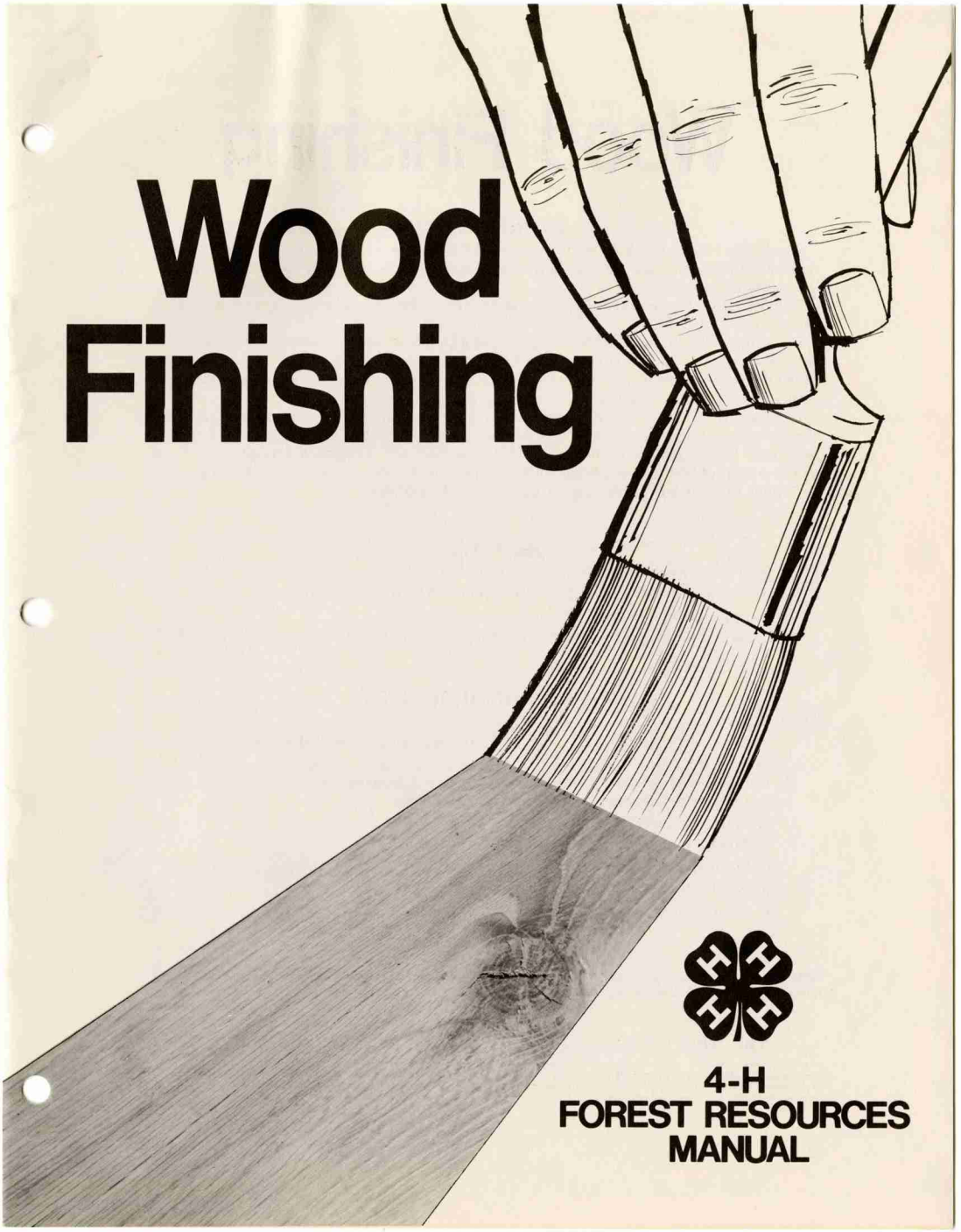
Wood Finishing



4-H
FOREST RESOURCES
MANUAL

Wood Finishing

INTRODUCTION

Would you like to finish or refinish a piece of furniture or a craft item? If you take the time and effort to prepare your wood, you will want to make sure that the final appearance is just what you wanted.

But often, the color, quality of finish or gloss turns out to be somewhat different from what you wanted.

