and care for a show card paint brush.
12. Apply wood filler or other sealers.

Plan of Procedure.

In doing this job you should proceed as follows:

____ 1. Choose pattern and have approved.
____ 2. Take pattern from source material.
____ 3. Get stock from instructor and trace pattern on it.
____ 4. Cut out pattern using coping saw and saw-jack.
____ 5. File edges smooth.
____ 6. Sand edges smooth.

____ 7. Have cutout inspected.

____ 8. Color using show card paint.

____ 9. Apply wood filler.

____10. Fasten hanger on back side in the proper position.

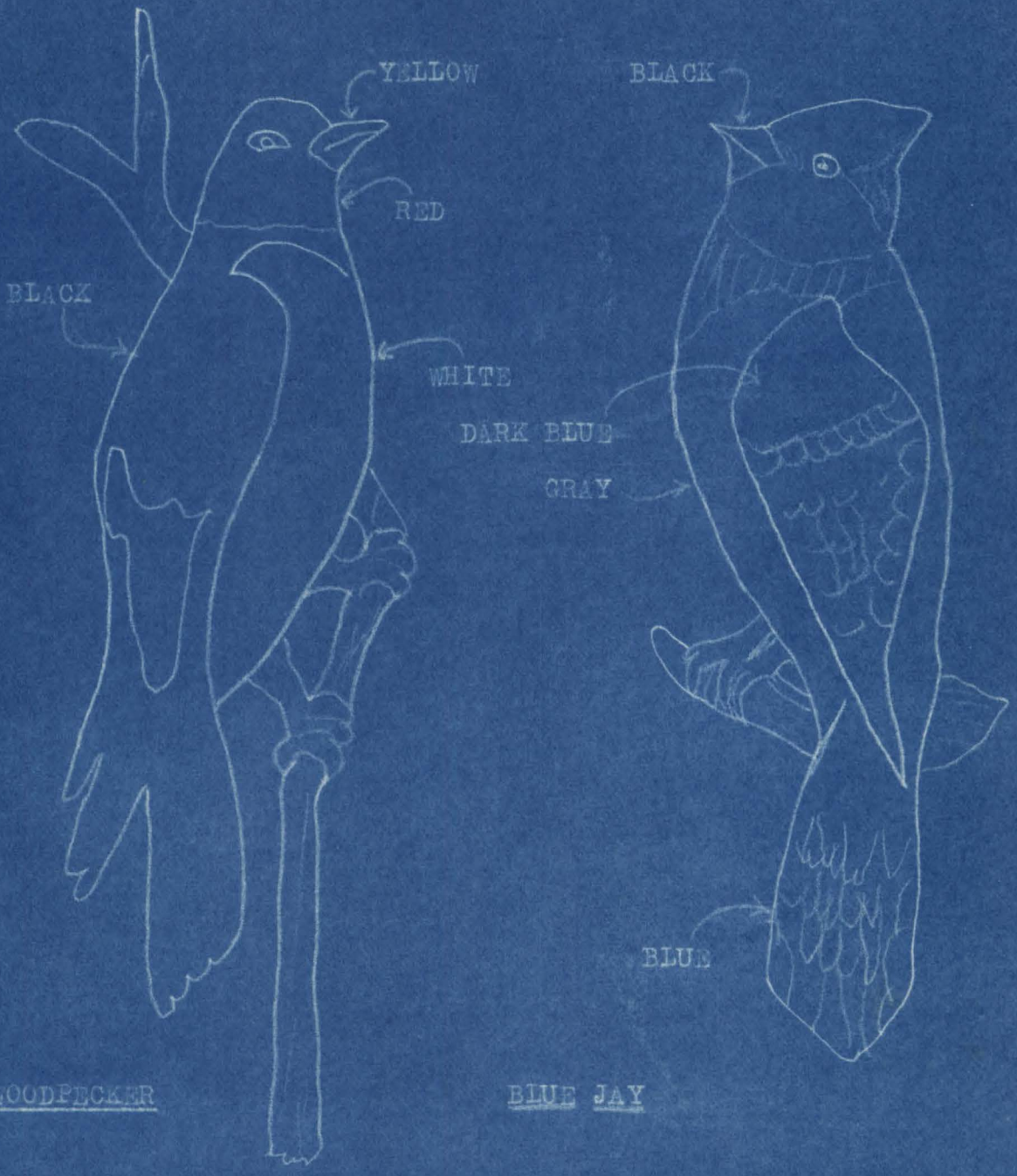
____11. Fill out work sheet and have work graded.

Test of Workmanship.

When you have finished this job, test your work as follows:

1. Are the curves smooth and graceful?
2. Did you saw parallel to the outline?
3. Did you get a good job of applying the paint?

HANGING SILHOUETTE *



WOODPECKER

BLUE JAY

* Suggested project for Laboratory Assignment No. 1

CLIP BOARD

Introductory Statement.

A clip board can be very useful for taking class notes and holding loose sheets of paper.

Job Specifications.

This clip board is to be made of gum according to the dimensions given on the attached drawing. The project will be given a coat of enamel on both edges, ends, and chamfer. When enamel is dry, you are to give the project two coats of linseed oil, then wax. When the desired finish has been acquired the instructor will provide you with a clip.

Bill of Material.

1 piece of board, $\frac{1}{2}$" thick, 9" wide, 12" long.

1 clip

Tools Needed for Job.

Cross cut saw	Awl
Try square	Twist bit
Jack plane	Hand drill
Rule	Paint brush

General Directions.

1. Follow steps of procedure, unless you have a better suggestion, but first check with the instructor before deviating.

2. When you come to a new step in the plan of procedure, ask your instructor for a demonstration.

3. You may receive help from your classmates but that

won't excuse you for work improperly done. Your instructor is the teacher.

4. Check over the tests of workmanship before beginning work.

Tool Processes Involved in This Job.

In making this project, you will have an opportunity to acquire a degree of skill in the following manipulative processes.

New learning units; How to:

1. Read a working drawing.
2. Develop a bill of material.
3. Lay off measurements with a rule.
4. Lay off pattern on stock.
5. Test for squareness and trueness with a try-square.
6. Assemble and adjust a jack plane.
7. Plane a surface true and smooth.
8. Plane an edge square with face.
9. Plane an end square with face and edge.
10. Sharpen a plane iron.
11. Proceed properly in squaring stock.
12. Saw outside curves with a coping saw.
13. Smooth a surface with sandpaper.
14. Cut countersink with a chisel.
15. Saw to a line with a cross cut saw.
16. Layout curves with divider.
17. Trim with a chisel.
18. Finish outside curves with a wood file.
19. Gage with a marking gauge.

20. Layout bevel-cut with T-bevel.

21. Adjust and secure sliding T-bevel.

22. Layout and cut a regular chamfer with plane.

23. Test bevel-cut with a T-bevel.

24. Drill holes using a hand drill.

25. Apply enamel with a brush.

26. Clean and care for enamel brush.

27. Smooth a surface with a scraper.

28. Apply linseed oil to stock.

29. Apply Wax.

Review operations; How to:

1. Insert a coping saw blade in frame and adjust it.

2. Cut along a line with a coping saw.

3. Finish outside curves with sandpaper.

Steps of Prodedure.

In doing this job you should proceed as follows:

____ 1. Study drawing and specifications.

____ 2. Obtain stock and check it.

____ 3. Plane one surface true and smooth.

____ 4. Square an edge with face.

____ 5. Square an end with face and edge.

____ 6. Cut to length and square the end with face and edge.

____ 7. Cut to width.

____ 8. Cut to thickness.

____ 9. Have this piece checked by instructor. ____

____10. Layout curves and locate holes.

____11. Have work checked by instructor. ____

____12. Cut away surplus stock using coping saw.

____13. Trim curve smooth using a chisel.

____14. Layout chamfer.

____15. Cut chamfer.

____16. Drill holes.

____17. Sand all surfaces.

____18. Paint edges and ends.

____19. Apply linseed oil.

____20. Apply Wax.

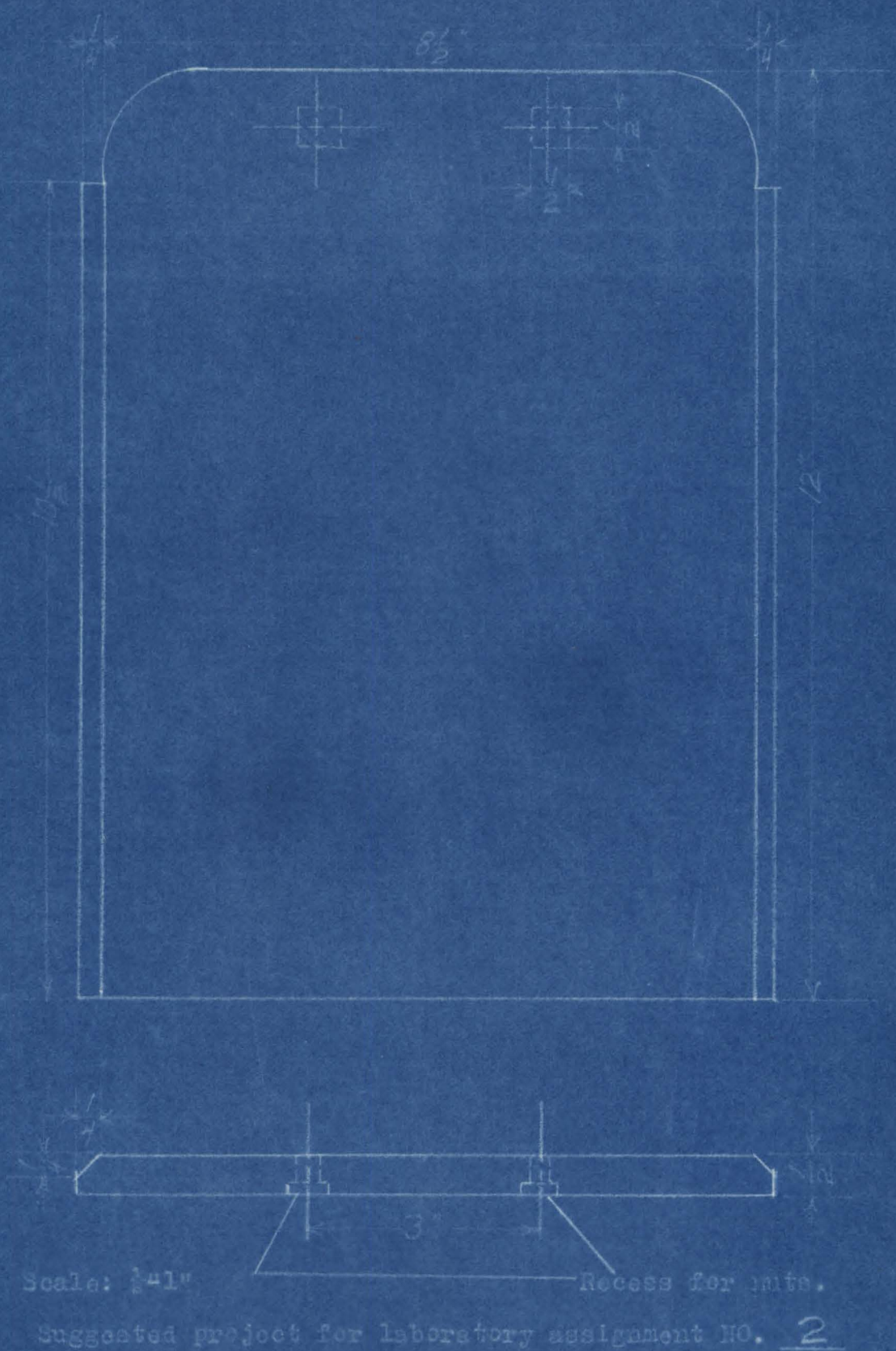
____21. Fill out plan of procedure, apply test of workmanship and turn project in to instructor for inspection and grading.

Test of Workmanship.

When you have finished this job, test your work as follows:

1. Check board for squareness.
2. Are all dimensions within tolerance?
3. Are the curves smooth?
4. Is the chamfer a 45 degrees chamfer?
5. Did you do a good job of painting?

CLIP BOARD



Scale: ½"=1"

Recess for nuts.

Suggested project for laboratory assignment NO. 2

BOOK ENDS

Introductory Statements.

A set of bookends are very useful to hold your books on a shelf and keep your desk looking neat.

Job Specification.

The book ends are to be made of gum. They are to be finished with a golden oak stain and varnished. A pumice stone and oil finish is to be given to the varnish.

Bill of Material.

2 pieces--Base--$\frac{1}{2}$"thick X 3" wide X 4" long.

2 pieces--End--$\frac{1}{2}$" thick X 3" wide X 3" long.

4 screws.

Tools Needed for Job.

Rule	T-bevel
Awl	Twist drill
Back saw	Hand Drill
Jack Plane	Scraper
Sandpaper	

General Directions.

1. Review old learning units from time to time to be sure you know them.

2. Check with instructor from time to time on the progress of your work.

3. Try and perform the type of craftsmanship of which you will be proud.

4. The easiest way to cover up a mistake is to avoid making it. Think! Think!

5. If there is a shortage of tools, keep them on the table in front of you where they may be shared.

Tool Processes Involved in the Job.

In making the book ends, you will have an opportunity to receive instructions in the new operations listed below and to practice them on the book ends. In addition, you will be able to get additional practice in some of the learning units you already have had experience.

New tool process; How to:

1. Check materials when received.
2. Test for straightness with a try-square.
3. Pare with a chisel.
4. Score and notch to aid in chiseling.
5. Saw to a line with a back saw.
6. Use a bench hook.
7. Fill holes using plastic wood.
8. Layout duplicate parts.
9. Drill holes using a brace drill.
10. Countersink for screws.
11. Fasten with screws.
12. Drive screws with common screw driver.
13. Mix oil stain and apply it with a brush.
14. Clean and care for a brush used in applying stain.
15. Layout and cut a dado-joint.
16. Apply varnish.

17. Clean and care for a brush used in applying varnish.

18. Rub a finish with pumice stone and oil.

19. Remove liquid from a full container.

20. Open a paint can with a screw driver.

21. Layout and cut topers.

Review operation; How to:

1. Read a working drawings.

2. Develop a bill of material.

3. Layout measurements with a rule.

4. Test for squareness and trueness with a try-square.

5. Assemble and adjust a jack plane.

6. Proceed properly in squaring stock.

7. Smooth a surface with sandpaper.

8. Trim with a chisel.

9. Layout and cut a chamfer with a plane.

10. Test bevel cut with a T-bevel.

11. Smooth a surface with a scraper.

Plan of Procedure.

In doing this job you should proceed as follows:

_____1. Study drawing and specifications.

_____2. Procure stock and check it.

_____3. Plane a surface true and smooth.

_____4. Cut a length and width and square with face.

_____5. Measure and layout duplicate parts of bases.

_____6. Measure and layout duplicate parts of ends.

_____7. Have instructor check work. _____

_____8. Cut to the dimension for each part.

_____9. Plane taper on bases.

____10. Layout angles and chamfers.

____11. Have instructor to check work. _____

____12. Plane angles on ends.

____13. Plane and pare chamfer on ends.

____14. Layout dado on bases.

____15. Have instructor to check work._____

____16. Cut dados on bases.

____17. Drill holes for screws.

____18. Countersink for screws.

____19. Sand all parts.

____20. Assemble parts.

____21. Apply stain.

____22. Varnish.

____23. Rub with pumic stone and oil.

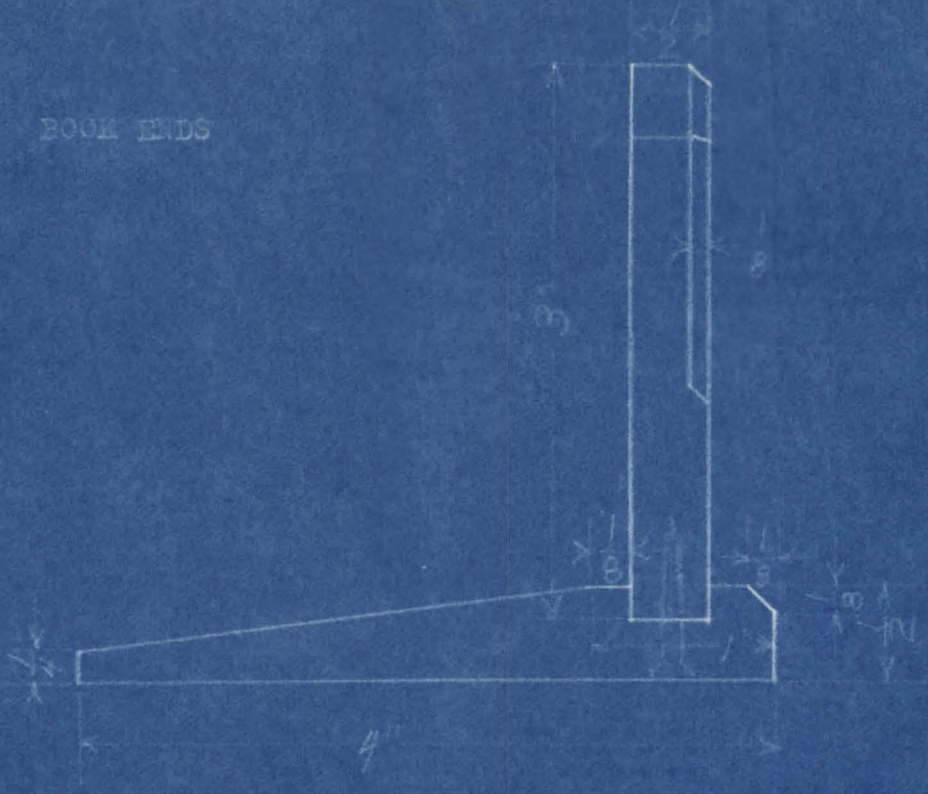
____24. Fill out a plan of procedure, test of workmanship, and hand it and project into the instructor for checking and grading.

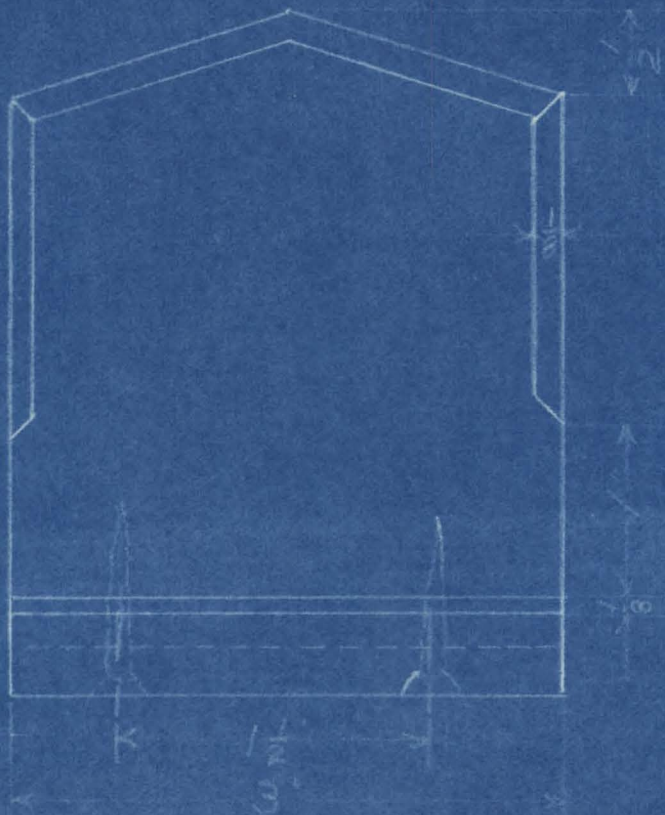
Test of Workmanship.

When you have finished this job, test yourself on the following points.

1. Do you have a neat fit at the joints?
2. Do the pieces fit square?
3. Are dimensions as specified?
4. Is this the best to your ability? Why?

BOOK ENDS





Suggested project for laboratory assignment NO. 3

BOOK END - INCISE CARVING

Introductory Statement.

This project is one that may be substituted for the one in laboratory assignment No. 3. This one is a different design and gives you a chance to put your own inititals on the book ends.

Job Specification.

The book ends are to be made of 3/4" solid stock. The base is 3/4" X 2" X 6" and has a 1/4" chamfer cut at 45 degrees angle around the front and both sides. The upright is 3/4" X 4" X 4" with a design of the student's choice. The incise carving is to be in the face of the upright. The extended base which slides under the books is 1/4" X 4" X 4". To be finished natural with stain used in the incised carving.

Bill of Material.

2 pieces--Bases--3/4"thick X 2" wide X 6" long.

2 pieces--Upright--3/4" thick X 4" wide X 4" long.

2 pieces--Extended Base--1/4" thick X 4" wide X 4" long.

Tools Needed for Job.

Carving tools	Back saw
Rule	Jack plane
Awl	T-bevel
Hand drill	Twist-drill
Scraper	Sandpaper

General Directions.

1. Choose a design that is fitting for your work.

2. Choose a design that is not too intricate for you, for your tools, or for the work at hand.

3. Have instructor check pattern chosen or pattern developed before proceeding.

4. Make this project only if you have a need for it.

Tool Processes Involved in the Job.

In making the project in wood working, you will have an opportunity to receive instruction in the new learning units listed below as well as acquire more skill in the review ones.

New learning units; How to:

1. Get out stock.
2. Cut a groove using a chisel.
3. Layout arcs using a compass.
4. Assemble and adjust a block plane.
5. Shape edges and ends of a board with a block plane.
6. Apply lacquer with a brush.
7. Clean and care for a brush used in applying lacquer.

Review operations; How to:

1. Take pattern from source material.
2. Transfer pattern to stock.
3. Plane a surface true and smooth.
4. Plane an edge square with face.
5. Plane an end square with face and edge.
6. Drill holes using a hand drill.
7. Fasten with screws.
8. Drive screws with common screwdriver.

9. Mix oil stain and apply with a brush.

10. Clean and care for a brush used in applying stain.

Plan of Procedure.

In doing this job you should proceed as follows:

____ 1. Get out Stock.

____ 2. Base.

____ a. Measure length.

____ b. Cut to length using backsaw and bench hook.

____ c. Measure to width.

____ d. Cut to width using a backsaw.

____ e. Plane all surfaces true.

____ f. Measure and lay off chamfer.

____ g. Plane chamfer.

____ h. Mark location for groove of extended base.

____ i. Use chisel to cut the groove for extended base.

____ 3. Extend Base.

____ a. Measure to size and saw with backsaw.

____ b. Square to size with block plane.

____ 4. Upright.

____ a. Measure to length, saw with backsaw.

____ b. Measure to width, saw with backsaw.

____ c. Use compass to lay off arcs.

____ d. Saw arcs with coping saw.

____ e. File curved edges smooth.

____ 5. Decorating upright.

____ a. Transfer design to face of upright.

____ b. Incise the design.

____ 6. Assemble for marking holes for screws.

____ 7. Layout location for screws and drill holes.

____ 8. Countersink for flat head screws in extended base.

____ 9. Stain the incise design a dark color.

____10. Sand all areas smooth for finishing.

____11. Assemble using screws.

____12. Apply lacquer.

____13. Fill out a plan of procedure, test of good workmanship, and hand it and project into the instructor for checking and grading.

Test of Workmanship.

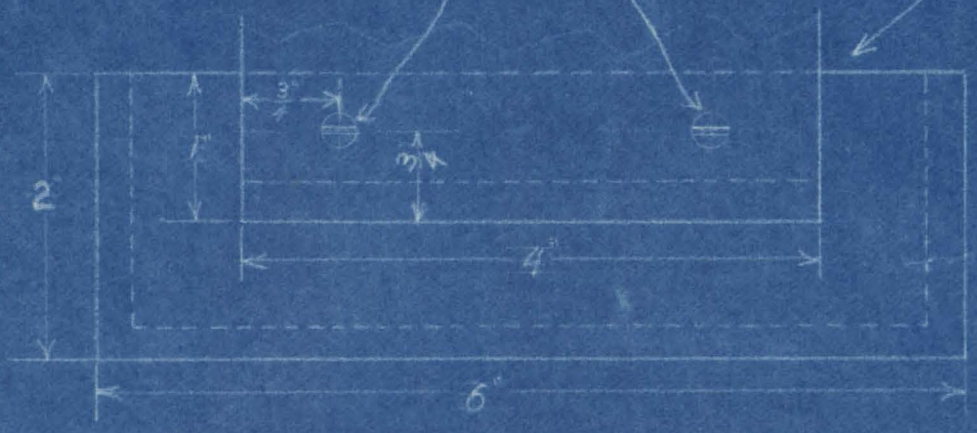
When you have finished the job test your work as follows:

1. Are the corners square?
2. Are the curves smooth?
3. Are the thicknesses accurate?
4. Do the pieces fit properly?
5. Does the upright stand up straight?
6. Is the design neat?

BOOK END * INCISE CARVING

Base- $\frac{3}{4}$" - 2" - 6"
Upright - $\frac{3}{4}$" - 4" - 4"
Extended Base - $\frac{1}{4}$" - 4" - 4"
Chamfer on Base - $\frac{1}{4}$" - 45 degree
Fasten Together With Screws

Bottom view.



Scale Unknown

* Suggested project for Laboratory Assignment No. 4

BOOK STAND

Introductory Statement.

This stand can be very useful to hold a book while you are studying or it can be used to place on a desk to hold pictures and special items.

Job Specifications.

This book stand is to be made of walnut. It is to have a chamfer on each side. The book stand is to be stained dark drown, filled, and given a varnish finish. It is to be assembled with 1½" No. 9 flat head screws. The varnish is to have a pumice stone finish, then waxed.

Bill of Material.

1 piece--Upright--5/8" thick X 9" wide X 12" long.

1 piece--leg--5/8" thick X 6" wide X 6" long.

1 piece--Book rest--7/16" thick X 1" wide X 10" long.

5 screws.

Tools Needed for Job.

Screw driver	Block plane
Dowel pin gauge	Coping saw
Drill brace	Auger bit
Glue	Try square
Bar clamps	Woodworker's vise
Hand clamps	Jack plane

General Directions.

1. Do not work fast at the expense of good work.

2. Use plenty of newspaper on floor and benches and tables when doing "messy" work.

3. Have you read the latest safety chart that is displayed in the shop?

Tool Processes Involved in the Job.

In making the book stand, you will have an opportunity to receive instruction in these new took operations. Also have practice on some of the learning units you already have had experience in.

New operations; How to:

1. Gage with a marking gauge.
2. Attach and adjust auger bit depth gauge.
3. Bor holes with an auger bit.
4. Prepare and apply casco or cascomite, or weldwood glue.
5. Make an edge to edge glue joint.
6. Glue up stock.
7. Layout arcs using a compass.
8. Assemble and adjust a block plane.
9. Shape edges and ends of a board with a block plane.
10. Shape an edge or end with a file.
11. Sharpen a scraper.
12. Apply filler with a brush.
13. Clamp up stock using a bar-clamp.
14. Hold stock using a hand screw clamp.
15. Drill holes for a dowel pin using a doweling jig.
16. Make a dowel joint.

Review Operations; How to:

1. Get out stock.
2. Lay off pattern on stock.
3. Test for straightness with a try-square.
4. Gold stock with a woodworker's vise.
5. Finish outside curves with a wood file.
6. Finish inside curves with sandpaper.
7. Apply wax.
8. Layout bevel-cut with a T-bevel.
9. Drill holes using a brace-drill.
10. Countersink for screws.
11. Smooth a surface with a scraper.
12. Apply varnish.
13. Clean and care for a brush used to apply varnish.
14. Rub a finish with pumice stone and oil.

Plan of Procedure.

In doing this job you should proceed as follows:

_____1. Study drawings and specifications.
_____2. Procure stock and check it.
_____3. Plane a surface true and smooth.
_____4. Plane an edge square to face for glue joint.
_____5. Plane surface of other board true and smooth.
_____6. Plane edge square to face for glue joint.
_____7. Layout centers for boring dowel holes.
_____8. Have instructor check work. _____
_____9. Bore holes in edge of boards with the aid of a bit gauge.
____10. Cut dowel pins to fit the holes.
____11. Glue joint.

____12. Scrape dried glue off work.

____13. Proceed by planing face true and smooth.

____14. Plane an edge and end square with the face.

____15. Cut to width and length.

____16. Plane to width and length.

____17. Plane to thickness.

____18. Layout 60° angle on face board.

____19. Have instructor check work. ____

____20. Layout chamfer and design.

____21. Have instructor check work.____

____22. Cut 60° angle, design, and chamfer.

____23. Precure stock for book rest.

____24. Work book rest to dimensions.

____25. Procure stock for leg.

____26. Plane face true and smooth.

____27. Diagram shape on to wood.

____28. Have instructor check diagram.____

____29. Cut the leg out using a coping saw.

____30. Pare the curves.

____31. File the curves to shape.

____32. Plane ends true to face.

____33. Locate and layout centers for holes for screws.

____34. Have layout checked by instructor. ____

____35. Drill holes for screws.

____36. Sand all surfaces.

____37. Assemble parts.

____38. Apply stain.

____39. Apply filler.

____40. Apply varnish.

____41. Rub with pumice stone and oil.

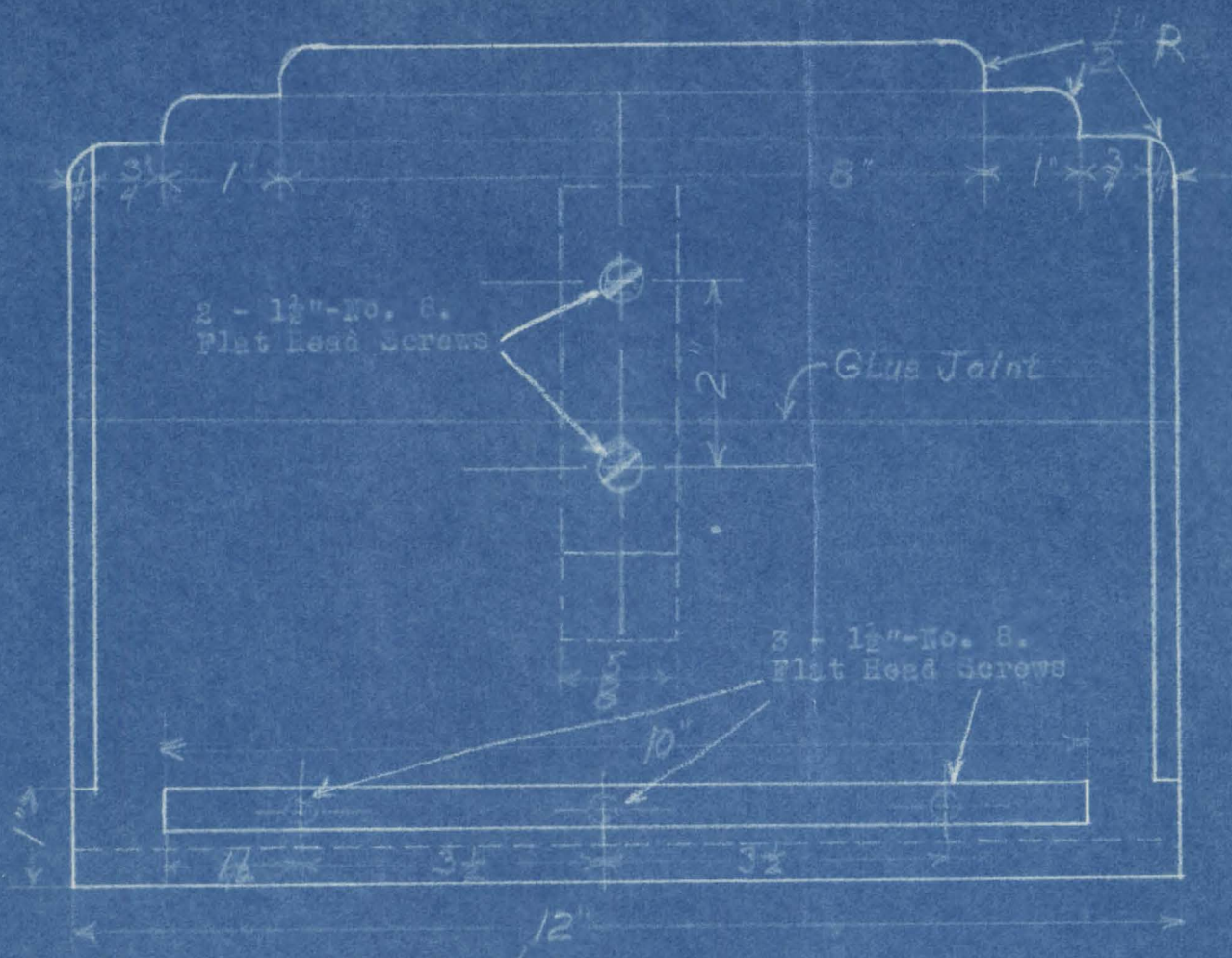
____42. Wax.

