Spraying Basics

Select your gun, match it to the finish, and then practice the basic spray strokes

BY JEFF JEWITT

It's a pity that so few woodworkers have taken the plunge and begun spray finishing. Lack of information is the main reason, and manufacturers bear much of the blame. Makers of professional spray systems assume you're already familiar with spraying, while the manuals for entry-level equipment give only basic details, and instructions on cans of finish tell you to consult your spray-gun manual.

To remedy this dearth of useful information, I'll describe the main types of spray guns and show you how to match the gun to the finish. By spraying various pieces of furniture, I can demonstrate the different spray strokes that will work best on each kind of surface. Together with the Finish Line (p. 117) on setting up to spray, this information will allow you to begin finishing the way the pros do.

Match the finish to the gun

A spray gun mixes pressurized air and liquid finish in a process known as atomiza-

CHOOSING A GUN

Newcomers to spraying should use a high-volume, low-pressure (HVLP) spray system for the efficient way it converts liquid to droplets (atomization) and transfers those droplets to the object being sprayed.

TURBINE-DRIVEN HVLP

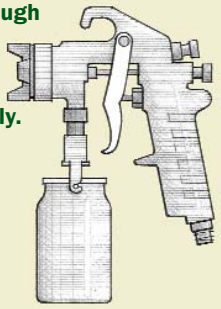
The first HVLP guns were powered by converted vacuum-cleaner motors, which evolved into two-, three-, and four-stage fans known as turbines. These HVLP systems offer a number of advantages to novice sprayers: They're normally sold as a packaged set, including the turbine, an air hose, a gun, and multiple needle/nozzle sizes for different finish viscosities, and generally come with good directions. Systems range in price from $300 to $1,000. You can get a good system for around $600.

COMPRESSOR-DRIVEN HVLP

If you already have an air compressor, you may want to consider buying a gun that will use the air from this source (see below). Known as conversion guns, they convert the high-pressure air from the compressor to a high volume of low-pressure air at the spray tip. Prices range from $100 to $500, with good-quality guns available for less than $300.

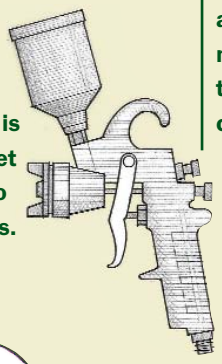
Suction feed

Air expelled through the front of the gun creates a venturi effect, pulling the finish into the gun. Although it's fine for medium- and low-viscosity finishes, this conversion spray gun can't pull up thick finish with enough speed to spray efficiently.



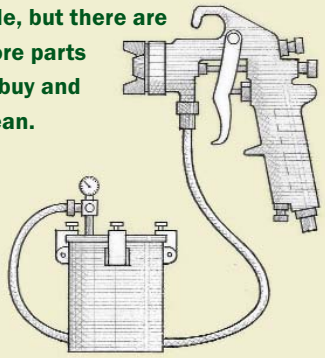
Gravity feed

With the finish container mounted above the gun, this system lets gravity push the material down into the gun. Not only can you spray thicker materials more efficiently, but the gun also is easy and quick to clean. However, it is harder to get the gun into tight spaces.



