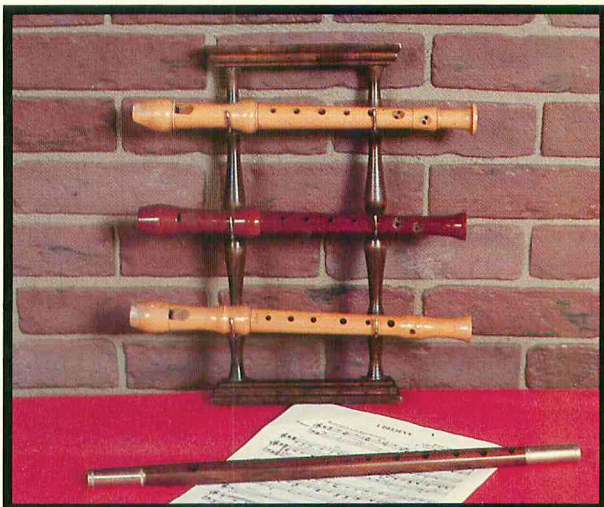


1769

THE WOODTURNER'S HANDBOOK



FRANK W. COGGINS

THE WOODTURNER'S HANDBOOK

FRANK W. COGGINS



TAB BOOKS Inc.

Blue Ridge Summit, PA 17214

Also by the Author from TAB BOOKS Inc.

No. 1569 *Clocks—Construction, Maintenance & Repair*

FIRST EDITION

FIRST PRINTING

Copyright © 1985 by TAB BOOKS Inc.
Printed in the United States of America

Reproduction or publication of the content in any manner, without express permission of the publisher, is prohibited. No liability is assumed with respect to the use of the information herein.

Library of Congress Cataloging in Publication Data

Coggins, Frank W., 1919-
The woodturner's handbook.

Bibliography: p.
Includes index.

1. Turning. I. Title.

TT201.C64 1985 684'.083 84-24003

ISBN 0-8306-0769-2

ISBN 0-8306-1769-8 (pbk.)

Front cover photographs by Frank & Nancy Coggins

Contents

Acknowledgments

Preface

Introduction

1	Lathe Selection	1
	Size and Capacity—Lathe Components—Dremel Moto-Lathe—Combination Lathes—Shopbuilt Lathes—Shopcraft Wood Lathe—Turret Lathes	
2	Tools	20
	Cutting Action—Use of the Various Chisels	
3	Safety and the Workplace	29
4	Spindle Turning	31
	Beads—Swag Lamp—Cup Holder—Jewelry Holder—Recorder Rack—Candleholders—Canes—Cane Stand—Table/Lamp Combination	
5	More “Centers” Turning	52
	Using Recycled Wood—Plastic for Turning—Nonfunctional Objects—Turning Rings	

6	Faceplate Turning	78
	Laminating—Faceplate in Horology—Spindle and Faceplate Combination—Wood on Wood—Grooves for Inlays—Removing Scratches from Metal Plates—Turning Circles—Desk Clock—Rounding Out a Cube—Starting the Cube—Shaving Soap Container	
7	Architectural Turning	103
	Screens and Scrims—The Race Track Clock—Pillars	
8	Turning Balls	109
9	Dolls and Other Toys	112
	Other Toys—Games—Yo-Yo's—Ball Toy—For the Tiny Tot—Other Quickie Toys	
10	Square Turning	127
	Faceplate Turning—Candlestick	
11	Turned Woodware for Gift Giving	131
	Salad Spoons—Boxes—Desk Caddy—Bongo Drums—Head Bed—Miscellaneous Items—Minicondiment Set	
12	Finishing	141
	Wax—Varnish—Shellac—French Polishing—Lacquer—Oil Rub—Stains—Painting—Brush Care—Sanding	
13	Woods for Turning	150
	Teak—Mahogany—Pine—Walnut—Hickory—Lignum Vitae	
14	Ornamental Turning	152
	Design and Function of the Ornamental Lathe—International Wood Collectors' Society—Modifying Existing Lathes—Restoration and Use of an Ornamental Lathe	
15	An Introduction to Metal Turning	177
	Basic Usage—Filing and Polishing—My Metal-Turning Lathe—Tips on Lathe Buying—Learning to Use the Metal-Turning Lathe—Lathe Maintenance—Tools	
	Appendix	200
	Glossary	201
	Bibliography	204
	Index	209

Acknowledgments

When John Donne said, “No man is an island, entire of itself . . .,” he might well have been talking about authors everywhere. In no way whatsoever could this book have been compiled without the generous assistance of innumerable people. Many shared their experience and knowledge from allied fields, others donated time and physical effort, and still others made available materials and equipment to make this manuscript possible.

Sincere thanks go first to my wife, Nancy, who worked beside me night and day long before the first word was written, right up until the manuscript was shipped. She is responsible for each and every one of the drawings that appear within these pages.

Loretta Holz gave much of her time, provided important photographs and research material, and

remained permanently “on call.” Marjorie Coggins loaned valuable photographic equipment; Richard Miller, valuable objects of art; Patricia Hayes; Joe Zabinski; Mrs. Charlotte Gray; Richard Hillman; Don Ellenberger and his son, Bradley; Kimberly Coggins; Harold Perry; Estelle Selzer; Nora Edwards; Dorothy Ashton, for Elmer’s Glue and Krylon; Dick Williford, of Sears, Roebuck and Co.; Gary J. Kisner, for the BenchMark Tool Company; Terri Jones-Wood, for Hofmann Corporation, Brentwood, Tennessee—all contributed in one valuable manner or another. Our sincere thanks to all and to others whose names do not appear. (All of the photography, unless otherwise noted, was done by Nancy Coggins and myself).

Preface

MANY YEARS AGO I WAS INTRODUCED TO the woodworking lathe in a grade school “manual training” class. That the exposure was not a nightmarishly traumatic experience is due solely to the forbearance and patience of the instructor. In retrospect, the gleaming machine with the functional chisels laid out before it was most impressive, and the preliminary instruction served to whet my appetite. For some reason, the first project involved the use of a faceplate: we were going to make wooden ashtrays. A piece of wood about 6 inches square was provided—we were shown how to determine the center, position it on the faceplate, and fasten the wood to the plate with screws.

There were eight youngsters in the class, and with the instinct a teacher soon acquires if he is to survive, our instructor’s eyes flicked from one to the other of his charges. He evidently detected a bit of mischief coming up and turned his head from showing me how to mount the faceplate on the lathe’s mandrel or spindle. At this very moment, I elected to throw the switch to turn on the machine. The faceplate, only partially screwed up, whirled loose, hit the wall in back of the lathe, and

ricocheted across the room. It crashed against the far wall with a resounding bang. The instructor’s look of disappointment, face pale with the thought of how seriously someone might have been injured, still haunts me.

He retrieved the faceplate, inspected it and mounted it properly on the lathe. He made certain that I was holding the chisel correctly, then allowed me to produce my ashtray. The irony of the whole incident lay in the fact that no one in my whole family smoked. For years, my mother used the finished ashtray, which had turned out quite nicely, as a receptacle for pins, needles, and thimbles.

Safety precautions are always mandated with the use of any machine, but this incident is cited because of its rarity—the turner’s lathe is one of the safest of machines (except perhaps for the potter’s wheel). Thankfully, the experience never generated a fear of the machinery, thus closing the door to many pleasant hours of creative accomplishment and satisfying production. There was a lengthy period between the turning of that ashtray and my reacquaintance with the lathe.

Still, it seemed almost inevitable that a lathe

would become part of my life. In the '60s, as an offshoot of working with polyester resins and acrylics, I began making automotive gearshift knobs. The process involved encapsulating emblems—the VW insignia, the Mercedes star—in 2-inch clear balls. The finished sphere was never perfectly round when removed from the mold: a hole had to be drilled, and a thread tapped so it could be rotated rapidly on a motor shaft for rounding and polishing. It was difficult to control the speed of the motor or the effect of the finished product. It always seemed, too, that the whirling ball might fly off the shaft just as my original ashtray did, and the fear of this led me to use a lathe with its variable speeds and infinite control. That more can be done with a lathe than just rounding off balls is the subject of this book.

Turning wood, plastic, metal, or any other material is unique in that the workpiece moves while the tool that changes the configuration of its surface is just held against the object, as opposed to hacking away at it. Control remains totally with the craftsman, quite as if he were whittling a branch or using any number of familiar hand tools.

Acquiring a lathe, especially for wood, need not involve monumental expenditures. Many of the projects included in this book were turned on a lathe that cost less than \$100. A lathe that can turn both metal and wood with great precision will cost three or four times that much, but such a machine is well worth the price when the items it can produce are considered. Simple wood-turning lathes can be fabricated quite easily from bits and pieces if you wish to become familiar with the device before shopping around with checkbook in hand. In fact, initial work with a simple, inexpensive lathe is recommended. Valuable knowledge can be acquired about necessary accessories if you decide to dedicate yourself to the craft. My first lathe did not have mounting capability for a three- or four-jaw chuck and, while I have been able to get around this in many instances, I do regret this lack immensely.

Today, there is literally a cult-type enthusiasm for working with lathes. The variety of items that can be made with one is phenomenal: miniaturists have embraced little Dremel lathes to turn out doll house items, accomplished turners spend

thousands of dollars for lathes that produce exquisite ornamental or decorative pieces, horologists can cite, almost by rote, the significant role that the watchmaker's lathe or *turns* has played in the history of timekeeping over the past 400 years, and even architecture has benefited from the use of the tool.

Remember though, there is a vast difference between painstakingly turning a handle for your favorite chisel and the dazzling speed with which handles for a set of Craftsman chisels come off an automated lathe assembly line. When I first set up a simple lathe, the neighborhood kids came in requesting a demonstration of our "bat" machine. Someone had spread the word that we could make baseball bats any time we wanted! The youngsters had made a tenuous connection between our apparatus and that with which (often in an upright position and in multiples of dozens at a time) St. Louis Sluggers and other well-known bats are produced commercially.

In any event, I hope to pass on my continuing romance with the multi-purposed turner's lathe and to offer here a number of projects demonstrating the serviceable and decorative items you can produce with increasing degrees of skill over the years. The history of the lathe, the manner in which it was used by different societies over the centuries, how it has changed yet remained so basically unchanged, is the exciting story which I intend to intersperse throughout the pages of this book. The tools and accessories used with a lathe are a fascinating story in themselves. You'll learn how to make some of them yourself.

I never concentrated on selling the products of my lathe. For the most part, the finished item, whether a clock part or a piece of sculpture, is so special to me that I wouldn't part with it for any price. I have no hesitancy, however about sharing my techniques.

Just as I have been inspired by dedicated turners, many of whom had passed away long before I was born, I hope that every reader will find the inspiration that will cause him to switch on his lathe sooner than he would have had he not leafed through this book.

Introduction

THE FIRST WORDS WRITTEN BY ANYONE DISCUSSING the lathe almost always concern its long history. While I do not take umbrage with this, it always seems that the topic is treated far too lightly as the writer slides on to what he thinks will most delight the reader. It is almost as if that worthy old adage: Never underestimate the intelligence of the reader or overestimate his knowledge, was written to be ignored. For this reason, I recommend you visit your local library and devote some time to the excellent histories there. Because of the scope of the subject, I will deal only briefly with the history of lathe turning.

I have found over the years that when people become deeply interested in a given subject, whether it be astronomy, shell collecting, or lathe turning, they strive to amass every bit of information available on it. At an exhibit of lathe-turned items held at the American Craft Museum II, in New York, I recently overheard several discussions revolving around sources for books on any and all types of lathes. News of the availability of out-of-print books was leapt upon as if it were information about long lost friends or relatives. The availability

of lathes manufactured by certain companies generated a high level of interest, too, with certain brand names being mentioned repeatedly. It was obvious that these people had come to this museum (where unusual lathe work was being demonstrated and exhibited) because they hungered for more information than had been previously available.

The *Oxford Universal Dictionary* defines a lathe as a machine for turning wood, metal, ivory, etc., in which the article to be turned is held in a horizontal position by means of adjustable centers and rotated against cutting tools. *Webster's New 20th Century Unabridged* reads almost identically. The definition, at best, is an oversimplification. Many lathes today and in years gone by held the article to be turned in a vertical position. The scope, the capability, and the versatility of the lathe can best be described in books—not paragraphs!

In the late 1780s, John Jacob Holtzapffel formed a company to manufacture lathes in London. The company continued in business right up until 1914. During the 1800s, the Holtzapffel family (father and son) turned out a five volume work on all facets of lathe turning. Anyone truly serious about

the lathe should not pick up a chisel without acquiring this mammoth work. (Dover Publications, Inc., 180 Varick Street, New York, NY 10014 has reprinted Volumes IV and V but not the earlier volumes. You will have to scrounge around to dig up the rest of the series.) The reader will find more about Holtzapffel in Chapter 14 on ornamental turning.

Histories are still going around and around on this subject, with the latest consensus being that the invention of the lathe occurred somewhere around 1000 B.C. A papyrus painting dated to 300

B.C. depicts two men sitting or squatting facing each other and doing what appears to be a vertical turning. The man on the left holds a tool against a vertical dowel. The top end of the piece has a spool-like section around which is looped a short length of cord. The man on the right uses both hands to manipulate the cord back and forth, causing the wood to rotate. It was a two-man job and remained so for a thousand years or more.

Later, a bow, similar to the one used by ancient Egyptians for drilling, replaced the helper. The bow's cord was looped around the workpiece, and

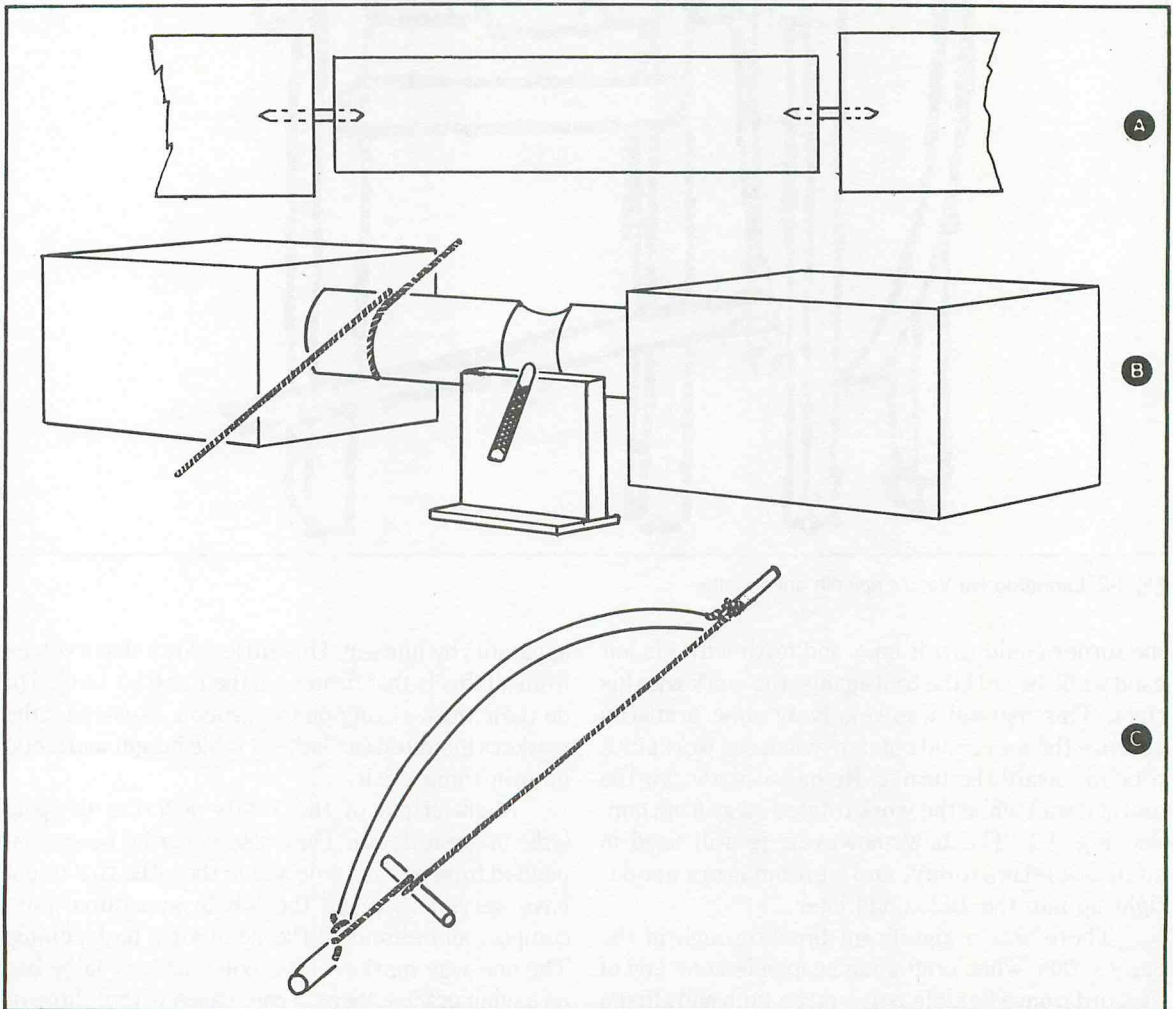


Fig. 1-1. The bow lathe. (A) Work crudely suspended between centers. (B) Cord on workpiece, primitive tool in position. (C) Bow with cord on workpiece.

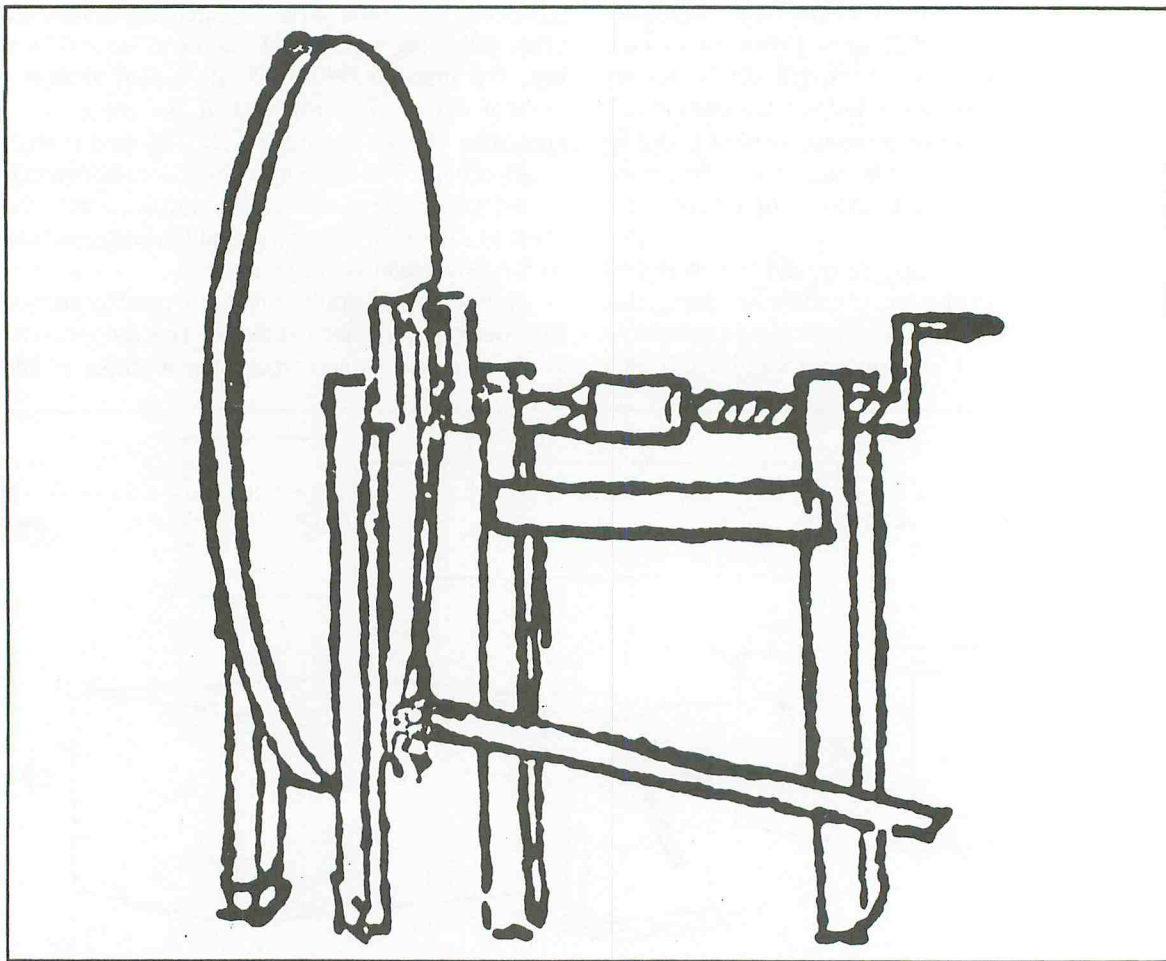


Fig. I-2. Leonardo Da Vinci's spindle driven lathe.

the turner could saw it back and forth with his left hand while he held the tool against the work with his right. This method was relatively slow primarily because the tool could cut only when the workpiece rotated toward the turner. He had to withdraw the tool and wait while the work rotated away from him. See Fig. I-1. The bow, however, is still used in some societies today, and watchmakers used it right up into the 1920s and later.

There was a significant breakthrough in the early 1700s, when craftsmen suspended one end of the cord from a flexible pole or tree limb and affixed the other end of the cord to a small plank beneath the lathe. Here again, the turner could work the

apparatus by himself. One little oddity that evolves from all this is that turners in the Far East tended to do their work sitting on the ground. Western lathe workers mounted the lathe at table height and stood up to manipulate it.

Manuscripts of the 1700s describe the *pole lathe* in great detail. They also describe bows suspended from a cross pole above the lathe that might have served to make the whole apparatus more compact and eliminate the need for a high ceiling. The one-way motion of the pole and bow lathe had no saving grace except in rare cases where three or more bowls were turned from one piece of wood. The chips made by the curved tools employed

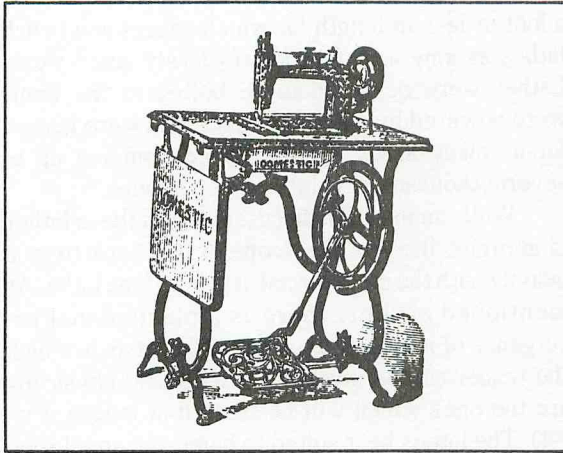


Fig. I-3. Old sewing machine with treadle and flywheel. Power goes by belt to wheel on machine head.

would be removed from the orifice of the bowl by the backward movement of the lathe.

It was not too long before the pole was supplanted by the wheel. Leonardo da Vinci took a crack at this (Fig. I-2) and designed a *spindle-drive lathe* around 1500, but it evidently didn't catch on. At first a large wheel, set away from the lathe as shown in Fig. I-2, was turned by hand or, in some

cases, by foot. An assistant was pressed into service once again to turn this wheel and sometimes he, too, required an assistant. The value of this change lay in the fact that the lathe now turned continuously in one direction. The turner no longer had to remove his tool except to inspect and admire his work.

Those extra assistants must have irked the employer because the great wheel was soon reduced in size and incorporated into the lathe stand in a manner similar to the sewing machine shown in Fig. I-3. The turner could depress a treadle with his foot to work the lathe. Early lathes, wheels, and treadles of this type were still made of wood, but progress seemed to seesaw back and forth during this period. Metal wheels like those used on sewing machines (Fig. I-3) began to be used, but they were fitted with one or two cranks that required that ubiquitous assistant!

And so it went right on up into the middle 1700s. Having the lathe rotate continuously in one direction changed the whole scheme of things. Many factors came to bear simultaneously on the lathe and the use to which it was put. Changing styles in furniture, home objects, and architecture

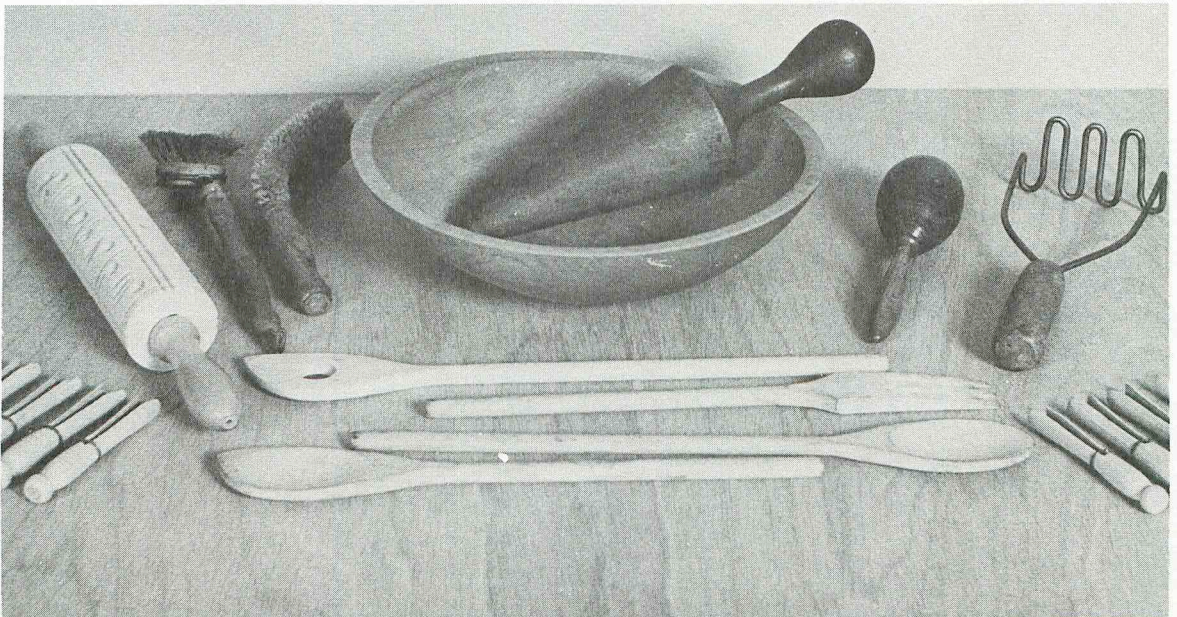


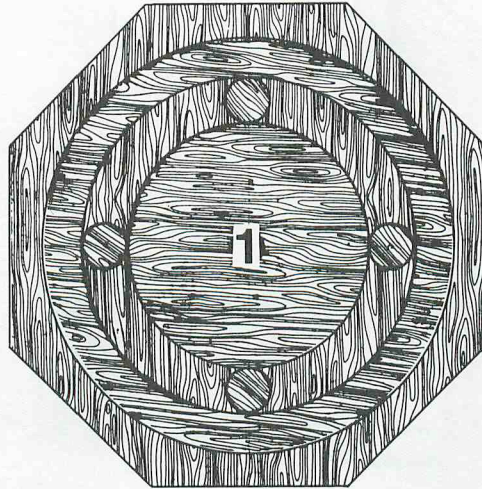
Fig. I-4. Turned items that are always in the domestic household.

had their impact. The first precision machine for boring engine cylinders was perfected by John Wilkinson, an Englishman, in 1774. It was a variation on the lathe in that it had a single cutter mounted in a boring bar, supported at both ends, which was slowly run through the cylinder. The real difference here was that the cutter revolved rather than the workpiece (the cylinder). So effective and accurate was this apparatus that it was used to bore the cylinders for the steam engine perfected by James Watt. (These cylinders had an inside diameter of 50 inches!) By 1850, faceplate lathes had been designed that could turn a flywheel at least 40 feet in diameter. The trick here was to suspend the lathe's faceplate over a gigantic pit.

From this period on, lathes developed at a breakneck pace in all directions. There were lathes

a foot or less in length for watchmakers and bench lathes as long as 3 feet for relatively small work. Lathes were designed to be bolted to the floor, were powered by electric motors, and were geared for as many as 24 spindle speeds ranging up to several thousand revolutions per minute.

While an in-depth discussion of all these lathes is in order, it is not the scope of this book to deal heavily with the commercial aspects of the lathe. As mentioned earlier, there is a phenomenal resurgence of interest in turning. The areas in which the reader can be involved actively and physically are the ones which will be treated at length (Fig. I-4). The lathes best suited to home and small shop use are the ones which will be given priority, and the "hands on" information accumulated on these follows.



Lathe Selection

THERE IS A VILLAGE IN MEXICO CALLED Paracho where the indigenous turners still use the primitive bow with a thin thong to power their simple lathes. They make their turning tools from old files, which is not unusual among dedicated turners today. File metal is a very tough material and does not have to be resharpened frequently. I have a number of such tools in my collection and describe them in Chapter 2.

These Mexican workers manipulate the bow with the left hand while holding the tool against the rest with the right. They make and decorate hollowware using a beautiful wood called *madrona*. Back and forth the left hand goes, as if sawing wood, while the workpiece alternates in direction, losing a bit of itself to the makeshift chisel each time it revolves toward the worker. It is a slow process, indeed, when compared to the little Dremel lathe that puts out 3450 rpm. But the Mexican work is beautiful, and the point is that one doesn't have to have a Dalton or a Shopsmith to be truly creative. Let's take a look at some of the options.

SIZE AND CAPACITY

There are some basic ground rules that help make certain that the lathe selected does not prove inadequate as the turner becomes more accomplished. A suitable lathe for woodworking should be able to handle a table leg 36" long between centers (Fig. 1-1). It should also be able to turn a bowl or a disk 12" in diameter. This is generally referred to as the lathe's *swing* and is the largest diameter that can revolve on a faceplate without hitting the lathe bed or support. The swing measurement can be tricky in that the tool rest support should be taken into consideration because it rests on the bed. You should be wary about this because the height of the tool rest support is not always included in the descriptive literature on new lathes.

When the support for the lathe (the bed) is made up of two cylindrical rods or two heavy lengths of metal with a space between them it is called a *gap bed*. Most woodworking lathes are of this configuration, but if the bed is all one piece then

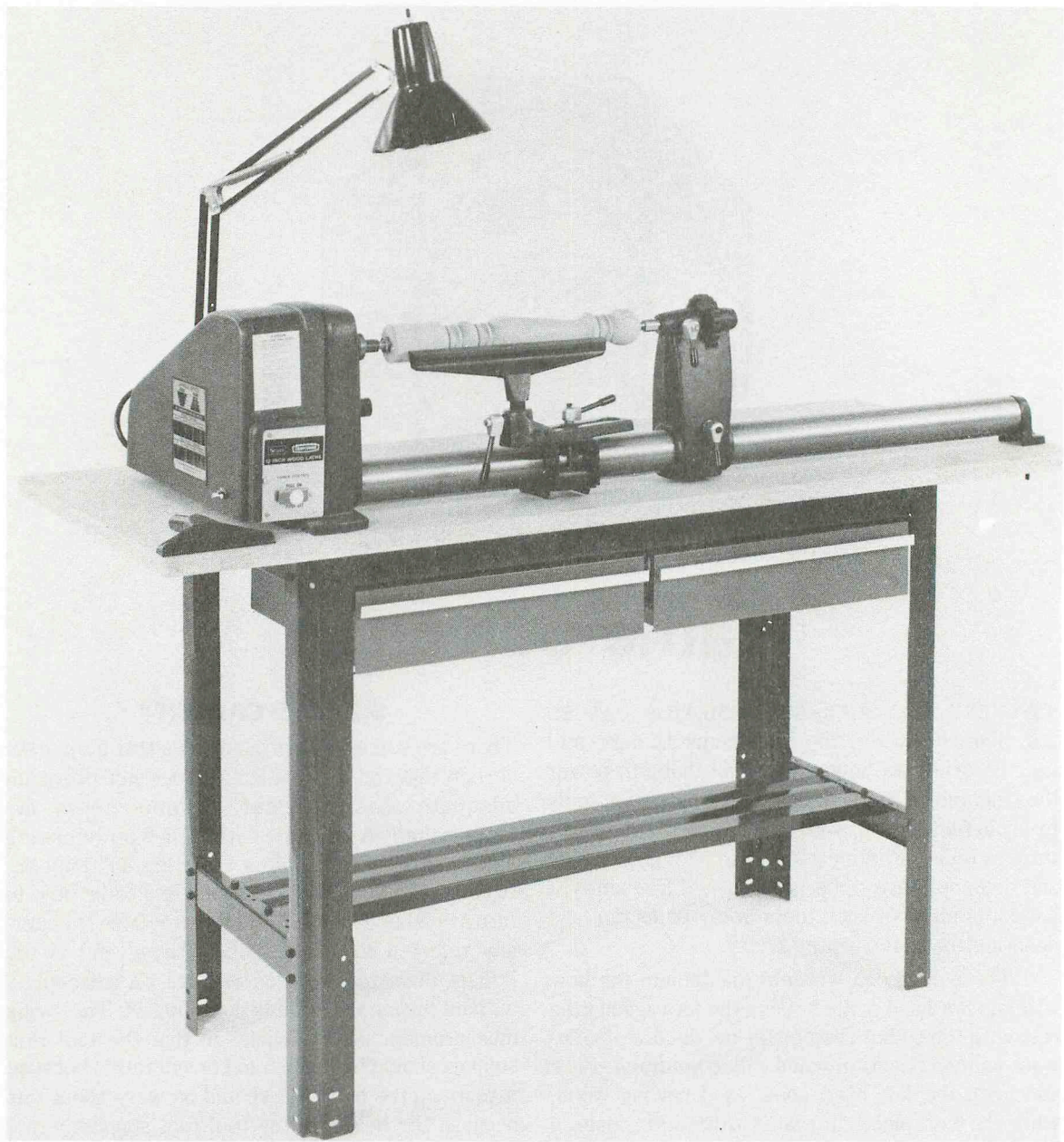


Fig. 1-1. A woodworking lathe. Courtesy Sears, Roebuck and Company.

large faceplate turnings may have to be done on the left side of the headstock. There usually is no provision for a tool rest on this side of the lathe, so a *tool rest stand* may have to be used. On some of the less expensive lathes, the headstock spindle may have

the threads for mounting faceplates and spurs on the right-hand end only, which may prove to be a limiting factor.

If large size faceplate turnings are required, then a lathe on which the whole headstock can be

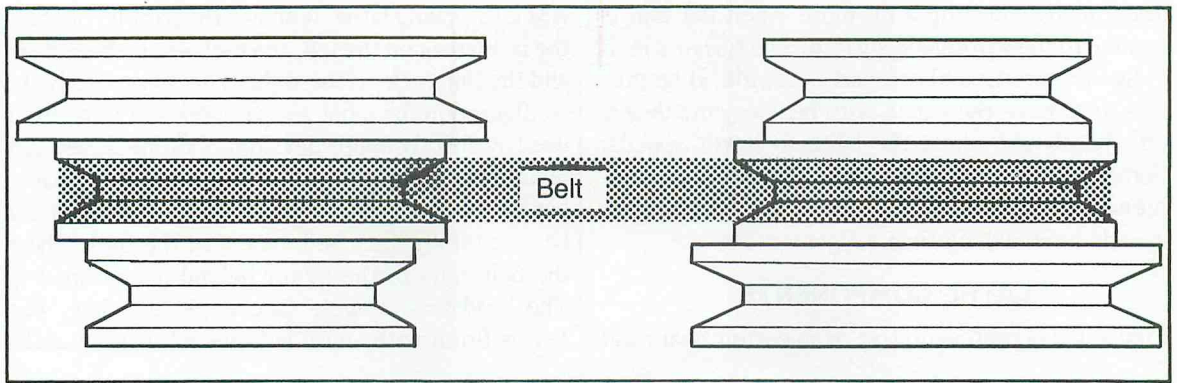


Fig. 1-2. Three-step pulley setup.

swung around certainly should be investigated. It is recommended, too, that the headstock spindle be able to accept at least a three-jaw chuck.

The motor for most lathes is usually sold separately. If large turnings are to be made on a regular basis, it is advisable to fit the lathe with the most powerful motor recommended by the manufacturer. For ordinary woodworking, I have used a $\frac{1}{2}$ hp motor delivering 1725 rpm for years without any deleterious effect on the motor. Variable speed is a must, of course, and because the lathe usually comes equipped with a three-phase pulley, the motor should be equipped similarly. The smallest segment of the motor pulley should be parallel to the largest section of the headstock pulley. The motor should have a stand with elongated bolt holes attached to it for belt tensioning.

