

STOCK SCENERY CONSTRUCTION HANDBOOK

THIRD EDITION

**BILL RAOUL &
MIKE MONSOS**

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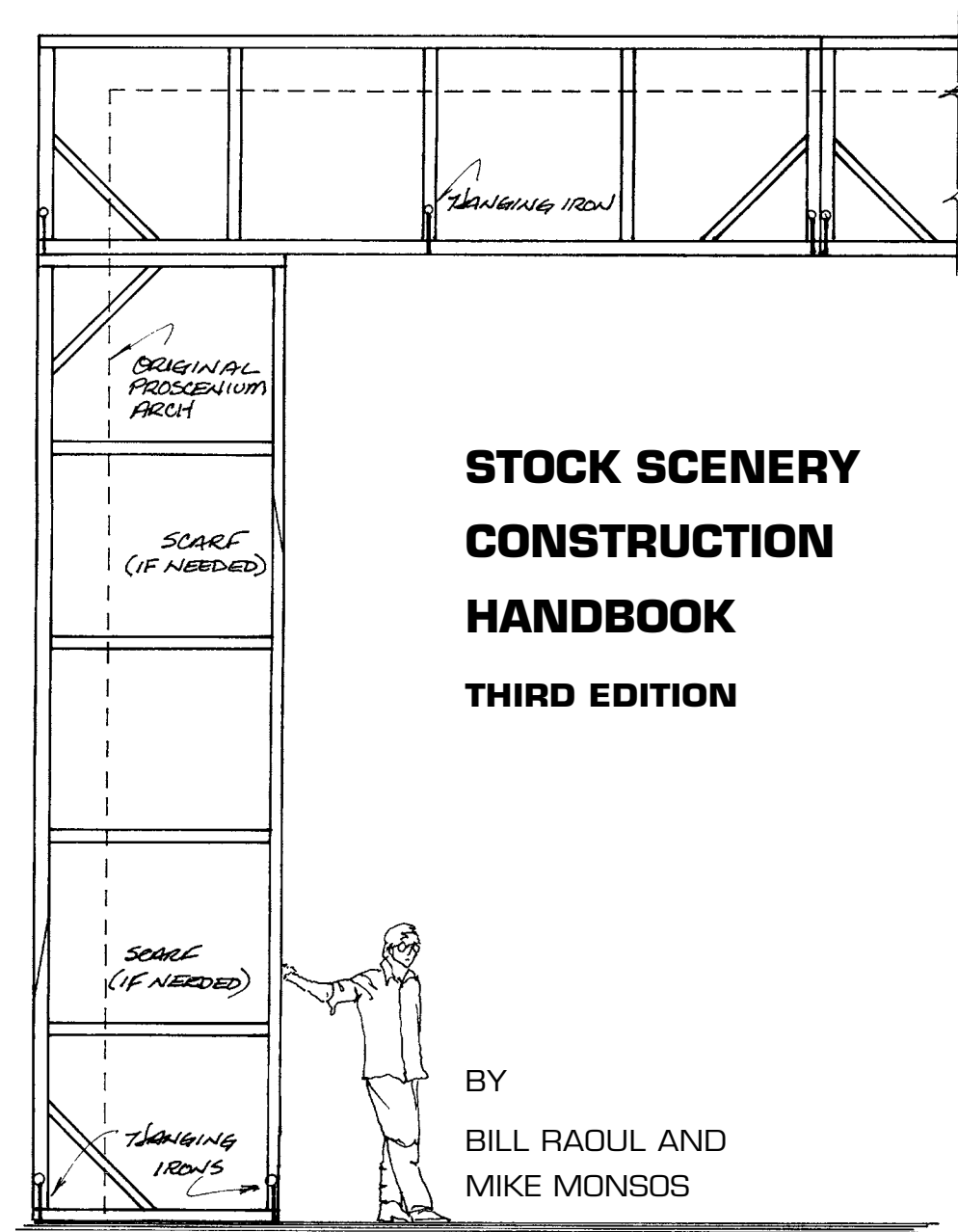
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**STOCK SCENERY
CONSTRUCTION
HANDBOOK**



STOCK SCENERY CONSTRUCTION HANDBOOK THIRD EDITION

BROADWAY PRESS
LOUISVILLE, KY
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PREFACE

Bores can be divided into two classes: those who have their own particular subject, and those who don't need a subject.

—A.A. Milne

Scenery construction must certainly qualify as a subject, but I sincerely hope my digestion of it will not land me in either of Mr. Milne's classes. For more than thirty-five years I have found scenery construction fascinating, frustrating, and even baffling, but, at the same time, exciting and very satisfying. It is a subject in constant change, as is the rest of the theatre. I have also noticed that the more things change, the more they seem to stay the same. That, of course, has changed my thinking.

To some, the techniques and methods presented here will appear old-fashioned and outmoded. I can only counter with an acquiescent nod and hope if they ever need to get back to some of the basics, I don't bore them. There is nothing more instructive than observing the past, and if this handbook becomes something of a history of yesterday's techniques and methods, I have at least succeeded in preserving part of our theatrical heritage. But I truly believe it is more.

In this time of world waste, conspicuous consumption, and increasing shortages, we have a responsibility to conserve and reuse. Fortunately, our recycling plant is the theatre, and we all know it must reflect the times.

Before I bore you with my soapbox, let me say my thank yous to the hundreds of talented people who have been my co-workers. Their training methods, skills, and thoughts have been diligently collected and stored. Many of their wonderful ideas have metamorphosed to the point of nonrecognition, but, originally, I stole them nonetheless.

This book is now a fourth overhaul of what began as classroom handouts. They were gathered into a slim volume called *Flat Frame Construction*, which grew into a larger handbook, *Stock Scenery Construction*, which bears some youthful resemblance to the present tome.

Paul Carter, author of the invaluable *Backstage Handbook*, has my thanks for connecting me with publisher David Rodger, whose patience and help have been most appreciated. Stacia Graham, whose fleet fingers typed many a draft, deserves my grateful thanks. Carol Morris, whose red pen flowed around many an indefinite pronoun and dangling thought, certainly clarified many of the muddier passages. However, none of them knows, as I so gratefully do, how much we must all thank Tim Paul for his uncountable hours as proofreader, gentle suggester, and astute critic. The remaining errors must be his, but I will gladly assist him in correcting them if you will be so kind as to point them out.

My thanks ultimately go to my colleagues in the Department of Drama/Dance, and to those within the University of Montana who so graciously granted me the sabbatical leave which enabled me to rework this information.

SECOND EDITION NOTES

Second printings and second editions are both gratifying, but while the first is a mark of popularity, the later must admit the need for change. To the many people who have contacted me with kind comments, insightful suggestions, and reprimands for omissions, I am extremely grateful. Most users praised the limited scope of this handbook but had specific queries that I have tried to answer in the expanded sections on drops and hard-wall scenery with related items. The number of questions specifically about paint and not the techniques of using it per se were surprising and prompted the new final chapter. To those who wanted a section on steel and metal construction I can only apologize for my lack of knowledge and urge them to seek those answers from a qualified source. However, my limited experience leads me to believe metal shops and woodshops need to be separate areas. The droppings on the floor and particulates and fumes in the air are not compatible. Metal is, however, an excellent scenic material and often perfectly answers the scenery demand of cost vs. weight vs. strength.

Again I must thank those same people who facilitated the first edition for their continued support... with the possible exception of the sabbatical committee... and if reception of this edition is as positive, who knows? They say: "Third's a charm!"

THIRD EDITION NOTES

Books are the quietest and most constant of friends; they are the most accessible and wisest of counselors, and the most patient of teachers.
—Charles William Eliot

Bill Raoul has been my friend, mentor, teacher, and critic for over thirty years now. So when he asked me if I would accept the task of creating the next edition of this gloriously useful book, I had to consider what this book meant to me personally. I learned to build scenery from this book. I have absorbed its thought process of evaluating the pros and cons of stock scenery. It taught me to appreciate the history of scenic carpentry and the methods of construction that have been passed down to us. It informs my understanding of why we make certain choices in the shop.

I decided that, yes, I did want to help keep this important book current so new generations of students can learn from it the way I had. And I want to honor the education I received at the University of Montana under Bill.

PART 7 • SHOP TALK, SHOP TRICKS, AND SHOP-MADE TOOLS

USING UP SCRAP MATERIAL

Waste not, want not. Oh, were it only so! However, it is possible to keep the dumpster hungry by using up most scrap. Below are some suggested recipes for leftovers.

PLYWOOD SCRAP

Panel materials, including $\frac{3}{4}$ " plywood and $\frac{3}{4}$ " particle board (ugly stuff), can be used for caster boards (see Drawing 4-15). Stock fasteners (see Drawing 2-4) can be made from scraps of $\frac{1}{4}$ " plywood. Wait until you have a goodly amount of scrap for the conversion because it usually ties up the equipment in the shop. Plywood that is $\frac{1}{4}$ " thick by $5\frac{1}{4}$ " wide (with the grain direction) should be saved for curved platform construction (see Drawing 4-7).

1× STOCK SCRAP

Any 1× stock which is $3\frac{1}{2}$ " wide (this could also be $\frac{3}{4}$ " plywood or $\frac{3}{4}$ " particle board) is good for making up caster boards. These can be laminated up and stored away until needed (see above).

Shorter pieces of 3" wide 1× stock make good picture battens (see Drawing 2-45). These are standardized to stock flats and can be stored in readiness—a great time-saver when you need just one more.

The same 3" wide 1× stock, also in shortish pieces, is just what the doctor ordered for step legs (see Drawing 4-10). Time, or a prophetic look into the future, will tell you approximately how many of these you will need down the road. There are rarely enough. Laminate them in those off days.

Pieces of 2" wide 1× stock which is 3'-0" long can be made into corner braces (see Drawing 2-3 and text). These are always needed and can be easily stored away. Toggles from broken and discarded flats can also be used up in this way.

Tailing strips, which are usually broken up and tossed, make excellent paint stir sticks.

Standardize their length to fit the size buckets you use and to facilitate storage. There is nothing as luxurious as a fresh, disposable paint stick.

SAWDUST

Keep a box under the table saw to catch sawdust. A bucket of sawdust in the paint area is ideal to soak up any spilled paint. It also makes the floor a lot less slippery. Just sprinkle it on any puddle and sweep it about. Pick it up before the paint dries, so it doesn't stick to the floor.

A pail of wet sawdust makes an excellent and inexpensive sweeping compound. It keeps the dust down when cleaning up the shop. Boy, it could probably stretch hamburger for meat loaf, too.

FIREWOOD

Small scraps of wood make excellent starter wood for fireplaces and campfires.

SHOP-MADE TOOLS

Most shop-made tools are designed to make working with power tools a safer experience, or at least one which keeps fingers connected to the palm.

Drawing 7-1 shows the push stick, one of the simplest, but most necessary of all tools. Push sticks should be made up in quantity and discarded when the bottom becomes too chewed up by the saw blade. To add a real touch of class, rout all edges (except the notch at the bottom) with a round-over bit.

The two trimming guides (see Drawing 7-2) are both handy. The guide for the circular saw is a great time saver because the edge of the plywood is also the edge of the kerf cut by the saw and can be easily aligned to the cut line on the board. Of course, different circular saws will each need their own guides.

Also in Drawing 7-2 is a guide to remove the bow from a piece of wood. It will need to be as long and as wide as the wood to be de-bowed. Once the outer bow has been trimmed off, the saw must be reset and the piece fed through with the flat edge against the fence. This certainly beats snapping a line and freehanding the piece through the saw.

The scarf taper jig (see Drawing 7-3) is designed to be used with a portable circular saw. The length of the taper is up to you. Approximately 18" is ideal. The first cousin of this jig is the taper jig discussed in Drawing 4-20.

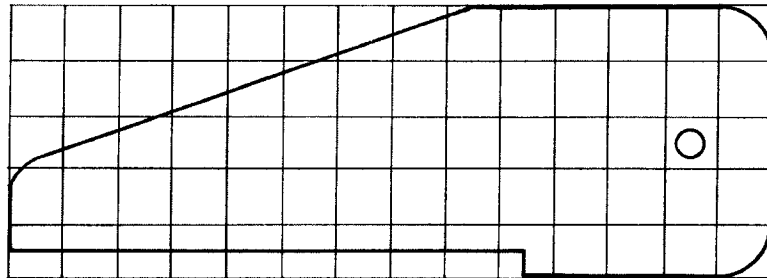
The "hand," also called a feather board or finger board, is certainly worth the little effort it takes to construct (see Drawing 7-4). When clamped to a table, the "fingers" will keep constant tension on a board and help ensure a good cut. Notice the curved top allows two different approaches, thus giving more flexibility.