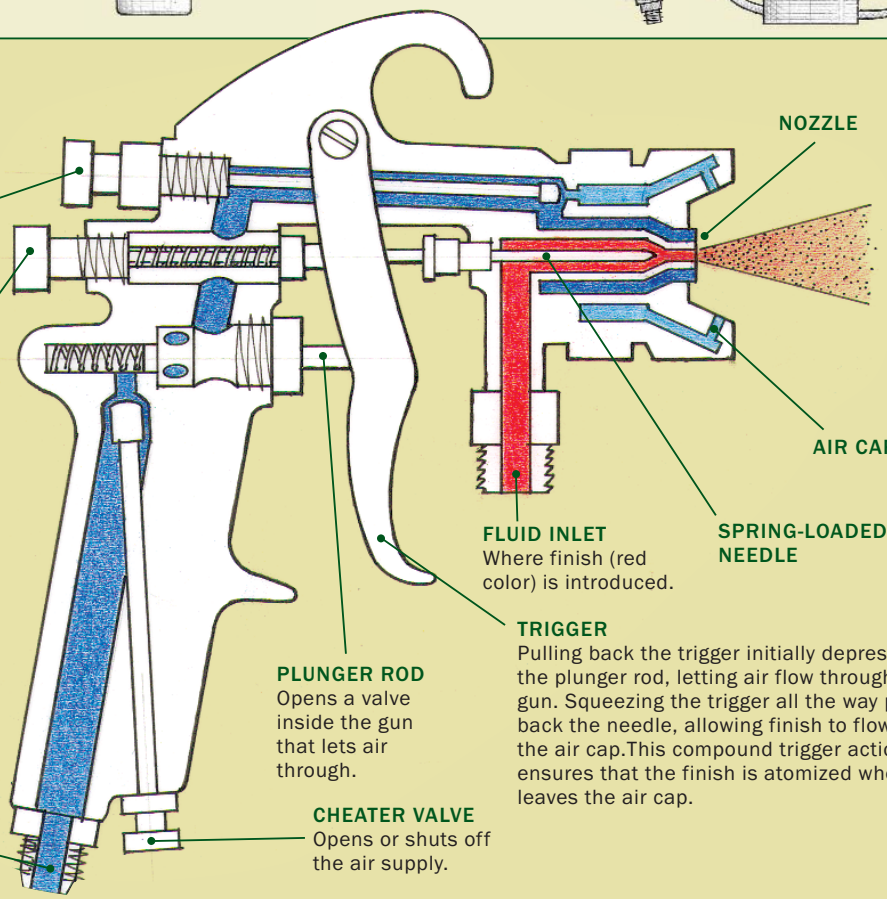
Pressure feed

You can pressurize either a cup attached to the gun or a remote pot that delivers the finish to the gun through a hose (below). The latter system makes the gun smaller and more maneuverable, but there are more parts to buy and clean.



ANATOMY OF A SPRAY GUN

The components of most spray guns are the same as this typical HVLP conversion gun.



FAN-WIDTH CONTROL VALVE
When the valve is closed, air is directed through the center and small annular holes of the air cap, resulting in a small, round spray pattern. Opening the valve lets air (blue color) into the outer horns of the air cap, which pushes the round pattern in from the sides, creating a flatter, elongated spray pattern.

NOZZLE

AIR CAP

FLUID INLET
Where finish (red color) is introduced.

SPRING-LOADED NEEDLE

FLUID-DELIVERY VALVE
Adjusts the needle to control the amount of finish let through.

TRIGGER
Pulling back the trigger initially depresses the plunger rod, letting air flow through the gun. Squeezing the trigger all the way pulls back the needle, allowing finish to flow to the air cap.This compound trigger action ensures that the finish is atomized when it leaves the air cap.

PLUNGER ROD
Opens a valve inside the gun that lets air through.

AIR INLET
The point at which air (blue color) is introduced into the gun.

CHEATER VALVE
Opens or shuts off the air supply.

Drawings: Vince Babak

START WITH THE FINISH

Measure the viscosity. *Submerge the viscosity cup in the finish and time how long it takes for the stream of finish to break.*

VISCOSITY CHART

Generic finish viscosity	Viscosity time [a]	Appropriate needle/nozzle size [c]		
		Gravity feed	Suction feed	Pressure feed
Thin	10-15 sec. [b]	1.1 mm	1.3-1.4 mm	0.7 mm
	15-23 sec.	1.2-1.3 mm	1.5 mm	0.8-1.0 mm
	23-35 sec.	1.5 mm	1.7 mm	1.1 mm
Medium	35-40 sec.	1.5-1.7 mm	1.9 mm	1.1–1.2 mm
	40-45 sec.	1.7 mm		1.2-1.3 mm
	45-55 sec.	1.9 mm	2.2 mm	1.3-1.5 mm
Thick	55+ sec.	2.2 mm	N/R	1.5-1.7 mm

[a] Measured in a Ford No. 4 viscosity cup with finish at 70°F
[b] Water = 10 seconds
[c] To convert millimeters to inches, multiply the millimeter figure by 0.03937

Choose the right-size needle/nozzle. *The higher the viscosity of the finish, the larger the needle/nozzle to achieve good atomization.*

Filter the finish. *Strain the finish through a cone filter to catch impurities that could clog the spray gun.*

tion. For proper atomization, it is critical to adjust the gun to the thickness, or viscosity, of the finish you want to spray.