Finishing woods in various ways can become a delightful and rewarding experience. You can use a variety of different colors and finishing systems to express individual creativity. This advanced woodworking project provides opportunities for you to use your ideas for developing individual schemes.

In order to achieve a finished appearance which closely meets your expectations, you should experiment with several finishing schemes applied to different panels of matching woods before doing the final work. In this project you will finish several small wood panels using a variety of materials and schemes. The methods learned in this project can be applied to other 4-H projects, such as crafts and home furnishings.

OBJECTIVES

1. To learn proper procedures in preparation of wood surfaces.
2. To become acquainted with different types of wood-finishing materials.
3. To learn proper application of finishing materials.
4. To become acquainted and to gain experience with a number of finishing schemes.

PROJECT REQUIREMENTS

FIRST YEAR

1. Use the *4-H Record, 4-H R-1-8*, and add additional sheets of notebook paper as necessary.
2. Complete the processes for Panels 1 through 7 as described on pages 9-10. Keep records of the following information for each panel:
   a. Materials used.
   b. Mixing proportions.
   c. Technique of applications.
   d. Kind of wood used.
   e. Results.

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Published by
THE NORTH CAROLINA AGRICULTURAL EXTENSION SERVICE

North Carolina State University at Raleigh and the U. S. Department of Agriculture, Cooperating. State College Station, Raleigh, N. C., George Hyatt, Jr., Director. Distributed in furtherance of the Acts of Congress of May 8 and June 30, 1914.

10-71-4M 4-H M-14-12

SECOND YEAR

1. Use the *4-H Record, 4-H R-1-8*, and add additional sheets of paper as needed.
2. Complete the processes for Panels 8 through 14 as described on pages 10-12. Keep records of the following information for each panel:
   a. Materials used.
   b. Mixing proportions.
   c. Technique of applications.
   d. Kind of wood used.
   e. Results.

THIRD YEAR

1. Use the *4-H Record, 4-H R-1-8*, and add additional paper as needed.
2. Finish or refinish a piece of furniture by choosing one of the following:
   a. A scheme completed in a previous year.
   b. A new scheme of your choice.
   Note: If a new scheme is chosen, finish a panel of matching wood species prior to finishing the furniture.
3. Keep records of costs required for finishing or refinishing your furniture.

DEMONSTRATION IDEAS

1. Complete several steps of a finishing scheme at home. Apply one step on the panel during a demonstration. Explain the steps and procedures involved.
2. Exhibit several completed panels. Explain the steps in the scheme for each panel.
3. Illustrate the principle in preparing a stain, using the information as outlined in this manual.
4. Sand two panels of similar wood. Rough sand the first and fine sand the second. Apply the same oil stain mixture to each panel and explain difference in color.
5. Exhibit several finishing materials and demonstrate use of several on a variety of prepared panels.
6. Exhibit panel that has been finished similar to Panel No. 11. Remove strips of masking tape one by one during the demonstration and explain what material was used in each step and how that material was applied.

These ideas will assist you in sharing what you have learned with others. The material in this project can be very beneficial to adults as well as 4-H members.

MATERIALS

This list of materials should be helpful in completing the project:

1. Wood panels (6" x 8") as per requirements.
2. 1 brush (1"-1½") good quality natural bristle.
3. 1 brush (1"-1½") nylon bristle.
4. Clean rags.
5. Wood bleach—hydrogen peroxide or commercial bleach.
6. Rubber gloves.
7. Stain (commercially prepared or prepare own mixture—½ pt.).
8. Paint thinner (1 gal.).
9. Boiled linseed oil (1 pt.).
10. 1 tube each of the following universal tinting colors:
    a. burnt umber
    b. burnt sienna
    c. yellow ochre
11. Variety of small containers—baby food jars.
12. Several sheets of sandpaper of the following grit sizes: 100, 120, 150, 180, 200, 220, 400 and 600 wet-dry.
13. Neutral-colored wood filler (½ pt.).
14. Varnish—(clear-semi gloss) 1 pt. or less.
15. Masking tape—roll ½" width.
16. Brushing lacquer (1 pt. or less).
17. Steel wool—½ dozen pads each of 3-0 and 4-0.
18. Wood polish—small container (for example, lemon polish).