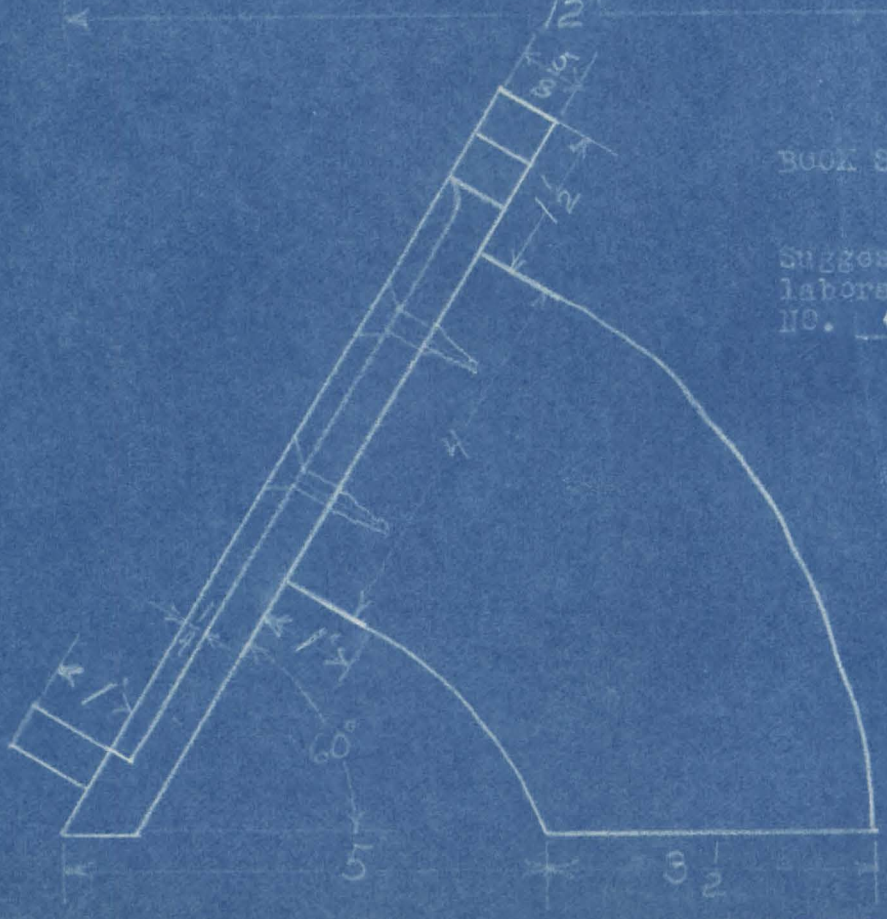
____43. Fill out plan of procedure, apply test of workmanship, and turn it and project into instructor for checking and grading.

Test of Workmanship.

When you have finished with this job, test your work as follows:

1. Is the angle 60° angle?
2. Are the stop chamfers equal?
3. Are the curves smooth?
4. Is the back leg finished to correct arcs?
5. Does the bookstand set level and flat?





BOOK STAND

Suggested project for laboratory assignment No. 6.

MY SHINE BOX

Introductory Statement.

This would be a handy box which you can keep all your shoe polishing equipment and a place to shine your shoes.

Job Specifications.

This project is to be made of both plywood and solid stock. The plywood is to be 3/16" and the solid stock is made from both 3/4" and 7/8" material. Letters chosen by the student are to be carved and nailed to the side with brads. Letters are made from 3/16" plywood. The finish is to consist of two coats of paint. Paint inside a different color than the outside.

Bill of Material.

1 piece--handle--7/8" thick X 2" wide X 11" long.

1 piece--base--3/16" thick X 4" wide X 11" long.

2 pieces--sides--3/16" thick X 7" wide X 11" long.

2 pieces--ends--3/4" thick X 6" wide X 10" long.

4-1¼" No. 6 Flat head screws.

20-5/8" No. 3 Round head screws.

Tools Needed for Job.

Cross cut saw	Hammer
Block plane	Sandpaper
Countersink	Compass

General Directions.

1. Review old learning units from time to time to be sure you know them.

2. Read over entire plan of procedure before beginning work.

3. When you come to a new step in the plan of procedure, ask your instructor for a demonstration.

4. Check off the steps of procedure as you complete them.

Tool Processes Involved in the Job.

In making the shine box, you will have an opportunity to receive instruction in these new tool operations. Also have practice on some of the learning units you already have had experience.

New operation; How to:

1. Saw to a line with a rip saw.
2. Make holes for small screws or brads using a brad awl.
3. Round edges using a plane.
4. Round edges using sandpaper.
5. Layout irregular designs by means of square.
6. Apply paint with a brush.
7. Clean and care for a brush used to apply paint.
8. Sharpen a screw driver.
9. Set nails or brads.
10. Drive and draw nails.

Review operations; How to:

1. Layout duplicate parts.
2. Shape an edge or end with a file.
3. Remove liquid from a full container.
4. Open a paint can with a screw driver.

Steps of Procedure.

In doing this job you should proceed as follows:

____ 1. Read the drawing carefully.

____ 2. Make a bill of material.

____ 3. Get out stock.

____ 4. Ends.

____ a. Layout shape on both pieces.

____ b. Cut to shape using cross bit saw, rip saw and coping saw.

____ 5. Sides, top and bottom.

____ a. Measure off length and width on all pieces.

____ b. Cut to line using cross cut saw, rip saw.

____ 6. Square stock to size.

____ 7. Sand all edges smooth.

____ 8. Assemble for fit.

____ 9. Measure location and drill holes for screws.

____10. Design letters, cut to size for fastening to side of shine box.

____11. Mark location for letters.

____12. Sand all surfaces smooth.

____13. Stain the letters.

____14. Apply two coats of paint to shine box.

____15. Fasten letters to side with brads.

____16. Fill out plan of procedure, apply test of workmanship, and turn it and project into instructor for checking and grading.

<u>Test of Workmanship</u>.

When you have finished this job, test your work as follows:

1. Is the box square?

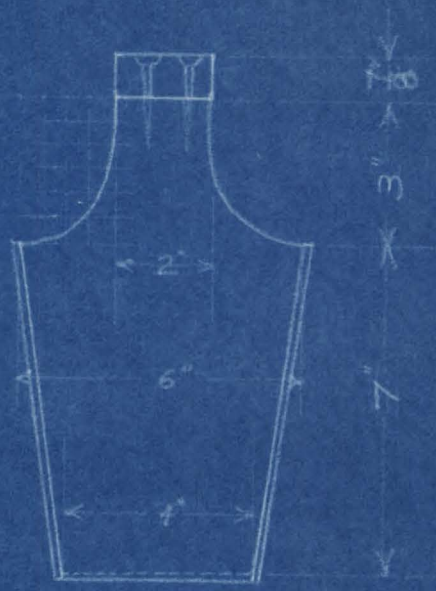
2. Do all the pieces fit evenly?

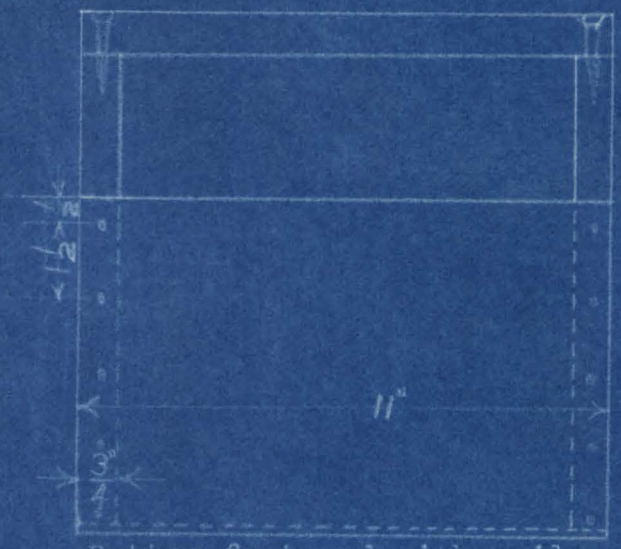
3. Did you get a smooth curve on the end pieces?

4. Do your letters have a neat appearance?

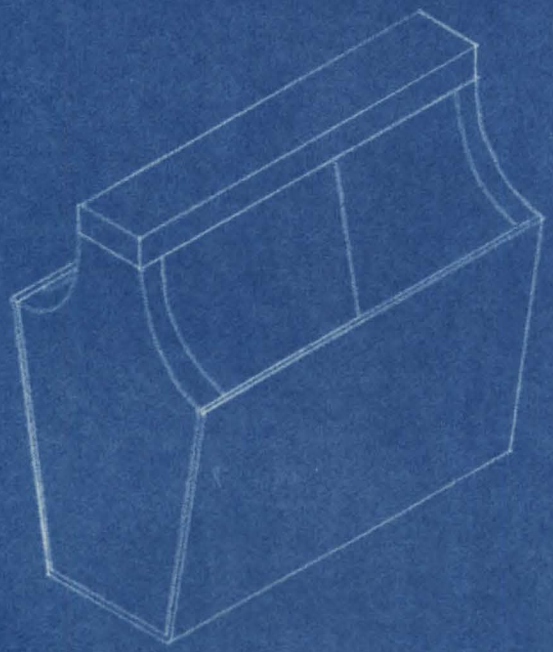
5. Are there brush marks in the paint?

6. Did you mark the location for the screws evenly?





Bottom fastened with nails



MY SHINE BOX

Bill of Material

1 piece - handle-
3/8"- 2"- 11"

1 piece - base -
3/16"- 4"- 11"

2 pieces - sides -
3/16"- 7"- 11"

2 pieces - ends -
3/4"- 6" -10"

4 - 1 1/4" No.6 Flat Head screws.

20 - 5/8" No.3 Round Head screws.

Scale: $\frac{1}{4}$" =1"
1 Square =$\frac{1}{2}$"

Taken from: Feirer, John L., Industrial Arts Woodworking, p.256.

Suggested project for Laboratory Assignment No. 5

STAND FOR A POTTED PLANT

Introductory Statement.

Your mother would love this project so she can set some of her pretty potted flowers on and then set it on the floor near a window.

Job Specifications.

The stand for potted plants is to be made of walnut. It is to be stained brown, filled, and given a varnish finish. The varnish is to have a pumice stain and oil finish, waxed. It is to be assembled with 1" No. 8 flat head screws.

Bill of Material.

1 piece --base--3/4" X 6" X 6"

4 pieces--legs--3/4" X 1" X 3½"

8 Screws--1" No. 8 Flat head

General Directions.

1. Ask the instructor concerning any point you are in doubt about.

2. Check with your instructor from time to time on the progress of your work.

3. You may receive help from your classmates but that will not excuse you for work improperly done. Your instructor is the teacher.

4. Check over the tests of workmanship before beginning work.

Tool Processes Involved in this Job.

In making this stand for a potted plant, you will have an opportunity to receive instructions in the new operations listed below and to practice them on the stand for a potted plant.

New operations; How to:

1. Hold stock using "C" clamp.

Review operations; How to:

1. Read a working drawing.
2. Develop a bill of material.
3. Lay off measurements with a rule.
4. Lay off pattern on stock.
5. Test for squareness and trueness with a try-square.
6. Hold stock with a woodworker's vise.
7. Assemble and adjust a jack plane.
8. Plane a surface true and smooth.
9. Plane an edge square with face.
10. Plane an end square with face and edge.
11. Sharpen a plane iron.
12. Smooth edge with a file.
13. Layout curves with divider.
14. Saw to a line with a rip-saw.
15. Finish outside curves with sandpaper.
16. Finish inside curves with sandpaper.
17. Layout duplicate parts.
18. Layout and cut a regular chamfer with a plane.
19. Drill holes using a hand drill.
20. Fasten with screws.
21. Apply varnish.

22. Rub a finish with pumice stone and oil.

Plan of Procedure.

In making this job, you should proceed as follows:

____ 1. Study drawing and specification.

____ 2. Procure stock and check it.

____ 3. Plane a surface true and smooth.

____ 4. Cut to length and width and square with face and ends.

____ 5. Cut to thickness.

____ 6. Have instructor check work. ____

____ 7. Layout legs by use of squares.

____ 8. Layout dupulicate parts.

____ 9. Have instructor to check layouts. ____

____10. Cut irregular curves with coping saw.

____11. Cut legs to shape using chisel.

____12. Layout holes in legs and on platform of the stand for screws.

____13. Have instructor check layout for holes.____

____14. Drill holes for screws.

____15. Layout and cut chamfer on platform.

____16. Sand all parts.

____17. Assemble parts.

____18. Have instructor check work for finish.____

____19. Apply stain.

____20. Apply filler.

____21. Apply varnish.

____22. Rub finish using pumice stone and oil.

____23. Wax.

____24. Fill out plan of procedure, apply test of workmanship, and turn project and work sheet into instructor for inspection and grading.

Test of Workmanship.

When you have finished this job, test your work on the following:

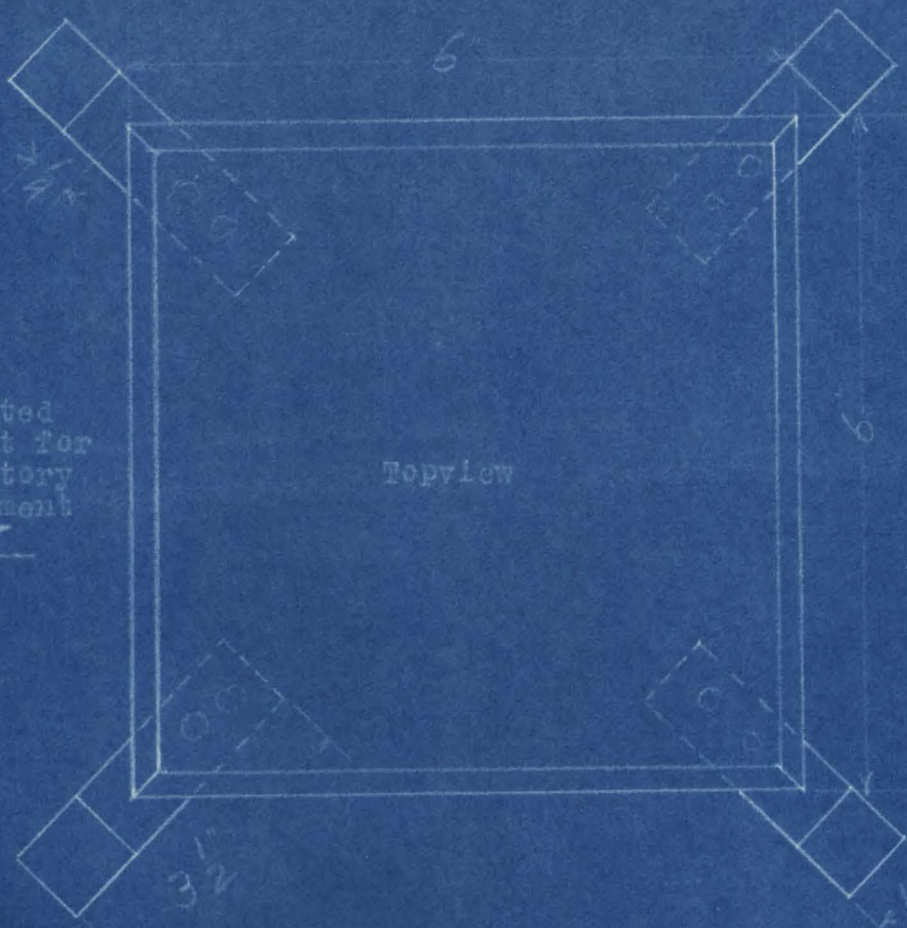
1. Are all the surfaces square with face?

2. Are legs same size and measurements according to the drawing?

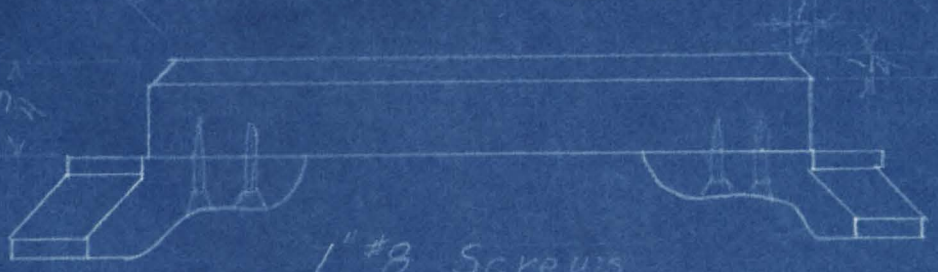
3. Are curves on legs smooth?

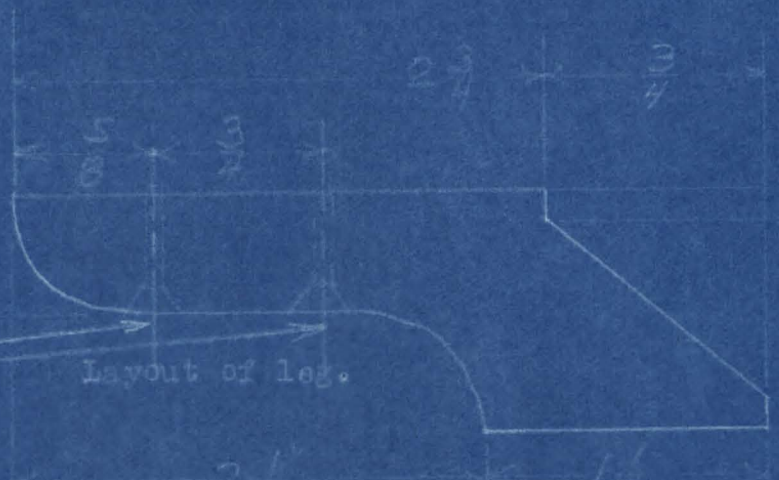
4. Is the finish smooth and beautiful?

STAND FOR A POTTED PLANT



Suggested project for laboratory assignment NO. 7





DACHSHUND TIE RACK - CARVING

Introductory Statement.

Your father will like this so he can have a place to hang all of his ties.

Job Specifications.

The tie rack is made by shaping several parts and joining them together. The rack which may be shaped like a bone is 3/8" X 1" X 12½". The dog is shaped by use of the "squares method" allowing each square to equal an inch. The rough size for the dog is 5/8" X 4½" X 12½". Two dowel rods hold the rack to the feet of the dog. Carving tools may be used for outline carving. Maybe stained or leave natural. Finish is to consist of two coats of lacquer, rubbed down and waxed.

Tool Processes Involved in This Job.

In making this project, you will have an opportunity to acquire a degree of skill in the new learning units listed below as well as acquire addditional skill in the review units.

New operations; How to:

1. Develop a pattern by using squares.
2. Sharpen a knife.
3. Whittle with a carving set.
4. Round and soften arrises by whittling.
5. Make stop cuts.

Review operations; How to:

1. Cut line with a coping saw.
2. File and sand edges smooth.

3. Drill holes with dand-drill.

Steps of Procedure.

In making this job, you should proceed as follows:

____ 1. Select pattern and have approved.

____ 2. Get out stock.

____ 3. Lay off square for developing pattern.

____ 4. Cut figure to shape, using a coping saw.

____ 5. File and sand edges smooth.

____ 6. Locate and drill holes for dowels in both the dog and rack.

____ 7. To give character to the dog, you can shape the eyes, ears, and tail with a carving knife.

____ 8. Cut dowels to length and sand to a tight fit in the holes.

____ 9. Make rack in the shape of a long bone.

____10. Assemble with glue and allow to dry.

____11. Stain or leave natural or apply show card paint to decorate.

____12. Prepare and apply lacquer--rub down with wet-dry sandpaper.

____13. Apply second coat of finish--rub down when dry.

____14. Apply coat of paste wax and polish.

____15. Write out work report.

____16. Take project and worksheet to instructor for grading.

Test of Workmanship.

When you have finished the job, test your work on the following points:

1. Is the edge smooth and graceful?

2. Did you saw parallel to face?

3. Do the carving knife works show?

4. Do the dowel sticks fit tight and are they parallel or square to the face?

5. Is the finish smooth?

DACHSHUND TIE-RACK

Bill of Material

1 piece dog
5/8"-4 3/4"- 12 1/2"

1 piece rack
3/8"- 1"- 12 1/2"

2 pieces dowel rod
3/8"Dia.-2"L.

Scale: 1 square = 1/2"

Taken from: Feirer, John L., Industrial Arts Woodworking, p. 257.

Suggested project for Laboratory Assignment No. 8

COOKBOOK SHELF

Introductory Statement.

Does your mother have a nice place to keep her cook book? Now you can make a shelf she can use to hold her cook book.

Job Specifications.

This cook book shelf is made from solid stock. The cut sizes are given on the drawing. The dados are cut in the side pieces, cut to a depth of 3/16 inches. The top corners may be formed to suit the student. Use the "squares method" if it is a free hand form. Finish with two coats of varnish.

Tool Processes Involved in this Job.

In making this project, you will have an opportunity to acquire a degree of skill in the new learning units listed below as well as acquire additional skill in the review units.

New operations; How to:

1. Fit more than one shelf.
2. Apply varnish.
3. Care for a brush used to apply varnish.

Review operations; how to:

1. Square duplicate pieces.
2. Cut a dado.
3. Assemble using clamps and glue.
4. To make a bill of material.

Steps of Procedure.

In making this job, you should proceed as follows:

____ 1. Study the drawing.

____ 2. Make a bill of material.

____ 3. Get out stock.

____ 4. Lay off all measurements and check.

____ 5. Saw to size using proper saws.

____ 6. Lay out angles, and end designs using the proper saw.

____ 7. Cut angles, arcs, and end designs using the proper saw.

____ 8. Locate dados on the side pieces and cut using sloyd knife and small chisel.

____ 9. Make trial fitting.

____10. Sand all areas smooth.

____11. Apply glue to joints, assemble and clamp. Use care to clamp it square.

____12. When dry, remove clamps, remove any excess glue from joints.

____13. Give a final sanding.

____14. Apply varnish.

____15. Wax and polish.

____16. Fill out work sheets.

____17. Turn in project and worksheet to instructor for grading.

Test of Workmanship.

When you have finished this job, test your work as follows:

1. Are the shelves parallel?
2. Do the joints fit snug.
3. Are the shelves square with the side?
4. Does the book shelf hang straight?
5. Are the end grains sanded clear?

Cook Book Shelf

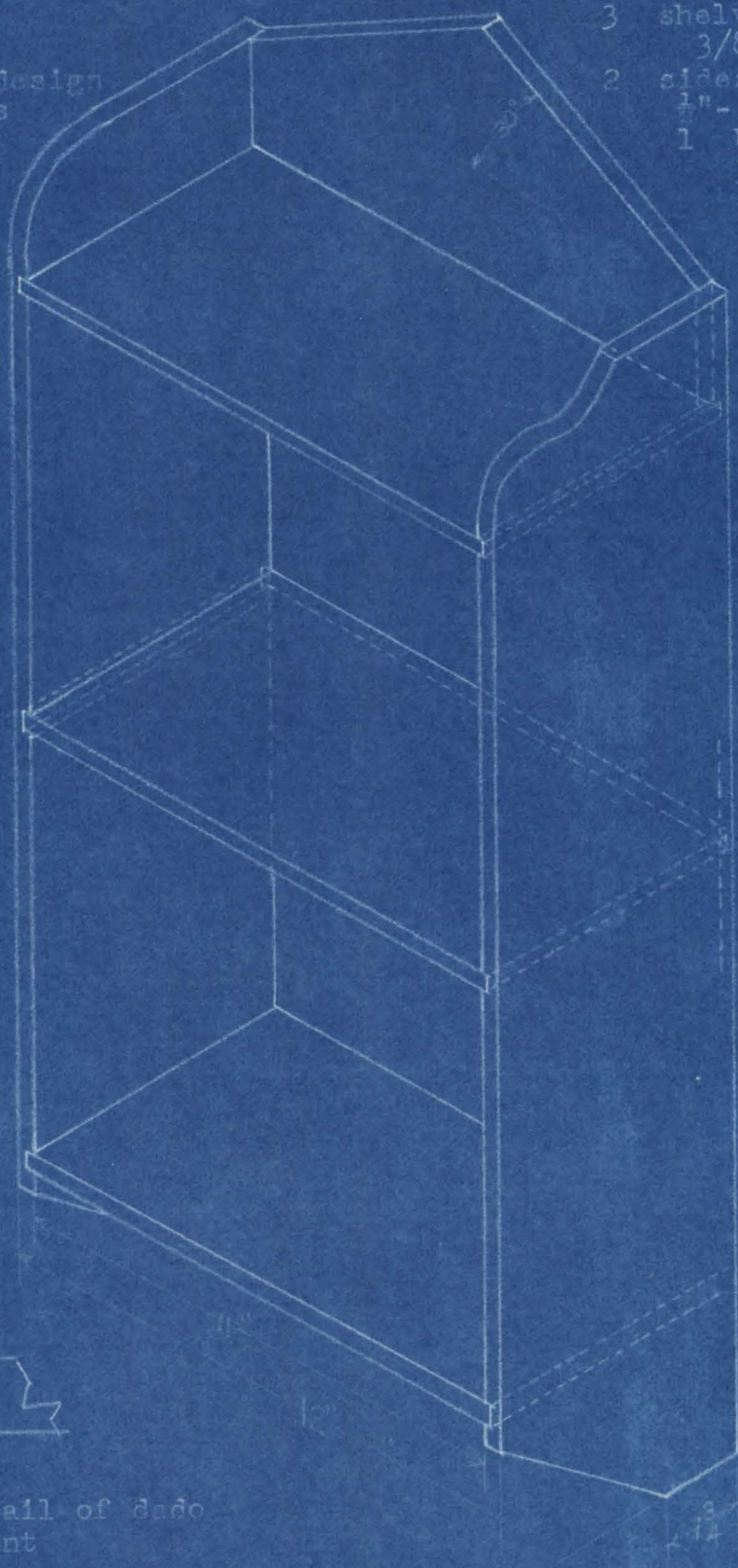
Optional design for curves

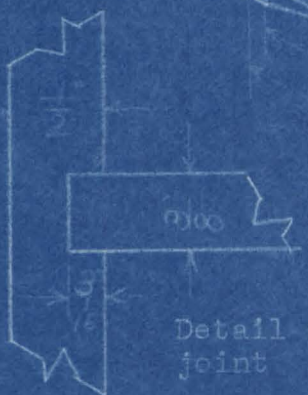
Bill of Material

3 shelves--
3/8"- 6"- 11 3/8"

2 sides--
3/8"- 6"- 25 1/8"

1 back--
3/8"- 5 1/8"- 11"





Detail of dado joint

Suggested project for Laboratory Assignment No. 9

MINT TRAYS - CHASE CARVING

Introductory Statement.

Each of you enjoy candy. So why not have a tray to keep candy handy?

Job Specifications.

Each mint tray is of different size but the operation for each is nearly the same. The design is developed by the "Square's method." Gouges are used to form the hollowed area. The direction the grain runs has a lot to do with how easy it is to carve. Remember, best results are going with the grain and not across or against grain. The depth of the hollow is to be 3/8" deep. Finish with linseed oil.

Tool Processes Involved in this Job.

In making this project you will have an opportunity to acquire a degree of skill in the new learning units listed below as well as acquire additional skill in the review units.

New operations; How to:

1. Care using a quick gouge.
2. Carve using a flat gouge.
3. Use a fluter gouge in making fine lines.
4. Apply linseed oil.
5. Care for a brush used in applying linseed oil.
6. Apply a sealer of shellac.
7. Care for a brush used to apply shellac.

Review operations; How to:

1. Develop a pattern by the "Square's method".

2. Cut to a line with a coping saw.

3. File and sand edges smooth.

4. Apply lacquer.

Steps of Procedure.

In making this job, you should proceed as follows:

____ 1. Choose a pattern you wish to make.

____ 2. Obtain wood stock and transfer design to wood.

____ 3. Plane both surfaces level and to proper thickness.

____ 4. Work with the grain when using gouge.

____ 5. Start with a quick gouge.

____ 6. Level bottom using flat gouge.

____ 7. Use a fluter gouge to make the veins of the leaves.

____ 8. After inside has been completed, cut the outside to shape with a coping saw.

____ 9. The angle on the outside of the tray may be rounded from the top to the bottom.

____10. Sand all areas with much care.

____11. Apply linseed oil and rub it into the wood pores.

____12. Apply three or four coats of linseed oil, one each day. Rub each coat.

____13. Apply a sealer of shellac.

____14. Rub smooth with fine sandpaper.

____15. Apply two coats of lacquer and rub after each coat.

____16. Wax and polish.

____17. Write out worksheet.

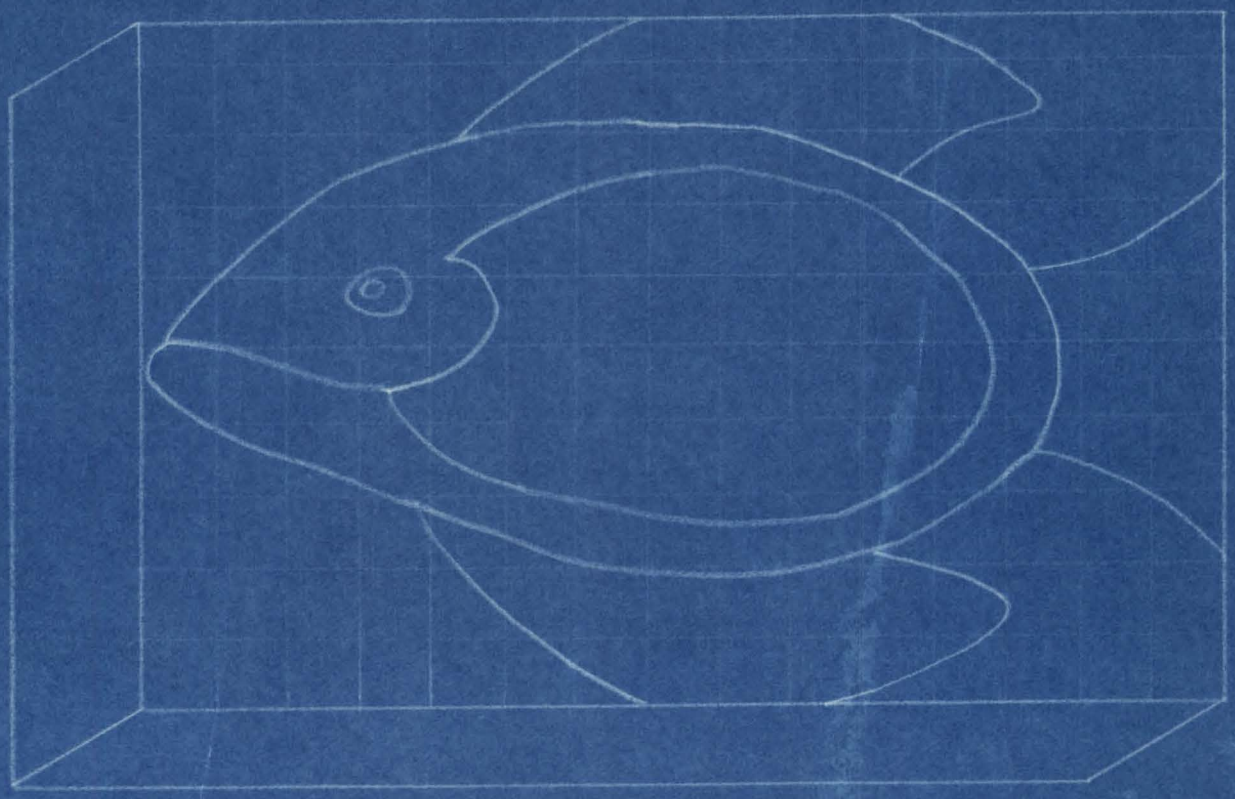
____18. Take project and worksheet to instructor for grading.