Measure the viscosity of the finish—A viscosity measuring cup is small with a precisely machined hole in the bottom. Most turbine-driven spray guns come with this type of cup, but owners of conversion guns can purchase one for around $10. I use a Ford No. 4 cup, which is standard. If your cup is different, a conversion table is available at www.finewoodworking.com.

Viscosity is affected by temperature, so before you try to measure it, make sure the finish is at 70°F. Begin by submerging the cup in the finish, and then take it out. Start timing when the top rim of the cup breaks the surface of the finish. Raise the cup 6 in. over the can, and when the first break appears in the fluid stream, stop the clock. The number of seconds passed is the measure of the finish's viscosity (see the chart above).

Select the appropriate needle/nozzle—Once you know the viscosity of the finish, the next step is to choose the matching-size needle/nozzle and sometimes air cap. Keep in mind that the different styles of gun (gravity, suction, or pressure feed) use different-size needle/nozzles for the same finish. Always use the smallest needle/nozzle that you can, as the smaller-diameter ones generally atomize finishes best. Try thinning the product before you select a larger needle/nozzle.

Some cheaper guns may come with only one size needle/nozzle, and in extreme cases the manual may not even specify what size needle/nozzle that is. In this case, you'll have to thin the finish until you achieve good atomization. Manufacturers of water-based finishes typically recom-

Photos: Mark Schofield

ADJUST THE GUN

Set the air pressure. *With the gun's trigger depressed to allow only air to pass, set the outlet air pressure at the compressor, taking into account the hose-pressure drop (see the chart below).*

HOSE-PRESSURE DROP

Inside diameter of hose	Pressure at compressor	Pressure drop		
		15-ft. hose	25-ft. hose	50-ft. hose
5/16 in.	40 psi	1.5 psi	2.5 psi	4 psi
	60 psi	3 psi	4 psi	6 psi
3/8 in.	40 psi	1 psi	2 psi	3.5 psi
	60 psi	2 psi	3 psi	5 psi

Pressure drop is the amount of air loss from the compressor regulator to the gun's air inlet. For pressures below 40 psi, the pressure drops in the hose are negligible.

mend thinning with no more than 5% to 10% of distilled water. Beyond that, you will have to use a viscosity reducer dedicated to that finish. Add the water or reducer in increments of 1 oz. per quart of finish until it sprays properly.

For the best finish "off-the-gun," it is a good idea to strain all finishes as you pour them into the gun. A fine- or medium-mesh cone filter works well to strain impurities from water-based clear finishes; a medium-mesh filter works for paint.

Create a good spray pattern

Once you've matched the finish to the gun, make final adjustments at the gun. Also, select a respirator with cartridges suitable for the type of finish you will be spraying.

Setting up a conversion gun—High-volume low-pressure (HVLP) spray guns have a maximum inlet pressure of 20 to 50 psi; the exact figure is either stamped on the gun's body or given in the instructions. Conversion, or compressor-driven, HVLP spray guns are designed to reduce this inlet pressure to 10 psi at the nozzle, enough to atomize most finishes. With the trigger of the gun slightly depressed to release air but not finish, set the compressor's regulator to slightly above this maximum inlet pressure. This allows for the hose-pressure drop (see the chart above), which is caused by friction as the air passes through the hose. To avoid this calculation, install a miniregulator at the gun to set the pressure.

Turn the fan-width and fluid-delivery valves clockwise so that they're closed. If your gun has a cheater valve (a built-in air regulator), make sure it's open. While the trigger is fully depressed, open the fluid-delivery valve a few turns, which regulates the amount of fluid going through the nozzle. Set it low for delicate spraying of edges and small areas, or open it up for spraying large surfaces. Spray a piece of

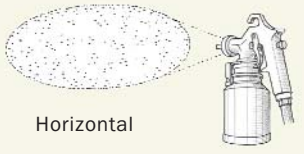
DIAL IN THE SPRAY PATTERN

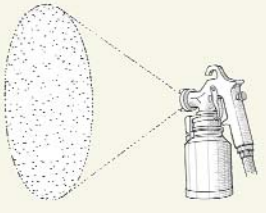
The type of gun will determine the method of adjustment for the shape and orientation of the spray pattern.