The V-block (see Drawing 7-4) is fairly self-explanatory. It will prevent round stock from turning, which can break the drill bit, throw the piece off the table, or give the operator a good whapping. This jig can be used against the fence of the radial arm saw for cutting doweling and full round.

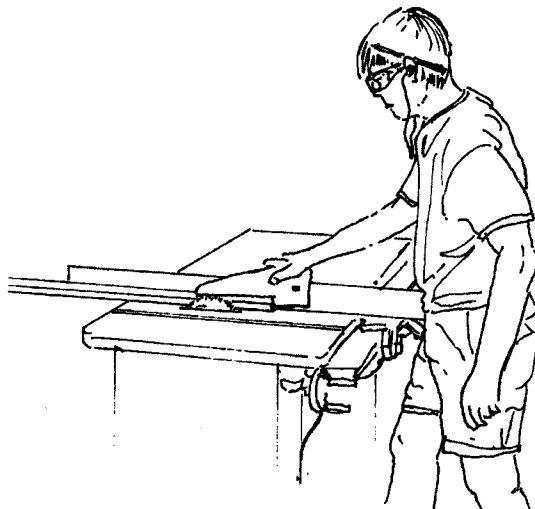
Drawing 7-5 shows three helpers for curved lines. If you cannot find trammel points, a piece of 1×1 will easily substitute. Drill a hole through one end to accept the pencil and drive a nail for the pivot point. Granted, it's crude, but effective.

The folding work stands in Drawing 7-6 are included because they might inspire a homemade version. They are a variation on the continental parallel (see Drawing 4-24 and following), but have been refined to a great extent. Whether or not you decide to build your own or investigate buying some, these clever tables may be the ideal solution for any shop which must be put away at night and come out again the next day.

Some of the other shop-made tools already discussed include the marking gauge (see Drawing 2-8), the whiskey stick (see Drawing 2-29), and the bolt hole jigs (see Drawing 4-12). The folding sawhorses (see Drawings 2-32 and 2-33) certainly qualify as a shop-made tool. And, to push a point, the flat frame square (see Shop Math, Drawing 6-23) should probably be included.



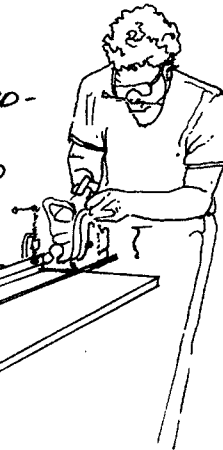
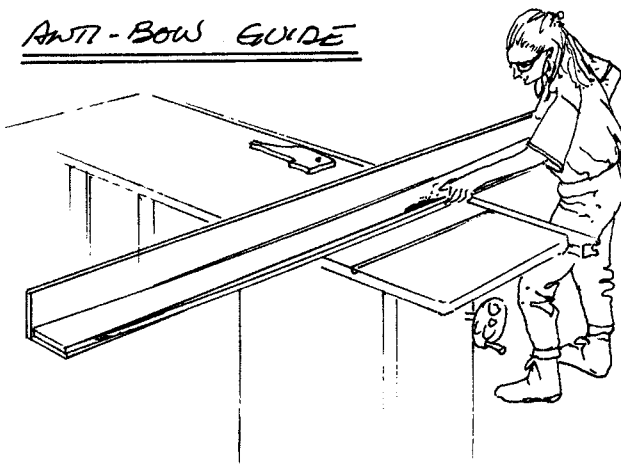
THE PUSH STICK DRAWN ABOVE (IN A ONE-INCH GRID) IS BUT ONE OF MANY DESIGNS AVAILABLE. HOWEVER, IT DOES DO SEVERAL THINGS QUITE WELL. IT IS TALL ENOUGH TO RIDE ABOVE MOST FENCES AND THEREFORE NOT "SNAG" FINGERS PLUS IT KEEPS THE HAND WELL ABOVE THE BLADE. THE HALF-INCH NOTCH AT THE BOTTOM ALLOWS GOOD PRESSURE ON THE BOARD THUS HOLDING IT TO THE TABLE.



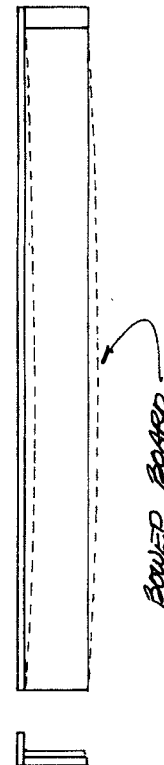
TO USE THIS STICK AS A "HAND" TO HOLD A PIECE AGAINST THE FENCE, HOLD THE NARROW END IN ONE HAND AND PRESS THE ROUNDED BUTT END AGAINST THE WOOD. THIS WILL APPLY PRESSURE AND ALSO ALLOW THE BOARD TO GLIDE PAST.

CIRCULAR SAW GUIDE

A PIECE OF $\frac{1}{4}$ " PLYWOOD OR HARD-BOARD WITH A 1x3 LAMINATED TO ONE EDGE CAN BE CLAMPED TO PANEL TO BE CUT. SOLE PLATE OF SAW RIDES AGAINST 1x3 AND BLADE CUTS AT EDGE OF PLYWOOD.

ANTI-BOW GUIDE

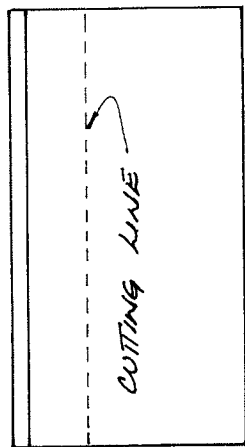
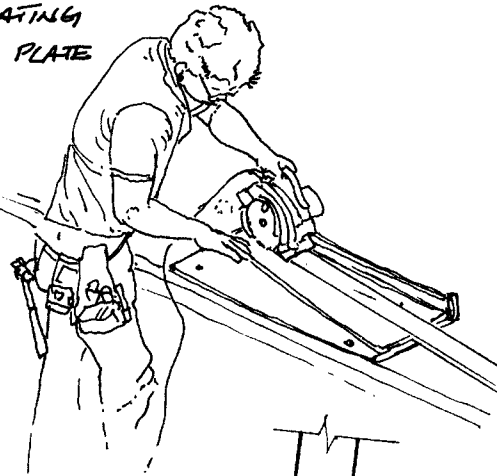
PLACE BOWED BOARD ONTO GUIDE. SET FENCE ON TABLE SAW TO TRIM EDGE. FLIP BOARD, RESET FENCE, AND TRIM TRUE.



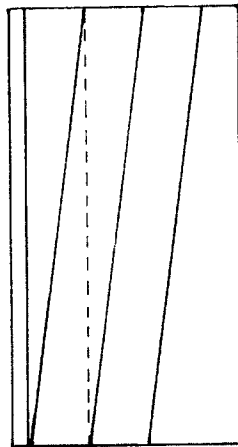
STEP ONE: ON A PIECE OF PLYWOOD MOUNT A "FENCE" OF 1X STOCK TO EDGE AND DRAW A LINE INDICATING DISTANCE FROM EDGE OF SOLE PLATE OF CIRCULAR SAW TO BLADE.

STEP TWO: MOUNT A TAPERED PIECE OF STOCK FROM LINE TO 1X STOCK FENCE. ADD A SECOND PIECE OF STOCK, PARALLEL TO TAPER. THE DISTANCE APART IS THE SAME AS THE WIDTH OF THE STOCK TO BE TAPERED.

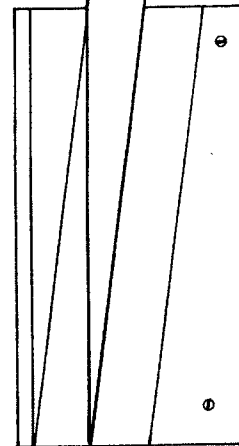
STEP THREE: SCREW (OR CLAMP) PLYWOOD TO WORK TABLE OR FLOOR, INSERT STOCK TO BE TAPERED INTO JIG AND GUIDE SAW AGAINST FENCE.



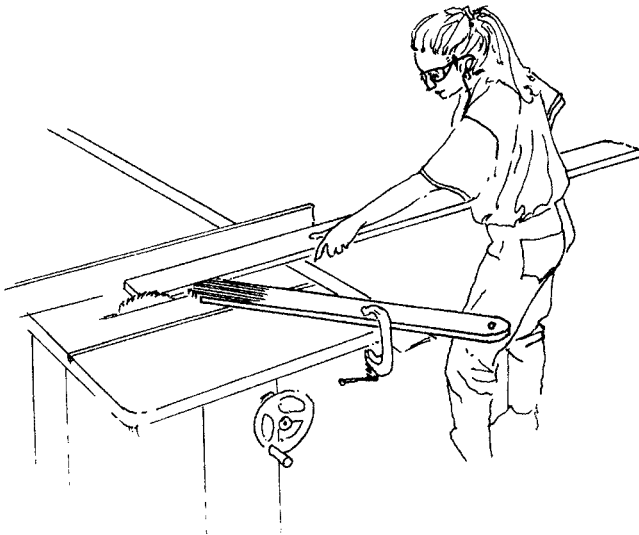
STEP ONE



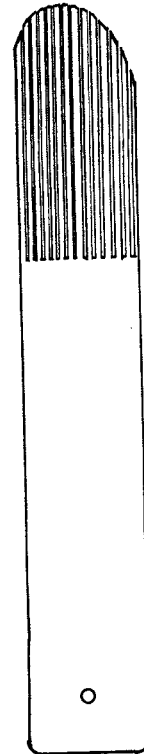
STEP TWO



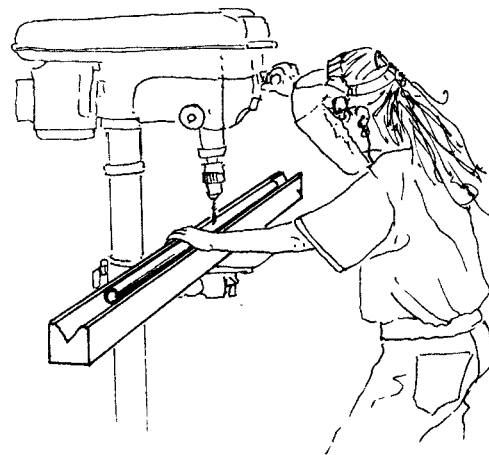
STEP THREE



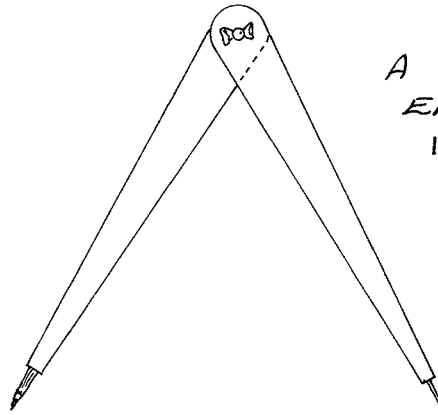
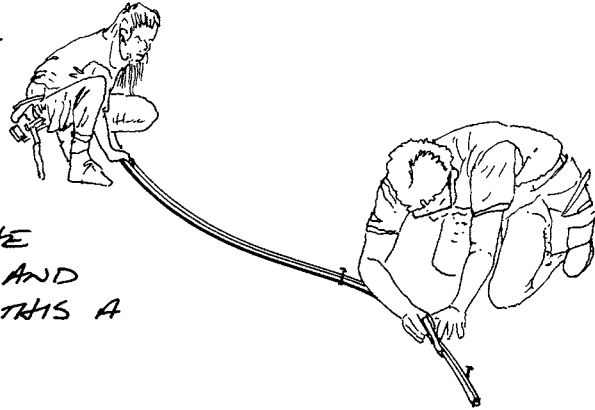
A WOODEN "HAND" IS ONE OF THE HANDIEST OF SHOP-MADE TOOLS. WHEN CLAMPED TO A TABLE, ITS "FINGERS" PRESS AGAINST THE STOCK AND HOLD IT AGAINST THE FENCE. MAKE AS NEEDED, BUT KEEP THE WORKING END CURVED AND THE FINGERS ABOUT $\frac{1}{4}$ " WIDE, AND THE KERF OF THE BLADE BETWEEN.