SAFETY PRECAUTIONS

Some materials that are used in this project are potentially dangerous. Safety precautions must be exercised at all times. Here are some helpful hints which you should be familiar with:

1. *Proper ventilation*—Many finishing materials give off odors and fumes that can be quite irritating, especially lacquers. Be sure the room in which you are working is properly ventilated. Do not breathe excessive fumes.
2. *Chemical irritations*—Many chemicals cause irritations to the skin. Any contact with skin or clothing must be washed off quickly. The wood bleaching agents must be used cautiously. Wear rubber gloves when using a bleach. All brushes and containers must be properly cleaned after being used.
3. *Storage of materials*—Finishing materials should be kept in tightly-closed containers. Cleaning materials, such as turpentine, mineral spirits or lacquer thinner, should not be left in open containers.
4. *Fire hazards*—Keep all materials away from open flames. Most finishing materials are flammable; the lacquers are the most dangerous.
5. *Storage of used rags*—Do not leave wet, used rags to accumulate in cans or piles; they are an extreme fire hazard. Allow the used rags to dry out thoroughly in a properly ventilated area (preferably outside).

SOME FINISHING TERMINOLOGY AND DESCRIPTIONS

1. SURFACE PREPARATION

When preparing the bare wood surface, keep in mind one *important* thing: any irregularities, scratches or other physical marks left in the surface will usually be magnified when a color and finish are applied. Even the most sophisticated and laborious finishing schemes will appear as an unattractive piece of work if the wood surface has not been given careful treatment.

A. Sanding

Proper sanding is a *must*. There are mainly two kinds of sanding: (1) the cut down or leveling of the surface to remove marks left by machining, and (2) polishing with progressively finer grit abrasives to reduce the coarser grit scratches left by the previous sanding.

Start with the coarser grits and work progressively to the finer grits. Usually a 100 to 120 grit (2/0 to 3/0) paper will be sufficient to remove marks left by a cabinet planer. Sand down to at least a 180 to 220 grit paper.

Always use a sanding motion in the direction of the wood grain whenever possible. If hand sanding, use a sanding block to insure a level surface. Round the edges of the sanding block to avoid gouging by the sharp corners.

When sanding is completed, remove all excess sanding dust and wipe clean. Hold the wood near good lighting and position so that maximum reflection is possible. This way, you can best observe the surface to check for any sanding irregularities. Keep all prepared surfaces free from contaminants, such as grease from fingers. Finishes will not adhere properly to the wood that has been contaminated. Use benzene or naphtha to remove grease spots.

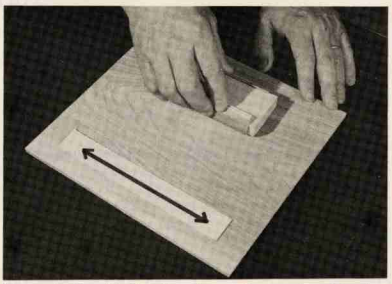


Figure 1. Sand in the direction of the wood grain using a sanding block.

B. Bleaching

The original color of the wood (for example, red mahogany) may often be undesirable.

Instead of masking or covering the undesirable color with heavy coats of wood stain, the bare wood should be bleached to a neutral color. Heavy coats of stain, especially with heavily pigmented wiping stains, will make the wood appear as though it had been painted, and mask the grain you are really trying to preserve.

Several wood bleaches are available commercially. Many are packaged in two containers. *Follow directions closely.* Wet the wood surface with the prepared bleaching agent and let dry on the surface.

Figure 2. Use rubber gloves while applying bleach to the wood surface.

Some commercial preparations require sponging with water to neutralize the surface. Oxalic acid dissolved in water at 2 to 5 percent is also another bleaching agent, especially for removing black iron stains from oak. Always use rubber gloves when bleaching.

The surface wood fibers are raised during the bleaching operation. These fibers must be sanded before proceeding to a staining operation. Use a fine grit paper (for example, 220) and sand only enough to remove the raised surface fibers.

