5-27-1957

A Proposed Course Guide for Junior High Crafts

Charles W. Cole

Candidates for the master's degree must file the following certificate with the Dean:

1. (To be filed before the middle of the term in which the degree is to be conferred.)

I certify that Charles W. Cole has completed a paper entitled A Proposed Course Guide For Junior High Crafts

I recommend acceptance in partial completion of the requirements for the Degree, M. S. in Education. The paper was read by Dr. Robert Sonderman, Instructor Dr. Walter A. Klehm, Advisor.

Date May 27, 1957

Walter A. Klehm
Adviser

A PROPOSED COURSE GUIDE

FOR JUNIOR HIGH CRAFTS

By

Charles J. Cole
May 1957

Submitted Under Plan B In Partial Fulfillment
Of The Requirements For The Degree,
Master Of Science In Education

Approved:

[redacted]

May 27, 1957
Date

Dr. Robert Sonderman
Instructor I.A. 575

Approved:

May 27, 1957
Date

Dr. Walter A. Klehm
Advisor

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WOODCRAFT

Introduction

Wood is one of America's most abundant and widely used natural resources. It also has the unique feature of being the easiest natural resource to harvest, supplant, and conserve. With such a value placed on wood and lumber it behooves every American to help conserve our supply of trees from which these products come so it will be adequate for generations to come.

Trees provide the raw materials for many thousands of wood-fabrication industries and their hundreds of thousands of products. Many of these products are so common place that we seldom think of them as a direct result of some form of the lumbering industry.

Generally speaking, there are five commercial forests in the United States from which our lumber is harvested. The Northern Forest, an area north and east in this country includes approximately 132 million acres of timber, and produces both hardwoods and softwoods. White pine, red spruce, hemlock, and other conifers are mixed with the hardwoods.

The Central Forest, comprised mostly of hardwoods, extends roughly through the central-eastern section of the United States. It covers approximately 47 million acres of ground.

The Southern Forest stretches from Virginia through eastern Texas and from Oklahoma to the Gulf of Mexico. The yellow pines (longleaf, shortleaf, loblolly, and slash) are predominate. Cypress is found in the southern lowlands, and

a considerable amount of hardwoods grow amoung the pines. This area exceeds 183 million acres.

The Western Forest covers the twelve western states and 35 per cent of the continental United States. Softwoods, chiefly ponderosa, Idaho-white, and sugar pines, predominate in this area. Some hardwoods are found in this area also.

The Pacific Coast Forest extends along the moist, western slopes of Washington, Oregon, and northern California. The timber in Washington and Oregon is primarily Douglas Fir with a scattering of hemlock, western red cedar, and Sitka spruce. In northern California the characteristic tree is the redwood, one or the world's largest. This commercial forest covers approximately 28 million acres.

These five commercial forests comprise a very fast increasing factor of the wealth of America. This factor should lead us all to see that conservation of this tremendous natural resource is of utmost importance.

As the lumber from these forests reach the mills, it starts on it's way through many processes that will produce the wood we use or some of the thousands of different products that are made from it.

Products From the Forest -- Old and New

Probably one of the more important products that is made from wood is paper. The newspapers, magazines, books, and practically every form of the recorded word is dependent upon paper in some form or another. Six per cent of the annual timber harvest is used for making pulp from which paper is manufactured. Wood is converted into pulp by a chemical process.

A laminated paper product called Papreg has been produced by impregnating sheets of paper with resin and subjecting them to heat and pressure. This material is lighter and stronger than metal and plays an important part in aircraft production among other things.

Nearly all portions of the tree serve some useful purpose. In modern mills even waste sawdust and shavings are processed in various ways to produce types of insulation, insulating materials, wallboard, and pressed wood products. When these scraps can serve no further useful purpose they are burned as fuel.

Research by scientists has shown that the cellulose fiber of wood when treated with chemicals can produce one of the ingredients of Rayon. Rayon is especially useful and suited for the manufacture of the cords which form the body of pnuematic tires. These fibers can also be woven into fabrics that make a very serviceable cloth which is used widely in the manufacture of various articles of clothing.

Other products produced from the cellulose content of wood are gunpowder, imitation leather, felt, plastics, lacquers, glycerine, sugar, alcohol, molasses, yeast, and food protien.

Lignin, the other component of wood, can be treated and turned into such products as tanning agents for leather, a binder in mixing concrete, a water softner and purifer, a base for fertilizers, and a flavor known as vanillin.

Extracts from wood produce another array of products that

are important to our everyday life. Such materials as solvents, sugar, dyes, drying agents, and spirits necessary in many manufacturing processes are extracted from trees. Turpentine and resins are extracted from oleoresin and are a basic necessity of the paint industry.

Perhaps the most commonly known product of trees is wood. Wood as we see it every day in a thousand and one manufactured items such as pencils, chairs, beds, tables, telegraph and telephone poles, posts, doors, houses, floors, and many other articles too numerous to mention. The success of wood as a construction material is no mystery. It's easy working qualities, adaptability to various designs, and the natural warmth of the beautiful grains make it a pleasing material to work with and produce articles.

Common Varities of Wood

The novice wood worker or craftsman soon finds himself choosing certain woods because they possess the characteristics which he desires. Of the hundreds of species of trees found in the United States, the ones following are perhaps the most commonly used for production of lumber in useable form due to the possession of characteristics given for each one:

Ash -- Heavy, hard, elastic, tough, brown. Used in the manufacture of agricultural instruments, furniture, and boat oars.

Basswood or Linden -- Soft, straight-grained, light-

brown, easily worked. Used for general articles of woodenware, furniture, wood pulp. Tough inner bark used for mat fiber.

Beech -- Close-grained, hard, pale-brown or buff. Used for fuel, woodenware, chairs, shoe lasts. Nuts are edible.

Cedar, Red -- Light, soft, brittle, close-grained, fragrant, durable. Used in chests and closets for protection from moths; also used for lead pencils and fence posts.

Cherry, Black or Sweet Birch -- Heavy, strong, hard, close-grained, deep ruddy brown with yellow sapwood. Used for furniture and boat building.

Cypress, Bald -- Straight-grained, easily worked, light-brown. Used for general construction, provides effective paneling.

Fir, Douglas -- Light, ruddy or tan-yellow. Used for construction purposes, railroad ties, and piles.

Gum, Sweet or Red -- Hard, heavy, close-grained, reddish brown. Used for building and furniture. Can be stained readily to resemble mohogany. Sap used in chewing gum and medicine.

Magnolia, Cucumber -- Soft, light, close-grained, satiny texture, light ocher yellow. Used for cabinetmaking (often stained to walnut shade).

Maple, Sugar-- Heavy, very hard, strong, close-grained, takes fine polish. Used for interior finish, floors, turnery, shipbuilding, shoe lasts, fuel.

Oak, Red -- Hard, strong, light brown. Good for building purposes but rarely for furniture because of coarse grain.

Oak, White-- Strong, heavy, hard, tough, pale brown. Important building and furniture wood, especially for floors, beams and ship building because of strength.

Pine, Short Leaf -- Moderately coarse-grained, hard, durable, gold ocher to pale buff-yellow. Used for interior finish and flooring.

Pine, Western White -- Light, soft, pale brown, and commercially of great value.

Pine, Western Yellow -- Hard, strong, light, color from pale yellow to terra-cotta red. One of the most valuable lumber trees of the western states.

Pine, White -- Pale, buff-yellow, soft, durable, easily worked. Used for building purposes.

Poplar, Cottonwood -- Light, soft, pale brown, or pale buffish white. Used for boxes, pails, and similar woodenware, and paper pulp.

Redwood -- Crimson brown, soft, brittle, straight-grained, easily worked. High commercial importance, manufactured into interior finish, furniture.

Tulip Tree -- Pale buff, close, straight-grained, light, soft, easily worked, does not readily split, warp, or shrink. Prized for interior finish work and cabinetmaking.

Walnut, Black -- Deep brown, hard, heavy, rather brittle, coarse grained. Used in fine furniture, woodwork and boat building.

Along with the common woods of the United States listed, there are some foreign grown woods that are of importance to the wood worker due to their use in many familiar products. These woods are important because they possess characteristics desired that cannot be duplicated with American woods.

Balsa -- Extremely light in weight, easily worked, light tan. Used for rafts, decoys, model work, sound deadner, and protective packing for furniture.

Ebony -- Extremely hard, dense, dull black with an array of stripes ranging from dark brown through grey to brownish orange. Suitable for inlays, marquetry, small articles of turnery. Very difficult to work. To dense to float in water.

Lemonwood -- Hard, fine, even texture, light yellowish-brown, easy to work. Used principally for archery equipment. Retains original shape very well.

Teak -- Moderately strong, hard, straight-grained, oily, rich brown. Used for furniture, floors, ship building, but its use is limited by scaricity and high cost.

AREAS OF PUPIL DEVELOPMENT

It is the purpose of this section to make suggestions as to the content for a unit of instruction in wood craft.

Specific Areas of Development

A. To develop some measure of skill in the manipulation of woodworking tools and materials.

B. To gain some understandings concerning information basic to woodworking.

C. To develop in each individual desirable habits, traits, and attitudes.

D. To develop some appreciation relative to design, craftsmanship, and more specifically, products made of wood.

E. To develop an interest and some understanding concerning individual and group health and safety in the use of woodworking tools and materials.

Areas of Instruction:

A. Manipulative Areas

I. Planning
   a. Read a working drawing
   b. Make a bill of material
   c. Select an appropriate undertaking
   d. Select the material necessary to do the job
   e. Calculate the cost of the job
   f. Estimate the time required to complete the job

II. Layout
   a. Take a measurement with a rule
   b. Lay off measurements with a rule
   c. Lay out patterns on stock
   d. Lay out and test square cuts with a try-square
   e. Gage with a marking gage
   f. Lay out duplicate parts
   g. Lay out chamfers and bevels
   h. Lay out rounds
   i. Lay out angle cuts

III. Holding Tools
- a. Hold stock in a woodworkers vise
- b. Hold stock with a hand screw clamp
- c. Hold stock with a "C" clamp
- d. Hold stock with a bar clamp
- e. Hold stock with a saw jack

IV. Tooth Cutting Tools
- a. Saw to a line with a cross-cut saw
- b. Saw to a line with a back saw
- c. Saw to a line with a coping saw
- d. Shape an edge or end with a file
- f. Shape irregular shapes with a file
- g. Smooth a surface with sand paper
- h. Smooth irregular shapes with sand paper

V. Edge Cutting Tools
- a. Assemble and adjust a jack plane or smooth plane
- b. Assemble and adjust a block plane
- c. Plane a surface true and smooth
- d. Plane an edge true and square to a surface
- e. Plane an end true and square to a surface and edge
- f. Plane to length, width, and thickness
- g. Cut a chamfer using a plane
- h. Round edges using a plane
- i. Round edges using a spokeshave
- j. Sharpen a plane iron, chisel, and spoke shave
- k. Sharpen a scraper
- l. Trim and pare with a chisel
- m. Trim and pare with a knife

VI. Boring Tools
- a. Bore with an auger bit
- b. Drill holes using a hand drill
- c. Drill with a "Yankee" push drill
- d. Countersink for screws
- e. Counterbore for screws

VII. Fastening Devices
- a. Drive and draw nails
- b. Set and fill nail holes
- c. Fasten with corrugated fasteners
- d. Fasten with screws (round, flat, and oval head)
- e. Fasten with dowels
- g. Fasten with common wood joints
- h. Fasten with glue
- i. Fasten using combinations such as joints and glue