The speed at which the lathe runs is a most important factor in turning out quality work as well as preventing damage to the workpiece or worse, injury to the operator. There is a rule of thumb on this: the larger the workpiece, the slower the lathe speed. The rule is mathematically sound in that it is

based on the number of surface feet that pass the tool in a minute. More will pass when a workpiece is 6" in diameter than will in the case of a 3" disc or cylinder. Optimally, the same number of surface feet should pass the tool continually. Fortunately, there is an inherent latitude built into the figure for the speed at which a wood-turning lathe must run, so hardness of the wood, size, and even surface condition do not demand extremely accurate calculations or inflexible lathe rpm for every single workpiece. Manufacturers generally supply a spindle speed chart with the lathe indicating the proper speeds and how to attain them by the placement of the belt on the pulleys. A three-step (Fig. 1-2) motor pulley having the same measurements as the spindle pulley will produce the following speeds with the pulley combinations indicated in Table 1-1. Use these speeds according to the workpiece diameter as shown in Table 1-2.

It should be noted that two pulleys of the same size, no matter how large, will produce no more than the original motor speed. The rated rpm tends to drop a little once the lathe is running (motor

Table 1-1. Lathe Speed for Various Diameter Pulleys.

RPM	Spindle pulley diameter (inches)	Motor pulley diameter (inches)
785	4	2
1080	3	2
1725	3	3
2800	2	3
3800	2	4

Table 1-2. Lathe Speed for Various Diameter Workpieces.

Workpiece dia. (inches)	RPM roughing	RPM finishing
Up to 2"	1725	3800
2" to 3"	1080	2800
3" to 5"	785	1080
5" to 8"	785	785

under load) and drop a bit more when the tool is applied to the workpiece surface. The turner's individual preferences play a part here, too. If he prefers to remove the waste with heavier cuts (*hog it off*), he should adjust the lathe to lower speeds. Some lathe makers such as the Shopsmith recommend lower speeds for rough cuts and higher speeds for finishing than suggested above.

LATHE COMPONENTS

Figure 1-3 is representative of an earlier Sears and

AMT 12" swing lathe. It shows the parallel bar bed, the headstock on the left, the tool rest in the center, and the tailstock on the right. This is generally the configuration for most simple woodworking lathes used by strictly nonprofessionals. Some lathes may feature parallel flatways or a single diamond-shaped bar for the bed, however. For safety, the headstock here is totally enclosed except in the back where the belt exits to the motor behind it (not shown). The headstock spindle (see exploded view, Fig. 1-3) is fitted with an oil hole for lubrication of the

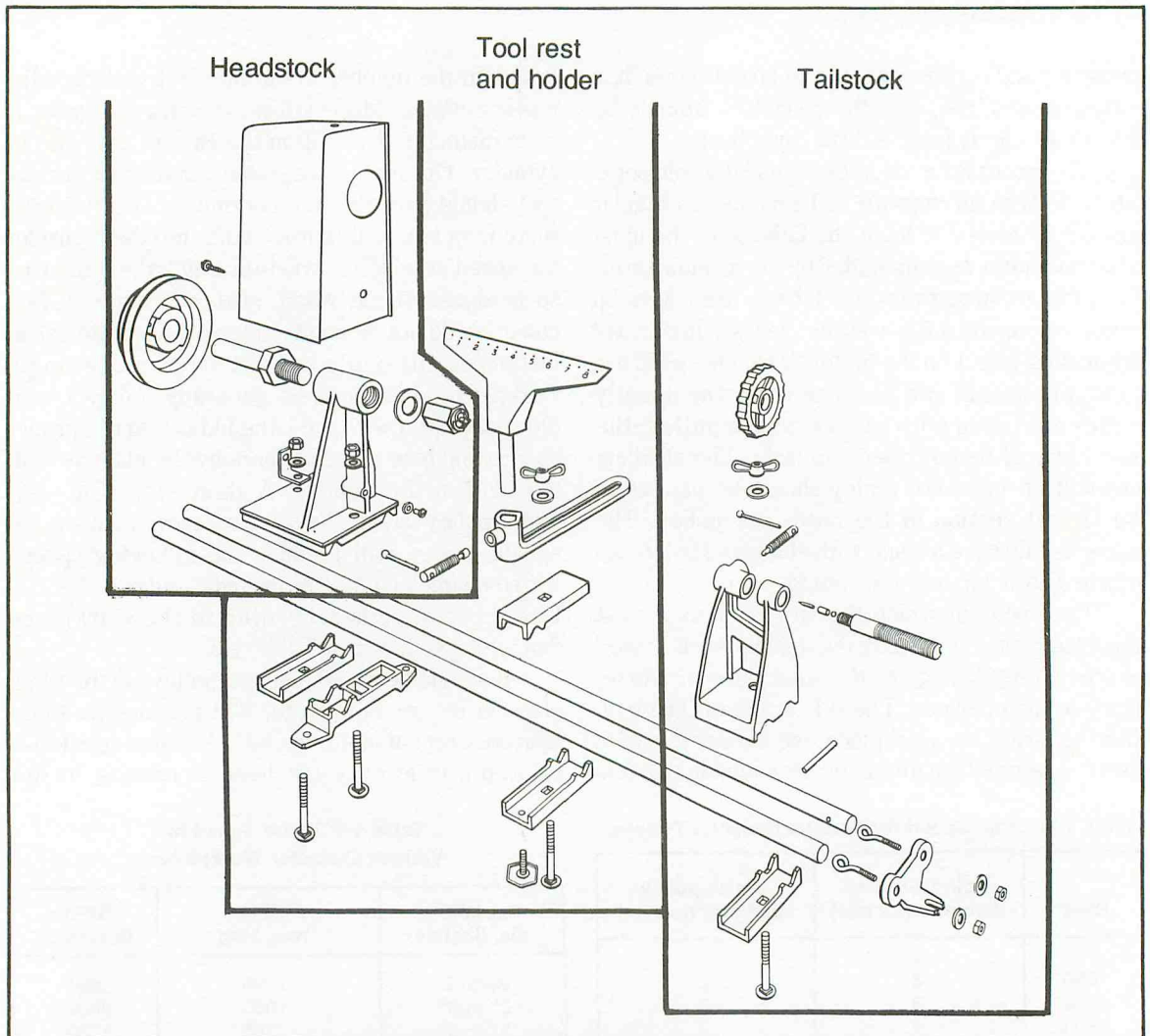


Fig. 1-3. Exploded view of simple wood-turning lathe. Courtesy Sears, Roebuck and Company.

spindle bearings. A few drops of light oil—enough to fill the gap or chamber between the bearings—should be applied occasionally, according to the manufacturer. A few drops of light oil should also be applied to the tailstock ram assembly to keep the apparatus running smoothly. Burning of wood workpieces can be minimized by adding a small amount of lubricant to the cup center. Some authorities recommend the application of a small amount of petroleum jelly, which I have found to be quite effective.

Many lathes, more elaborate in design, have hollow headstock spindles or *mandrels*, the inside ends of which are ground to standard *Morse tapers*. This permits centers and some small fittings with tapered shanks to be pushed in and held by friction. Removal is accomplished by knocking the centers out with a thin rod through the spindle hole. This capability, plus the ability to add two- and three-jawed chucks, is well worth having. Another advantageous fitting, not always available, is an indexing arrangement in the headstock. It is a necessary requirement for fluting and reeding, as will be described later.

On some lathes an abbreviated *fender* or shield, which exposes the phased pulley, is substituted for the headstock housing. The large end of this left-side pulley is bored with holes so that it can be pegged in a fixed position to hold the spindle firmly. On others, a perforated disc (usually with 48 holes) is affixed to the left end of the spindle, and a guide pin bracket is mounted on the lathe housing to lock the disc in position. Such an assembly, depending upon the original design of the lathe, may be made up with relative ease.

The *tailstock*, whose main function is to support the right-hand end of the workpiece, also has a locking spindle. On this particular lathe it has a ball bearing live center with a free-turning pin. The whole center can be removed and a chuck substituted on the threaded end of the spindle. This permits drilling from the tailstock. The tailstock is moved along the bed until the pin lines up with the workpiece center. The tailstock is locked. Fine adjustments can then be made with the handwheel, and the spindle is locked.

With the use of carbide tipped chisels and special tools, this basic wood-turning lathe will accept plastic readily. It is to be assumed that some soft metals such as brass may be turned on this type of lathe but only in emergencies and with hardened tools that tend to scrape rather than cut.

The tool rest on this lathe is simple. Similar to a number of other lathes, it can pivot (for faceplate turning), and move in and out relative to the workpiece. The base is slotted for this purpose. The rest (T-shaped) is made with a stem that fits in a hole in the base. Once set at the right height, it is locked in position by a threaded bolt and pin lock assembly. Tool rests vary in size—that is, in the distance from end to end of the “T” on top. In the case of very long ones, provision is sometimes made for a second base that will take an additional stem built into the “T”. This arrangement functions well when waste removal is rapid from end to end.

Faceplates are generally considered an optional accessory and will be discussed in Chapter 2.

DREMEL MOTO-LATHE

A place for this novel little lathe (Fig. 1-4) is being made because of its similarity to the lathe previously discussed. Known as the Dremel Moto-Lathe, it has a 1½” swing and a 6” bed. The headstock is powered by a small electric motor developing 3450 rpm. It is direct drive—no belts, hence no variation in speed is possible. Yet, if it is used in accordance with the instruction manual, quite satisfactory results can be obtained (Fig. 1-5). It will turn quite acceptable spindles for short candlestick holders, and miniaturists have seized upon it to produce various and sundry bowls, drawer pulls, finials, and even little goblets all identical and no larger than a thimble. There is available for small lathes such as the Dremel an electronic speed control originally designed for the old Unimat. It is a silicon controlled rectifier (SCR) that will govern the speed of any universal (ac-dc motor) and is rated for either 5 or 10 amps. Retailing at \$40, the device would have to be evaluated in the light of how important speed reduction is to the average small lathe user.

The Dremel is truly a hobbyist’s lathe (Fig.

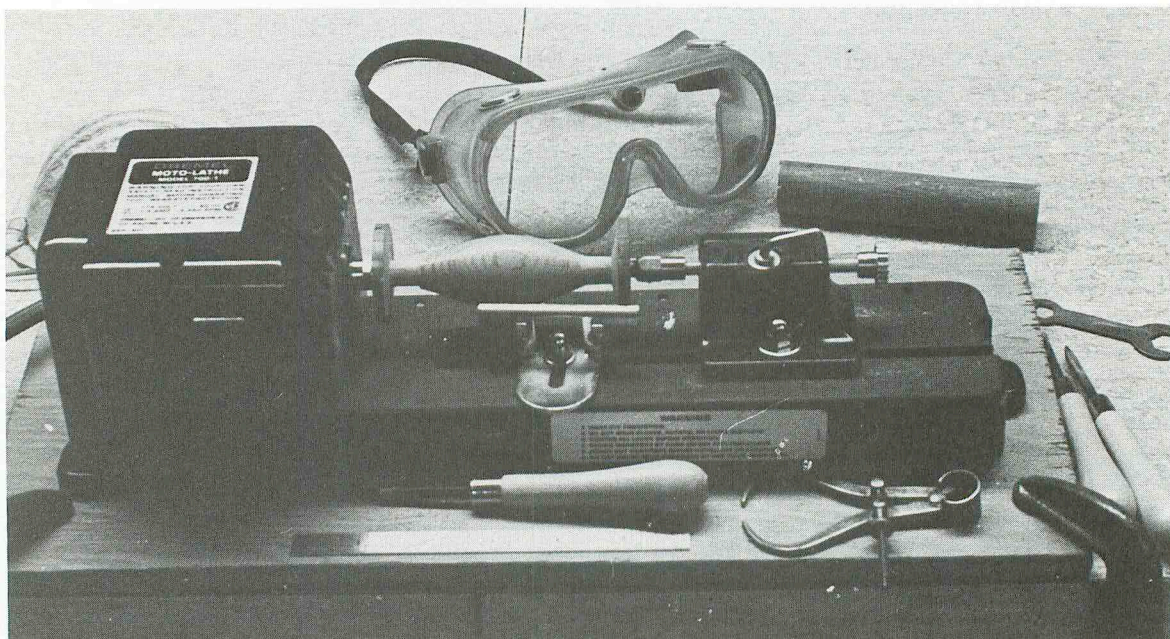


Fig. 1-4. Dremel Moto-Lathe with partially completed handle for clock spring release tool.

1-6), although the manufacturer recommends it for craftworkers and artists as well. It does not compare with a clockmaker's lathe, but rigid pivot wires can be reduced in diameter with it.

It has a faceplate turning capability, too, provided the workpiece does not exceed $1\frac{1}{2}$ " in length and the same measurement in diameter. These dimensions include a $\frac{1}{2}$ " section touching the faceplate (Fig. 1-7) that cannot be used. Any piece having a usable portion longer than 1" should be mounted between the head- and tailstocks and treated as a spindle, in which case any excess can be cut off when the turning is finished.

Use of the tiny chisels furnished with the lathe is exactly the same as with a larger lathe except that they *cannot* be used for metal, plywood, or fabricated woodlike materials. Needle files must be substituted in this instance. For scraping action, the chisel must contact the workpiece a hair above the center line. Cutting action requires raising the tool rest and the chisel slightly higher. Despite the fact that all the chisels are extremely lightweight, the skews and gouges must be held with two hands. The

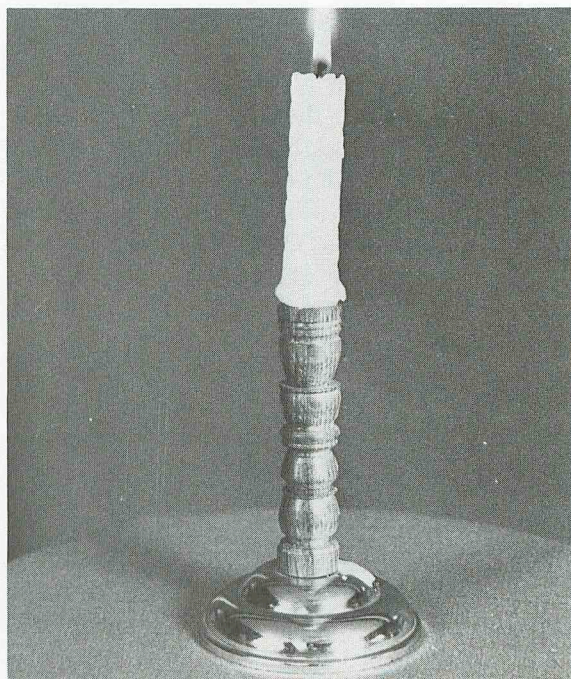


Fig. 1-5. Candlestick turned by 14-year-old on Dremel Moto-Lathe.

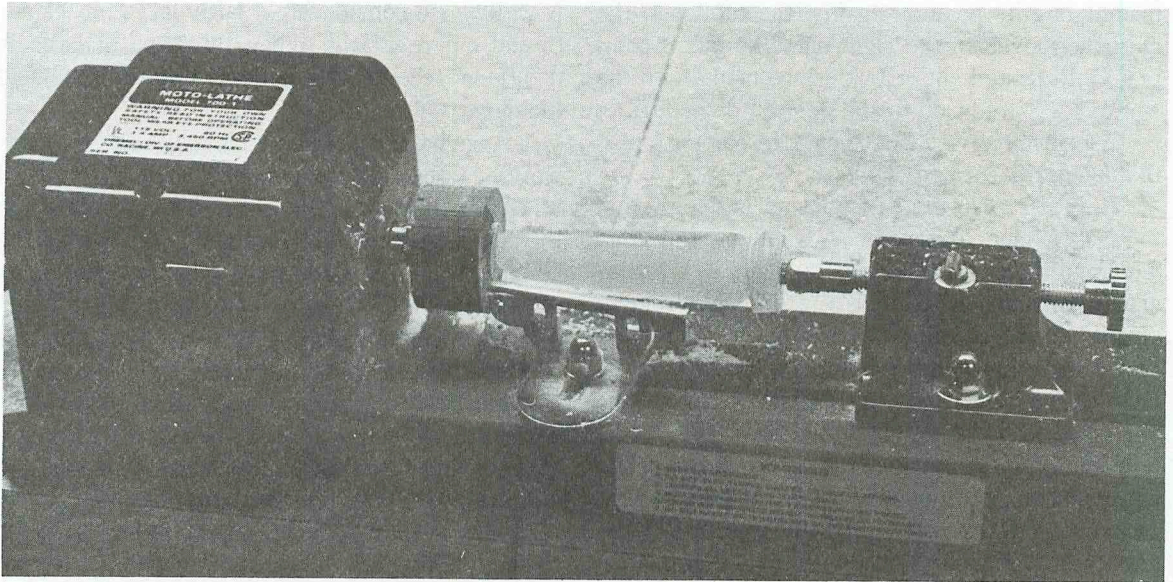


Fig. 1-6. Plastic handle for clock cleaning brush being turned on Dremel Moto-Lathe.

right hand grasps the handle and directs the chisel against the workpiece, while two fingers of the left hand stabilize the tool on the rest and guide it in its cutting action to the left. Accuracy is lost if an attempt is made to use just one hand.

An exception is made when the skew is used to round a square piece of wood. The index finger of the right hand is placed under the chisel and touching the tool rest. The tool is fed in toward the workpiece about 1/16" then, with the index finger

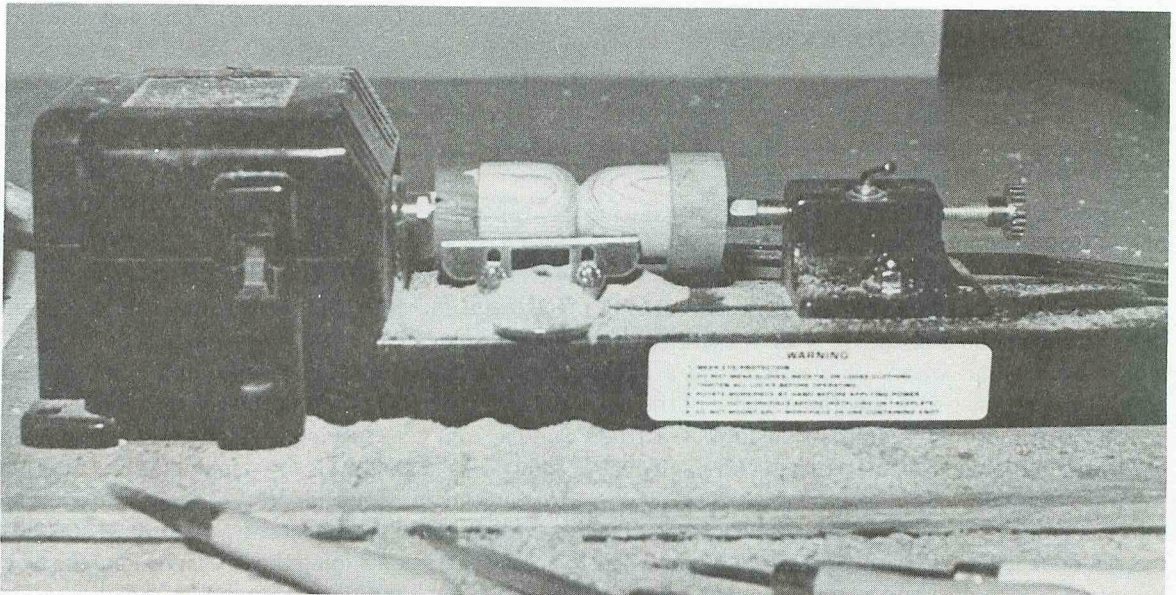


Fig. 1-7. One-half-inch must be left untouched by headstock.

maintaining its position against the tool rest, the chisel is moved to the right until the cut is completed. Repeated cuts like this are made until the workpiece is reduced to the desired diameter.

One hand is used when using the parting tool in the manner described above.

In other respects, the Dremel is operated in the same manner as an ordinary woodworking lathe. The manufacturer offers a chucking device designed to handle 1/16" to 1/4" stock but a regular chuck would be much more practical. Some miniaturists have fitted a three-jaw chuck to the Dremel, but right up to this writing, I have never been able to find one that would fit.

There is a chap named Anker Rasmussen (Anker Manufacturing, 1270 S.W. 162nd Avenue, Beaverton, Oregon, 97006) who makes a lathe-duplicator designed for use with the Dremel lathe. He also produces a *live center*, a center finder, and a number of brass templates all of which (including the Dremel Moto-Lathe), he will furnish as a kit. A letter to him will bring information on all these goodies. The Moto-Lathe has been a worthy addition to the Dremel line, and it would be used frequently enough to justify having one in a home workshop.

COMBINATION LATHES

The time comes for many turners when a simple woodworking lathe just is not enough. The need to cut threads, knurl metal handles, perhaps even to shape brass and other soft metals arises. The time to upgrade one's equipment is at hand! You can go in one of two directions, depending somewhat on the funds available. You may want to invest in a 7" to 12" swing (36" between centers) metal-turning lathe that combines accuracy with versatility and would turn metal, wood, or plastic. Such a lathe would cost at least \$1500 without many of the accessories you would require. Consider it a true investment, though, capable of paying for itself over a period of time.

Such lathes provide 16 speeds, 54 feeds, and are rated for 1/1000 of an inch accuracy. Screws can be cut with it, tools could be made or repaired with it. It stretches beyond the realm of the hobbyist and

is well worth considering if fairly large pieces are turned out regularly. When this type of lathe is mentioned, the purists mention Myford, Enco, and Maximat.

A suggested alternative is to retain the wood-working lathe and supplement it with an Edelstaal Machinex 5 or similar machine. Twenty years ago the forerunner of the Machinex 5, known as the Unimat, was one of the most popular little lathes manufactured. There are still many of them around. The accompanying photo (Fig. 1-8) shows one currently in use. The base unit (3" swing, about 7" between centers) fitted with a 1/10 hp 115V motor cost \$119.50, and a fairly complete set of accessories would have cost another \$150.00. It was, and is, a truly versatile miniature machine tool.

The Machinex 5, its replacement, sells for close to \$500. Ten of the most necessary accessories, such as a three-jaw chuck, lathe tool set, boring bars, drill set, etc., would cost another \$250. It is the kind of machine that would find a place in an industrial research and development laboratory, a dental lab, or the shops of gunsmiths, clock repairmen, architectural modelmakers, and many other craftsmen. There are similar machines less expensive on the market, but this is just about the Rolls-Royce of the lot. Some of the projects done for this book on a woodworking lathe would have been effortless on this machine.

Readers who are not to be deterred by the phrase "some assembly required," might save money by purchasing a lathe like the Micro II, marketed through Caldwell Industries, 603-609 East Davis Street, Luling, Texas, 78648. It has a 4.5" swing and a 15" bed (9 3/4" between centers), and sells for \$99. But here's the rub: it comes knocked down! It must be assembled by the purchaser. Some engineering types might find this no deterrent whatsoever, but the layman who wants to get right on with turning certainly might demur. In addition to assembly, some lapping of the carriage to the bed is required. It is a simple operation, according to the manufacturer, a matter of applying lapping paste and sliding the carriage along the bed, back and forth for about 15 minutes. The operation is then repeated with the cross-slide and the car-

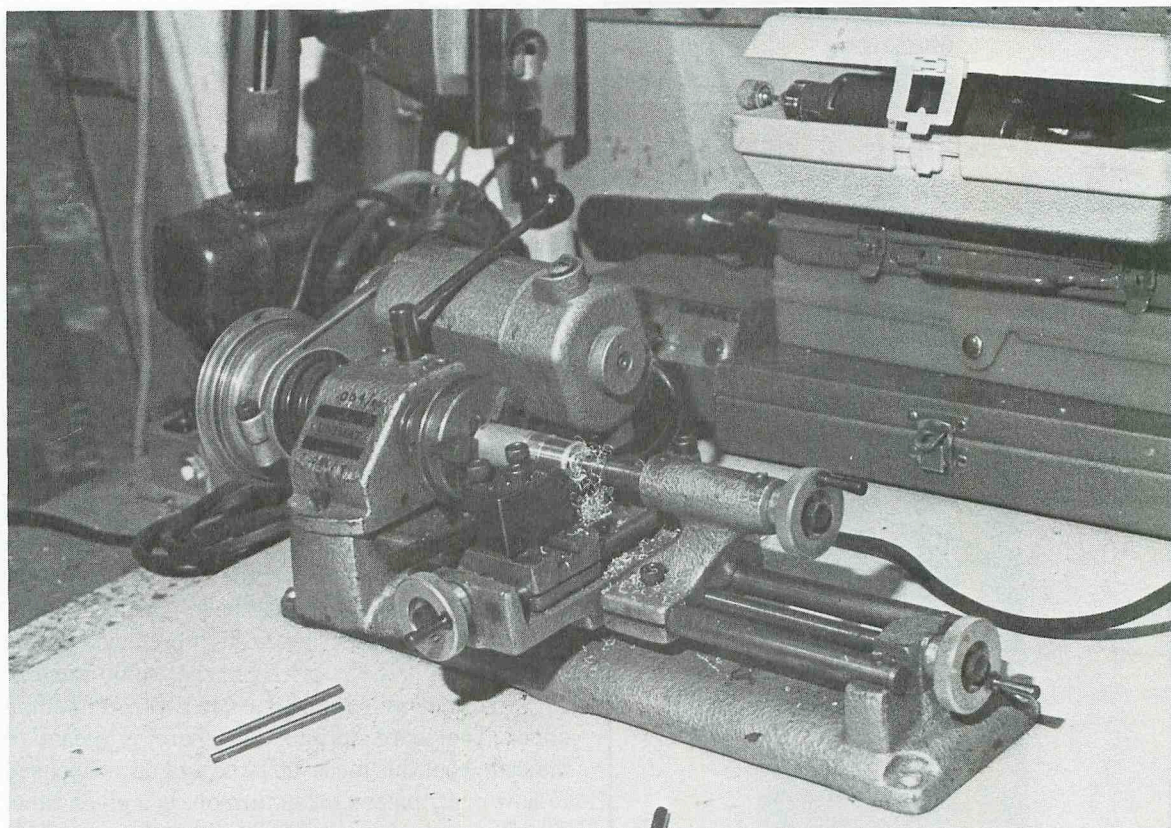


Fig. 1-8. The Unimat, still popular, had a 3" swing with 7" between centers. Courtesy George Holz.

riage. After that, all the remaining lapping paste is washed off and all sliding surfaces treated with lots of oil. Were it not for this, I would say it was a most cost effective type of purchase. It may still be to some people.

Initial outlay still in mind, you might consider the Taig Micro Lathe, which is somewhat similar to the Caldwell Industries Micro II. The tailstocks, for example, are almost identical. The Micro Lathe may be purchased completely assembled for about \$100 or in kit form for just under \$90. No machining is necessary in either case. The full address of this manufacturer appears in the appendix.

Sherline sells a similar lathe, more comparable to the Machinex 5 in appearance and in engineering than the two cited above. The Sherline lathe has a 3" swing over the bed (1.75" swing over the carriage) and a distance between centers of 8". It

retails for \$300. This can be considered a reasonable expenditure even with the addition of some of the necessary "accessories."

Thus far, discussion has revolved around lathes in the lower end of the price spectrum. Prices for compact lathes can range well up over \$2000, without figuring in the cost of vital accessories like three-jaw chucks, milling attachments, sets of collets, speed reducers, and tool bits. Just to cite a few prices: the Cowells 90 Center Lathe runs about \$1500; Enco 10" and 12" bench lathes about \$3000; Maximat Mentor 10 about \$3300.

The discussion here, it should be noted, is about lathes with which the general public is somewhat familiar. There are specialized lathes for automobile mechanics, and there are lathes designed exclusively for large scale industrial use (actually considered as commercial machine tools). Auto-



Fig. 1-9. This tool was often used by hobbyists as the nucleus for a little lathe.

mated, frequently run by computers, and mammoth in configuration, they do not fall within the realm of this book.

SHOPBUILT LATHES

Prior to the introduction of Dremel's Moto-Lathe, it was normal procedure for model car builders and other hobbyists to use the Moto-Tool (Fig. 1-9), also made by Dremel, as the nucleus for a little lathe. The tool is direct drive, of course, with interchangeable collet capability. At that time, the hobbyists had to build their own housing or support when using this tool as the headstock. Since then, Dremel has introduced a sturdy vise (called the D-vise) with a Moto-Tool holder (Fig. 1-10). Initially, hobbyists set up one Moto-Tool as the headstock and another as the tailstock, but this appears to be a bit of "overdesigning". (Amateur clock and watchmakers may have gone the Moto-Tool route, too, because a high-precision Boley clockmakers' lathe is priced in the \$4000 range.)

Production capabilities is limited in some areas. The word "production" here is meant to indicate what this made-up lathe will do as opposed to how many pieces it can turn out in a given time. The first prohibition is its inability to turn anything larger than 1" in diameter. This restriction comes directly from the manufacturer. The plus factor in this area is that the D-vise with its Moto-Tool holder works admirably when screwed firmly to a mounting board. Another limitation is that the largest collet size is $\frac{1}{8}$ ". Still, it proves ideal for turning clock pivots and shafts, model car axles, steering columns, and gearshift levers, miniature scale model spindles, and other minute items. Many of the Moto-Tool's normal uses apply even when it is fixed in this horizontal position. A tailstock arrangement holding a small chuck can be set up to accept tiny drill bits just thousandths of an inch in diameter. Routing, sawing, sanding, and accurate slotting all can be accomplished with the tool in this mode. Due to the workpiece size limitations, woodworking would be held to a minimum, making its use highly specialized. Anyone owning one of the constant speed Moto-Tools, or any other rotary-type tool similar to this one, could use a silicone

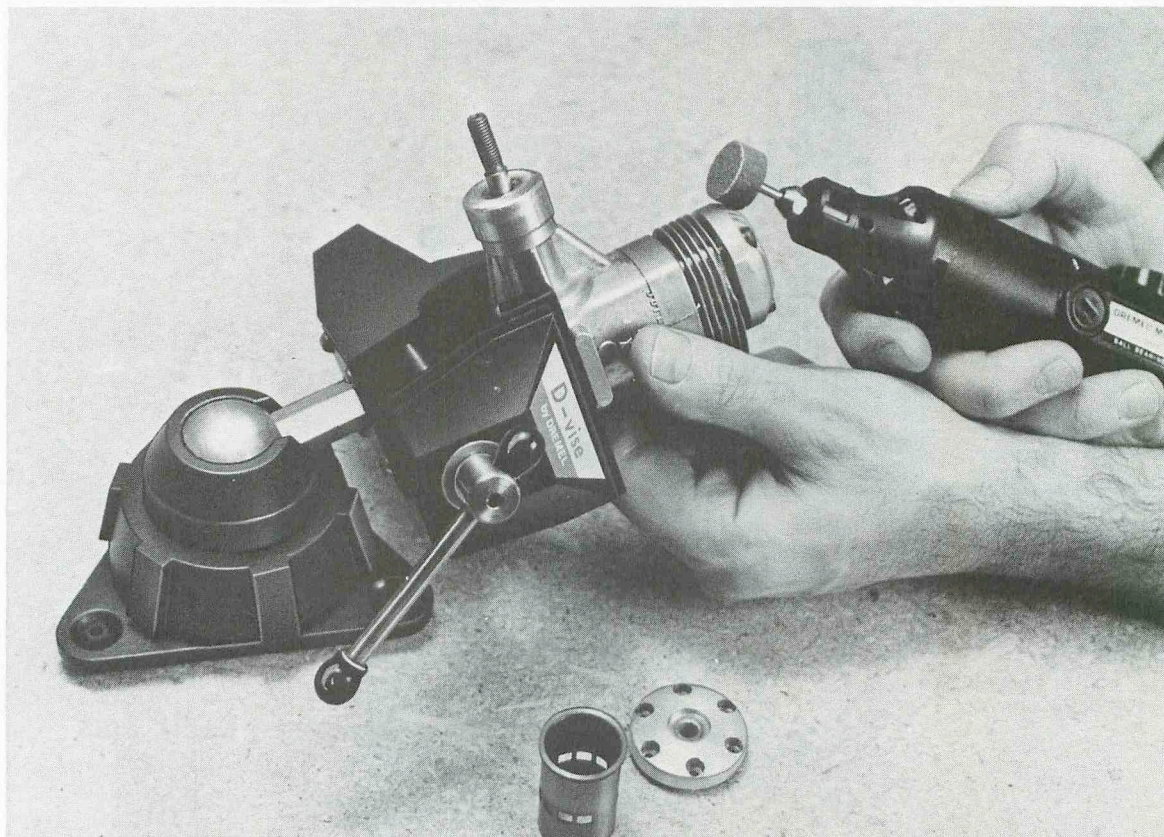


Fig. 1-10. Called the D-Vise, this tool has an accessory to hold a Dremel Moto-Tool.

controlled rectifier speed control or one of the solid state speed controls supplied by Dremel. Faceplate turning would not be one of its strong points, either.

One of the traditional methods of making a lathe (somewhat larger than the one described above) involves the use of a bicycle wheel. The spokes and the rim are discarded leaving the hub and the axle (Fig. 1-11), which becomes the headstock spindle. Bits and pieces of 2"×4" wood are required, depending upon the swing and bed or carriage length desired. Two pieces of 2"×4" stock 24" in length are laid out side by side (the 4" dimension perpendicular to the table) with a 2" gap between them to serve as the lathe bed. The 24" measurement is arbitrary, although greater lengths may induce unwanted flexing when the lathe is under stress. Another 6" piece of 2×4" is fitted between the two long pieces at the left end. It

should be cut and drilled as shown in the drawing (Fig. 1-12). The hole at the top is to accept the hub. A small piece of wood is screwed down over it as indicated. Adding screws through the holes that originally held the spokes on the hub will

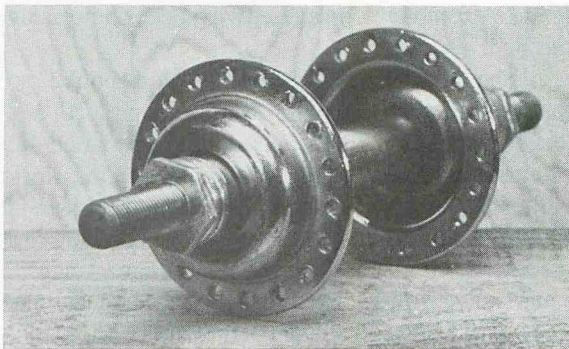


Fig. 1-11. Bicycle hub and axle for homemade lathe.

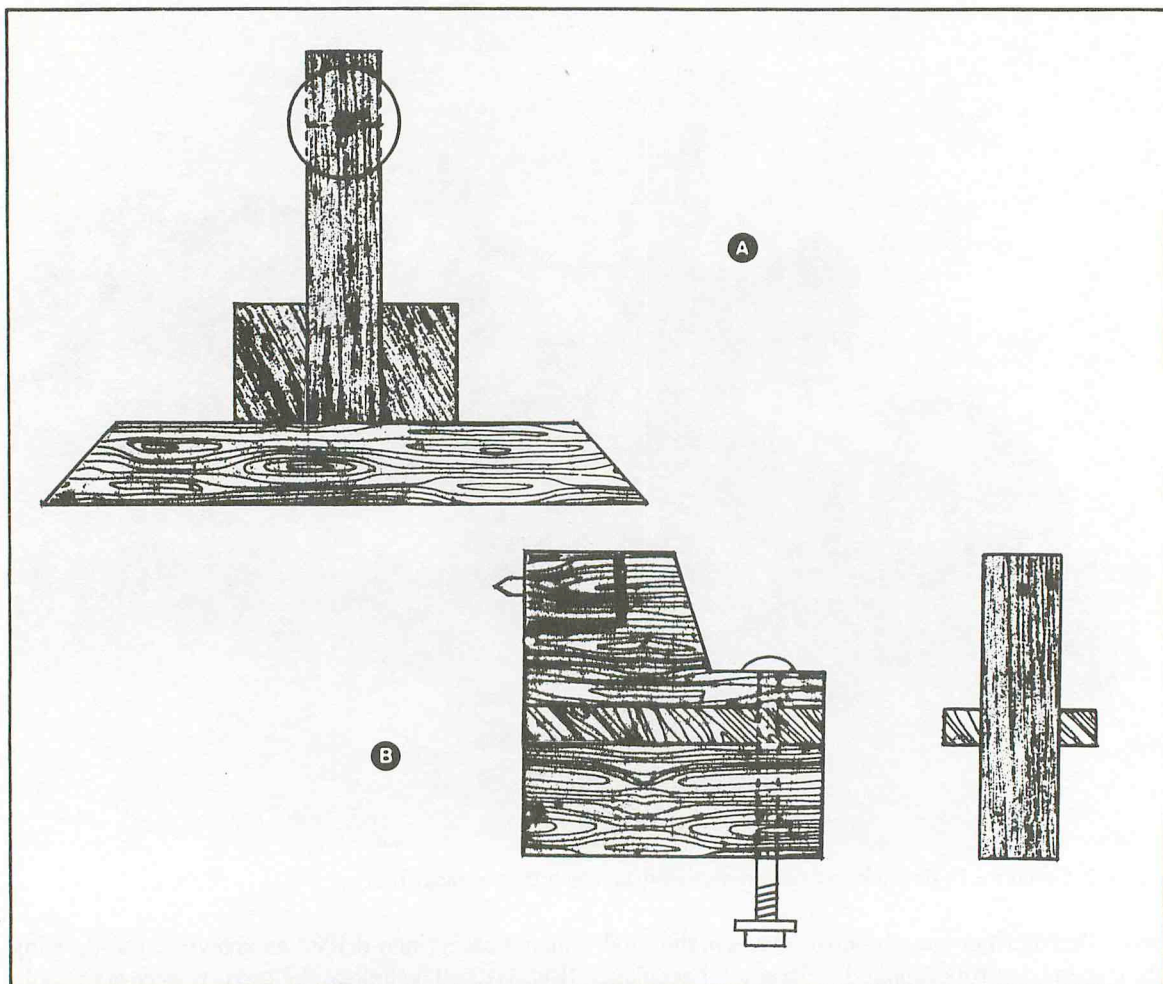


Fig. 1-12. Headstock arrangement for bicycle hub lathe (A). Tailstock and support (B).

strengthen it and reduce the possibility of movement from side to side. Bolt this headstock support to the extreme left end of the two pieces comprising the bed.