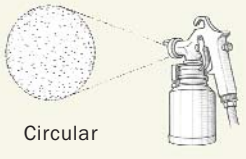
Conversion guns require two adjustments. *A valve at the back changes the pattern from circular to elongated. Twisting the air cap changes the orientation of the spray pattern.*

Turbine guns are adjusted at the front. *To adjust the pattern from circular to horizontal to vertical, just turn the air cap.*

Rather than alter the way you hold the gun, adjust the spray pattern to suit the object being sprayed. For vertical surfaces, a horizontal pattern gives optimum coverage; when spraying flat panels in the crosshatch pattern, adjust the gun to get a vertical pattern. A tight circular pattern reduces overspray when finishing narrow parts, such as slats and legs.

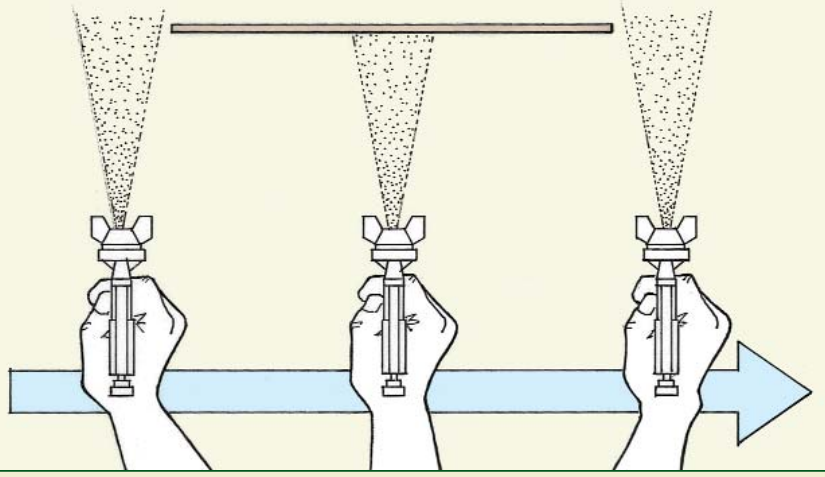






THE BASIC SPRAY STROKE

Hold the spray gun at the same distance from the workpiece for the entire pass over the surface. Start spraying off the edge of the workpiece and proceed over the surface. Stop spraying off the other edge.



scrapwood or some corrugated cardboard. Ideally, you want a fine and uniform pattern of droplets across the width of the spray. If you have coarse, large droplets, either the finish is too thin or the needle/nozzle is too large. The reverse is true if the gun sputters or spits. If the finish looks good, keep turning down the air pressure in 5-psi increments until you start to see the finish form a dimpled surface resembling an orange peel. Then raise the air back up 5 psi. Note this as the proper air pressure for the finish you're using. Operating the gun at the lowest pressure possible saves material by reducing bounce-back and overspray.

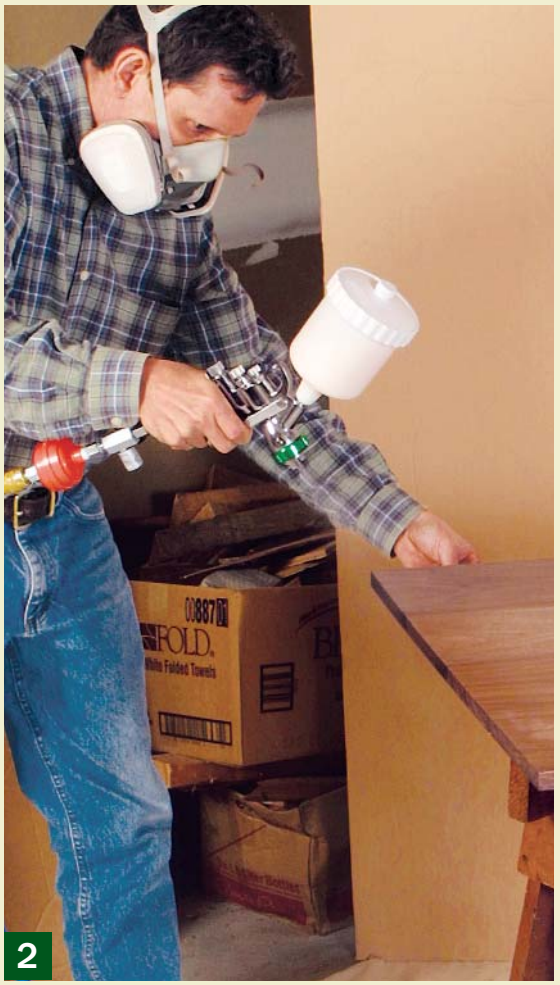
The fan-width control valve on the gun regulates the spray pattern. As you open the valve, the spray pattern becomes elongated (for more on spray patterns, see p. 71). When you open the valve, you also

FINISH A PANEL IN FOUR STEPS

To achieve a good finish on a flat panel, you need even coverage on all surfaces. The use of a nail board and turntable (see p. 118) allows you to finish the top surface while the bottom is still wet and to direct the spray (and the overspray) toward an extractor fan.