Test of Workmanship.

When you have finished this job, test your work on the following:

1. Are there any gouge marks?
2. Are the surfaces and curves smooth and graceful?
3. Does the object have the appearance of a Mint dish?
4. Is the hollowed out area at a uniform depth?
5. Did you wait one day between each coat of linseed oil?
6. Did you use the pattern wisely when choosing the grain direction?

Mint Tray Fish Dish



Bill Of Material

1 piece 1"- 4 3/4"-7½"

Scale: 3/4"-1"
1 Square = ½"

Taken from: Bell, Enid, Wood-carving Projects, p. 81

Suggested project for laboratory assignment no. 10

PEN AND LETTER RACK

Introductory Statement.

As time goes you will want to write and receive letters. This can be a nice private place to hold your letters.

Job Specification.

This pen and letter rack is constructed of both plywood and solid stock. Check drawing to the size and shape of each piece of stock. This is a review of most tool operations and various joint constructions and fastening devices.

Tool Operations Involved in this Job.

In making this project, you will have an opportunity to acquire a further degree of skill to the use of most manipulative tools.

Review process; How to:

1. Get out stock.
2. Make a bill of material.
3. Cut stock using a crosscut saw.
4. Cut stock using a ripsaw.
5. Cut arcs using a coping saw.
6. Trim arcs with a chisel.
7. Square stock to size using a plane.
8. Planing end grain with a block plane.
9. Cut a dado joint.
10. Cut a mortise and tenon joint.
11. Drill holes for screws with a hand drill.
12. Bore holes with a brace and bit.

13. Assemble using clamps, glue, screws, and nails.

14. Apply stain and filler.

15. Apply shellac, lacquer, or woodfiller.

16. Apply wax.

Steps of Procedure.

In making this job, you should proceed as follows:

____ 1. Study the drawing.

____ 2. Make a bill of material.

____ 3. Get out stock.

____ 4. Base.

____ a. Measure to width and length.

____ b. Square base to size using a plane.

____ c. Layout chamfer.

____ d. Cut chamfer with plane.

____ 5. Back.

____ a. Measure to width and length.

____ b. Square to size using block plane.

____ c. Layout the curve and cut with coping saw.

____ 6. End.

____ a. Obtain a piece of stock large enough for both end pieces.

____ b. Square stock for ends to size.

____ c. Layout shapes of ends on stock, cut into with backsaw.

____ d. File the arcs smooth.

____ e. Locate and mark location for blind dado to fit the front piece.

____ f. Cut with knife and chisel.

____ 7. Front.

____ a. Measure and cut to size.

____ b. Square to size.

____ c. Measure and cut to fit blind dado.

____ 8. Holders.

____ a. Layout shape on stock.

____ b. Bore ½" hole for holding pencils and saw into.

____ c. Locate tenons and cut to shape with backsaw.

____ d. Cut mortise in proper location in end pieces.

____ 9. Assemble all parts for fit.

____10. Sand all surfaces smooth.

____11. Assemble and locate holes for screws.

____12. Drill and countersink for screws.

____13. Assemble with the use of glue, screws, and clamps.

____14. Remove clamps when glue dries and sand all surfaces for finish.

____15. Use filler and stain or leave natural.

____16. Apply two coats of shellac, lacquer, or wood filler.

____17. Wax and polish.

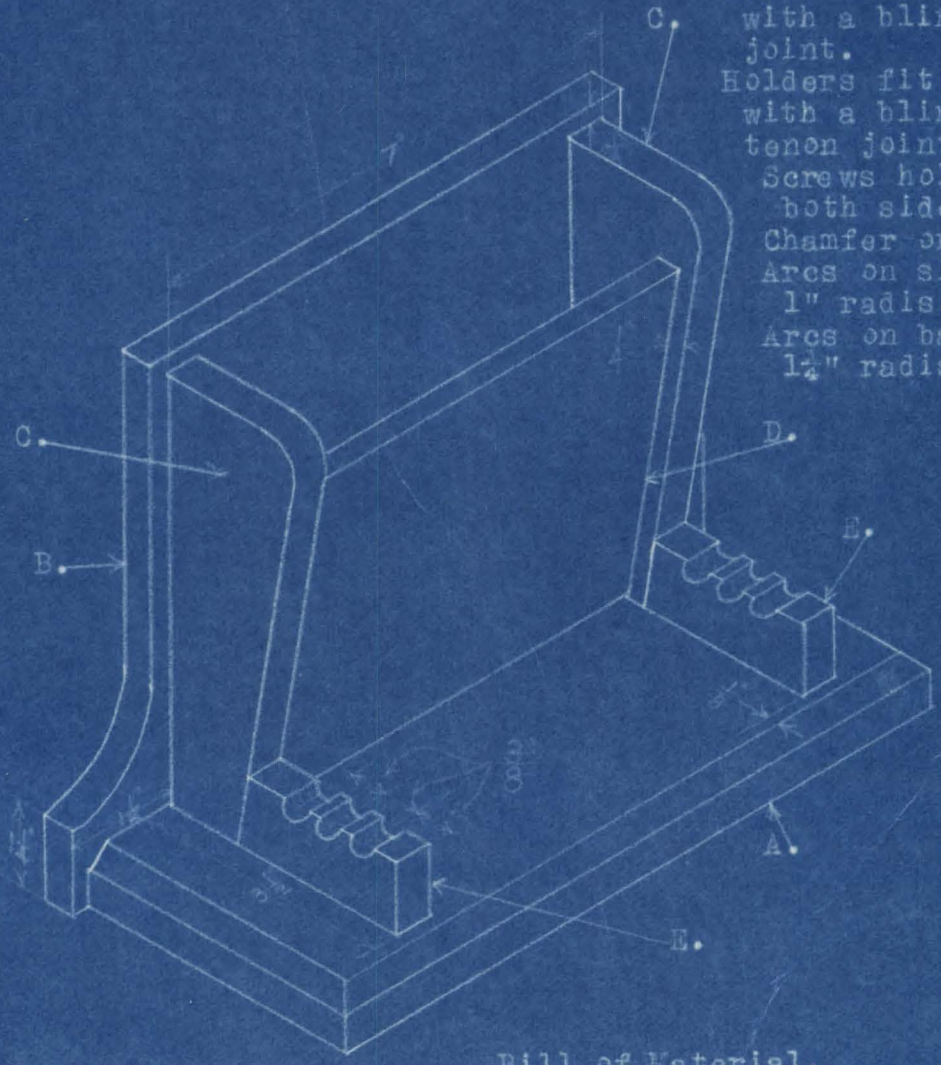
____18. Take project and worksheet to instructor for grading.

Test of Workmanship.

When you have finished this job, test your work as follows:

1. Do all parts fit even?
2. Are the end pieces parallel?
3. Does the back stand straight?
4. Did you get a good fit on the mortise and tenon joint?

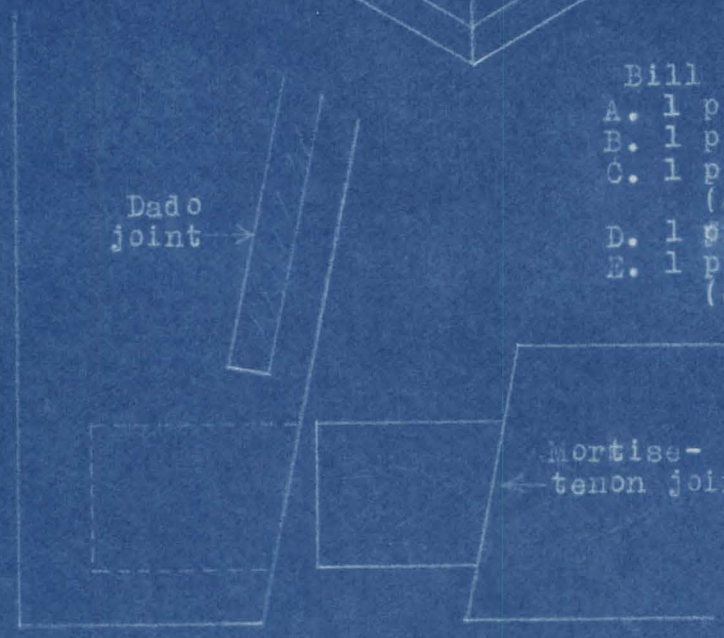
A PEN AND LETTER RACK*



Front fits into sides with a blind dado joint.
Holders fit into sides with a blind mortise-tenon joint.
Screws hold back to both sides and base.
Chamfer on base.
Arcs on sides are 1" radis.
Arcs on back are 1¼" radis.

Bill of Material.

A. 1 piece, base, ¾"-4"-9½"
B. 1 piece, back, 3/8"-7"-10"
C. 1 piece, sides, ½"- 3 1/8"-6" (cut into two pieces)
D. 1 piece, front, ½"-5"-6 3/8"
E. 1 piece, holders, ½"-2 1/8"-3" (cut into two pieces)



Scale: 3/8"=1"

Sectional view of Dado joint and Mortise-tenon joint.

Taken from: Yabsley, P., Educational Craftwork in Wood, p. 20.

Suggested project for Laboratory Assignment No. 11

SOLID FIGURES - ROUND SCULPTURING

Introductory Statement.

Do you have any young brothers or sisters at home? If so, they might enjoy this little wooden animal to play with.

Job Specifications.

To be made of 1 3/8" thick X 3 1/2" wide X 2 1/4" long, (larger if design requires) and whittled to shape with a pocket or sloyd knife. Carving tools may be used for surface carving. Staining is optional. Finish is to consist of two coats of wood seal, rubbed down and waxed.

Tool Operations Involved in this Job.

In making this project, you will have an opportunity to acquire a degree of skill in the new learning units listed below as well as acquire additional skill in the review units.

New operations; How to:

1. Whittle to a contour line.
2. Carve from design. Leave the design raised.
3. Carve from a design, cutting the figure in.

Review operations; How to:

1. Get out stock.
2. Cut to a line using a coping saw.
3. Gouging a line.
4. Sand surfaces smooth.

Steps of Procedure.

This is a general plan of procedure which will aid in doing

the carving. In certain designs a few steps will be omitted.

_____1. Select a pattern.

_____2. Trace the pattern to full size.

_____3. Transfer it to stock.

_____4. Remove excess wood outside the outline with a coping saw.

_____5. Gage a pencil line around the center of the block as a guide when carving.

_____6. Outline the ears, head, and legs.

_____7. Outline the rear view and round the body but do not cut the tail off.

_____8. Remove areas between the forelegs and hind legs.

_____9. When the object is taking form, care must be taken in order to add the details and give the object a real life-like look.

____10. Sand all parts thoroughly.

____11. Finish can be in accordance with the whittler's desire.

____12. Write out worksheet.

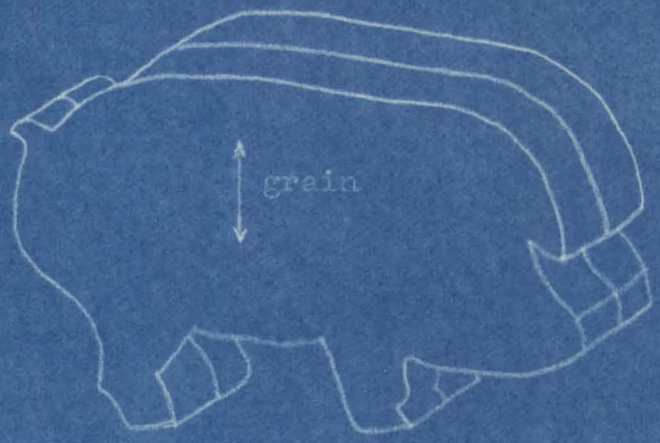
____13. Take project and worksheet to instructor for grading.

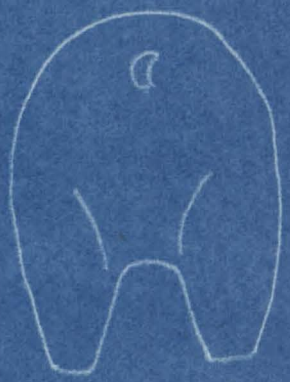
Test of Workmanship.

When you have finished this job, test your work as follows:

1. Is the contour smooth?
2. Is the carving symmetrical?
3. Is the finish satisfactory?
4. Are the details of the carving clear and smooth?
5. Did you remove all workmanship marks with sandpaper before applying finish?

Solid Figures Round Sculpturing (Pig)





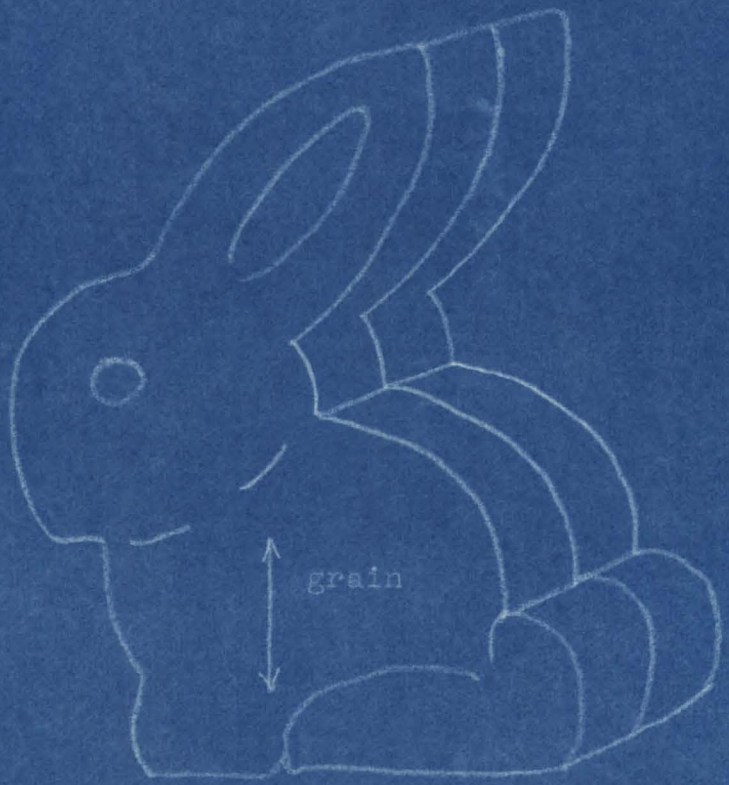
Bill of Material

1 block of wood
1 3/4"- 3½"- 2¼"

Taken from: Van Tassel, Raymond, Woodworking Crafts, p. 13.

Suggested project for Laboratory Assignment No. 12

Solid Figures Round Sculpturing (Rabbit)



Bill of Material

1 block of wood
1 3/4"- 3¼"- 4"

Taken from: Van Tassel, Raymond, Woodworking Crafts, p. 15.

Suggested project for Laboratory Assignment No. 12

Section III

STUDY ASSIGNMENTS

A. Planning

B. Layout And Measuring Tools

C. Woods And Plywoods

D. Holding Tools

E. Tooth Cutting Tools

F. Edge Cutting Tools

G. Boring Tools

H. Fastening Devices And Tools

I. Abrasives

J. Finishes And Brushes

PLANNING

Unit Objective

To have the student better understand the procedure used in laying out plans, how to organize the steps in the construction, assembly, and finish a project by an orderly plan.

Study Outline

The following subject-matter information should be acquired by the student during the study of this assignment.

A. Sketching Material
   1. Pencil
   2. Paper
   3. Rule

B. Sketching Technique

C. Pictorial Drawing
   1. Oblique
   2. Isometric
   3. Perspective

D. Working Drawings
   1. Alphabet of lines
   2. Placement of views
   3. Blocking-in techniques
   4. Dimensioning practice
   5. Detail drawings
   6. Assembly drawings

7. Bill of material

8. Plan of procedure

Directions

A. Read the references listed below.

B. Write out the answers to the questions on the unit; turn these in at the time designated by instructor.

References

A. Read the Information Sheets No 1 Page I2.

B. Class notes.

C. Groneman, Chris H., General Woodworking, McGraw-Hill Book Company, New York, Section I, Units 1, 2, 3, 4, and 5.

Questions

1. Explain what is meant by the expression, "Drawing is a universal language."

2. What is meant by alphabet of lines?

3. Name three common kinds of picture drawings.

4. List the line symbols and explain use of each.

5. What three views are most commonly necessary in a working drawing?

6. What tools are needed for freehand sketching?

7. Why is a drawing generally reduced in size when drawing?

8. What is a "plan of procedure?"

9. Name five parts included in a plan of procedure.

LAYOUT AND MEASURING TOOLS

Unit Objectives

To acquaint the student with the many layout tools, their uses, and care for them.

Study Outline

The following subject-matter information should be acquired by the student during the study of their assignment.

A. Kinds
   1. Bench rule
   2. Folding rule
   3. Common rule
   4. Compasses
   5. Try-square
   6. Carpenter square
   7. Steel tape
   8. Marking gauge
   9. Others

B. Function of each tool

C. Selection and care of each tool

Directions

1. Read the references listed below.
2. Write out the answers to the questions on the unit; turn these in at the time designated by the instructor.

References

1. Read the operation sheets No. 1 Page 02.
2. Read the information sheets No. 2 Page 17.
3. Class notes.
4. Groneman, Chris H., General Woodworking, McGraw-Hill Book Company, New York, Unit 6.

Questions

1. What type of rule is commonly used by woodworkers?
2. What are the common units of measurements used by woodworkers?
3. How is the rule placed on work for accurate measurements?
4. What is the advantage and disadvantage in measuring from the one inch mark instead of from the end?
5. A board 4 1/4 inches wide is to be divided lengthwise into five equal parts. How can this be done with a rule? How could it be divided into three equal parts?
6. What is the purpose of squaring lines all around a board?
7. What may be the reason if the first and last lines squared do not meet?
8. What is understood by gauging a line, and how may it be done?
9. What are the principal points of a marking gauge?
10. How is a marking gauge adjusted accurately to a given distance?
11. What are the linear standards of measurement?
12. How many eighths are there in 1 3/8 inches?
13. Name six tools which might be used for measuring.

WOODS AND PLYWOODS

Unit Objectives

To give the student information concerning lumbering processes, kinds of lumber, and uses. To explain the manufacturing of plywood and its uses.

Study Outline

The following subject-matter information should be acquired by the student during the study of this assignment.

A. Woods
   1. Lumbering process
   2. Sawing methods
   3. Seasoning
   4. Kinds and uses
      a. Hard woods
      b. Soft woods
   5. Plywood
      1. Method of cutting
         a. Rotary
         b. Slicing
         c. Sawing
      2. Uses
      3. Advantages and disadvantages over solid stock.

Directions

A. Read the references listed below.

B. Write the answers to the questions on this unit and hand them in at the time designated by the instructor.

References

A. Read the information sheets No. 4 Page I20.

B. Class notes.

C. Groneman, Chris H., General Woodworking, McGraw-Hill Book Company, New York, Units 35, 36, 37, 38, and 39.

Questions

1. Name two duties of a timber cruiser.
2. Name the two initial operations in logging.
3. Name a modern method of skidding logs.
4. Name three methods of getting logs to a sawmill.
5. What purpose does the log pond at a mill serve?
6. What kinds of saws are used to saw a log in a mill?
7. How is power furnished in sawmills?
8. What is an "edger"? a "trimmer" saw?
9. Explain two methods of drying lumber.
10. Name the three basic steps in the manufacture of lumber.
11. What is the function of a planing mill?
12. What is the difference between "veneer" and "plywood"?
13. Name six articles made from plywood.
14. Describe the two methods of producing veneer.
15. What is the advantage of plywood over solid stock?

HOLDING TOOLS

Unit Objective

To acquaint the student with the many holding tools, their uses, care, and kinds.

Study Outline

The following subject-matter information should be acquired by the student during the study of this assignment.

A. Kinds and Sizes

1. Benches
2. Vises
3. Clamps
4. Saw jack
5. Bench hook
6. Sanding block
7. Saw-horse

B. Use and Care

Directions

A. Read the references listed below.

B. Write out the answers to the questions on the unit; turn these in at the time designated by the instructor.

References

A. Read the information sheets No. 3 Page I12.

B. Class notes

C. Instructor's discussions

Questions

1. What is the function of holding tools?

2. In respect to opening and closing the jaws of a vise, what two types of clamps do we have?

3. In the school shop, are the trouble free vises more important than those which have rapid action?

4. What are four uses of a bench hook?

5. What is the function of a saw jack?

6. How can one know the correct height when adjusting and using a saw jack?

7. When are sanding blocks needed?

8. When are saw-horses helpful?

9. What four types of clamps may the woodworkers use?

TOOTH CUTTING TOOLS

Unit Objectives

To acquaint the students with the different tooth cutting tools and how to use and care for them.

Study Outline

The following subject-matter information should be acquired by the student during the study of this assignment.

A. Kinds and Sizes.
   1. Coping saw
   2. Back saw
   3. Cross-cut saw
   4. Rip saw
   5. Files

B. Uses and Care

C. Safety Measures

Directions

A. Read the references listed below.

B. Write the answer to the questions on this unit and hand them in at the time designated by the instructor.

References

A. Read the operation sheets No. 2 Page 07.

B. Read the information sheets No. 5 Page I25.

C. Class notes

D. Groneman, Chris H., General Woodworking, McGraw-Hill Book Company, New York, Unit 7.

Questions

1. What are the differences between a crosscut saw and a rip saw?

2. What is a kerf?

3. Explain the action of the crosscut saw when cutting.

4. Explain the action of the rip saw when cutting.

5. Why must the teeth of a saw have set?

6. What would the figure 8 on the saw blade mean?

7. Are there as many teeth as points per inch?

8. Where does the backsaw get its name?

9. Why is the part of a board to be sawed off placed outside the sawhorse?

10. Why should a board always be placed flat when crosscutting?

11. What measures should be taken to avoid cutting into the bench top or vise when ripping in the bench vise?

12. How can a board be ripped in a bench vise in the correct sawing angle?

13. Why does a backsaw cut finer than an ordinary crosscut saw?

14. What are the advantages of a bench hook in sawing?

15. How can a backsaw be guided to make a straight cut?

16. Which saw should be used for each of the following operations?

    A. Sawing a circular hole, 5 inches in diameter in a one inch board.

    B. Sawing out a circular table top, 3/4 inches thick and 18 inches in diameter.

C. Sawing a curved outline in 1/4 inch stock.

D. Sawing a pattern.

17. How should the teeth of a coping saw point (A) When the work is held in a bench vise? (B) When the work is held on a saw bracket?

18. Should the saw be pulled or pushed when starting a cut? Why?

19. Why should the final strokes in sawing be short and light?

20. Name the three characteristics by which files and rasps are classified.

21. What determines the length of the file?

22. What is a file card?

EDGE-CUTTING TOOLS

Unit Objectives

To introduce the student to the different edge cutting tools, their uses, care for and safety measures.

Study Outline

The following subject-matter information should be acquired by the student during the study of this assignment.

A. Kinds and Sizes
   1. Chisel
   2. Knife
   3. Planes
      a. Jack
      b. Smooth
      c. Jointer
      d. Block
      e. Spoke shove
   4. Cabinet scraper
   5. Scrapers

B. Use and care for each tool

C. Safety measures

Directions

A. Read the references listed below.

B. Write the answers to the questions on this unit and hand them in at the time designated by the instructor.

References

A. Read the operation sheets No. 3 Page 018.

B. Read the information sheets No. 6 Page I32.

C. Class notes.

D. Groneman, Chris H., General Woodworking, McGraw-Hill Book Company, New York, Unit 8, 9, 10, 11, 13, 14, and 15.

Questions

1. What plane is used most?
2. Name the various planes and give their use?
3. What is the purpose of the plane iron cop?
4. What is the purpose of the thumbscrew on a cabinet scraper?
5. List the steps in squaring a board.
6. What is the proper method in testing true surface?
7. How may a wide board be held in a vise while planing end grain?
8. Can you plane a board to required thickness and still not have the faces true?
9. Briefly state two methods of planing end grain properly.
10. What is the proper way to lay a plane on the bench when it is not in use?
11. What will be the results if the chisel edge has nicks in it?
12. Are the wood chisel and the cold chisel used for the same purpose?
13. In chiseling horizontal work, whould the level be up or down?
14. In trimming concave work or curves, should the level edge of the chisel be against the work or away from it?

15. What is the purpose of scraping?

16. When is it best to use a cabinet scraper on a board instead of planing it?

17. What might be wrong with the blades if only dust is produced?

BORING TOOLS

Unit Objectives

To introduce the students to the many boring tools, their uses, care for, and safety measures.

Study Outline

The following subject-matter information should be acquired by the student during the study of this assignment.

A. Bits
   1. Kinds
      a. Auger bit
      b. Brace drill
      c. Drill points
      d. Countersink
      e. Wheel-cutter
      f. Brad awl
   2. Size and selection
   3. Care and use

B. Bit Tools
   1. Kinds
      a. Brace
      b. Hand drill
      c. Depth gauge
      d. Automatic drill
      e. Drill press

2. Care and use

3. Safety measures

Directions

A. Read the references listed below.

B. Write the answers on the unit and hand them in at the time designated by the instructor.

References

A. Read the operation sheets No. 4 Page 030.

B. Read the information sheets No. 7 Page 138.

C. Class notes

D. Groneman, Chris H., General Woodworking, McGraw-Hill Book Company, New York, Unit 16.

Questions

1. List the dimensions of auger bits up to one inch.

2. What is the difference between an "auger bit" and a"drill bit"?

3. Does the number stamped on the shank of an auger bit denote the numerator or denominator of the fraction determined by that size bit?

4. What are the sizes of auger bits which have the following numbers stamped on the shank: 5, 6, 7, 10, 11, and 16?

5. What kind of bit is used for boring holes larger than one inch in diameter?

6. List four other types of bits and give their primary uses.

7. How can you bore a hole through a board without splitting the back side? Describe two methods.

8. What kind of bit is used with the brace when boring holes smaller than 1/4 inch?

9. What three methods are used to list sizes of dull bits?

10. How might you make a depth gauge?

FASTENING DEVICES AND TOOLS

Unit Objectives

To give the student information concerning the many nails, screws and their many uses. Also to acquaint them with the tools needed to use these fastening devices.

Study Outline

The following subject-matter information should be acquired by the student during the study of this assignment.

A. Kinds of Fastening Devices
   1. Nails
      a. box
      b. common
      c. finish
      d. brad
      e. casing
      f. cut
   2. Screws
      a. flat head
      b. oval head
      c. round head
      d. lag screw
   3. Others
      a. corregated fasteners
   4. Selection and Uses

B. Fastening Tools

1. hammer
2. nail set
3. screwdriver
4. function of each tool
5. selection and care
6. safety measures

Directions

A. Read the references listed below.

B. Write the answers to the questions on this unit and hand them in at the time designated by the instructor.

References

A. Read the operation sheets No. 5 page 035.

B. Read the information sheets No. 8 page I43.

C. Class notes

D. Groneman, Chris H., General Woodworking, McGraw-Hill Book Company, New York, Unit 17, 18.

Questions

Concerning Nails

1. List the four common types of nails and explain their uses.
2. What is meant by clinching? toenailing? setting?
3. What tool is used to set the head of a finishing or casing nail?
4. From what material are nails made?

5. Should the point of a nail set be larger or smaller than the head of the nail? Why?

6. What is the length of the following nails? 2d, 4d, 5d, 9d, 16d, 20d.

7. What must you know about nails before purchasing them?

8. Give three important rules to remember when nailing.

9. What might it be necessary to do before driving a nail through hardwood?

10. How can you secure greater leverage when pulling a nail?

Concerning Screws

1. Name the three most common types of screws used in woodwork.

2. Where are roundhead screws used mostly?

3. When should brass screws be used?

4. List all the information needed to buy the correct screws for a particular job.

5. What tool is used in setting a flathead screw?

6. How large should the hole be for the shank of the screw?

7. Why should a screwdriver point not be sharpened to a chisel edge?

8. List two advantages in the use of the phillips head screw.

9. List three advantages in using screws instead of nails.

10. Illustrate the correct shape of the tip of the screwdriver with relation to the screw slot.

11. What is the purpose of the pilot and anchor holes?

ABRASIVES

Unit Objectives

To provide each student an opportunity to study and learn about the various types, grades, and uses of the abrasives materials used in woodworking.

Study Outline

The following subject-matter information should be acquired by the student during the study of this assignment.

A. Kinds
   1. Flint
   2. Garnet
   3. Aluminum oxide
   4. Wet-dry sandpaper
   5. Steel wool
   6. Pumice stone
   7. Rotten stone

B. Uses

Directions

A. Read the references listed below.

B. Write out the answers to the questions on the unit; turn in at the time designated by the instructor.

References

A. Read the operation sheets No. 6 page 041.

B. Read the information sheets No. 9 page I49.

C. Class notes

D. Groneman, Chris H., General Woodworking, McGraw-Hill Book Company, New York, Unit 24.

Questions

1. Is sandpaper considered a cutting tool? Why?

2. What abrasives are commonly used to make sandpaper?

3. How many sheets are there in a ream ?

4. What is the usual size of a sheet of sandpaper?

5. Should sanding be done in preference to planing and scraping? Why?

6. Why should sandpaper not be tacked to a sanding block?

7. What will happen if you sand across the grain?

8. What other abrasives instead of sandpaper might be used on wood?

FINISHES

Unit Objectives

To provide each student an opportunity to learn the various kinds of finishes, how they are applied, and how finish materials and equipment should be cared for and stored.

Study Outline

The following subject-matter information should be acquired by the student during the study of this assignment.