The lathe assembly must be raised about 2" so that the tailstock can be moved back and forth and locked in position. The supports should extend out from the lathe so that it can be bolted to the work table. The support for the tailstock end is shown in Fig. 1-12. The tailstock is a very easy task. Secure a piece of wood 2" thick and about 5" square. Cut a 2" square piece out of the upper right-hand corner. Add a piece of wood about 1" square on either side, a ½" below the cut out portion. Drill a hole ½" inch

in diameter straight down through the portion of wood toward the rear of the piece (where the cut out had been). This is to accept a long bolt with a large washer and nut on the end. The tailstock is locked in position in this manner. Of course, it is not a true tailstock without some sort of dead center. Actually, all that is needed is a lag screw or bolt ground to a point on one end and screwed into the business end of the tailstock at exactly the right height.

The tool rest can get rather complicated if it is to be adjustable for height. Take a piece of 1" thick wood, 7" long, and cut it so that it is about an ⅛" below the center of the headstock shaft. Cut the ends back so that it is about 4½" wide on the

bottom. There is no use in getting real fussy with it because the chisels will eventually dent the top of it, and it will have to be replaced periodically. Just clamp it in position to the lathe bed with a couple of C-clamps.

The front end of the spindle is usually a $\frac{3}{8}$ " thread, which can be fitted with a chuck from an ordinary hand drill. Alternatively, a 3" or 4" pulley with four holes drilled about $\frac{1}{4}$ " inside the perimeter can be locked on to the end. A $\frac{1}{2}$ " thick wooden disc can be screwed to the pulley to make a workable faceplate. The left-hand end of the headstock spindle is too short to accept a three-phase pulley

but 2", 3", or 4" pulleys can be locked on to it as the need arises. The motor ($\frac{1}{4}$ or $\frac{1}{2}$ hp, 1725 rpm is suggested) can be equipped with a three-phase pulley. Despite its plain Jane appearance, it will prove quite sturdy and will serve the builder well for a long time before something more elaborate is wanted or needed.

The lathe idea that follows is offered in the interest of increased accuracy, a greater swing, and, perhaps, increased versatility. The headstock is fabricated from a commercial arbor (Fig. 1-13) or polishing head. Either of these will provide at least an 8" swing, but the polishing head is much more

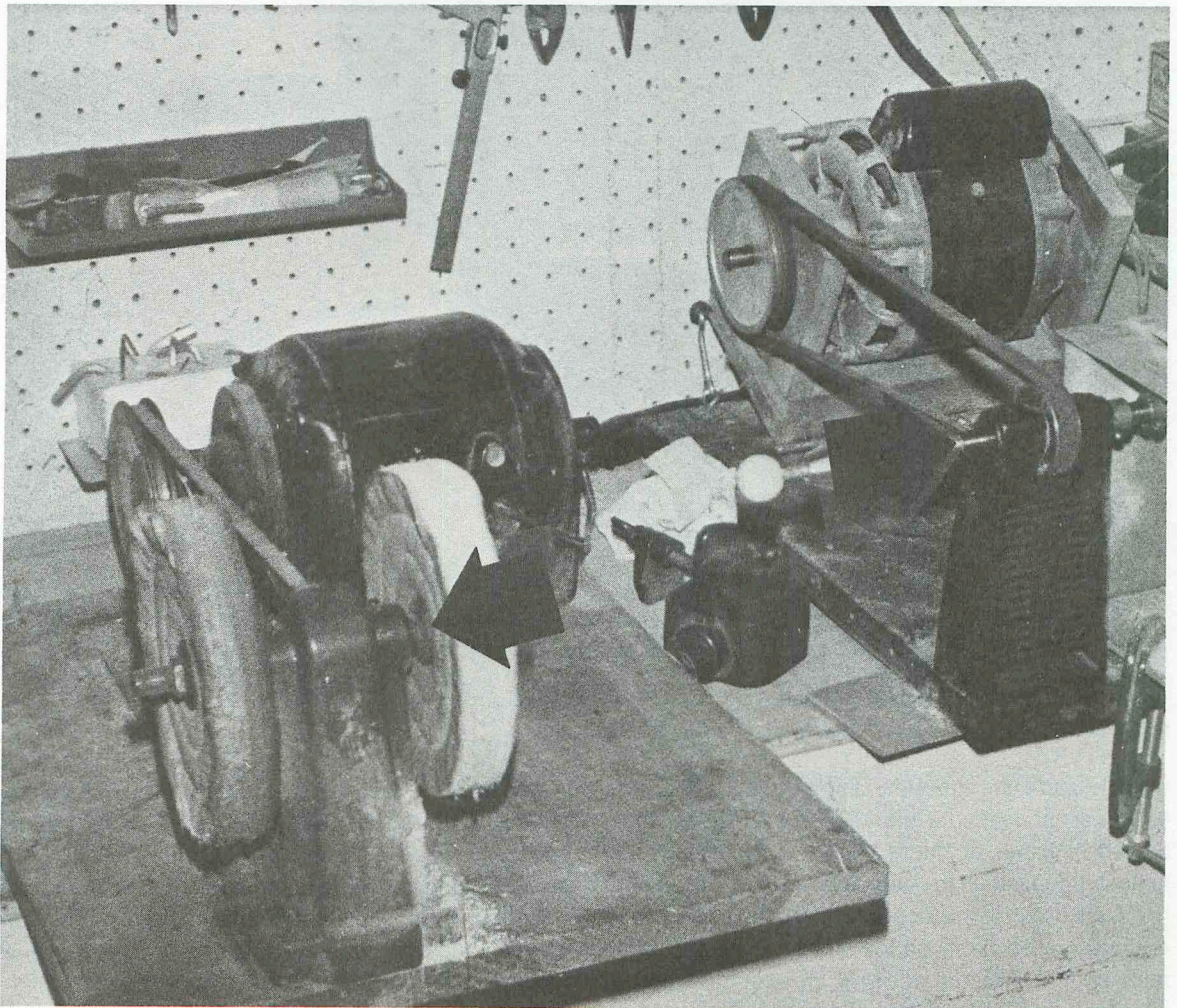


Fig. 1-13. Commercial arbor could serve as lathe headstock (arrows).

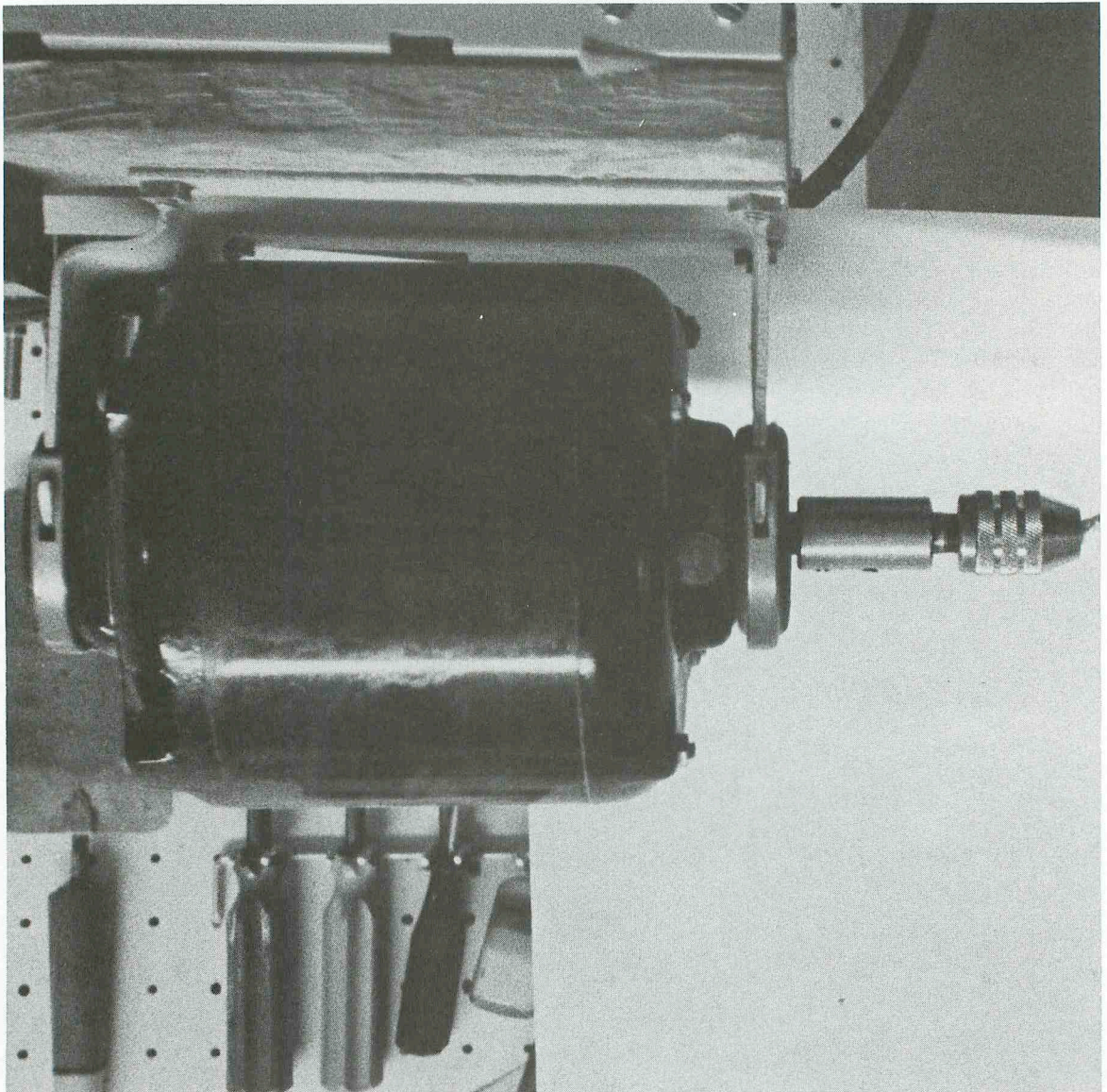


Fig. 1-14. Motor on stand would power direct drive faceplate lathe.

durable and runs quieter. The polishing head has ball bearing races, while the arbors shown have copper bearings or liners. After a time it becomes almost impossible to slide the spindle out should the belt have to be replaced. Both types come equipped with a 2" pulley in the center, but in making up a lathe out of either this can be ignored. The pulley will go on the end of the shaft.

The lathe bed will be similar to the one on the bicycle hub lathe described above, except that there can be no gap on the headstock end. A $\frac{1}{2}$ " or $\frac{3}{4}$ " board 7" long and wide enough to cover the two bed boards plus the gap must be placed on top. The gap on the tailstock end can be filled with a 2" wide piece of wood, flush with the top of the lathe bed. The rest of the lathe can be built quite the same as

the one above, the elevation from the table included. Motor power and speed should also be the same. The swing will be a minimum of 8".

A third variation on this theme is a simple faceplate lathe utilizing a motor and stand as shown in Fig. 1-14. In this case, the motor is direct drive but 1725 rpm are low enough not to be dangerous. A

motor delivering 1425 rpm could be substituted if one just happened to be at hand. A lathe bed in the true sense of the term is not needed, but some provision has to be made for the tool rest. The simplest method is to mount the motor centered at the very end (on the left end) of a board 2 feet long by 1 foot wide. A pulley about 3½" in diameter with

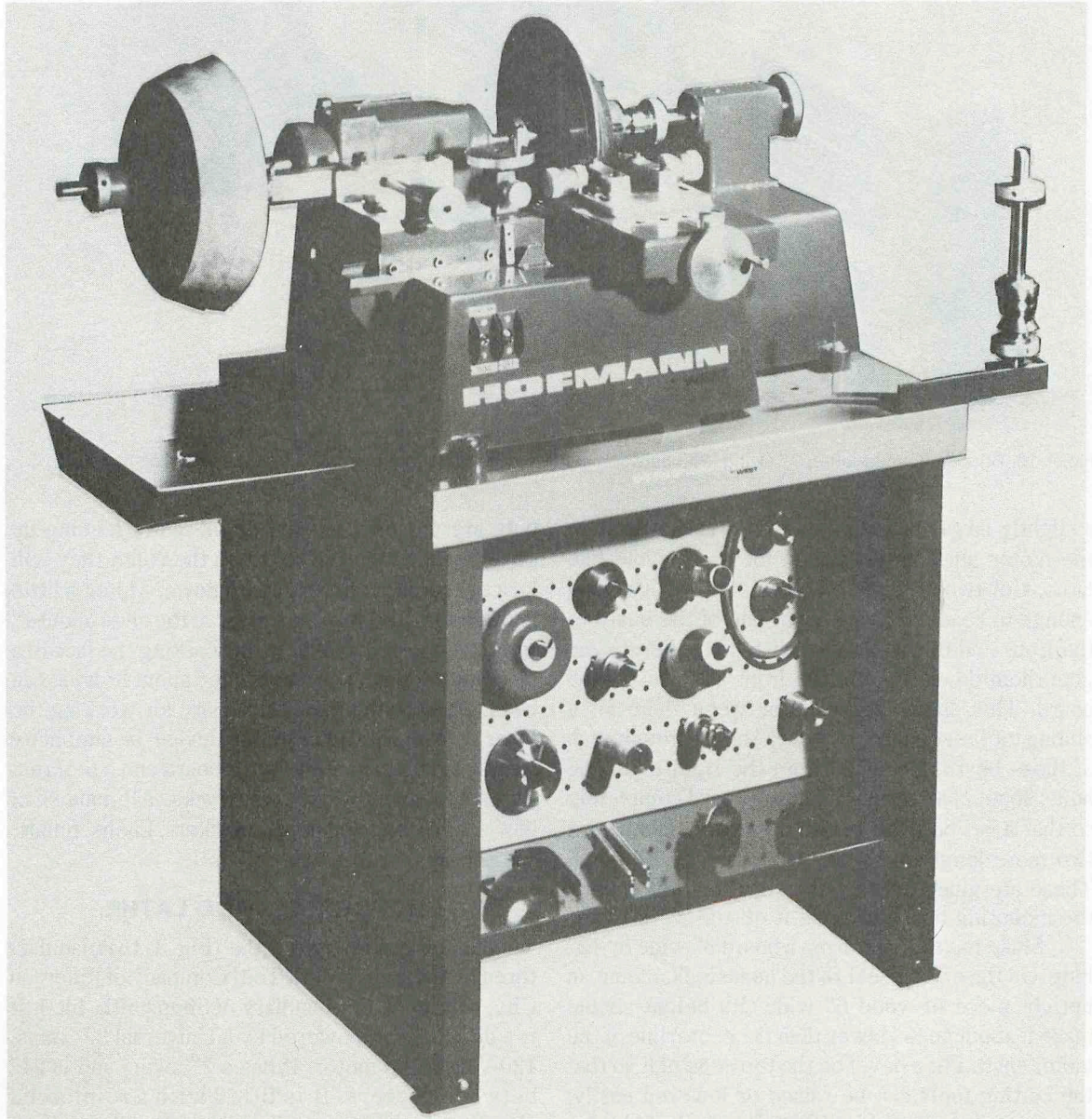


Fig. 1-15. Mechanic's lathe for truing brake drums. Courtesy Hofmann Corp., Brentwood, Tennessee.

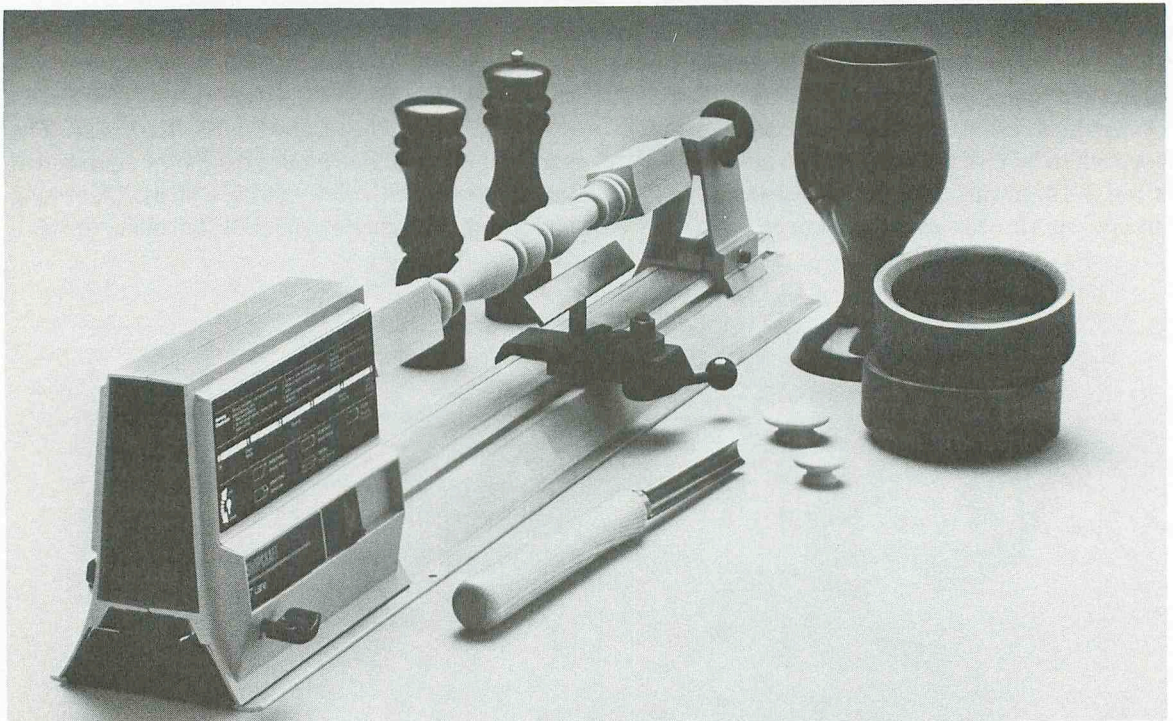


Fig. 1-16. Shopcraft wood lathe, 7" swing, 24" between centers, with direct drive $\frac{1}{3}$ hp, 3.0 amps, 120-volt motor.

a slightly larger faceplate disc on it is mounted on the motor shaft as described for the bicycle hub lathe. Cut two 1" square pieces of wood just long enough to reach from the right end of the board to the front end of the wooden disc plate. Screw and glue them down 2" from the front and back of the board. This should leave 6" between them for a sliding tool rest board. Drill a $\frac{3}{8}$ " hole through each of these boards about 2" from the right end. The holes should pierce the mounting board completely so that a $\frac{3}{8}$ " bolt can be fed up from beneath. Cut two more lengths of wood 1" square by 12" long. These are glued beneath the right and left ends of the mounting board to raise it off the work table.

Make the tool rest from a board 6" wide by 12" long. On the end closest to the headstock, mount an upright piece of wood 6" wide. Its height should make it about an $\frac{1}{8}$ " lower than the centerline of the motor shaft. Put a bevel on the top edge of it so that the cutting tools can be raised or lowered easily. Now it can be seen that if large washers and wing

nuts are put on the ends of the bolts feeding up through the mounting board on the right, they will lock the sliding tool rest board down. Mount a little knob about 1" high in the center of the slide about 1" from the end. This slide is for working the face of a piece. An L-shaped piece of wood about 3" wide can be clamped to the mounting board for working the edge of a piece. The whole device is simplicity itself—a motor on the left of a board and a tool rest that slides up to it between tracks. All manner of bowls, eggs, salt and pepper shakers, knobs, finials, and terminals can be turned on it.

SHOPCRAFT WOOD LATHE

This is a relatively new lathe (Fig. 1-16) manufactured by the BenchMark Tool Company of Jefferson City, Missouri, (a subsidiary of Shopsmith, Inc.). It is a direct drive, powered by a Universal 3.0 amps, 120-volt, $\frac{1}{3}$ hp motor. It has a 7" swing and is 24" between centers. It is fitted with a reinforced aluminum bed and an easily adjusted tool rest. Both

headstock and tailstock are moveable, which increases its versatility. The tailstock adjusts for drilling and boring. The motor is full enclosed with no belts or pulleys. It features a removeable safety key to prevent accidental starting, plus a linear speed control to allow work to be started slowly and offers fast, one motion shut-off. It has a very real potential for more than just ordinary turning. The net weight is only 20 pounds, which means that it can be set up and used in a limited working space.

TURRET LATHES

Turret lathes, used basically for metal turning, are manufactured in a variety of types and sizes. They differ from the other lathes described above in that a hexagonal turret is substituted for the tailstock and a square turret replaces the usual tool-post holder

for many operations. The two shown here (Figs. 1-17 and 1-18) are considered small as turret lathes go—some are manufactured so large that they can be used to turn the huge rolling machinery in steel plants. Turret lathes are considered excellent for exactly duplicating items in quantities exceeding 100 or more. There are two basic types, the *ram-type* and the *saddle-type*. The ram-type are easy to handle, fast, and suited to small workpieces. The headstock will accept lengths of round stock through its hollow center and extending out the left end. Parts can be turned and then cut off when finished. Some of these lathes will accept such rods or “bar” stock up to 3” in diameter. Items up to 20” in diameter can be chucked in some turret lathes. The full story on the two appearing here is included in Chapter 15.

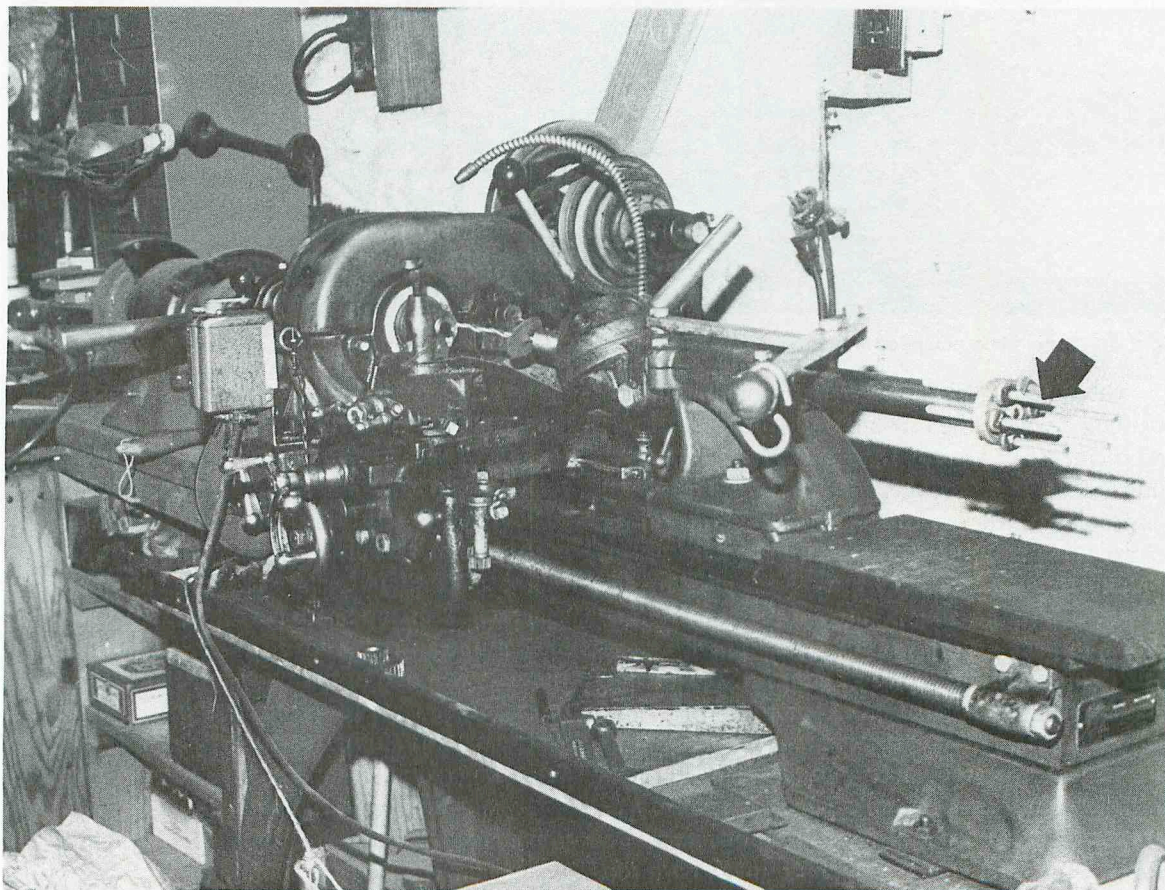


Fig. 1-17. Small turret lathe. Rods on end of ram (arrow) are stops to control feed.

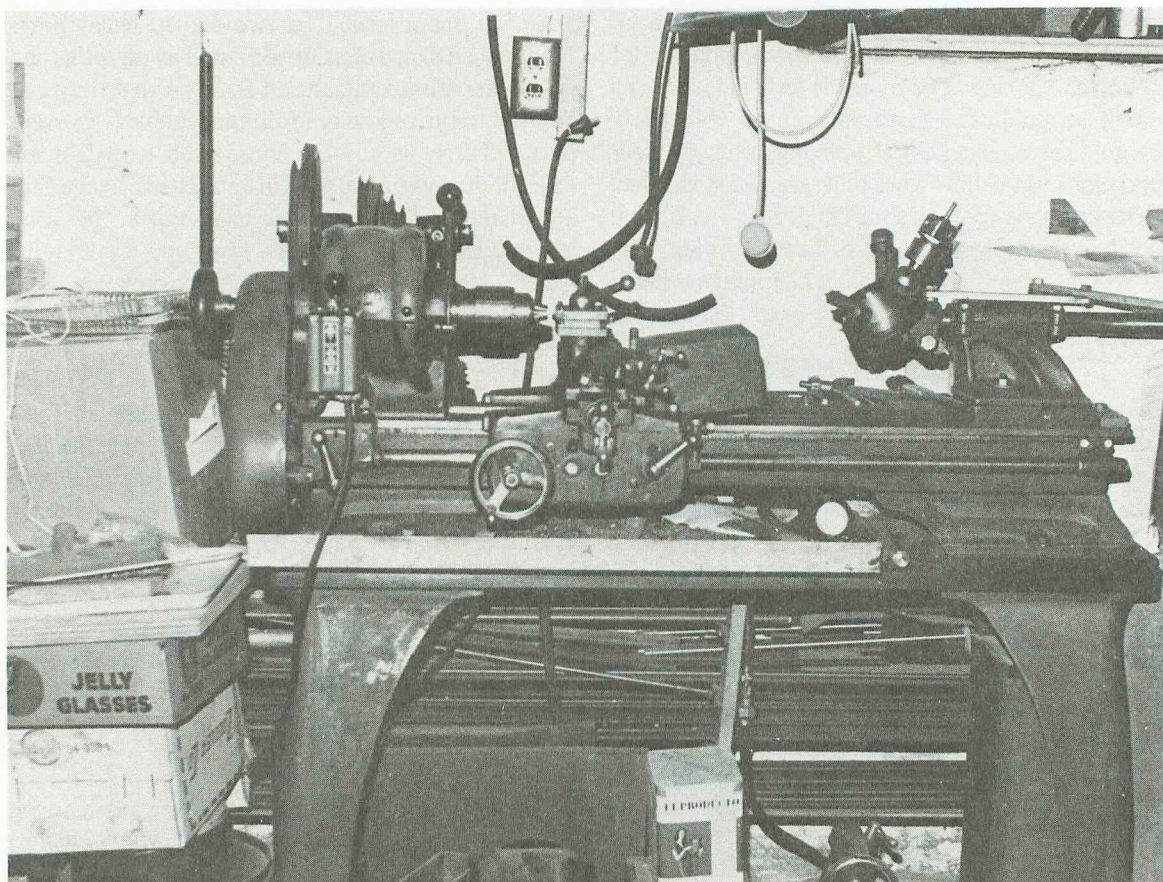


Fig. 1-18. Turret lathe equipped with quick-set tool post.

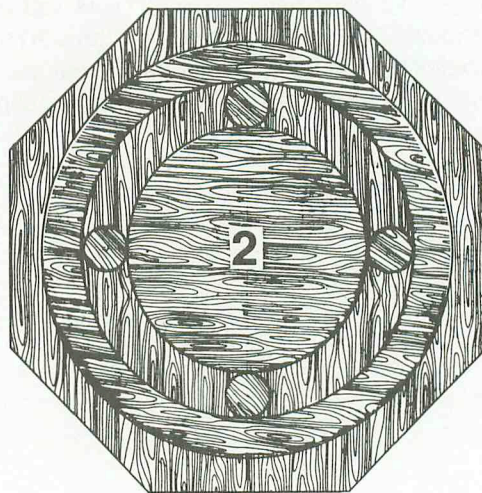
On the ram-type lathe, the tools on the turret, positioned where the tailstock would be normally, and turret itself are mounted on a *ram slide*. The slide is clamped to the lathe bed and remains fixed. The tools are thrust forward with a handle that controls a bar-type slide. This forward stroke can vary from 4" to 13" depending upon the configuration of the particular lathe. Adjustable stops are fitted in a circle around the outboard end of the ram. The turret up by the headstock is used in lieu of a tool-post holder. It adds to the speed of production since four cutters can be mounted and rotated or indexed for each succeeding step of the job in hand. The lathe in Fig. 1-17, it will be noted, is fitted with a regular toolpost. Note also that the slightly larger lathe (Fig. 1-18) has a Jacobs chuck on the headstock mandrel and another smaller one on the

turret. This was the setup found on the lathe just before it changed owners.

Saddle-type turret lathes are generally very large pieces of machinery designed for heavy-duty work. They will take bar-type work as large as 12" in diameter and chuck jobs about 36" in diameter. One of the major differences between the ram-type and the saddle-type is that the latter has the saddle constructed differently. The turret is mounted firmly on the saddle and moves along the lathe bed when a cut is taken. This mounting offers the greatest rigidity for the turret no matter how long a cut is taken, and cut lengths are limited only by the length of the lathe bed. The saddle-type turret lathes break down into two additional types: *fixed-center* and *cross-sliding* turret lathes. The fixed-center moves along the bed in a line parallel to the

axis of the spindle. The cutters and tool holders are often built into heads that revolve. The cross-sliding turret (hexagonal in shape like the fixed-center turret) is fixed to a slide mounted on top of the saddle. Movement at right angles to the centerline is possible. This means that it can move forward or backward and to the right or left. It can,

when the need arises, be locked on the slide, in which case it operates like the fixed-center turret. Tooling costs and setup times are said to be reduced with this arrangement. These lathes are for high production use and would rarely, if ever, be seen in a small shop or that of a hobbyist.



Tools

ONCE THE LATHE IS SET UP AND THE WORK-piece properly mounted, the time is at hand to apply the cutting tool to it. The object to be fashioned remains hidden in a block, cylinder, or disc, and all the waste around it must be removed to reveal it. Paramount at this point is the speed at which it must be revolved and the shape of the tool selected to remove the waste. If the workpiece is irregular in shape, a cardinal rule is that it should be turned at a slow speed. In an old book that turned up during my research, the author clearly stipulated that “a high speed is essential for good work in wood turning.” This was quite true at the time he wrote the book because treadle-powered lathes were still in vogue at that time. He might have worked up a speed of 785 rpm, pumping away like mad with his left foot. In any event, 785 rpm on a woodworking lathe *is* today’s slow speed, and though there may be some pounding on an extremely rough or irregular piece of wood, a sharp tool will soon reduce it to the desired roundness.

Wood turning is normally done with a series of chisels. The basic set (Fig. 2-1) includes a *gouge*, a

skew, a *parting tool*, a *spear-point*, and a *round-nose* (similar to a gouge but with no curvature on the top side) and a *square-nose* (Fig. 2-2). There are variations on some of these—right-hand skew, left-hand skew, wide gouge ($\frac{3}{4}$ "), narrow gouge ($\frac{1}{4}$ "), and even a square-nose (Fig. 2-3) with a cutout in it for turning beads. This last generally has to be made up by the operator. There are those who aver that the gouge is the most versatile of the lot, while others grind up unique parting tools which they state emphatically will do almost anything on a rotating piece of wood or plastic. Included here are additional noncommercial “chisels” (Fig. 2-4) ground from large, steel boring bars that will hog off waste as smoothly as cutting butter.

CUTTING ACTION

Applying the tool to the wood for the initial cut is a technique in itself. The right hand grasps the handle of the chisel while the left holds the blade. Some operators hold the blade with the palm down, especially for rough cuts, thus holding the chisel down

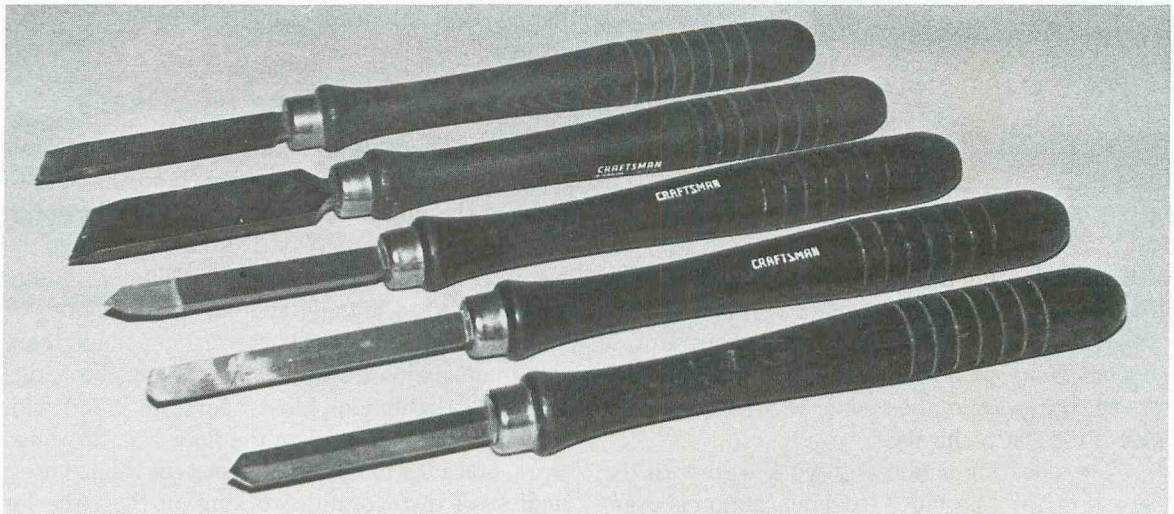


Fig. 2-1. Set of lathe chisels. From bottom to top: parting tool, flat gouge, spear-point, large and small skews.

on the tool rest but maintaining control of the depth of feed by pressure of the fingers against the rest. When the workpiece has been smoothed somewhat, the hand position with the thumb on top (Fig. 2-5) and the fingers holding the blade may be used. Control of left to right movement is more positive in this manner.

When the tool is held flat on the tool rest with the handle neither lowered or raised above the center line, the chisel is said to be used with a *scraping* action. Scraping is considered easy and relatively safe for the novice. Nothing is more nerve shattering than to have the chisel dig in to the workpiece, stall the lathe or, even worse, gouge out

a huge chunk of material. If the tool rest is a short one it is best to work from right to left taking shallow cuts at each pass until the left end of the rest is reached. Stop, reposition it toward the left, and proceed as before until the tailstock end of the work is reached.