Spray the edges. *With the gun parallel to the panel's surface, make one pass on all four edges.*

Dealing with runs. *If you spot an area with too much finish, quickly wipe away the surplus and apply another light coat.*



Recoat the edges. *With the gun now at a 45° angle to the panel, give the edges a second coat of finish.*

may have to turn up the air pressure going into the gun, so it's a good idea to keep an eye on your regulator.

Setting up a turbine-driven gun—Fully open the cheater valve on the gun. The correct air/liquid balance is established the same way as on a conversion gun. However, on most turbine guns, the position of the air cap determines the shape and orientation of the spray pattern. When the air cap's horns are in the horizontal position, the spray pattern is wide and oriented vertically. When you rotate the air cap 90°, the spray pattern is horizontal. The intermediate position makes the spray pattern tight and round.

Mastering the art of spraying

Before spraying any piece of furniture, dismantle large items as much as you can. Remove backs from carcase pieces and remove drawer bottoms, if possible. If you have a complicated project that includes a lot of slats, consider finishing them before final assembly.

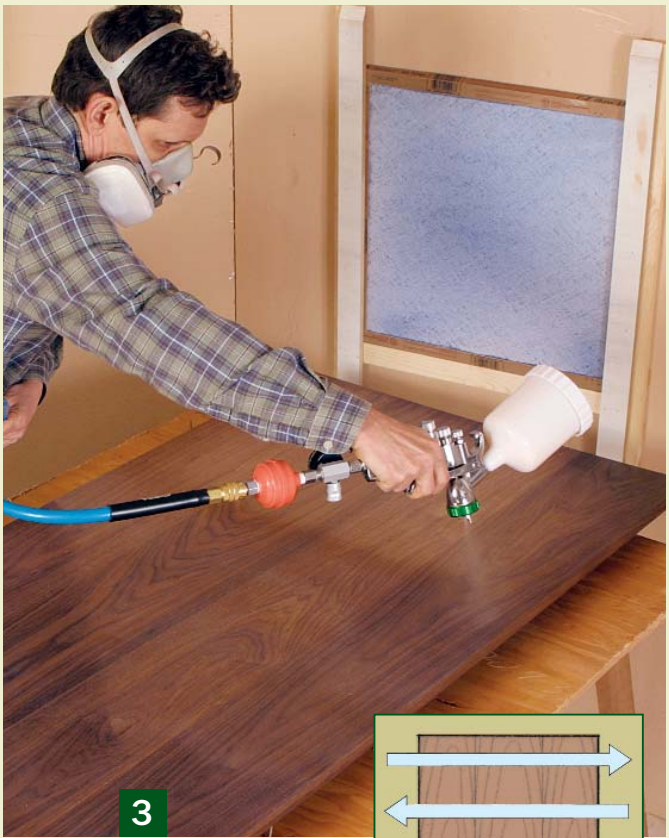
How much finish to apply—Novice sprayers often get carried away with the ease of laying down a finish, and so they apply too much at once.

You should aim for each coat to be about two thousandths of an inch thick, or in spraying terms, two mils. A mil gauge is a piece of metal with teeth in mil increments. To use the gauge, spray some finish onto an impermeable surface such as laminate or glass. Drag the gauge through the wet finish, keeping it 90° to the surface and pressed down. Withdraw the gauge and note the first tooth that isn't coated with finish, as well as the one next to it that is coated. Your depth of finish will be an intermediate thickness between these marks. If you have trouble seeing clear finishes on the gauge, sprinkle talc on the wet teeth and blow it off. The talc will stick to the wet teeth.