2. STAINING

Staining is a method of adding color to wood. The material soaks into wood, but should not mask the grain. There are many different kinds and forms of wood stains. Generally, the pigmented wiping stains are a favorite with the amateur. This stain consists of finely-ground mineral pigments suspended in a *vehicle*, namely oils. Since the pigments will settle to the bottom of the container during storage, always stir well before using. Use naphtha or mineral spirits for reducing the stain, if needed.

Use a lint-free rag or clean brush when applying the stain to the wood (refer to Figure 10d, page 11). Put on a liberal amount. After being allowed to set 5 to 10 minutes, or until the surface begins to dull, wipe the excess off with a soft rag. Usually the longer the stain remains on the surface, the more is absorbed by the wood, and consequently the darker the color appears.

Figure 3. Basic materials for preparing your wood stain.

Mixing Colors

Colors of stains vary from one brand to another. For example, a "walnut" stain of one brand may be of a different shade from another brand. If you do not desire the exact color of a commercial brand, you have several alternatives: (1) Buy a prepared neutral vehicle and add Universal colors to suit your own color preference; (2) Prepare your own vehicle and add desired Universal colors, or (3) Alter the color of a commercially tinted and prepared stain by adding small amounts of desired Universal colors. The first two offer much

more flexibility, expecially when finishing small wood panels, in that you can mix several different colors or shades using only one container of vehicle.

To prepare a vehicle for pigmented wiping stains, mix the following thoroughly: 3 parts paint thinner, 1 part boiled linseed oil. These proportions are not exactly critical. The more oil added, the deeper and more lustrous the color will be, but too much oil will not allow the vehicle to dry properly and gumminess may result.

Basic wood colors or tones are: brown, red and yellow. To achieve these colors, you need only three small tubes of Universal colors: burnt umber, burnt sienna and yellow ochre. The colors must be added in small quantities to the prepared vehicle. Usually, all three of the basic colors are mixed in various proportions to achieve the natural wood tones. Apply the prepared stains in the same manner as a commercial wiping stain.

3. WASHCOAT

A washcoat is used to prevent one coloring operation, such as filling, from bleeding into the previous one, like staining. Commercial washcoats, or *sealers*, are available, such as varnish or lacquer sealer. These should not be confused with the "penetrating sealer" type of finish material. You can mix your own washcoat by diluting a top coat with the proper solvent in a ratio of about 1 to 3. Apply the washcoat or sealer with a clean brush (refer to Figure 10f, page 12).

4. FILLERS

Wood paste fillers are used to fill the grain pores of such open-grained woods as oak, mahogany, ash or walnut. Filling enables the wood to be finished with a smooth feel and look, rather than an "open-grain" look. In addition, the filler is used to emphasize wood grain. Contrasting color between stain and fillers is very common.

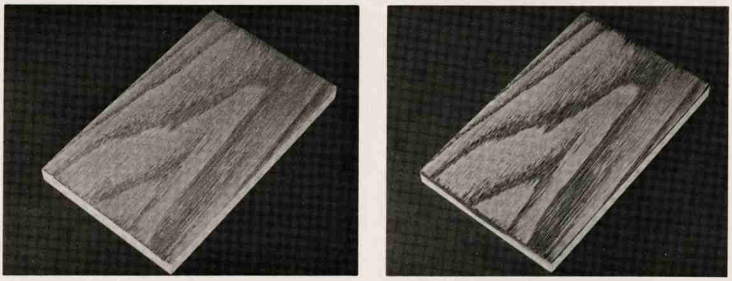


Figure 4. A filler can be used to emphasize the wood grain—(left) before applying filler, and (right) after applying filler.

Universal colors may be added to the filler in order to produce a desired color.

In applying a filler, brush a liberal amount on the surface, initially, using a movement parallel to the grain. Then use a brushing motion perpendicular to the grain to insure that all pores are entirely filled.

After the filler is applied, the solvents evaporate and leave the solid content deposited in the pores and on the wood surface. This usually takes from 10 to 20 minutes, depending upon the weather conditions. The excess filler must be wiped off. The wiping operation is very important. You should remove only the excess filler, leaving the recesses or pores of the wood filled. Wipe with a rough cloth such as terry cloth or burlap. Be sure that you wipe at the right time. If wiped too soon after the filler was applied, the filler will be removed by the action of the rag. If wiped too late, it is difficult to remove the excess filler. Watch the surface very carefully. When the filler has flattened to a dull appearance, wiping should begin. Wipe first in a rotary motion across the grain to "press" or pack the filler into the pores.