VIII. Finishing
- a. Prepare stock for finish

b. Mix and apply oil and water stain
c. Apply enamel and paint
d. Apply filler
e. Apply woodseal with brush and cloth
f. Apply varnish with a brush
g. Clean and care for brushes
h. Apply paraffin or paraffin oil
i. Apply novelty finishes
j. Apply suede-tex
k. Rub a finish with pumice and rotten stone

B. Information Areas

I. Planning
a. The importance of drawing and plans in woodwork
b. The meaning of lines and symbols found on woodworking plans and drawings
c. Methods of analyzing jobs, planning procedures, making bills of materials, and computing costs from woodworking plans, drawings, and lumber price lists

II. Layout Tools
a. Layout tools used in woodworking
b. Factors concerning the selection, cost, and care of layout tools

III. Holding Tools
a. Types, sizes, and uses of holding tools used in woodworking
b. Factors concerning the selection, cost, and care of holding tools

IV. Tooth Cutting Tools
a. Types, sizes, and uses of the various saws used in woodworking
b. Factors concerning the selection, cost, and care of hand saws
c. Types, shapes, sizes, and uses of the various files used in woodworking
d. Factors concerning the selection, cost, and care of files
e. Types, grades, and uses of sandpaper, steel wool, and other abrasive materials used in woodworking

V. Edge Cutting Tools
a. Types, sizes, and uses of the various planes and chisels used in woodworking

b. Factors concerning the selection, cost and care of planes and chisels

VI. Boring Tools
a. Types, sizes, and uses of the tools used to bore holes in wood
b. Factors concerning the selection, cost, and care of wood boring tools

VII. Fastening Devices
a. Types, sizes, cost, and uses of nails, brads, screws, and other fasteners used in woodworking
b. Types, sizes, cost, and uses of common hardware used in woodworking
c. Types, characteristics, cost, and uses of glue
d. Types, characteristics, and uses of common wood joints

VIII. Finishing
a. Types, uses, and preparation of stains, fillers, paint, varnish, woodseal, lacquer, enamel, and other finishing materials
b. Methods of cleaning and storing brushes

C. Personality Area

Throughout the course the instructor will call to the attention of the pupils the desirable habits, traits, and attitudes commonly accepted in our culture. These attributes should be taught daily concurrently with the other areas of instruction. Listed below are a few practices that may be of help in developing some of the desirable habits, traits, and attitudes that we hope to impart to the students:

a. Development of a student personnel system
b. Encouragement of group activities when desirable
c. Assignment of reports to be worked out by groups

D. Appreciation Area

I. Basic rules of good design
II. Factors to be considered in purchasing furniture and other products involving the use of wood
III. Criteria for evaluation of finished products make in the school shop
IV. Through field trips, movies, and during daily class sessions the instructor can do much to increase the individual pupils appreciation of good craftsmanship and design

E. Health and Safety

Throughout the course the instructor will call to the attention of the pupils the principles of cleanliness adequate ventilation, sufficient light, proper methods of waste disposal, and proper toilet habits to the end that each pupil can live a healthy life. Throughout the course the instructor will seize every opportunity to emphasize the proper and safe use of tools and materials.

F. Modifying Factors

The extent to which any or all of the activities listed above can be undertaken will depend upon the local situation governed by the following factors:

I. Experience, training, ingenuity, energy, and skill of the instructor
II. Facilities available in terms of tools, equipment, and supplies
III. Capabilities and interests of the pupils

SELECTED PROJECTS

Projects, from the student's point of view, are things to be made in the school shop. From the teacher's point of view, they are a means to ends; they are the most important device at his command for teaching manipulative content.

Projects should provide for four types of activity on the part of the student: (1) purposing, (2) planning, (3) execution, and (4) judging or evaluation. That is, the student should either propose his own project or accept one assigned by the instructor as worthwhile; he should plan the project thoroughly himself or follow a well-made plan prepared for him; he should see the project through from start to finish, doing the various operations himself; and when the job is complete, he should evaluate his own work, with the view of taking stock of what he has learned and determining where improvements may be made in his procedure or workmanship.

Besides providing the four types of student activity outlined above, projects should conform to these criteria of project selection: (1) they should include some of the things taught in the course, perhaps a small number of units in the first projects and larger numbers of units as the student progresses; (2) they should interest and challenge the student, and yet be within his range of ability; (3) they should be well designed and, if possible, have a practical use which will suit the student when completed; (4) they should be suited to school

shop conditions such as tools and materials available, and cost; (5) they should be of such a nature that the student can complete them in a reasonable length of time and should lead him on to other worthwhile projects.

On the following pages will be found a series of projects that have been organized as instructional sheets. These are presented in this form to serve two purposes, first, to provide certain projects that meet established criteria and second, to point out one method of organizing project material for presentation to the students.

CARVING PROJECT "HOMER HOUND"

Bill of Materials:

Name of Part	Kind of Material	No. of Pieces	Finished Dimensions Thickness, Width, Length
Dog	Pine	1	1/2" x 2" x 4"

Steps of Procedure:

1. Trace selected pattern
2. Select meterial
3. Transfer pattern to wood
4. Saw out stock to pattern with coping saw
5. Mark off lines for nose, ears, legs, and tail
6. Carve to finished size*
7. Remove all tool marks
8. Apply finish

*Refer to process model

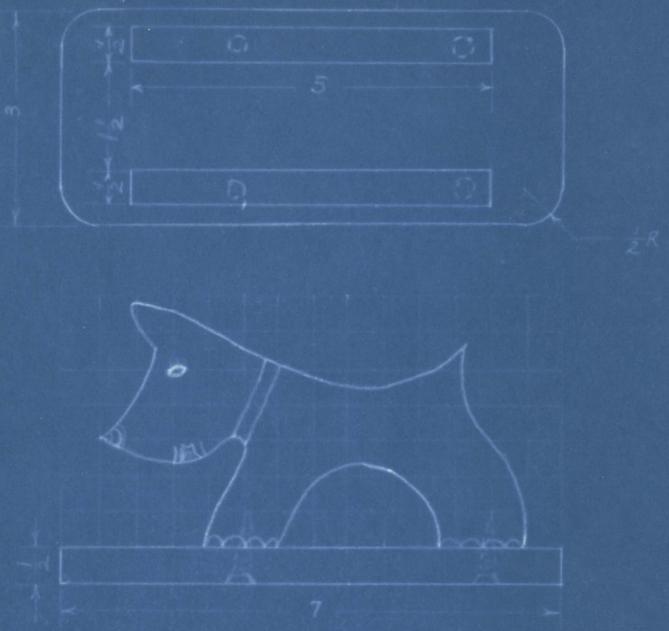
Test of Workmanship:

1. Has carving been carefully done with no splits or chips? Yes( ) No( )
2. Have all tool marks been removed? Yes( ) No( )
3. Is the finish applied evenly and smoothly? Yes( ) No( )
4. What would you do to improve your project? _____

_____

LETTER OR NAPKIN HOLDER

Note: Shape and design of upright pieces may be selected by the student.



Bill of Material:

Name of Part	Kind of Material	Quantity	Finished Dimensions
Base	Pine	1	1/2" x 3" x 7"
Uprights	Pine	2	3/8" x 3 1/2" x 5"

Steps of Procedure:

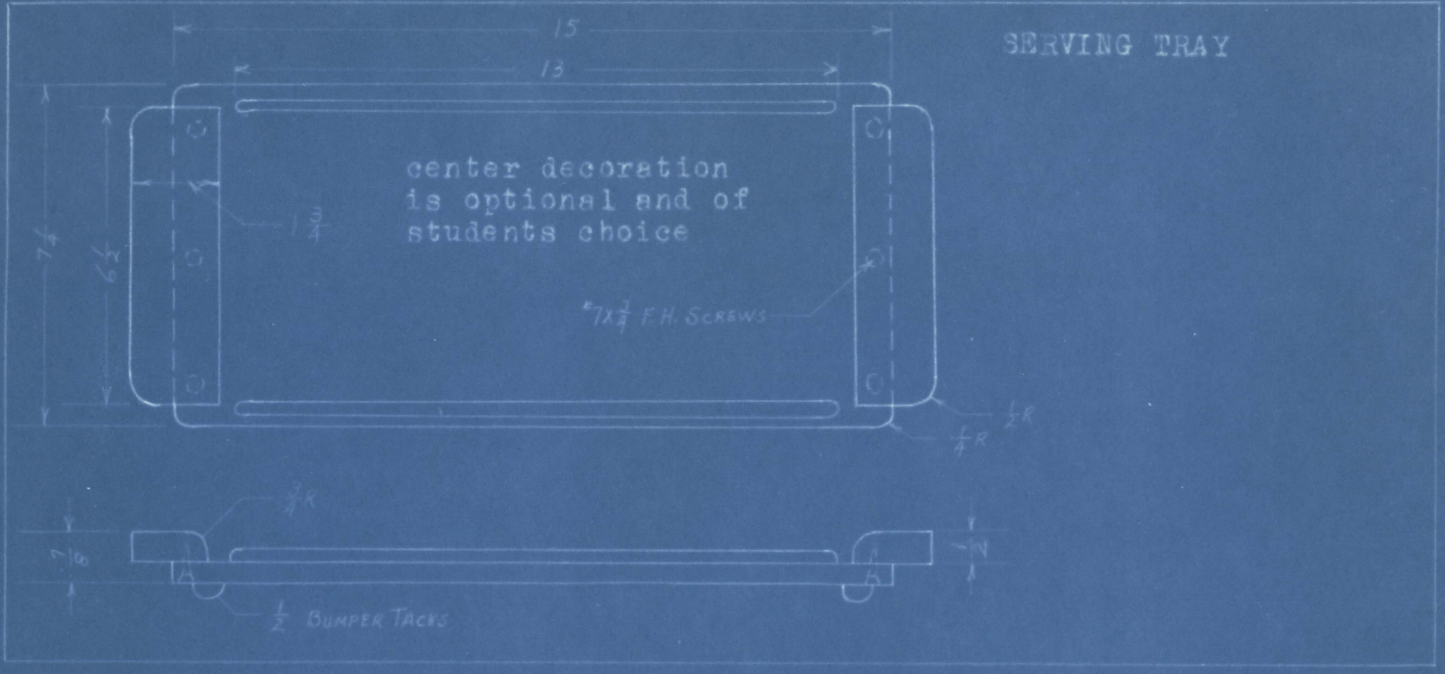
1. Select appropriate stock
2. Cut to rough size
3. Cut and square base to finish size
4. Layout round corners on base and cut
5. Trace pattern for uprights
6. Transfer pattern to wood
7. Saw out pattern with coping saw
8. File and smooth edges of uprights
9. Remove tool marks from all pieces
10. Drill shank holes in base and pilot holes in uprights
11. Finish painting design on uprights
12. Apply finish to base
13. Assemble project
14. Fill out work sheet and turn in for evaluation

Test of Workmanship:

1. Are all parts square and true? Yes( ) No( )
2. Are uprights neatly formed and smoothed? Yes( ) No( )
3. Are all tool marks removed? Yes( ) No( )
4. Do uprights fit flush to base? Yes( ) No( )
5. Is the finish smooth and the design well applied? Yes( ) No( )
6. What would you do to improve your project? _____

_____

SERVING TRAY



Bill of Material:

Name of Part	Kind of Material	Quantity	Finished Dimensions
Bottom	Mahogany	1	3/8" x 7 1/4" x 15"
Handles	Mahogany	2	1/2" x 1 3/4" x 6 1/2"
Trim	Mahogany	2	1/4" x 1/4" x 13"

Steps of Procedure:

1. Select appropriate stock
2. Cut stock to rough size
3. Trim and square stock to finish size
4. Layout and cut rounded corners and edges
5. Apply selected design to face of tray
6. Remove all tool marks with sand paper
7. Drill shank holes in bottom of tray and pilot holes in handles
8. Attach handles with wood screws
9. Glue trim pieces in place and allow to dry
10. Apply finish
11. Fill out work sheet and turn in for evaluation

Test of Workmanship:

1. Are all the parts and finished project square and true? Yes( ) No( )
2. Are all tool marks removed? Yes( ) No( )
3. Is the assembly of the project neat and carefully done? Yes( ) No( )
4. Is the finish smooth and even? Yes( ) No( )
5. What would you do to improve your project? _____

_____

SUGGESTED VISUAL AIDS

Effective teaching depends not only on tools and materials. Visual aids such as charts, booklets, bulletins, and displays are valuable in making the experiences of the student clear and concrete in his mind. Through the use of such materials we can interest the student to a higher degree and provide experiences not easily obtained in any other way. Listed directly below and on the following pages are sources and examples of visual aids that will aid the student in wood craft work:

Companies and Corporations Providing Free Visual Aids

American Forest Products Industries, Inc.
1816 North Street, N. W.
Washington 6, D. C.