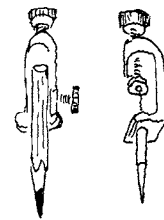
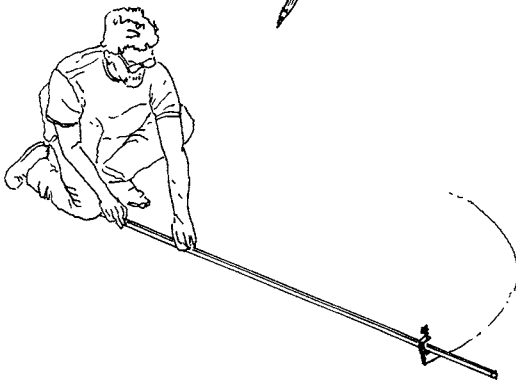
THE "V" BLOCK IS QUICKLY MADE AND ABSOLUTELY NECESSARY WHEN TRYING TO DRILL ROUND STOCK. A 4x4 WILL ACCEPT THE "V" OR LAMINATE TWO PIECES OF 2x4 WITH A CHAMFER ON EACH PIECE.



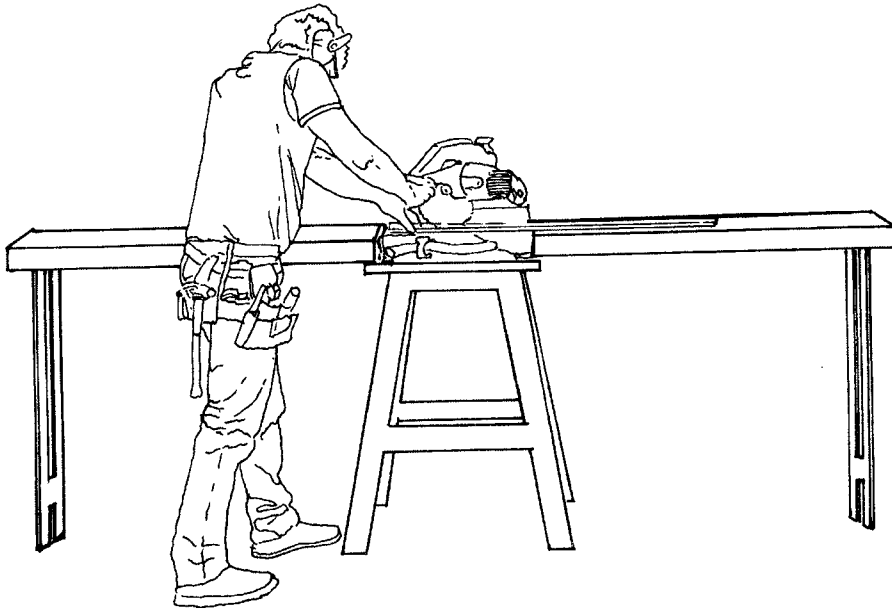
UNUSUAL CURVES CAN BE "SMOOTHLY" DRAWN BY FORCING A NARROW PIECE OF PLASTIC OR A THIN, KNOT FREE TIMING STRIP TO CONFORM TO THE CURVE. A FEW NAILS AND HELPFUL HANDS MAKE THIS A BREEZE.



A BOW COMPASS IS EASILY MADE WITH 1x STOCK. A 3/8" CARRIAGE BOLT WITH A WING NUT HOLDS THE TOP. DRILL ONE END FOR A PENCIL, THE OTHER FOR A HEADLESS NAIL.

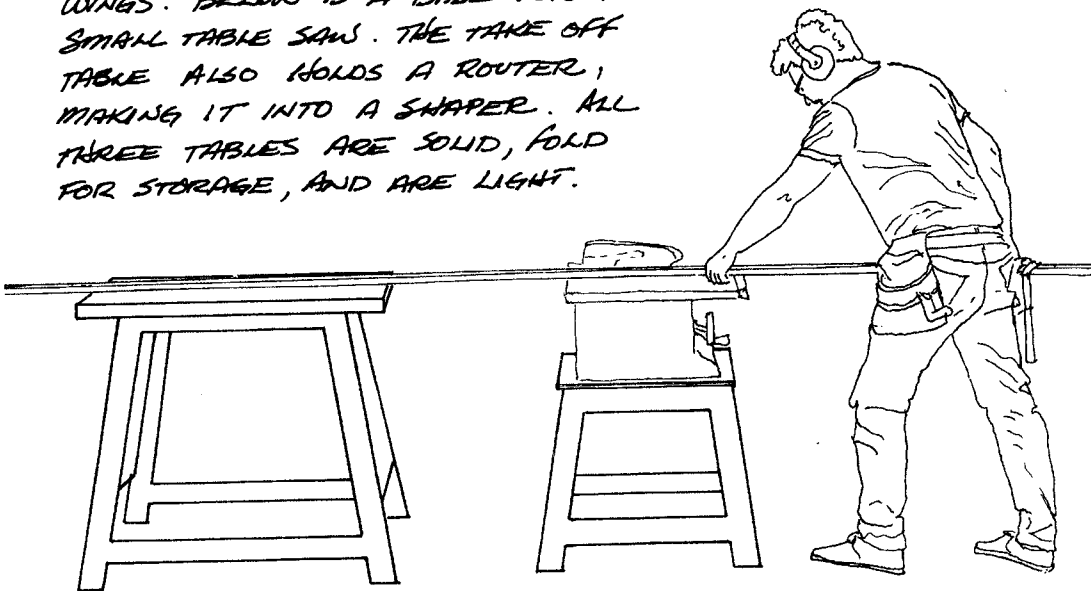


TRAMMEL POINTS ARE AVAILABLE AT GOOD HARDWARE STORES. ONE HOLDS A PENCIL, THE OTHER HAS THE POINT. BOTH CLAMP ONTO A PIECE OF 1x STOCK. AN EXCELLENT COMPASS FOR LARGE CIRCLES.



THE DRAWING SHOWS THREE PORTABLE TABLES
DESIGNED AND BUILT FOR THE CONSTRUCTION SITE.

ABOVE IS A CHOP SAW TABLE WITH
WINGS. BELOW IS A BASE FOR A
SMALL TABLE SAW. THE TAKE OFF
TABLE ALSO HOLDS A ROUTER,
MAKING IT INTO A SHAPER. ALL
THREE TABLES ARE SOLID, FOLD
FOR STORAGE, AND ARE LIGHT.



PART 8 • PAINT

INTRODUCTION

From the get-go as we try to saddle Ol' Paint it must be understood that this section is not about being a painter. The skills and training required to be a scenic artist must be learned elsewhere. There are a number of excellent books, some fine schools, and a life-time of opportunities which can be explored. This chapter will, hopefully, fill in enough basic background to allow a paint area to be planned, organized for production, and utilized in an efficient, safe, and cost-effective manner.

Also, from the get-go let me stress that all paint is potentially hazardous to your health and to those in the area where it is used. I have tried to contain the warnings, but like the toxicity of paint they often pop up.

A BIT OF HISTORY

Today's commercial paint is a relatively new concept in product marketing. From earliest times humans have decorated with paint. In the Middle Ages the formulas for tempera with its egg binder were jealously guarded secrets of craftsmen. White lead paint became widely available in the seventeenth century, but more people seemed to paint their faces than their homes. It was the later large-scale manufacture of linseed oil from the flax plant and pigment-grade zinc oxide which allowed paint manufacturers to become an industry. However, it was not until 1880, when Henry Sherwin put the first standard-formula, quality-controlled, ready-mixed paint on the market, that people no longer had to purchase powdered white lead and pigments and add their own linseed oil and turpentine. It was the skill required to mix paint, not the largely ignored dangers encountered in using it, which gave rise to an army of professional house painters who survived well into the twentieth century. After World War II there was the introduction of less toxic, water-based paints. Scenic artists, like most theatre people, at the forefront of tradition, continued to mix their own paints from bins of colored pigments and pots of heated glue. Many are still doing so, and indeed, the color range of powdered pigments has rarely been surpassed.

Ironically, the upheavals of war contributed more to the progress of paint and dye stuffs than any aesthetic movement. The German monopoly on chemically derived

pigments forced other countries to re-invent the color wheel when World War I began. Aspirin was another important theatrical staple wrenched from German supremacy at the same time. In addition to new materials to replace ones temporarily unavailable because of hostilities, labor shortages forced more machinery to be utilized, and a better, more consistent product resulted.

The Second World War was even more disruptive to paint manufacture but resulted in many new binders including the perfection of alkyd resin, a type of polyester. Water-based paints, prior to 1900, were mainly lime wash (lime, tallow, and water) but distempers (powdered pigments to be mixed with various sizes) were in common use. Milk was mixed with quicklime to help make whitewash, and this developed into a line of casein paints. To make paint more water resistant, drying oils were added. During World War II, German industries searched for an alternative to using oil, in dwindling supply and urgently needed elsewhere, and chemists invented polyvinyl acetate (PVA), a new binder for paint.

The Germans invented Buna, a synthetic rubber, in the mid-1920s, but it didn't become commercially viable until the war created shortages of natural rubber. It was utilized in the United States immediately after the war in the manufacture of rubber-based paint, commonly called latex paint. However, PVA paints since then have surged ahead and captured a large part of the market. These are the acrylic paints sold everywhere. The Second World War also saw the invention of epoxy resins and polyurethanes, both of which have found their way into the paint industry and emit fumes of death and destruction. Well, okay, they smell and are more dangerous.

PAINT CHOICES

The wide variety of paints available today, and their specialized uses, present choices for the scenic artist which would amaze and perhaps bewilder the painter of even half a century ago. All paint consists of pigment (color), binder (the glue), and medium or vehicle (the liquid). In many paints, a fourth part (filler and additives) can provide opacity, mildew resistance, freezing resistance, longer shelf life, and so on. The binder and medium combine to become the vehicle which carries the other ingredients. Pigment is color to most, but it is a bit more complicated. Pigments are small particles suspended in the binder and medium. Pigments are derived from earth (e.g., yellow ochre), minerals (e.g., malachite), and dyes (organic, and, since the mid-nineteenth century, often synthetic). Pigment can be created from an inert ground, whitening for example, over which dye is precipitated. The particles are suspended in the medium and binder, but the dye can bleed out and become soluble in the liquid. This partly explains why paint will wash out of clothes but also leave a stain. Of course, most paint chemists combine the above in various ways to achieve the desired color. Poisonous ingredients for the color-accepting inert ground (like lead white, unavailable since 1973) are no longer used, but the dust and peeling paint found in older buildings are still lethal.

PAINT TIP How much paint is needed to complete a job? The question is complex, and the answer is always “a bit more.” In truth, even the most experienced painter can be caught short. There are many variables—surface, viscosity of paint, applicator, temperature, humidity, person painting, buckets kicked over, and the like. A rough starting point would be 300 to 400 square feet of coverage per gallon. Usually scenic paint is thinner than house paint—water is a budget-conscious extender—and while it does affect the long-lasting strength of the paint, the fleeting life of most scenery is not adversely affected by thinning the paint.

To get large quantities of paint ready for the job, it is often advisable to box the paint (Drawing 8-1). Boxing paint also helps ensure a consistency of viscosity and color. To box paint, select at least three buckets which will more than hold the total amount of paint. Fill each part way and then add the contents of the first bucket to the others. Add part of bucket two back into the first bucket and to the other. Pour bucket three into one and two. Continue alternating until the paint is thoroughly mixed about. Pouring through a large paint strainer that fits over a five-gallon bucket will help mix different paints and also trap any debris, sawdust, dirt, dried paint film, or stray animals. Always wet the strainer first. This will facilitate cleanup. Boxing paint in five-gallon buckets can take its toll on the back. Lift carefully. “A pint’s a pound the world around”; but a gallon of paint weighs between 8 and 11 pounds.

Many painters prefer to avoid the back strain which can result from boxing paint and utilize one of the many commercial mixing wands which fit into a power drill. They do fast and excellent work, but make sure the drill is powerful enough for the job. Take particular care to avoid paint spills with an electric drill. Keep the plug off the floor and away from mixing area. It is best to devote an old clunker drill to the paint area because it will inevitably be repainted to match each bucket of paint. Scenery people frown on such decorative additions.

The large strainer used in boxing paint is still invaluable for removing unwanted debris from paint. In addition to those mentioned above, the strainer will retrieve shop items including nails, staples, bolts and screws, lunch, and the furniture from the designer’s model.