Gentle an action though it may be, scraping, in our opinion, is less productive on freshly centered, rough, or irregular work.

Once it is mastered, a *shearing* action removes waste quite effectively. It is especially good with gouges and works well with a skew used judiciously. For this action, the left side of the gouge blade is raised so that the right-hand portion of the

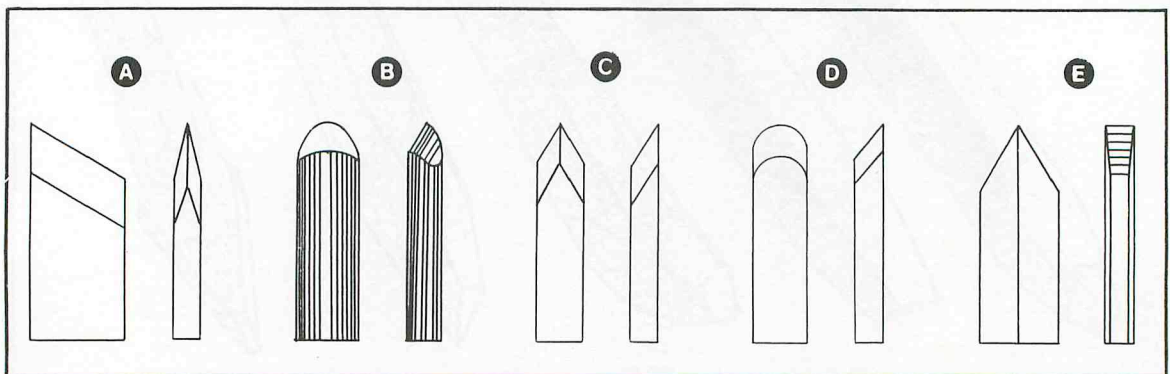


Fig. 2-2. Chisel points: (A) spear-point, (B) round-nose gouge, (C) spear-point, (D) flat-nose gouge, (E) parting tool.

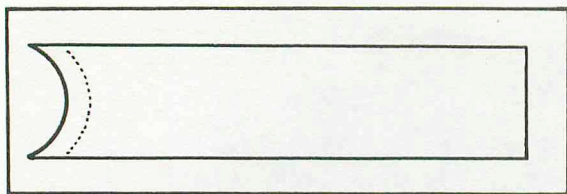


Fig. 2-3. Tool for turning beads made up from an old file.

blade is supported on the tool rest (Fig. 2-6). The position of the blade is not quite vertical, and the proper angle will vary for the individual operator. It depends, too, on how much waste has been removed. Here, again, the task is best accomplished with razor sharp chisels.

The shearing action will work well with the skew (Fig. 2-7), provided extreme caution is exercised, and the speed is kept *slow*. The shearing comes into play when the tool edge is advanced along the work, left to right when working right of center and vice versa when working toward the headstock.

The third method, the *cutting* action, involves elevating the edge of the tool by lowering the handle. A light cut when working this way, as well as a slow speed, is mandatory. This action calls for complete and absolute familiarity with the tools and exactly how they perform. Just changing the position of one's body may cause the chisel to feed more

deeply than intended, causing it to dig in disastrously.

USE OF THE VARIOUS CHISELS

Despite its laudable versatility, the gouge is always used for roughing out operation. It works best to remove the edges from square stock. The rough cuts are best started 2" or 3" from the end and the waste removed toward the end. The $\frac{3}{4}$ " gouge should be used initially and certainly not the $\frac{1}{4}$ " one. Also, while light cuts are recommended there is no implication here that the grip on the gouge should be lightened. Most operators stand with both feet firmly braced on the floor and, for rough work, brace the tool handle against the thigh. I use a high stool that permits working on the lathe for longer hours, but this may be uncomfortable for some operators especially when working the headstock end of a spindle.

You get used to working with a gouge much more rapidly than with a *skew*. The latter gets its name, incidentally, from the angle at which the edge is ground. There are skew chisels that are ground square across the end, but the types with the double bevel and the canted edge seem to work with less effort. Until you get used to handling the skew (Fig. 2-8) it can be a sheer disaster! Here are some clues about making it work well.

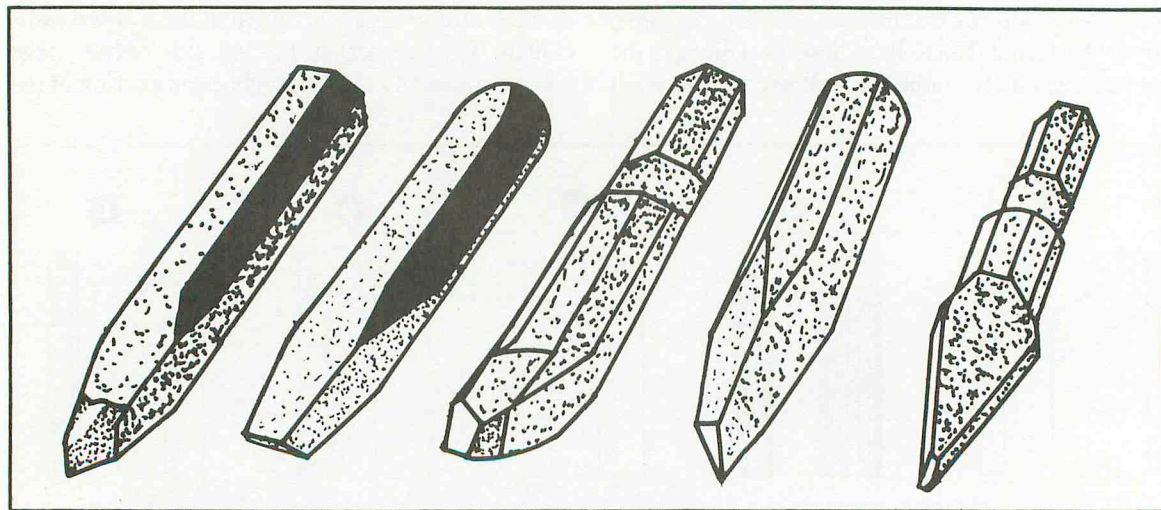


Fig. 2-4. Old "boring bars" reground as substitute chisels.

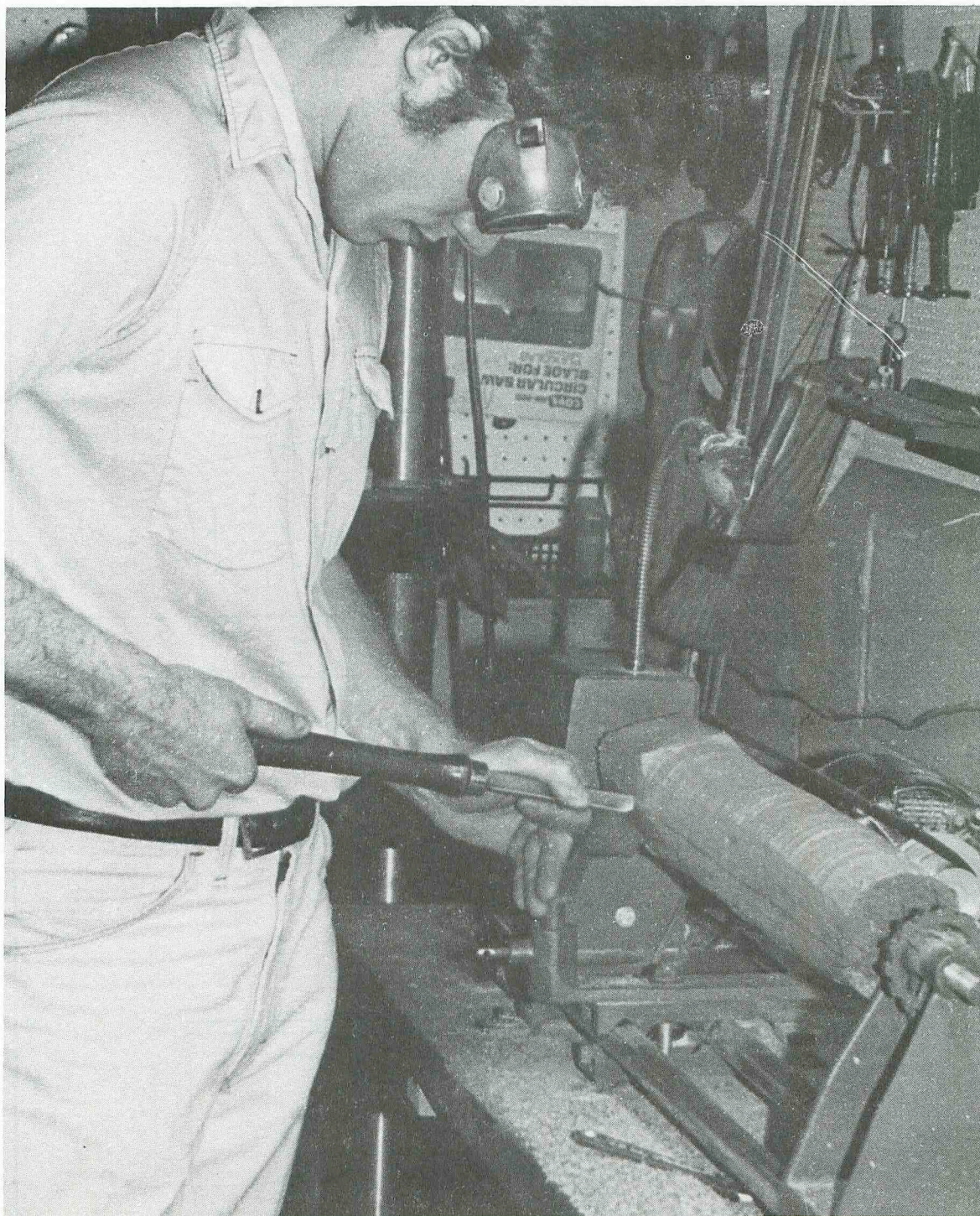


Fig. 2-5. Using a round-nose gouge.

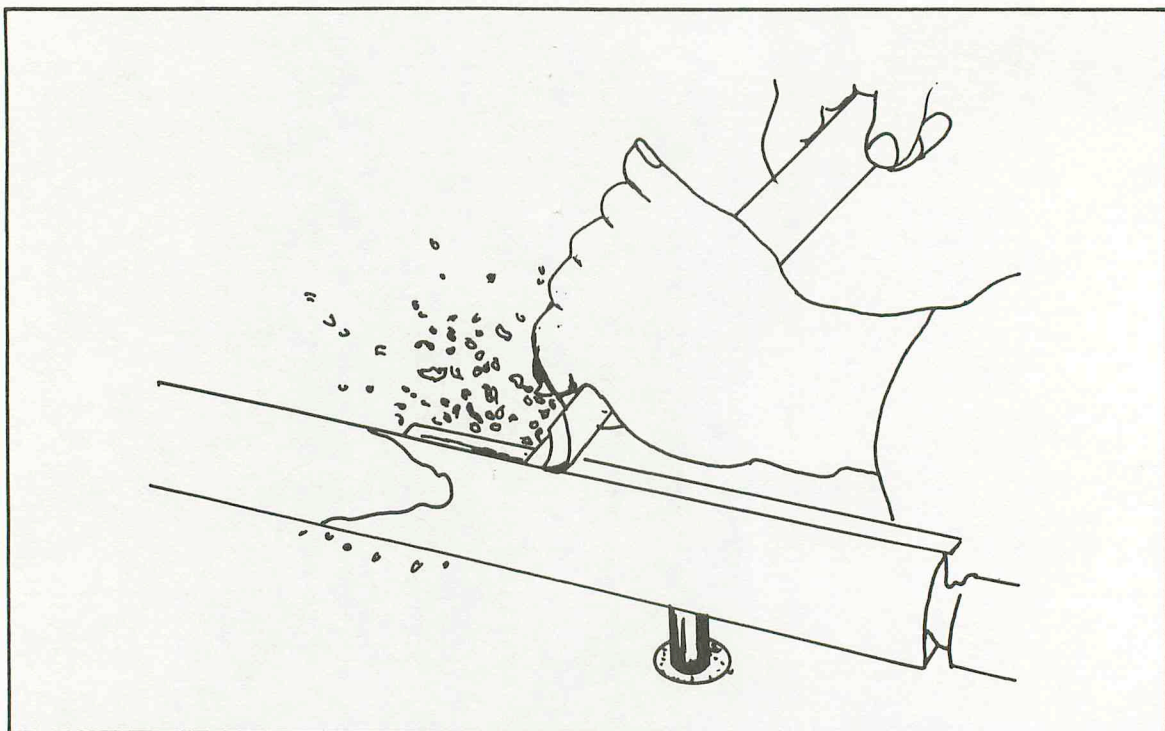


Fig. 2-6. Position of gouge on tool rest. Courtesy Loretta Holz.

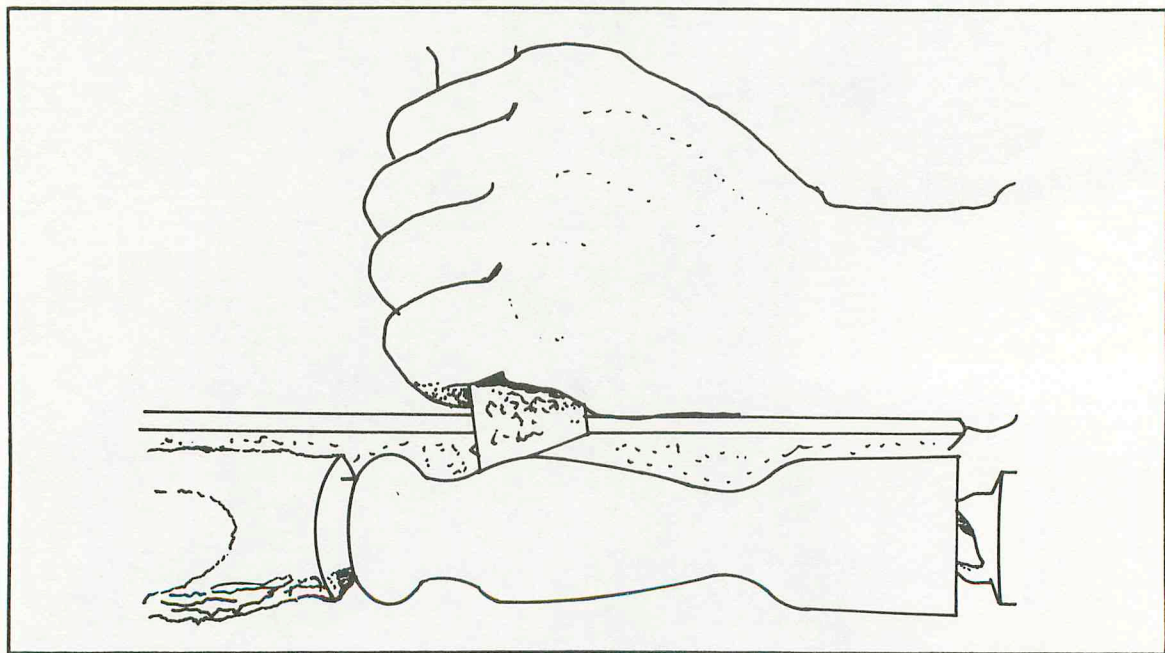


Fig. 2-7. Using the large skew. Courtesy Loretta Holz.

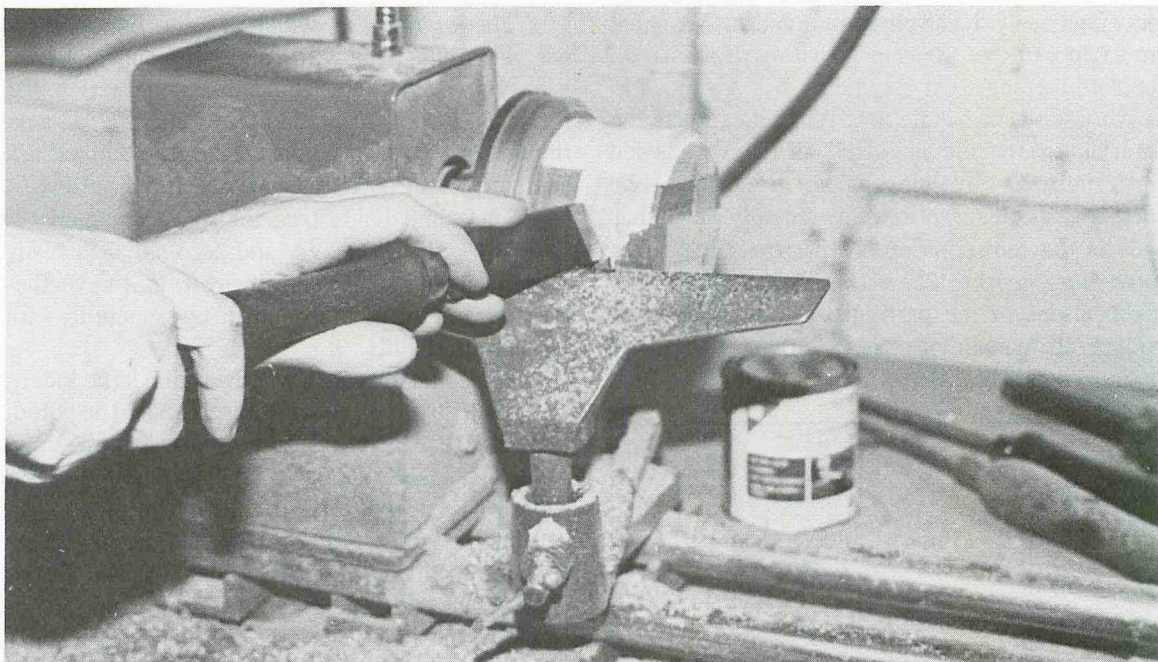


Fig. 2-8. Large skew removing waste on laminated base.

First, the handle must be held down and to the left of the cutting blade. A rule of thumb to remember is that while its bevel is almost flat against the workpiece only *the lower half* of the cutting edge is used. It is moved along with a slicing action. If the upper edge contacts the work, horrible “dig-ins” occur. Frankly, its use on rough cuts is to be avoided like the plague. It can be used for smoothing and finishing in a scraping mode and here it is very effective. Bring the handle up level with the cutting edge, almost flat against work and ease it along. It will take off any ridges remaining from the rough cutting operation very nicely. Some operators believe that, used properly, it leaves very little sanding to be done. It can be used also to turn *beads* with a bit of practice. Beads are curved sections or bands around the piece and appear frequently on lamp bases, candle sticks, and similar objects of conventional design. The bead making technique is not so difficult if a skew half the width of the bead is used. The technique will be discussed at length later. The skew works well to square ends, to cut Vs and tapers, and to mark off areas for other operations.

The *parting tool* serves a number of purposes and some operators become totally enamored with it. It is great, with the aid of calipers (Fig. 2-9), for establishing the depth of cuts. It will produce shoul-

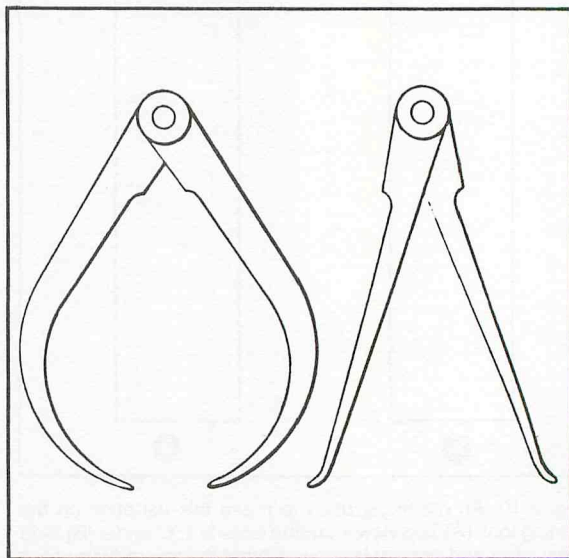


Fig. 2-9. Outside and inside calipers.

ders effortlessly. It can clean ends and cut Vs, and it can even remove sizable portions of waste on faceplate turnings. On a spindle, it is advanced to the work with the handle low. When it contacts the material, the handle is raised as the tool is fed gently into the revolving piece. In essence, one starts with a cutting action and gradually a switch is made in the tool position so that the edge penetrates more deeply. The action is faster this way. Modifications of the parting tool can be used to produce all manner of curves without the use of another chisel (Fig. 2-10).

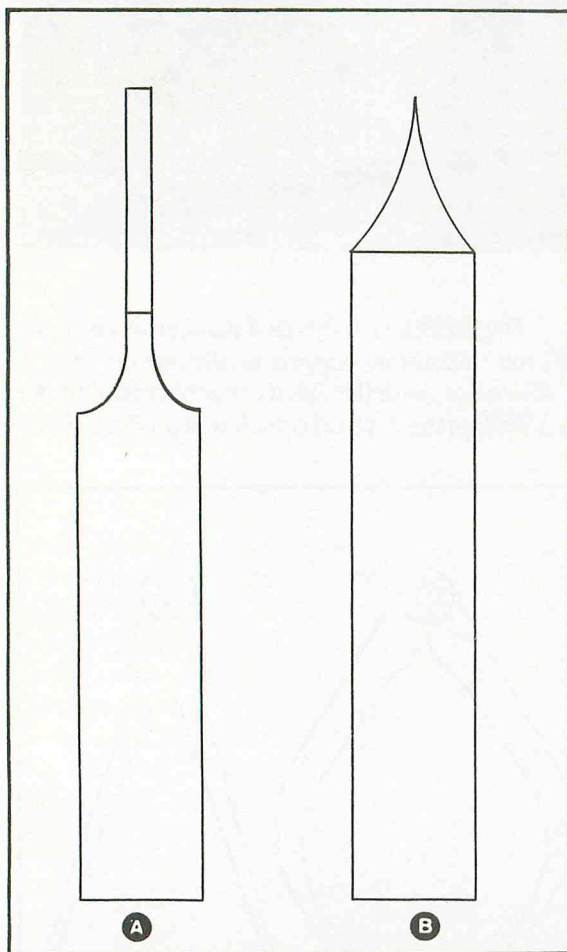


Fig. 2-10. An old file is used to make this variation on the parting tool. (A) Top view—cutting edge is 1/6" wide. (B) Side view—top and bottom is ground back 1/2" to produce sharp point. See text.

The *square-nose*, which is quite like an ordinary wood chisel but with a more pronounced bevel, is easy to use with its required scraping action, but there is nothing truly glamorous about it. If anything, it may turn balls better than other chisels but anything it can do they can do better, I believe.

The same holds true for the spear-point. It smooths well, forms Vs, and accomplishes many scraping jobs. I tend to shy away from it nevertheless because the point may dig in unexpectedly with numerous results.

You could operate a woodworking lathe indefinitely with just these basic tools. It should be noted, however, that turning extremely hard wood, some plastics, and soft metals will dull them rapidly. For such work, carbide-tipped chisels can be used in lieu of the ordinary steel ones. On metal-cutting lathes, the cutting edge of the tool bit has different angles than those on wood turning chisels. Some-one working materials other than wood, but not utilizing a metal-turning lathe, can adapt and grind for his own use chisels embodying these angles. Turning steel and nonferrous metals, incidentally, is always done on the wood-turning lathe with a scraping action and a slow speed. In some cases, holding a file on the tool rest and on top of the workpiece will remove waste quite satisfactorily.

Some time ago we acquired a batch of what must have been old boring bars from a large milling machine or a commercial lathe. By grinding the points similar to those on metal lathe tool bits, they could be used admirably for turning (Fig. 2-11) blanks of polyester resin. This material is very abrasive, and these tools were substituted for the ordinary chisels to keep the "good" ones from becoming dull prematurely. Properly hardened and tempered, they produced an excellent finish. Another adjunct to this tool making endeavor was the use of discarded files. Square files, with one corner held directly above another, were ground back to a 60-degree angle. Used like a graver, they, too, produced astonishing results. They work well for acrylics as well as polyester.

An old 1/4" square file is ideal for this. Two sides are ground in (from the tip to a point about 1" back) so that the center portion is 1/16" wide. The



Fig. 2-11. Turning acrylic with specially ground tool. Waste comes off acrylic in long spirals.

file is then turned on its side and beveled from 1" back to the tip, which produces the cutting edge. These bevels are slightly hollow ground. In essence it resembles a spear-point except for being ground square across the tip. Not only is it a strong tool, it can be resharpened quickly and repeatedly. It is extremely versatile, functioning as a skew, a parting tool, a scribe, and even as a narrow gouge when it comes to roughing off waste. It can be used to make beads, square up corners, and even produce coves. The first one I made up was $\frac{1}{8}$ " wide across the tip, more like a true parting tool. A narrower tip is used far more frequently. Both work exceptionally well on acrylics and resins. Care should be exercised not to overheat the metal during the grinding process.

Polyester, while not toxic when fully cured, produces a dust much finer than wood, and a mask or respirator should be worn when working it. Acrylics do not powder, but produce long spirals and often complete rings as the waste is removed. Acrylics tend to heat up much quicker than most

other materials and should be worked with plenty of ventilation due to the acrid fumes sometimes given off.

This technique of making cutters, gravers, and parting tools is not common practice but it is not totally unknown. It was a routine procedure in the nineteenth and early twentieth centuries, and was a totally accepted procedure in England in the '20s and '30s. Use of homemade boring bars is described in Chapter 14. The reground (Fig. 2-12) bars mentioned earlier are quite stubby, about $\frac{3}{4}$ " in diameter. This means that to bring the cutting edge in proper juxtaposition with the workpiece, the tool rest has to be lowered somewhat. Additionally, these tools are a bit more maneuverable when fitted with long handles.

Frequently, the equipment furnished with a lathe rapidly becomes inadequate. Expenditures must then be made for suitable accessories or, where possible, they must be made up by the operator. This is not an insurmountable task, particularly if the lathe in question is a metalworking

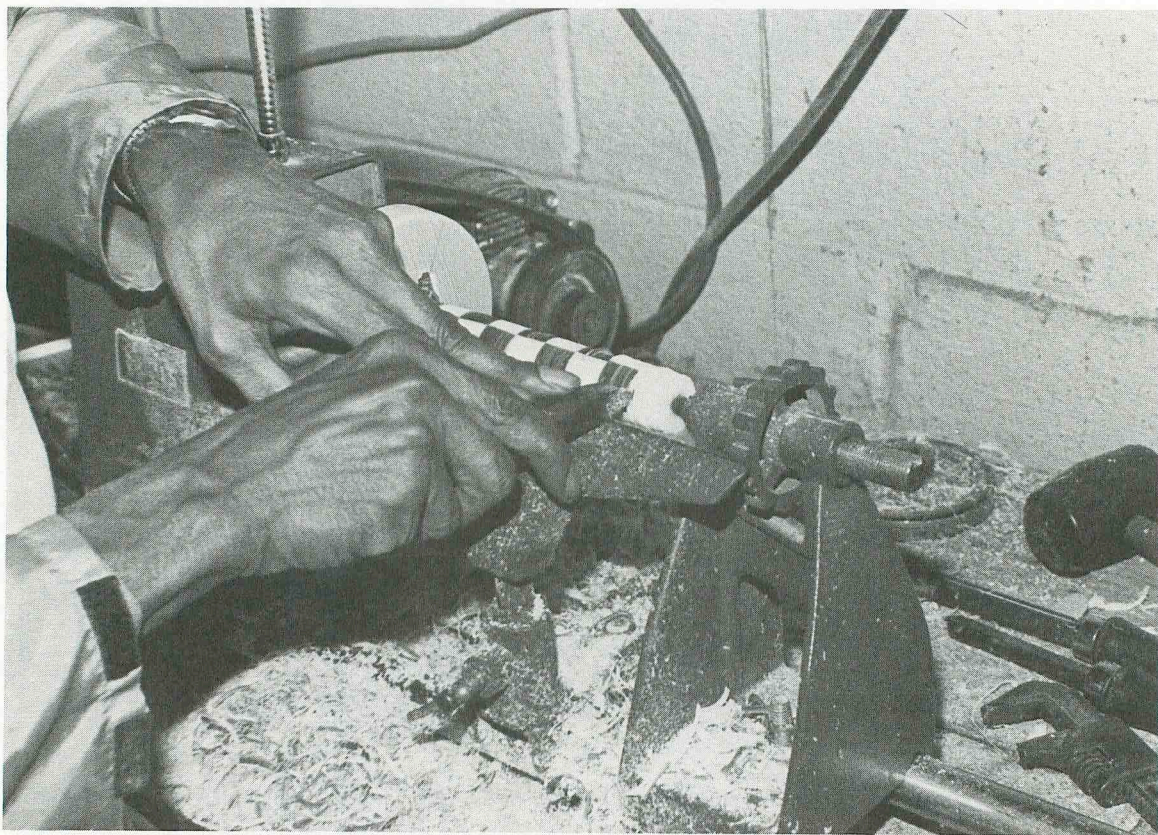
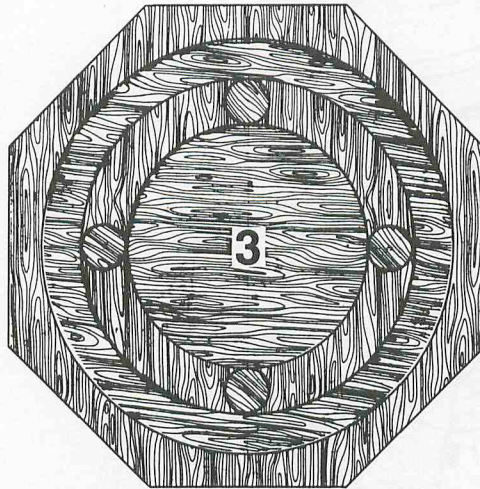


Fig. 2-12. Cutting a lip on an acrylic spindle with special tool.

one. For the woodworking lathe, there are some handmade accessories that will increase the scope of the work that can be done, and these will be

introduced in the chapters where projects utilizing them are described.



Safety and the Workplace

THE RULES THAT FOLLOW ARE RECOMMENDED by the Power Tool Institute, and they are cited here for emphasis. The initial purchaser of a lathe usually gets a copy as part of the instruction manual. Long hours and experience with the lathe will highlight the importance of the rules.

- ☐ Read the owner's manual and all the information obtainable about the lathe.

- ☐ Don't use the lathe or any power tool in damp or wet locations, and keep the work area well lit. My arrangement includes a dual bulb 4' fluorescent lamp over the lathe table. The work area was originally set up so that all tools or machines were against walls, leaving lots of room in the center area for photography and movement. This is not the wisest arrangement by any stretch of the imagination. The lathe operator in this case sits with his back to the entrance of the room. If someone should enter suddenly while he is concentrating, the operator's startled movements may force the chisel into the workpiece, causing irreparable damage. All visitors, in any event, should be kept a safe distance from the work area.

- ☐ There is an old saying, "If it doesn't fit, don't force it!" that could be paraphrased here. Don't force the tool. Let the lathe do the work. The chisel should be held against the work but not with an overbearing pressure.

- ☐ Do not wear loose clothing or long sleeves. The latter is a very serious hazard.

- ☐ Use safety glasses *always*, a mask (Fig. 3-1) when appropriate, and some sort of cap to keep the dust from the hair.

- ☐ Keep all the unused chisels or tools on racks or off to the right of the lathe. Keep them sharp at all times and clean for best and safest performance. Follow lubricating instructions religiously and know the proper method of changing accessories.

- ☐ Double check all mounted work and locks to make certain the workpiece remains in working position.

- ☐ Install a switch on the left side of the lathe table so that it can be turned off quickly.

- ☐ Do not try to check smoothness of the workpiece with the fingers. Shut lathe down and rotate piece by hand to inspect.

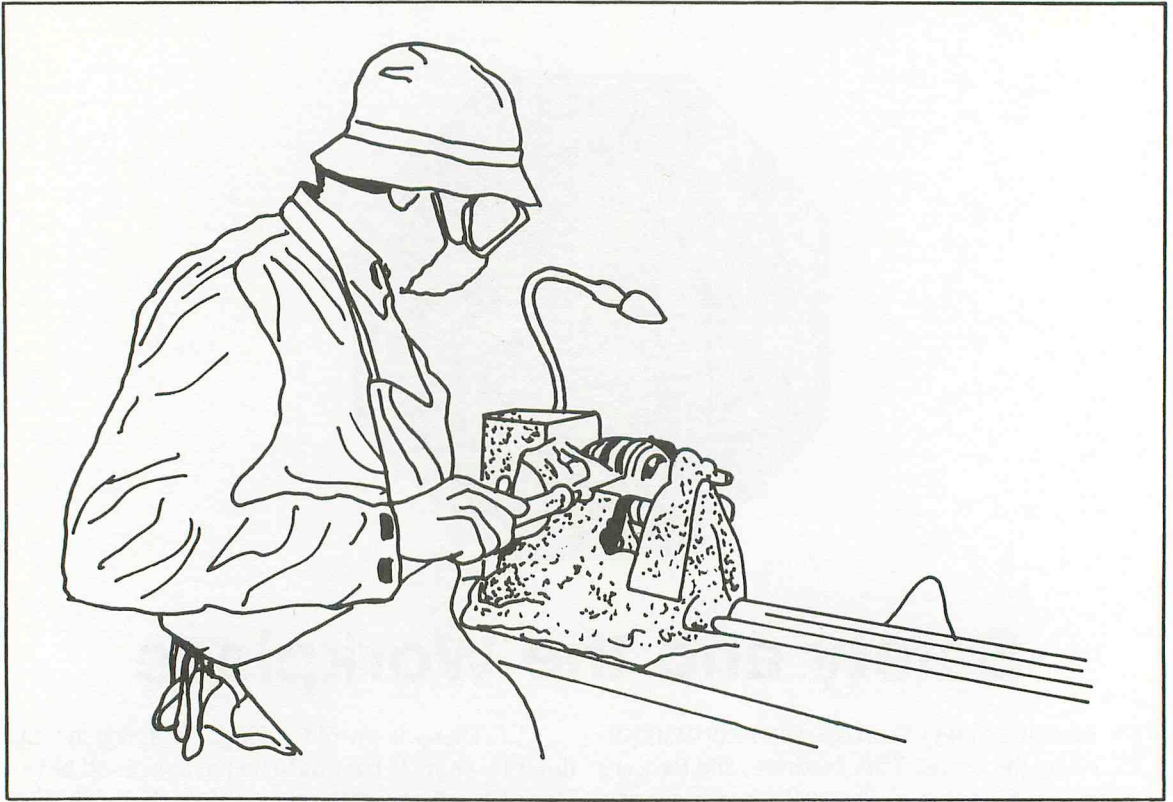


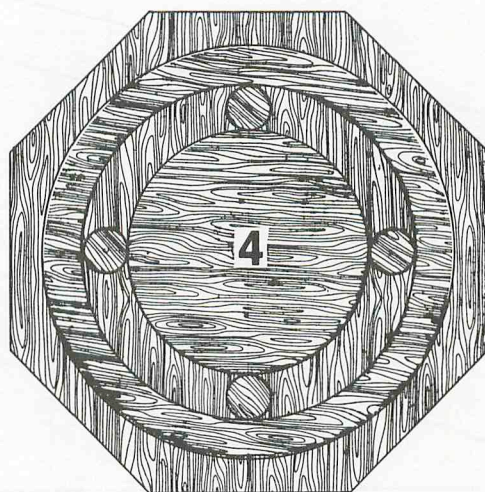
Fig. 3-1. Wear safety goggles and, when necessary, a mask.

□ In addition to locating the lathe properly in the shop, the height of the work table or bench should be given serious thought. The problem is minimal here if the table is purchased simultaneously with the lathe, but serious consideration should be given to the height of the lathe from the floor in relation to the height of the person who will be using it most frequently. Quite like the correct position for operating a typewriter, the lathe should be just high enough that the forearm holding the chisel extends straight out from the elbow. The

headstock area should not be too close to another machine like a drill press, because this may be restrictive when working the portion of the work closest to the headstock spindle.

□ Make provisions for proper ventilation for comfort and for those rare occasions when turning a material may generate undesirable fumes.

□ Do not let enthusiasm for a project or a desire to finish in one evening force you to work when very tired. This is a prime time for accidents.



Spindle Turning

A FAR GREATER PROPORTION OF THE WORK normally turned on a lathe falls into the category of material turned between centers than on a faceplate, in a chuck, or similar device. The projects in this book reflect this ratio, although a great deal of pleasure can be derived from producing work by any one of the methods suggested above. The first piece turned successfully is always a delight, but success is contingent on knowing just how each of the chisels work and the proper method for setting up a piece of work.

Remember that there is a spur on the headstock and a *dead center*—a point on the tailstock between which the work must be centered. When the workpiece is square, diagonal lines should be drawn to determine the center point (Fig. 4-1). This applies to both ends, of course, but for firm mounting of the spur on the headstock end, the diagonal lines should be cut into a depth of about $\frac{1}{8}$ " with a saw. This is not necessary on the tailstock end, but if the wood is extremely hard it may be expedient to drill a hole to accept the dead center.