American Paper and Pulp Association
122 East 42nd Street
New York 17, New York

Behr-Manning Corporation
1053 Seifert Street
Troy, New York

Delta File Works, Inc.
4837 James Street
Philadelphia 37, Pa.

Disston and Sons, Inc., Henry
Philadelphia 35, Pa.

Du Pont de Nemours and Company, E. I.
Wilmington, Delware

Franklin Glue Company
Columbus 15, Ohio

General Motors Corp.
Educational Relations Section
Department of Public Relations
Detroit 2, Michigan

Gatfelter Company, P. H.
Spring Grove, Pa.

Irwin Auger Bit Company
Wilmington, Ohio

Le Page's, Inc.
P. O. Box 291
Gloucester, Mass.

Master Rule Mfg. Company, Inc.
40 Mulberry Street
Middletown, New York

National Paint, Varnish, and Lacquer Association, Inc.
1500 Rhode Island Avenue, N. W.
Washington 5, D. C.

Nicholson File Company
23 Acorn Street
Providence 1, Rhode Island

Paxton Lumber Company, Frank
2900 Bryan Avenue
Fort Worth 1, Texas

Rockwell Manufacturing Company
Delta Power Tool Division
400 North Lexington Avenue
Pittsburg 8, Pa.

Sherman-Williams Company
101 Prospect Avenue, N. W.
Cleveland 1, Ohio

Stanley Tools
Educational Department
New Britain, Conn.

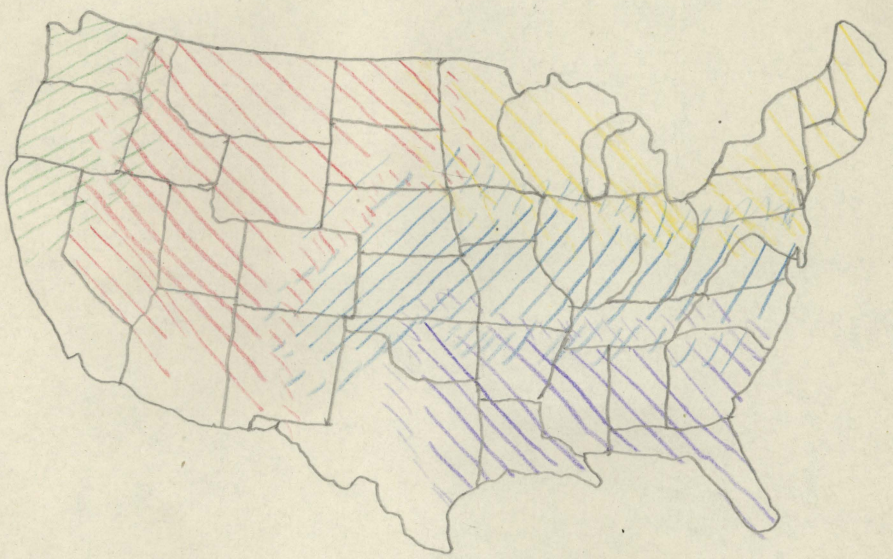
Superintendent of Documents
U. S. Government Printing Office
Washington 25, D. C.

United States Plywood Corp.
55 West 44th Street
New York 36, New York

Western Pine Association
510Yeon Building
Portland 4, Oregon

Commercial Forests of the United States

A map of the United States diagramed like the one illustrated would clarify this information and help the students to retain it better. This device could be used as a bulletin board chart or individual maps could be given to each student and they could sketch in the area themselves.

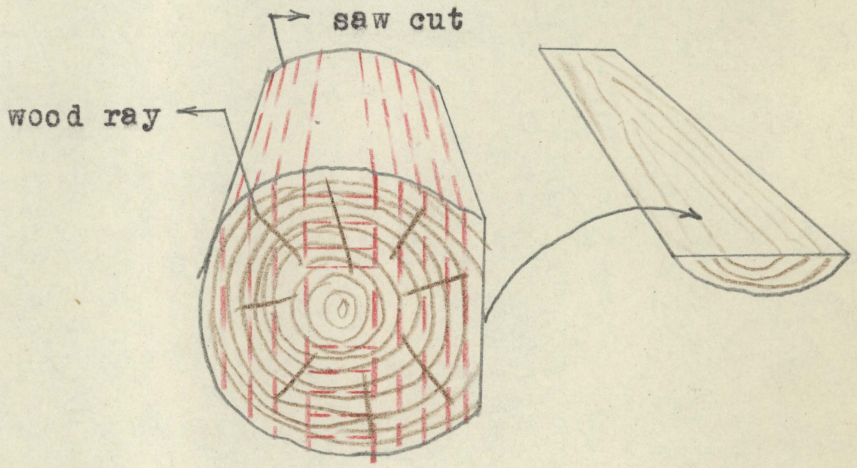


Key

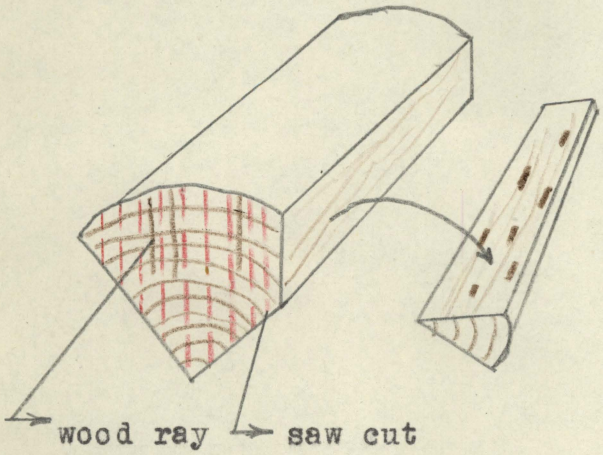
- Pacific Coast Forest
- Western Forest
- Central Forest
- Northern Forest
- Southern Forest

Three Methods of Cutting Logs Into Lumber After It Reaches the Mill

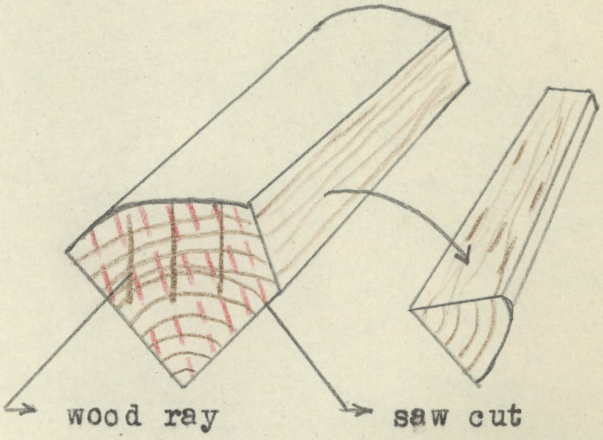
Plain Sawed (Flat)
(cut tangent to annual rings)



Quarter Sawed
(showing figure)



Rift Sawed
(showing pencil line grain)



SOURCES OF FILMS AND FILMSTRIPS

American Forest Products Industries, Inc.
1319 Eighteenth Street, N. W.
Washington 6, D. C.

General Motors Corporation
Public Relations Department
Detroit 2, Michigan

U. S. Department of Agriculture
Washington 25, D. C.

U. S. Forest Service
Washington 25, D. C.

Veneer Association, The
600 South Michigan Avenue
Chicago 5, Illinois

Western Pine Association
510 Yeon Building
Portland 4, Oregon

In addition to the above listed sources of film and filmstrips, the instructor should contact the nearest audio-visual center for additional help in securing and using these aids to teaching.

SELECTED BIBLIOGRAPHY

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

2. Groneman, Chris H., & Feier, John L., General Shop, McGraw-Hill Book Company, Inc., New York, New York, 1954.

3. Frank Paxton Lumber Company, Handbook for the Woodworking Industry, Frank Paxton Lumber Company, Chicago, Illinois, 1951.

4. Madden, Ira C., Creative Handicraft, The Goodheart-Willcox Company, Inc., Chicago, Illinois, 1955.

5. Newkirk, Louis V., General Shop for Everyone, D. C. Heath Company. Chicago, Illinois, 1952

6. Olson, Delmar W., Industrial Arts for the General Shop, Prentice-Hall, Inc., New York, New York, 1955.

7. Waltner, Elma, Carving Animal Caricatures, McKnight & McKnight Publishing Company, Bloomington, Illinois, 1951

PLASTIC CRAFTS

Introduction

The plastics industry as we know it is relatively new, yet today thousands of articles in everyday use are made from various kinds of plastics. Many things which once were made of metal, wood, glass, clay, or leather are now made of plastics because they can be made better and more economically with this new material.

We think of plastics as a new material but actually their history dates back to 1868 according to most authorities. A young American printer named John Wesley Hyatt was searching for a new material to be used as a substitute for ivory in billiard balls. A $10,000 prize had been offered for such a discovery. He found that cellulose nitrate, formed by the action of nitric acid on cotton cellulose, mixed with camphor and treated with proper amounts of pressure and heat, produced a substance which could be molded into desired shapes. He called this new material Celluloid.

From Hyatt's discovery of Celluloid, the history of plastics began to grow. The next plastic to be discovered was a casein plastic by Adolph Spitteler, a German. Dr. Leo Baekeland, an American, produced his contribution of Bakelite in 1909. Since this, many new plastics have been produced until now there are more than twenty known types in wide use.

The noun plastic means a material that can be shaped by

molding. Such materials as pitch, tar, amber, shellac, rubber, clay, and asphalt are natural plastics. The plastics which are most used in industry are synthetic substances produced by complicated chemical processes. These are the plastics with which we are familiar.

Kinds of Plastics

Plastics, depending upon their physical properties, may be classified as thermoplastic or thermosetting materials. Thermoplastic materials can be formed into desired shapes under heat and pressure and become solids upon cooling. If they are subjected to the same conditions of heat and pressure, they can be remolded. Thermosetting materials acquire infusibility under heat and pressure and cannot be remolded.