PAINT TIP Fiberglass window screen makes an excellent cleaning aid. When crumbled up like a sponge it will chew away and rinse away dried and hardened paint in buckets and on the handles and ferrules of brushes. It is not as destructive to plastic buckets as a stainless steel wire brush. The wire brush can also be quite abrasive on natural bristles. The screen is also an excellent strainer for removing crudities from paint. It is not, however, a fine enough mesh for straining paint for spray guns.

PAINT TIP Spilled paint (gawd forbid this ever happens) is easily handled in the shop with damp sawdust. Keep a bucket handy. When paint is spilled, first try to contain the language. Next attempt to scoop up as much paint

as possible with the brush and put it back, either in the original bucket or a handy substitute. If the paint is contaminated with sawdust, etc., a quick strain often revives it. After the bulk of the spill is removed, dump the damp sawdust over the area and work it about with a broom. Sweep up the paint-saturated sawdust immediately or the binders in the paint will adhere the sawdust to the floor.

PAINT FINISHES

The finish or the amount of sheen of paint is achieved in the manufacture. Paint is formulated with proscribed flattening agents and the result is noted on the label—e.g., flat, eggshell, gloss, etc.—and on ideal surfaces will give the promised finish. There are four common finishes which scenic artists often need to duplicate. A flat finish which produces a matte surface has no sheen. This is easy to achieve. The word *flat* on the can will usually give this—unless of course, it must remain flat and then it will shine like crazy. Rubbing and buffing flat paint will help it shine. Flat finishes have the great advantage of not reflecting stage lights and thus remaining in the background.

Eggshell has a slight gloss and works well on stage if the surface must be cleaned or wiped down. It will shine more under lights and reveal any imperfections in the surface of walls, etc.

Semigloss is what it purports to be—a step below gloss. Paint with high gloss finish can glisten under stage lights but is often required.

If a higher or lower gloss is needed, there are excellent translucent and transparent water-based finishes of various shine available. These can replace solvent-based shellac, lacquer, and other gloss coverings. If there is too much shine on a finish, clear matte varnishes are available. There are also excellent satin products. These are usually milky in the can but dry clear and are applied after the original paint job has dried. They will also change the color underneath, usually deepening and intensifying it. One great advantage of applying the sheen after painting is the ability to utilize paints already in stock. It is generally not advisable to mix liquid clear finishes with paint in the can. This will change the sheen of the finish but also creates a glaze paint which will not cover as well. Of course, if you wish to tint a glaze, please feel free. Clear finishes can be applied by brush, roller, or spray. They can be thinned somewhat (which can affect the total amount of sheen) and applied in several coats to build up a richer finish.

SCENE PAINT

Most paints designed and sold to theatres are water based. In addition to latex and acrylic there is still a wide variety of paints with other binders. The once-standard scenic paint was powdered pigments. These are still available and have a wide variety of available color. The binders required range from animal glues (from hides to hooves) through

rubber-derived binders and more modern chemically derived polymer binders. The older binders usually require separate preparation involving soaking and cooking in a glue pot (a double boiler-like device) before they can be diluted with water to create a size which is then added to the powdered pigment. There are scenic artists who still prefer these paints, but their years of experience allow them to avoid the pitfalls inherent in this system.

The preparation of powdered scene paint can be messy and requires some knowledge and experience. It is critical to wear a HEPA (High Efficiency Particulate Attenuating—that's a hepa syllables) face mask when mixing the powder. Inhaling the dust is dangerous, particularly with the dye-base powders. Once the paint is prepared it is relatively safe. Be forewarned, however, that many of the binders quickly spoil, and the resulting odor would gag a dog on a gut wagon.

The trickiest part of mixing powdered pigments is possibly finding the correct strength of size water; not enough and the dried paint will rub off; too much and there will be a glue shine on the surface. Of course, different colors will require different amounts of binder. The results can be beautiful.

PAINT TIP When buying cartridges for face masks (which should be fitted for each worker), purchase a combination HEPA-organic vapor cartridge which should cover the painter for just about every hazardous task.

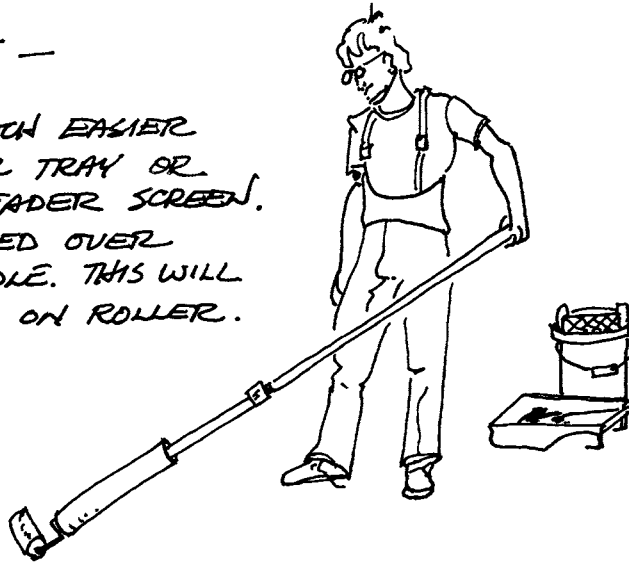
To make scenic paint more user friendly, manufacturers (no doubt with prodding from both costume and lighting designers) began distributing casein paint. Casein paint is available in powdered form (pigment and binder already combined) but is more commonly found premixed to a thick paste in cans and buckets. The painter need only scoop out the needed color and dilute with water to the desired consistency. The binder in casein was originally a protein made from dried curds of skim milk. This crumble was powdered and a few secret ingredients were added (ammonium carbonate or ammonium hydroxide) which can emit a vapor to open the sinuses and roll your socks down. Today, the cow is no longer required, as the casein binder is chemically manufactured. When dry, casein paint is relatively durable with a flat finish. Casein paints dilute a great deal compared to other types, a fact which is reflected in their higher cost.

As mentioned earlier, paint is pigment, binder, and medium. The quality of the paint will vary. Generally speaking, “you get what you pay for.” Cheap paint is stretched by adding excessive amounts of whiting, clay, or other hamburger-helper. This makes a very heavy can of paint which requires several heavy coats to cover, and in addition to excessive labor, saves nothing.

As a general rule, scenic paint is applied in a much thinner coat than house paint. Good paint (even house paints) can be thinned and still cover well... an obvious savings.

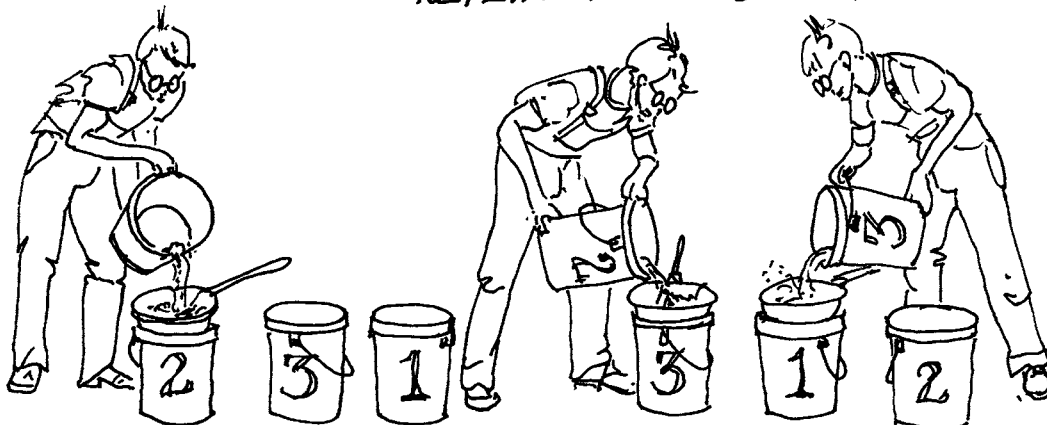
ROLL ON MACDUFF —

ROLLING FLOORS IS MUCH EASIER WITH A DEEP ROLLER TRAY OR BUCKET WITH A SPREADER SCREEN. NOTE 2" PIPE SLIPPED OVER EXTENSION POLE HANDLE. THIS WILL ELIMINATE PRESSING ON ROLLER.



BOXING PAINT —

CAUTION: VERY SOPHISTICATED! USE AN OPTIONAL STRAINER. POUR CONTENTS OF FIRST BUCKET INTO BUCKETS TWO AND THREE. NEXT, POUR BUCKET TWO INTO ONE AND THREE. NOW POUR BUCKET THREE INTO ONE AND TWO. REPEAT AS REQUIRED. PHEW!



WHERE TO BUY PAINT

If the theatre is located in a major city (OK, New York) there are probably local suppliers for all painted needs. Most theatres are outside this area and stocking paint becomes more of an issue. Local paint stores are an excellent source for paint and related supplies. Often there are industry ties, and it is not difficult for specialty paints to be ordered. Local suppliers are a valuable resource—build a good relationship here. Of course, paints created expressly for the theatrical trade are available through catalogs. But in areas of extremely cold winters many distributors are hesitant to ship paint because freezing can destroy the binders. This could help determine the paint system or systems you decide to use.

The local paint store stocks a lot of white paint which is colored to customer choice with universal tinting colorants, a thick, concentrated pigment. These colorants, while not inexpensive, are reasonably priced and can be purchased and stocked in a paint shop. Designed for house paint, they will mix into paints which have either an oil- or water-based binder. The colorant is available in handy squeeze bottles or cans. The squeeze bottle seems made for the scenic artist. The greatest advantage of using a local paint store is that they incur the cost (and space required) to stock a variety of useful paint products. While you pay for this service, it is often worth it.

ON THE STORING OF PAINTS

Paints are a lot like people. Moderate temperature is best. Avoid storing paint near heat—direct sunlight, next to a furnace or radiator—especially solvent-based paints. Water-based paints dislike heat too but are ruined if they freeze. The binders break down, and costumers have been known to kill. Because of the more stringent health regulations many of the dangerous preservatives once common in commercial paints have been removed or reduced. Paint will now rot quite quickly, especially after being opened and even more so after being thinned with water. Some shops add Lysol or formaldehyde to retard spoilage. Formaldehyde may be carcinogenic, and if the smell doesn't get your nose, cancer will. It is best to use paint fairly quickly. Whatever type of paint becomes stock in a shop, it is best to try to limit the variety. The intermixing of diverse paints, solvent and water-based notwithstanding, is fraught with unknown results. Sometimes they cooperate, but never when they must.

BRUSHES

Paint brushes are still the most common painting tool. There are as many varieties and variations of brushes as there are of wrenches, but a brush almost always consists of a handle, bristles, and a ferrule which holds the bristles to the handle. Drawing 8-2 exposes the most intimate workings of a quality brush. Note that the bristles are grouped, in this case in rows, and set into a resinous, often epoxy substance. The bristles are sometimes

separated by plugs which open-up the interior of the brush for more surface to hold and evenly discharge paint. The bristles and plug(s) are glued to the block or heel of the handle and bound on by a ferrule. The ferrule is commonly a rust-proof metal, usually stainless steel or brass, but if you're into leather, fret not—leather ferrules are available on some brushes.

There are two groups of bristles: natural and man-made. The natural bristle is from animal hair, either from the body or snout. The bristle of Chinese pigs has long been treasured for its great length, strength, superior flexibility, and ability to hold paint, releasing it in a steady flow when the brush is dragged across a surface. The natural bristle, like human hair, is a filament with a bit of tooth and an end which is split. Hair salons reap fortunes trying to eliminate this dreaded split end, but it is great on brushes and cheaper for pigs. The split end prevents the liquid from sliding off the hair and creating a drip. Man-made bristles are flagged by beating or exploded by blasting to fray the tip of the filament to try to duplicate nature's helpful but unfashionable split end. Natural bristle also tapers. It is thicker where it attaches to the body of the animal and thinner at the tip. This taper is somewhat duplicated in man-made bristles by stretching the filament in the manufacturing process.

As a rule of thumb, natural bristles are best for solvent-based paints, varnishes, and shellac. Man-made bristles, nylon or polyester, are best for man-made paint—acrylics and polyvinyl (both often generically called latex). Because these water-based paints are thicker, they clog onto the less resilient natural bristles. The water is also absorbed into the porous bristle which swells it, softens it, and can aid in loosening it from the resinous base which holds it. However, because much scenic painting uses thinned down commercial paints or naturally thinner scenic paint, the natural bristle brushes can be used. They do have a superior ability to hold a charge of thinner paints but will become saturated and limp-out after a long day of use.