When the wood is round, the center may be

determined with the center-finder shown in Fig. 4-2. The stock is positioned in the angle of the made up center-finder and lines are drawn across the ends of the stock. It is practically foolproof and takes but a moment. Mounting the spur is accomplished in the same manner as with square stock.

It is a little more difficult when the work is irregular in shape, but the device shown in Fig. 4-3, consisting of concentric circles engraved or scratched of a piece of flexible clear plastic, will accomplish the task with little effort. The hole in the center of the clear plastic permits marking the center of the work either with a pencil or a fine punch. When the piece is ready for mounting, stand it up on end and tap the spur center with a mallet (not a hammer) to set it. Bring the tailstock up into position and when the dead center is in the hole in the wood, lock it. The fine adjustment of the tailstock is then made with the tail spindle hand-wheel. Check the position of the belt to make certain that it is on the slow running segments of the pulleys—2" on the motor pulley and 4" on the spindle pulley. Give everything one final check, and

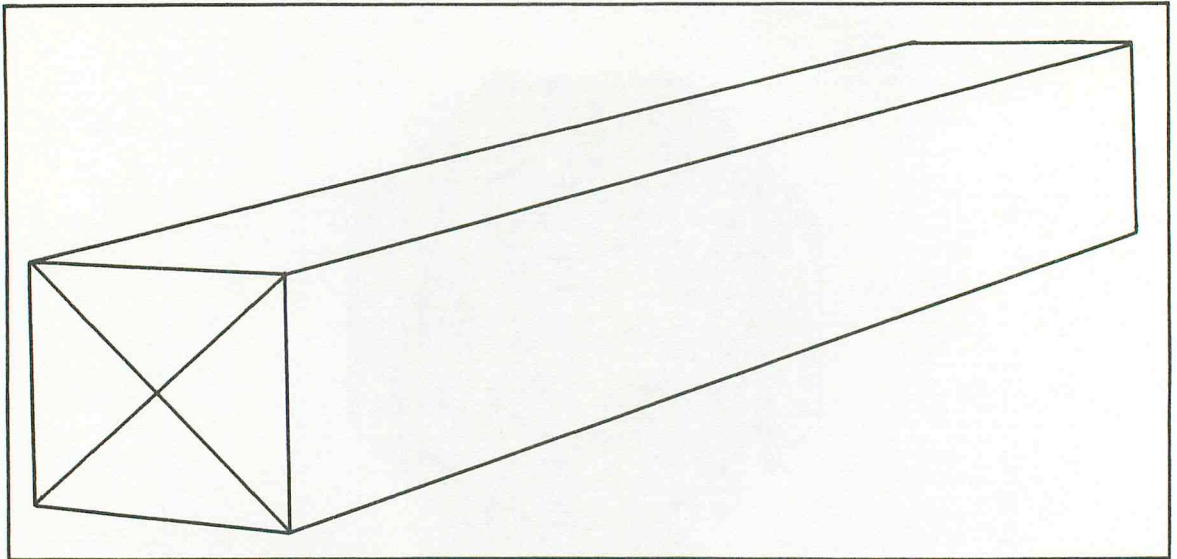


Fig. 4-1. Diagonal lines are drawn across the end to determine the center.

then switch on the lathe.

Start about 2" or 3" inches in from the right end with the gouge and work over to the right, taking a fine cut as described earlier. When the piece is

round all the way across, dimensional lines may be placed on it with a pencil. Use a ruler to measure off the segments desired or use a *template*, which is in essence a layout of the piece to be turned. The

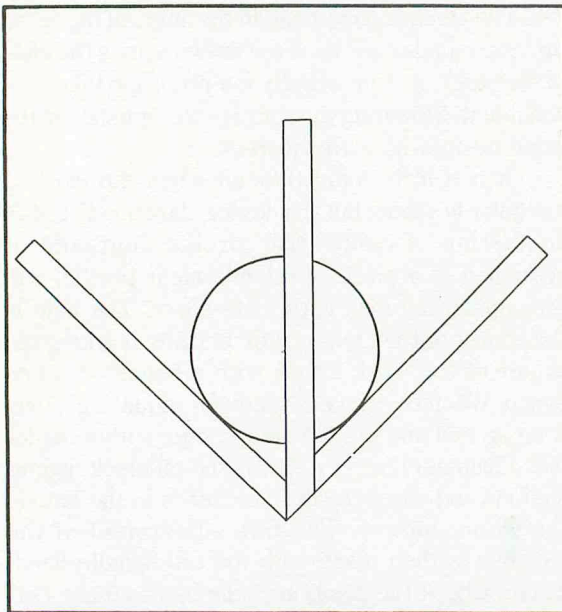


Fig. 4-2. Center finder is laid across end of cylinder and a line drawn. Rotate cylinder and draw several more lines to determine center.

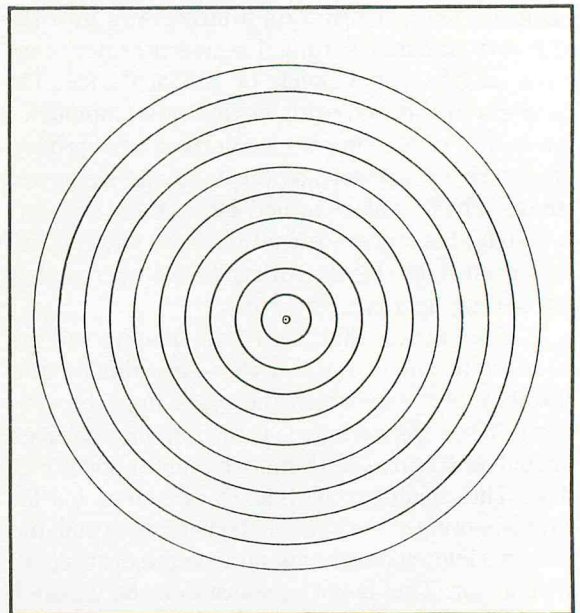


Fig. 4-3. Acrylic plate with etched rings is rested on end of irregular piece to find true center.



Fig. 4-4. Turned lamp base of dark wood. Bottom is turned separately.

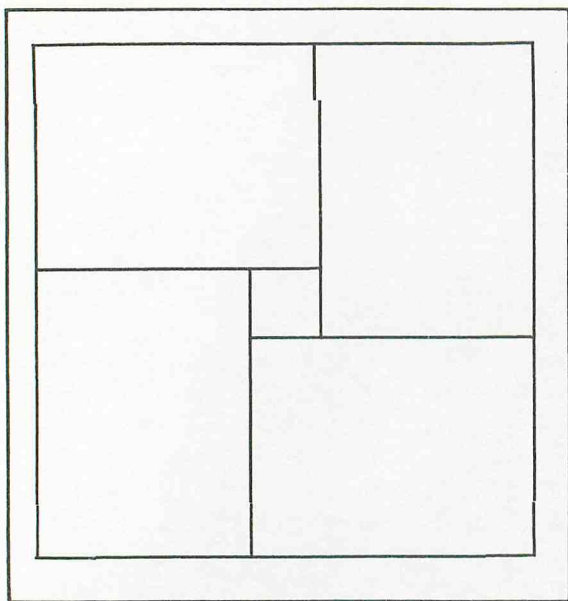


Fig. 4-5. Glue four pieces of wood together as shown to make lamp "stem" with center hole. Plug holes on ends to mount on lathe.

pencil marks may be applied while the work rotates at slow speed. A light touch is all that is required if the piece is rounded off pretty well. If some portions are going to be cut away deeply they can be marked off at the right depth by using the parting tool on the outer dimensions. Use an outside caliper to determine when the correct diameter of the stock is reached at the dimension points. Some operators conduct this operation while the lathe rotates, but I usually shut down momentarily. When the ends of the caliper slide across the stock, the correct diameter has been reached. In removing the waste between the guide cuts made by the parting tool, always work from a high area to a low one. Doing the opposite can cause the gouge to dig in. If there is to be a relatively large hollow, work down to the center gradually from both sides.

Included in this chapter are a collection of items that use spindle turning in slightly different forms. Lamp bases seem to lend themselves to spindle shapes. The little lamp shown (Fig. 4-4) is a combination of spindle and faceplate turning. (One problem that arises immediately is the longitudinal hole through the stem for wiring. This should be drilled before turning the piece just in the event that drilling goes crooked. Drilling the hole is not so acute here because the stem is not overly long.

There are ways around this, however. One of the simplest is to glue two pieces of wood together, both of which have a groove routed or cut right down the middle. Both ends have to be plugged, of course, so that the glued up piece can be centered accurately on the lathe.

The other method is to glue four pieces of wood together so that a hole remains right smack in the middle (see Fig. 4-5).

Once mounted on the lathe, the stem is turned to the shape shown in the photo of the finished object. The shape should be planned in advance and a template made as shown in Fig. 4-6. Note, too, that a *collar* or *peg (tenon)*, not visible in the photograph, must be turned on the bottom end so that it can be press fitted and glued into the circular base.

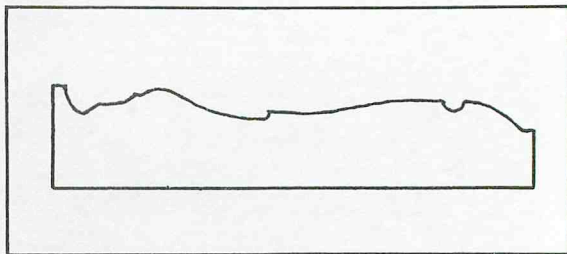


Fig. 4-6. Plan and make template to aid in turning lamp spindle.

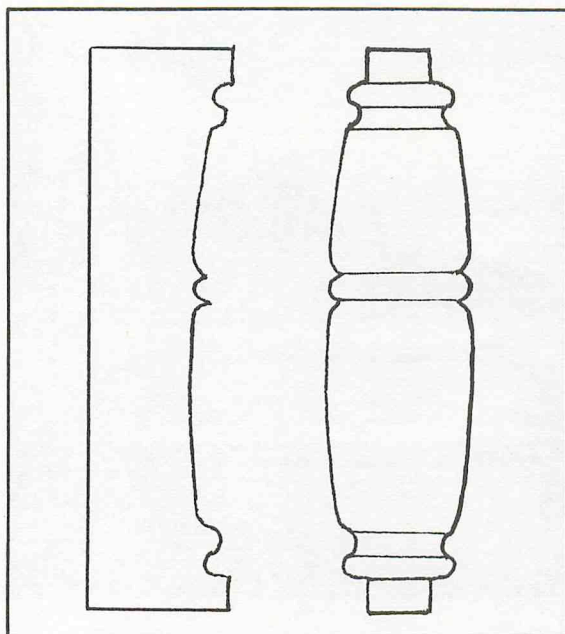


Fig. 4-7. Spindle (right) and template used to turn it (left).

This end, reduced in size from the rest of the stem, can be cut with a small gouge and finished with a skew. The shoulder is cut square with a parting tool. The base, as mentioned above, is a faceplate

turning. The procedure for faceplate turning is explained in Chapter 6. ,

BEADS

Both the lamp just described and the one that follows have at least one bead incorporated into the design. Beads are nicely rounded rings Fig. 4-7 which give the appearance of being raised above the rest of the piece. These are fairly easy to make with normal chisels but they do require a little practice. The width of the bead is marked off either with a pencil or with the point of a skew held on edge and fed into the wood. The skew, with the long point still down, is used to make V cuts on either side of the mark. These Vs should be deep enough so that the bead can be rounded off without the wood on either side of it being affected. Now, the skew with the point still down is held against the left side of the unformed bead, and the handle is moved gently to the right. This will round off the left side and top portion of the bead to the center. The rounding may not be accomplished with the first pass but the second time should do it. This procedure is repeated on the right side of the bead.

There is another technique for making beads

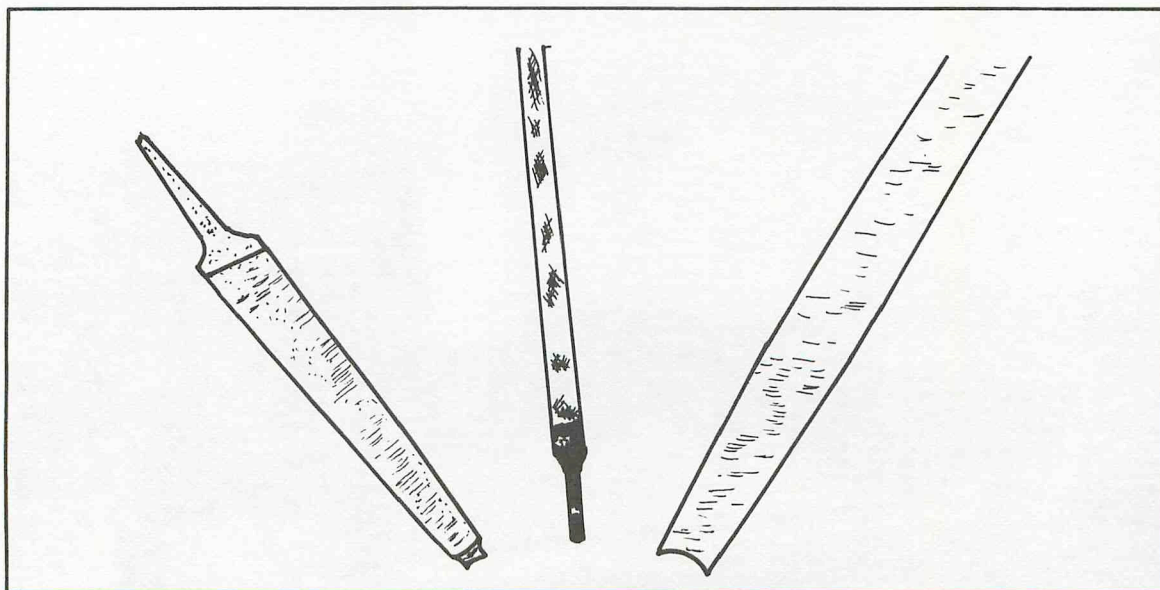


Fig. 4-8. Files (right and left) ground as bead cutters. Center file is ground as special parting tool.

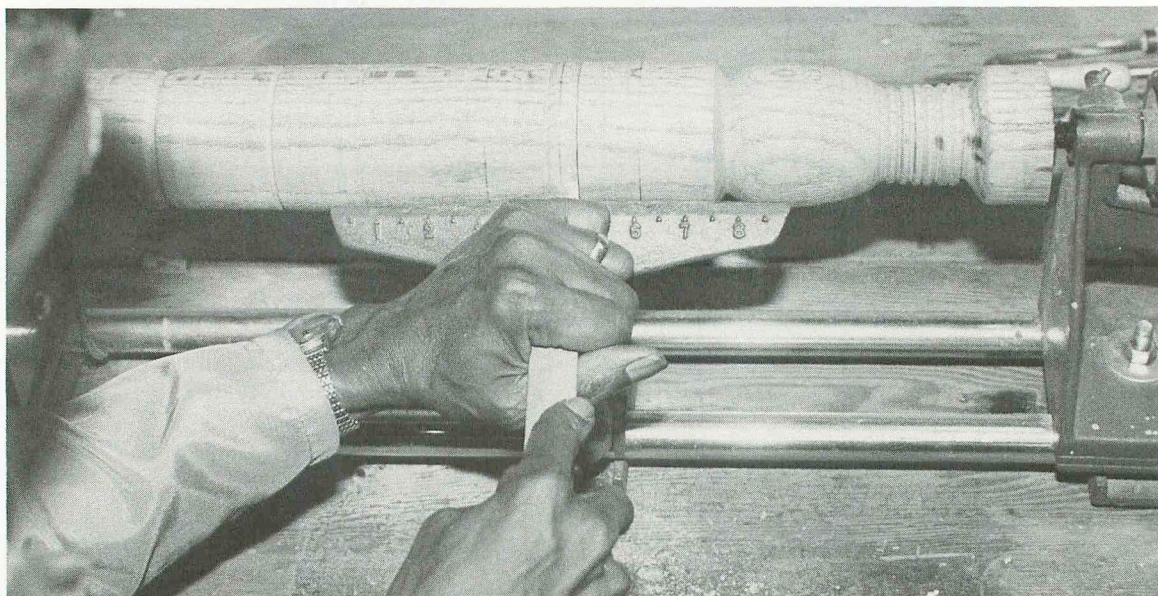


Fig. 4-9. Cutting bead with special tool.

that works as well or better. It reaches back over the years to a time when operators did not hesitate to make up their own tools. Select an old flat file with an end of about the width of the bead to be turned. Grind off the teeth or serrations on the top side, just enough to provide a smooth area extend-

ing from the end to a point about 1" back (Fig. 2-3). Grind a smooth curve into the end with a point projecting on each side. The underside should be ground back to produce a 45-degree bevel with the same contour as the curve. If the file is flat, both top and bottom of the curve and bevel can be ground

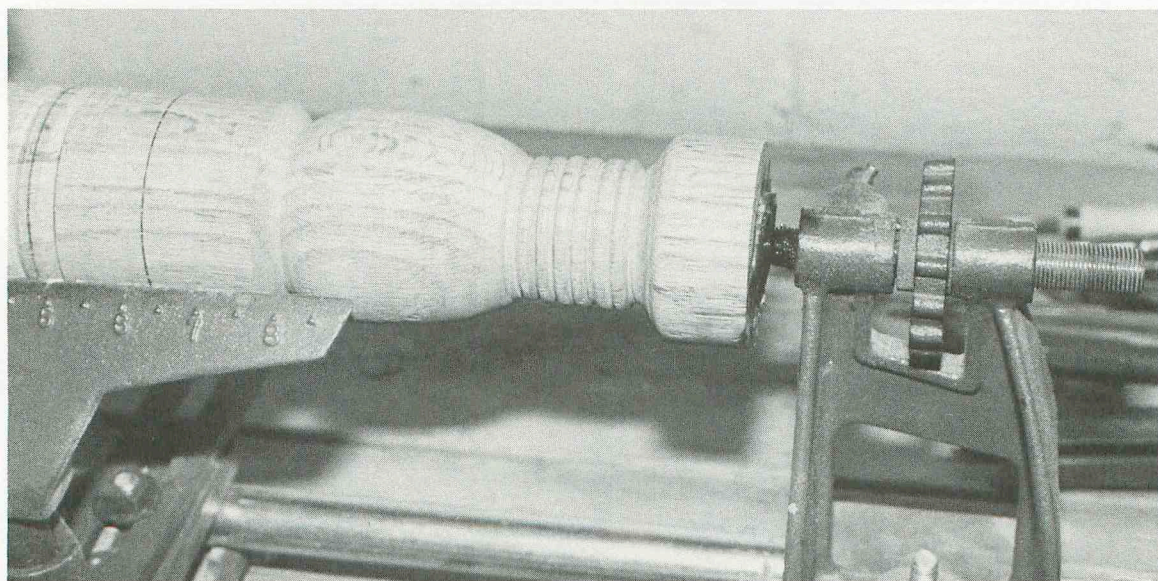


Fig. 4-10. Closeup of beads cut into end of spindle.



Fig. 4-11. Turned base on hanging swag lamp.

simultaneously. If a half-round file is selected, the grinding will have to be done in two steps. While these "cobbled up" tools make beautiful beads, the one difficulty arises when larger beads have to be made. You might wind up with four or five files (Fig. 4-8) ground this way. The effect produced is definitely worth it, nevertheless. When larger beads, or balls (Fig. 4-9) for that matter, are required it's back to the narrow gouge at least for the preliminary waste removal (Fig. 4-10). Larger balls will get full treatment later on.

SWAG LAMP

This hanging lamp (Fig. 4-11) has a base about 4" in diameter at the largest point. This makes a somewhat bulky turning, even if the length is only 8". One way to deal with this is to start with a piece of wood about 2½" square and build up the large portion by adding pieces 2" thick, slightly longer than the bulbous area. The turning then involves less waste removal. The hole for the threaded lamp pipe was drilled through from both ends. The line cord does not go through the base in this case, but the pipe and the metal terminal on the bottom serve to join the harp and the base. The socket is in the top of the harp and the lampshade just rests on it.

CUP HOLDER

A lot of these cupholders (Fig. 4-12) are sold today in fancy gift shops. They are relatively easy to make with the main shaft consisting of a simple straight turning embellished by a number of beads. The arms take a little more skill, it will be noted, because they should be exactly the same. Care must be taken with the shoulders of the unturned portions. The hollows between these sections are worked with a narrow gouge (¼"), and the waste removal is always down into the hollows from the high points. All four of them could be made from one piece of wood but a thin rod-like dowel such as this can flex or whip as it is turned. A *backrest* must be used. This is a support with rollers on it that holds the workpiece up as it rotates. This is not a standard accessory and, although one can be made up fairly easily from scrap wood and 1¼" diameter casters, it is simpler to do two arms at a time. A template

should be made up and used for these, because any difference one from the other will be apparent immediately. The finished holders are glued into the upright, which is in turn screwed to the stand from the bottom.

JEWELRY HOLDER

This is still another use to which spindle turnings (with faceplate base) can be put (Fig. 4-13). It is not a new item but is shown here because the spindle has style. Design is an important factor in this type of turning. Here the curves flow into each other. The portion just above the bottom cabachon is duplicated up near the top. Completing the whole form and topping it off is the acorn shape. There is an aura of tradition surrounding it, belying the fact that it seems so simple at first glance. For contrast, the string of olive-wood beads was added at the base.

RECORDER RACK

The spindles here (Fig. 4-14) feature three beads (not visible behind the recorders), one centered and the other two at the ends of handle-shaped turnings. The rack, with its flowing simplicity, does not detract from the expert turning of the wooden recorders. Hung on a wall, it is functional yet tastefully exhibits someone's pride in the instruments. Both spindles have tenons which are glued into the top and bottom pieces. This construction might also have been used as the front of a clock.

CANDLEHOLDERS

The traditional and the modern vie for attention in the case of these candle holders (Fig. 4-15). On the right is a combination of wood and metal with a colonial spirit that is a delight to the eye. Note that the detailing at the base of the ball is quite the same as that above it. The tall holders are truly modern—no embellishment, no base! They are slender, but balanced, and allow you to concentrate on what was most important to their designer—the wood itself. The ashtray is of the souvenir variety, often turned out by the thousands and stamped with the name of some tourist spot: Niagara Falls; Howe Caverns; or Ho-Ho-Kus, New Jersey. It is a

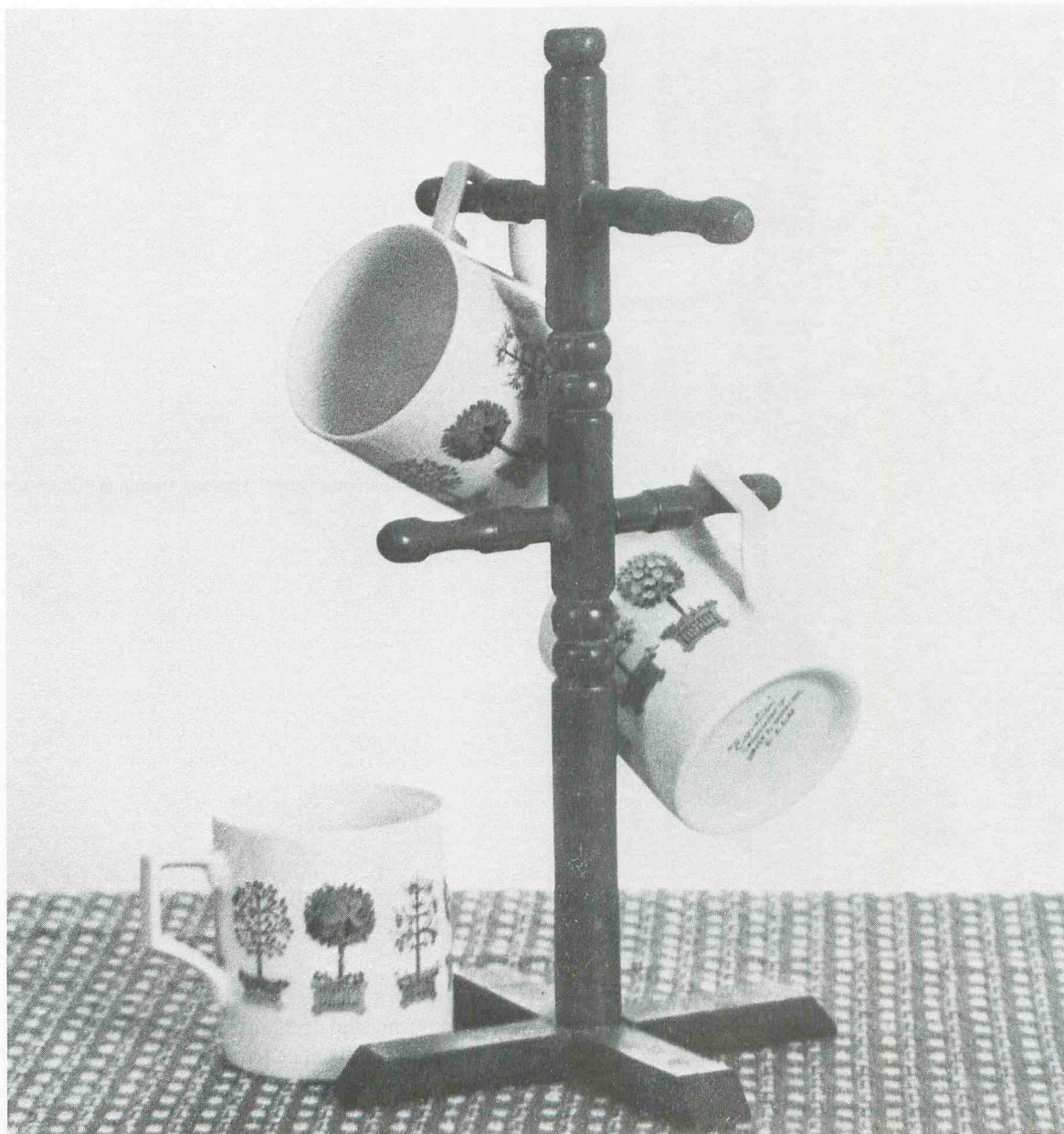


Fig. 4-12. Cup holder of simple yet functional design.

“glue-up” of soft, dark, and light wood. The little projections (handles like on a ship’s wheel), will be discussed further in the section on clocks.

CANES

An old, old book on turning, dating back to the

1870s, included a two-page table listing all the items that could be made with the use of a lathe. There were about 300 items cited although candle sticks and variations thereof appeared at least five times. Many of the listings are archaic, some of them unknown today. There were, to cite a few:

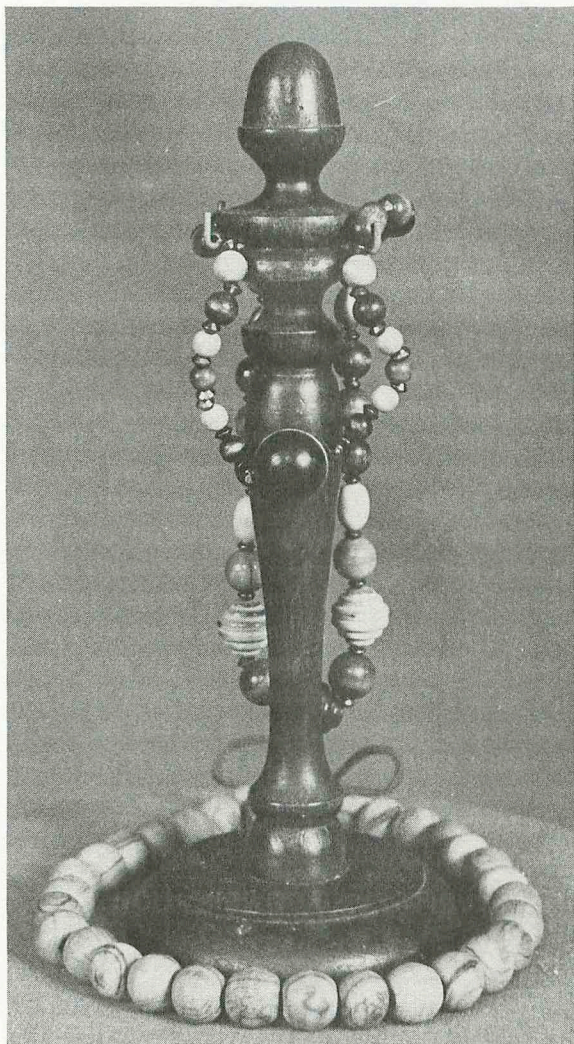


Fig. 4-13. Old-fashioned jewelry holder. Beads at bottom are of olive wood.

epergnes, nutmeg graters, ostrich egg vases, chatelaines, sundials, voice conductors, whip racks and handles, and walking sticks.

The mention of walking sticks was an immediate attention-getter because canes are enjoying a mild revival today. Interest has been stimulated somewhat by collectors, of course, but furthered even more by craftspersons who have revived the lathe as a form of artistic expression.

Just recently, a book entitled, *Cane Curiosa* was published. It sells for \$65 and was written by a woman who is a cane collector. When the canes that appear in this book (Fig. 4-16) were exhibited in

use, collectors appeared as if out of nowhere and offered information on their sword canes and other turned memorabilia once used by fops, dandys, and, in the early 1900s, women. There were canes with heads that opened to reveal miniature cosmetic cases replete with lipstick, powder, and mirror. Advertisers used walking sticks to promote products, and some of these still turn up in flea markets. There were canes that incorporated devices in the shank akin to a vertical window shade which, when unrolled, revealed street maps of cities in the United States, Boston among them. And there were the batons carried by army officers (a symbol of

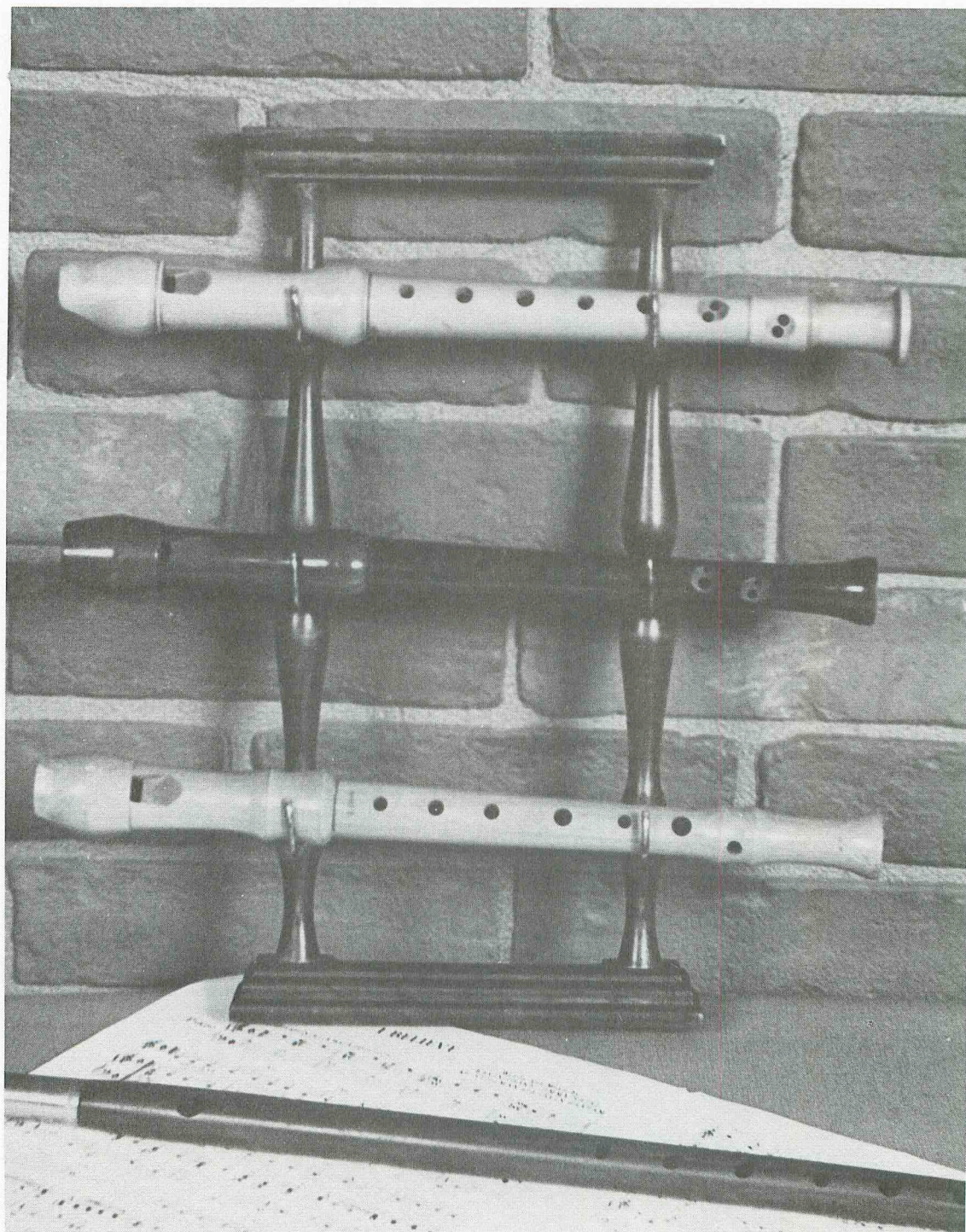


Fig. 4-14. An unusual use of spindles to display musical instruments.



Fig. 4-15. Candlesticks in the old tradition and the new, plus a laminated wood ashtray.

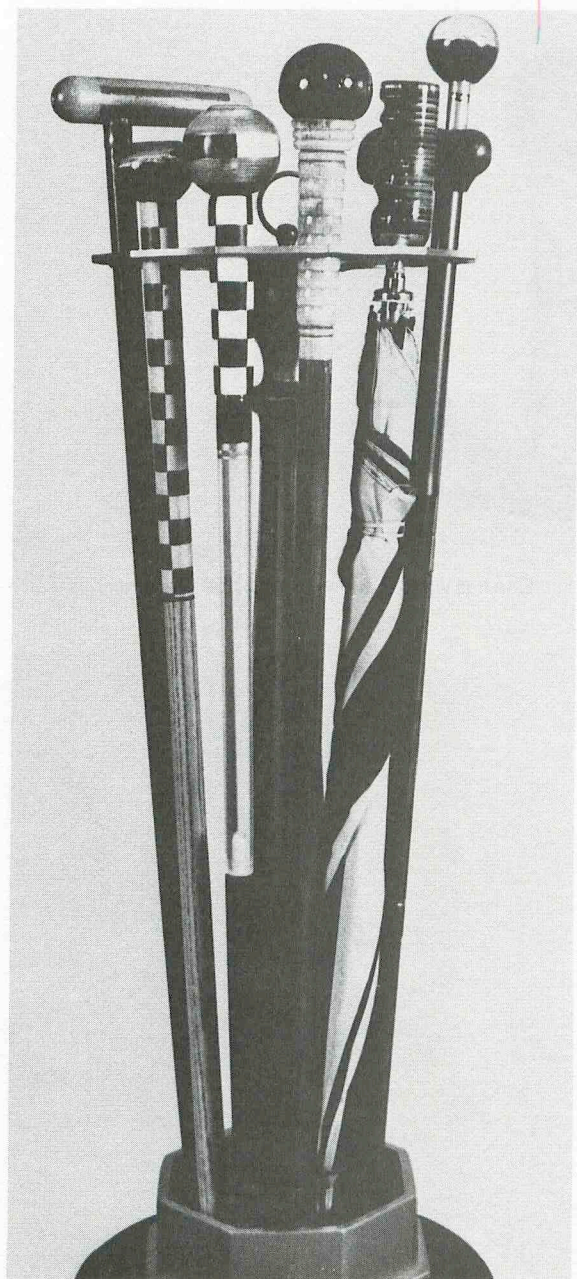


Fig. 4-16. Collection of turned walking sticks. All heads and knobs, including umbrellas, are also turned.

office, the dictionary has it).

In any event, the walking stick can use many of the accepted lathe techniques, becoming in itself an ongoing conversation piece. Normally a cane is about 32" long. The diameter varies from about $\frac{3}{4}$ " to just over 1". Rest assured that a spindle this long,

centered on the lathe, will develop some whip without the aid of a backrest. A simple solution is to make up a cane in three sections. (Another reason to do this is that flamboyant embellishment extending from the cane head down to the rubber tip would pall on even the casual viewer after a bit.)