A. Kinds
   1. Stains
      a. water
      b. oil
      c. spirit
   2. Woodfillers
   3. Thinners
      a. alcohol
      b. turpentine
      c. linseed oil
      d. lacquer thinner
   4. Transparent Finishes
      a. shellac
      b. lacquer
      c. varnish

d. wax

5. Paints and Enamels

6. Brushes

a. care for each

b. sizes

c. uses

Directions

A. Read the references listed below.

B. Write out the answers to the questions on this unit; turn these in at the time designated by the instructor.

References

A. Read the operation sheets No. 7 page 045.

B. Read the information sheets No. 10 page 156.

C. Class notes

D. Groneman, Chris H., General Woodworking, McGraw-Hill Book Company, New York, Unit 22, 25.

Questions

1. List three reasons for putting finishes on wood.

2. How does stain differ from paint?

3. How are water stains made?

4. Why are the oil stains used more often?

5. What is the purpose of stain?

6. Name three woods on which stain is unnecessary?

7. Why is woodfiller used?

8. Name three kinds of woods which do need filler.

9. Name three kinds of woods which do not need filler.

10. From what material is woodfiller made?

11. Which is applied first, stain or filler?

12. Explain the part insects play in the production of shellac.

13. How is the stick-lac removed from the tree?

14. In what proportion should flake shellac be used?

15. How is white shellac made?

16. What causes shellac to dry rapidly?

17. From what is lacquer made?

18. Why cannot lacquer be used successfully over finishes containing linseed oil?

19. What can you say concerning the application of lacquer with a brush?

20. What is a solvent for lacquer?

21. How does lacquer dry?

22. What ingredients are found in varnish?

23. What two purposes has varnish solved since the early times?

24. What is Copal gum, where is it found, and for what is it used?

25. What liquid is used to thin varnish?

26. Name the different kinds of varnish and their uses?

27. What is the drying time for varnishes in general?

28. Which requires the longer period for drying, varnish or shellac?

29. What solvents may be used to clean a varnish brush?

30. Of what are our modern waxes made?

31. In what forms are modern waxes prepared?

32. From what is linseed oil made?

33. How can linseed oil be prepared to cause it to penetrate deeper?

34. From what is turpentine obtained?

35. Turpentine is a solvent for which finish?

36. Alcohol is a solvent for which finish?

37. Brushes used in applying lacquer may be cleaned best with what?

38. List the principal ingredients of paint.

39. Are paints generally opaque or transparent?

40. What solvents are commonly used to clean paint brushes?

41. What should be done with rags soaked in linseed oil? Why?

42. What is the main difficulty with applying enamel?

43. Describe the method used in cleaning a brush used in applying paint, shellac, lacquer, water stains.

44. What is the source of material for bristles in the best grade of paint and varnish brushes?

Section IV

OPERATION SHEETS

A. Layout And Measuring Tools

B. Tooth Cutting Tools

C. Edge Cutting Tools

D. Boring Tools

E. Fastening Devices

F. Abrasives

G. Finishes

LAYOUT AND MEASURING TOOLS

Information:

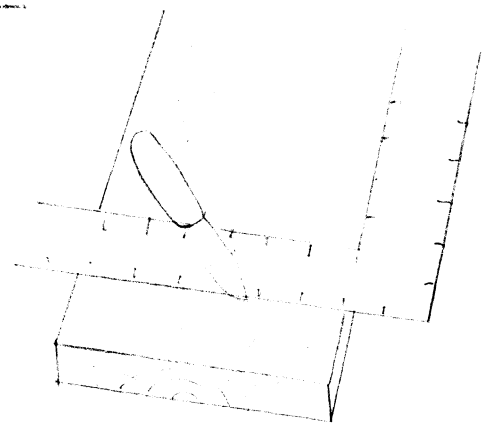
One of the most important operations every woodworker should know, is that concerned with the proper laying out and cutting of stock. The particular part of furniture that you wish to make should be systematically laid out with a pencil and carefully checked with the drawing before cutting.

Instructions:

A. Laying out lengths:

1. Square a line across the end of the board at a place which will avoid end checks and imperfections. Place the blade of the square firmly against the edge of the board, and mark the line against the tongue of the square on the board surface of the board so that the mark will be at a ninety-degree angle with the edge. Fig. 1

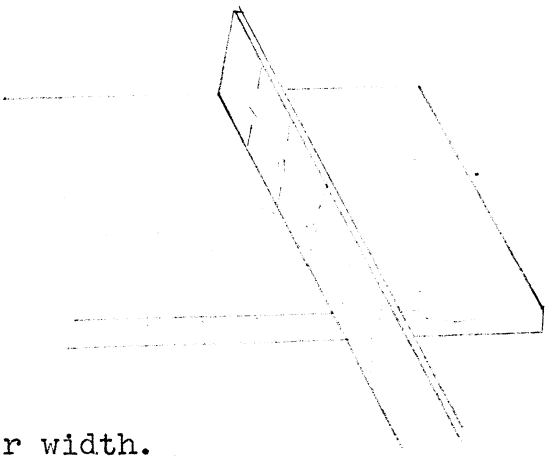
FIG. 1



Squaring a line across a board.

2. Lay out the desired length with a suitable measuring rule, and mark with a sharp pencil or knife. When using a rule, you can secure a more accurate measurement by placing the rule on its edge. Fig. 2.

FIG. 2



Measuring for width.

3. Square the line just marked by following the procedure described in step 1.

B. Laying Out Widths:

1. Measure and mark the desired width with any of the measuring tools. Fig. 2. A board may be divided into any number of pieces of equal widths by laying the rule edgewise across the board in a diagonal position. Fig. 3.

FIG. 3

Dividing a board into equal or proportional parts.

2. Mark the width layout on the board by either of the methods shown in Fig. 4a and Fig. 5b.

   a. (Rule and pencil)

   b. (Line along a straight edge)

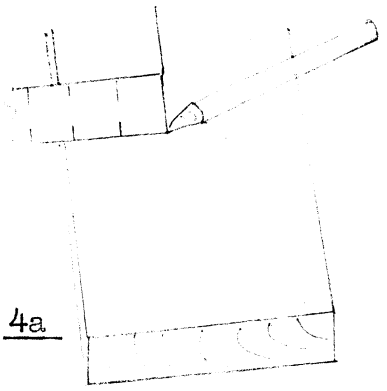


FIG. 4a

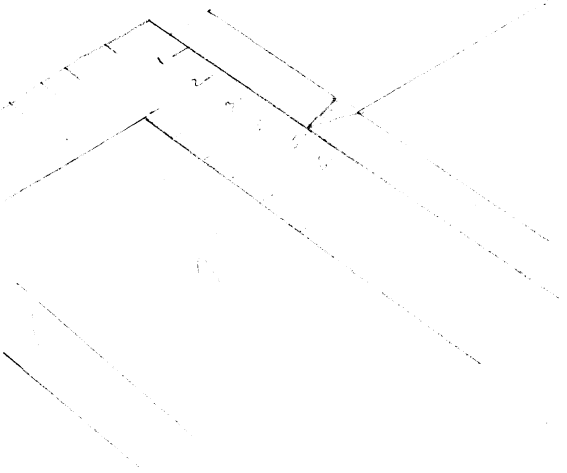


FIG. 5b

C. Gauging widths and thickness:

1. Adjust the marking gauge to the desired distance to be marked.
2. Check the setting against a rule to make certain that it is accurate. Fig. 6.
3. Push the marking gauge forward on the wood to make the desired markings. Hold the head of the gauge firmly against the edge of the board while scribing a light line.

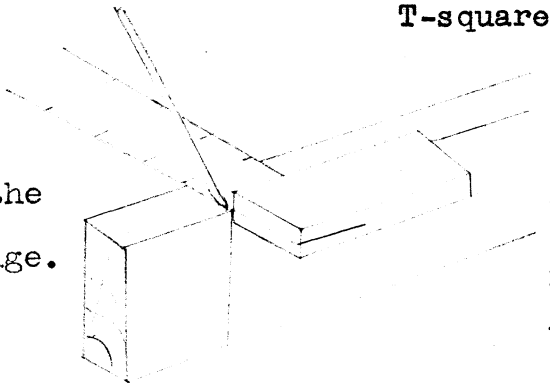
FIG. 6

Checking measurement of the marking gauge.

D. Laying out edges:

Mark a line on the edge of the board extending the face line. Hold the handle of the T-square firmly against the board side or face of the board while marking along the blade. Fig. 7.

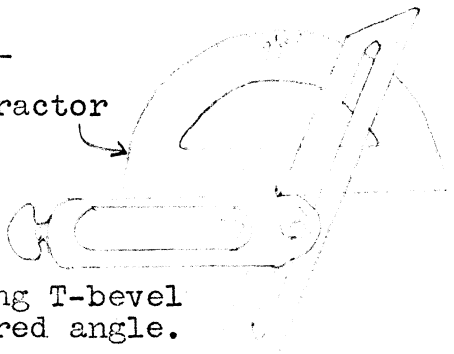
FIG. 7



Extending the face line along an edge.

E. Laying out angles:

FIG. 8



Adjusting T-bevel to desired angle.

1. Adjust the T-bevel to the desired angle and tighten in position with the screw on the handle.

This laying out tool is especially useful for any angle. The degree setting of a T-level may be obtained by the use of a protractor. Fig. 8.

2. Hold the handle firmly against the edge of the board and mark along the edge of the blade. This is similar to the method of marking with the use of a T-square.

Compiled From:

1. Feirer, John L., Advanced Woodwork and Furniture Making, Charles A. Bennett Co., Publishers, Peoria, Illinois, 1954, pp. 59-64.

2. Groneman, Chris H., Exploring the Industries, The Steck Company, Publishers, Austin, Texas, 1953, pp. 1-24, 25-37.

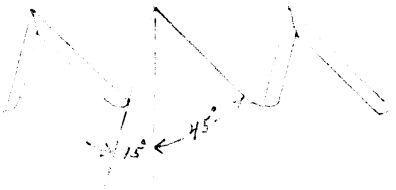
3. _____, General Woodworking, McGraw-Hill Book Company, New York, 1952, pp. 1-11.

HOW TO SAW WITH A CROSS-CUT SAW

Information:

1. A cross-cut saw is used for cutting across grain.
2. A cross-cut saw is used to cut plywood and manufactured boards.
3. A cross-cut saw has teeth shaped like a knife edge. (Fig. 1)

FIG. 1



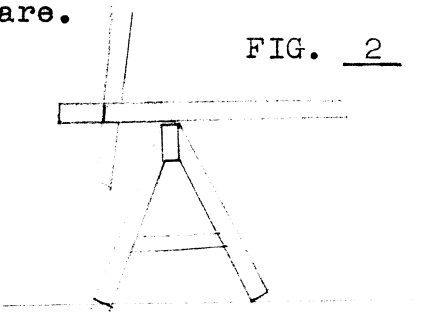
Teeth of a crosscut saw.

Instructions:

A. Cross-cutting on sawhorses:

1. The board to be cut is laid on two sawhorses, the length to be cut off is measured, and a line is squared across the board, using a pencil and a large try-square or a framing square.
2. The end to be cut is placed outside one of the sawhorses and the board is held firmly by putting one knee on it. Fig 2.

FIG. 2



Crosscutting on a sawhorse.

3. The cut is started on the waste side of the line. The thumb is used as a guide for the sae, raising it slightly from the board to avoid being cut if the saw should slip out of control. Sawing is begun by taking a few short strokes. Then, when the saw cut has been well started, sawing is continued with long, even strokes, using the whole length of the saw. The sawing must be done as close to the line as possible without sawing away any part of it. The side of the saw is held perpendicular to the board and the cutting edge at the angle of about forty-five degrees.

4. When the board is almost cut through, the length and force of the strokes are decreased, and the piece that is being cut off is supported to prevent splitting.

5. Some prefer to hold the saw handle with four fingers, Fig. 3, while others extend the index finger along the handle in order to better guide the saw. Fig 4.

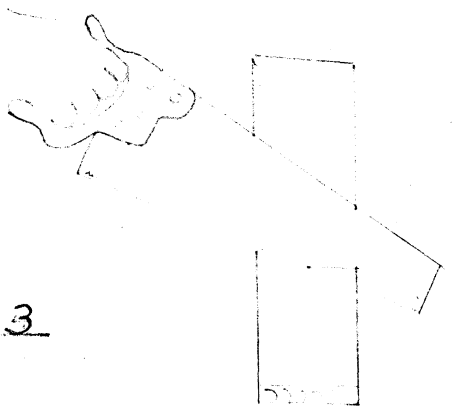


FIG. 3

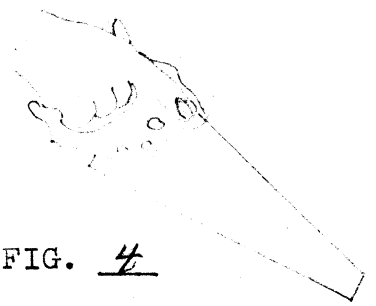


FIG. 4

B. Cross-cutting in bench vise:

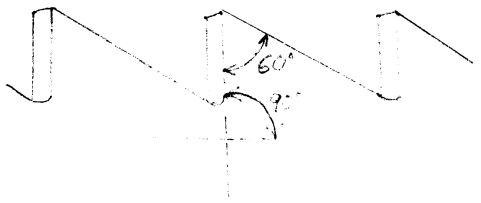
A short board may also be cross cut in a bench vise. In this case it should always be clamped flat in the vise and never on edge. If placed on edge the saw cannot be held at the proper angle. It comes in contact with too small a portion of the wood at a time. This causes the saw to jerk and chatter.

HOW TO SAW WITH A RIP SAW

Information:

1. Use a rip saw when cutting with grain or lengthwise of the board.
2. A rip saw has teeth shaped like a chisel. Fig. 5.

FIG. 5



Teeth of a ripsaw.

Instruction:

A. Ripping on sawhorses:

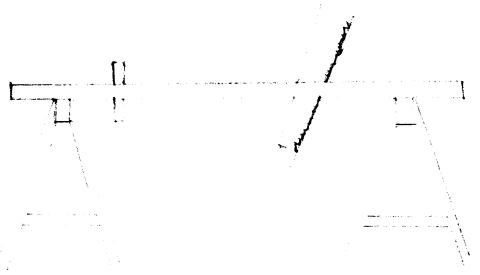
1. The line along which the board is to be ripped is laid out. This line may be marked with a marking gauge or a pencil if the edge of the board is planed. If the edge is rough, the width to which the board is to be ripped is measured at two or more points, and a line is drawn through these points along a straight edge.

2. The end of the board projects over one of the sawhorses when starting the cut, and one knee is placed on the board to hold it steady. The sawing is done on the waste side of the line which is followed as closely as possible without cutting away any part of it.

3. As the cut progresses, the sawhorse is moved to the end of the board and the sawing is continued between the two sawhorses. Fig. 6.

4. Although the saw may be in perfect condition, it will bind in some boards which are in a springy condition due to uneven drying. In such a case the saw kerf is kept open by driving a wedge into it. Fig. 6.

FIG. 6



Sawing with a ripsaw using a wedge to keep the saw kerf open.

5. Small boards are cut on one sawhorse by cutting halfway through from each end. The saw is held at an angle of about sixty degrees with the horizontal when ripping.

B. Ripping in a bench vise:

1. Short pieces of stock are most conveniently ripped in a bench vise. The piece is clamped so that it is perpendicular or plumb.
2. To avoid cutting into the bench top or dulling the saw on the iron vise, a piece of wood is placed on the bench top directly behind the board being ripped.
3. The saw is started on the waste side of the line. Although the correct sawing angle is about sixty

degrees, it is more convenient in this case to hold the saw nearly horizontal and steady the board with the other hand. This tends to prevent chattering.

4. The ripping is completed either by reversing the board in the vise and sawing from the opposite end, or by clamping it so that the saw cut is continued outside the end of the bench.

5. Another way to rip a narrow board in a bench vise is to place it so that its edges are in contact with the vise jaws. The worker stands to the left of the bench, the board is clamped in the vise at an angle of about sixty degrees, and it is steadied with the left hand. The saw is held horizontally in the right hand. In this way the correct sawing angle is maintained.

HOW TO USE A BACK SAW

Information:

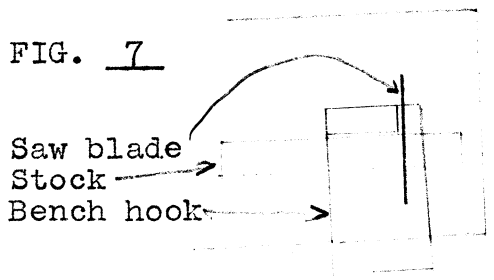
1. A backsaw has teeth similar to those of a cross cut saw, but they are smaller and finer.
2. It is used in making joints andin accurate cutting and fitting.

Instructions:

A. Sawing with back saw using bench hook.

1. A line is square around the piece to be cut, and the piece is held firmly against the short cross-piece of the bench hook, so that the line marked comes just outside the end of the crosspiece. Fig. 7. If it is to be sawed all the way through, the teeth of the saw will not injure the bench top, but will only come in contact with the surface of the bench hook.

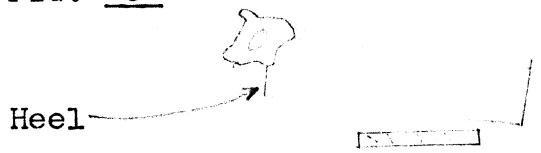
FIG. 7



2. The thumb of the left hand is used as a guide for the saw. The cut is started on the far edge of

the stock, with the heel of the saw raised. Fig. 8 .

FIG. 8

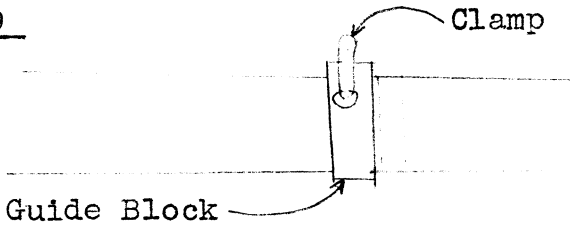


As the cutting progresses, the saw is lowered little by little to a horizontal position.

B. Sawing with backsaw using bench vise.

1. When crosscutting, the stock is clamped in the bench vise so that the saw cut falls outside the end of the bench.
2. To aid in getting a straight and accurate cut, a triangular groove is made with a knife and chisel on the waste side of the line. It is easy to start the saw in such a groove.
3. The beginner may use a block nailed or clamped to the board as a guide for the backsaw. Fig. 9 .

FIG. 9



HOW TO SAW WITH A COPING SAW

Information:

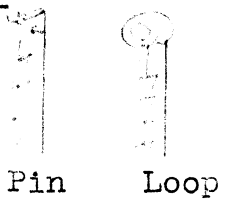
1. A coping saw is used to saw outside curves on light stock. A coping saw may be used for inside work.
2. Its fine blade is brought under tension by the spring in the steel frame.
3. There are two kinds of coping-saw blades, those with a pin through each end and those in which the ends are bent into loops. Fig. 10.

Instructions:

A. Sawing with a coping saw.

1. The coping saw is used on thin stock for both outside and inside curves. If the work is clamped in a bench vise, the coping saw is held horizontally with the teeth pointing away from the handle. Fig. 12.

FIG. 10



2. When a saw bracket is used, the saw is held in a vertical position with the teeth pointing down toward the handle. Fig. 11.

3. All inside cutting (fretwork) with the coping saw is done as follows. A small hole is bored through the wood with a twist bit and the saw blade is inserted through this. The blade is then brought under tension in the usual way.

FIG. 11

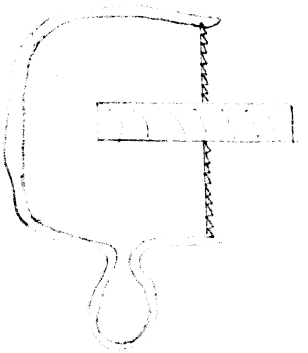
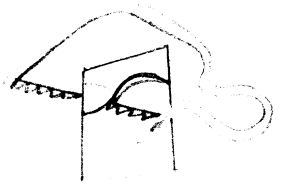


FIG. 12



SAWING WITH A COMPASS OR KEY-HOLE SAW

Information:

The compass saw is like a small ripsaw with a short, narrow blade. The keyhole saw is like the compass saw, but its blade is narrower. These two saws are used principally for sawing inside curves in heavier stock.

Instructions:

The work to be sawed is clamped in a bench vise. One of more holes, large enough to admit the point of the saw, are then bored with an angle bit.

Compiled from:

1. Duncan, Glenn S., Recreational Craft Work, Eastern Illinois State College, Charleston, Illinois, 1951, pp. 122-123.
2. Groneman, op. cit., pp. 51-53. (Exploring the Industries)
3. Groneman, op. cit., pp. 18-22. (General Woodworking)
4. Hjorth, Herman, Basic Woodworking Processes, Bruce Publishing Company, Chicago, Illinois, 1935, pp. 40-48.

EDGE CUTTING TOOLS

Information:

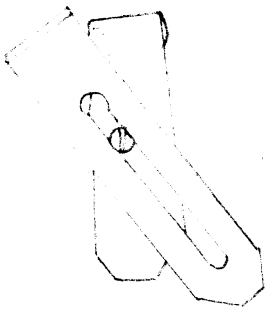
The plane is an indispensable tool to the woodworker.

Instructions:

A. Assembling:

1. Test the plane-iron for sharpness.
2. Place the plane-iron cap on the flat side of the plane- iron with the screw in the slot. Fig. 1.

FIG. 1

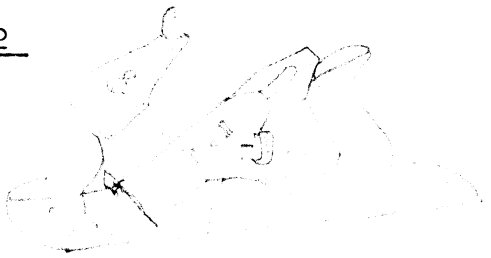


Assembling the plane-iron cap and plane iron.

3. Pull the plane-iron cap back and turn it straight with the plane-iron.
4. Slide the cap toward the cutting edge of the plane-iron. The cap should never be pushed over the edge of the blade.
5. Adjust and fasten the plane-iron cap with a screw driver. The cap should be about 1/16 inch from the cutting edge of the blade for average work.
6. Assemble the blade and plane-iron cap in the plane by placing the plane iron with its bevel

side down on the frog. Fig. 2. Make certain that the plane iron is placed properly on the lateral adjusting lever.

FIG. 2



Assembling parts of a plane.

7. Place the lever cap over the plane-iron assembly so that the screw slides properly in the slot. Fig. 2.
8. Press the cam on the lever cap to hold the entire assembly securely. If the cam does not press easily, re-check the assembly.

B. Adjusting:

1. Move the plane iron with the lateral adjusting lever until the cutting edge is parallel with the bed of the plane.
2. Regulate the depth of cutting by manipulating the adjustment nut mear the handle to the right of left until the desired depth is obtained.

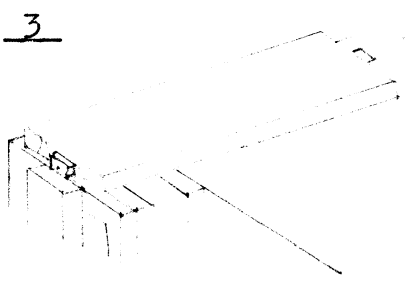
C. Squaring lumber:

Square first surface:

1. Select the best surface or face of the board. It is assumed that the board has been cut to

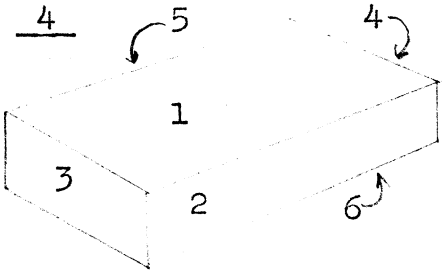
approximate length. Fig. 4. 2. Place the board on the bench and fasten it securely between the vise dog and a bench stop. Fig. 3. Arrange it so that you can plane with the grain.

FIG. 3



Board fastened securely on bench ready for planing.

FIG. 4



Sequence of steps in squaring a board.

1.	face	4.	end
2.	edge	5.	edge
3.	end	6.	face

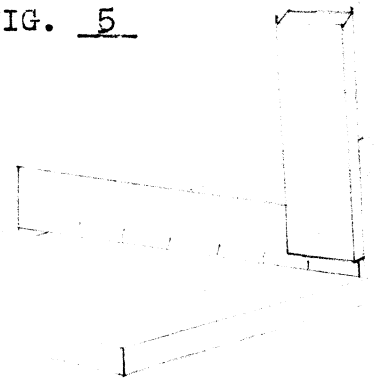
3. Adjust the cutting depth of the plane iron so that it is uniform and not too deep.

4. Plane the surface until it is clear and smooth.

5. Test the surface for flatness with the blade of a try square or with the tongue of a framing

square, Fig. 5. The entire blade should be in contact with the surface throughout the complete length.

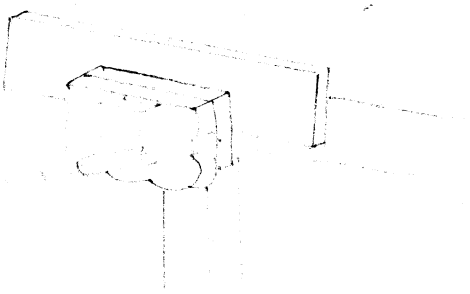
FIG. 5



Testing for flatness.

6. Test the surface across diagonals to detect a wind. It may be necessary to use a longer straightedge, such as a framing square. Test across both diagonals.

FIG. 6



Placing a board in a vise for edge planing.

Squaring the first edge:

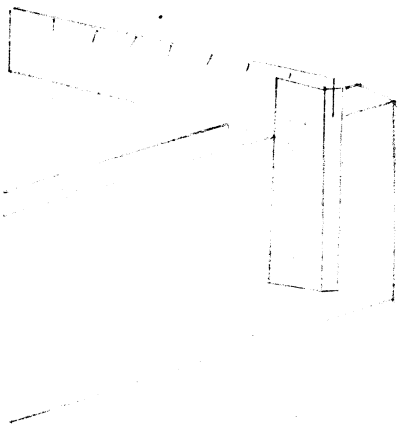
1. Select the best edge. This will probably be the one requiring the least amount of planing.

2. Fasten the board in a vise with this edge up and with the direction of the grain away from you. Fig. 6.

3. Plane the edge until it is square with the planed surface, or working face.

4. Test the edge with the face for squareness. Fig. 7.

FIG. 7

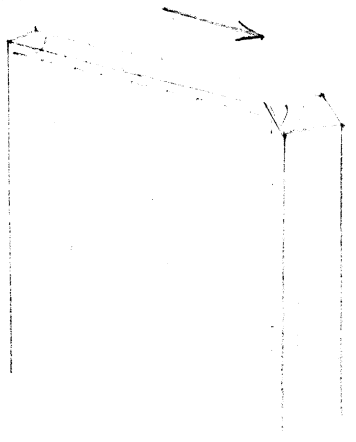


Testing an edge for squareness.

Squaring first end:

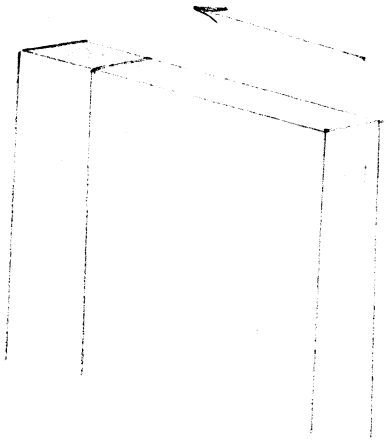
1. Select the best end.
2. Fasten this board in a vise with this end up.
3. Select the procedure you will use in planing the end from one of the following steps.
   a. Chamfer the end as shown in Fig. 8. This chamfer should be from the unfinished edge. You may plane in

FIG. 8



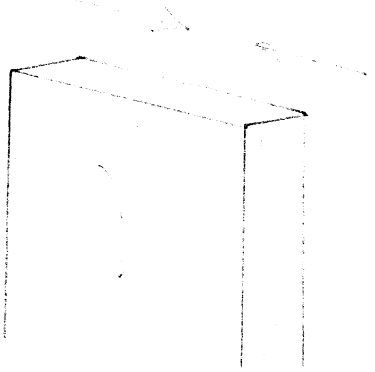
Chamfering an end for end planing.

FIG. 9



Adding a piece of scrap stock for end planing.

FIG. 10



Planing end grain from both directions.

the direction of the arrow without splitting the edge.

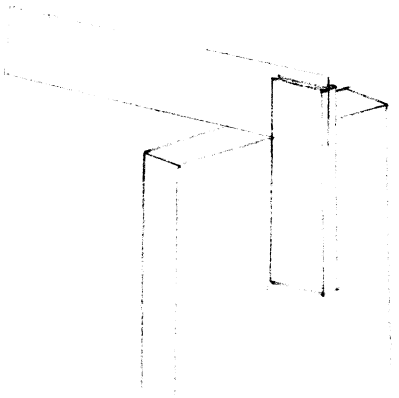
b. Fasten a narrow piece of scrap wood against the unfinished edge. Fig. 9. Plane in the direction of the arrow to minimize the splitting of the outer edge.

c. Plane two-thirds of the distance across the end from one side and then reverse the direction. The opposite edge will not split off if the plane is lifted off before going completely across. Fig. 10.

4. Plane the end until it is square with the

planed surface and edge. A wide board may be held in a vise conveniently if it is supported with a hand-screw clamp which has been fastened to the board so that the clamp rests flat against the bench top.

FIG. 11



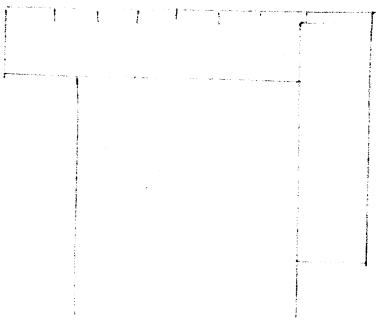
Testing the squareness of an end with the surface.

5. Test the end for squareness with the working face and with the planed edge. Fig. 11 and Fig. 12.

Squaring opposite end:

1. Measure the board for the exact desired length and mark it.
2. Mark the length square with the planed edge.
3. Cut off the surplus with a crosscut saw or backsaw. Allow 1/8 inch for planing to the line.

FIG. 12



Testing the squareness of an end with the planed edge.

4. Plane this end of the line so that it will be square with both the planed face and edge.

Squaring opposite edge:

1. Measure and mark the board for the desired width.
2. Cut off the surplus stock, if necessary, with a rip saw. This is desirable only when the waste to be removed is approximately 3/8 inch or more. Allow inch for planing to the line.
3. Plane this edge to the line so that it is square with the working face or surface and with both ends.

Squaring final surface:

1. Mark the board for thickness with the marking gauge. The gauge line should be put on both edges and ends.
2. Plane this last face or opposite surface to the gauge line. Test it frequently for squareness and for smoothness.

D. Assembling and adjusting a spokeshave:

1. Test the blade for sharpness.
2. Put the blade into the frame so that the slots of the blade will seat on the adjusting nuts.
3. Place the lever cap over the blade so that the slot will slide under the lever-cap screw.
4. Hold the blade securely by tightening the back-cap thumb-screw.

5. Adjust for the proper cutting depth by means of the adjusting nuts.

E. Forming with a Spokeshave:

1. Adjust the setting of the cutting edge for uniform depth.
2. Fasten the stock securely in a bench vise.
3. Smooth the curved edge with the spokeshave until the exact pattern line is reached. You may use this tool effectively by either pushing or pulling it, whichever is convenient.