A good brush will do a good job and last a long time if properly selected and maintained. When selecting brushes, pick a bristle which is designed for the type of paint being used. Hold the brush by the handle as you would when painting. It should be comfortable in your hand and have good balance. Make sure the ferrule is solidly attached. The ferrule will take a beating when spattering. Gently pull the bristles. If you have a hand full of hair, put the mangy brush back. The bristles must be solidly fused inside the ferrule. Press the brush in your hand and observe how the bristles spread. They should fan out evenly from the ferrule. When the brush is lifted, the bristles should return to their original position. Examine a single bristle. Is the tip flagged? When you stroke the bristles between two fingers, is there a slight bit of tooth on the filament? This will help hold the paint. Is the brush much more expensive than you can afford? If so, it is probably a good brush.

Paint brushes are made in a wide variety of sizes and shapes for the construction industry. Each brush is designed for a specific job. Theatre people usually don't care about the original job but should select brushes which will ensure their needed fin-

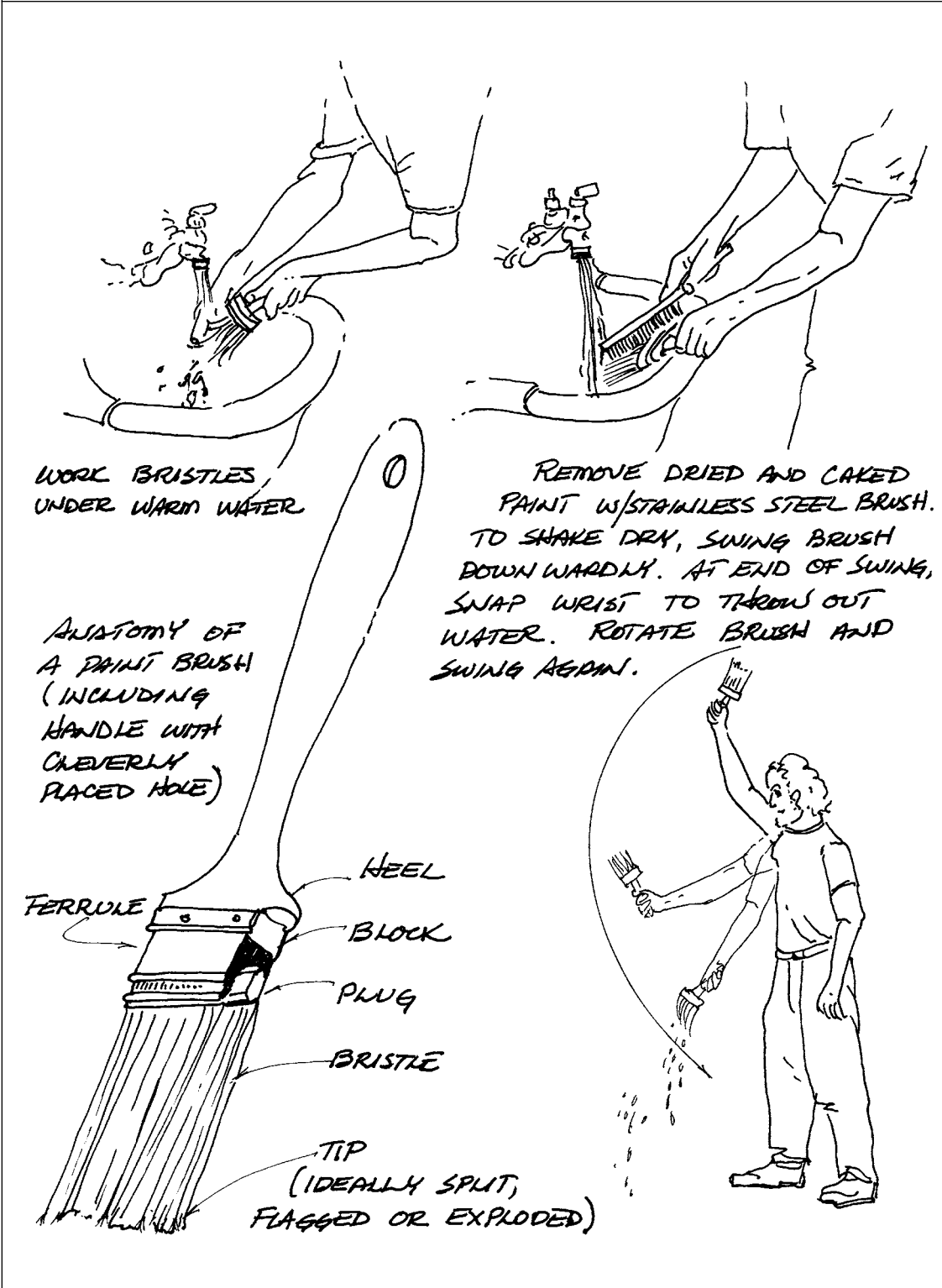
ish. Commercially available brushes can be found in any good paint store, but inferior brushes lurk about everywhere else from grocery stores to cut-rate chains. They have even invaded some good paint stores...there goes the neighborhood. The best brush handles are wood and vary in shape and length. Quality plastic handles are becoming more common. The ferrules also vary in shape, metal, and method of attachment—nails, rivets, or crimping. Some ferrules are joined with a folded edge, some are soldered. The bristles, as discussed earlier, can be natural, man-made, or even a combination. The shape of the cluster of bristles can be fairly flat on the tip end, or they can be set with the end chiseled or tapered (Drawing 8-3). The end profile can be straight across or angular, either flat or chiseled. The bristles could be grouped into a round or oval shape. Natural bristles are set by hand and built from the tip. The shape of the end of the brush is laid up because each bristle must terminate with the natural flagged end. This is one reason why natural bristle brushes are so expensive. Once the desired shape is created, the block end is trimmed, set into a resinous substance to bond the bristles together, and is then attached to the block or the heel of the handle. All this is bound together with the ferrule. Brushes of man-made bristle, normally nylon or polyester of various colors, can be set and attached to the handle before the tip is shaped. After being cut and chiseled to the desired shape, the end of the brush is then subjected to beating or blasting to abrade the ends of the bristle. It hurts to be beautiful.

PAINT TIP General Doozendont says, "It is hard on a brush to switch back and forth between solvent-based and water-based paints." Because small amounts of residue from either solvent can bind with the opposite and make cleaning difficult, it is better to use separate brushes.

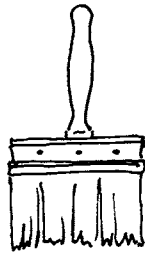
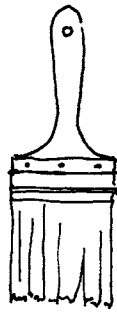
PAINT TIP Don't store brushes or let them soak or dry standing on the bristles. This will permanently bend the bristles and give a new challenge to painting. Sometimes this deformation can be magically healed in brushes with man-made bristles by holding the brush in hot water—just below boiling—for a few minutes. As with people, this will sometimes straighten them out. Reshape the bristles by wrapping the brush in heavy paper to hold the shape. No guarantee of success.

SIZES AND SHAPES

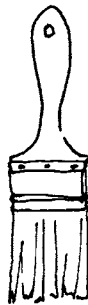
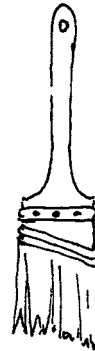
Dutch brushes and primers (see Drawing 8-3) are large brushes which measure 5" or 6" across the ferrule and can be at least 1" thick. Dutch brushes can be even larger: 7½" wide and up to 2" thick. They have long (4½" to 5¼") bristles. Dutch brushes are also called calcimine brushes. Calcimine is a rough coating for walls and ceilings containing, as a major ingredient Dutch White, which can be anything from various species of clay to, at one time, pure white lead. Thus, when house painters mixed a Dutch paint, they obviously applied it with a proper Dutch brush. The smaller brushes, still available today, are designed for ceilings and large wall areas. Their high cost and the introduction of the roller will probably see their ultimate demise. A pity because they hold a good charge of



A CONSORT OF BRUSHES

BLOCK-
"DUTCH"

WALL

VARNISH-
WALLANGLE
SASHFLAT
SASHSQUARE
TRIMCHISEL
TRIM

paint and can make quick work of large areas. These large brushes are most valuable for priming and laying in large fields of color. The 4" wall brush is still popular with professional house painters, manufactured in some quantity, and therefore available in many choices and at a price which only requires a mortgage on first children. Smaller versions of this brush, those both narrower and thinner, are called trim brushes.

Related to the trim brush is the sash brush designed for painting the narrow sashes on windows. The bristles are set both flat and angled, which gives the latter the mysterious name angular sash brush. Common sizes for sash brushes range from 3" down to 1". The angular sash is excellent for its original use and for cutting-in paint to a prescribed line, lining along various trims, and the like.

A long-handled oval brush now utilized almost completely by scenic artists is called a fitch. Because the house painter no longer uses fitches they are difficult to find and are usually sold by theatrical suppliers and are, as one might think, unreasonably expensive. Fitches appeared in the latter part of the nineteenth century. Originally made from the fur of the polecat or fitchew, these smaller, often oval shaped brushes have a ferrule that tapers toward the longish handle and the bristles flare out slightly. Even by 1873, Spon, in his book, *Workshop Record*, called small hogs-hair brushes which resembled the earlier fitch, by their now common name. If you wish to ferret out some for your shop, try a theatrical supply house. Scenic fitches range from large and expensive 3" and 2" sizes called foliage brushes to narrower brushes, down to 1/4". The narrower fitches are called liners for obvious reasons...you can cruise when using them. The best fitches are made of white China pig bristles and despite their cost are an invaluable addition to a scenic artist's kit. We will not discuss their caboodle.

Foam brushes make any professional painter bristle with indignation, but the sponge-on-a-stick can be useful for on-site touch up, quick and dirty lining work, or in situations where water may not be available. Their inexpensiveness and inability to last through repeated jobs make them an ideal disposable painting tool. They will, indeed, self-destruct on many surfaces. The width of a foam brush can be diminished to any desired size with a pair of scissors, mat knife, or good teeth. Many scene painters carry an assortment of these ugly little brushes, carefully concealed from the mocking of co-workers.

SPECIALTY BRUSHES

As any professional painter, and certainly professional scenic artist, will tell you, there are many brushes available which are not found in most local paint stores. There are stencil brushes with short, tightly packed bristles in a round ferrule, designed specifically for pushing paint through a stencil. These are often used for other tricks of the trade. Script and stripers have extra-long bristles which are set to taper to a fine point. This allows thick and thin lines with the same brush—ideal for scrollwork and lettering. These softer bristle brushes are most useful in painting marble veins. There are brushes specifically for stains and varnishes created for the professional woodworker which transfer well into a scenic shop. Their long-term usefulness is determined by the protection of the scenic

artist. Disposable brushes with natural bristles are called chip brushes and will service many uses with normal care. The variety of brushes is far vaster than these notes. Check with your local paint store. They will have many catalogs offering much more than they normally stock. Specialty companies will offer a selection to bankrupt a Rockefeller. For the individual scenic artist, an investment in quality brushes will pay handsome dividends (in addition to being a tax-deductible expense). For the general paint shop, any brush will last only as long as its proper use and upkeep.

PAINT TIP If you do not have water or solvent available to wash a brush, wrap it in aluminum foil, plastic wrap, or even a newspaper to retard drying by air contact. Wash well as soon as possible. This wrapping method will not hold more than a few hours.

BRUSH CLEANING

A considerable investment can be made in brushes. Proper cleaning is therefore mandatory to maintain both the buck and the brush. If you are using solvent-based paints, employ the proper solvent for cleanup. In a well-ventilated area, and wearing proper protective clothing and masks, fill a container with enough solvent to reach the ferrule. Insert the brush and press it about, turning and twisting the handle to loosen and dissolve the paint. A paint brush comb will help loosen hardened paint. When the solvent has become saturated with the paint, move to a new container with fresh solvent. Most solvent-based paints will require three or four changes of cleaner to remove enough paint so the solvent is barely tinted by the residue in the brush. Do not pour solvents down the sink drain. In addition to endangering the water supply, solvents are often incompatible with water and will clog the drain. Because the fumes are combustible, some rather explosive results have been recorded. Store used solvents according to their saturation of removed paint. Paint will settle in used solvent. Careful decanting will contain the sludge in the bottom, and the poured off top can be re-used. This can be done many, many times. It is economical to begin washing a brush in used solvent and change to progressively less contaminated batches when cleaning. Once the brush is clean, smooth the bristles back to their original shape. Hang the brush up by the handle. For disposing of no longer usable solvents (or paints) read the section following.