Figure 5. Applying a wood filler over the washcoat.

Figure 6 Wiping the wood filler using a rotary motion.

The excess filler should be wiped off across the grain. A final *light* wiping with a clean cloth should be done with the grain to remove any streaks. The filler should be allowed to dry before any additional work is done. Usually a 24-hour period is a good rule of thumb.

If the filling operation has not been satisfactory, repeat the application until all pores are completely filled.

5. TOP COATS

Three types of top coats will be used in the project: (1) oil-resin finish, (2) varnish, and (3) lacquer.

A. *Oil-resin Finish*

This finish, when properly applied, produces a rich, warm appeal that will not peel or crack. The material soaks into the wood. Commercial "penetrating" sealers are available. You may wish to make your own. A good formula to use is: 2 parts varnish (fast-drying alkyd type); 1 part boiled linseed oil; and 3 parts paint thinner.

Work the oil resins into the wood with a brush, rag or bare hands. As the material soaks into the wood, add more resin material until saturated. Then wipe the surface well. Do not let it become tacky. If this condition exists, rub out with mineral spirits. Let the resins dry for at least 24 hours. Then apply a second (and third) coat. Rub down at once upon application with a soft pad or leather strip. Extensive rubbing will be required.

The oil-resin finish may be applied over a stain or stain-filler, but not over a washcoat. Coloring pigments mix well in the oil-resins. You can apply a color to the wood in the step when applying the oil-resin. The coloring coat should be the first step; always use a clear coat for the last step.

B. *Varnish*

Many kinds of varnish materials are available. Some varnishes are made to produce a "high-gloss", while others resemble a "satin" or rubbed effect. You may wish to try both.

The varnish should be brushed on with a fine bristled brush. Care must be exercised to reduce the number of bubbles. These may be reduced by using a clean brush on a clean surface. Sand lightly (using 320 grit) between coats, especially if bubbles or contaminants exist.

C. *Lacquer*

Lacquers dry more rapidly than varnishes. The material should never be mixed with a varnish system, since the materials will not mix. Lacquers are generally sprayed commercially; however, slow-drying (15 to 20 minutes) lacquers are avail-

able. This will allow the use of a brush. Lacquers should be "flowed" on rather than brushed, as in painting. Do not go over areas, if it can be avoided, when the material is wet. Apply several coats to the samples.

Figure 7. "Flowing" the brushing lacquer on the wood sample panel.

Figure 8. Rubbing the finished surface using wet/dry sandpaper and water. Note the circular motion.

6. Rub and Polish

A good finishing job is not completed until the surface is rubbed and polished. Several materials can be used: (1) 4-0 steel wool, (2) 4-F pumice and a light vegetable oil, or (3) 400 or 600 wet/dry sandpaper. You can control the degree of gloss, in addition to leveling the surface, to perfect smoothness with proper rubbing. If the surface has hardened drips or small pits, start with the 400 wet/dry sandpaper. Use water as a lubricant.

On Panel Numbers 9, 10, 11 and 12 on pages 10-12, wax the surface using a liquid or paste wax.

Cleaning and Caring for Brushes

There are two essential reasons for cleaning your brush: (1) to prevent hardening of the bristles, and (2) to keep the bristles free of contaminants. ALWAYS clean your brush following the use of different finish materials and especially after you have finished for the day or completed the job. To conserve cleaning materials, wipe your wet brush on a clean rag or paper to remove excess material before submerging in the cleaning fluid. For an oil-base material, use turpentine or mineral spirits (for example, paint thinner, varsol, etc.) for the cleaning material. When using lacquers, use only lacquer thinner. Do not mix these two cleaning materials.

Two small cans of cleaning material are desirable, one for removing the bulk of the finishing material from the bristles and the other to remove the remaining finish material. Do not permit the brush to set overnight. After cleaning, dry your brush by stroking the bristles between your fingers. Store your brush in a dry place which is well protected from sander dust or other such contaminants. A brush which has been cleaned and cared for will give you longer service.