F. Cutting and Trimming with a Chisel:

Horizontal chiseling:

1. Fasten the wood firmly in a bench vise.
2. Push the chisel with one hand while using the forefinger and thumb of the other hand as a brake. Make certain that the bevel of the chisel is turned up when it is used in this manner.
3. Continue to make thin cuts, taking care to stop each time before reaching the opposite side. Fig. 13 illustrates the procedure for cutting across the board to protect the grain on the opposite side.

Vertical chiseling:

FIG. 13

Horizontal chiseling.

1. Fasten the wood securely in a bench vise or hold it firmly on a bench hook.
2. Hold the flat side of the chisel against the wood in a vertical position.
3. Hold the chisel with one hand and guide the blade with the other. The left hand will serve as a brake.
4. Push the chisel and apply a shearing cut.
5. Use a wooden or fiber mallet, if necessary, to drive the chisel in cutting out Mortises.

Curved Chiseling:

1. Fasten the wood securely in a bench vise.
2. In cutting a round corner, move the chisel in a shearing cut across the work by making several short strokes. Make certain that the bevel edge of the chisel is up.
3. In trimming a concave edge, hold the bevel side of the chisel against the wood while pushing it with the right hand. Use the left one to hold the chisel against the work. Always work with the grain.

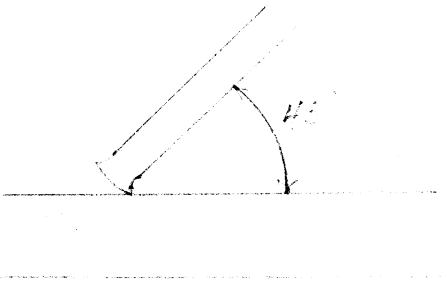
G. Assembling and Adjusting Scrapers:

1. Test the blade for properly burred edge.
2. Place and tighten the blade in its proper position in the frame.
3. Adjust the blade for depth of scraping action with the thumb nut or thumbscrew.

H. Handscraping:

1. Grasp the scraper blade firmly between the thumb and the fingers so that it can be sprung to a slight curve with the thumb and forefinger. More effective scraping action will result if the blade is held to the approximate angle of forty-five degrees. Fig. 14.

FIG. 14



Angle for handscraping.

2. It is sometimes convenient to pull the scraper blade toward you.

I. Smoothing with Cabinet Scraper:

1. Assemble and adjust the blade in its proper place in the cabinet-scraper body.

2. Grasp the scraper handles firmly in your hands, with the thumbs pressing on the frame back of the blade.
3. Try the scraper on a piece of wood and adjust it further until it produces a fine, thin, even shaving.
4. Scrape the surface of the wood with long, even strokes and with the grain, with the cabinet scraper turned slightly so that it will produce a shearing cut.
5. Continue scraping until the entire surface has been smoothed evenly.

Compiled from:

1. Groneman, op. cit., pp. 54-62, 69-75. (Ex. the Indus)
2. Groneman, op. cit., pp. 23-48. (Gen. Woodworking)

BORING TOOLS

Information:

It will frequently be necessary to bore holes with a brace and bit. It is important that the hole be bored straight and that the bit does not break through the wood on the opposite side.

It is frequently necessary to make small holes when fastening with screws, nails, and bolts. Holes less than 1/4 inch in diameter are usually made with a hand drill.

The hand drill is used to turn drills such as the wood boring drills and drill bits. It has a chuck consisting usually of three jaws that hold the bit. Such a drill will turn a bit faster than will a brace. One revolution of the handle will turn a bit four or five times.

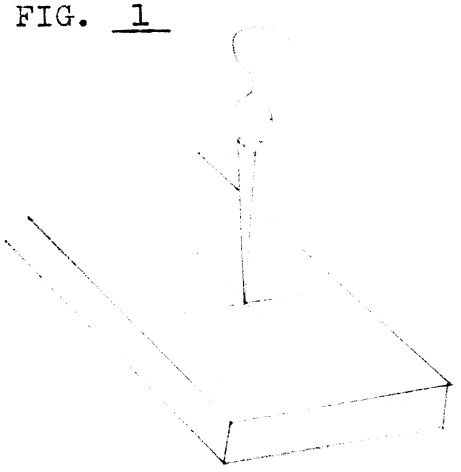
Instructions:

A. Boring a Hole:

1. Select the correct size square-shank angle bit or other bit for boring into wood.
2. Place the bit in the chuck of the brace. To place the bit in the chuck, grasp the chuck shell and turn the handle to the left until the jaws open wide enough for the toper shank of the bit to pass the ends of the chuck jaws.

3. Fasten the bit firmly in the chuck by turning the handle to the right until the bit is held securely.

FIG. 1

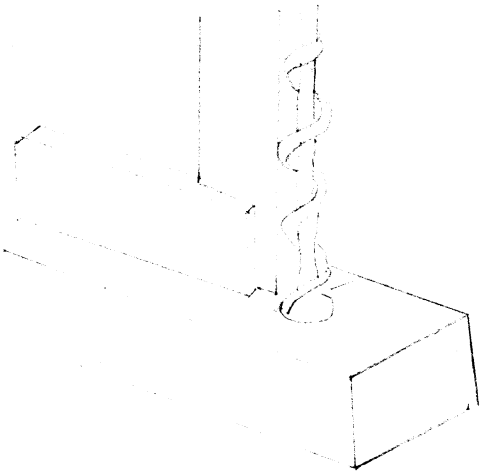


Starting a hole with an awl.

4. Mark the location for boring the hole. If possible, start the hole with an awl to give the feed screw a definite hold. Fig. 1.

5. Place the feed screw at the spot marked for the center of the hole, and with a firm pressure of the arm make a few turns with the brace to start the hole.

FIG. 2

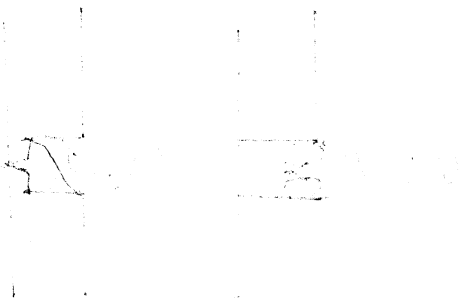


Testing boring for accuracy.

6. Test the boring by holding a try square on the wood and against the bit to make certain that the hole is being bored at right angles to the surface of the work, Fig. 2.

7. Bore carefully until the point begins to come through on the back side. Fig. 3. Step 1.

FIG. 3



Step 1 Step 2

Step 1- Correct procedure in boring a hole.
Step 2- Boring a clean-cut hole.

8. Remove the bit from the hole by reversing the direction of the boring. Fig. 3. Step 2.

9. Bore through the back side to make the hole clean-cut and without splinters. Fig. 3. Step 2. Another method of boring a hole without splintering the backside of the board is to have a piece of scrap wood behind the board. Holes bored with an expansion bit should be backed up with a piece of scrap wood to prevent splintering. In boring for dowel joints, use a regular shortened dowel angle bit with a dowel jig.

B. <u>Boring to a specified depth</u>:

1. Fasten an angle bit of the desired diameter in a brace, as described in steps 2 and 3 of the preceding section.

2. Fasten the adjustable metal depth gauge on the bit to regulate the depth the bit is to bore. The wooden depth gauge is also suitable to use.
3. Check this depth against the rule.
4. Proceed in boring the hole until the depth gauge stops the boring action.
5. Remove the bit and shake out the loose wood particles in the hole.

C. Drilling a hole:

1. Select the straight-shank drill bit or the automatic drill of the desired diameter.
2. Fasten the straight-shank drill bit in the hand-drill chuck, much as you fasten an angle bit in the brace. The automatic drill is held in a special chuck. It is advisable to refer to the instructions which accompany the automatic drill for fastening as well as for using automatic bits.
3. Locate and mark where the hole is to be drilled.
4. Place the bit on the mark, and hold the drill steady in direction desired while turning the crank to a constant, but not too fast, speed.

Compiled from:

1. Fryklund, Verne C. and Laberge, Armand J., General Shop Woodworking, McKnight and McKnight, Publishers, Bloomington, Illinois, 1936, pp. 27-28, 51-53.

2. Groneman, op. cit., pp. 62-64. (Exploring the Industries)

3. Groneman, op. cit., pp. 48-53. (General Woodworking)

FASTENING DEVICES-NAILS

Information:

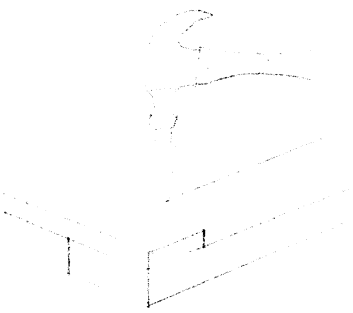
A great deal of skill is involved in driving, setting, and pulling nails correctly. Almost everyone has occasion to drive and pull nails; it is essential to know how to use a hammer and how to select the correct nail to use for the particular job.

Instructions:

A. Driving Nails:

1. Select the proper type and size of nail for the job.
2. Hold the nail firmly with one hand making the first light blow.
3. Remove the hand which holds the nail, and continue to strike the nail directly on the head until it is driven flush with the wood. Try to avoid bending the nail.
4. Where necessary, set the head of the nail about 1/16 inch below the surface of the wood. Fig. 1.

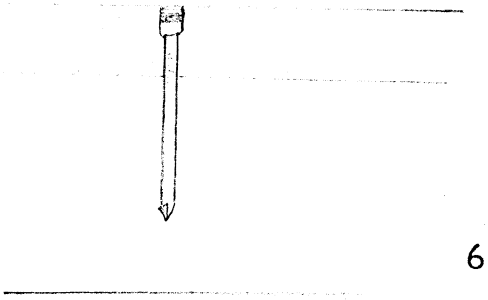
FIG. 1



Setting a nail.

5. Fill the hole with putty, wood plastic, or dough if the nail has been set. Fig. 2.

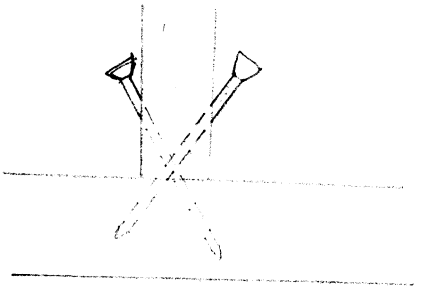
FIG. 2



Covering a nailhead.

6. Fig. 3. illustrates how nails may be driven in order to produce what is termed toenailing.

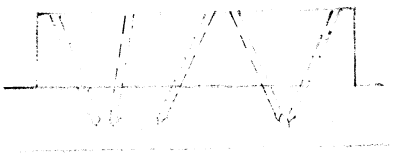
FIG. 3



Toenailing.

7. Nails which are driven at an angle have a greater holding power than those driven straight. Fig. 4.

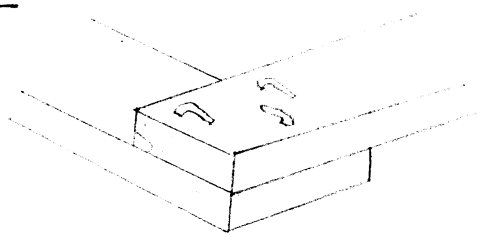
FIG. 4



Driving nails at an angle to increase holding power.

8. To clinch nails in holding two or more boards securely check Fig. 5.

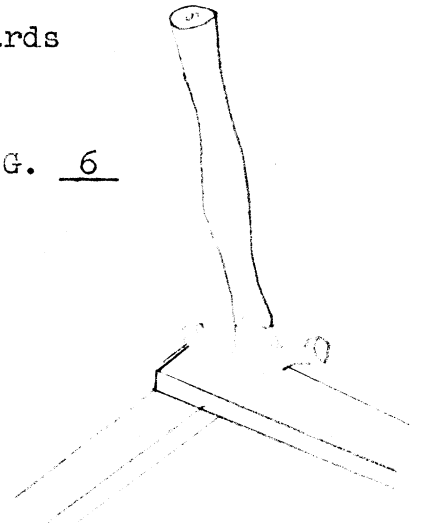
FIG. 5



Clinching nails to hold boards securely.

B. Pulling Nails:

FIG. 6

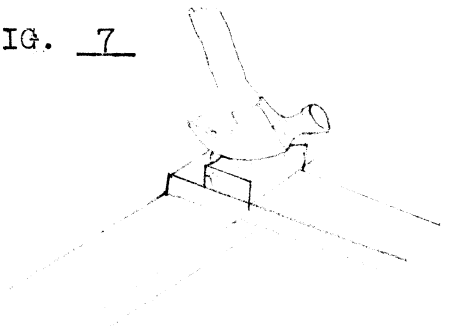


Pulling nail with claw hammer.

1. Slip the claw of the hammer under the head of the nail and pull the handle until it is at nearly ninety degrees with the board. Fig. 6. Put a piece of heavy cardboard or a thin piece of wood under the hammer head to protect the surface of the board.

2. To pull a nail which is too long to come out as outlined in step 1, slip a block of wood under the head of the hammer. Fig. 7. This will increase the leverage and lessen the strain on the hammer handle.

FIG. 7



Pulling nail with increased leverage.

FASTENING DEVICES-SCREWS

Information:

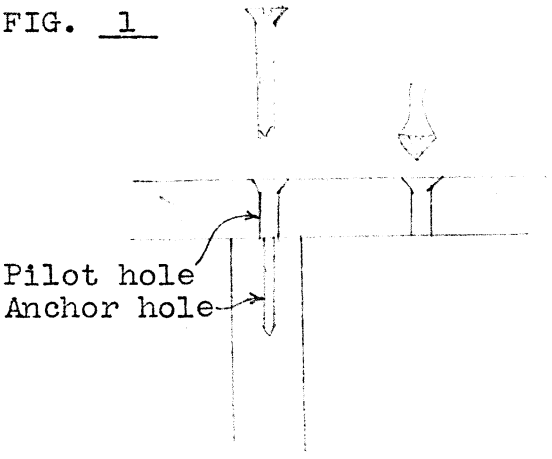
Screws are used for fastening boards and for assembling projects. A project which has been fastened with screws can be dismantled and reassembled without injury.

Instructions:

A. Fastening with a screw:

1. Locate the location for the screw hole. A dent with an awl makes an excellent beginning for boring or drilling a hole.
2. Select the bit of the correct size for drilling or boring the pilot hole. The size of the bit should be large enough to clear the shank of the screw.

FIG. 1

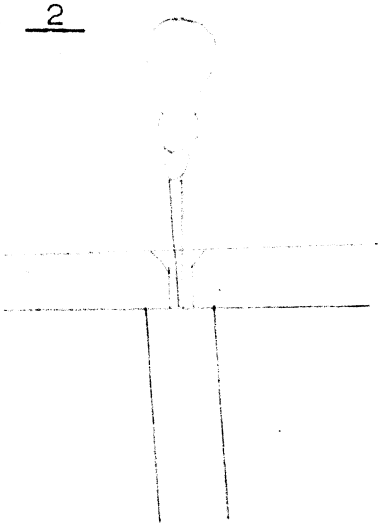


Pilot and anchor holes.

3. Fasten the bit in the brace or the drill in the hand drill, and make the pilot hole. Fig. 1.
4. Place boards for the joint in

position, and mark the location of the anchor hole with an awl. Fig. 2. If a drill bit is not available for making this hole, a nail with the head cut off may be used in a hand drill for the purpose. A nail can be made to cut a larger hole by flattening it near the point.

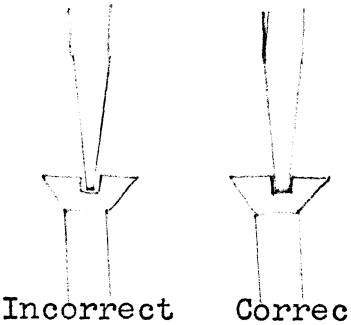
FIG. 2



Marking for anchor hole.

5. Bore or drill the anchor hole.
6. Countersink the pilot hole slightly if a flat-or-oval head screw is to be used. Fig. 1. Make sure that you do not countersink too deeply, or the head will pull into the wood.
7. Select the screw driver which fits the slot of the screw snugly. The tip should be ground properly. Fig. 3.

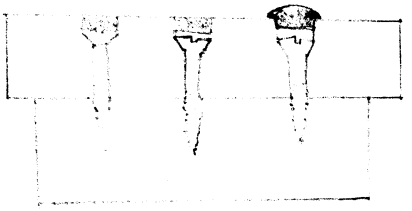
FIG. 3



Incorrectly and correctly shaped screw-driver tips.

8. Fasten the screw with a screw driver, or with a screw driver bit and brace. Hold the screw driver firmly and in line with the screw to prevent it from slipping out of the screw slot. If the screw turns too hard, unscrew it and coat it with soap.
9. If the screw is to be hidden or to be covered with a wooden button of plug, it will be necessary to set the head in the wood. Fig. 4. Standard-size wooden plugs are available commercially, or you may make them.

FIG. 4



Methods of recessing flathead screws.

Compiled from:

1. Duncan, op. cit., pp. 101-106.
2. Groneman, op. cit., pp. 65-68. (Ex. the Indus.)
3. Groneman, op. cit., pp. 54-60. (General Woodworking)

ABRASIVES

Information:

The abrasive materials used in woodworking are generally used in the finishing processes and then only after all other tool processes have been completed.

Instructions:

A. Preparing the surface:

1. Inspect all visible surface to make sure that all mill marks have been removed with the plane or scraper.
2. Remove all trace of glue on the visible surfaces, especially around joints.
3. Raise the existing dents by moistening the dented areas with water. Grain cannot be raised if the fiber has been broken.
4. Fill small knots, holes, checks, or other open defects by melting in colored stick shellac, or by pressing in a colored wood plastic, a wood dough. Select the color that will match the wood when finished.
5. Dress the hardened shellac or wood plastic smooth to the wood surface with abrasive paper.

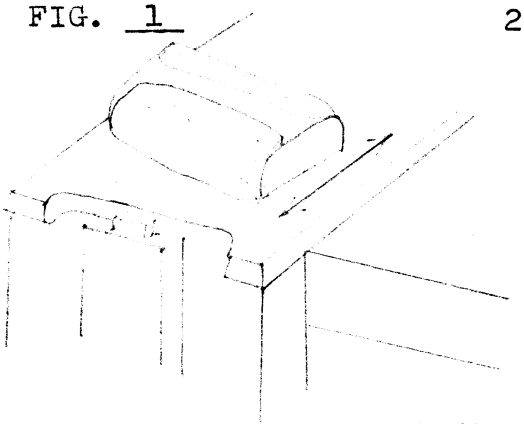
B. Preparing sandpaper:

1. Tear a piece of nine-by-eleven inch sandpaper into four equal parts. This can be done most conveniently by placing the sheet, abrasive side down, on a flat surface and tearing it along the edge of a framing square.
2. Prepare a block of wood for holding the sandpaper to measure approximately 3/4 by 2 1/2 by 6 inches.
3. Fold the quarter sheet of sandpaper around the block so that it can be held securely with the hand. Do not tack the paper on the block because the block may slip and the tacks marr the surface to be sanded.

B. Sanding:

1. Fasten the piece to be sanded securely on the bench, or place the project so that it can be held conveniently while sanding.

FIG. 1

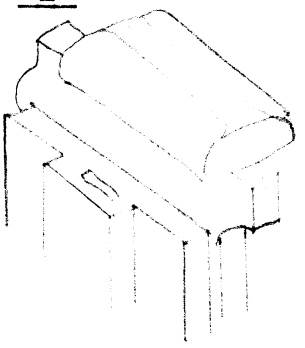


Sanding a surface with the grain.

2. Sand all flat surfaces and edges with the grain using an even pressure. Fig. 1. Avoid sanding across grain or in a circular

motion, because this will injure the wood fibers. The first sanding should be done with reasonably course sandpaper, and the final sanding with a fine or very fine for best results.

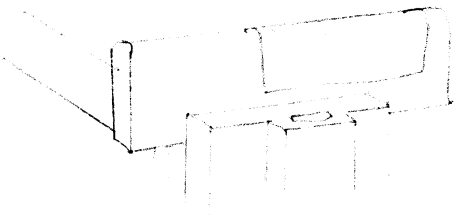
FIG. 2



Sanding an edge.

3. Sand edges and ends in a similar manner. Fig. 2.
4. Sand concave, irregular edges and molded or shaped edges by wrapping the sandpaper around a block of wood that is formed to fit the particular outline.

FIG. 3



Sanding a rounded edge.

5. Sand rounded edges by cupping the sandpaper in the hand to keep an even pressure on the curvature. Fig. 3.
6. Sand all corners and arrises lightly with worn sandpaper. An arrise is the edge formed by two surfaces meeting at right angles.

7. Inspect all visible surfaces, edges, and ends to make sure that they have been properly sanded in preparation for applying finish.

Compiled from:

1. Groneman, op. cit., pp. 75-76. (Ex. the Indus.)
2. Groneman, op. cit., pp. 88-90. (Gen. Woodworking)

FINISHES

Information:

Wood finishing, if properly done, can increase the natural beauty of the wood or, if poorly done, can detract greatly from an otherwise well-designed and well-made article.

A knowledge of the various types and kinds of finishes and how they are applied is necessary, not only in working with wood, but is also necessary in order to buy furniture or other products made of wood. Quality of the product is oft times indicated by the quality of the finish.

Instructions:

A. To apply stains:

Oil Stain:

1. Select the color of stain desired for the finished effect.
2. Pour some stain into a cup or other open container.
3. Brush the stain on a piece of scrap stock of the same wood as the project to test the color. If the test is dark, lighten it by adding turpentine.
4. Apply a coat of linseed oil to all exposed end grain.

5. Apply the stain with a medium sized brush to the entire project. Brush it on with long, even strokes. It is desirable to stain the underneath parts first.
6. After it has been on approximately two minutes wipe off surplus stain from the project with a cloth.
7. Allow the stained project to dry for at least six hours. If the wood is open grained, it will be ready for a filler; if it is close-grained, the filler may be omitted.

Water stain:

1. Sponge the wood to be stained lightly with water and allow to dry for two hours.
2. Sand the dampened area with a No. 2/0 sandpaper. Make certain to sandpaper with the grain.
3. Clean the sanded areas with a brush.
4. Mix the water color in a cup or other open container according to the directions given by the manufacturer.
5. Test the color of the stain on a piece of scrap wood. Wait until it dries thoroughly to determine the true color.
6. Apply the stain evenly with a medium-sized brush to the entire project. Brush on with long, even strokes and keep overlapping at a minimum.

Surplus water stain is not removed from the surface; therefore, all brush marks will show if the stain is not applied evenly. Allow to dry for at least six hours.

7. Sand lightly with No. 2/0 sandpaper to reduce any raised grain.
8. Clean the project thoroughly with a clean brush in preparation for further finishing.

Spirit stain:

1. Mix the spirit color stain in a cup or other open container, according to the directions given by the manufacturer.
2. Test the color of the spirit stain on a scrap piece of wood which is the same as the project. If the stain is too dark, dilute it with denatured alcohol or with the thinner recommended by the manufacturer.
3. Brush the stain on evenly with a medium-sized brush. Since any surplus will not be wiped off, take care that the brushing is even and that the surface is covered thoroughly. Allow to dry for at least six hours.
4. Sand all surfaces lightly with No. 2/0 sandpaper.
5. Clean the project thoroughly with a clean brush in preparation for further finishing.

B. To apply wood filler:

1. Mix the filler to a thin paste with turpentine or Japan drier.
2. Add the desired color in oil, and stir the paste until it is thoroughly mixed.
3. Apply the filler on the exposed surfaces of the project with a stubby brush. Rub it into the wood by working the brush across the grain.
4. Continue to rub the paste filler into the pores of the wood thoroughly with the palm of the hand, working across the grain in a circular motion.
5. When the glossy appearance disappears and the filler looks dull, wipe surplus off across the grain with a small piece of burlap. Continue this until the entire project has been covered.
6. Wipe the project lengthwise on the grain with a clean cotton cloth. This removes cross-grained strokes.
7. Clean the filler from corners and grooves with a sharp-pointed stick. Do not use a piece of metal such as a screw driver or a chisel, because it will injure the grain and final finishing surface.
8. Allow the fillered project to dry ten to twelve hours before proceeding with further finishing.

C. To apply shellac:

1. Check the surface to see that it is free from dust. Also make certain that the stain or filler is thoroughly dry.
2. Pour a small amount of the stock white shellac into an open container, such as a cup.
3. Thin the shellac with approximately one-half alcohol and stir the mixture.
4. If the project to be shellacked has drawers or other removable parts, take them out so that they can be finished separately.
5. Apply thinned shellac to the entire project, using a medium-sized brush. In applying shellac to vertical surfaces, start at the top and work down. Finish the lower portions of the project first, leaving the top surface to the last. Apply shellac evenly and quickly because it dries rapidly. Do not over-lap more than absolutely necessary.
6. Allow the coat to dry at least six hours; then rub it smooth with No. 00 Steel wool. Rub with the grain whenever possible. Rub carefully so that you do not rub through the shellac coat at the edges and corners.
7. Wipe the surface clean with a cotton cloth and then with the hands.
8. If you desire a shellac finish, apply another coat of a richer mixture of two-thirds shellac

and one-third alcohol just as you did the first coat.

9. Allow the second coat to dry eight to ten hours; then rub smooth with No. 00 steel wool.
10. The final coat may be rubbed with pumice stone and oil and then with rotten stone and oil if you wish a fine finish. Rub with the grain.
11. Apply a coat of good grade of furniture paste wax; allow it to dry fifteen to twenty minutes; then rub it to a luster with a clean cotton cloth.

D. <u>To apply lacquer by brush</u>:

1. Make sure that the surface is free from dust before applying the first coat of lacquer. Wipe the surface with a clean rag dampened slightly with lacquer thinner.
2. Apply a thin coat of shellac to your project first. This serves as a sealing coat and at the same time it provides a base for the lacquer. Allow eight hours for drying and then sand with 4/0 sandpaper.
3. Apply, or flow on, the lacquer with your brush and do not brush over the same place more than once. Lacquer cannot be brushed back and forth in the same way that varnish and paint are brushed. It must be flowed on very rapidly. Finish the brush strokes out to the edge and ends.

4. Allow the lacquer to dry for three or four hours and then sand the rough spots very lightly with 4/0 sandpaper.
5. Flow on a second coat.
6. Two coats of lacquer are sufficient when applied over a surface that has been sealed with shellac.
7. Sand lightly with No. 6/0 waterproof sandpaper and rubbing oil. Clean off the surface with a soft cloth.
8. If you wish a smooth velvet finish, rub and polish the final coat of lacquer with rotten stone and oil. Be sure to work carefully into the corners.

E. <u>To apply lacquer by a spray gun</u>:

1. Pour sufficient sealer into the spray-gun container for finishing the project. Dilute the sealer with approximately one-half thinner and stir the mixture.
2. Fasten the container to the spray gun assembly. Make certain that all fittings are secure, and that the gaskets are tight. Consult the manufacturer's chart for the particular spray gun you use to learn its adjustments.
3. Turn on the compressor and regulate the air pressure between fifty and sixty pounds.
4. Pull the trigger of the spray gun and adjust the

nozzle so that the liquid will come out in an even mist.

5. Spray the finish by moving the gun left to right and vice versa in an even pattern. Always try to keep the nozzle of the gun at the same distance from the work. This will require you to follow the path of the gun with your body as it is moved back and forth.
6. Finish the underneath portions of a project first and do the top surface last.
7. Remove the container from the gun and pour the remaining sealer back into its original can. The lid should be kept tight on the can at all times to keep the sealer and lacquer from evaporating.
8. After the sealer has dried approximately one hour, sand the sealed surface with No. 6/0 sandpaper.
9. Pour enough lacquer into the spray-gun container to spray the entire project. Never fill the container more than one-third full of lacquer, because thinner must be added.
10. Dilute the lacquer approximately one-third to one-half with thinner and stir the mixture.
11. Fasten the container to the spray gun, checking all connections.
12. Spray a coat of lacquer over the entire project in a manner similar to that employed in spraying on the sealer, step 5.

13. Most projects will require from three to five coats of lacquer. Each coat except the last, should be sanded lightly with No. 6/0 sandpaper after the lacquer has dried two to three hours.

14. Remove the container and pour the remaining lacquer mixture into its original can.

15. Clean the spray gun and the container with lacquer thinner. This can be accomplished by spraying some lacquer thinner through it.

16. If desired, rub the final coat with a commercial rubbing compound. This is not necessary in all cases, but sometimes it improves the final appearance.

17. Apply a coat of good paste wax, allow it to dry twenty minutes, and then polish it with a clean cotton cloth.

F. <u>To apply varnish</u>:

1. Check the surfaces to be varnished to make certain that they are free from dust and that any previous finish is thoroughly dry.

2. Pour a small amount of varnish directly from the can into a cup or other container of convenient size and shape. It is advisable to follow any directions on the can regarding thinning the varnish.

3. Thin the first coat of varnish with turpentine if the directions on the can advise it.
4. Apply the first coat with a good grade of fine, long bristle brush. Flow the varnish on evenly with long strokes. Varnish has a tendency to run; check your work in a good light for all angles and brush out immediately any runs which develop.
5. Allow the coat to dry at least twenty four hours.
6. Rub the varnished surface lightly with No. 6/0 wet-dry sandpaper and water. The rubbed-varnished surface will turn a milky color and remain so until the next coat is put on. This initial rubbing smooths down the high places of the varnish to produce a smooth base for the next coat.
7. Apply two coats of varnish, or more as necessary, without thinning it.

G. <u>To rub varnished surfaces</u>:

1. Prepare a mixture of No. FFF pumice stone with rubbing, paraffin, or lubricating oil.
2. Rub this on the varnished surface back and forth in the direction of the grain with a soft pad. Rub until all traces of brush marks and other imperfections have been smoothed out.
3. Wipe the surface clean to remove all pumice stone and oil.

4. Prepare a mixture of rotten stone with rubbing, paraffin, or lubricating oil.
5. Rub this on the varnished surface in a manner similar to that described in step 2. Pumice and rotten stone are fine, abrasive powders which smooth the varnished surfaces and remove the gloss. A fine luster and sheen will be the result of hard rubbing. A commercial rubbing compound may be used instead of these mixtures.
6. Apply a coat of high-grade furniture paste wax, allow it to dry fifteen to twenty minutes, and then polish it with a clean cotton cloth.

H. <u>To apply paint or enamel</u>:

1. Prepare the surfaces for painting or enameling. Read the directions on the can or container before it is opened. Each manufacturer prescribes the correct mixture and technique for the application of his particular brand of paint or enamel. The drying time is also specified.
2. Note whether the directions specify the use of primer coat. If so, this should be applied before proceeding.
3. Shake the can thoroughly, remove the lid, and pour off some of the top liquid into a temporary container.

4. Stir the base mixture with a wooden paddle, and mix the liquid back into it a little at a time until it is thoroughly blended.
5. Add turpentine, linseed oil, or the recommended thinner in accordance with the instruction on the can.
6. Select a suitable brush of high quality with the bristle set in rubber.
7. Dip the brush into the paint so that about three-fourths the length of the bristles absorbs paint. Press surplus paint or enamel off on the edge of the can as the brush is removed.
8. Apply the paint or enamel to the project with long, even strokes. A little practice will determine the proper amount to apply to the surface. It should cover smoothly and evenly but not be allowed to run.
9. Allow the coat to dry thoroughly according to the time given in the directions, and then sand smooth with No. 2/0 sandpaper. Wipe the surface off with a clean cloth before applying the next coat.
10. Apply the second and third coats, if needed, according to these instructions, omitting sanding the final coat.