Plastics may also be classified according to their chemical sources. The twenty or more known basic types fall into four general groups: 1) cellulose plastics, 2) synthetic resin plastic, 3) protein plastics, and 4) natural resin plastics.

The cellulose plastics include the acetate, nitrate, butyrate, propionate, ethyl cellulose, and regenerated cellulose plastics. The cellulose nitrate plastics are the oldest in the group, and Celluloid is the oldest example. These plastics are made by treating cotton linters or wood pulp with acids in the presence of some catalyst.

The synthetic resins include the phenol-formaldehyde, phenol-furfural, urea-formaldehyde, melamine-formaldehyde, vinyl,

styrene, polyethylene, coumarone-indene, nylon, and the acrylic plastics. These plastics are made from phenol, formaldehyde, urea, acetylene, theylene, benzene, petroleum, and glycerol.

The protein plastics are made from soy beans, milk, coffee, beans, peanuts, cashews, and other agricultural products. The casein plastics are the most common group of protein plastics.

The natural resins include shellac, asphalt, rosin, amber, and pitch. These materials are usually cold molded with fillers.

It may simply said that the many types of plastics are derived from coal, petroleum, salt, sulfur, cellulose, lime, air, and water. Hundreds of formulas are used in making the twenty or more basic types of plastics. Different conditions and uses for plastics call for different formulas, therefore, plastics can be custom-built in order to produce a plastic with the characteristics that will meet a specific need.

Plastics in Modern Industry

Plastics are manufactured in the form of molding powders, sheets, rods, and tubes. They are then sold to fabricators and molders who make them into usable products or parts. The molding powders are processed by one method of manufacture and the sheets, rods, and tubes by an altogether different method. The molding powders may be either fine powders, granulated, or pill form. In any form the powder is in an uncured state.

Most plastics are fabricated by the molding process. This process is comparable to foundry work in the metal industry. Both

thermoplastics and thermosetting plastics may be used in this process. When many identical pieces are to be made the molding process usually is the most economical.

Molding powders can be converted into useful articles by three different methods; compression molding, injection molding, and extrusion.

Compression molding requires the use of hardened steel molds which are scientifically designed and made with extreme accuracy. Their cost often runs into thousands of dollars. The mold is made of two or more parts and forms a cavity the exact shape of the article to be produced. The molds have channels running through them so that they can be heated with steam or cooled with water. At the beginning of the operation, an accurately measured amount of molding powder is put into the open mold. Then the mold is closed, pressure is applied, and steam is circulated through the parts. The heat changes the molding powder into a soft mass, and the pressure forces the plastic into all the parts of the cavity. After a given length of time, water is pumped through the parts of the mold to cool them and cause the plastic to harden. The thermosetting plastics do not have to be cooled to harden, so they may be removed from the mold hot. The complete cycle for molding by the compression method may require as much as twenty minutes.

In molding articles weighing more than two ounces, the injection molding process requires heavy and expensive hardened steel molds used in complex, automatic machines so this process is usually limited to small, light articles. Small, hand operated injection molding machines with a capacity of one-half

to two ounces may use lighter molds. In this process the molding powder is fed into a heated cylinder. The cycle starts with a closed mold. There is an opening in the mold that connects with the cylinder. The plunger in the cylinder moves forward and squeezes the hot plastic into the cavity of the mold where it hardens as the mold cools. This process is limited to the manufacture of relatively small products. Usually articles weighing more than 32 ounces cannot be made economically by injection molding. This process has the advantage of speed, since the entire cycle can sometimes be completed in as little time as ten seconds. Many small articles can be molded in multiples, often fifteen or twenty at a time. Such products as spoons, combs, and knobs are often made by injection molding processes.

The extrusion method also requires the use of expensive machines, but no mold is necessary. A die is used which is relatively small and need not be expensive. This process has received a great deal of attention from molders the past few years since it is the fastest and cheapest way of producing plastic articles. However, production is limited to such items as rods, tubes, moldings, and edgings. The machine used is similar to the injection machine. At the end of the cylinder is the die which contains an opening of the desired shape and size. As the plastic is heated in the cylinder, it is forced forward with a revolving screw. As it is formed through the die, the plastic takes the shape of the opening. The process is comparable to squeezing toothpaste out of a tube. The strip hardens

immediately and may be cut to lengths or may be coiled on a reel.

A method of shaping that has recently come into extensive use is the vacuum forming of thermoplastic sheets. This technique was developed during the war for shaping the noses and turrets for military aircraft. Acrylate base plastics have been used extensively for this purpose. To accomplish this fabrication a large air-tight metal chamber is used which has a vacuum attachment. A hot sheet of plastic is clamped on top of this chamber and the air is exhausted from the inside by means of a vacuum pump. The low pressure inside the chamber and the high or standard pressure on the outside forces the hot plastic into the chamber. A small needle valve or an electric eye at the bottom of the chamber shuts off the vacuum valve when the plastic sheet is down to the desired depth. The plastic is allowed to cool for a few minutes, after which time it is removed and the clamp marks trimmed off. There are no "mark-off" or marks from the mold left on the finished product.

A modification of this process is known as the "snap-back" method in which the plastic sheet is drawn into the chamber as before. Then a form of the desired shape and size is lowered into the chamber. At this point a valve is opened allowing the air to slowly equalize the pressure in the chamber. The plastic "memory" causes the sheet to return or "snap-back" to it's original shape except where the form prevents it from doing so. Thus the plastic comes up around the form and there is allowed to cool in the shape of the form.

Laminating with plastics is a process that is becoming increasingly used in industry. Cloth, wood, canvas, paper, or such materials is thoroughly soaked with unpolymerized phenolic plastic. Plastic in this form resembles varnish. Sheets of material thus treated are then piled one upon another to the desired thickness. At this point they are placed either in a press with heated plates or are subjected to ultra high frequency electric current or polymerize the plastic. This produces a tough compact mass. This process can be used for molded shapes as well as for sheets. Such products as molded plywood, automobile gears, bearings on large ships, table tops, counter tops, fire resistent wood, and wainscoating for interior decoration are manufactured by this method.

Other uses for plastics in industry include coating objects for protection, plating articles for protection, and to add beauty and long life to them.

The method of working with plastic with which we are all familiar is the forming and shaping of sheets, rods, and tubes with common, inexpensive tools that are found in the school shop. Both thermoplastic and thermosetting plastics are fabricated into useful projects in this manner. The use of heat for forming broadens the variety of shapes obtainable with thermoplastics.

AREAS OF PUPIL DEVELOPMENT

It is the purpose of this section to make some suggestions at to the content for a unit in plastic craft and to offer some suggestions for organization of the content.

Specific Areas of Pupil Development

A. To develop some measure of skill in the manipulation of the tools and materials used in plastic craft.

B. To gain some understandings concerning information basic to plastic craft.

C. To develop in each individual desirable habits, traits and attitudes.

D. To develop some appreciation relative to design, craftsmanship, and more specifically, products made of plastic.

E. To develop an interest and some understanding concerning individual and group health and safety in the use of plastic working tools and materials.

Areas of Instruction

A. Manipulative Areas

I. Planning
   a. Read a working drawing
   b. Make a bill of materials
   c. Select an appropriate undertaking
   d. Select the material necessary to do the job
   e. Calculate the cost of the job
   f. Estimate the time required to complete the job

II. Layout
   a. Take a measurement with a rule
   b. Lay off measurements with a rule
   c. Layout a pattern on stock
   d. Layout and test square cuts with a try-square
   e. Gage with a marking gage
   f. Layout chamfers and bevels
   g. Layout rounds
   h. Layout angle cuts

III. Holding Tools
- a. Hold stock in a woodworkers vise
- b. Hold stock with a hand screw clamp
- c. Hold stock with a "C" clamp
- d. Hold stock with a saw jack

IV. Tooth Cutting Tools
- a. Saw to a line with a coping saw
- b. Saw to a line with a back saw
- c. Saw to a line with a hack saw
- d. Shape an end or edge with a file
- e. Shape irregular curves with a file

V. Edge Cutting Tools
- a. Assemble and adjust a block plane
- b. Plane an edge true and square to a surface
- c. Plane and end true and square to a surface and an edge
- d. Plane to width and length
- e. Smooth and edge using a scraper
- f. Sharpen a plane iron
- g. Sharpen a scraper

VI. Drilling and Punching Tools
- a. Drill holes using a hand drill and drill bit
- b. Counter sink for screws
- c. Counter bore for screws
- d. Punch a hole in thin plastic using a leather punch
- e. Drill holes using a drill press

VII. Fastening Devices
- a. Fasten with drive screws
- b. Fasten with self-tapping screws
- c. Fasten with bolts
- d. Fasten with common joints
- e. Fasten with plastic cements
- f. Fasten using combinations such as joints and cement

VIII. Finishing
- a. Remove tool marks using wet or dry sandpaper
- b. Buff or polish by hand
- c. Buff or polish using a power buffer

B. Information Areas

I. Planning
- a. The importance of drawing and planning in plastic craft

b. The meaning of lines and symbols found on drawings and plans
c. Methods of analyzing jobs, planning procedures, making bills of materials, and computing costs from plans, drawings, and price lists.

II. Layout
a. Layout tools used in plastic craft
b. Factors concerning the selection, cost, and care of layout tools

III. Holding Tools
a. Types, sizes, and uses of holding tools used in plastic craft
b. Factors concerning the selection, cost, and care of holding tools

IV. Tooth Cutting Tools
a. Types, sizes, and uses of the various saws used in plastic craft
b. Factors concerning the selection, cost, and care of hand saws
c. Types, sizes, and uses of the various files used in plastic craft
d. Factors concerning the selection, cost, and care of files
e. Types, sizes, and uses of thread cutting tools used in plastic craft
f. Factors concerning the selection, cost, and care of thread cutting tools

V. Edge Cutting Tools
a. Types, sizes, and uses of the various planes used in plastic craft
b. Factors concerning the selection, cost, and care of planes used in plastic craft
c. Types, sizes, and uses of scrapers used in plastic craft
d. Factors concerning the selection, cost, and care of scrapers used in plastic craft

VI. Drilling and Punching Tools
a. Types, sizes, and uses of tools used to drill holes in plastic
b. Factors concerning the selection, cost, and care of tools used to drill holes in plastic
c. Types, sizes, and uses of tools used to punch holes in thin plastic
d. Factors concerning the selection, cost, and care of punching tools

VII. Fastening Devices
- a. Types, sizes, cost, and uses of drive screws, self-tapping screws, and bolts used in plastic craft
- b. Types, sizes, cost, and uses of common hardware used in plastic craft
- c. Types, characteristics, cost, and uses of cement used in plastic craft
- d. Types, characteristics, and uses of common joints used in plastic craft

VIII. Finishing
- a. Types, sizes, cost, and uses of the various abrasives used in plastic craft

C. Personality Area

Throughout the course the instructor will call to the attention of the pupils the desirable habits, traits, and attitudes commonly accepted in our society. These attributes should be taught daily concurrently with the other areas of instruction. Listed below are a few practices that can be carried out to help impart desirable habit, traits, and attitudes:

I. Development of a student personnel system
II. Encouragement of group activities when desirable
III. Assignment of reports to be worked out by groups

D. Appreciation Area

I. Basic rules of good design
II. Factors to be considered in purchasing products involving the use of plastic
III. Test of workmanship for evaluation of finished projects made in the school shop
IV. Through field trips, movies, and during daily classes the instructor can do much to increase the individual pupils appreciation of good craftsmanship and design

E. Health and Safety

Throughout the course the instructor will call to the attention of the pupils the principles of cleanliness, adequate ventilation, sufficient light, proper methods of waste disposal, and proper toilet habits to the end that each pupil can live a healthy

life. Throughout the course the instructor will seize every opportunity to emphasize the proper and safe use of tools and materials.