Cleaning water-based paints is somewhat easier and certainly less hazardous to your health and the work environment. Warm water is best. Cold water hardens the paint. Hot water can warp the bristles and soften the binders in the ferrule. Warm water helps loosen the paint and float away the residue in the brush. Hold the brush under running water and work the bristle with your hand (Drawing 8-2). The water should be comfortable. *Never* run the water directly into the end of the brush. This will force the bristles to bend back. As they try to resume their shape, the rushing water can knot them which will result in a definite bad-hair day. A good working over with a paint brush comb may help eliminate the problem if it happens. To remove dried or hardening paint from the ferrule or on the bristles, judiciously use a stainless steel wire brush. Hold the paint brush

against the edge of the sink, and with the metal brush, work from the ferrule down to the tip of the bristles. This will loosen paint on the ferrule and help dislodge any remaining in the bristles near the ferrule. Excessive use of the steel brush can abrade the bristle and allow it to curl. Make certain the brush is clean. The water should run clear; when it is, place a bit of soap on the bristles. Some shops keep a cake of soap for this use. Others use a bucket with slightly thinned dish soap. Murphy's Oil Soap is also a favorite. Work the brush with your hands to develop good suds, which will lift out any remaining paint. When you are sure the brush is clean, rinse well, and shake out any excess water. Never, never, never beat the brush against the side of the sink or any solid object. This shock will break apart the ferrule and can crack the resinous bond with the bristles. Reshape the bristles and hang up by the handle. Yes, on natural bristle brushes, a periodic short soak in hair conditioner makes them feel extra pretty.

The necessity of washing brushes properly cannot be stressed enough. When hurriedly and superficially cleaned, the residue of paint left near the block and plugs dries and becomes impossible to remove. This build-up will continue and eventually, but rather quickly solidify, robbing the bristles of their long flexibility and forcing them to separate, thus losing the shape. When a paint brush more closely resembles a toilet brush the condition is called *finger* and is about as useful.

Much of the drying and hardening of paint in the plugs can be eliminated if the brush is soaked in warm water for a few minutes before painting. This will wet up the area and retard any stray paint trying to settle in for a long winter's nap. Make sure you shake out all excess water before starting to paint (see Drawing 8-2). Swing the brush downward and sharply snap the wrist. Rotate the brush 180 degrees in your hand and swing again. The number of sharp snaps and concomitant rotations are left to the discretion of the painter. Do not soak brushes for long periods of time, either before beginning or between jobs, and certainly not over night. Natural bristles will swell, become limp, and even expand enough to break the resinous binder and even the ferrule. Wood handles will also absorb water and swell. Many a well-fit ferrule will be split open if brushes soak too long. When the brush dries, the handle shrinks and the bristles begin to wobble within the ferrule. The ferrule can even part company with the handle. Not a pretty sight. No amount of counseling with a hot glue gun or construction adhesive will ever repair this once ideal marriage. It is obvious that the time and care required for cleaning must be built into the work schedule. The expenditure here will certainly pay off. A good brush will last many, many years and, as with other tools, become the hard working extension of skilled hands.

DISPOSING OF PAINT

"After the ball is over, after the dance is done..." what does one do with left over paint? If another show is coming up, perhaps it can be used. Certainly similar values or colors of like paint can be boxed together for a future primer or base coat. Darker colors make an excellent start for back-paint.

If it is the end of a season and the paint won't store for the break—too hot, too cold, or no place available—try to give the paint away. This is most feasible if the paint is in its original cans which have all the correct safety information.

If no one wants the free paint or it is long separated from its original can, you can dispose of it. If the paint is latex, simply remove and discard the lid. Place the can away from children and pets and let the paint dry completely. It will harden in the can and can then qualify as household refuse. You can hurry this process by mixing the paint with sawdust or cat litter and letting the goo dry. Do not pour paint down drains. It can clog the drain and will eventually affect drinking water.

Solvent-based paints (those alkyd or oil-based problem children) require additional care in their disposal. The paints and accumulated fumes are ignitable. NEVER pour these down drains (especially one on a septic tank), into storm sewers, or even on the ground. The chemicals eventually leach down and damage the water table. Most solvent-based paints qualify as a household hazardous waste (HHW), and if your community has special days for collecting such things, take advantage of the service. If not, contact a local or state government environmental control agency for assistance.

Paint thinners, turpentine, mineral spirits, and solvents should *not* be poured down drains or on the ground. Always try to allow paint to settle in the container and carefully decant the re-usable liquid. The sludge can be poured into cat litter, spread out in a well-ventilated area, and allowed to dry *completely*. Again the same people who helped dispose of the solvent-based paints can assist with the disposal of these remains.

Check your 311 nonemergency information system, in the Yellow Pages, or search online under “waste disposal” to see if a local company or agency can offer help. It can't be said too many times: never, never, never pour paints or their solvents down a drain.

SOLVENT “BORN AGAIN” CLEANERS

A note on solvent-based brush cleaners is in order. These cleaners are strong, will eventually eat through dry, hardened paint on the bristles, the ferrule and handle, and return flexibility to the most catatonic brush. However, the cleaner may permanently weaken some man-made filaments, leaving them listless, limp, or permanently awry. It can do even meaner things to natural bristles. Use these cleaners with caution and help speed up the process with a paint brush comb or old kitchen fork, so the paint is quickly loosened and the bristles are subjected to a minimum of saturation. Take care to avoid personal contact—these cleaners are toxic.

Another cleaning solvent available is lacquer thinner. This will attack the dried residue clinging to bristles and packed around the plugs. It is also excellent for cleaning spray gun parts. However, great care must be exercised. Read the warnings on lacquer thinner and re-read the section on solvents and the section on disposing of paints.

Like Dr. Frankenstein, you can create a monster using potentially dangerous cleaners. It is always better to wash out brushes promptly and properly. But there is something

about playing god when you see an expensive brushed heeled-up hard, its once supple filaments hideously bent, warped, and curled in crooked disarray. Does it bring out the goodness in you or guilt from bad handling in *les temps perdu*?

PAINT TIP Most glue used in scenic construction, particularly in covering flats, is not really compatible with paint, even if both are water solvent. To protect tempers, not to mention scenic brushes, have separate, inexpensive brushes or rollers for glue. One method which helps identify and isolate the glue stuff is to paint brush handles and glue buckets a bright blue. Eventually, “blue buckets are glue buckets—blue brushes are glue brushes” will sink into the consciousness of some shop personnel; that it remains unconscious for others still requires vigilance. Separate buckets with lids allow the shop glue to remain for extended periods and eliminates the constant washing of glue buckets. One additional advantage resulting from separate and clearly marked glue buckets is the avoidance of pouring glue into paint (or vice versa). Certainly the inadvertent admixture lessens the effectiveness of both. Some paints and glues even react chemically and make something akin to cold tapioca or ripe cottage cheese.

A BIT MORE HISTORY

Paint rollers were patented by 1890. The rollers were covered with lambskin, and the like, but were not commercially successful. In early 1940, Earl Thomas of Thomas Products Co. was making a roller covered with stipple carpet used by decorators to create patterned wall finishes on plaster. After 1943, this small specialty company working out of a garage also made lambskin rollers for applying base coats. When World War II ended, victorious America utilized the German formula for a man-made rubber-based paint, and Kem-Tone hit the market. Rollers worked well with this new paint. By 1946, several companies began manufacturing rollers. Added impetus came from the post-war redecorating boom and the style-setting decorators’ use of very deep colors. These easily showed brush marks. Union painters were contractually forbidden to use labor saving rollers but would literally pull the blinds and secretly roll on the intensely desired colors—leaving no brush marks. It was not until the mid-sixties that rollers were not disallowed in union contracts.

Solid core wood rollers also appeared after the war. When large ships were in dry dock, many were painted from barges using rollers with long extension handles. Contractors ordered the solid roller so disgruntled union painters could not inadvertently step on the roller, crush it, and thus render it useless. The union only wanted to prove the need for larger crews with the more traditional and reliable brush. Europe and the Far East discovered the roller, and painting the ships of the world moved away from union control.

ROLLER COVERS AND HANDLES

Paint rollers are, certainly for the non-union painter, a mid-twentieth century invention. Originally made by laminating lamb's skin around a roller, they are now available in a wide variety of napped coverings, various widths, and even shaped foam. Natural lamb covered rollers are still manufactured for solvent-based paints. Many synthetic napped versions are available at reasonable prices. Avoid cheap rollers. They will shed their coverings during the paint job, and the cheap cardboard tube has been known to collapse. Less expensive rollers are excellent for jobs where cleanup is problematic, which would certainly include all solvent-based paints, because it is easier, safer, and often cheaper to simply throw away the used cover. For water wash-up paints, however, better quality roller covers will last many, many jobs, and cleaning is not too difficult with a roller spinner that quickly rotates the roller and throws the paint out of it. Roller spinners are available at any good paint store and are worth the investment. Keep an oil can handy to lubricate the internal parts if they become rusty. Rollers must be carefully washed, or they become cement-like columns. The nap or depth of pile available on normal covers ranges from long (1" to 1¼") through medium (½" to ¾") to short (¼"). Obviously, the thicker the nap, the more paint it will hold, and the more readily the roller will cover uneven surfaces. Thick napped rollers may also discharge too much paint on smooth surfaces, leave drips, sagging runs, lines, and a stippled finish, very much like a well-filled pair of polyester pants. Disposable rollers and those covered with foam rarely cover as well as a properly selected quality napped roller.

Rollers come with their own set of accouterments: roller pans or trays, wire or plastic spreader screens made for both roller trays and buckets, and handle extenders. A good roller pan should comfortably fit the roller and have a well deep enough to hold sufficient paint for extended rolling. The investment in a quality roller handle cannot be stressed strongly enough. Because the handles are interchangeable with many roller covers, they receive constant use. A heavy, contoured handle on the roller frame which fits the hand well will drastically cut down on fatigue. The end of the handle should be threaded for an extension pole. The end caps which support the roller and allow it to rotate should be nylon or some other material which resists paint and will spin smoothly on the handle's metal shaft. A sturdy spring cage extending between the end caps indicates a superior roller handle. Poles are available in many lengths and in a variety of materials. Some poles are even adjustable. Invest in quality extension poles. They will save frayed tempers at cleanup time when none of the push brooms in the shop has a handle.

PAINT TIP One trick of the trade which will save the painter's back when rolling floors or painting acreage (large amounts of scenery in a similar flat position) is to slip a length of 2" iron pipe (approximately 18" long) over the extension pole and down to the handle (Drawing 8-1). This will rest at the base of the handle and put a constant weight on the roller, thus removing the need to press the roller to the floor. Arms and back will note a remarkable difference in fatigue. Many

scenic artists dislike rollers, but others embrace their wide variety of surfaces and availability. Some embrace things we cannot discuss.

SPRAY GUNS

Spray guns, both hand-pump and compressor-driven, are useful painting tools. While hand sprayers have been around for many years, it was only in 1909 when the DeVilbiss Company applied the same principles as their medical atomizer to a paint gun and combined it with compressed air that the paint sprayer came into being. It revolutionized the infant automobile painting industry and had a profound impact on painted furniture, too. But, as with most things which save time at one end, more is required at the other. Cleanup and maintenance cannot be ignored with sprayers. Adequate time and care must be assured, or the major investment will quickly bankrupt the theatre. Spray equipment requires a pressured air supply, available in many shops, but it must be regulated for the required pressure of the individual gun. Spray equipment usually requires a compressor with a large capacity air tank, unlike most shop tools which require high pressure but little volume. Spray guns not compatible with shop tools can use a pressure regulator, and one compressor and tank will make both viable.

PAINT TIP One good source for spray guns and related items is an automotive parts and supply store. These establishments often clean and repair spray equipment. These health spas for sprayers can be most refreshing between shows.