I. <u>Care and cleaning for brushes</u>:

1. For temporary storage of brushes laden with an oil finish, its bristles may be immersed in turpentine or kerosene.
2. For indefinite periods of time, all brushes should be thoroughly cleaned and allowed to dry.
3. Even for short periods of storage, shellac and lacquer brushes should be cleaned as explained below.

    A. To clean paint, enamel, and varnish brushes that have not hardened:

        1. Fill small containers with enough kerosene to saturate bristles.
        2. Work kerosene thoroughly into the bristles.
        3. Remove brush from kerosene and squeeze bristles to remove surplus liquid.
        4. Repeat the above process at least once.
        5. Holding the brush with bristles upward and spread apart, pour a generous amount of a good liquid soap into the bristles.
        6. Take brush in right hand, scrub vigorously with bristles well spread in the palm of the left hand.
        7. Rinse soap solution from brush with clean water, warm preferred, repeat procedure. Finally, inspect bristles

by pulling them apart and if dirty repeat scrubbing.

8. Wrap paper towel around bristles, holding it in place by a rubber band. Be sure that bristles are not too closely compressed. Hang brush up to dry.

Note: If the above brushes have been allowed to harden, soak in varnish remover all night; then proceed to clean as instructed.

B. To clean shellac brushes:

1. Fill small container with enough alsohol to saturate bristles.
2. Work alcohol thoroughly into bristles.
3. Remove brush from alcohol and squeeze liquid from bristles.
4. Repeat the above process two or three times.
5. Hang brush up to dry.
6. When brush is to be used again, dip in alcohol to soften.

C. To clean lacquer brushes:

1. Fill small container with enough thinner to saturate bristles.
2. Work thinner thoroughly into bristles.
3. Remove brush from thinner and squeeze liquid

from bristles.

4. Repeat the above process several times.

5. Hang brush up to dry.

Compiled from:

1. Duncan, op. cit., pp. 89-90.

2. Feirer, John L., Advanced Woodwork and Furniture Making, Charles A. Bennett Co., Publishers, Peoria, Illinois, 1954, pp. 141-153.

3. Fryklund, op. cit., pp. 73-80.

4. Groneman, op. cit., pp. 82-86. (Ex. the Indus.)

5. Groneman, op. cit., pp. 91-99. (Gen. Wood.)

6. Hjorth, op. cit., pp. 212-214.

7. Wheeler, Hubert, Industrial Arts General Woodwork, Missouri State Department of Education, Division of Public Schools, Jefferson City, Missouri, 1951, pp. 62.

Section V.

INFORMATION SHEETS

A. Planning

B. Layout And Measuring Tools

C. Holding Tools

D. Woods And Plywoods

E. Tooth Cutting Tools

F. Edge Cutting Tools

G. Boring Tools

H. Fastening Devices And Tools

I. Abrasives

J. Finishes And Brushes

PLANNING

INFORMATION:

Understanding a Working Drawing

You will need to understand the meanings of the various types of lines and to know how to interpret the views. The working drawing or sketch provides a language which explains to you the dimensions of the various parts of the project and shows you how it is assembled. In studying a deawing, you will follow exactly the same technique that a mechanic or craftsman employs before he attempts to build any part of a project.

LINE SYMBOLS:

The line symbol in Fig. 1 is known as the alphabet of lines and the following description of each will aid you in reading drawings.

FIG. 1

A _____ BORDER

B _____ OBJECT

C _ _ _ _ _ _ _ _ HIDDEN

D _ EXTENSION

E _ CENTER

F < > DIMENSION

Line symbols.

Border lines, if they are supplied, are the heaviest of all lines. They are used only for making a neat border around a drawing.

Object lines are fairly

heavy and very distinct. They are the lines which represent the visible portion of an object and are very important to the craftsman.

Hidden or invisible lines are represented by short dashes which make up a broken line. They show that portion of an object which needs to be shown but is not visible in the view drawn.

Extension lines are then, long dashes which extend the edges of a view so that dimension lines may be used effectively between them. These lines should never connect with solid or object lines.

Center lines are light dot and dash lines which indicate or mark the center of radius of any dircle or curve. Every major arc or circle should have interesting center lines.

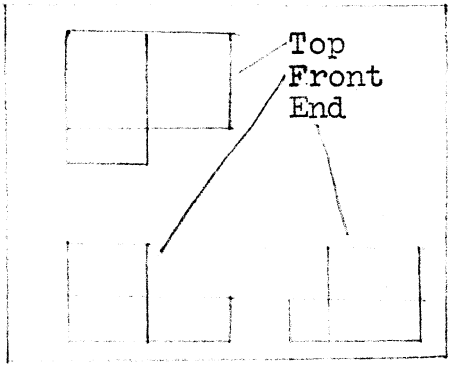
Dimension lines are light lines which include measurements. All dimensions are indicated by this type of line. When you read a drawing, you should assume that the dimension is from the point of arrow on one end of the dimension line to the point of the arrow on the other end.

Generally a drawing must be reduced to size to get it on a sheet of paper of convenient size; thus the draftsman will use a scale to make the reduced drawing. It should be pointed out that all dimensions given on a drawing will be the actual size that the object should be when it is completed.

VIEWS OF A DRAWING:

In order to include all measurements and details of construction, it is necessary to show three views: front, top, and right end, Fig. 2. Often two views, front and top or front and one end, will be adequate to include all measurements and construction details. It is seldom necessary to show more than three views. It is possible to show six views: front, top, rear, underneath, right end, and left end. This type of working drawing is referred to as projected orthographic views.

FIG. 2



Location of views.

Sometimes drawings are shown in a pictorial sketch with dimensions on it. Such a drawing appears very much like a photograph with dimensions on it. This method is satidfactory only for projects with little detail.

PLANNING YOUR PROCEDURE

INFORMATION:

Any building or construction requires a carefully

thoughtout plan. The building contractor will approach his problem or project of constructing a dwelling or business building very carefully in order that the proper materials, the correct tools and equipment, and the sub-contractors will be available at the time desired. He knows that if he does this his structure will be completed in the specified number of days without a minimum of waste in materials and time.

These specialists do not always write out their plan of procedure in detail. You may rest assured that during training it was necessary for them to plan each step on paper so that the supervisor or teacher could check it and suggest additions, or a more efficient method to the solution of the problem.

The project which you intend to build is a problem, and every problem requires a solution. Filling out your plan sheet is your approach to solving the problem of building something from wood.

Many plan sheets include the following data:

1. The working drawing (or reference to where it may be found).
2. A listing of the operations or procedures which list the steps that will be followed in building the project.
3. A bill of materials.
4. A list of tools required.

5. References or sources for the project ideas.

Compiled from:

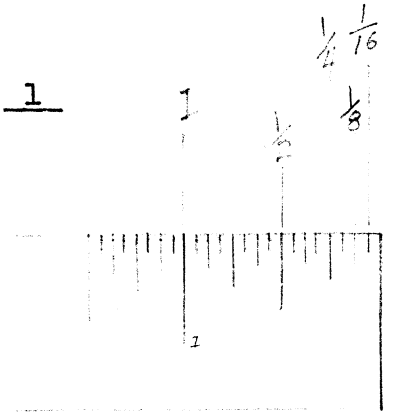
1. Groneman, Chris H., General Woodworking, McGraw-Hill Book Company, New York, 1952, pp. 2-7.

LAYOUT MEASURING TOOLS

INFORMATION:

Accurate measurements is one of the basic skills to be mastered in working with wood. The foot and an inch are standard linear measurements used in most shops and industries. Practically all measuring tools used in woodworking are divided into marks of 1, 1/2, 1/4, 1/8, 1/16 inch, see Fig. 1.

FIG. 1



Divisions of an inch.

TOOLS:

The tools commonly used for measuring and laying out are the one or two foot wooden bench rule, steel square, try-square, two-foot folding rule, zig zag rule, flexible steel tape, T-level, marking gauge, and knife.

Two-foot bench rule.

Fig. 2. One of the most frequently used tools is the two-foot wooden bench rule. One

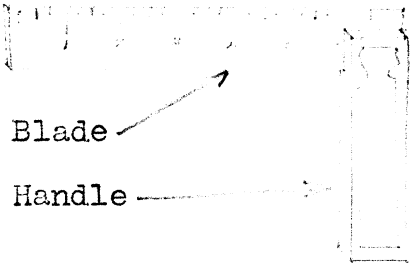
FIG. 2

Two-foot wooden bench rule.

side has graduations of one-half inch; the other is divided into markings of 1/16 inch.

Steel Square. This square has a 24-inch blade and a 16-inch tongue. It is used in bench, cabinet, and carpentry work to measure, to square lines, to test large surfaces for wind, to test for squareness in assembly, and to layout rafters, roof framings, and stairs. There are numerous tables on the two arms of the square which provide valuable information for use in carpentry. Fig. 3.

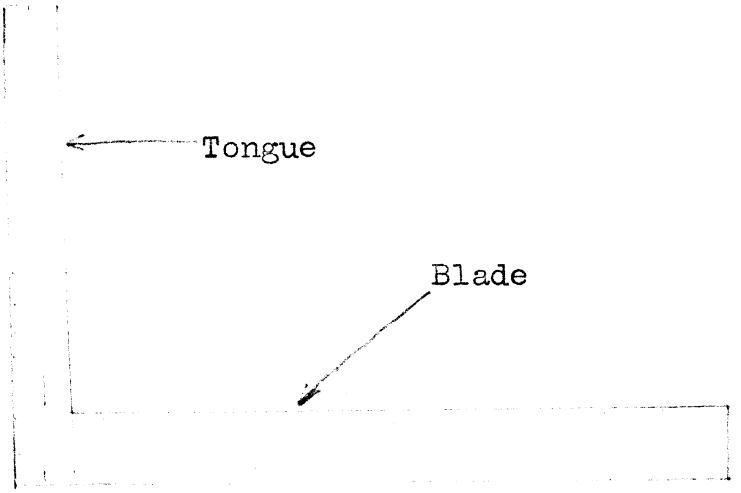
FIG. 4



Try Square.

Try Square. The try square, Fig. 4 is one of the most used tools for squaring, testing and measuring. It is usually made of steel, but sometimes the handle is of wood.

FIG. 3



Steel Square.

Two-Foot Folding Rule. This rule, Fig. 5, is so constructed that it folds into an over-all compact length of six inches. It is used for measuring.

FIG. 5

Two-foot folding rule.

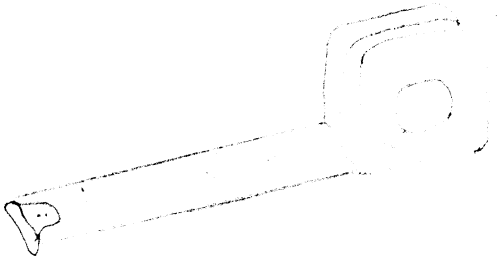
Zig Zag Rule. The zig zag rule, Fig. 6, is built somewhat like the following rule and usually extends to a six-foot length. It is generally made of wood but sometimes is available in one of the lighter weight metals. It is useful for long measurements.

FIG. 6

Zigzag rule.

Flexible Steel Rule. A flexible steel rule, Fig. 7, which extends six foot in length is convenient either outside or inside measuring.

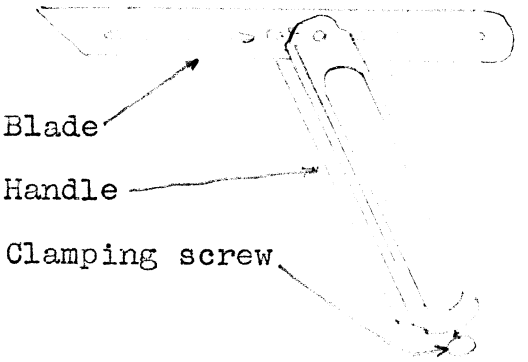
FIG. 7



Flexible steel rule.

T-Bevel. This tool, Fig. 8, resembles the try square in appearance but has a movable blade which can be adjusted for laying out at any angle. It is also employed for testing levels, and angles.

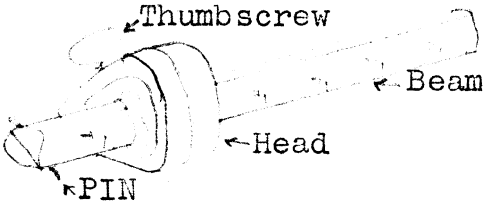
FIG. 8



T-bevel.

Marking Gauge. The marking gauge, Fig. 9, is used for scoring, or for rolling a line parallel to a given space, edge or end. It is made of either wood or metal, but most gauges are of wood. There is a metal spur point, which must be kept as sharp as a knife at all times. The beam, or main bar of the gauge, has measurements imprinted on it similar to those on a try square or rule. It is always advisable to check the measurements from the spur point to the movable head in order to ensure the most accurate measurement, because the spur point sometimes becomes bent or loose.

FIG. 9



Marking Gauge.

Knife. This tool, Fig. ____. may be used for accurate marking across the grain of the wood. It may also be used for cutting and whittling.

FIG. 10

Knife.

Compiled from:

1. Duncan, Glenn S., Recreational Craft Work, Eastern Illinois State College, Charleston, Illinois, 1951, pp. 109-112.

2. Groneman, Chris H., Exploring the Industries, Steck Company, Austin, Texas, 1953, pp. 47-51.

3. Groneman, Chris H., General Woodworking, McGraw-Hill Book Company, New York, 1952, pp. 12-17.

HOLDING TOOLS

INFORMATION:

Even though one may have an abundant supply of tools used for shaping materials, he will be unable to use them to their best advantage without appropriate holding tools. Holding tools are those designed for the purpose of securely holding materials while tool operations are being performed as well as holding parts for glueing. Good work is difficult even for a craftsman unless he possesses a supply of these tools.

Some of the more common holding tools used by the woodworker are benches, vises, bench-hooks, saw-jacks, sanding blocks, saw horses, and various kinds of clamps. Each of these holding tools will be now discussed in greater detail with respect to their use, care, kinds and sizes.

BENCHES:

To the woodworker, a bench containing a vise is the most important holding tool in his equipment. It is here that he holds his stock while cutting it to the desired size and shape.

VISES:

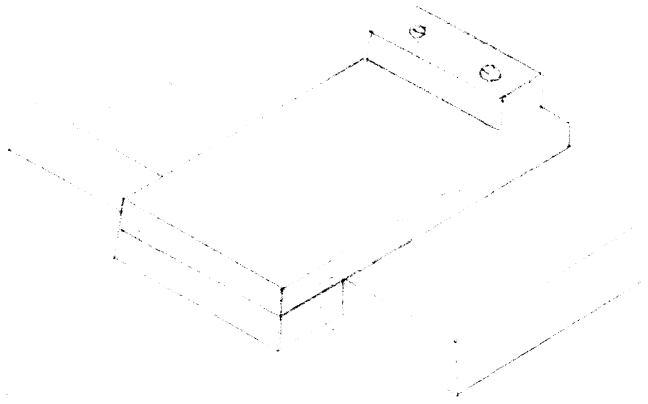
Woodworker's vises to be attached to benches are

obtainable in a number of designs and sizes. When purchased most benches contain one or two vises of good quality. Usually these vises are rigidly attached to the bench. These vises may be purchased in two forms as to screw action, rapid acting and continuous screw. In the rapid acting type, it is unnecessary to turn the handle continuously to open or close the jaws. By turning the handle backwards a half turn the movable jaw can be opened or closed by merely pushing or pulling on it. If the jaw is to be moved great amounts, this is an advantage. However, since the nut on the screw in this vise is in two parts, it is a source of trouble. In the continuous screw type of vise, one finds it necessary to turn the handle continuously to either open or close the jaw. This makes them a little slow in action but this is offset by their causing little or no trouble through years of service.

BENCH HOOK:

To the bench woodworker the bench hook, Fig. 1, is a valuable tool. This tool is used in connection with four tool operations: sawing, nailing, drilling, and chiseling. In each case it serves to prevent the bench top from being marred. This is most important to the careful worker. When smaller pieces of stock are to be cut accurately to length, the woodworker will employ a back saw. He usually finds that this small piece of stock can easily be held on the bench hook for this cutting.

FIG. 1



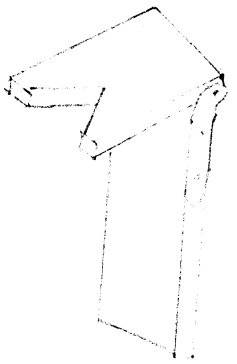
Bench hook.

With the forward cleat made short on the right side, the saw may operate over the bench hook. As a result when the saw cuts through the stock, it will strike the bench hook instead of the bench top.

SAW-JACK:

The saw-jack, Fig. 2, is a companion tool to the coping saw. When it is necessary to cut thin materials with a coping saw, one will find it an advantage to support the stock on both sides of the saw. The holding tool needed is a saw-jack. The saw-jack may be of the rigid or folding type, the latter consuming less storage space. It is difficult to specify the height of a saw-jack because of the different heights of individuals. However, its top should be several inches above the elbow of the person

FIG. 2



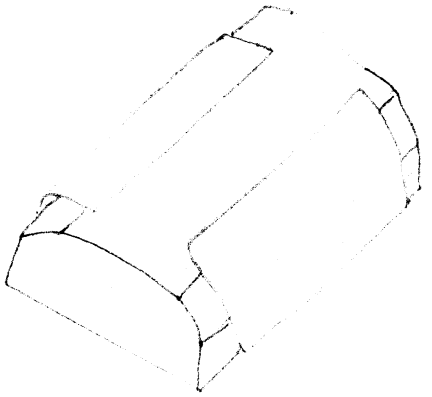
Saw jack.
(folding type)

when standing beside it. This enables the forearm to be horizontal when one is operating the coping saw.

SANDING BLOCK:

When sanding flat or convex surfaces, the sandpaper should always be held tightly around a flat sanding block, Fig. 3. Better sanding is done as well as increasing the life of the sandpaper. When using sandpaper without a block, the frequent bending of sandpaper breaks off the grit.

FIG. 3



Sanding block.

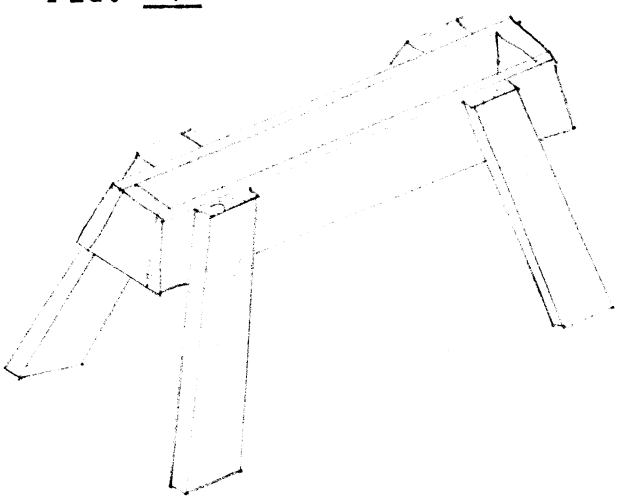
While sanding concave edges, a round sanding block which is nearly as large as the curve should be used to hold the paper. Flat sanding blocks should be about 3/4 inch thick, 2 3/4 inches wide, and 4 inches long. Along two edges there should be a large chamber. The face between the two chambers is the top of the block. The edges around which the paper is folded should be slightly round. The woodworker should have round sanding blocks of two or three diameter and about six inches long.

SAW HORSES:

Both to the carpenter and to the bench woodworker, saw horses, Fig. 4, are valuable holding tools. When

large pieces of stock are to be cut with a saw, they are placed on a pair of horses which makes for easier sawing. Especially are saw horses needed when large pieces of plywood are to be cut. They should be so constructed that each has a double beam along the top which enables the saw to be operated between the bars and allows the stock to be supported on both sides of the cut. With thin materials this is especially advantageous. The height of saw horses should be according to the height of the individual who is using them. This may vary from 12 inches for small children to 24 inches for adults. Saw horses should be assembled with glue and screws in order that they always will be rigid.

FIG. 4



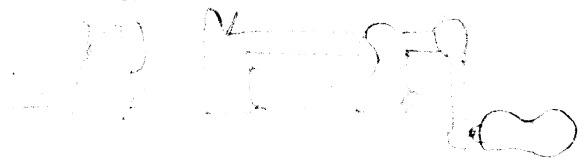
Saw horse.

CLAMPS:

There are several common clamps used by the woodworker, namely: Bar, Fig. 5 ; hand-screw, Fig. 6 ; carriage, Fig. 7 ; spring, Fig. 8 . The Bar Clamp is especially used by cabinet makers because of its length which ranges from two feet to seven feet opening. They should not be

forced and the screw and its ball and socket should be kept properly lubricated. Bar clamps with wood beams are also available and are quite satisfactory when great pressure is not needed.

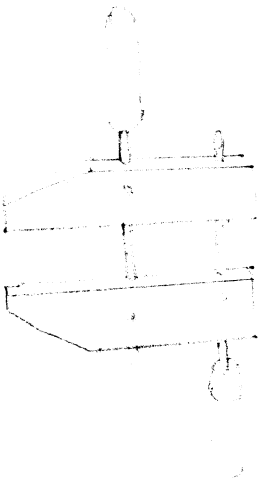
FIG. 5



Bar Clamp.

The Hand Screw clamp is one of the newer forms of clamps and has become quite popular as a clamping device. This is due to its many advantages over other types of clamps, ease and speed of opening and closing jaws, wood jaws which do not tend to mar the surface being clamped, ease of exerting greater pressure, and ability to hold irregular shaped pieces of stock. These clamps can be damaged when they are forced beyond safe limits. Hand screw clamps are made of carefully selected maple.

FIG. 6

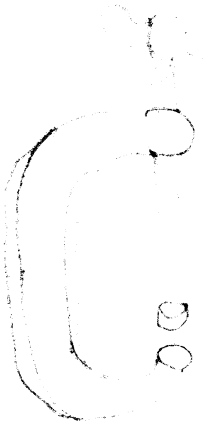


Hand-screw.

As it is true of all clamps, the size of the hand screw clamps is determined by the distance which the jaws will open, ranging from two inches to 17 inches.

The Carriage Clamp which is often called a "C" clamp is quite useful around a shop since it can be used in restricted quarters. It is not as rapid action as the hand screw clamp nor can as much force be exerted with it. On finished work, scrap blocks of wood must be placed next to the metal parts to prevent mars from being made. These clamps are usually made from malleable iron to prevent breaking. On the better grade of carriage clamps, close fitting acme threads are used on the screw. Sizes in carriage clamps range from one inch to 12 inches. In the sizes smaller than 2 1/2 inches they are called junior carriage clamps. As for other types of clamps, their size is the maximum distance between the jaws.

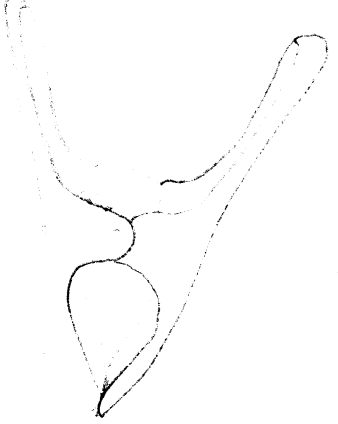
FIG. 7



Carriage clamp.

The Handy Clamp is a spring clamp, a strong spring in its handle exerts the force that grips the pieces being held. On small pieces of work this clamp is desirable because little danger can result from too much pressure exerted. These clamps can be applied with one hand while the parts to be clamped can

FIG. 8



Handy spring clamp.

be held by the other hand. These clamps come in three sizes whose jaws will grip stock with maximum diameter of one inch, two inches, and three inches respectively.

Compiled from:

1. Duncan, Glenn S., Recreational Craft Work, Eastern Illinois State College, Charleston, Illinois, 1951, Pp. 129-134.

WOODS AND PLYWOODS

INFORMATION:

One who works with wood will naturally be interested in learning something of its sources and of the processes employed in bringing it from the forest to the lumberyard or shops. Many scientific studies must be made to determine the volume and suitability of the timber in a particular area as well as to figure out the most practical method of logging. The amount or volume of timber is estimated by men called cruisers, who make a sampling of the number of trees by species and sizes. On the basis of this information, commercial companies secure the maximum timber from their cutting. The cruisers also plan transportation routes.

If the timber stands in remote areas, it is sometimes necessary to build a logging camp to house the workers and to construct roads in order to make the region accessible.

LOGGING:

The first actual operations in logging are those of felling and bucking. In these processes the trees are cut down and the trunks are cut into suitable lengths for transportation to mills.

After they have been cut, the logs must be skidded or hauled from their original place to loading sites. The most modern method of skidding is by use of tractors.

Specially designed logging trucks are used extensively in hauling logs to the mills. In some parts of the country logs are still loaded on railroad cars for shipment or floated down rivers and streams to mills. Where the latter method is feasible, it is the least expensive transportation. The chief disadvantages are that considerable damage is done to logs in transit and there must be adequate water supply to keep the mill supplied with logs for a year.

PRODUCTION OF LUMBER:

Most of the lumber produced in the United States is processed at power driven sawmills, which range in production from 3,000 to 1,000,000 board feet of lumber per day. The larger mills are usually steam powered, while the smaller ones often use gasoline or diesel engines. When logs are received at the sawmill, they are usually dumped into a log pond where they are sorted according to species and grade. From the pond they are carried up an incline to the deck of the mill, where they are washed in readiness for sawing.

The log to be sawed is clamped securely on a movable carriage which operates on a straight track and carries it past a stationary band saw or circular saw. The larger mills generally use the band saw; the smaller ones, the circular saw.

After the board has been cut from the log, it falls on a set of rollers which carry it for further processing.

Small mills often possess no other equipment but the saw; hence, each piece is cut to length and width individually. In large sawmills a machine called an edger, rips rough edges off boards and cuts them to standard widths. They are then cut into standard lengths with trimmer saws. The manufacturing processes of cutting the log into boards, ripping the boards into widths, and cutting them into lengths are the three basic steps in the manufacture of lumber.

At larger mills lumber is graded, sorted, and seasoned. The grading and sorting is according to standardized grading rules, and the seasoning is either by air drying or by drying in kilns. The length of time required for air drying varies according to the kind of weather, the wood, the dimensions of the board, the arrangement of the yard, and the method of piling. Kiln drying takes less time and eliminates some danger of deterioration.

After the boards have dried, the lumber may be sent to a planing mill, where the boards can be planed and the edges jointed or prepared for a tongue-and-groove joint. They may also be fabricated into any number of manufactured products, such as window frames, sash, and doors.

The final marketing of lumber is highly organized and competitive, as is marketing of all commercial products. Lumber may be sent directly from the sawmill to local retail dealers or to wholesale yards; these, in turn, provide needed materials to builders and individual customers.

VENEERS AND PLYWOODS:

The ancient Egyptians conserved their rare and beautiful woods by slicing them into thin veneers, which they glued to more common woods of lesser beauty just as furniture makers do today. These veneers were the ancestors of our modern all-purpose plywoods.

Veneer is a very thin sheet of wood which has been sliced from a log with a straight knife blade or with a rotary cutter. The rotary method pushes the log against a long, sharp steel blade, which cuts it into two long continuous sheets the sidth of the log. This latter process resembles the unwinding of a large roll of wrapping paper. Veneer is matched into very beautiful patterns to form table tops, cabinets, panels, and other pieces of handsome furniture.

Veneers are cut commercially by four generally accepted methods: sawing, slicing, rotary cutting, and half-rounding. They are available cut in their sheets ready for industrial, school, or home use and may be used in construction.

Plywood is an example of making thick pieces of wood from thin ones. It is built by gluing three or more veneer strips into panels which have the grain of the wood running crosswise on alternate layers. This construction gives greater strength and resistance with a minimum of weight. Panels are available in various plys, sizes, and thicknesses. Plywood, when properly worked, can be formed into many shapes and designs. Plywood manufactured for exterior

construction is bonded together with synthetic resin glues which are unaffected by either sun or water. Scientists and structural engineers often use specially built plywood in the construction of large buildings, such as airplane hangars.

There are numberous glues suitable for plywood and veneer construction. Resin glue is one of the better types of adhesive because it is stain-free on woods and will produce waterproof or highly water-resistant bonds.

Compiled from:

1. Groneman, Chris H., General Woodworking, McGraw-Hill Book Company, New York: 1952, Pp. 157-164.

2. Groneman, Chris H., Exploring the Industries, Steck Company, Publishers, Austin, Texas: 1953, Pp. 39-47.

TOOTH CUTTING TOOLS

INFORMATION:

The saw is one of the oldest tools known to mankind. The most primitive form dates back to the stone age when flint with ragged edges was used for cutting. Although the operation of the modern saw made of steel is very similar to that of the ragged flint one, refinements have developed the steel saw into a highly efficient cutting tool.

TOOLS:

Saws common to woodworkers are the cross cut, the rip saw, and the back saw. The size of a saw is determined by the length of the blade in inches. The more

FIG. 1

8 crosscut points per inch 7 teeth

6 rip points per inch 5 teeth

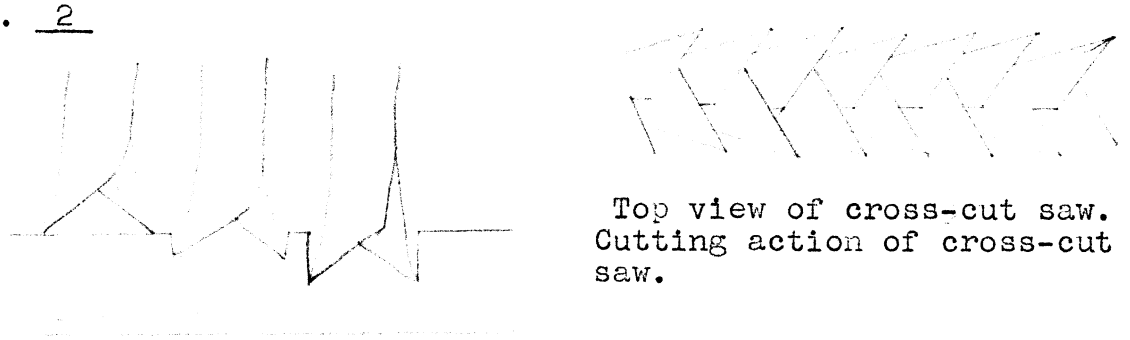
Points per inch on crosscut saw and ripsaw.

popular sizes are the 24- and 26-inch ones. The coarseness or fineness of a saw is designated by the number of points per inch, Fig. 1. There will always be one more

point than tooth per inch. For example, an eighth point saw will have seven teeth per inch. A coarse saw is better for doing fast work and for cutting green lumber; a fine one is more satisfactory for doing smoother, accurate cutting on dry, seasoned wood.

Cross cut saw. This is used to cut across the grain of the wood, Fig. 2 . The teeth are set and filed. They cut into the wood to make the kerf (saw cut), Fig. 2 .

FIG. 2



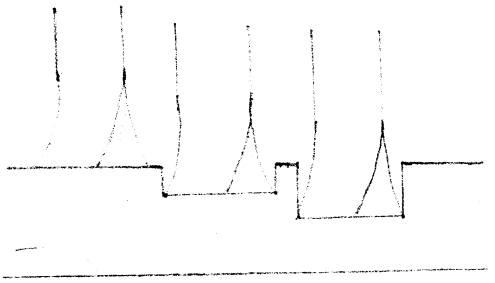
Top view of cross-cut saw. Cutting action of cross-cut saw.