F. Modifying Factors

The extent to which any or all of the activities listed above can be undertaken will depend upon the local situation governed by the following:

I. Experience, training, ingenuity, energy, and skill of the instructor
II. Facilities available in terms of tools, equipment, and supplies
III. Capabilities and interests of the pupils

SELECTED PROJECTS

Projects, from the student's point of view, are things to be made in the school shop. From the teacher's point of view, they are means to ends; they are the most important device at his command for teaching manipulative content.

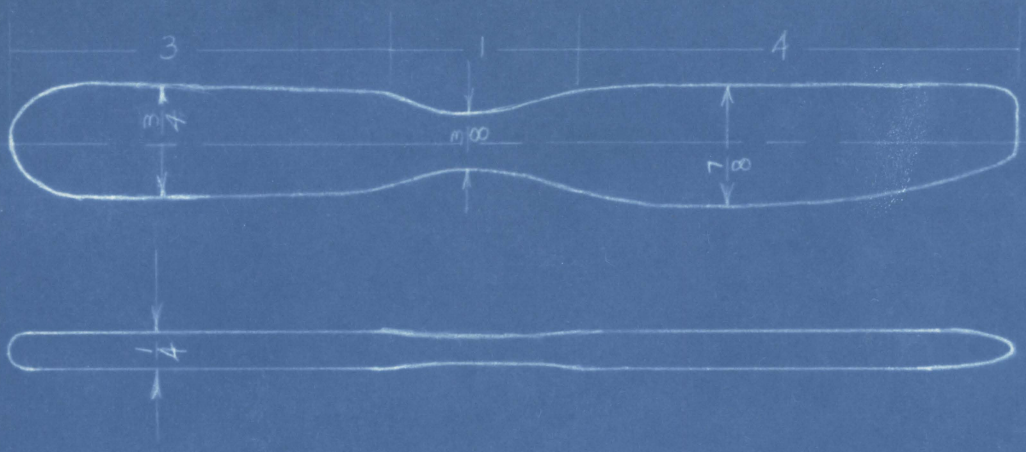
Projects should provide for four types of activity on the part of the student: 1) purposing, 2) planning, 3) execution, and 4) judging or evaluation. That is, the student should either propose his own project or accept one assigned by the instructor as worthwhile; he should plan the project thoroughly himself or follow a well-made plan prepared for him; he should see the project through from start to finish, doing the various operations himself; and when the job is complete, he should evaluate his own work, and judge it with the view of taking stock of what he has learned and determining where improvements may be made in his procedure or workmanship.

Besides providing the four types of student activity outlined above, projects should conform to these criteria of project selection: 1) they should include some of the things taught in the course, perhaps a small number of units in the first projects and larger numbers of units as the student progresses; 2) they should interest and challenge the student, and yet be within his range of ability; 3) they should be well designed and, if possible, have a practical use which will suit the student when completed; 4) they should be suited to school

shop conditions such as tools and materials available, and cost; 5) they should be of such a nature that the student can complete them in a reasonable length of time and should lead him on to other worthwhile projects.

On the following pages will be found a series of projects that have been organized as instructional sheets. These are presented in this form to serve two purposes, first, to provide certain projects that meet established criteria and second, to point out one method of organizing project material for presentation to the students in a convenient form.

RELISH APPLICATOR



Note: All edges tapered to round edge
Cutting edge beveled to sharp edge

Bill of Material:

Name of Part	Kind of Material	Quantity	Finished Dimensions
Applicator	Plastic	1	1/4" x 7/8" x 8"

Steps of Procedure:

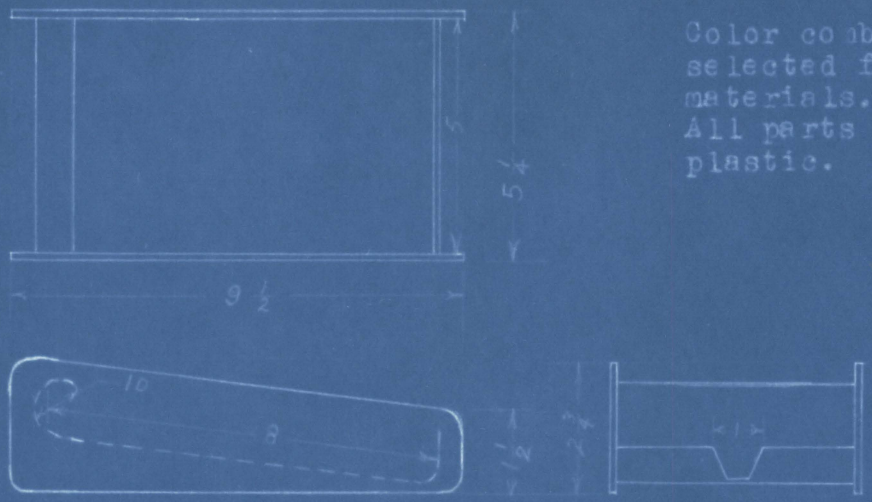
1. Select appropriate material
2. Trace pattern onto paper backing
3. Cut around outline with coping saw
4. Remove paper backing
5. Shape and smooth edges with file or scraper
6. Remove tool marks with sandpaper
7. Remove all sanding marks by buffing
8. Fill out work sheet and turn in for evaluation

Test of Workmanship:

1. Is the project free from all scratch marks? Yes( ) No( )
2. Is the project shaped well? Yes( ) No( )
3. Does the blade have an even taper? Yes( ) No( )
4. What would you do to improve your project? _____

_____

NOTE PAD TRAY



Color combinations to be selected from available materials.
All parts are 1/8" thick plastic.

Bill of Material:

Name of Part	Kind of Material	Quantity	Finished Dimensions
Body	Acrylic plastic	1	1/8" x 5" x 10 1/2"
Side	Acrylic plastic	2	1/8" x 2 3/4" x 9 1/2"

Steps of Procedure:

1. Select appropriate material
2. Trace pattern of pieces onto the paper coating
3. Cut around outline with coping saw
4. Remove saw marks from edges with file
5. Sand the edges smooth
6. Polish all edges by buffing
7. Heat and form body of tray
8. Cement sides in place
9. Fill out work sheet and turn in for evaluation

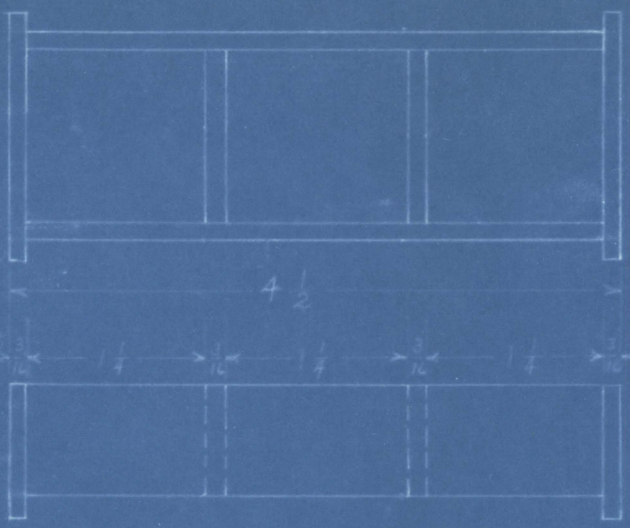
Test of Workmanship:

1. Are all tool marks removed? Yes( ) No( )
2. Are sides perpendicular to the body? Yes( ) No( )
3. Is the body formed smoothly and evenly? Yes( ) No( )
4. Do the sides fit flush to the body? Yes( ) No( )
5. What would you do the improve your project? _____

_____

STAMP TRAY

Color of material may be selected from available materials.



Bill of Material:

Name of Part	Kind of Material	Quantity	Finished Dimensions
Body	Acrylic plastic	1	1/8" x 2 3/8" x 4 1/8"
Ends	Acrylic plastic	2	3/16" x 1 3/8" x 3/4"
Dividers	Acrylic plastic	2	3/16" x 1" x 1"

Steps of Procedure:

1. Select appropriate stock
2. Trace patterns onto paper backing
3. Cut around outlines with coping saw
4. File edges to shape and smooth
5. Sand edges to remove file marks
6. Remove scratches by buffing
7. Remove paper backing from body
8. Heat and form body
9. Remove paper backing from ends and dividers
10. Cement ends to body
11. Cement dividers into place
12. Fill out work sheet and turn in for evaluation

Test of Workmanship:

1. Are all scratches removed from edges and surfaces? Yes( ) No( )
2. Is the body formed smoothly and evenly? Yes( ) No( )
3. Do the dividers fit into the body flush? Yes( ) No( )
4. Do the ends rest evenly on a surface? Yes( ) No( )
5. What would you do to improve your project? _____

_____

SUGGESTED VISUAL AIDS

Effective teaching in the school shop depends not only on tools, materials, and instruction by the teacher. Visual aids such as charts, booklets, bulletins, and displays are valuable in making related information permanent and practical for the student. Through the use of selected visual materials we can stimulate the interest of the students to a higher degree and provide experiences not easily obtained in any other way. Listed below are sources and examples of visual aids that will aid the student in working with plastic to gain some understandings:

Companies and Corporation Providing Free Visual Aids

Cadillac Plastic Company
651 West Baltimore
Kansas City 15, Kansas

Cope Plastics, D. W.
9833 Highway 99
St. Louis 21, Missouri

Dixon, Incorporated, William
32-42 East Kinney Street
Newark 1, New Jersey

Dupont de Nemours and Company, E. I.
Wilmington, Delaware

Plastic Products Company of Utah
371 South Main, P.O. Box 1415
Salt Lake City 11, Utah

Van Horn Plastics
1905 Ingersoll
Des Moines, Iowa

[redacted]

[redacted]

[redacted]

On the preceding page is shown a drawing of a proposed visual aid showing the various colors and types of plastics available. This aid is designed to accomodate approximately twenty five samples of plastic. The construction can be altered to display any desired number of samples. The front panel has cut out windows to allow viewing of the samples. It is also removable to allow the instructor to change the panels of plastic relatively easyily.

Samples for the display were obtained from the following companies:

Peterson Brothers
3832-34 North Southport Avenue
Chicago 13, Illinois

Plastic Parts and Sales
1157 South Kingshighway
St. Louis 10, Missouri

In addition to the samples, literature on various types of plastics and catalogs of the companies were obtained.

The panel is constructed to either hang on a wall or be displayed on a table. The frame and panels are to be made of wood to give permancy to the panel.