Because much theatre painting is done with different paints of different viscosities and particulate sizes, the guns must be able to accept these differences. Not all spray guns or spray heads are created equal. Check with your supplier. The old reliable Hudson sprayer, a hand-pump garden sprayer, can easily be converted to air. The tank must be metal. Drill a hole at the top to receive a male fitting for the air hose. After the fitting has been brazed into place, the tank will give excellent results on about 40 lbs. of pressure. It is also possible to replace the short hose between the tank and the nozzle wand with a long piece of air hose which will alleviate carrying the heavy tank while painting. However, the long hose must be properly and thoroughly cleaned, which seems to take forever. If you are setting up spray equipment, remember you will also need more hose than you plan for, and don't even think you can use the shop construction hoses. Buy enough fittings to make up several sets of extra hoses, and some T fittings, which will allow more than one gun to feed from the source. Additional regulators for air pressure will also be needed. Live it up. There are also airless sprayers that do not require an air supply. The feed hose goes directly into the paint bucket. Again, the heads need to have the ability to emit a variety of paints.

There are many small, hand-held sprayers on the market. These are usually made of plastic and are common in garden stores. They are invaluable for smaller paint jobs, touch-up, or on-site projects with no air supply. Check out the ability to push paint through the nozzle before buying a case. Cleanup is essential, or these sprayers instantly become disposable.

Oil and water do not mix, and this is particularly true with spray equipment. Don't try to use both or you will curse that last person who used a different paint. Spray equipment, regardless of the type of paint being applied, must be used with the proper protective masks, goggles, and clothing. Adequate air movement is also a must. Spray painting must not be done in any area where others are working unless everyone is adequately protected. If you can see or smell the spray, it is dangerous.

One further caution on spray equipment. Make certain only trained personnel use it. In addition to the added health hazards, the health of the equipment is seriously jeopardized when used improperly or even badly adjusted. Cleanup is critically important. Dried paint and rusted parts will rapidly decrease the efficiency of spray guns, and any advantage gained in their use will cease. Nothing is more frustrating than a spray gun which sputters, splatters, and constipates to a complete halt in the middle of a project.

SAFETY

Paints fall into two rather loose categories: water-based and solvent-based products (often erroneously called oil based). The latter can be quite toxic and should be used only by professionals who understand the paint's unique properties. The painters must be prepared with proper safety protection for themselves and others working within the area of the fumes or overspray or in physical contact with the paint or its solvents. The dangers of toxic buildup in the body are real, and the federal warnings noted on the manufacturer's label must be followed by the user. Because the toxic properties can be ingested, absorbed through the skin upon contact, or through inhaling the fumes, toxic paint—read all paint—is dangerous. Protect your skin and certainly any cuts or abrasions with the proper clothing and gloves. Wear a respirator properly designed to filter the fumes and overspray unique to the product and solvents required for cleanup. Remember that the fumes created when paint dries and cures are also dangerous. Truly, the life you save will be your own. Even if you do not experience any reaction—sore throat, watery eyes, nausea, or headaches—know that the paint is dangerous and protect yourself. Of course, if you react in any negative way, stop using the product immediately. No one has the right to insist you continue working and endangering yourself. That is the law. Call your local health authorities or the OSHA hotline if you feel you are being coerced. Workers who are well, work well. Off the soap box.

Become good friends with the knowledgeable people who run the paint store or supply house where you will be buying. Don't be afraid to ask questions, and feel free to ask for the Safety Data Sheets (SDS), previously called Material Safety Data Sheets (MSDS), which, by law, must be provided for every hazardous product sold. These should be available on the job site. This information is often eye opening to the dangers, both immediate and potential, and can help decide a product's appropriateness for a certain job or shop. Always try to find the best product for the job, but it is not a bad compromise to find a healthier product. While theatre is more important than life, the show will go on, and so

should the people working in the shops. Who put that soap box back under me?

Each solvent-based product requires its own solvent for cleanup of equipment and painter, and these solvents are usually not only incompatible with other products, but more dangerous if combined. Many non-professional paint shops ban all toxic solvents. If not banned, keep these dangerous paints and solvents in a *locked*, combustion-proof cabinet. If this diatribe has not convinced you, carefully read the section on solvents. As consumers become more aware of dangerous products and refuse to use them, safer substitutes will become available. There is usually a safer product already on the market. Try to use it. Commercial paints are designed for years of wear, a situation luckily not common to most theatrical endeavors where the everlasting finish can be faked.

SOLVENTS

Paint, including what is generically called latex paint is potentially a health hazard. However the risk of toxic poisoning is drastically increased with solvent-based products, especially those misnamed oil paints. This includes various varnishes, shellacs, lacquers, and other finishes sold both by the bucket and aerosol can. It must also include paint removers and paint strippers. The solvent required is often a clue to the health hazard.

A solvent is a liquid which will thin down or dissolve another material. Water is an excellent example and should be the solvent of choice. Unfortunately, water will not always work, but with educated choices and careful selection of materials, especially paints, water can become the dominant solvent in any shop. The price is right, it is easily disposed of, and except for the most serious whiskey drinker, nontoxic. Most shop health hazards—and they are serious—can be alleviated, even eliminated by using only water-solvent paints and finishes. That said, here is some information on common organic solvents used to clean, dissolve, or thin non-water based products. In addition to prepping the surfaces for some highly toxic finishes, organic solvents are used to clean up tools, brushes, rollers, and all too often the worker's hands, face, and other exposed areas. Some solvents found in paint shops include acetone, turpentine, ethyl alcohol, and premixed solvents created with a variety of often changing components, including mineral spirits, petroleum distillates, lacquer thinner, and naphthas. Many of these solvents disguise their toxicity under a trade name and sweet perfume. Read the labels and their dangers will be exposed. Every hazardous product sold in the paint store must have a Safety Data Sheet (SDS)—which will identify the contents and note any dangers. Federal law requires these sheets list hazardous ingredients. The sheets must be available where the products is sold and should be given to you upon request. SDS are also available on the Internet.

Organic solvents are hazardous to your health. They can affect the nervous system, respiratory system, skin, eyes, and internal organs. They will adversely affect the reproductive systems in both men and women. With the already evaporating gene pool, don't add fuel to the fire. Pregnant women must avoid toxic solvents at all times. Pregnant men should have used more protection.

Both the toxicity of and the exposure to a solvent can affect the worker. This, of course, varies with the material, conditions in the workplace, and the worker. However, the following guidelines are useful. Avoid breathing vapors. Adequate ventilation is a must. An open window doesn't cut it. Central air conditioning doesn't cut it because it recycles the air. However, once the foul fumes find their way into the front office, things will change. Large amounts of fresh air must move through the work area and be exhausted to the outside.

Avoid skin contact with toxic solvents. Wear appropriate protective gloves. Many household gloves simply melt away. When finished with the work, wash up with soap and water. Do not clean skin with solvents. There are many non-toxic skin cleaners available, but baby oil or olive oil will remove most paints from the skin.

Wear proper body protection. This is important when painting and when pouring solvent. Do not expect protection from normal eye glasses. Never wear contact lenses unless protected by goggles. If using solvents, a plumbed eye-wash fountain should be in the area.

Always wear gloves when handling solvents. Make certain there is good ventilation, but wear the proper vapor respirator if required. Smoking can also draw the toxic chemicals into the mouth, throat, and lungs. Do not eat or drink around solvents. The food can hold toxic waste which will be ingested. Even though odor is often the least harmful part of a toxic solvent, remember, if you can smell—tell. This is particularly important on first notice of solvent odor. The nose will often shut down as a part of its protective reaction after extended presence of toxic fumes.

FIRE PRECAUTION

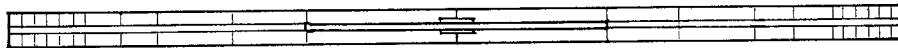
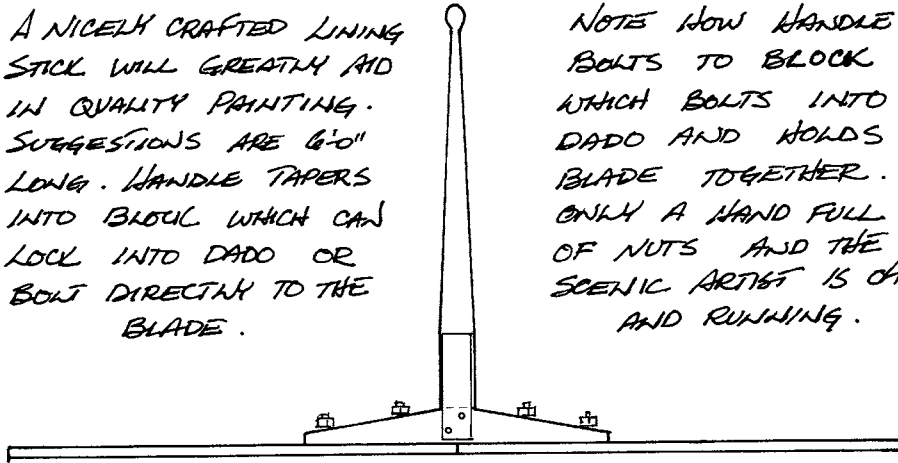
Almost all solvents will combust or explode. They must be stored in proper metal cabinets. Open flame (which includes smoking), electrical sparks (which includes welding), and carving Styrofoam with knives heated on a gas stove (which includes your certain death) must be avoided. While it is an excellent idea to have a class ABC multi-purpose, dry chemical fire extinguisher in any shop, it is mandatory if using solvents.

USEFUL AIDS FROM THE SHOP

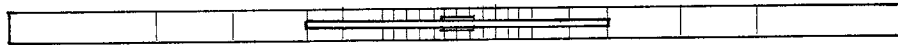
The snapline may seem common enough but those used in the scene shop are usually a box filled with colored chalk. This chalk is excellent at depositing a bright red, yellow, or blue line. For the painter, this line never disappears and tints the paint job accordingly. The chalk, beautifully designed for what it does, will not easily blow away, flog away, or brush off. Blame the colorant in the powdered chalk. Painters prefer stick charcoal or even white chalkboard sticks which can be pulled over a line and then snapped onto the object which will eventually be painted. Buy a chalk box and fill it with powdered charcoal or whatever is ideal. The most long lasting chalk line is a piece of 1 × 2 about 6" long with the edges slighted rounded upon which

A NICELY CRAFTED LINING
STICK WILL GREATLY AID
IN QUALITY PAINTING.
SUGGESTIONS ARE 6'-0"
LONG. HANDLE TAPERS
INTO BLIND WHICH CAN
LOCK INTO DADO OR
BOLT DIRECTLY TO THE
BLADE.

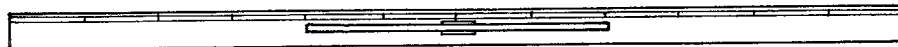
NOTE HOW HANDLE
BOLTS TO BLOCK
WHICH BOLTS INTO
DADO AND HOLDS
BLADE TOGETHER.
ONLY A HAND FULL
OF NUTS AND THE
SCENIC ARTIST IS OFF
AND RUNNING.