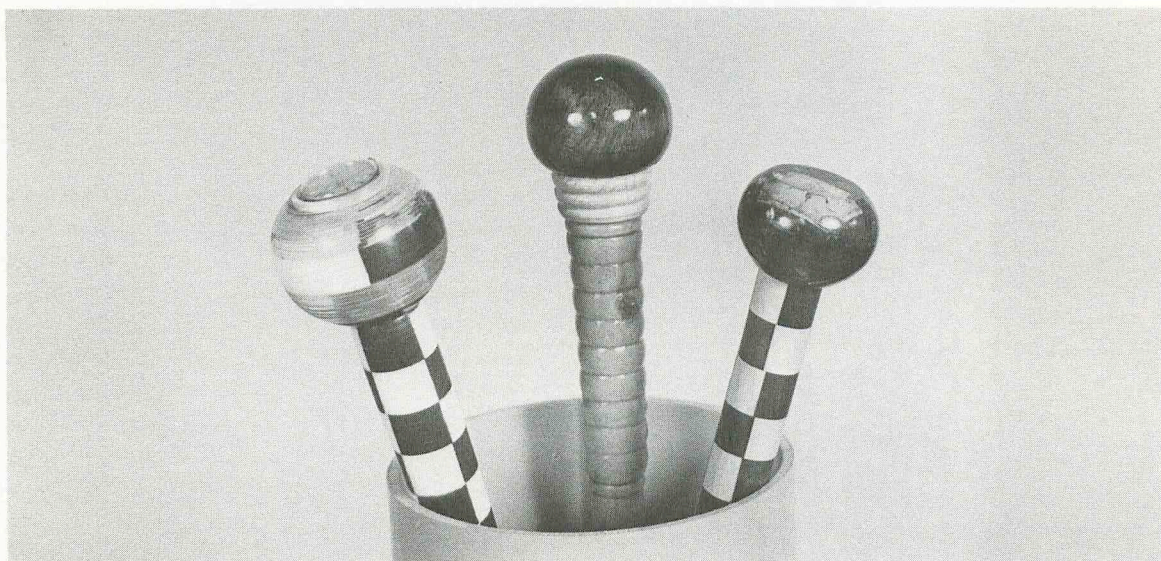


Fig. 4-17. Walking sticks with checkerboard patterns—right and left. One has working watch in top of ball, the other has watch parts encapsulated in resin.

Still another reason for sectioning a cane is that some woods are heavier than others. If one opts to use acrylic, it will soon be observed that the weight could be close to excessive to carry around constantly.

The checkerboard effect used on two of the canes shown here (Fig. 4-17) was the most popular of all the turning efforts, by far. The procedure to reproduce it follows:

Select two kinds of wood, relatively equal in hardness and cut $6\frac{3}{4}$ " cubes from them—half light wood, half dark. The more accurately the cubes are cut, the better they will fit together when stacked. Glue them up in squares—two whites and two darks. When all the squares are thoroughly dry sand them lightly just enough so that they fit flush one on top of another when stacked (Fig. 4-18). They are positioned one dark cube in a square immediately above a white one, of course, hence the checkerboard effect. When they are all glued and stacked they should be clamped or weighted and allowed to dry overnight. Because the bonding from top to bottom is on the grain edges, this portion of the cane might not withstand the impact of falling on the floor. The stacked composite should be drilled completely through the center and a $\frac{1}{4}$ " dowel

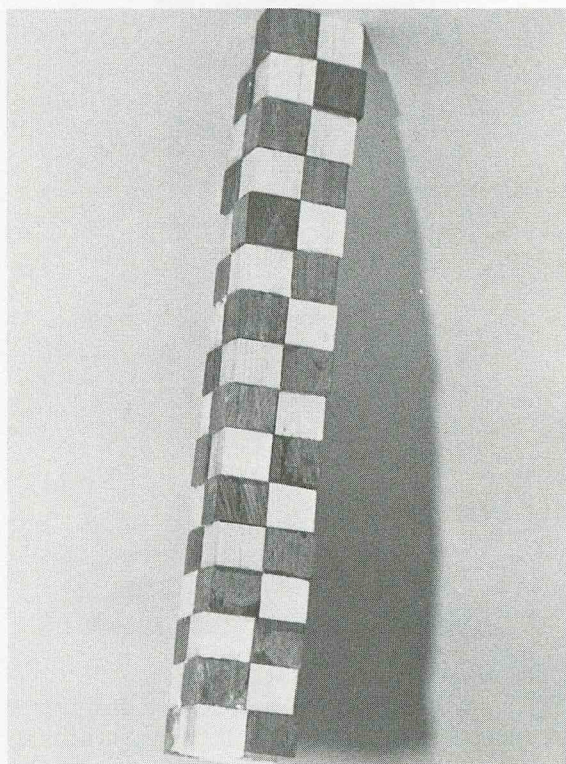


Fig. 4-18. Cubes of alternating colors are glued side by side, then squares are stacked and glued as shown.

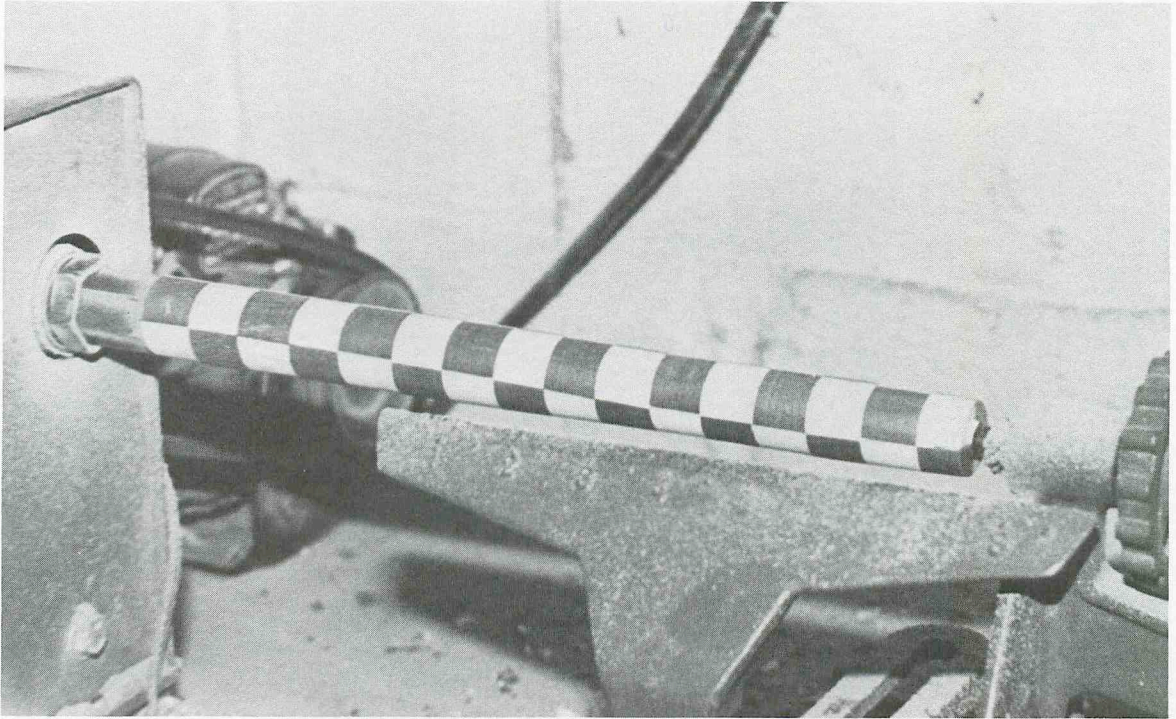


Fig. 4-19. Blank (prepared stock) is turned between centers.

glued in lengthwise.

Now it can be turned (Fig. 4-19). Treat the spur end as the top. If the piece to which it is to be fitted has a taper, measure the top end of it and turn the tailstock end of the glued-up piece to the same dimension.

When measuring the bottom piece of the cane for its diameter dimension, check carefully to determine that it is truly round along its full length. This will eliminate a lot of work matching the ends of the two pieces when fitting time comes. This particular cane was made in two pieces, the bottom (Fig. 4-20) being a cutoff from a "drug store" variety. Although it was about 22" in length, chucking it in the lathe posed no problem with whip because the sole purpose here was to sand and polish it.

The middle cane in (Fig. 4-15) is a combination of turnings, one of which (the ball) was salvaged from a scrap turning. The ball, with the beads immediately beneath it, was a laminate of two different woods cut from the square object shown in (Fig. 4-21). The middle beaded portion (Fig. 4-22)

was turned from a quite different type of wood and the beads engineered so that it appeared to be a part of the top piece. Note the tenon (Fig. 4-23) turned into the top end of the middle portion for fitting into the top piece. Here again the long piece (Fig. 4-24) was centered on the lathe and sanded to a smooth, high finish.

CANE STAND

The most effective method of displaying canes, it seems, is to use some sort of stand (Fig. 4-25). This is particularly so if the holder is lathe turned. Cane and umbrella stands were a fitting part of home furnishings years ago and some may still be found out in the hall by the coat rack today. This one is an original of mine, and although designers and stylists may find fault with it, it is extremely functional. The spindle was turned similarly to projects described earlier. It just fit on the lathe but turned with no problems.

The fluting took a little doing. *Flutes* on a turned piece are hollows, gently curved, that run

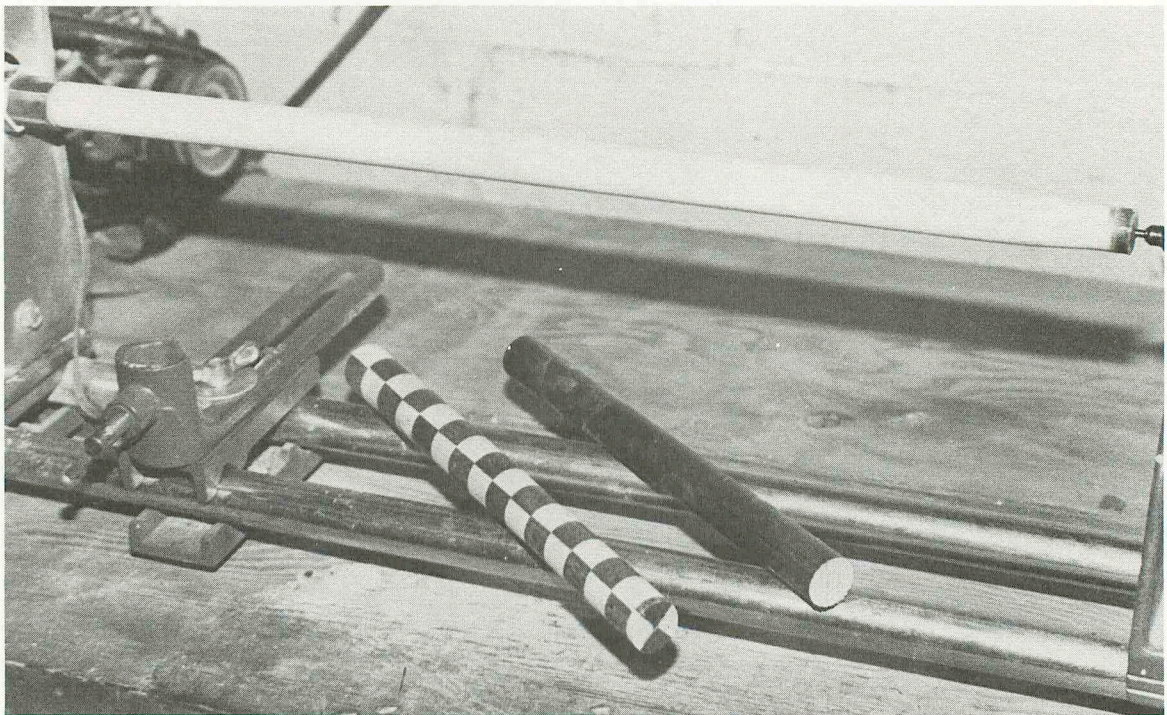


Fig. 4-20. Lower portion (from another cane) is mounted between centers for sanding.

almost the full length of the piece. *Reeds* are raised curves embellishing a piece in the same manner as the flutes. The flutes usually peter out onto a

smooth area while reeds are generally taken right up to a bead or a rounded shoulder. Expert woodworkers do not hesitate to carve them, using

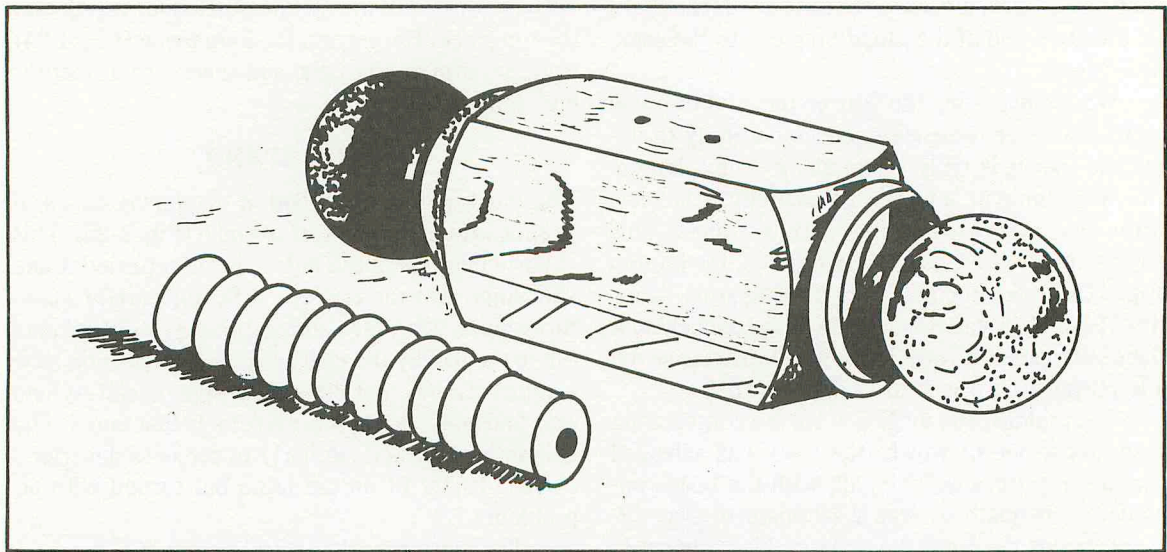


Fig. 4-21. Cane head was cut from piece in back and turned down to size.

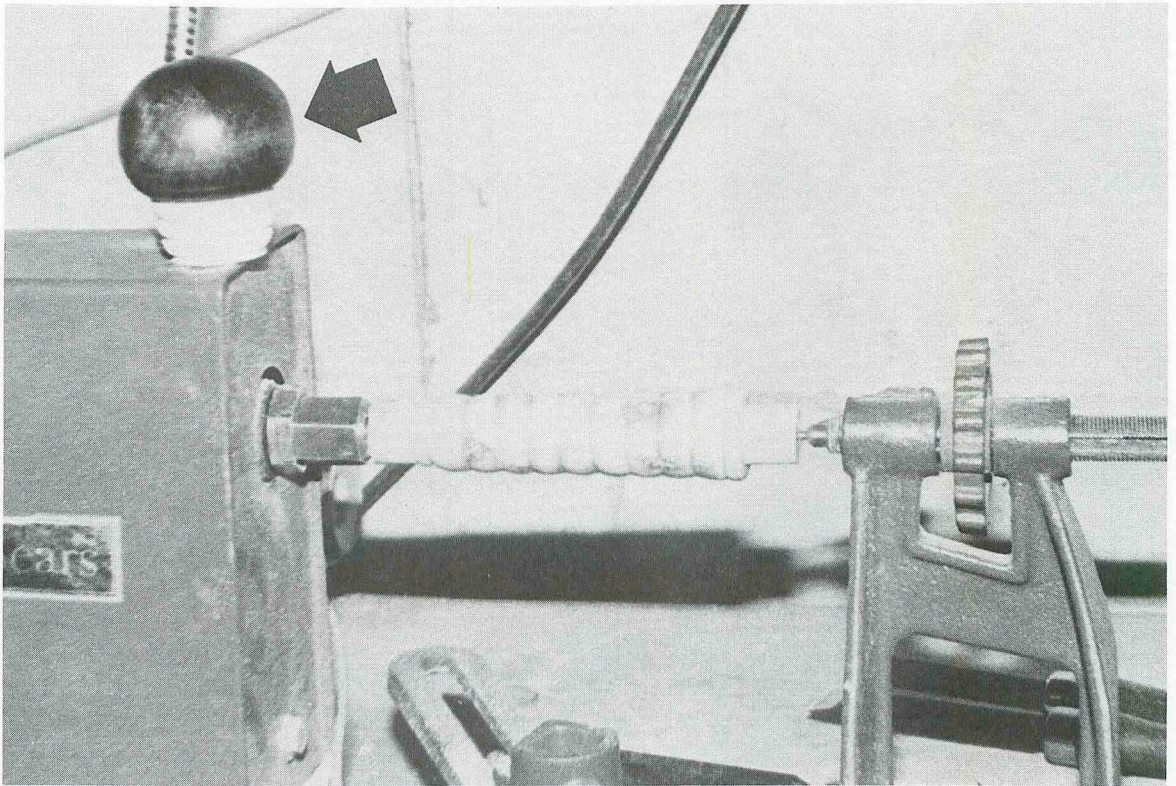


Fig. 4-22. Beads are turned on white wood to match head (left).

lines drawn longitudinally on the piece as guides. They whip out the carver's V-tools and gouges and go to it, despite the fact that the task may involve fluting or reeding four table legs. What I do *not* know about carving would fill a book larger than this one, so an alternate method had to be used—some sort of machine, perhaps. A router comes to mind

immediately but this tool is far more manageable on flat work than curved surfaces. It is written somewhere that a board could be clamped beside the spindle, the router braced on it and the flutes cut that way. This seemed a bit beyond my capabilities: the spindle had been turned and it would have been a shame to ruin it. The next possibility that pre-

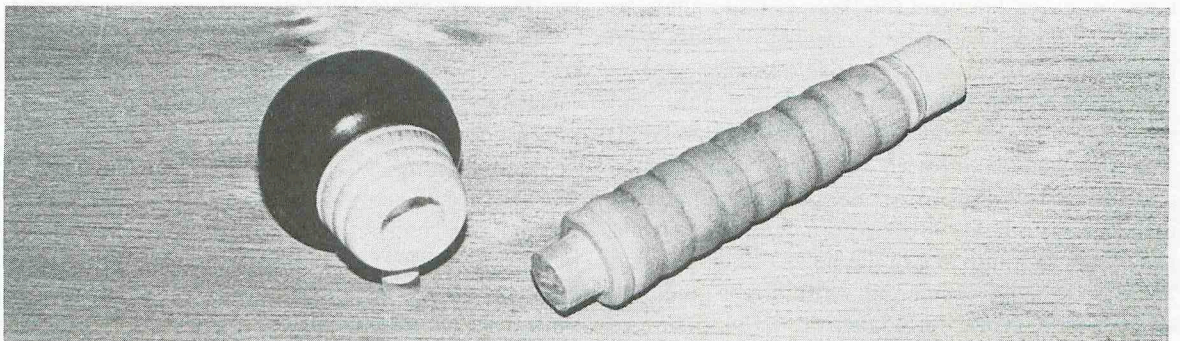


Fig. 4-23. Hole was drilled in head to accept tenon.

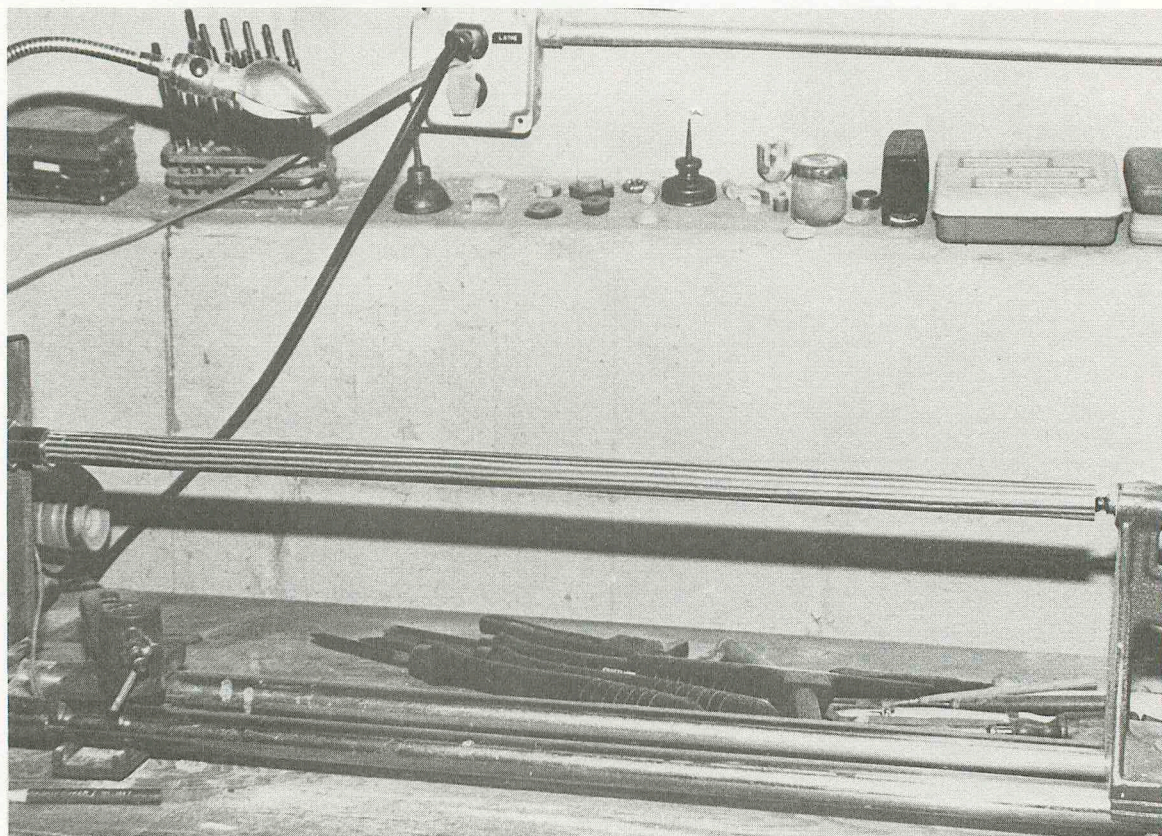


Fig. 4-24. Lower portion of cane, mounted on lathe for sanding.

sented itself involved the use of a *flexshaft* with a shaper cutter. Here, indeed, was a possibility, provided the spindle could be held firmly on the lathe, and the flexshaft could be braced so that it moved only to the right or left parallel to the spindle.

On this particular lathe the headstock spindle does not extend beyond the three-speed pulley, so an indexing head had to be worked out somehow on the right side. Fortunately, it could be managed by affixing an 8" disc to the hexagonal spur center and mounting a bracket on top of the headstock hood. The disc was drilled with 30 holes evenly spaced just inside the circumference. The bracket was drilled with a hole, so that an indexing pin could pass through it into one of the holes on the disc and lock the spindle. This setup, with slight modifications, should work on almost any lathe not fitted with an indexing head.

Rigging the flexshaft entailed making a sturdy little stand for clamping it in the "T" rest holder. The device is slid along the bed repeatedly until the flute is made with a series of light cuts. The arrangement works well, at least for an occasional shot at fluting a spindle. The bottom of the stand is routine carpentry while the top is merely a piece of composition board drilled with holes large enough to accept the rubber cane tip when the walking stick is put away. The flexshaft holder is not dealt with in greater detail because making one up would always be contingent upon the shape of the particular lathe bed and the "T" rest. I have seen several methods of rigging the shaft so that it slides along a rigidly mounted guide bar clamped to the bed with auxiliary tool rest holders. I am in the throes of mounting the elevating mechanism of a photographic tripod (minus the head) to the lathe bed.

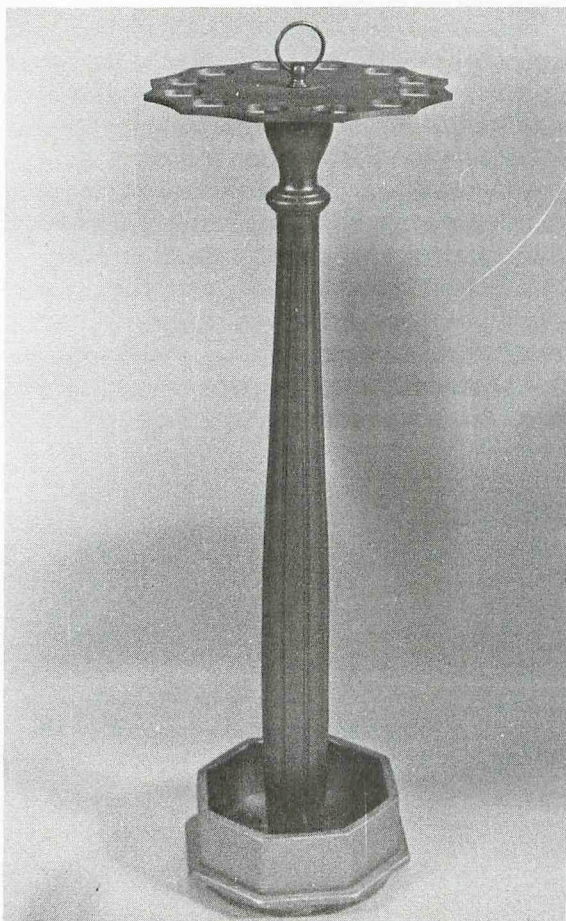


Fig. 4-25. Cane stand with fluted spindle and top plate drilled to hold canes.

With it, moving the flexshaft will just be a matter of cranking the handle to the right or left.

A friend brought his mother to my studio recently to see the canes discussed above and the lathe with which they were made. She viewed everything with interest then told this story:

"My grandfather was a slave, you know. But he had a good master who taught him a lot of things. And when freedom came, my grandpa stayed right with his master. One of his jobs was fixing all the harnesses for the master's horses. Grandpa saved all those thick pieces of leather he cut off, you know, and he cut them into little circles. Then he glued them together one on top the other until they were just about as long as one of them walking sticks

there. And I don't remember now how he did it exactly but he made the sticks round and smooth, smooth, smooth. Then he polished and polished till they shone. And the white folks came from miles around to buy his walking sticks. He always had a little money in his pocket. Seems to me like he must have did it with one of those contraptions like you got there. He was good with his hands and made all kinds of machines.

"And you know the sad part? None of my uncles—and not even my father—ever learned how to make those walking sticks! Grandpa took his secret to the grave with him. Now, that's really sad!"

I've contacted another friend who works leather as his avocation and asked him to save all the scraps he accumulates, especially sole leather. And I do not have just walking sticks in mind!

TABLE/LAMP COMBINATION

This end table/lamp (Fig. 4-26) was acquired at a flea market. It was purchased (for a dollar or two) because it represents a somewhat unusual approach to spindle turning. Of special interest is the clever approach to mounting the lamp socket, as well as the method used so that the whole lamp assembly could be moved to the right or left. The hole drilled in the horizontal lamp support rests on a bead turned on the vertical column. It works! There is another hole drilled in the ball just above the socket into which a short length of threaded steel pipe (called a *nipple*) is fitted. The line cord goes up through the nipple, back to a hole drilled between two beads on the support, and down along the upright lamp column behind the table to the wall outlet. That all the spindles may have been mass produced in groups on lathes equipped to turn many of them simultaneously should not detract from what is, indeed, a unique design.

This piece of furniture was used, without refinishing, in a teenager's room for several years. When she tired of it, all the spindles were salvaged, some of them turning up eventually as candlesticks and other items. The first time a previously turned spindle like this is reused, it may come as a surprise that it appears out of round. It is almost impossible

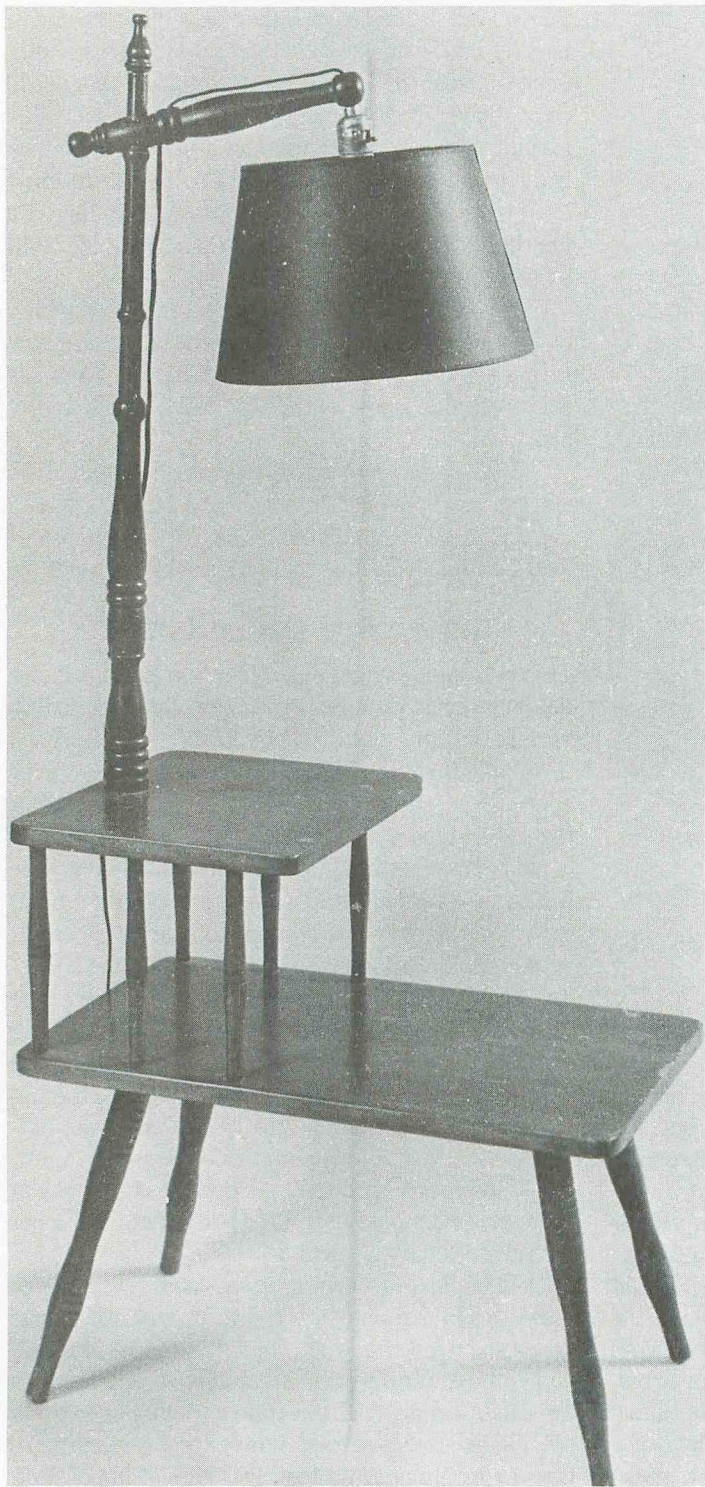


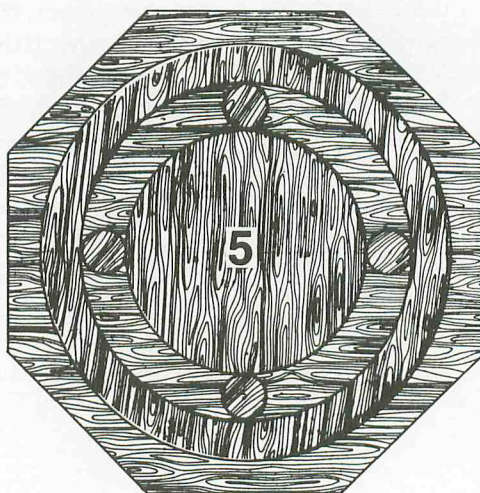
Fig. 4-26. Lamp/table combination with variety of turned spindles.

to center the piece exactly as it had been done for the initial turning. The original centering points have been cut away because most pieces are turned with a bit of excess on each end for just this purpose.

The result is that the second turning will produce a somewhat thinner profile. It may not pose a problem if you are aware of this in advance. Short, fat, conical table legs, can frequently be turned again with the large diameter end being used to work up an attractive base, a tiny bedroom lamp, or a stand for a vanity mirror. The wood reclaimed from older furniture is usually quite good and will

turn well.

A respirator-type mask should be worn during such an endeavor, however, because turning off the varnish or other finish on a piece will often produce a dust with an acrid odor that may irritate the lungs. Initial application of paint or varnish remover is a good idea, but some finishes often penetrate the surface of the wood and will come off only in the turning. Nevertheless, this is a source for wood with the added advantage that the "roughing out" phase of the work has been done previously by someone else. It's a great idea for practice pieces.



More “Centers” Turning

TURNERS THE WORLD OVER SEEM TO MAKE more handles than anything else. Yet the old list mentioned in Chapter 4 suggested this item just three times—handles for carpenter’s tools, handles for turning tools, and parasol handles. The first two categories, while perfectly acceptable, take in a lot of territory but leave so much else unmentioned. There are turned handles many of us use every single day without ever giving them a thought. There are letter opener handles (Fig. 5-1), rubber stamp handles (Fig. 5-2), handles for canes (Fig. 5-3), and handles for paint rollers, to mention a few.

There are even handles with a repeatable history behind them. The shaving brush handle (Fig. 5-4) is a case in point. Despite the popularity of shaving soap dispensed from an aerosol can, thousands of these brushes (22,000 solely by one firm in London) are made annually. The most costly ones, priced a bit under \$300, have bristles of carefully selected badger hair from China and Siberia. Many of the brushes are still made by hand and, in the case of the manufacturer in London, at least, the

handles are lathe turned. The familiar shape of the brush handle in the photo is but one of about a dozen designs offered. The hard shaving soap used was always dispensed from a little wooden bowl also turned on a lathe.

Rubber stamp handles have their own unusual story, too. There is national underground cult of rubber stamp collectors who correspond with each other across the country by painfully stamping out their letters and notes. They issue newsletters, exchange and sell catalogs offering the stamps for sale, and even, with increasing frequency, make the stamps themselves. They would probably never think twice about the handle, which has had the same basic shape for about 100 years, but then not all have access to a lathe to turn up these little knobs. When a readymade handle cannot be acquired readily, they resort to the use of precut bits of molding, doweling, or whatever else ingenuity decrees. Avid collectors of old rubber stamps haunt defunct post offices and liquidator auctions for obsolete stamps with useless legends in archaic type

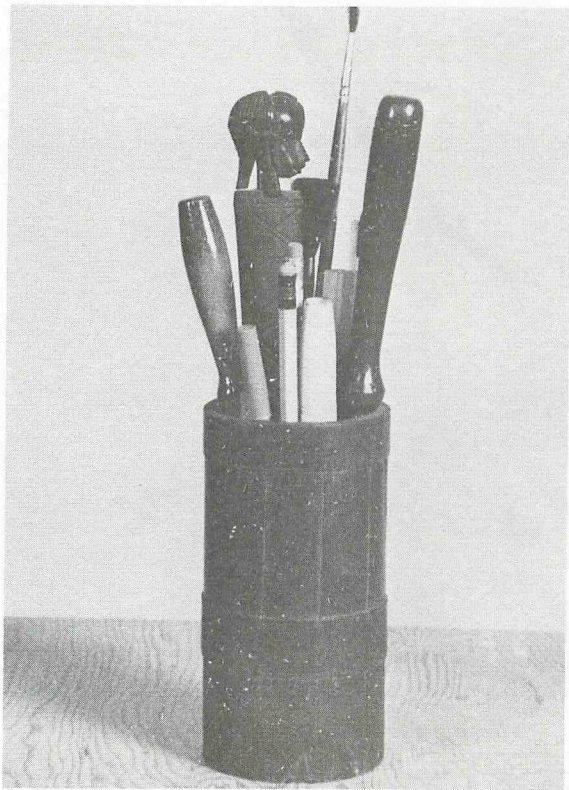


Fig. 5-1. Turned letter opener handles on the right and left side of this desk caddy, which is also lathe-turned.

faces, but with fabulously turned wooden handles. It is only then that the handles get the attention they deserve. What a pity!

USING RECYCLED WOOD

Ebony. Lignum vitae. Mahogany. Sycamore. It would be nice if one could reach into the storage bins and select a piece of exotic wood when a project had to be accomplished. Lumberyards rarely have anything more than the barest essentials for home repair. Good wood can be ordered from houses like Constantine, but there is always a waiting period involved. Fortunately, for most everyday projects “found” wood often will not only suffice but turn up quite lovely pieces. An old mantel-type clock case discovered while rummaging through an attic had the words “solid mahogany” deeply stamped on the bottom. Needless to say, it was retrieved, dismantled, and, at various rpm on the lathe over an evening or two, turned into a most gratifying piece of work.