SOURCES OF FILMS AND FILMSTRIPS

The instructor should contact the nearest audio-visual center for his school or obtain a catalog of films to aid him in securing films or filmstrips for use in teaching. In addition to the school audio-visual center the following sources of films and filmstrips may be contacted for additional or different materials:

Bakelite Company
300 Madison Avenue
New York 17, New York

Dupont de Nemours and Company, E. I.
Wilmington, Delaware

Monsanto Chemical Company
Plastics Division
Springfield 2, Massachusetts

Rhom and Haas Company
Washington Square
Philadelphia 5, Pennsylvania

SELECTED BIBLIOGRAPHY

1. Cherry, Raymond, General Plastics, McKnight & McKnight Company, Bloomington, Illinois, 1948.

2. Groneman, Chris H., General Shop, McGraw Hill Book Company, Inc., New York, New York, 1954.

3. Groneman, Chris H., Plastics Made Practical, Bruce Publishing Company, Milwaukee, Wisconsin, 1948.

4. Newkirk, Louis V., General Shop For Everyone, D. C. Heath and Company, Chicago, Illinois, 1952.

5. Newkirk, Louis V., Hewitt, C., and Zutter, L., Adventures With Plastics, D. C. Heath Company, Boston, Masschusetts, 1947.

LEATHER CRAFT

Introduction

When primitive man learned to tie a hard piece of skin around his feet to protect them from stones and thorns, he increased his hunting speed; when he learned to put water in skin bags, he increased his traveling range and freed himself from the necessity of returning to rivers and springs for longer periods of time; and when he learned to hide behind a tough piece of skin, he became a better warrior, more often victorious. Thus one sees the early advantages in the utilization of skins and hides for protection and clothing.

As the knowledge of leather usage increased, tribes made tents, beds, carpets, armor, harness, and shoes out of it. It was also employed for bowstrings, shields, fastening for arrow heads on shafts, and ornaments. Later, canoelike boats were built, and drums of leather were used as means of communication.

Articles of leather thirty-three centuries old have been found in Egypt, where it was classed with gold and ivory in value. The Eygptians, during Biblical times, used leather for sandals, but, since these were vary rare and expensive, only the Pharaohs wore them.

The beginnings of recorded history were found on skin rolls which existed in 15CC B. C., and through the years manuscripts written on such parchment have been preserved.

Romans, in the time of Caesar, made wide use of leather,

since their methods of tanning were developed to a relatively high degree. They made common use of leather sandals, and, as indication of high rank, a shoe called the "calceus" was worn. The Roman senator of this period wore the high, black calceus laced down the front, while the noble-blooded patricians wore red shoes.

The Roman soldiers wore leather caps as part of their regular equipment.

Marco Polo, the famous world traveler from Venice, returned from China during the thirteenth century and reported that the great war lord, Kublai Khan, lived in leather tents lined with ermine fur. The Chinese of this period also used flexible tanned leather, highly colored and decorated, for bed coverings and dress.

Clothing worn during the fourteenth and fifteenth centuries consisted chiefly of leather doublets and hose, and shoes in fanciful shapes. It was in this period also that bookmaking became a highly developed art, and books were bound with handsomely tooled leather. Likewise, during this period the guilds, which were the forerunners of the modern trade unions, were formed. These professional groups exerted a powerful influence on the leather industry. They controlled apprentice training because the masters, who were the craftsmen, selected the boys to be trained in this skill.

Leather played an increasingly important part in the life of

the early colonial settlers of America. It was used for leather stockings, knee breeches, jackets, and coats. It was also used for square-toed shoes, saddles, upholstery for chairs, and to take the place of springs in the early coaches.

In this modern time, manufacturers often use exotic designs in their products which are made possible by the use of such leathers as those obtained from snakes, lizards, sharks, and alligators in the making of shoes, luggage, belts, and handbags.

Preparing the Leather

There are two types of treatment that skins and hides undergo before they become leather: 1) curing or dressing and 2) tanning. Curing or dressing hides and skins is the lengthy perliminary process in which the skins are prepared for tanning by the removal of all flesh, hair, and foreign particles that could cause the skin to decay before tanning takes place. Curing preserves the skins until they can be tanned.

Tanning is the process by which the cured hides and skins are converted into durable and lasting leather through the medium of either vegetable or mineral agents, often referred to as vegetable or "chrome" tanning agents.

Modern methods of preparation for tanning are basically the same as those used by the early settlers. Modern machines and the use of chemicals have been added to increase the effectiveness and speed of processing the leather.

The preparatory steps in dressing the hides and skins are

alike regardless of whether the leather is to be tanned by the use of vegetable or chrome salts.

When the hides and skins are received in a tannery they are immediately placed in cold storage until ready for treatment. The first step in preparing skins and hides for tanning is to wash and clean them until they are soft and free of most of the foreign matter. It is often necessary to use chemicals to expediate this operation. The hides are placed in soaking pits where the chemicals soften dry hides and skins and make it easier to remove the foreign particles.

The soft, flexible stock is now passed through a fleshing machine, which has revolving knives that cut away undesirable foreign matter such as fat and surplus flesh.

Hides and skins now receive further chemical treatment in which hair must be removed. This is accomplished by submerging them in a solution of lime and sodium sulphite. This treatment requires approximately one week.

When the skins and hides have been removed from the solution they go through an unhairing process by machine which is similar to the fleshing operation except that it is more thorough. After the skins and hides leave the machine they are stretched over beams and final traces of hair and epidermis are removed by hand.

Skins must now be treated to a softened condition before they can be tanned. This is carried out in a pickling process, which is a further treatment by chemicals. However, the skins are now too pliable, being very similar to cloth, and they must be worked

further in a solution containing sulphuric acid, salt, and water, after which the stock takes on the feel of leather.

These steps complete the essential cleaning and dressing preparation prior to actual tanning.

Chrome Tanning

Chrome-tanning leather is usually used in shoe uppers, gloves, and garments. It is a speedy process by which the dressed skins can be converted into leather in a day's time.

Chrome is derived from the metal chromium, converted by heat and a chemical reaction into bichromate of soda. The crystals thus formed, when treated with suphuric acid and glucose, make a green solution or liquor which is used in chrome tanning.

The dressed skins and hides are put into tanning drums containing the chrome solution. When they emerge they are a light bluish color which must be removed by the application of baking soda.

Shaving the skins and hides is the next step. This is done by inserting them between spiral cutting knives on a shaving machine. This process reduces the skins and hides to a rather uniform thickness.

In the event that the leather is to be colored, at this point it is sent to the dyeing department. The coloring process and the subsequent oiling cause the stock to emerge very wrinkled; therefore the skins are tacked on frames so they will dry smoothly.

Vegetable Tanning

Vegetable-tanned leathers are used mostly for tooling, stamping-belt material, luggage, upholstery, harness, and shoe soles. This process requires a much longer period of time than does chrome tanning. It usually takes from two to six months.

Tannin, the agent used in this process, is extracted by a method known as leaching (similar to brewing coffee), from certain barks, nuts, and leaves. It is then diluted to the desired strength in hot water.

Skins and hides, which have been prepared for tanning in a similar process to that for chrome tanning, are hung on frames which move back and forth through a solution of tannin liquor. This circulates the solution so that the treatment and coloring of the skins will be uniform. They are put through a series of such vats, in each of which the solution is increased in strength, until the skins are thoroughly saturated. It usually requires from two to three weeks for the hides to swell properly and become ready for the next treatment.

They are now removed from the frames and placed in lay-away vats. A layer of skins and hides is covered with ground bark, to which the tannic acid solution is added. This operation is repeated from four to seven times, requiring two to six months to secure the desired quality of leather.

The leather is then taken from the vats and put into another vat filled with hot water, where the excess tanning liquid, sediment, and bark are washed away. The leather is further cleaned

in a scrubber to remove all final traces of undesired matter.

Leather becomes very dry after this treatment and must be given flexibility and life by rubbing it with a natural oil, such as cod oil, a very good lubricant for this purpose. It is then hung in a dark, well-ventilated, humid, drying loft where it dries to the right texture. Skins and hides are now ready to move through the finishing process.

Finishing of Leathers

Various textures in leather are obtained by glazing, buffing, and graining.

A glazed finish is produced from the friction which results when a glass cylinder rubs over the leather to produce a highly polished, glazed surface.

A buffed finish is usually produced by hand. This is accomplished by rubbing two pieces of leather together, with the grain sides facing, forward and backward, crossing and recrossing, until the desired effect is produced. Fancy grains are often made by spraying the leathers with various colored solutions. Each of these operations requires expert hand manipulation of each skin to produce the desired product.

Sources and Kinds of Craft Leather

The craftsman may use a wide variety of leather in his work today. These different leathers come in almost any color desired. Many have been embossed so that the grain will imitate other and more expensive leathers. A brief description of the most common

leathers and their sources used in craft work will be given on the following pages:

1. Alligator: Genuine alligator comes in several different shades of brown and mahogany. It may be used for billfolds and handbags, but it cannot be tooled. Skins may range up to 14 1/2" wide and 6C" long. Most alligator skins are imported from Mexico, Central South America, the Philippine Islands, and Africa. However a few are found in the bayous of Florida and Louisiana.

2. Calfskin: This is an ideal tooling leather for billfolds, ladies' purses, etc. It comes in all colors. The size of the skins will range from 1C to 14 square feet. The largest portion of calfskins used in the United States is obtained in the United States, but some calfskins are imported from Canada, Mexico, and Argentina.

3. Cowhide: This leather may be tooled if it is not embossed. It is ideal for belts and projects that must withstand hard wear. The size of hides may range from 2C to 25 square feet. They are obtained from the same sources as calfskins.

4. Lambskin: This leather comes in the form of suede or many different embossed grains, such as alligator, ostrich, and fancy designs. It is used for linings, purses, and belts. The skins may vary in size from 7 to 9 square feet. These skins are obtained from every important country except Japan. About half are produced in the United States.

5. Lizard: Genuine lizard may be had in all colors. It is not toolable and is used for billfolds and purses. The skins

are small, ranging in size from 9" to 17" long. Lizard skins are obtained almost exclusively from Africa.

6. Morocco: Genuine Morocco goatskin may be obtained in most colors. It is used for billfolds, linings, book bindings, etc. Skins may vary from 7 to 1C square feet. Morocco grain may be embossed onto other leathers. These skins are obtained from Central Africa.

7. Ostrich: Genuine ostrich is expensive, but it works beautifully into billfolds, purses, and book covers. It comes in russet, brown, and black. The skins range in size from 1C to 14 square feet. Ostrich skins are imported from South Africa.

8. Pigskin: Genuine pigskin may be tooled, but this is not advisable. It comes in either natural or black. It may be used for letter cases or purses. The skins range in size from 12 to 2C square feet. Pigskins are generally imported from Europe because pigs slaughtered in this country are not skinned.

9. Elkhide: It is used for moccasins and belts. It generally comes in only natural and brown. The hides may vary in size from 18 to 22 square feet. Most of the Elkhides come from Canada.

1C. Sheepskin: The leather made from sheep skins comes in the form of suedes, many different embossed grains, and tooling sheepskin. Tooling sheepskin does not tool as well as calfskin, but the cost is less than half. It can be used for suede purses, linings, bookmarks, and book covers. It may be obtained in all colors. The size of the skins may range from 7 to 9 square feet.

Sheepskin like lambskin, is obtained from almost every important country in the world except Japan.

11. Skiver: This is a thin split of leather which is generally used for linings. It is available in all colors and comes in sheepskin, calfskin, and cowhide. Skins may vary in size from 6 to 12 square feet.

12. Steerhide: This is the best tooling leather next to calfskin. It may be used in making all projects. It comes in natural or two-tone colors and in different weights. The size of the hides may vary from 20 to 28 square feet. Steerhides are obtained primarily in the United States.

13. Suedes: They have many uses and come in all colors. Most suedes are made from sheepskin or calfskin. The skins will average from 7 to 9 feet.