FINISHING SCHEMES

This project consists of applying several different finishing schemes to a variety of common woods. Small, flat panels (approximately 6″ x 8″) are ideal for the project. These panels may be obtained at some lumber yards, cabinet or furniture manufacturers or in Industrial Arts Departments at various schools. Hardwood plywood or solid wood may be used. Both open-grain and close-grain woods are required.

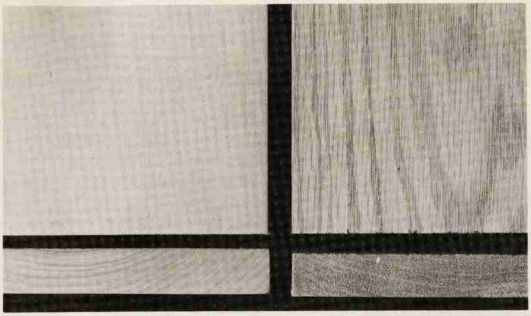


Figure 9. Illustration showing the difference between open-grain species (right) and close-grain species (left). Note that the pores on the open-grain wood (bottom, right) are clearly visible.

Here is an outline describing the schemes to be used on the project panels. The number of panels you will be required to complete for the project are outlined in the Requirements Section on pages 2-3.

Panel Nos. 1 and 2

Purposes:

1. To illustrate effect of sanding on stain penetration and degree of coloring.
2. To determine necessity for proper surface preparation.

Wood: Close-grain, light-colored (cherry, poplar, black gum, maple, birch & beech).

Procedure:

1. Sand Panel No. 1 using 100 grit paper only.
2. Sand Panel No. 2 using progressively finer grits to at least 220.
3. Apply the same colored wiping stain to both panels.
4. Compare panels after stain has dried.

Panel No. 3

Purpose:

To compare degree of coloring between open-grain and close-grain wood.

Wood: Open-grain light-colored (oak, elm, ash, hickory).

Procedure:

1. Sand and stain panel No. 3 in the same manner as panel No. 2.
2. Compare panel Nos. 2 and 3 after stain has dried.

Panel No. 4

Purpose: To compare degree of coloring between sapwood (light) and heartwood (dark).

Wood: Your choice but select a panel which contains both sap and heartwood.

Procedure:

1. Sand panel to 220 grit. (Start with coarser grit such as 100 or 120.)
2. Apply same stain as used in preceding panels.
3. Compare color between heartwood and sapwood.

Panel No. 5
Purpose: To gain experience in preparing stains and mixing colors.
Wood: Light-colored, close-grain (black gum, maple).
Procedure:

1. Divide a fine-sanded panel into six equal parts using masking tape.
2. Prepare a stain vehicle by mixing 3 parts paint thinner to 1 part boiled linseed oil (approximately 1 cup).
3. Divide the above mixture into six small containers. To each container, add several drops of Universal (or oil) colors as follows:

Container	Color
1	burnt umber
2	burnt sienna
3	yellow ochre
4	burnt umber & burnt sienna
5	burnt umber & yellow ochre
6	all 3 in equal proportions

4. Apply the stain, one mix to a respective area.
5. Compare colors (you may wish to try other mixtures, including other colors as well as intensity of color).

Panel No. 6
Purpose:To gain experience in bleaching and matching colors.
Wood: Mahogany or walnut.
Procedure:

1. Fine sand the panel.
2. Divide the panel into two areas using masking tape.
3. Bleach one area.
4. Divide the bleached area into two equal areas with tape.
5. Stain one area to match the original color. You may use the remaining bleached area for trial and error.

Panel No. 7
Purpose: To compare the results of a filler application: (1) with a washcoat and (2) without a washcoat.
Wood: Open-grain, light-colored (oak or ash).
Procedure:

1. Fine sand the entire panel.
2. Stain the entire panel with a color of your choice. (Select one of the stain mixtures used for panel No. 5.)
3. Divide the panel into two equal parts with masking tape.
4. Apply a washcoat to one area.
5. Apply a filler which is darker than the stain to both areas.
6. Compare results.

Panel No. 8
Purpose: To compare matching to contrasting colored fillers.
Wood: Open-grain.
Procedure:

1. Fine sand the panel.
2. Apply dark-colored stain.
3. Apply washcoat.
4. Divide panel into two areas with masking tape.
5. To one area, apply filler that is colored to contrast with the stain color (light color). To the other area, apply a filler that matches the stain color.
6. Compare appearance.