BLADE MARKED FOR EASY END MEASURE



BLADE MARKED FOR CENTER WORK

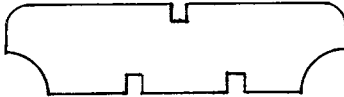


BLADE HAS OLD TAPE MEASURE ATTACHED

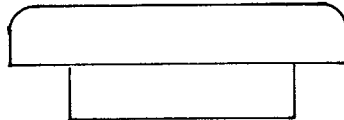
DETAIL VIEWS OF BLADES:



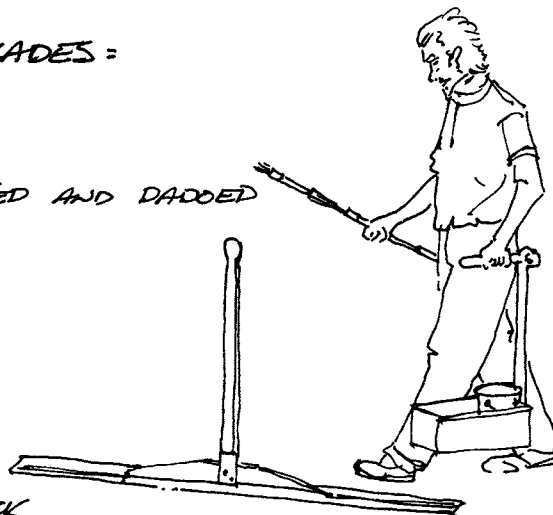
ROUTED, MITERED, KERFED AND DADOED

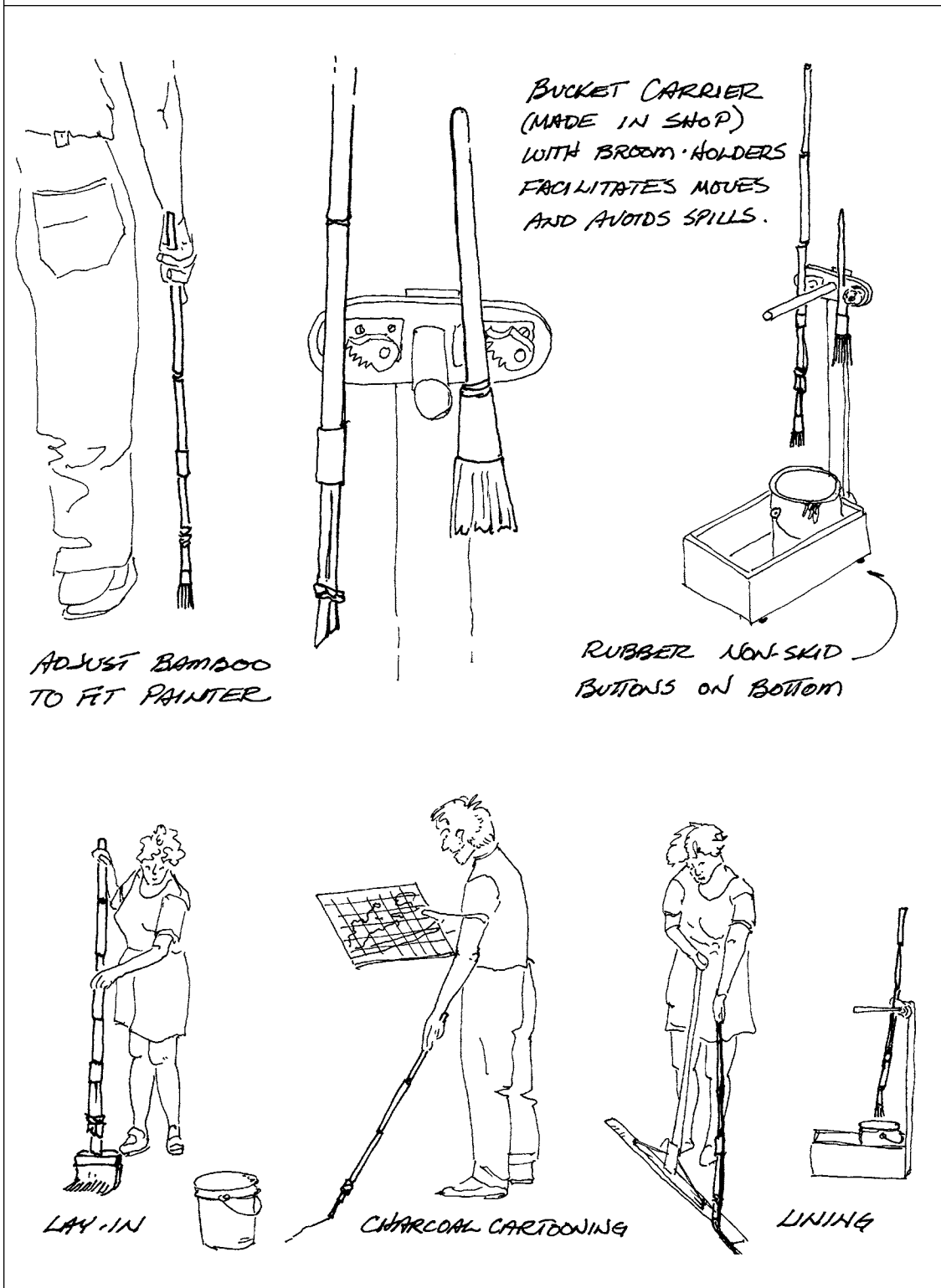


ROUTED AND KERFED



ROUTED LAMINATED STOCK





you wind up a long piece of mason's line, a strong heavyweight cotton string. To use, unwind what you need, fix the end, whether with a loop over a nail or hand it to an assistant, and pull a piece of stick charcoal along the string. It's a bit messy as the string cuts through the charcoal, but the charged line, when snapped, leaves a beautiful, straight impression. The charcoal line can be "erased" in quick order with a flogger. A bowline can facilitate one person snapping and is especially useful for vertical work. To make one, think of flat frame construction and take a piece of 1× stock as long as the line you wish to snap. Attach a short rail (about 10") to each end of this stile using corner blocks. Affix a piece of mason's line to the back of one end. Place the line around the front of one rail to the other. Stretch the line tightly and attach to the back of the second rail. You now have a taut line which can be charged with charcoal, placed against a surface, and snapped.

FLOGGERS

Floggers are useful tools for urging on sluggish workers and also cleaning up charcoal lines and stray debris from objects being painted (Drawing 8-3). To make one, and they must be made, take a piece of 1×, about 2' long. Smooth the edges to be comfortable in the hand. Next, tear muslin scraps into one-inch strips about 1'-6" long. Attach a dozen or so strips to the end of a stick. A quick whip across the surface, and no longer needed charcoal lines will be removed. (When asked why he was so happy living with the sadist, the masochist answers, "Beats me." This explains nothing about scenic artists.) Avoid breathing charcoal dust. Remember what it does to coal miners.

LINING STICKS

Lining sticks can also be useful to the scenic artist. There are two basic styles: handheld for vertical painting and floor based, with extended handle, for working horizontally. Both must be light, rigid, and well balanced. They must also have an edge that is raised from the surface to be painted. This prevents capillary action which can pull the paint under the stick and deposit it onto the surface.

Lining sticks for vertical painting rarely exceed five feet in length, mostly because it is awkward to reach farther when painting. A piece of 1× stock with the edges beveled will work well. A wood block handle centered on the stick helps holding it. If the edges are rough and grab the bristles of the brush, a strip of ever-useful duct tape can be wrapped around the beveled edge to smooth it. Variations on lining sticks abound, and they are often crafted for specific jobs and then discarded.

Floor sticks for lining (Drawings 8-3, 4 and 5) are almost always double sided to alleviate the need to twirl the stick and clip a bucket of paint or even the ankle of a neighbor painter. The board is often a bit wider than the handheld horizontal stick so it will stand upright, but lightness is still a major consideration. Many scenic artists mark off the blade to help measure on the floor. It does save the back and even some time trying to find a tape measure.

Note how the handle mounts to the lining stick (Drawing 8-4). To keep the handle centered and as thin as possible, thus avoiding getting in the way of the brush being pulled along the blade, the 1/4" straps on both sides attach it to a base block. The dado for the base block is centered and runs the length of the blade. This locks in the handle. The dado also helps eliminate tension in the wood which builds as the wood ages. The kerfs running along the bottom of the blade also lessen the chance of tension warps. Scenic artists who travel often cut their favorite lining sticks in half. The two pieces are held together by the base block, when it is snugly locked into the dado. The handle also bolts on. This easily lets the long and somewhat awkward stick break down and pack into an overhead compartment on airlines or become carefully checked baggage.

BAMBOO

Floor painting should be done with a minimum of back bending. This requires brushes with long handles. Some European manufacturers make brushes with handles that are threaded on one end and screw into the block. However, the utilization of bamboo sticks and poles (Drawing 8-5) is a very practical and inexpensive way to temporarily extend any brush handle. By inserting the handle into the pole and not taping it to the side of a broom handle, the bristles are still in a straight line with the handle, and the painter has good balance and control of the brush. A collection of bamboo poles is just the ticket. Bamboo has joints or knees along the stalk which are solid through the piece. To create an extension handle, cut the bamboo on an angle just past a joint. Sand down the sharp edge. Take a chisel and place it in the cut end. A slight tap will split the hollow shaft to the next joint. Rotate the chisel 90 degrees and split the shaft again. There should be four legs into which you can insert the brush handle. A large rubber band can be wrapped near the cut end, creating a sphincter-like grip. Be careful rolling this rubber band up and down—the edges of the split bamboo are razor sharp and will easily cut into hands, fingers, or anything else you may find useful. You may want to do a bit more sanding. Another thing which will make the bamboo more efficient on the insertion end is several wraps of duct tape just above the first joint. While the joint will stop the splits from continuing through the pole, continual use will eventually encourage the cracks ever upward until the pole disintegrates. Tape round the top end will also help hold the pole together, and it gives a smooth finish to protect your hand. A bamboo pole should last or years, especially if it is not dropped, stepped on, or run over by trucks.

Because bamboo poles should not be longer than comfortable for the painter (usually not much past the wrist), they become individualized to each painter (Drawing 8-5). The extended family of bamboos will eventually overrun even the most controlled shop. Variations include thin bamboo poles to hold charcoal sticks and felt markers for layout work and larger diameter poles for lay-in brushes.

Bamboo grows in many parts of the world, but if not native to your theatre area, try a garden supply store, import market, or craft store, either locally or on the Internet.

Phew. Final curtain!

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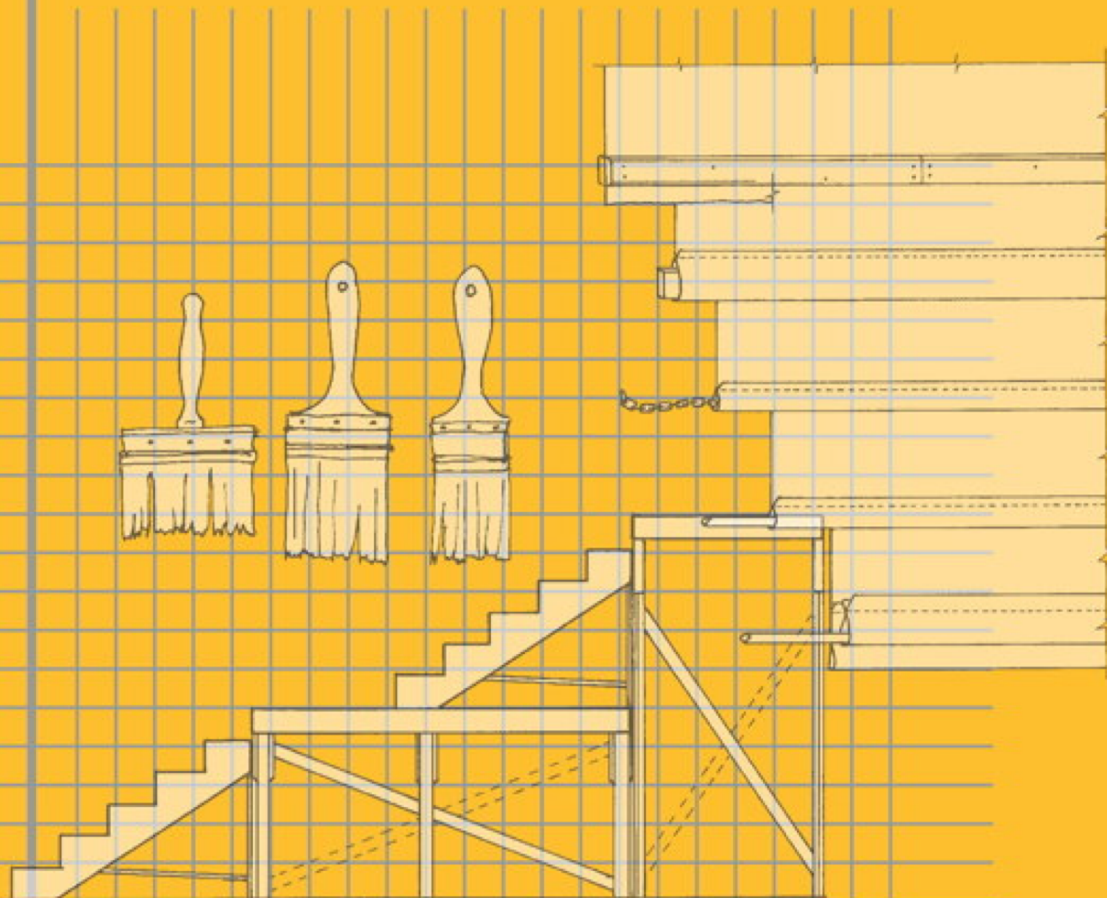
NOTES

This book is all about the basics—flats, platforms, ramps, steps, curtains, drops, paint. If you've never built scenery, this book will show you, in easy-to-follow steps, how to do it right the first time.

If you are an experienced builder, you will want to keep this book handy just in case you forget the answers to questions like:

- On an inside opening in a flat, what is the correct set back for plywood fasteners?
- Should fresh muslin always be used for a dutchman?
- What solvent will get dried paint out of a paint brush?

This third edition has been updated throughout by Mike Monsos, professor of Scenic Design/Technology at University of Montana, Missoula.



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