Dyes and Stains

The leather manufacturer colors the skins and hides with wood dyes or coal tar dyes. However, the individual craftsman may desire to color his own projects or at least part of the design which he has tooled. Materials such as water dyes, oil stains, spirit dyes, Higgins' waterproof drawing inks, and acids, salts, and oxides are available commercially and will produce the desired results.

AREAS OF PUPIL DEVELOPMENT

It is the purpose of this section to make some suggestions as to the content for a unit in leather craft and to offer some suggestions for organization of the content.

Specific Areas of Pupil Development

A. To develop some measure of skill in the manipulation of the tools and materials used in leather craft.

B. To gain some understandings concerning information basic to leather craft.

C. To develop in each individual desirable habits, traits, and attitudes.

D. To develop some appreciation relative to design, craftsmanship, and more specifically, products made of leather.

E. To develop an interest and some understanding concerning individual and group health and safety in the use of leather working tools and materials.

Areas of Instruction

A. Manipulative Area

I. Planning
- a. Read a working drawing
- b. Make a bill of materials
- c. Select an appropriate undertaking
- d. Select the material necessary to do the job
- e. Calculate the cost of the job
- f. Estimate the time required to complete the job

II. Layout
- a. Take a measurement with a rule
- b. Layoff measurements with a rule
- c. Layout a pattern on stock
- d. Prepare and use templates
- e. Layout diameters and radii
- f. Layout angles

III. Cutting Tools
- a. Cut leather with a draw-guage knife

b. Cut leather with a straight knife
c. Trim edges with a skiver

IV. Tooling and Carving
a. Prepare leather to be tooled
b. Tool leather with a modeling tool
c. Carve leather with a swivel knife
d. Bevel leather with a beveler
e. Shade and camouflage with proper tools
f. Decorate with veiner and seeder
g. Fill out background with background tool
h. Make decorative cuts with swivel knife

V. Lacing Edges
a. Estimate amount of lacing necessary and cut
b. Apply cement to leather
c. Punch holes for lacing with a punch or thonging chisel
d. Select and complete desired type of lacing

VI. Fastening Methods
a. Fasten using snap-buttons
b. Fasten using setting eyelets
c. Fasten using rivets
d. Fasten using the three hole method
e. Fasten by hand sewing

VII. Shaping Leather
a. Form a round strap handle
b. Form a loop
c. Fold heavy leather
d. Crease an edge using a creasing tool

VIII. Finishing
a. Clean and bleach with oxalic acid
b. Apply dye or dressing to edges
c. Dye surface using dye
d. Finish using wax
e. Finish using lacquer
f. Finish with neat-lac

B. Information Area

I. Planning
a. The importance of drawing and planning in leather craft
b. The meaning of lines and symbols found on drawings and plans
c. Methods of analyzing jobs, planning procedures, making bills of materials, and computing costs from plans, drawings, and price lists.

II. Layout
   a. Layout tools used in leather craft
   b. Factors concerning the selection, cost, and care of layout tools

III. Cutting Tools
   a. Cutting tools used in leather craft
   b. Factors concerning the selection, cost, and care of cutting tools

IV. Tooling and Carving Tools
   a. Tooling and carving tools used in leather craft
   b. Factors concerning the selection, cost, and care of tooling and carving tools

V. Lacing
   a. Cements used on leather
   b. Factors concerning the selection, cost, and uses of leather cements
   c. Punching tools used in leather craft
   d. Factors concerning the selection, cost, and care of punching tools
   e. Various types of lacing commonly used in leather craft

VI. Fastening Methods
   a. Various devices used to fasten leather
   b. Factors concerning the selection, cost, and uses of fastening devices

VII. Shaping Tools
   a. Tools used to form leather into various shapes
   b. Factors concerning the selection, cost, and care of tools used to form leather

VIII. Finishing
   a. Finishing materials used on leather
   b. Factors concerning the selection, cost, and use of finishing materials used on leather

C. Personality Area

Throughout the course the instructor will call to the attention of the pupils the desirable habits, traits, and attitudes commonly accepted in our society. These attributes should be taught daily concurrently with the other areas of instruction. Listed below are some practices that can be carried out to help impart desirable habits, traits, and attitudes:

I. Development of a student personnel system
II. Encouragement of group activities when desirable
III. Assignment of reports to be worked out by groups

D. Appreciation Area

I. Basic rules of good design
II. Factors to be considered in purchasing products involving the use of leather
III. Test of workmanship for evaluation of finished projects made in the school shop
IV. Through field trips, movies, and during daily classes the instructor can do much to increase the individual pupils appreciation of good design and craftsmanship

E. Health and Safety

Throughout the course the instructor will call to the attention of the pupils the principles of cleanliness, adequate ventilation, sufficient light, proper methods of waste disposal, and proper toilet habits to the end that each pupil can live a healthy life. Throughout the course the instructor will seize every opportunity to emphasize the proper and safe use of tools and materials.

F. Modifying Factors

The extent to which any or all of the activities listed above can be undertaken will depend upon the local situation governed by the following:

I. Experience, training, ingenuity, energy, and skill of the instructor
II. Facilities available in terms of tools, equipment, and supplies.
III. Capabilities and interests of the pupils

SELECTED PROJECTS

Projects, from the student's point of view, are things to be made in the school shop. From the teacher's point of view, they are means to ends; they are the most important device at hid command for teaching manipulative content.

Projects should provide for four types of activity on the part of the student: (1) purposing, (2) planning, (3) execution, and (4) judging or evaluation. That is, the student should either propose his own project or accept one assigned by the instructor as worthwhile; he should plan the project thoroughly himself or follow a well-made plan prepared for him; he should see the project through from start to finish, doing the various operations himself; and when the job is complete, he should evaluate his own work, with the view of taking stock of what he has learned and determining where improvements may be made in his procedures and workmanship.

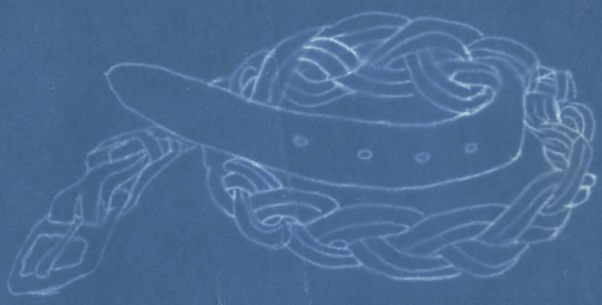
Besides providing the four types of student activity outlined above, projects should conform to these criteria of project selection: (1) they should include some of the things taught in the course, perhaps a small number of units in the first projects and larger numbers of units in the later projects as the student progresses; (2) they should interest and challenge the student, and yet be within his range of ability; (3) they should be well designed and, if possible, have a practical use when completed that will suit the student; (4) they should be

suited to school shop conditions such as tools and materials available, and cost; (5) they should be of such a nature that the student can complete them in a reasonable length of time and should lead him on to other worthwhile projects.

On the following pages will be found a series of projects that have been organized as instructional sheets. These are presented in this form to serve two purposes, first, to provide certain projects that meet established criteria and second, to point out one method of organizing project material for presentation to the students.

Note: In the event that kit materials are not used the leather and other materials will be obtained from the instructor.

BRAIDED BELT



Bill of Materials:

Kits containing all materials will be used.

Steps of Procedure:

1.	Fasten tongue of belt to a convenient working surface	( )
2.	Braid belt to desired length	( )
3.	Skive ends of unfinished surfaces of remaining strands	( )
4.	Locate and punch holes in buckle strap to receive buckle	( )
5.	Cement braided section to buckle strap	( )
6.	Crease edges of belt loop	( )
7.	Skive ends of belt loop	( )
8.	Fasten belt loops together with eyelet	( )
9.	Insert buckle and slip belt loop over the strap end	( )
10.	Press buckle strap over braided section firmly	( )
11.	Lace buckle strap to braided section	( )
12.	Mark and punch holes in tongue of belt	( )
13.	Crease edges of tongue	( )
14.	Clean and finish as desired	( )

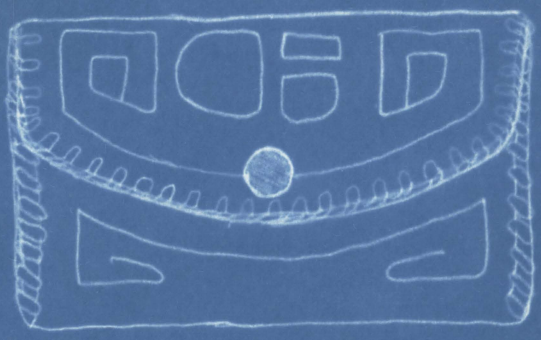
Test of Workmanship:

1.	Is the braid correctly completely?	Yes( ) No( )
2.	Is the buckle and belt loop located and fastened correctly?	Yes( ) No( )
3.	Are all edges creased?	Yes( ) No( )
4.	Is the belt the desired length?	Yes( ) No( )
5.	What would you do to improve this project? _____	

_____

Note: In the event that kit materials are not used templates for cutting and tooling will be obtained from the instructor.

COIN PURSE



Design to be choosen by the student.

Bill of Materials:

Kits containing all materials will be used.

Steps of Procedure:

1.	Prepare leather for tooling	( )
2.	Trace design with a modeling tool	( )
3.	Carve design with a swivel knife	( )
4.	Bevel design with a beveler	( )
5.	Shade and camouflage design with the proper tools	( )
6.	Decorate design with veiner or seeder tool	( )
7.	Fill out background with background tool	( )
8.	Make decorative cuts with swivel knife	( )
9.	Cement edges together	( )
10.	Punch holes for lacing using either thonging chisel or leather punch	( )
11.	Lace edges	( )
12.	Locate and punch holes for the snap-button assembly	( )
13.	Insert and fasten snap-button assembly	( )
14.	Clean and finish purse as desired	( )

Test of Workmanship:

1.	Is the tooling and carving done neatly and with even depressions?	Yes( ) No( )
2.	Are the edges laced neatly and evenly?	Yes( ) No( )
3.	Is the snap-button assembly located properly?	Yes( ) No( )
4.	What would you do to improve your project? _____	

_____

SMALL PURSE

Note: In the event that kit materials are not used templates for cutting and tooling will be obtained from the instructor.

Bill of Materials:

Kits containing all materials will be used.