When the need arose recently for some lightweight tool handles, checking out the various pieces of wood that are always around turned up a batch of Coates and Clark empty thread spools.

A long dowel, coated with glue, was driven

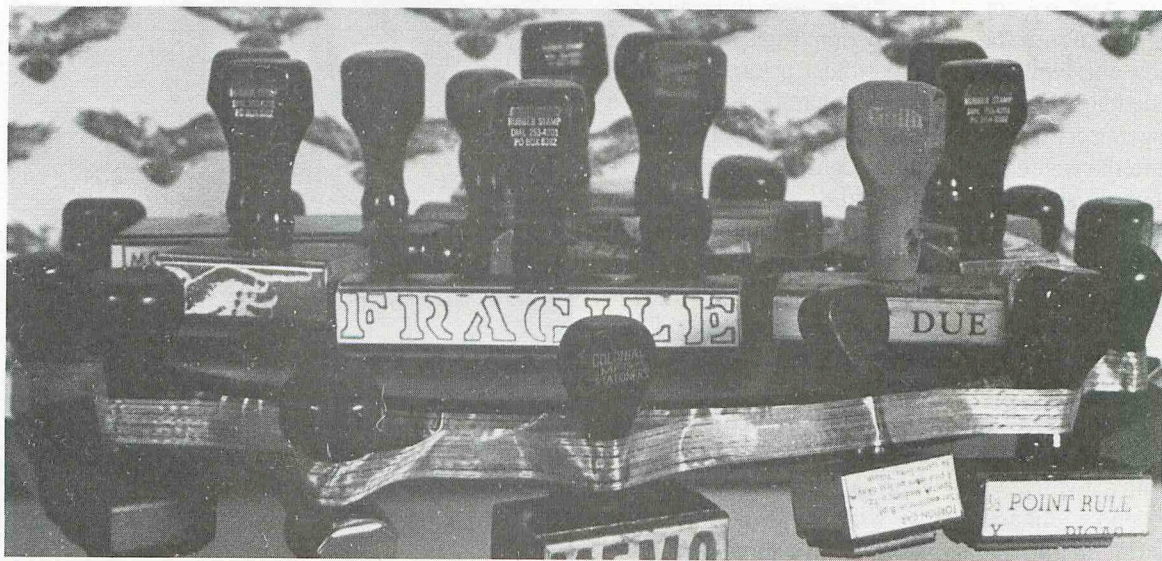


Fig. 5-2. Rubber stamps are among the most frequently used items with turned handles.

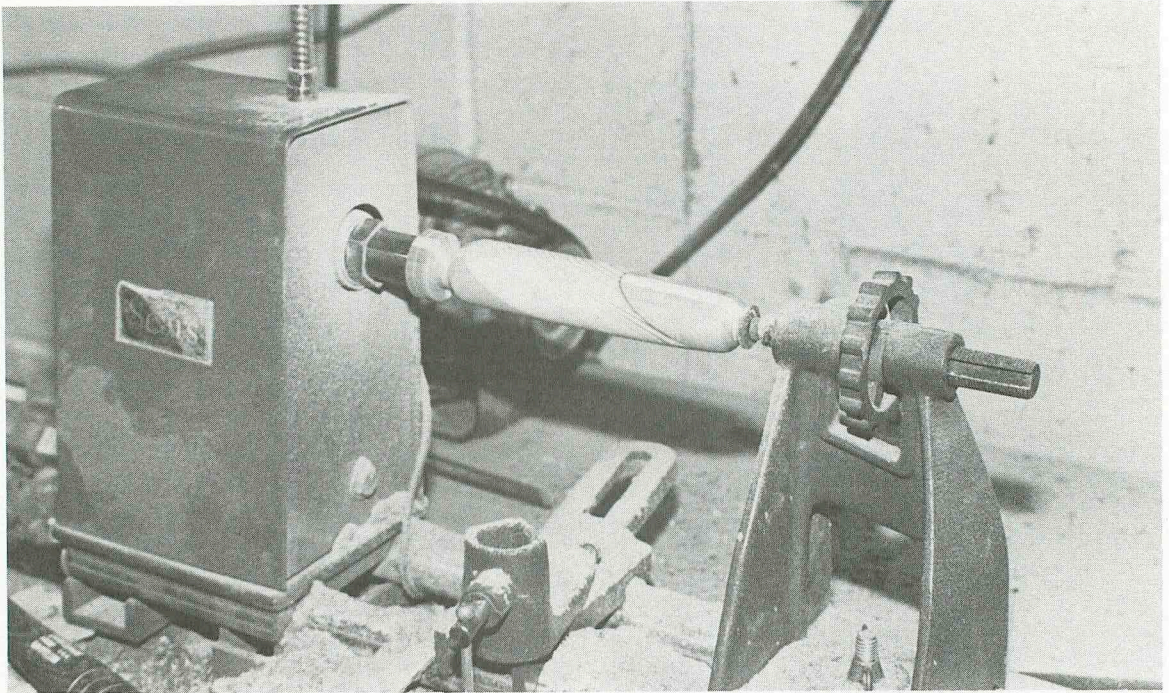


Fig. 5-3. Cane handle of laminated wood being turned.

through each one to produce a spindle (Fig. 5-5) about 12" long. The wood was rather soft, naturally, and it was anticipated that whip would develop when the middle of the pieces was worked. I made two handles out of the piece, and thus avoided having to turn the center portion. Figure 5-6 shows how the two handles looked just prior to the final finishing. I decided not to separate them with a parting tool, but rather to saw them apart, cutting into the waste portion in the center. The ends were then finished off with the aid of several grades of sandpaper. It was a simple matter then to drill them to fit on the tang ends of files ground back to serve as gravers.

There are some pitfalls in scavenging. Used wood may be riddled with nail holes, cracked, or warped. Frequently pieces salvaged turn out to be 1" or so shorter than needed for a particular project. Yet, you should think in terms of what can be done with a given piece of wood. A 10" piece of wood, for example, measuring 3" wide by 1½" thick may serve no purpose by itself. Four such pieces, however, could make the base of a lamp as described in



Fig. 5-4. Shaving brush with a frequently used handle pattern.

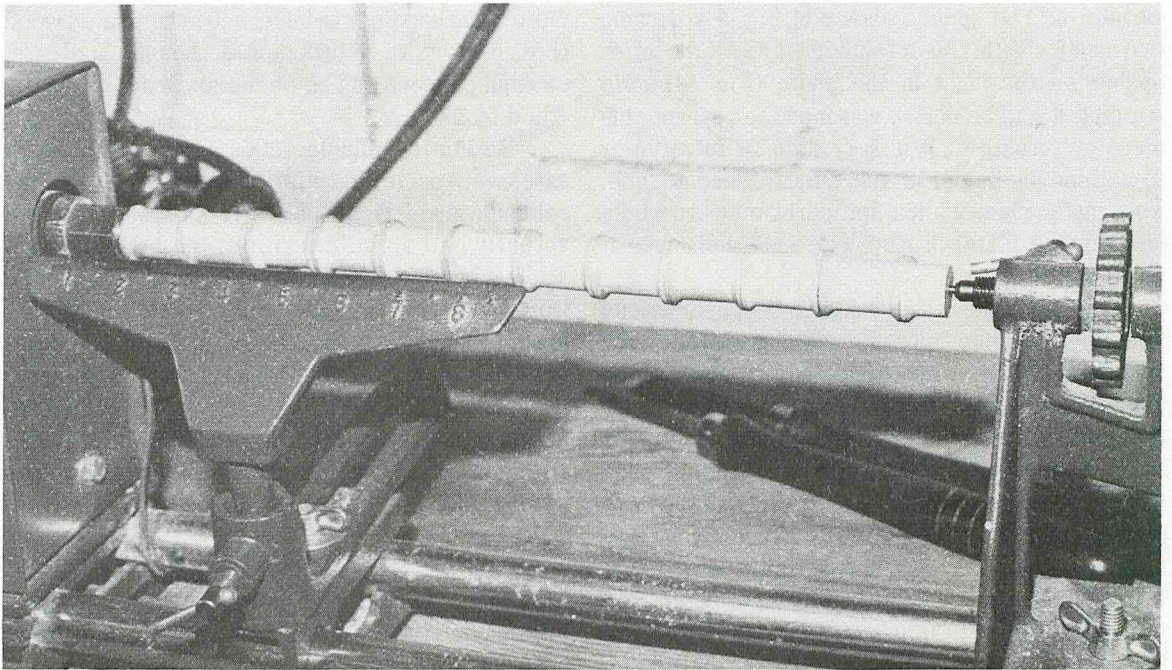


Fig. 5-5. Thread spools (an unusually soft wood) being turned.

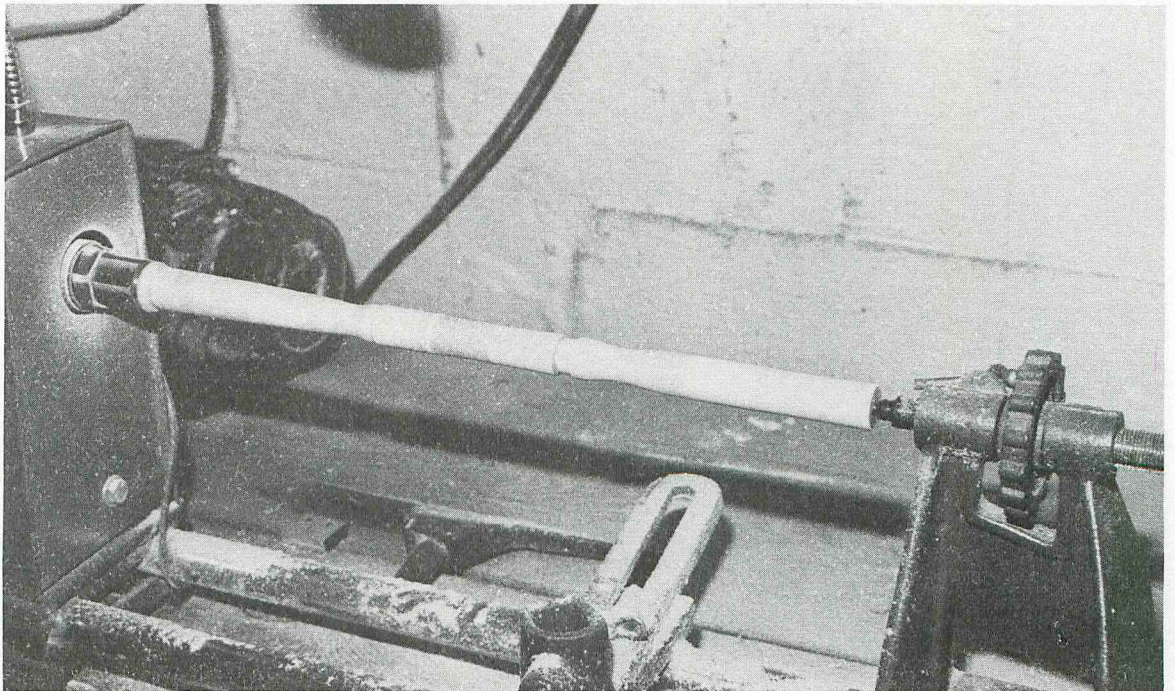


Fig. 5-6. Two handles with a segment of waste between them gradually take shape.

Chapter 4. The spindle shown in Fig. 5-7 became two handles with a bit of sanding—one for the letter opener on the right in the photo (Fig. 5-1). No attempt, it will be noted, was made to reshape this piece by turning it. It is very difficult to recenter something like this on the lathe a second time. Turning the piece while improperly mounted would just remove material from one side and make it visibly out-of-round.

The faceplate was used here because the end already had a tenon and could not be mounted on the spur center. One or two spindles like this are often found lying around, and it seems a shame to toss them out or use them for kindling when they might save valuable time on the lathe that might be used for a more worthy project. In lieu of using the faceplate for mounting a spindle with a tenon, scrounge up a wooden disc (Fig. 5-8) left from cutting a hole with a hole cutter. It will fit on the spur center and will allow room to maneuver the chisel on the headstock end of the turning. (Use of the parting tool is shown here.)

Before the topics of handles and recycled wood are exhausted, it should be mentioned that quite

interesting handles can be turned in laminated wood (Fig. 5-3). With a little extra thought and care, striking patterns can be obtained. Chapter 6 is devoted to this.

During the middle 1800s many mantel clock cases were decorated with what appeared to be half columns glued flush on either side. These were actually half spindle turnings, and the effect is achieved with a minimum of difficulty. The method would be to glue two pieces of wood together with a piece of paper between them—a sandwich, if you will—the wood being the bread and the paper being the baloney. The work is turned in the normal manner then, after sanding and polishing, the two pieces are split apart. Use a knife for this. Remove the paper residue by scraping or sanding.

PLASTIC FOR TURNING

Many tool handles and other items are made of plastic today. They are molded, usually, but this is not to say that plastic does not lend itself to turning on the woodworking lathe. A little brush for cleaning clock movements was turned from polyester resin on the Dremel lathe. The resin had been cast

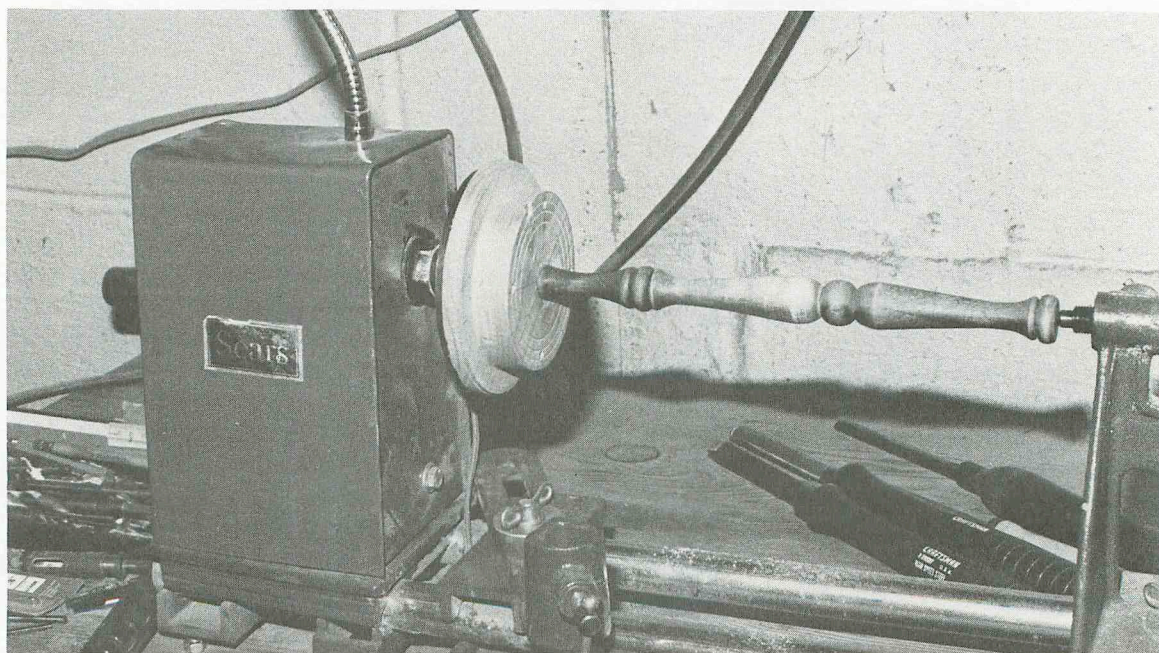


Fig. 5-7. Letter opener handles being cut and shaped from an old spindle.

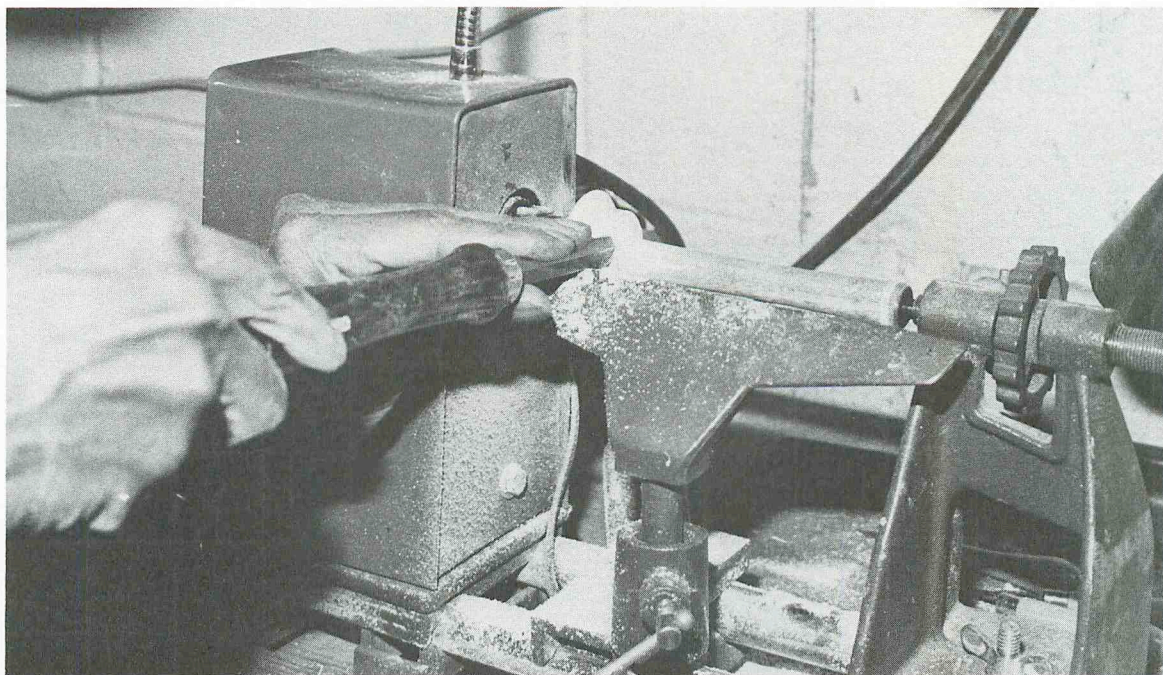


Fig. 5-8. Spindle mounted on spur center with the aid of a discarded wooden cutout.

in a cylindrical mold slightly larger in diameter than the finished handle. A certain amount of shrinkage occurs in the pouring and casting of polyester resin so the object is never perfect in shape. The fact that it was basically round with no corners or edges to remove, however, meant that it could be turned at the Dremel's high speed lathe without chipping or fracturing. Mounting the brush, which came with a threaded end, entailed drilling a properly sized hole and tapping it. The last few threads on the brush were coated with cyanoacrylate glue before it was screwed in as far as it would go. No ferrule was used because very little stress is ever placed on the brush. A clockmaker's hammer head is made from acrylic, but the lathe techniques are quite the same except that the speed on the woodworking lathe is set much slower than the Dremel's. The stock was square when mounted on the lathe. Instead of the usual wood chisels being used, the reground boring bars described in Chapter 2 were substituted. The initial cuts produced chips and flakes, but as the piece became round, threads, spirals and rings were removed depending upon how heavy a cut was taken. Neither wood nor plastic would withstand

the impact of hammering (no matter how lightly), so both ends of the hammer head were fitted with brass discs. Holes were drilled in their centers; countersunk and flat-head brass screws were used. When the discs were snubbed up tight on the ends, they were filed—screw head included—and polished. The discs may fall prey to denting, but they can be replaced quite readily.

Remember the parasol handles in the list in Chapter 4? Well, they're called umbrella handles these days and still lend themselves to being turned. This handle (Fig. 5-9) introduces still another technique, that of off-center turning. It is made up of a number of polyester resin discs cemented together like a stack of poker chips. They were drilled in the center and a dowel run through and glued so that the assemblage would withstand the hammering of the off-center turning. The initial step was to turn the cylinder perfectly round.

What is referred to here as *off-center turning* is commonly called *oval turning*. Normally, if the work is positioned alternately on two points, one to the right and the other to the left of center, a truly oval piece of work is produced. In the case of the

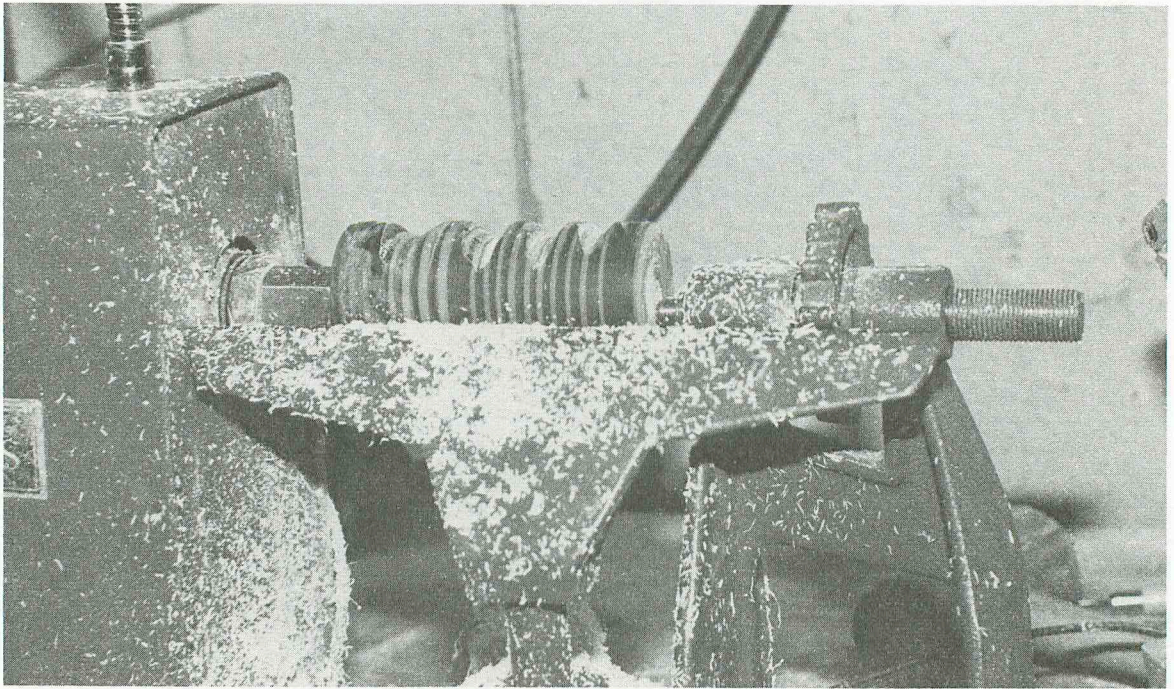


Fig. 5-9. Laminated resin discs for umbrella handle. Handle moved to off-center position to turn finger grips.

umbrella handle, all that was required were depressions to serve as finger grips. The piece, therefore, was positioned off center just once. The piece was removed from the lathe after being turned round and held in the clenched fist with the fingers touching. Heavy marks were made between the finger tips with a china maker. The piece was returned to the lathe, but placed in the off-center position (Fig. 5-10) and the waste removed between the marks. The way the piece rotates when turned off-center takes a bit of getting used to but it is not much worse than turning rough stock. When the turning and polishing was completed, the piece was rubbed with a plastic polish until it gleamed. The dowel was drilled out about a third of the way in, and the handle was press-fitted, indeed, hammered, onto the shaft of the umbrella.

The taller of the two checkerboard patterned canes is turned from brown and white acrylic squares. The difference in the way it was made when compared with the similar item turned in wood is a byproduct of the difference in the materials. First of all, the acrylic cubes are put together

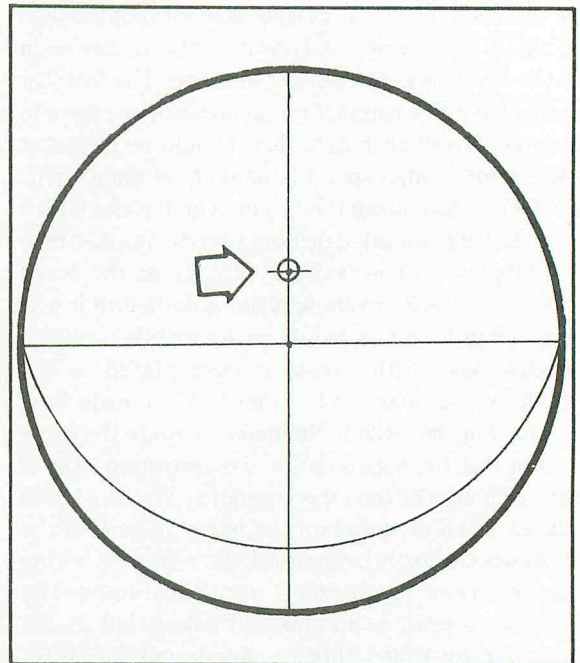


Fig. 5-10. Diagram showing off-center positioning to remove material to thin line.

with an acrylic cement that has a lightninglike capillary action. There is no leeway with regard to placement of parts once the cement has been applied. This also holds true for contact cement, which is often used with wood, but in this case other glues can be used. Then, too, acrylic cannot withstand the impact of being turned on a spur center as well as wood. The spur center soon chews into the acrylic and the workpiece begins to slip. Moving the tailstock in ceases to help after a while. A three-jaw chuck or something approximating it has to be brought into play. One solution is to make up a wooden disc large enough to be screwed on to a small faceplate with a square hole (Fig. 5-11) centered in the middle of it. The usual method of removing the waste in the square is to drill holes in the corners large enough to accept the blade of a coping or jig saw and then just cut from hole to hole. Cutting inside the guide lines a hair makes it easy to press-fit the stock in the square hole (Fig. 5-12) with a little judicious filing.

Regular chisels will turn the acrylic but, as mentioned earlier, they become dull quickly. Carbide-tipped chisels are the next best alternative, but they are rather expensive. What better

time, then, to use the reground boring bars mentioned in Chapter 2? Properly used, they slide along the acrylic, cutting off ribbons, thin spirals, and even circles of waste (Fig. 5-13). They almost ignore irregular junctures made by the number of pieces in the turning. As long as the point of the tool is not pointed sharply into the work, boring bar chisels turn a piece from square to round in a minimum of time. At this point, the skews and other tools for smoothing and finishing can be used. The speed of the lathe could be increased at this point, but I prefer to save the higher speeds for any sanding and polishing that would have to be done.

The headstock end remains square, having been press-fitted into the wooden disc on the faceplate. Its removal is fairly easy if a hole saw of the right diameter is available. The piece is removed from the lathe, the end held in a drill press vise (Fig. 5-14) lined with felt, and the square top end drilled with the hole saw running at a slow speed. If this is done well, it provides a tenon that will fit into a hole drilled in the ball to be used as the cane head (See Fig. 4-17). It works, with a little patience and attention to detail. (An alternate mounting is shown here.) The plastic owl head had been drilled and

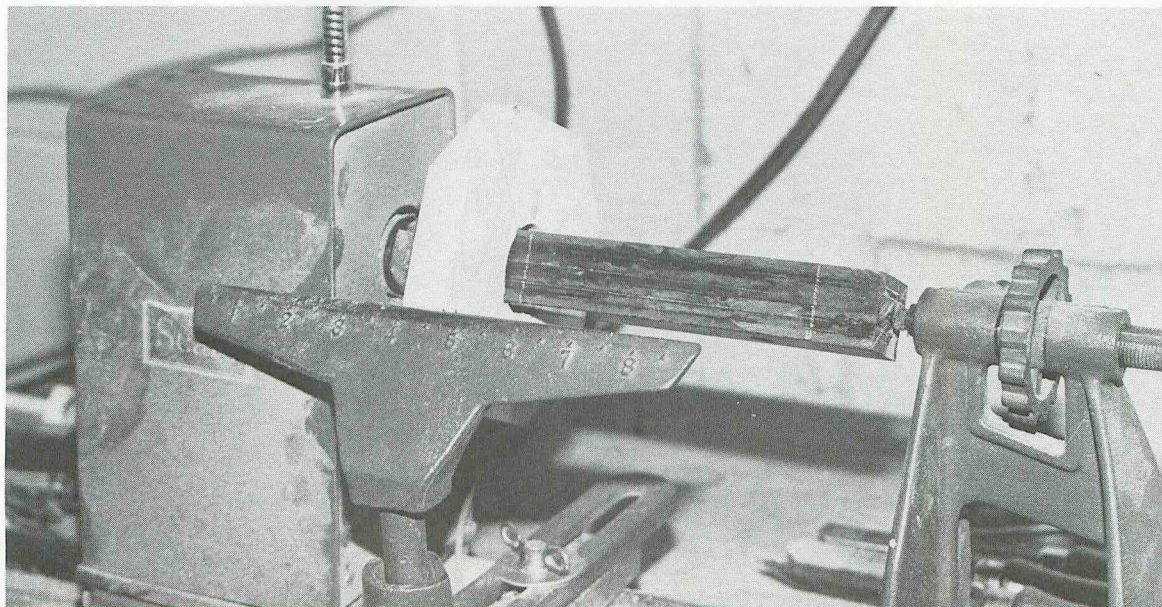


Fig. 5-11. Method of mounting stock too small for spur center.

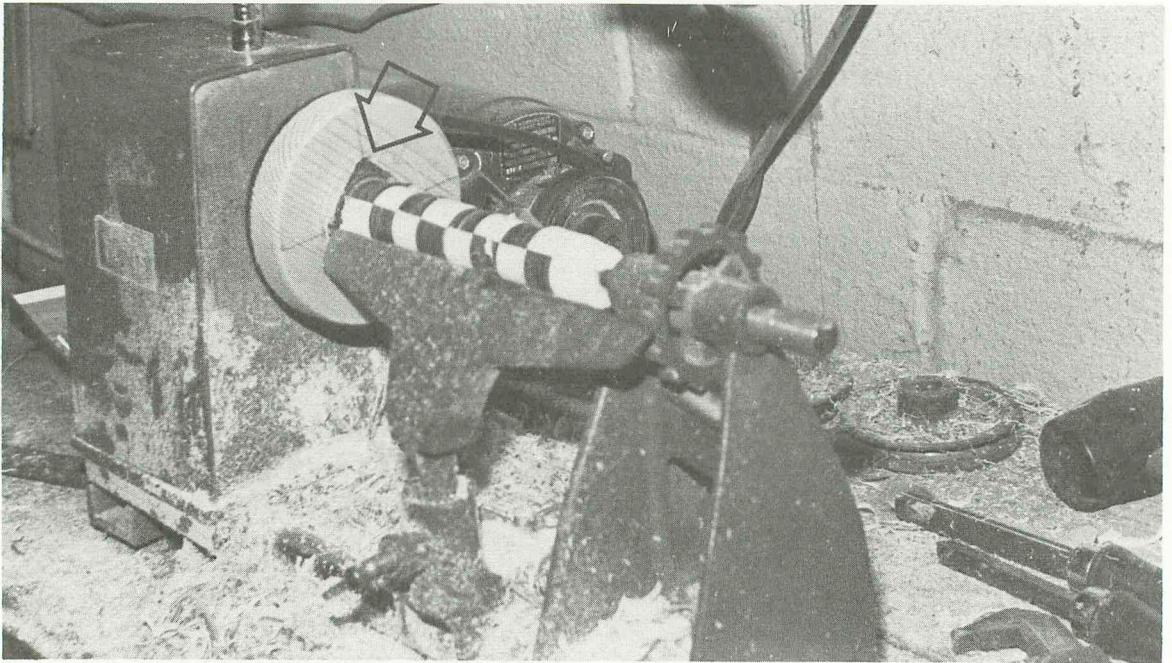


Fig. 5-12. Workpiece press-fitted into square center.

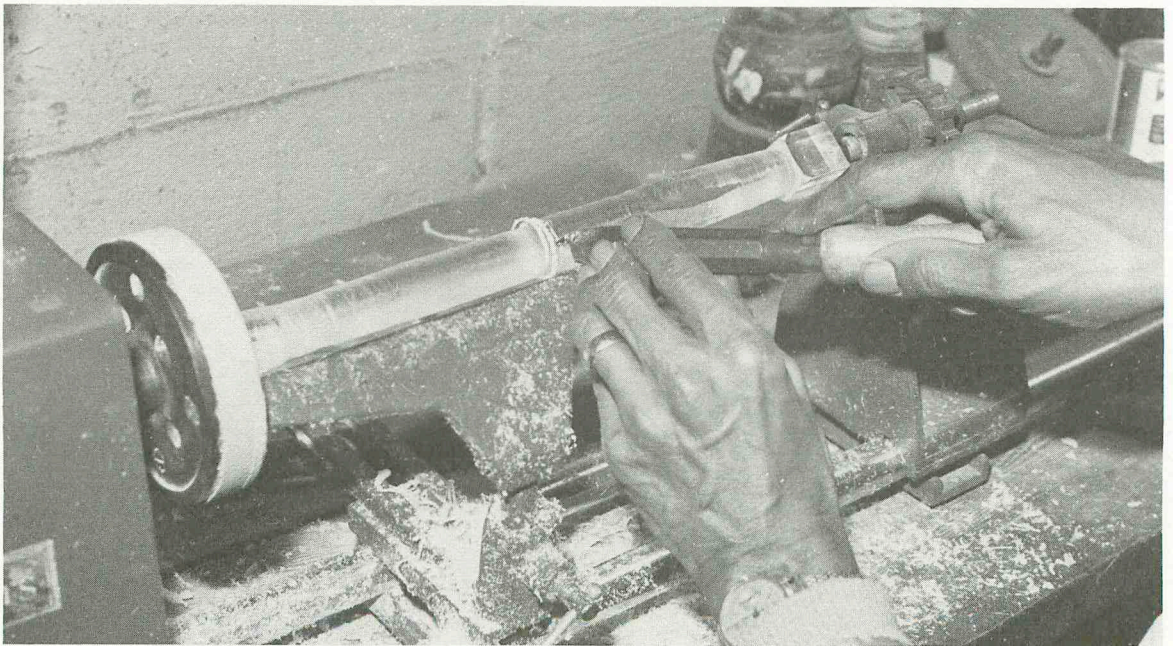


Fig. 5-13. Cutting acrylic produces ribbons, spirals, and circles of waste.

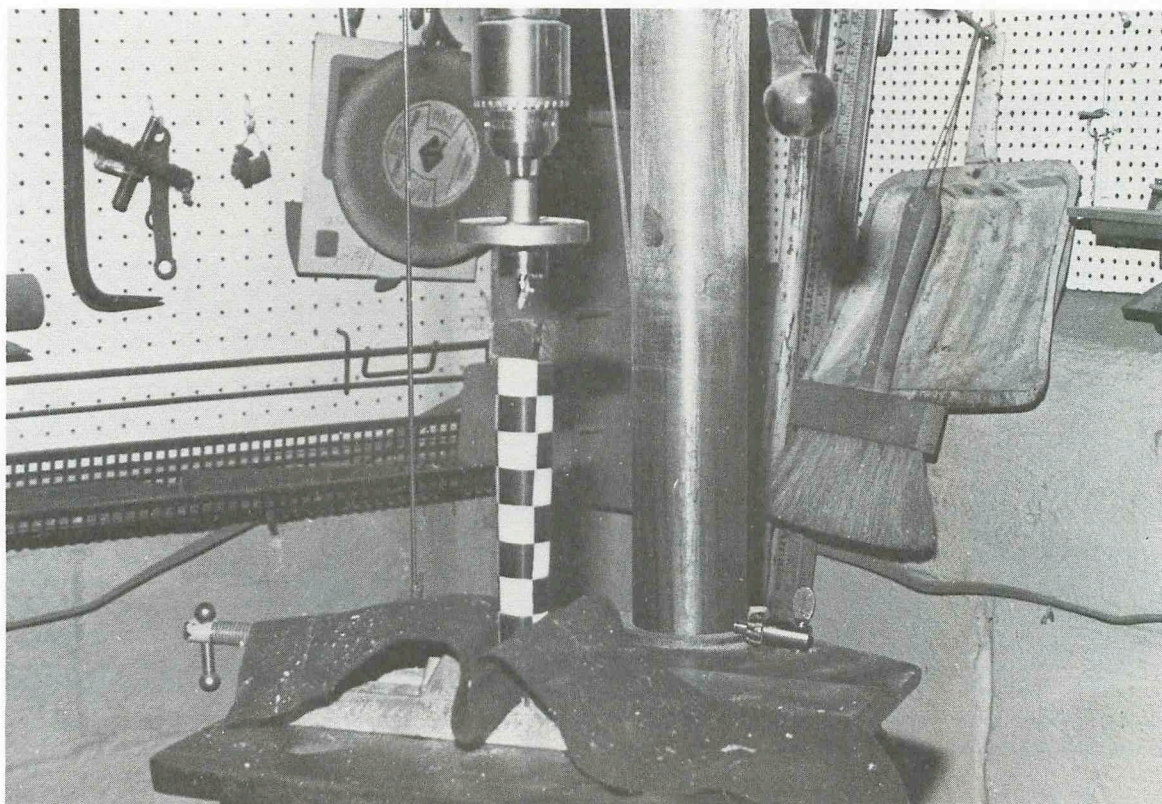


Fig. 5-14. Drilling with hole cutter produces tenon when outside waste is broken off.

tapped for a $\frac{3}{8}$ " bolt with the head removed. The hole in the top of the cane portion was drilled and tapped in the same way. A brass collar was put on the tenon described above and the owl's head screwed down on it. Interchangeable cane heads! How nice!