The teeth of saws are set, that is, bent alternately to the right and left, to make the saw kerf wider than the thickness of the saw blade. This prevents the saw from binding or sticking in the kerf. In addition to having the teeth set, high grade quality saws are taper ground and are thinner at the back than at the tooth edge. Saw teeth should always be kept sharp and properly set.

Ripsaw. The ripsaw is used for ripping or cutting with the grain of the wood, Fig. 3 . The teeth are longer and cut into the wood with short, chisel-like jabs. Fig. 4 . shows how the teeth of a ripsaw are filed and set and Fig. 3 describes the manner in which this saw cuts into the wood

to make the kerf.

FIG. 3



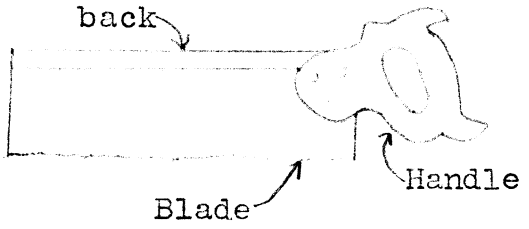
Cutting action of ripsaw.

FIG. 4

Top view of ripsaw teeth.

Back Saw. A back saw is a thin crosscut saw with fine teeth stiffened by a thick back, Fig. 5. A popular length is 12 inches with fourteen points per inch. This type of saw is used for very fine work in cabinet construction and for making joints.

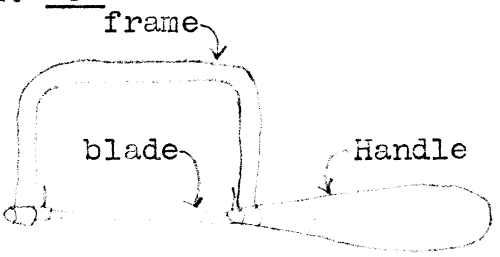
FIG. 5



OTHER TOOTH CUTTING TOOLS:

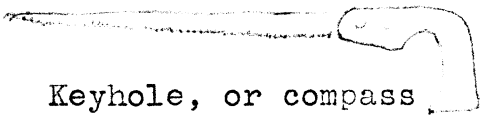
Coping Saw. The coping saw, Fig. 6, is especially useful for cutting small stock such as thin boards or plywood. The thin blade and the adjustment on the frame allow to be used in making sheet turns.

FIG. 6



Coping saw.

FIG. 7



Keyhole, or compass saw.

Keyhole or Compass Saw. A keyhole saw, Fig. 7, is useful for cutting a design, particularly the inside curves where a turning or coping saw cannot be used because of the limitations of the frame. The cut is usually started by boring a hole near the line to be cut.

FILE CARD:

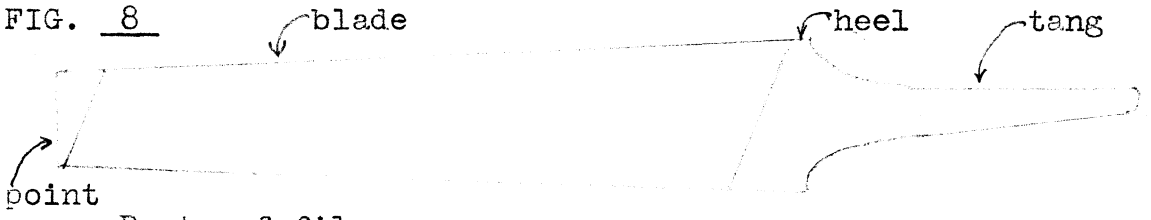
The file card has steel bristles which are used for cleaning the teeth on a file.

FILES:

Files and rasps have three distinguishing features: length, kind, and art. The length of a file is designated from the curve above the tang to the point, the tang not included, Fig. 8. Files for shaping wood range in length from six inches to 18 inches with the ten inch and twelve inch being the most commonly used. The width

of a file is in proportion to its length and does not need specifying.

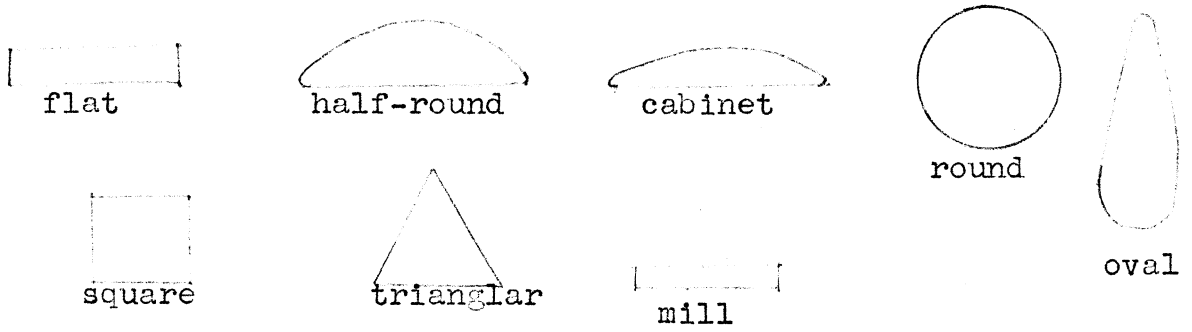
FIG. 8



Parts of file

The kind or name of a file has reference to the shape or style of the file; the most common being round, flat, square, half-round, triangular, oval, and mill, Fig. 9.

FIG. 9

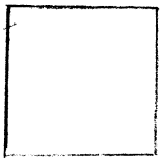


Shapes of files.

In respect to the cut of files, we have two divisions: types of cuts, and coarseness of the teeth. The type of cuts in files are as follows:

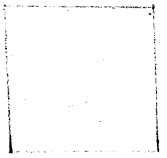
Single Cut--A file of this kind has single rows of teeth like a chisel point running across the blade at an angle of about 35° with the side of the file, Fig. 10.

FIG. 10



Single-cut file.

FIG. 11



Double-cut file.

Double Cut--A file of this type has two rows of chisel-like teeth across the blade. One of these cuts is made deep while at the opposite angles to it and not quite so deep is another row of teeth, Fig. 11.

Rasp Cut----This cut of a rasp is much coarser than that of a file. These cuts are punched in and are put in like the teeth of a regular file, not continuous, Fig. 12.

FIG. 12

Rasp-cut file.

The coarseness of the cut of file teeth has special reference to the distance between them. Machines are especially made to put in the teeth. It is a type of gauging process, and the coarseness of the teeth is regulated by the distance between the grooves and the type of machine used to cut them. The names assigned to the varying degrees of coarseness are: rough, coarse, bastard, second-cut, smooth, and dead smooth. Files used for woodworking purposes have their teeth farther apart than those for metal working.

For woodworking purposes, three shapes of files are primarily used: the flat, the half-round, and the cabinet with the full-round and square finding some use. Flat files are double cut and made in one degree of coarseness, the coarse. Their use is rather limited because the flat side of half-round files substitutes for them. They can be obtained in lengths ranging from six inches to sixteen inches.

The half-round wood file is also a double cut file made only in the coarse cut. It is used by woodworkers for smoothing convex and concave edges and shaping and fitting handles for tools.

For holding files easily, one should have some kind of handle on the tang. Files are not intended to cut on the return stroke and therefore should be lifted slightly. Files should be stored in such a way that they cannot come in contact with each other for the sharp hard teeth are brittle and easily damage. File teeth becoming clogged with resin and pitch may be cleaned by pouring alcohol over the file and brushing afterwards. Also using a file card will help clean the files.

Compiled from:

1. Duncan, Glenn S., Recreational Craft Work, Eastern Illinois State College, Charleston, Illinois, 1951, P. 124.

2. Groneman, Chris H., Exploring the Industries, Steck Publishing Company, Austin, Texas: 1953, Pp. 51-54.

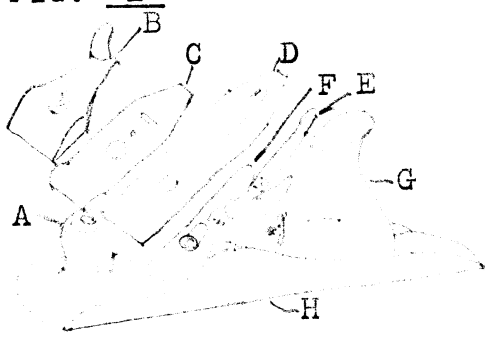
3. Groneman, Chris H., General Woodworking, McGraw-Hill Book Company, New York: 1952, Pp. 18-22.

EDGE CUTTING TOOLS

INFORMATION:

The plane is a valuable tool to the woodworker. Although there are several types, the assembly, adjustments, and general operations of all are similar. The most common types of planes are the jack, smoothing, jointer, block, and rabbet. The essential parts of a plane are shown in Fig. 1.

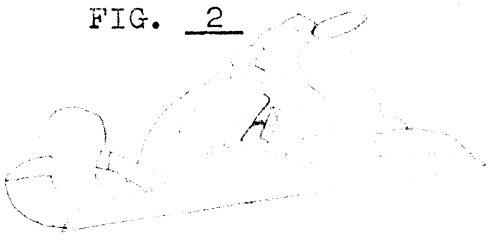
FIG. 1



A. knob
B. lever cap
C. plane-iron cap
D. plane iron
E. lateral adjusting lever
F. frog
G. handle
H. bottom

Parts of a plane.

FIG. 2



Jack plane.

PLANES:

The following descriptions of planes will enable you to select the one most suitable to your needs.

Jack Plane. This plane is the most universally used because of its size, utility, and all-round uses. It will perform the work of the smoothing, jointer, and block planes. It differs from the smoothing and jointer planes in length, having an approximate length of 14 inches, Fig. 2.

Junior Jack Plane. The junior jack plane is narrower

and shorter but is proportioned like the jack. The bed is usually ten inches long. It is of light-weight construction and is intended for children of grade and junior high school ages.

Smoothing Plane. This plane, Fig. 3, is identical to the jack plane except that the bed is only about eight inches long. It is primarily for fine work, particularly where ease of handling is important.

FIG. 3

Smoothing plane.

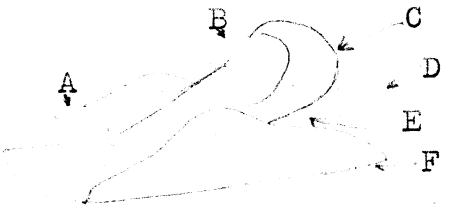
FIG. 4

Jointer plane.

Jointer Plane. The jointer plane, Fig. 4, resembles the jack plane except that the bed is from 22 to 30 inches long. It is used most often for planing the edges of boards preparatory to jointing or for dressing down long, flat surfaces.

Block Plane. This plane, Fig. 5, is constructed somewhat differently from the jack plane but is adjusted in a similar manner. It is very convenient for planing end grain or for easy handling of many small jobs, because it is designed to fit the palm of the hand.

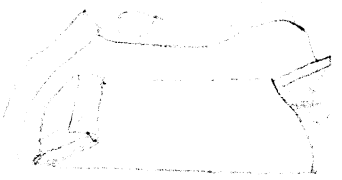
FIG. 5



A. Finger rest
B. Lever-cap screw
C. Lever cap
D. Adjusting screw
E. Plane iron
F. Bottom

Block Plane

FIG. 6

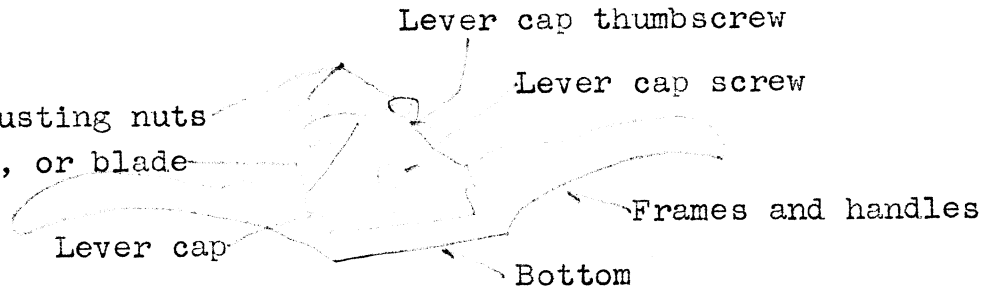


Rabbet plane

Rabbet Plane. The rabbet plane, Fig. 6, is described as "bullnose," because of its construction. It operates like the block plane but is narrower. The plane iron is located near the front of the bed for convenience in planing in close places. It will make a cut the full width of the bed and is used for planing surfaces near corners, rabbets, and for general close work. It is ideal for trimming tenons to fit snugly into mortries. The bed on the plane is about four inches long.

Spoke Shave. A spoke shave, Fig. 7, is a tool

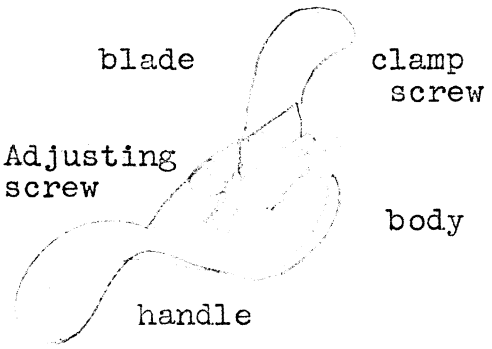
FIG. 7



Spoke Shave.

designed for cutting ans shaping. Early artisans in wood used it mainly for making spokes for wheels, hence its name. Today it is chiefly for forming concave and convex edges of stock and for making such projects as bows and the hulls for model boats. The cutter blade is sharpened very much as the plane iron is. Its general adjustment for cutting is controlled by adjusting nuts. The handles of the frame are built so that the spoke shave may be either pushed or pulled, depending upon the position and angle in making the forming stroke.

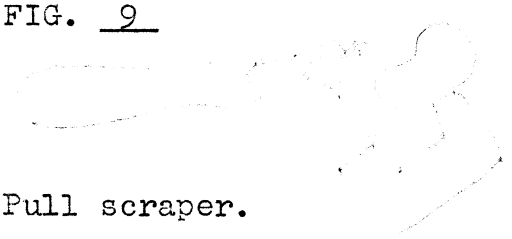
FIG. 8



Cabinet scraper

Cabinet Scraper. This is a metal frame with two handles which holds a scraper blade, Fig. 8. It is perhaps the most common scraper frame. It is pushed.

FIG. 9

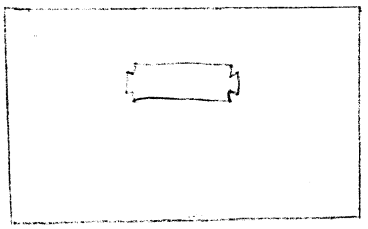


Pull scraper.

Pull Scraper. The pull scraper, sometimes referred to as the box scraper, Fig. 9, is pulled rather than pushed on the wood.

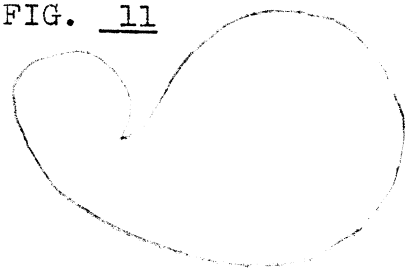
Hand Scraper. There are varying shapes of hand scrapers ranging from the rectangular, Fig. 10, to the swan neck, Fig. 11. They are thin, flexible pieces of high-grade steel which, when sharpened properly, will remove very thin shavings like those from a plane. They may be pulled or pushed and are particularly useful for smoothing stock in corners where cabinet scrapers will not reach. Since the blade is held in the hand, there is no assembly for the hand scraper.

FIG. 10



Straight-edged scraper blade.

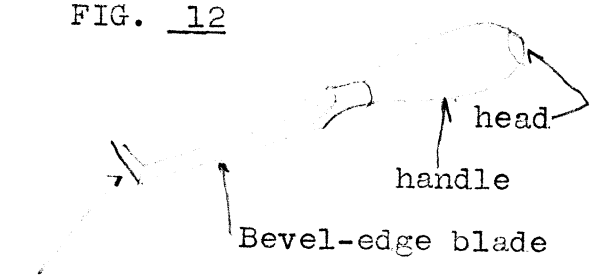
FIG. 11



Swan-neck scraper blade.

Chisels. Chisels, Fig. 12, are generally classified as the socket, or firmer, chisel and the tang chesel. These designations indicate the manner in which the handle is fastened to the blade. Both types employ a beveled cutting edge. The size of the wood chisel is determined by the width of the blade, the sizes commonly range from 1/8 to one inch by eighths and from one to two inches by fourths.

FIG. 12



A firmer wood chisel reinforced handle.

Gouges. Gouges are chisels which are used for grooving, for shaping edges, and for modelmaking. They are classified in two groups. One with the bevel on the inside of the blade, Fig. 13, and one with it on the outside, Fig. 14. The latter is used more often. The blades of all gouges are concave but vary in size from 1/4 to two inches in width.

FIG. 13

Inside-bevel gouge.

FIG. 14

Outside-bevel gouge.

Compiled from:

1. Groneman, Chris H., General Woodworking, McGraw-Hill Book Company, New York, 1953, Pp. 23-25.

2. Groneman, Chris H., Exploring the Industries, Steck Company Publishers, Austin, Texas, 1953, Pp. 54-55; 69-71.

BORING TOOLS

INFORMATION:

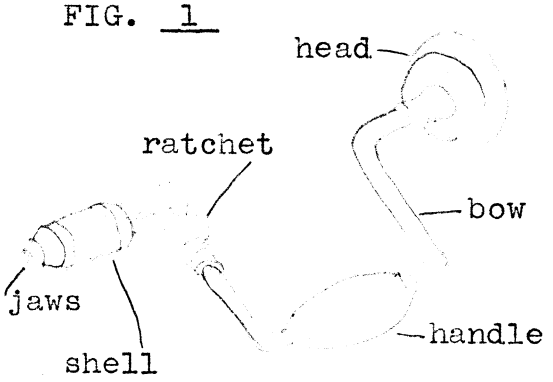
Holes are bored or drilled in wood for screws, bolts, dowels, inside sawing, and ornamentation. Some of the more common types of bits for boring or drilling are the auger bit, twist drill, iron drill, gimlet, expansive bit, foerstner bit, straight-shank drill, and automatic drill.

A depth gauge is a supplementary tool which is very useful in boring holes to a given depth.

TOOLS:

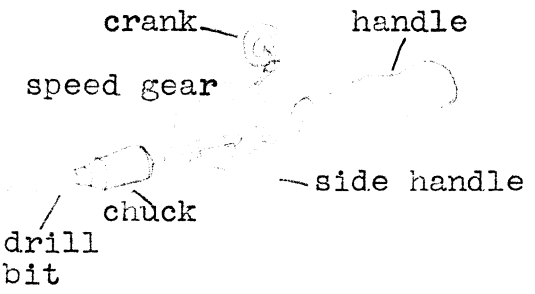
Brace. The brace, Fig. 1, is used with any of the bits which have the square tank (shank).

FIG. 1



Brace.

FIG. 2

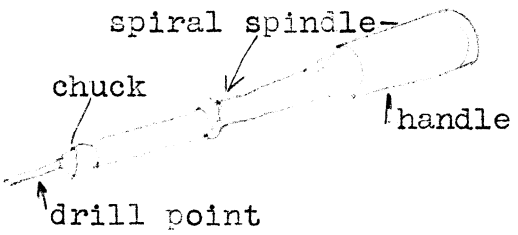


Hand drill.

Hand Drill. For holes less than 1/4 inch in diameter, the hand drill, Fig. 2, and a straight-shank bit are usually used in combination, but the brace and twist drill may be used.

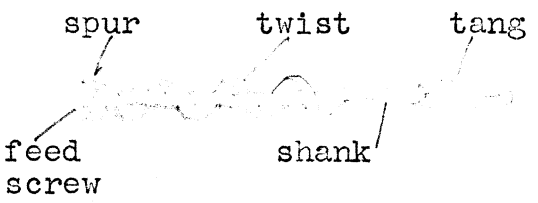
Automatic Drill. The automatic drill, Fig. 3, is often employed instead of the hand drill, the choice depending upon personal preference.

FIG. 3



Automatic drill.

FIG. 4



Auger bit.

Auger Bits. Auger bits, Fig. 4, are sized by sixteenths of an inch, ranging in measurement from 1/4 to 1 inch in diameter, that is, in the diameter of the hole each will make. These bits vary in length from 7 to 10 inches with the exception of the dowd bits, which are auger bits about 5 1/2 inches long. The number stamped on the square tang usually indicates the size in sixteenths of an inch. For example, a bit with "11" stamped on it will cut a hole 11/16 inch in diameter, one marked "6" will cut a 3/8 inch hole, because it is listed at 6/16 inch.

FIG. 5

Twist drill.

Twist Drills. Twist drills, Fig. 5, for wood are used to make holes for screws, nails, and bolts. They are sized by thirty-seconds of an inch and range from 1/8 to 1/2 inch.

FIG. 6

Iron drill.

FIG. 7

Gimlet bit.

FIG. 8

Expansive bit.

FIG. 9

Forerstner bit.

Iron Drill. The iron drill, Fig. 6, may be used for drilling holes in metal as well as in wood. They are sized in thirty-seconds of an inch and range from 1/16 to 5/8 inch.

Gimlet Drill. The gimlet bit, Fig. 7, is for drilling holes for screws. It bores rapidly and leaves a reasonably smooth hole. It is sized by thirty-seconds of an inch and ranges from 1/32 to 3/8 inch.

Expansive Bit. The expansive bit, Fig. 8, has a scale on the movable spur or cutter. Holes larger than one inch in diameter are bored with the adjustable expansive bit. These bits are available with various size cutters to bore holes from

one to four inches in diameter.

Foerstner Bit. The foerstner bit, Fig. 9, can do many boring operations which the auger bit cannot. Because of its construction it can bore a hole to any depth desired without breaking through the wood. These bits are available in sizes ranging from 1/4 to two inches in diameter and are numbered in the same way as auger bits.

FIG. 10

Straight-shank drill.

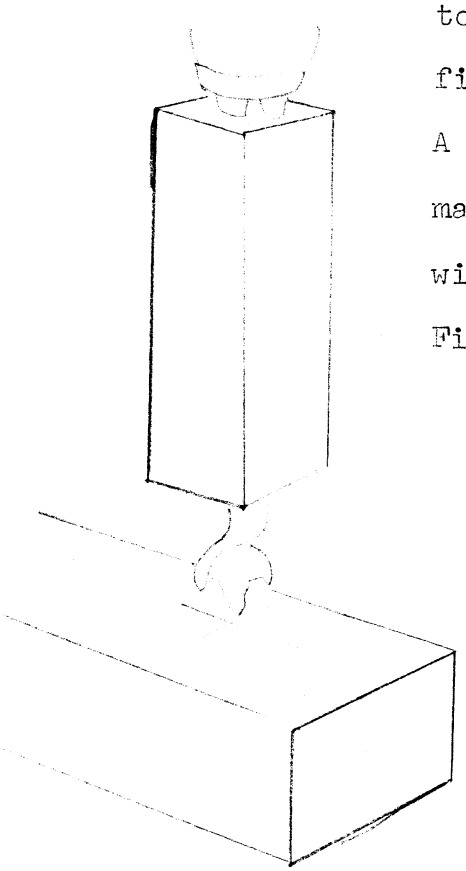
FIG. 11

Automatic-drill bit.

Straight-Shank Drill. The straight-shank drill, Fig. 10, is gauged for the diameter of holes to be drilled under any one of three systems: fractional, decimal, and numerical. The fractional is the most common for woodworking and is the most easily read. Fractional-size drills are designated by sixty-fourths of an inch, the smallest being 1/16 of an inch. Woodworkers generally have an assortment up to 1/2 inch.

Automatic-Drill Bit. An automatic-drill bit, Fig. 11, fits into the automatic drill and is used for drilling small holes.

FIG. 12



Wooden depth gauge.

Depth Gauge. A necessary tool in boring holes to specified depth is the depth gauge. A very simple gauge can be made by boring a hole lengthwise through a peice of wood, Fig. 12.

Compiled from:

1. Duncan, Glenn S., Recreational Craft Work, Eastern Illinois State College, Charleston, Illinois, 1951, Pp. 137-141.

2. Groneman, Chris H., Exploring the Industries, The Steck Company Publishers, Austin, Texas, 1953, Pp. 62-64.

3. Groneman, Chris H., General Woodworking, McGraw-Hill Book Company, New York, 1953, Pp. 48-53.

FASTENING DEVICES AND TOOLS

INFORMATION:

How Nails are Made and Sold

Until the colonial period the nails used in this country were made by hand. They were forged by hand from wrought-iron rods. The rods were made by rolling iron into small bars. In the early revolutionary days, the New England farmers were engaged in nail making as a profitable home industry. The war of the revolution brought on new economic demands and changes. One of these was the forced movement toward mass production in manufacturing. This marked the beginning of the making of nails by machine.

Early machine-made nails were of steel. They were really "cut nails;" they were cut from tapered plates. These nails were cut one after another from the edges of these plates. These early nails were square. The ends were blunt and the leads were square and much smaller than those of the nails now produced. These old square nails are still doing service in buildings erected in the early days of this country.

Modern nails are made from steel wire. The wire is drawn in special machines. A cast-iron power-driven drum is mounted on a bench and the wire is wound into this drum as it is drawn through a special form called a die. This die is made of high quality steel, and it is perforated

with holes that are gauged exactly to take a particular size of wire. These holes are tapered and the wire is started through the large end. The coil os wire from which the nails are to be made is placed on a reel. One end of the wire is passed through the die and fastened to the cast-iron drum. As the drum revolves, the wire leaves the coil as it passes through the die and is wound on the drum. The coil wire is placed on a reel in front of each nail machine. One end of the wire is fed into the machine through a small hole in a vertical casting. From the opposite side of the machine there comes a stream of nails which drop into small iron containers. The head of the nail is formed by a hammer blow from a very powerful device which is operated by a cam. The pointing is done by a pair of dies having V-shaped cutting edges.

The nails are now ready for polishing. They are placed in a larger iron revolving tumbler where they are rolled and tumbled against each other and the sides of the tumbler. Sawdust is also placed in the tumbler in order to clean the nails thoroughly of grease and dirt.

The number of nail machines in a given factory varies. Factories with 250 machines in operation are common. Each machine can produce from 150 to 350 nails per minute depending somewhat on the size of nails. Three-penny nails are turned out at the rate of 350 per minute, and sixty-penny nails at the rate of 650 per minute.

Nails are packed in kegs which hold one hundred

pounds. These kegs are marked to designate the size and the kind of nails contained in the kegs. Nails are sold in any quantity.

There are many kinds of nails and each has its particular use. There are a few kinds that everybody should know. They are: common nails, box nails, casing nails, and finishing nails, Fig. 1, and Table 1. Size of nails is specified by the term penny (d), prefixed by a number, such as 6d, 10d. They vary in size

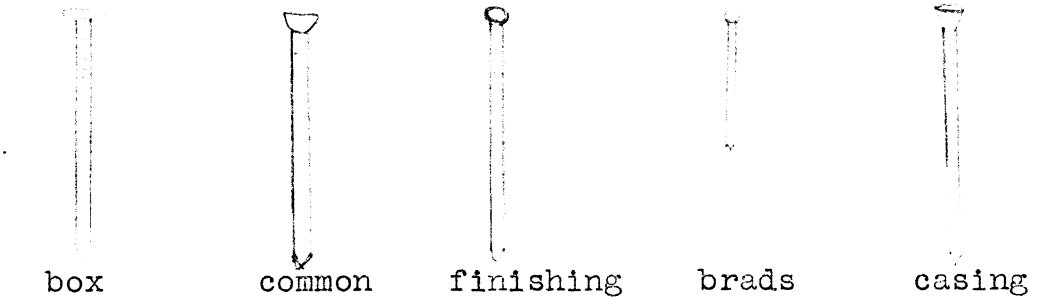


FIG. 1

Kinds of nails.

from 3-penny to 60-penny. The larger ones are called spikes.

It is interesting to know how the term penny (d) came into use. One theory is that the term had its origin in England and that it represented the price per pound in terms of pence. Another theory holds that in earlier times, nails were specified according to the weight of a thousand nails. Eight-penny nails weighed eight pounds to a thousand; four-penny nails weighed four pounds to the thousand. Which ever is true, we still buy nails according to the term penny: 4d, 6d,

8d, 16d, and so on.

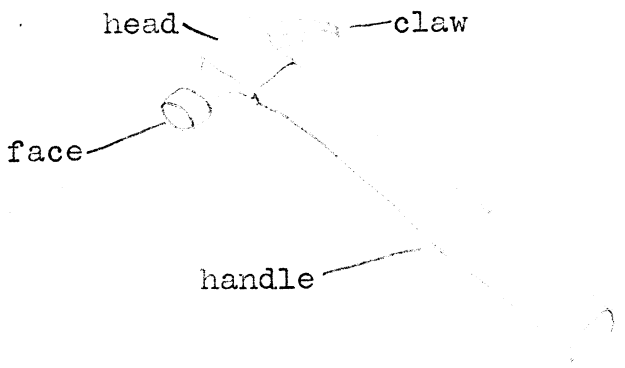
Common nails are larger in diameter and they have wider heads than do other nails. They are used almost entirely in rough carpentry.

Box nails are not as large in diameter as common nails but they have wide heads. They are used in box construction and in certain types of carpentry where common nails would be too large. Casing nails are used when large heads are undesirable as in blind nailing of flooring and ceiling. Casing nails are smaller in diameter than are box nails. Finishing nails or wire brads are the most slender of all nails and they have the smallest heads. They are used in fine woodworking such as in the inside finishings of homes and in blind nailing of furniture.

TOOLS:

The most convenient tool for driving nails is the claw hammer, Fig. 2. The size of this hammer is designated by the weight of the head, which ranges from seven to twenty ounces.

FIG. 2



Claw hammer.

The popular size has a 10-20-ounce head.

A nail set, Fig. 3, is used in setting the head of a finishing nail or casing nail. The tip is built with a slightly concave surface so that it will not slide off the nailhead too easily. Nail sets are available in a variety of tip sizes. Important rules to remember when nailing are: (1) the length of the nail should be three times the thickness of the first board the nail goes through; (2) the size of the nail should not be too large or it may split the wood; and (3) it is desirable when driving nails through hardwood to drill a very small pilot hole through the first board.

FIG. 3

Nail set.

TABLE 1

Sizes, lengths, and number of nails per pound are as follows:

		Number Per Pound		
Size	Length	Common	Finishing	Casing
2d	1"	860	1,558	1,140
3d	1¼"	594	884	675
4d	1½"	339	767	567
5d	1 3/4"	230	491	396
6d	2"	135	359	260
8d	2½"	96	214	160
10d	3"	63	134	108
12d	3¼	52	120	99
16d	3½"	38	91	69
20d	4"	30	61	50
30d	4½"	23	--	45
40d	5"	17	--	35
50d	5½"	13	--	--
60d	6"	10	--	--

FASTENING DEVICES

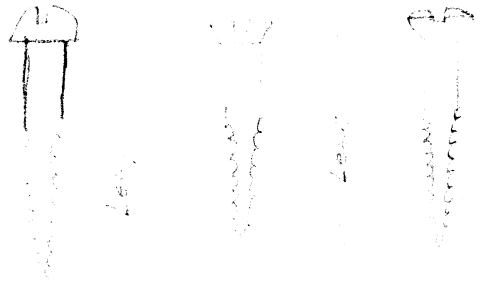
INFORMATION:

How Screws Are Made and Sold

Screws were at one time made by hand. A blank screw was forged on an anvil and threads were then cut with a file. Later the lathe was used in cutting these threads. It was rather difficult to replace these earlier hand-made screws. The coming of machines and mass production for supplying man's needs in greater quantity included machines for making screws. The screws made by these machines are more uniform and accurate in size than those made by hand.