Steps of Procedure:

1. Prepare leather for tooling ( )
2. Trace design with a modeling tool ( )
3. Carve design with a swivel knife ( )
4. Bevel design with a beveler ( )
5. Shade and camouflage design with the proper tools ( )
6. Decorate design with veiner or seeder tool ( )
7. Fill out background with background tool ( )
8. Make decorative cuts with swivel knife ( )
9. Sew zipper into gusset ( )
10. Cement gusset into place ( )
11. Punch holes for lacing using either thonging chisel or leather punch ( )
12. Lace edges ( )
13. Locate and punch holes for fastening loop handle ( )
14. Fasten loop handle into place using rivet ( )
15. Clean and finish purse as desired ( )

Test of Workmanship:

1. Is the tooling and carving done neatly and with even depression? Yes( ) No( )
2. Are the edges laced neatly and evenly? Yes( ) No( )
3. Is the zipperly properly installed? Yes( ) No( )
4. Is the handle located and fastened properly? Yes( ) No( )
5. What would you do to improve your project? _____

_____

SUGGESTED VISUAL AIDS

Effective teaching in the school shop depends not only upon tools, materials, and instruction by the teacher. Visual aids such as chart, booklets, bulletins, and displays are valuable in making related information permanent and practical for the student. Through the use of selected visual materials we can stimulate the interest of the students to a higher degree and provide experiences not easily obtained in any other way. Listed below are sourced and examples of visual aids that will aid the student in working with leather to gain some understandings:

Companies and Corporations Providing Free Visual Aids

Longhorn Company, The
P. O. Box 6566
Dallas, Texas

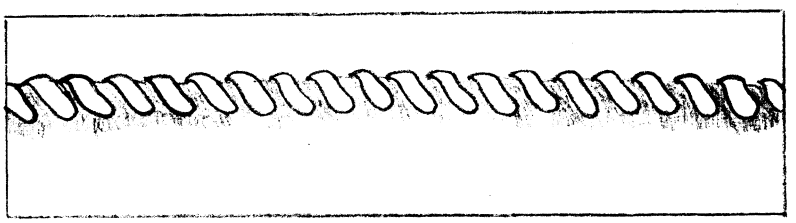
Ohio Leather Company, The
Girard, Ohio

Osborn Brothers Supply Company, Inc,
223 Jackson Boulevard
Chicago, Illinois

Tandy Leather Company
Fort Worth, Texas

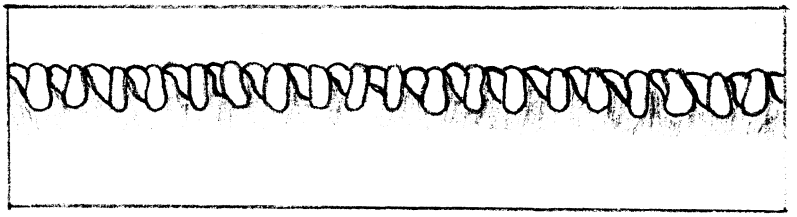
Tanners Council of America
411 Fifth Avenue
New York 15, New York

FOUR TYPES OF WHIP STITCH



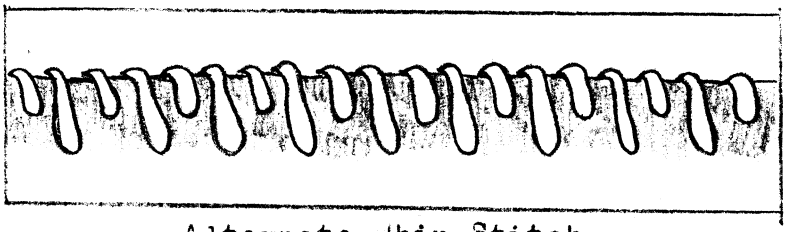
Single Whip Stitch

Requires three time the distance to be laced.



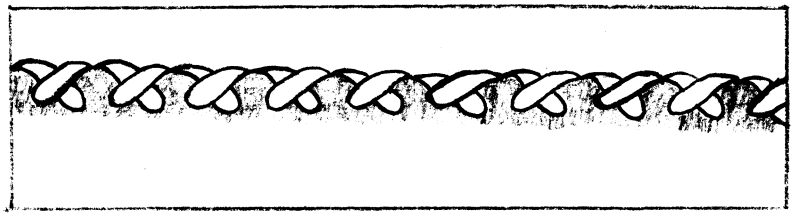
Double Whip Stitch

Requires six times the distance to be laced.



Alternate Whip Stitch

Requires four times the distance to be laced.

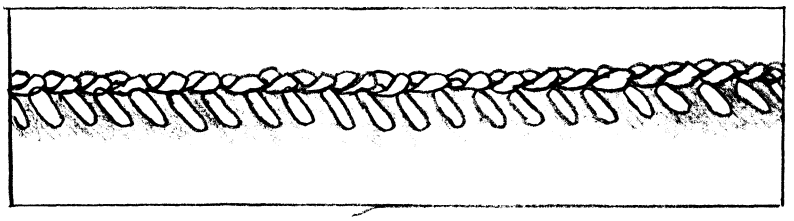


Cross Whip Stitch

Requires six times the distance to be laced.

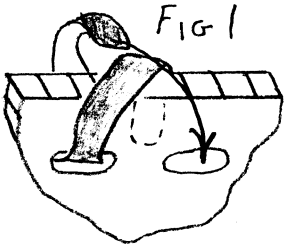
Drawings adapted from Lacing From Start to Finish by G. and J. Sitkin.

Double Cordovan Stitch



Sketch of Finished Lacing

Figure 1 shows how to start lacing. Arrow shows where to continue with the working end of the lacing.



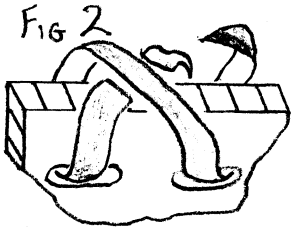
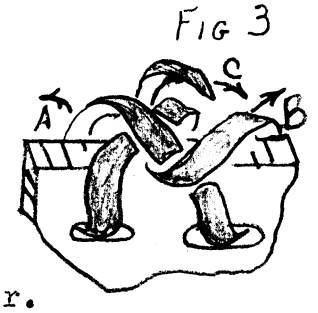


Figure 2 shows how to bring the working end of the lacing through the hole and cross it over to form the x.

Figure 3 shows how to bring the working end over and then under the center of the x. To tighten the first stitch pull the strands tight starting with A. Pull in the direction shown. Then continue with B and C in the same manner.



Drawings adapted from Lacing From Start to Finish by G. and J. Sitkin.

SOURCES OF FILMS AND FILMSTRIPS

The instructor should contact the nearest audio-visual center for his school or obtain a catalog of films from the center to aid in securing films or filmstrips for use in teaching. In addition to the school audio-visual center the following sources of films and filmstrips may be contacted for additional or different materials:

Ohio Leather Company, The
Girard, Ohio

Tanners Council of America
411 Fifth Avenue
New York 15, New York

SELECTED BIBLIOGRAPHY

1. Cherry, Raymond, General Leathercraft, McKnight & McKnight, Bloomington, Illinois, 1940.

2. Groneman, Chris H., Applied Leathercraft, Manual Arts Press, Peoria, Illinois, 1942.

3. Groneman, Chris H., Leather Tooling and Carving, International Textbook Company, Scranton, Pennsylvania, 1950.

4. Johnson, William H., Leathercraft, The Webb Publishing Co., Saint Paul, Minnesota, 1945.

5. Smith, Frederick R., Practical Leatherwork, Pitman & Sons, Ltd., New York, 1937.

RECOMMENDATIONS

From time to time while compiling the course guide, some useful information which did not seem to fit into any particular section came to my attention. Since much of this information would have a direct bearing upon the teaching of the content suggested, it was decided to include it in this section.

Criteria For Selection and Use of Visual Aids

In the visual aid section of each subject matter unit suggestions were made as to visual aid sources and teacher-made aids which might be used if the instructor is constructing his own. Listed below are ten points which should be considered before selecting, using, or constructing any visual aid:

1. Location -- Is the device located where it may be most effectively used?
2. Size -- Is the size such that the device is effective and practical?
3. Purpose -- Does the device satisfy the need?
4. Simplicity -- Is it the simplest device to satisfy the purpose?
5. Time -- Is the device used at the time needed and only at that time?
6. Durability -- Will the device last with a reasonable amount of care?
7. Modernity-- Is the device up to date?
8. Effectiveness -- Does the device accomplish it's purpose?
9. Cost -- Do the results justify the cost of the device?
10. Interest -- Does the device stimulate and hold attention?

If the above criteria are checked against each visual aid I am sure that only the most adequate and appropriate aids will be choosen and, it is hoped, used with the desired results.

Sources of Audio-Visual Aids For Safety, Health, and Desirable Habits, Traits, and Attitudes

In each subject matter unit the teaching of health and safety, and desirable habits, traits, and attitudes was mentioned. Some suggestions were given to facilitate integrating that information into the content program, but the teacher must be ever conscious of his responsibility to teach this material and it should command his daily attention. Listed below are some sources of films, filmstrips, and visual aids which will be of value to the instructor for the presentation of this information:

Affiliated Aentna Life Companies
Hartford 15, Connecticutt

Association of Casualty and Surety Companies
Accident Prevention Department
6C John Street
New York 38, New York

Bristol-Myers Products Division
Bristol-Myers Company
45 Rockefeller Plaza
New York 2C, New York

Division of Documents
Bureau of Publications
Harrisburg, Pennsylvania

Employers Mutual Fire Insurance Company
Home Office
Wausau, Wisconsin

Underwriter's Laboratories, Inc.
Chicago 11, Illinois

Organization of the Shop

The acceptance of the general shop organization of Industrial Arts laboratory on the Junior High level is wide spread in school systems today. Industrial Arts at this level is primarily concerned with exploratory experiences. The nature of exploratory experiences has contributed to the development of the general shop organization.

Of the various general shop organizations, the two that follow seem most appropriate. The limited general shop is built around one type of material such as wood, metal, or plastic, hence the students work in only one area at a given time. The comprehensive shop combines activities of various materials, such as wood, metal, leather, and electricity. The activities are unrelated, and not built around any one kind of material as they are in the limited general shop. This type of shop is recommended and has become very popular for the small community school where there is need for only one or two shops. At the lower levels this type of shop has proven very valuable for giving exploratory experiences. (1)

The type of shop or the number of activities to be offered in a shop depends upon several factors. Some of these are 1) the needs of the students in the community; 2) range of subject matter teachable with the staff and equipment; 3) the number of different shops or drafting rooms in the school;

(1) Silvius, Harold G., & Curry, Estell H., Teaching Multiple Activities in Industrial Education, McKnight & McKnight Publishing Co., Bloomington, Illinois, 1956, pp. 47-52.

4) the size of the community; 5) money available for the program; 6) occupations of the community; 7) avocational interests in the community; 8) the number, grade, and age of students scheduled for industrial arts; and 9) materials available in the community. A community survey will be instrumental in deciding upon all of the above factors. After all of these factors have been considered we should evaluate the results, keeping in mind what we hope to accomplish in the shop. (2)

For the purpose of this paper it is assumed that the exploratory experiences are important and the comprehensive general shop will be used.

The number of activities that may be presented at any one time depends upon the number and ability of the students, the size of the shop, and the organization and administrative ability of the instructor. To teach one major activity at a time is less complicated than several activities. To teach four major activities successfully at one time requires the services of a master teacher. It is recommended by the State Department of Illinois that only two activities be offered concurrently. (3)

In selecting activities to be taught together it is wise to keep in mind that some shop activities do not function well together. The layout of the shop will effect the type of activities that can be carried on simoultaniously. For instance an activity which is dirty, or causes messy conditions should

(2) Silvius & Curry, Teaching Multiple Activities, pp. 47-52.
(3) Ibid., pp. 47-52.

not be carried on where drafting or planning is to be carried on later. The availability of work stations in the shop will eliminate certain activities being taught concurrently.

Leather Craft

In the leather craft work at the junior high level and in a non-vocational situation, it is recommended that kits be utilized for project work. The expense of stocking the various types of leather needed and the waste of cutting is a tremendous expenditure. The money saved in the use of kit projects can be used to supplement other areas.

The leather craft project drawings have a feature that the other areas do not employ. After the steps of procedure an appropriate space for checking after that step is completed is provided. This could be carried on as an experiment to see if it improved the work or increased the logical thinking of the students.