Panel Nos. 9 and 10
Purpose: Learn techniques: (1) applying a top coat and (2) rubbing and polishing.
Wood: Close-grain of your choice.

Procedure:

1. Fine sand both panels.
2. Apply three coats varnish to No. 9 and three coats lacquer to No. 10.
3. Rub and polish both panels.
4. Note observations: (1) appearance and (2) ease of application.

Panel No. 11

Purpose: To finish a panel using a complete lacquer scheme.

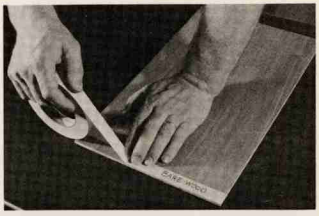
Wood: Open-grained (mahogany or walnut) —This panel needs to be at least 10 inches long.

Procedure:

1. Complete all eight finishing steps using colors of your choice (sanding, bleaching, staining, washcoat or sealer, filler, sealer, top coat, rub and polish).

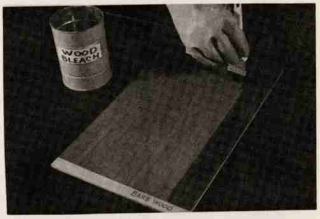
The following illustrations show the initial steps in the finishing schemes.

To begin this finishing scheme, finely sand the panel according to previous directions. Then place a strip of ½-inch masking tape across the top of the panel (refer to Figure 10a). Label this strip "Bare Wood".



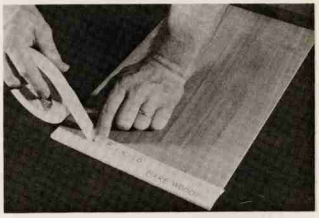
10a

Proceed to the second step (for example, bleach) throughout the entire panel with the exception of the taped area (refer to Figure 10b).



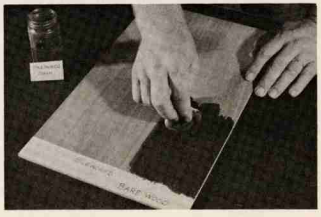
10b

After bleaching, place a strip of masking tape directly below the first strip, slightly overlapping previous strip. Label this strip "Bleached" (refer to Figure 10c).



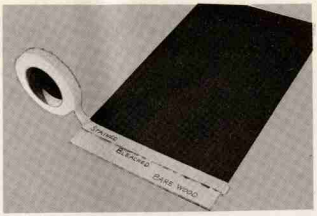
10c

Following the bleaching and taping, complete the staining operation on the remaining untaped surface (refer to Figure 10d).



10d

Allowing the stain to properly dry, place a masking strip next to the "Bleached" strip. Label this strip "Stained". (Refer to Figure 10e).

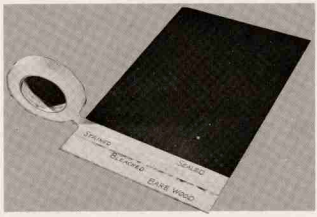


10e

Immediately following the staining and taping, apply a sealer coat (refer to Figure 10f).

10f

When the sealer has dried, place a masking strip next to the "stained strip". Label this new step "Sealed" (refer to Figure 10g).



10g

Proceed through the remaining finishing steps (filler, sealer, top coat, and rub and polish) using the same techniques of taping after each step as described above. When all the steps are completed, remove the tape strips and label the areas of wood where the strips *were* to identify the corresponding finishing step. Note the contribution each finishing step makes in developing the finished work.

Panel No. 12

Repeat panel No. 11 except use a varnish washcoat, sealer, and top coat.

Panel No. 13

Purpose: To learn techniques in preparation and application of an oil-resin finish.
Wood: Close-grain of your choice.
Procedure: Apply a resin-oil finish to the hardwood panel that has been properly sanded.

Panel No. 14

Purpose: To learn technique of preparation and application of a colored oil-resin finish.
Wood: Same kind as used in panel No. 13.
Procedure:

1. Apply one coat of a resin-oil finish that has been colored to your choice.
2. Apply a clear resin-oil finish over the colored undercoat.

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