There are many types of screws available for various purposes, but the flat head, round head, and oval head, Fig. 1, are most common. There are other kinds of screws, but they are regarded as special.

FIG. 1



round head | flat head | oval head

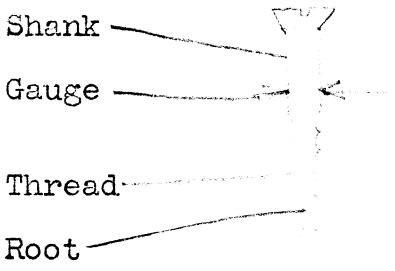
Common types of wood screws.

Screws are made of steel, brass, bronze, and copper. The most common are those made of steel and brass. Steel screws are the cheapest and are used on a job that is to be in

contact with moisture. Brass screws are best for jobs to be subjected to continued dampness, as in boat building or in general outdoor work.

Everyone should know how screws are specified and sold. The flat head screws are usually sold in the "bright" finish and the "round" head screws are sold in the "blue" finish. The gauge of a screw is a term used to specify the "shank" or diameter as measured under the head, Fig. 2. When buying screws specify them according to the length, gauge, shape, head and finish. For example, a 1 1/2 inch number 8 flat head, brass screw is designated as 1 1/2 inch-No. 8, F. H. B. Brass screw. A round head screw of the same size would be written 1 1/2 inch-No. 8, R. H. B.

FIG. 2



Parts of a screw.

The selection of the kind and size screw depends upon the job. Approximately two-thirds of the screw should enter the wood to which you are fastening. The proper

kind and size of screw to use is a matter of judgment and practice. If the stock is rather thin, leaving very little of it around the screw, a thin screw should be used. Such a screw should have a gauge number representing one of the smallest diameters available for the particular length of screw which you are planning to use. If you wish to use a heavy screw to gain extra strength, select one with a high gauge number for the length of screw which you expect to use.

You will notice that the larger the number representing the screw gauge, the larger the screw and, that each length of screw may be secured in several gauges. Screw gauges and vice gauges are not the same. The length of the flat head screw is measured over all. The length of round head screws is measured from the bottom of the slot to the point of the screw, Fig. 2.

Screws, except large ones, are packed in boxes containing one gross. Large screws are packed in boxes containing one-half gross. It is possible to purchase screws in any quantity, small or large, but the smaller quantities of less than a full box will cost more in proportion than does the larger amount.

Screws are used for fastening boards and for assembling projects. A project which has been fastened with screws can be easily dismantled and reassembled without injury.

The screw with the slotted head which will accommodate

an ordinary screwdriver has been used for a long time. A more recent trend in screw head designs is the Phillips-head screw, Fig. 3. This type is also available with the round, flat, or oval head. Screws vary in length from 1/4 to six inches and in gauge sizes from 0 to 24.

FIG. 3

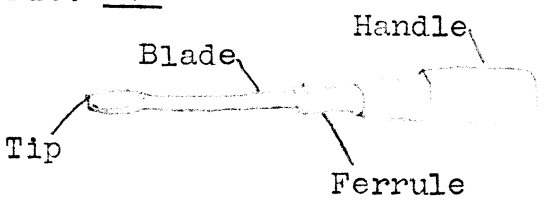
Phillips-head screw.

Screws are superior to nails as wood fasteners because they are more permanent, hold better, may be tightened easily, and allow the project to be readily dismantled. However, they do require much time in planning and care for proper insertion.

TOOLS:

In fastening with screws, the following tools are needed: hand-drill and straight-shank drill bits, brace and auger bits, awl, screw-driver, Fig. 4,

FIG. 4



Screw Driver

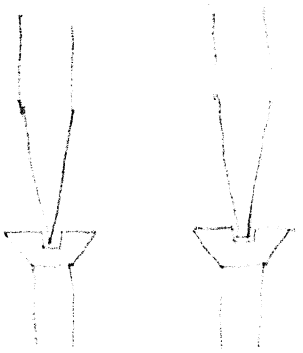
FIG. 5

Screwdriver bit.

FIG. 6

Countersink bit.

FIG. 7



Incorrectly and correctly shaped Screwdriver tips.

screwdriver bit, Fig. 5, and counter sink bit, Fig. 6. The tip of the screwdriver should be shaped to fit the slot of the screw, Fig. 7. The screwdriver used for the Phillips-head screw is very similar to the standard one except that it has a specially processed tip to fit the cross slots.

Table 1 provides the necessary information for the selection of screws, drills, auger bits, and pilot and anchor holes. Exact sizes cannot be given for the holes for wood screws. Variations in hardwood and in

softwood and snug or loose fits should be considered.

A trial fit in scrap wood is a practical solution.

Compiled from:

1. Duncan, Glenn S., Recreational Craft Work, Eastern Illinois State College, Charleston, Illinois: 1951, Pp. 101-106.

2. Frylslund, Verne C., and Laberge, Armand J., General Shop Woodworking, McKnight and McKnight, Publishers, Bloomington, Illinois: 1936, Pp. 88-93.

3. Groneman, Chris H., Exploring the Industries, The Steck Company, Publishers, Austin, Texas: 1953, Pp. 65-68.

4. Groneman, Chris H., General Woodworking, McGraw-Hill Book Company, New York; 1953, Pp. 54-60.

TABLE 1

Size of bits or drills to bore holes for wood screws.

Number of screws.		1	2	3	4	5	6	7	8	9	10	12	14	16	18
Approximate body dia. of screws.		5/64	3/32	3/32	7/64	1/8	9/64	5/32	11/64	11/64	3/16	7/32	15/64	11/64	19/64
First hole.	Twist-drill size.	5/64	3/32	7/64	7/64	1/8	9/64	5/32	11/64	3/16	3/16	7/32	1/4	17/64	19/64
(pilot)	Auger-bit number.	--	--	--	--	--	--	3	3	3	3	4	4	5	5
Second hole.	Twist-drill size.	-- --	1/16	1/16	5/64	5/64	3/32	7/64	7/64	1/8	1/8	9/64	5/32	3/16	13/64
(anchor)	Auger-bit number.	--	--	--	--	--	--	--	--	--	--	--	3	3	4

ABRASIVE

INFORMATION:

Sand paper consists of heavy tough paper covered on one side with crushed flint, quartz or garnet. This sand-like material is beld securely to the paper with a good quality of glue. Sand paper is a by-product of the packing house inasmuch as glue, being an essential part of the sand paper, is available. The paper in sand paper must be very tough. Therefore it is usually made from old manila rope which produces paper of the greatest strength. The sand on sand paper is passed through screens, each screen being numbered according to the degree of coarseness or fineness of sand paper desired. Thick glue is applied to one side of the paper and sand of the desired size is then sprinkled evenly over it. After the first coat of glue has dried, a second coat of thin glue is applied over the sand. This is to make sure that all particles become securely fastened to the paper.

Garnet is a reddish-brown hard, natural mineral. It is excellent for hand sanding and for some kinds of power sanding.

Flint, a grayish material made of soft sandstone, is good only for simple hand sanding and does not stand up well.

Aluminum oxide, an artificial abrasive, either reddish-brown or white in color, is used almost exclusively in

in commercial furniture making. It is excellent for all power sanding operations.

Grades of Abrasives

There are two methods of marking abrasives. One method is to number the abrasives according to the size screen through which it is graded. This method is used primarily for aluminum oxide. The other method is most often used for flint or garner. Here is a comparison of the two:

	Aluminum Oxide	Flint and Garnet		Aluminum Oxide	Flint and Garnet
Very fine	240	7/0	Medium	80	0
	220	6/0		60	1/2
				50	1
Fine	180	5/0			
	150	4/0	Coarse	40	1 1/2
	120	3/0		36	2
	100	2/0		30	2 1/2

Sandpaper is usually sold in sheets 9 x 11 inches in size, in bundles of a quir (24 sheets). The sanded surface never should be placed together.

OTHER ABRASIVES:

Pumice. Pumice is a white powder made from lava. It is one of the buffing and polishing compounds needed for smoothing finihses. No. 1 is for coarse rubbing and No. FF or FFF for fine rubbing.

Rottenstone. Rottenstone is a reddish-brown or grayish-black substance for smoother rubbing than pumice.

Steel Wool. Steel wool, sometimes used in place of sand paper, is used for rubbing after certain finishings operations. It is available in three grades: 0-coarse, 00-medium, 000-fine.

Wet-dry-abrasive Paper. Waterproof aluminum oxide paper in grades 240 or 320 is used with water or rubbing oil for sanding between finishing coats.

Compiled from:

1. Feirer, John L., Advanced Woodwork and Furniture Making, Charles A. Bennett Company, Publishers, Peoria, Illinois; 1954, Pp. 138-140.

2. Frykland, Verne C., and Laberge, Armand J., General Shop Woodworking, McKnights and McKnights, Publishers, Bloomington, Illinois; 1936, Pp. 93-95.

3. Groneman, Chris H., Exploring the Industries, The Steck Company, Publishers, Austin, Texas; 1953, Pp. 75-76.

4. Groneman, Chris H., General Woodworking, McGraw-Hill Book Company, New York: 1952, Pp. 88-90.

FINISHES AND BRUSHES

INFORMATION:

Stain is a colored transparent substance applied to wood in order to color as well as to bring out the natural beauty of the grain. Stains do not serve as preservatives and therefore do not protect the wood from the elements. The application of stain finish on new wood is most common. Stains are classified according to solvents used in their manufacture. The following are descriptions of the most common stains available.

STAINS:

Water Stains

Water stains are the best stains for bringing out the full beauty of the grain in nearly all woods. They really are a dye that can be bought in powdered form. The powder is dissolved in hot water at the time it is used. Water stains are inexpensive and may be purchased from dealers in wood working supplies.

Water stains usually produce clear uniform colors that penetrate the wood deeply. They raise the grain of the wood and are more difficult to apply than are other stains. The surface must be sanded after the stain has thoroughly dried. The beauty of the grain is not brought out until the final finish of shellac and varnish have been applied. Water stains cannot be used over oil stains,

shellac, wax and varnish until every bit of gum or oil has been removed.

Oil Stains

Oil stains are probably more expensive than other stains, but they are easily applied. They always leave the wood smooth and do not raise the grain as does water stain. Oil stains are popular because they dry more slowly and do not show brush marks. They can be used with excellent results on either softwood or hardwood.

Oil stains are made by mixing colors either in naptha, turpentine, benzine, or benzol. They may be purchased ready mixed in any color and quantity.

Spirit Stains

Spirit stains come in powdered as well as in liquid form and in nearly all the colors common to oil and water stains. Even fumed oad stain is available in the form of spirit stain. It can be bought ready for direct application to the wood. At one time when fumed oak finish was popular, the fumed finish was obtained by exposing the oak to ammonia fumes. Spirit stains now make the fumed finish less difficult to obtain. Alcohol is the solvent used in spirit stains.

Spirit stains at present are commonly used for patching in repair work. They are very seldom used on new work. They set fast and will produce visible gaps

and streaks unless the stains are applied quickly. They are not easily applied by beginners in finishing. Like all the other kinds of stain, the more solvent used, the lighter will be the color.

Wood Fillers

The purpose of wood fillers is to fill the pores of the wood and thus form a smooth, hard, non-absorbent surface upon which varnish and other finishing materials may be applied. Fillers are of two kinds, the liquid and the paste. Liquid filler is frequently used on close grained woods. One or two coats of very thin shellac may be used on cabinet and furniture work in place of commercial liquid filler.

On open grained wood, such as oak, a paste filler must be used instead of shellac or liquid filler. Paste filler is sold by the pound and in cans of various sizes. Only the best fillers should be used. These are made of finely ground silicon or "silex" mixed with linseed oil, turpentine, Japan dies, and suitable coloring material. Silex paste filler does not shrink when it dries and therefore it is very desirable to use as a filler for fine furniture. It should be of the same color as the stain and it is usually applied after the staining operation. Staining and filling are frequently done in one operation by applying a filler thinned with

an oil stain of the desired color. Filler is not intended to fill cracks or deep openings and it should not be confused with crack filler. However, thick paste filler as it comes from the container can be used as a crack filler.

THINNERS:

Linseed Oil

This material is a product of flaxseed and is used in bringing out the rich color of walnut, mahogany, and cedar. It is also an ingredient in exterior paints. Boiled linseed oil dries more rapidly than unboiled. When using it to bring out the color of the woods just mentioned, it is advisable to mix two-thirds linseed oil with one-third turpentine and to heat in a double boiler before applying to the wood. It should not be allowed to boil but should be heated to a temperature warmer than your finger can stand. It may be applied with a cloth swab or with a brush. Linseed oil mixed and heated will penetrate deep into the wood. If desired, this application may take the place of stain. It is suggested that a sampling be made on scrap lumber to determine whether the desired color tone can be achieved.

Turpentine

Turpentine is obtained from sap of the long leaf

pine tree. After considerable processing it is refined to the inflammable liquid used as a thinner in paints, enamels, and varnishes. Since it is a thinner for paints and enamels, it can be the cleaning agent for the brush used in the painting and for wiping up after a painting job.

Alcohol

This is a thinning agent for shellac and is composed of ethyl and wood alcohol. It will also clean brushes used in applying shellac.

Lacquer Thinner

Lacquer is thinned with a commercial lacquer thinner, each manufacturer having a special type for his product. It is obtainable in a high or medium gloss or in a dull tint. Lacquer thinner is used to clean brushes used in applying lacquer.

TRANSPARENT FINISHES:

Shellac

Shellac is produced by insects native to India called "lac-bup." As soon as the larvae of these insects are developed from the eggs they fasten themselves to twigs of certain trees and feed on the sap. In the course of digestion the sap is transformed into shellac and excreted

through the pores in the skin of the larvae. The larvae then pass through the other stages of their development, lay their eggs and die, never leaving the twig to which they fasten themselves. New larvae are developed from the eggs and the life cycle starts all over again.

The shellac covers the twigs of the trees, which are broken off and scraped. The raw shellac is then dried, cleaned, melted, and manufactured into large sheets, which are later broken into small pieces (flake shellac). Shellac is sold both in dry and liquid form. It is dissolved and thinned with alcohol. Four pounds of flake shellac dissolved in one gallon of alcohol is termed a 4-pound cut and is the usual stock solution. There are two kinds of shellac on the market, orange and white shellac. White shellac is produced by bleaching orange shellac.

Lacquer

The development of modern lacquer is one of the newer accomplishments of science in cooperation with industry. Lacquer has come into popular use in recent years. It is produced by dissolving nitrated cotton in a solvent consisting of banana oil, alcohol, benzol and solvent naptha. Copal gums of the highest quality, such as filtered shellac or synthetic resins, are added to the lacquer solution. Gums are added to lacquer to give a good body which is necessary in building a smooth surface quickly. Lacquer is made in the form of

transparent varnish and also in the form of colored enamel. The colored lacquers enamel is made by adding spirit soluable color pigments to the solution.

Lacquer dries quickly and produces a hard durable surface. It produces a fine finish which is not affected by changes in temperature. Modern lacquer is usually used in the form in which it comes from the manufacturer. A special thinning fluid is made for each brand of lacquer. The different brands of lacquers and thinners are usually not interchangeable. The thinning fluid is also used for cleaning the brushes after the lacquer has been applied.

Lacquer cannot be used over paste wood filler, oil stain, varnish, and paint if the finish is less than a few months old, unless a thin coat of shellac is first applied. Lacquer dissolves most paint finishes when they are new.

Some of the earlier modern lacquers dried too rapidly to be applied successfully with a brush. The use of certain materials in lacquer to slow the drying, such as castor oil and camphor, has made easier its application with a brush.

Modern lacquer dries through the loss of the solvent, a thinning fluid. The change is a physical process which occurs within a few hours. It dries entirely by evaporation.

Varnishes

Varnish is a transparent finishing material. When applied to wood, it acts as a preservative and also retains the natural beauty of the wood. It is made from copal gums, which are necessary in the manufacture of good varnish, are made of resinous substances found on decayed pine trees which grew centuries ago. These resinous substances are fossils. The term copal is a family name in many places which are now treeless and barren. In these barren places the copal is buried several feet under ground.

The linseed oil used in varnish is produced from flax seed. It is prepared for use by boiling in large kettles. It takes several months for the oil to reach the right degree of purity and clearness.

The copal gums are cleaned, melted and boiled with the linseed oil for several days. After this mixture has cooled, turpentine is added to it. The mixture is then stirred several times and placed in large tanks to age and ripen. Several months are required for this aging.

The quality of varnish which is obtained depends upon the grade of copal gum used, the proportions of turpentine and oil, the care and time given to the boiling process. Cabinet rubbing varnish contains more than the usual proportions of copal gum. It is for this reason that this varnish can be rubbed to a hard finish. It is

not as durable as the spar or long oil varnish which is used on outside work. It is used principally on cabinets and interior woodwork of high grade.

Spar Varnish contains a large amount of oil because it is intended for outside use. It is given the name "spar" because it was originally used in varnishing the spars and other outside parts of ships. The high grade of gum used in this varnish makes it very durable, and the large proportion of oil makes it very tough and elastic. A special oil known as china wood oil is used in the manufacture of high grade spar varnish because it forms a more water-proof finish than does linseed oil. Spar varnish dries slowly. For general use inside as well as outside, there is no other varnish that is as lasting as spar varnish. It is used on all outside work requiring varnish. Boats, doors, fishing rods, or almost any article that is exposed to weather, if varnished, should be coated with spar varnish.

Floor varnish consists of a carefully prepared mixture of oil and copal gum. This produces a hard, long wearing surface. Floor varnish is used on surfaces subject to constant wear such as school desks, counter tops, stools, and floors.

Flat varnishes dry without a high gloss and produce an imitation rubber varnish surface. Flat varnish is produced by adding materials, such as wax, aluminum

stearate or china clay to ordinary interior varnish. It is used on interior wood work and furniture when it is desirable to produce a soft dull finish without rubbing. The drying time is usually four hours.

Wax is made from bee's wax, paraffin, carnauba wax and turpentine. Cornauba was extracted from the leaves of a South American tree. Wax is sold both in liquid and paste form.

A wax finish is easy to produce but is not very durable. Water spilled on a waxed surface makes a dull spot, which usually can be removed or repaired by vigorous rubbing with a soft cloth.

OPAQUE FINISHES:

Paint

Paint is the most used and probably the oldest of finishing materials. It is used to preserve and to beautify wood surfaces. Paint is opaque, available in any color, and it has the quality of resisting moisture in any form. It may be classified according to its use, whether it is used outside or inside. Outside paint is usually prepared with white lead, white zinc, or both mixed with linseed oil and then thinned with turpentine. White zinc and white lead are the pigments or the coloring materials, and the linseed oil and turpentine are the binders of the paint. Raw rather than boiled

linseed oil is preferred for outside use. Until recently the best paints were mixed by the expert painter, but now the best grades may be purchased prepared and ready for use. Paint manufacturing has come to be one of our leading industries.

Inside paint is applied to inside surfaces and cheaper furniture when the beauty of the material grain is lacking. There are several kinds of inside paints. There are flat oil paints for painting plastered walls and ceilings; inside enamels for woodwork and furniture; tough wear resisting paints for wood floors, concrete floors and screens; and heat resisting paints for radiators. Each is especially adapted for its particular use and is available at any paint or hardware store.

Inside paint, like outside paint, is made from white lead, zinc, linseed oil and turpentine. Linseed oil paints tend to turn yellow when used for inside work and therefore a larger portion of turpentine than oil is used in making paints for inside use.

Enamel is used chiefly where gloss is desired on interior woodwork and furniture. This type of finish is easy to clean; the main difficulty is that it has a tendency to run or sag when being applied.

Brushes

Brushes should have special pain and care taken in the selection and care for the selection and care of the

brush determines to a great extent the final result of a finish. Since better brushes made from Chinese or Russian boar bristles set in rubber are expensive, they must be cared for properly to get full value from the expenditure. Some finishes keep a separate brush for each type of finish, so that there is no chance of using a poorly cleaned shellac brush for applying varnish.

When brushes are not in use, they should be kept in the solvent which serves as a thinner for the particular finish being applied, such as alcohol solvent for shellac, turpentine for enamel or varnish, linseed oil for exterior paints, and lacquer thinner for lacquer. One way to keep the bristles of a brush from bending while they are in a container with solvent is to drill a hole through the handle and then to suspend the brush by means of a wire passed through this hole and across the top of the can.

If a brush is not to be used for an indefinite period of time, it should be thoroughly cleaned in several changes of the solvent or in a suitable thinning agent and wiped clean and dry with rags. Benzine, lacquer thinner, a varnish remover will be helpful in the thorough cleaning of a brush. All rags and waste materials used in finishing and cleaning brushes should be disposed of as soon as possible as a precaution against spontaneous combustion.

Compiled from:

1. Duncan, Glenn S., Recreational Craft Work, Eastern Illinois State College, Charleston, Illinois, 1951, Pp. 89-90.

2. Feirer, John L., Advanced Woodwork and Furniture Making, Charles A. Bennett Company, Publishers, Peoria, Illinois, 1954, Pp. 141-155.

3. Fryklund, Verne C., and Laberge, Armand J., General Shop Woodworking, McKnight and McKnight, Publishers, Bloomington, Illinois, 1936, Pp. 105-110.

4. Groneman, Chris H., Exploring the Industries, The Steck Company, Publishers, Austin, Texas, 1953, Pp. 82-86.

5. Groneman, Chris H., General Woodworking, McGraw-Hill Book Company, New York, 1952, Pp. 91-99.

6. Hjorth, Herman, Basic Woodworking Processes, Bruce Publishing Company, Chicago, Illinois, 1935, Pp. 213-218.

LIST OF VISUAL AIDS.

1. Chisels for Woodworking, (Film Strip, Stanley Tools, 111 Elm Street, New Britain, Connecticut, 139 Frames). Covering: Types of Chisels; How a chisel cuts; Cutting notches, gains, rabbets; Cutting half lap joints; Cutting mortise and tenon joints; dovetails; Grinding chisels, whetting chisels, special chisels and gouges; Grinding and whetting gouges.

2. Forest Produces (Motion Picture, Encyclopedia Britannica Films, Inc., 1150 Wilmette Ave., Wilmette, Illinois, 11 minutes). Forest and their products utilized by man. Produced by the Conservation Foundation in Cooperation with the New York Zoological Society.

3. Forestry and Forest Industries (Motion Picture, Vocational Guidance Films, Inc., 215 East 3rd St., Des Moines 9, Iowa, 11 minutes). Work of people engaged in harvesting, processing, and distributing forest products.

4. Hand Sawing (Motion Picture, The Jam Handy Organization, 2821 East Grand Blvd., Detroit 11, Michigan, 20 minutes). Fundamentals of handling hand saws and choosing the right saw for the job.

5. How to Finish Plywood (Motion Picture, Douglas Fir Plywood Association, 301 Tacoma Cldg., Tacoma 2, Washington, 22 minutes). How plywood is painted, stained, enameled, wall-papered for various exterior and interior finishes.

6. Language of Drawing (Motion Picture, McGraw-Hill Book Co., Inc., Text-Film Department, 330 West 42nd Street, New York 36, N.Y., 10 minutes). Explains the necessity for a knowledge of mechanical drawing, the common language of the building world.

7. Making a Project With Hand Tools (Film Strip, Society for Visual Education Inc., 1346 West Deversey Parkway, Chicago 14, Illinois, 61 Frames). How to convert rough stock into a useful but easy-to-make project; how to square a board and use saws, planes, and other tools.

8. Measuring, Testing, and Marking Tools (Film Strip, Stanley Tools, 114 Frames). Covering: Foot and inch graduations; Bench and folding rules, Zigzag and extension rules; Pull-push and caliper rules; Types of squares; T-bevel and angle dividers; Marking and mortise gauges; Pencils, knifes, and scratch awes.

9. Plane Series (Film Strip, Stanley Tools, 126 Frames). Covering: Types of bench planes; Plane adjustments How to plane a board surface; How to plane an edge straight; End planing; Chamfer and bevels; Grinding the plane iron; Whetting the plane iron; Correction of poor planing.

10. Use and Care of Woodworking Tools (Film Strip, Photo Lab., Inc., 3825 Georgia Ave., Washington 11, D.C., 58 Frames). How to use simple woodworking tools.

Selected Bibliography

Bell, Enid, Practical Word-Carving Projects. Cleveland and New York: World Publishing Company, 1951.

Duncan, Glenn S., editor, Recreational Craft Work. Eastern Illinois State College, Charleston, Illinois, 1951.

Feirer, John L., Advanced Woodwork and Furniture Making. Peoria, Illinois: Charles A. Bennett Company, Inc., 1950.

Feirer, John L., Industrial Arts Woodworking. Peoria, Ill.: Charles A. Bennett Company, Inc., 1950.

Fryklund, Vern C., and Laberge, Armand J., General Shop Woodworking, Bloomington, Ill.: McKnights and McKnights, 1936.

Groneman, Chris H., Exploring the Industries. Austin, Texas: Steck Company, 1953.

Groneman, Chris H., General Woodworking. New York: McGraw Hill Book Company, Inc., 1952.

Hjorth, Herman, Basic Woodworking Processes. Chicago: Bruce Publishing Company, 1935.

Hjorth, Herman, Principles of Woodworking. Milwaukee: Bruce Publishing Company, 1947.

Johnson, William H., And Newkirk, Lewis J., General Woodworking Crafts. New York: The MacMillan Company, 1946.

Van Tassel, Raymond, Woodworking Crafts. New York: D. Van Nostrand Company, Inc., 1948.

Wheeler, Hubert, (Commissioner of Education), Industrial Arts General Woodwork. Missouri State Dept. of Education, Division of Public Schools, Jefferson City, Missouri, 1951.

Yabsley, P., Educational Craftwork in Wood. Peoria: Charles Bennett Company, Inc., Manual Arts Press, 1949.

Periodicals

Popular Mechanics, 100 Best Woodworking Projects, Chicago: Popular Mechanics Press, 1951.

Selected Equipment and Materials Source List

Machine Tools

Baldor Electric Company, 4353 Duncan Avenue, St. Louis 10, Missouri.

Black and Decker Manufacturing Company, Toueson 4, Maryland.

Cincinnati Tool Company, The, Waverly and Main, Cincinnati, Ohio.

Foley Manufacturing Company, 3300 North East 5th Street, Minneopolis 18, Minnesota.

Keller Divisions, Sales Services Manufacturing Company, 2365 University Avenue, St. Paul 14D, Minnesota.

Miller Falls Company, Dept. 1A-35, Greenfield, Massachusetts.

Oliver Machinery Company, Grand Rapids 2, Michigan.

Parks Woodworking Machine Co., Dept. 22, 1546 Knowlton Street, Cincinnati, Ohio.

Porter, H.K. Co., Inc., Disston Division, 174 Tacony, Philadelphia 35, Pennsylvania.

Powermatic Machine Company, Mc Minville, Tennessee.

Rockwell Manufacturing Company, Delta Power Tool Division, 402 D. North Lexington Avenue, Pittsburgh 8, Pennsylvania.

Tolerton Company, 265 North Freedom Avenue, Alliance, Ohio.

Walker - Turner, Division of Rockwell Manufacturing Company, Dept. W D-61, 400 North Lexington Avenue, Pittsburg 8, Pennsylvania.

Hand Tools

Adjustable Clamp Company, 424 North Ashland Avenue, Chicago 22, Illinois.

Armstrong Brothers Tool Company, 5222 West Armstrong Avenue, Chicago 46, Illinois.

Atkins Saw Divisions, Indianapolis 9, Indiana.

Borg - Warner Corporation, Indianapolis 9, Indiana.

Brodhead - Garrett Company, 4560 East 71 Street, Cleveland 5, Ohio.

Cincinnati Tool Company, Waverly and Main, Cincinnati, Ohio.

Greenlee Tool Company, 2024 Twelfth Street, Rockford, Illinois.

Hammett, J.L. Company, Cambridge, Massachusetts.

Irwin Bit Company, Wilmington, Ohio.

K - D. Manufacturing Company, Lancaster, Pa.

Mittermeier, Frank, 3577 East Tremont Avenue, New York 6J, New York.

Morgan Vises, 120 North Jefferson Street, Chicago, Illinois.

Stanley Tools, Department of Education, 474 Elm Street, New Britain, Connecticut.

Wilton Tool Manufacturing Company, Schiller Park, Illinois.

Lumber

Abitibi Corporation, Penoboscot Building, Detroit 26, Michigan.

American Walnut Manufactures Association, 666 Lake Shore Drive Chicago 11, Illinois.

Bedford Lumber Company, Shelbyville, Tennessee.

Brodhead - Garrett Company, 4560 East 71st Street, Cleveland, Ohio.

California Redwood Association, 576 Sacramento Street, San Francisco 11, California.

Craftsman Wood Service Company, 2729 Mary Street, Dept. F-6, Chicago 8, Illinois.

Crossett Lumber Company, Crossett, Arkansas.

Douglas Fir Plywood Association, 1119 A Street, Tocoma 2, Washington.

E. L. Bruce Company, Box 397, Memphis 1, Tennessee.

Frank Paxton Lumber Company, 5701 West 66th Street, Chicago, Illinois.

Foley Lumber Company, T. A., Paris, Illinois.

General Finishes Sales and Services Company, 1548 West Bruce Street, Milwaukee 46, Wisconsin.

George C. Brown and Company, Inc., Aromatic Red Cedar, Greensboro, North Carolina.

Hardwood Corporation of America, Educational Lumber Division, P.O. Drawer 1091, Ashville, North Carolina.

Koppers Company, Inc., Koppers Building, Pittsburg,19, Pa.

Pacific Lumber Company, 35 East Wacker Drive, Chicago 1, Ill.

Southern Pine Association, P.O. Box 1170, New Orleans, Louisiana.

United States Plywood Corporation, Weldwood Building, 55 West 44th Street, New York 36, New York.

W. P. Stark Lumber Company, Inc., Fairfax Industrial District, Kansas City, Kansas.

West Coast Lumberman's Association, 1410 South West Morrison Street, Portland 5, Oregon.

West Coast Pine Association, 510 Yeon Building, Portland 4, Oregon.

Woodall Industries, Inc., 3500 Oakton Street, Skokie, Illinois.

Hardware

Albert Constantine and Son, Inc., 2050 Eastchester Road, Dept. G-9, New York 61, New York.

American Screw Company, Providence, Rhode Island.

American Steel and Wire Company, Chicago, Illinois.

Atlantic Screw Works, Hartford, Connecticut.

Continental Steel Corporation, Kokomo, Indiana.

Frantz Manufacturing Company, Sterling,Illinois.

Gilbert and Miller, 404 Fourth Avenue, New York 16, New York.

Hebbard, Spencer, Bartlett and Company, Rockford, Illinois.

Hindley Manufacturing Company, Valley Falls, Rhode Island.

National Lock Company, Rockford, Illinois.

National Screw and Manufacturing Company, Cleveland, Ohio.

R. and P. Manufacturing Company, Worchester, Massachusetts.

Rockford Screw Products Company, Rockford, Illinois.

Southern Screw Company, Statesville, North Carolina.

Southern Screw Company, Statesville, North Carolina.

Tower Manufacturing Company, Madison, Indiana.

Upholstery Supply Company, The, 1033 North Fourth Street, Milwaukee 3, Wisconsin.

Wickwire Brothers, Inc., Cortland, New York.