The basic spray stroke—Lay a flat board or a piece of cardboard on a pair of sawhorses to practice on. Hold the gun perpendicular to the surface, about 6 in. to 8 in. away and about 3 in. off the bottom left-hand corner. Depress the trigger until finish comes out, and move the gun across the board until you get 2 in. to 3 in. past the far edge. Do not arc your pass; rather, lock your forearm so that the gun moves across the board at a constant height and in a straight line. As you make another pass, overlap the first by 50% to 75%. Move the gun fast enough to avoid puddles of finish,

Watch it on the Web

To see a video of the author spraying a finish, go to www.finewoodworking.com.



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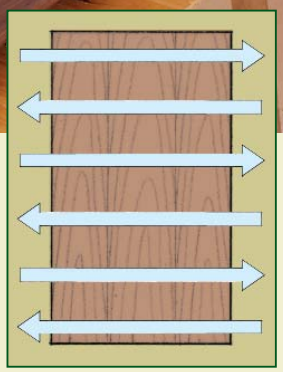

Spray across the grain. *Maintaining the gun at an even height over the surface, spray overlapping strokes across the grain.*

4

Then spray with the grain. *Turn the workpiece 90° and spray with the grain in the second half of a crosshatch pattern.*

CASE PIECES

Get down, and get under your cabinet. *Spray the underside of the shelves first (above). Then complete the inside of a cabinet by spraying the sides (right) followed by the tops of the shelves. In this way, the most noticeable surface is sprayed last and won't be affected by overspray.*

but not so fast that the surface feels rough when it has dried.

I start with the surface closest to me and work toward the exhaust fan in my spray booth (see p. 117) to reduce overspray landing on the wet finish and leaving it rough. Practice this basic stroke until it becomes second nature, because it is fundamental to all spraying.

Flat surfaces—The basic spray technique for flat surfaces is called a crosshatch. Begin with the underside of the piece: At a 90° angle to the grain, start your first pass at the edge closest to you and spray a series of overlapping strokes. Then rotate the top 90° (it helps to have it on a turntable) and spray with the grain.

Holding the still-dry edges, turn over the panel and place it back on the nail board. Spray the edges with the gun parallel to the surface, then bring the gun up to 45° to the top and spray the edges again to get extra finish on them. Finally, repeat the crosshatching on the top side.

If you get a drip, and you won't be damaging a delicate toner or glaze underneath, wipe the drip immediately with your finger and lightly respray the area.

Inside cabinets—Spraying inside a cabinet is a lot easier if you remove the back. If you cannot remove the back, you'll get a face full of overspray unless you turn the air pressure way down, which may result in a poorly atomized finish. Start on the underside of the top and then the two sides, leaving the bottom last so that overspray doesn't settle there and create a rough finish. For each panel, spray all four edges first before doing the center. Rotate the piece so that you always spray toward the back of the booth; this way, the fan will draw the overspray away from the piece. Blow away

Avoid runs on vertical surfaces. *Apply overlapping strokes from bottom to top, but do not apply a crosshatch spray across the grain, as too much finish likely will sag or run on a vertical surface.*

SLATS AND SPINDLES

With the stool upside down (left), spray the underside of the rails and the inside surfaces that are least visible. Flip the stool (below) and spray the visible areas, keeping the spray gun the same distance from the workpiece.

RAISED PANELS

The procedure is identical to that of a tabletop, with the addition of a first pass with the gun angled around the inside edge of the frame.

GRIDS

Treat grids and frames for glass-panel doors as a flat, continuous surface, and apply a crosshatch spray pattern.

the cloud of finish left inside by depressing the trigger of the gun slightly so that air but no finish comes through.

Verticals—Start at the bottom and lay down a continuous layer of finish until you reach the top. Overlap each pass 50%—as though you were spraying a flat surface—but don't crosshatch, because the extra finish will cause runs. For face frames, adjust the fan width to match the width of the frame members, if possible.

Complicated pieces—To spray a stool or a chair, work from the less-visible parts to the most visible. With the piece upside down, spray the underside and inside areas. Though less visible, they still have to be finished. Turn over the stool and rest it on four screws driven into the feet (see the photos above) to prevent the finish from pooling around the bottom of the legs.

Now spray the sides of the legs and the slats, working quickly to apply light coats. Finally, finish the outside surfaces that are most visible. As with vertical surfaces, the trick is to keep the coats of finish thin and to avoid sags and runs. □

Jeff Jewitt is a frequent contributor to Fine Woodworking *on finishing topics.*