Acrylic is heavy when compared to wood. From an aesthetic standpoint, one can forego some of the weight while retaining the beauty of the acrylic by making the remainder of the cane half wood and half acrylic. A length of acrylic such as this (Fig. 5-15) turns beautifully despite the emission of an acrid odor when it gets hot. It is a joy to work when the precise height of the toolholder has been arrived at, and the tools cut smoothly. These factors become a matter of individual preference for each turner. Akira Kobayashi pointed out, however, in his most definitive book, *Machining of Plastics*

(McGraw-Hill Book Co., 1967), that the most important factors in the proper turning of acrylic were slow speeds, shallow cuts, and the *rake* of the cutting tool. Perhaps this is why the boring bar cutter have been so effective. They are ground back to a 60-degree angle, like parting tools and metal cutting gravers. Quarter-inch square files ground this way also produce the continuous chips he suggests and are most desirable in producing good results. Discontinuous chips, Kobayashi found, "are accompanied by rough and inaccurate cut surfaces because the chips are produced by complex combinations of large compressive stress and shear stress."

In any event, the highly polished acrylic (Fig. 5-16) is not only unusual in a walking stick but counterbalances the striking appearance of the checkerboard effect. The bolt that joins the two sections together and the threaded hole are im-



Fig. 5-15. Acrylic will heat up if turned too rapidly, or if the cuts taken are too deep. Slow speeds, shallow cuts, plus correct rake of tool contribute to proper acrylic turning.

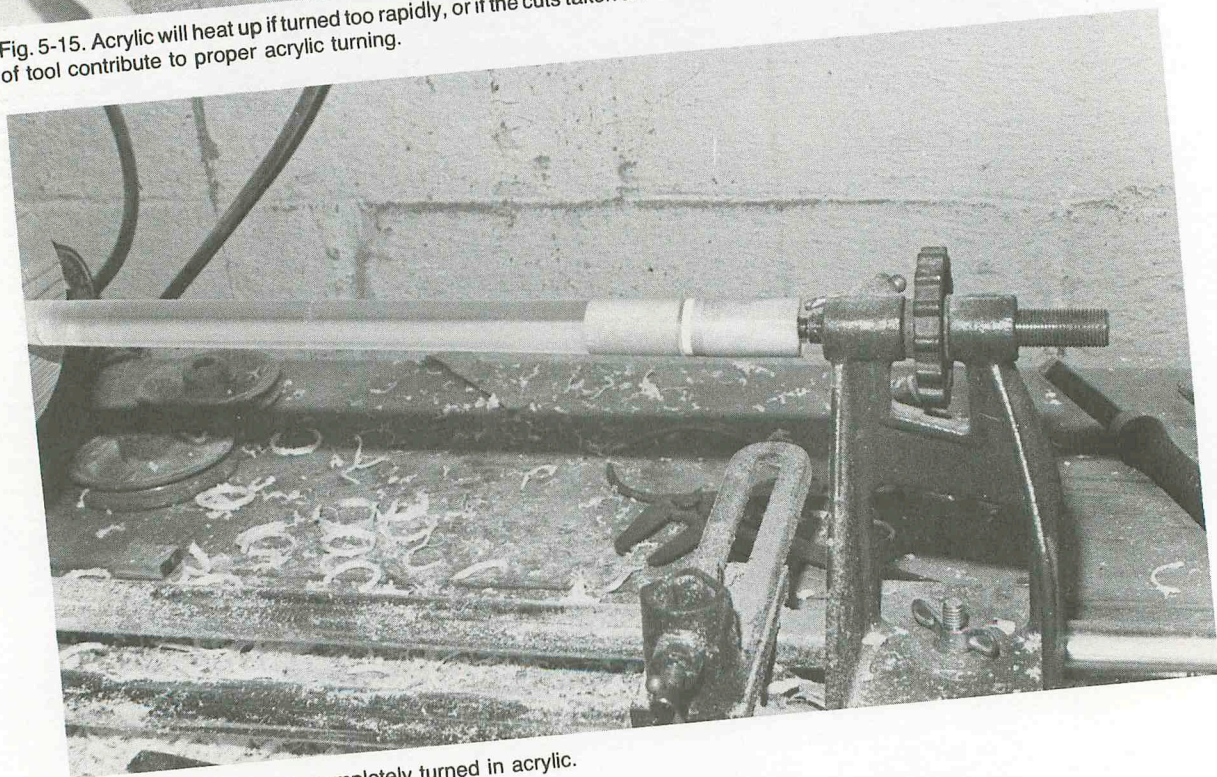


Fig. 5-16. Base for cane completely turned in acrylic.

mediately visible, which some persons may regard as detracting from the overall appearance. This may be combated by leaving that small area unpolished and spraying it with acrylic paint to match the dark color next to it. Here, again, this is a matter of preference. Some people rather enjoy the appearance of acrylic having been worked beneath the surface.

NONFUNCTIONAL OBJECTS

Wood, even those with the most exotic grain patterns, has but three dimensions with which to work: length, width, and depth. A brilliant sculptor, mas-

ter turner, or woodcarver, however, can take these basics and shape them to his bidding until the final result takes one's breath away. It is my belief, which may be debatable, that plastics can have a fourth dimension. Both artists and sculptors have embraced the medium, yet their reasons are not totally akin to mine. They see its durability, its workability, its imperviousness to weathering in some forms, the speed with which a piece can be finished, and the outsized objects that can be built. I see it as being able to reveal its inner self, particularly in the case of the resins and the acrylics.

In the beginning, commercial producers found

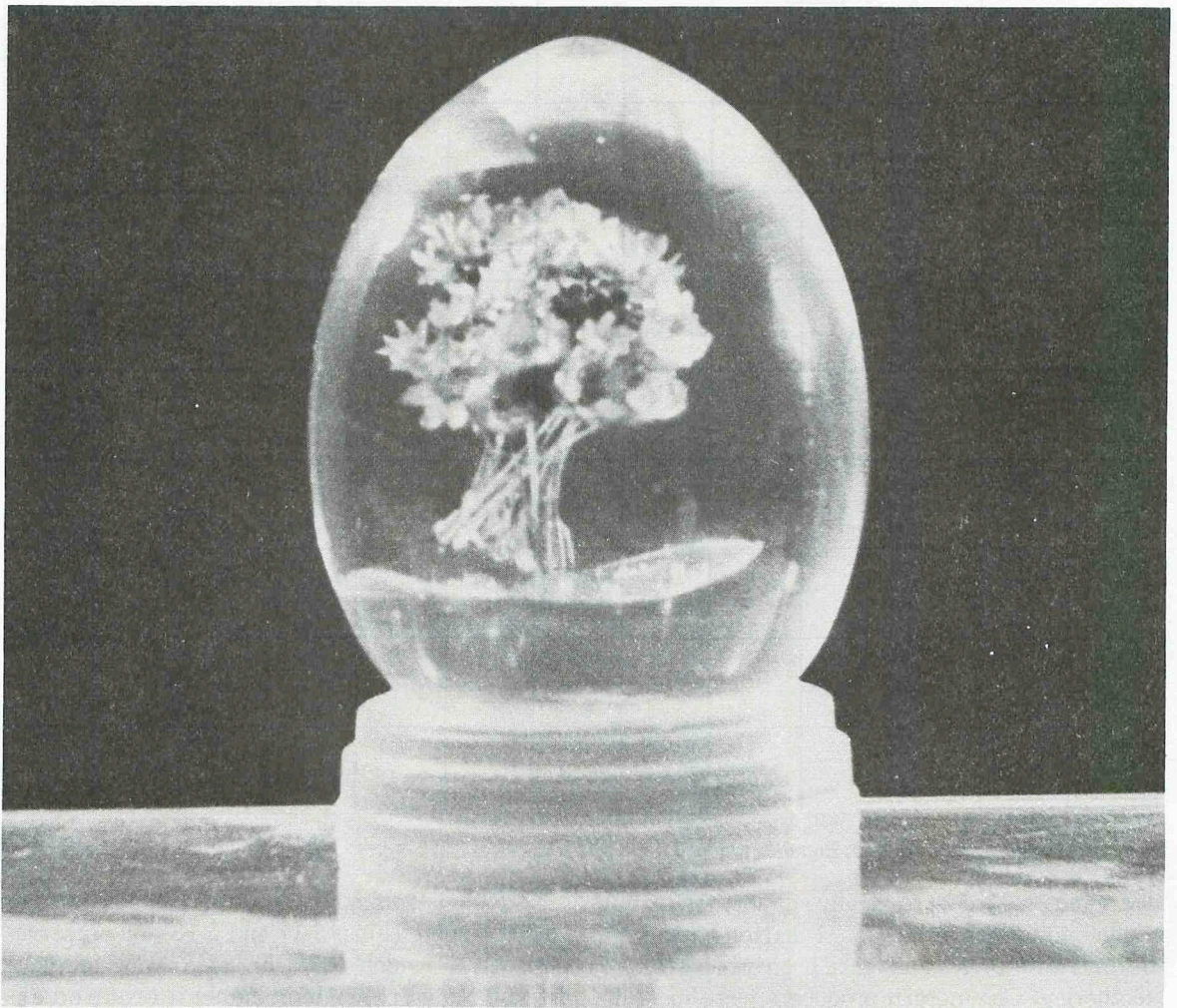


Fig. 5-17. Dried flowers embedded in a cylinder, which was then turned to this egg-on-a-pedestal shape.

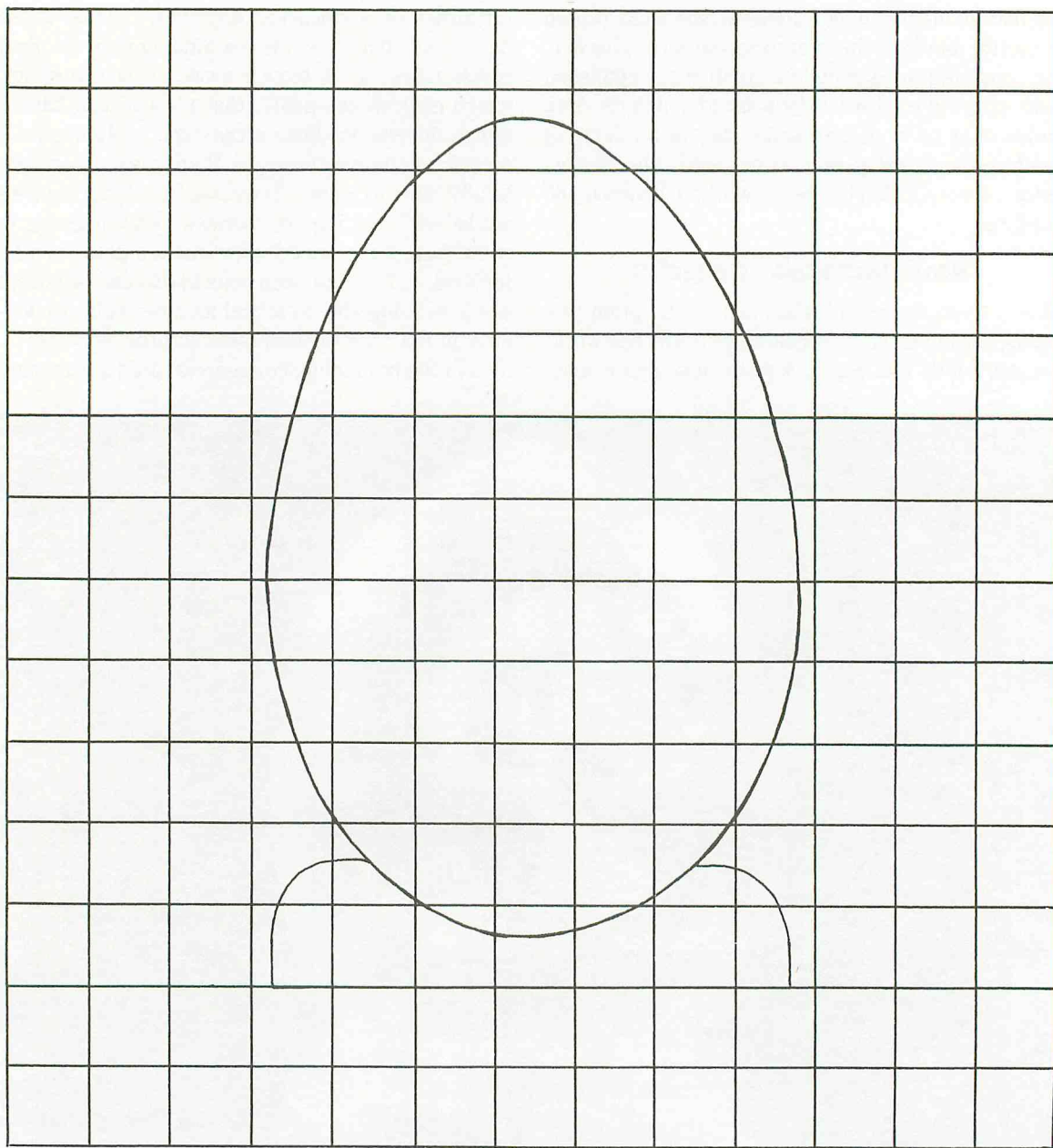


Fig. 5-18. Pattern for turned egg. Squares are $\frac{1}{2}$ ".

that some plastics were ideally suitable for coating wires and electronic parts. Plastics had a high dielectric strength and were highly resistant to weathering. Commercial producers were most interested in the practical properties of plastics.

Hobbyists found that plastics could be used to embed objects (Figs. 5-17 and 5-18) for preservation. Glass, which could be used, was far more difficult to work with, because it required extremely high temperatures during processing. Its

use for encapsulating was limited. When the properties of these plastics became common knowledge, just about everybody had a crack at working with them: people molded resins and embedded anything that did not move. The craze soon died out, because everyone went about it too hastily and did not master the techniques thoroughly. Pieces fractured horribly and the interest subsided in disappointment. Hobbyists were most interested in the workability of plastics.

The potential remained, however, and it is still being investigated and enlarged upon. I grasped the idea of first encapsulating an object and then turning away the molded shape (Fig. 5-19) to reveal the object housed in another shape (Fig. 5-20). The resins were ideal for this. Carrying the idea one step farther involved embedding bits and pieces of resin, dyed and pigmented, in large quantities of clear liquid resin. When these blanks (Fig. 5-21) were lathe turned, the fourth dimension was revealed. The objects had length, width, and height as with wood, but one could *see into them*. Striations of color flowed inside an egg on a pedestal (Fig. 5-22). Fractures and fissures due to the different

shrinkage stresses enhanced the overall effect. The turning was highly instrumental in making an unusual, unique object acceptable because of its totally recognizable exterior and the manner in which it was turned. I am most interested in the "inner beauty" of plastics.

Some of the limitations of the simple lathe that apply to wood also apply to plastic. The absence of a three- or four-jaw chuck makes the use of some sort of *cup chuck* mandatory. The disc with a centered hole is a variation on the cup chuck, but I believe that not attempting a project because an accessory is not available or cannot be used with a lathe is unthinkable. My tendency is to find something that can be utilized, even if it means reaching back into history and reviving techniques used when master turners were converting wood into Duncan Fyfe and Hepplewhite furniture.

Only polyester resin and the acrylics have been mentioned thus far, but the plastics that can be turned are innumerable. Even Styrofoam, and by that we refer exclusively to the product of the Dow Chemical Company, can be turned with satisfying results for decorative pieces (Fig. 5-23). (Although

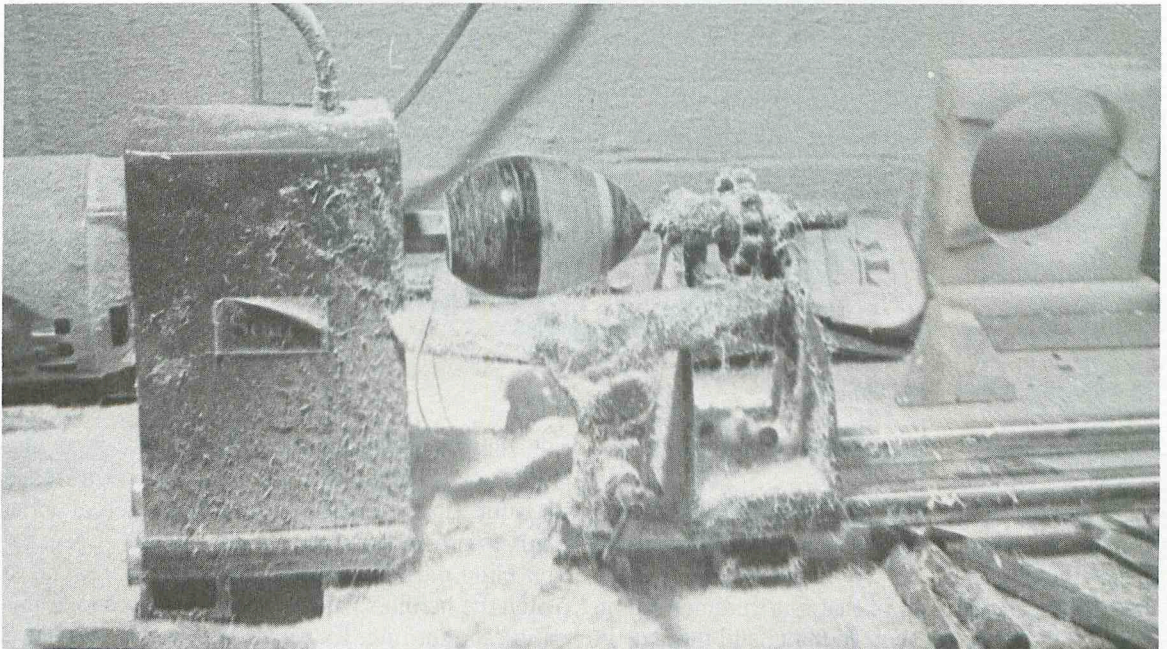


Fig. 5-19. Cylinder of resin being turned to egg shape.

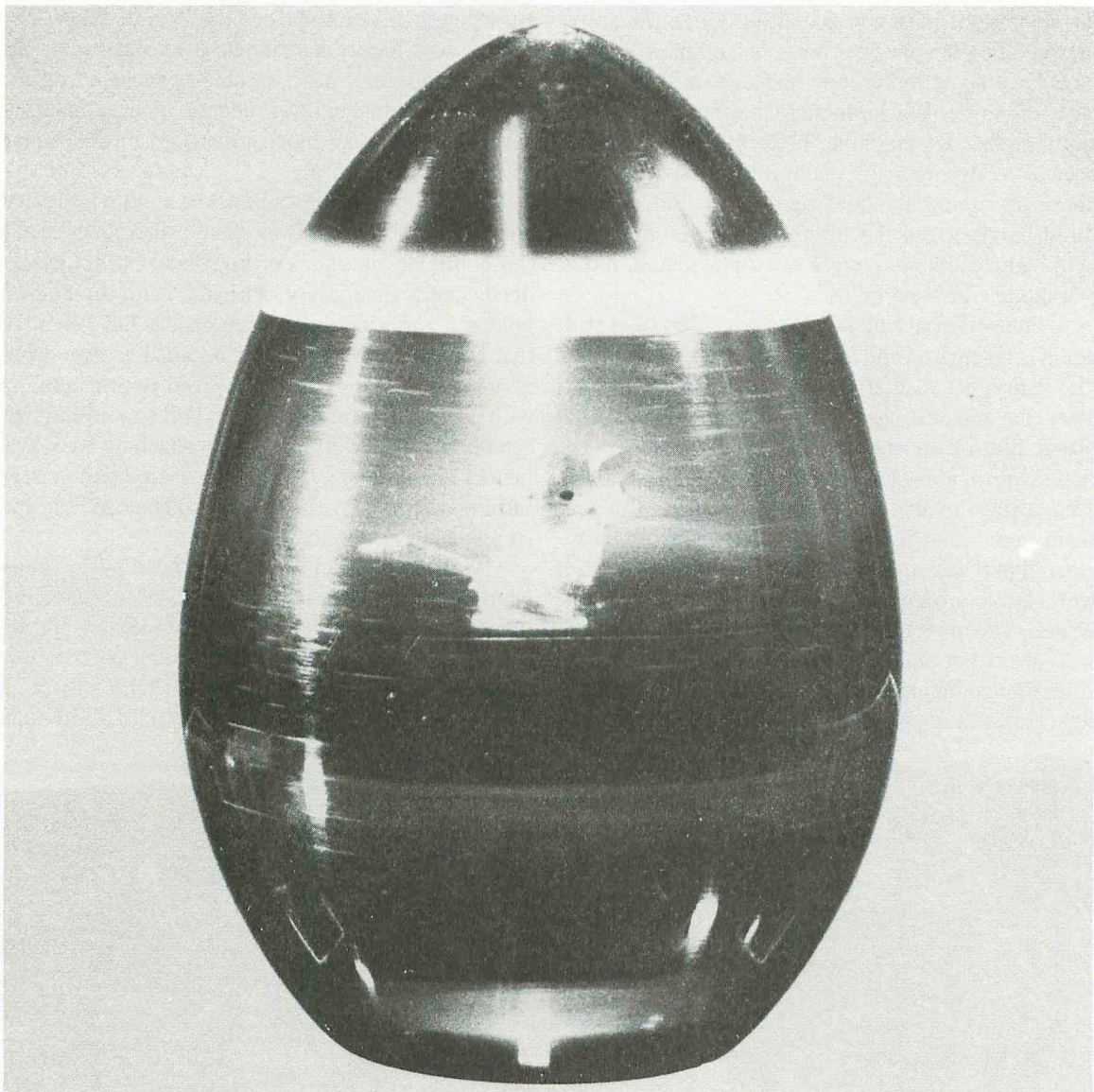


Fig. 5-20. Egg reveals baby chick inside.

a candleholder is a possibility, remember that Styrofoam will burn.)

Prior to continuing the discussion of plastic turning, never let it be said that we have an aversion to wood. Quite the contrary. There are times when the turner can add a bit of that fourth dimension in wood by expertly routing, reeding, and fluting. He can also achieve it by judicious laminating, and by

the addition of carved area. Shown here is an egg (Fig. 5-24) sitting low in its base, which was made by laminating several bits of wood together in an effort to produce a strong grain pattern. A precaution cited earlier is worth repeating here: try to match the hardness of the woods selected for lamination and turning. Extreme hardness in one piece in this specimen made the carving much more dif-

difficult than it might have been despite the fact that it did not affect the turning materially.

The piece took a bit of advance planning. After it was laminated, hexagonal templates were placed on the top and bottom of the block or *blank*. The wood was cut carefully to this shape on a 10" table saw with the blade tilted to match the templates. The $\frac{3}{4}$ " holes were drilled into each face the same distance from the bottom. They were drilled deeply, almost to the center of the piece. I used a spade bit for this, and the drilling served two purposes: it opened up the areas for the carving step, and it removed a bit of waste with a minimum of effort. It would have been more difficult to do the drilling after the egg portion had been turned.

The turning, which has been described for other projects, was easy although the piece might

have been cleaner had I used some of the chisels and other tools I acquired or made since then. The carving was done while the piece was hand-held for much of the procedure. (It is hard to lock up an egg shape like this at eyelevel.) The difference in wood hardness came into play here. A number of electric carving/engraving devices were used (Fig. 5-25), including the Dremel Moto-Tool, an especially good one called the Electro-Stylus, and one from Vibro-tool. The Dremel Motor-Flex Tool (not shown in the photograph) is excellent for this because it has a thin, pencil-like hand piece that makes it easier to probe into the holes at high speeds. No matter what tool was used, however, when it passed from the soft to the hard wood, progress was noticeably impeded.

(Surprisingly, such carving can be done on the



Fig. 5-21. Resin pourings prior to shaping on the lathe.



Fig. 5-22. Dyed and pigmented resin turned to egg shape.

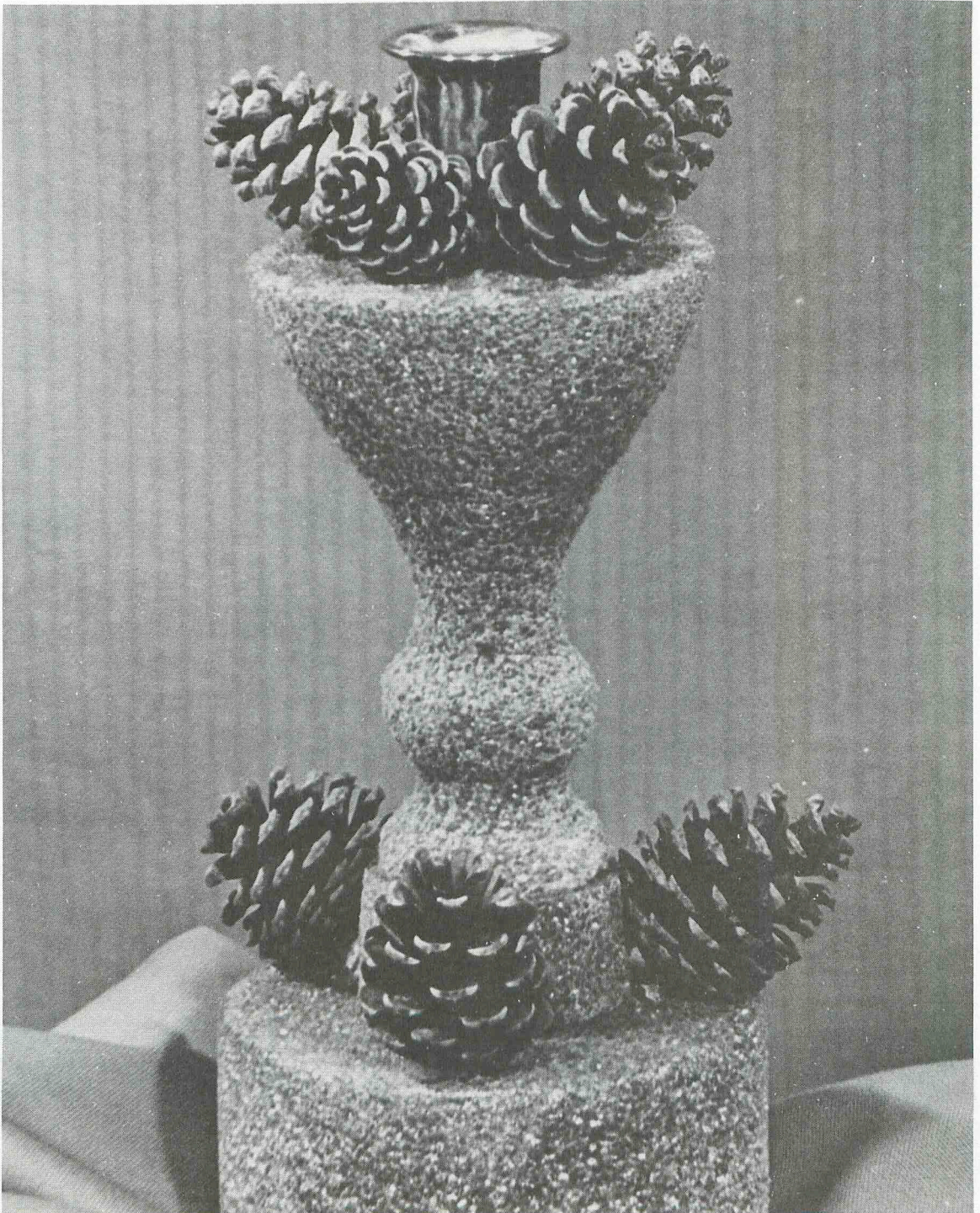


Fig. 5-23. Candlestick turned from Styrofoam.

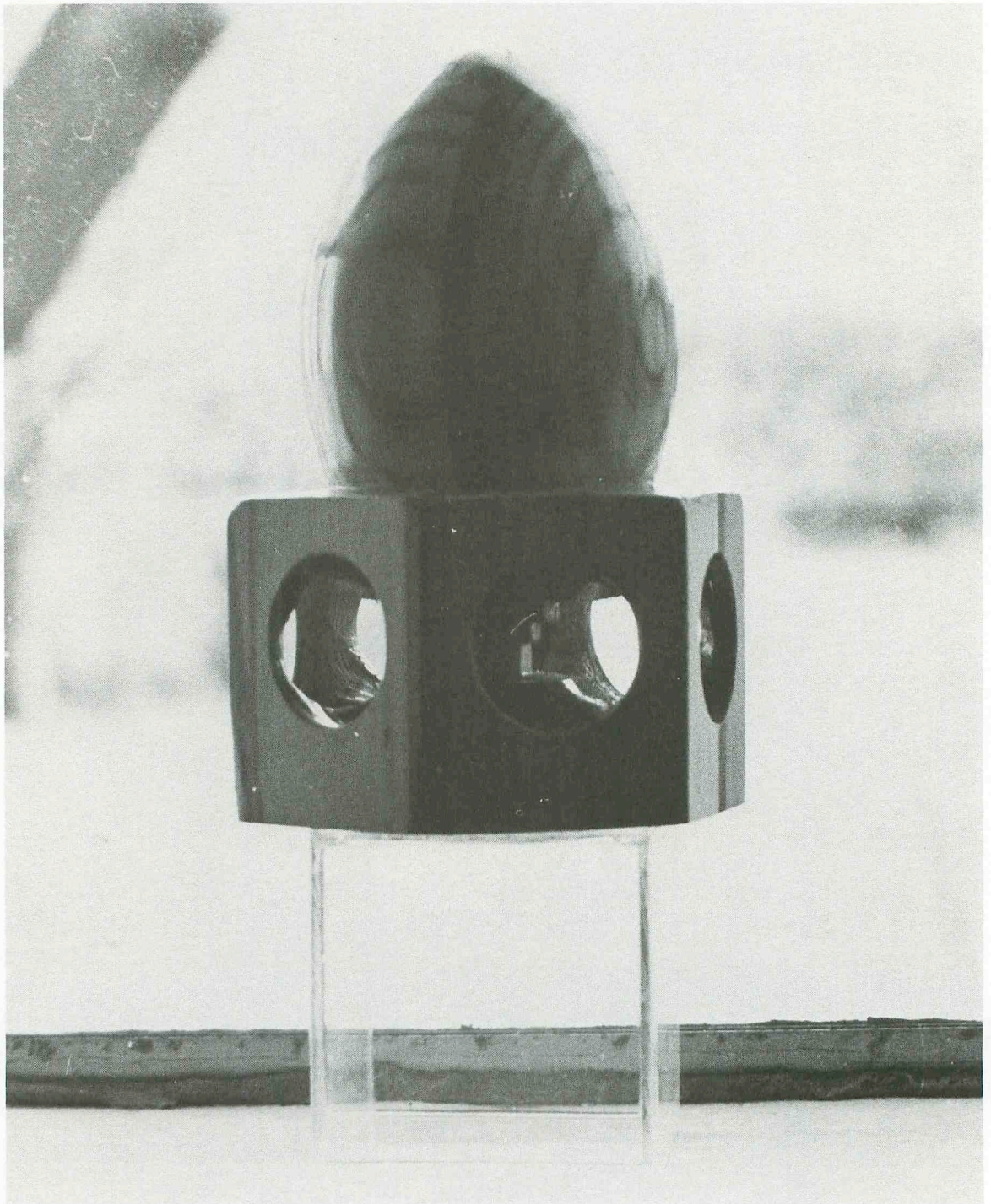


Fig. 5-24. Egg on internally carved base.

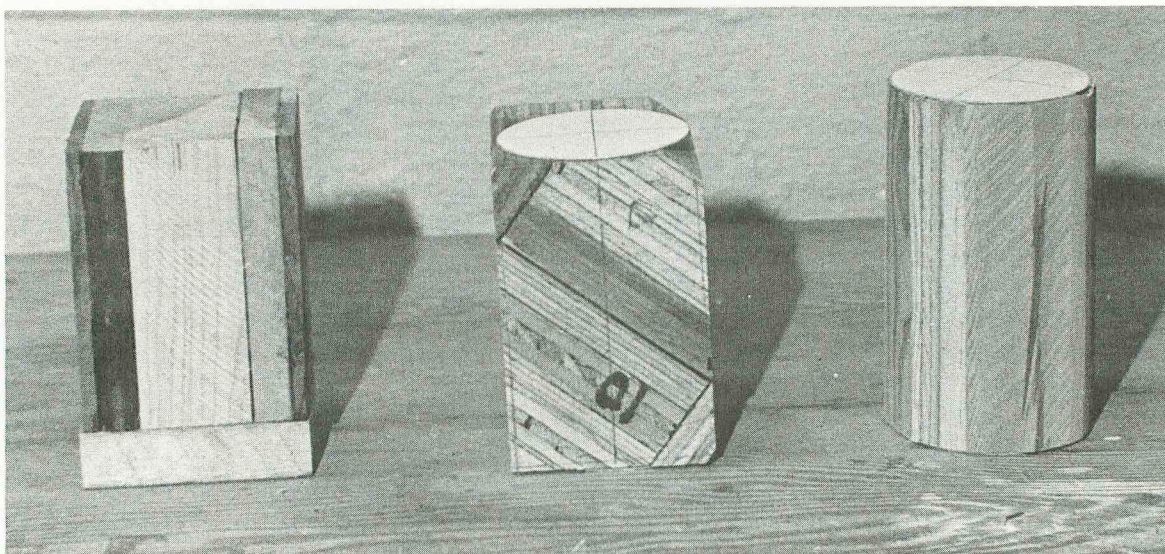


Fig. 5-27. Blocks of wood laminated for turning decorative items. Middle egg, Fig. 5-26, was made from center block.

and allowing it to dry overnight, a block was cut from it that showed the laminations on a distinct bias rather than parallel to the top and bottom (Fig. 5-28). When this was turned, the diagonal appearance was retained. These still fall in the category of centers turning, because for the best results the block should be supported by the tailstock. The spur center can be used rather than the faceplate because the plywood, laminated as it is, withstands the rigors of being turned until smooth.

The bull's-eye with a vertical line running behind it on the other wooden egg is the product of more conventional laminating. Different sized pieces were fitted together to make the laminated block. The bull's-eye is a remnant of a fairly small piece, most of which was turned away. Note the portion of another bull's-eye on the base, which was part of the turning.

Has the subject of centers turning been treated as if no other craft or art existed? I hope not. Here, for example, is a piece where the turning was but one of several means to an end. Moreover, all traces of the turning have disappeared on the finished object. The reason for such an unusual method lay in the fact that polyester resin is heavy, a conical shape had to be arrived at prior to getting the

eventual flat planes desired, and lathe turning proved to be the fastest method possible with the tools at hand.

One of the cylindrical blanks (Fig. 5-29) that had to be reduced and eventually shaped like the pentagonal figure behind it is shown. If the internal color was to be emphasized, it could not have beads or hollows distorting the windows through which it would be viewed. The five-sided aspect would offer something new with each viewpoint when one rotated it or walked around it. To avoid the pitfalls of mounting cured resin between centers, the top and bottom were sanded smooth and a $\frac{1}{4}$ " thick wooden disc was glued on. Turning it down to size was routine, although it would have helped if the lathe had been equipped with the eccentric mount for offset turning that some multi-purpose lathes have. The conical shape or taper was not that acute in this case, and it was arrived at after a brief period of thumping and bumping during roughing out. That was it for the lathe—the rest of the work was done with regular shop tools. The top and bottom had pentagonal templates (Fig. 5-30) placed upon them as guides to remove the rest of the waste. The first cut was extremely difficult (with a cut-off wheel), but it furnished a flat surface that made ensuing cuts

rather simple. Sanding and polishing followed, to produce the modern sculpture (Fig. 5-31) with a fourth dimension.

The lamp (Fig. 5-32) shown in this section's final set of photographs is commercially produced. The beads, collars, knobs, and faceplate turnings were probably turned by the hundreds. The tools were probably fed to the wood automatically and the beads parted (Fig. 5-33) off untouched by human

hands. It is much faster, certainly, than turning a single spindle with so many hollows and crests despite the fact that an internal *pipe* or stem is mandatory for bracing and for mounting the lamp socket and base. It does point up, however, the importance of the lathe in today's world, no matter how elaborate it may be. The other photos show additional items whose shapes are admired with little or no thought as to how they were made.

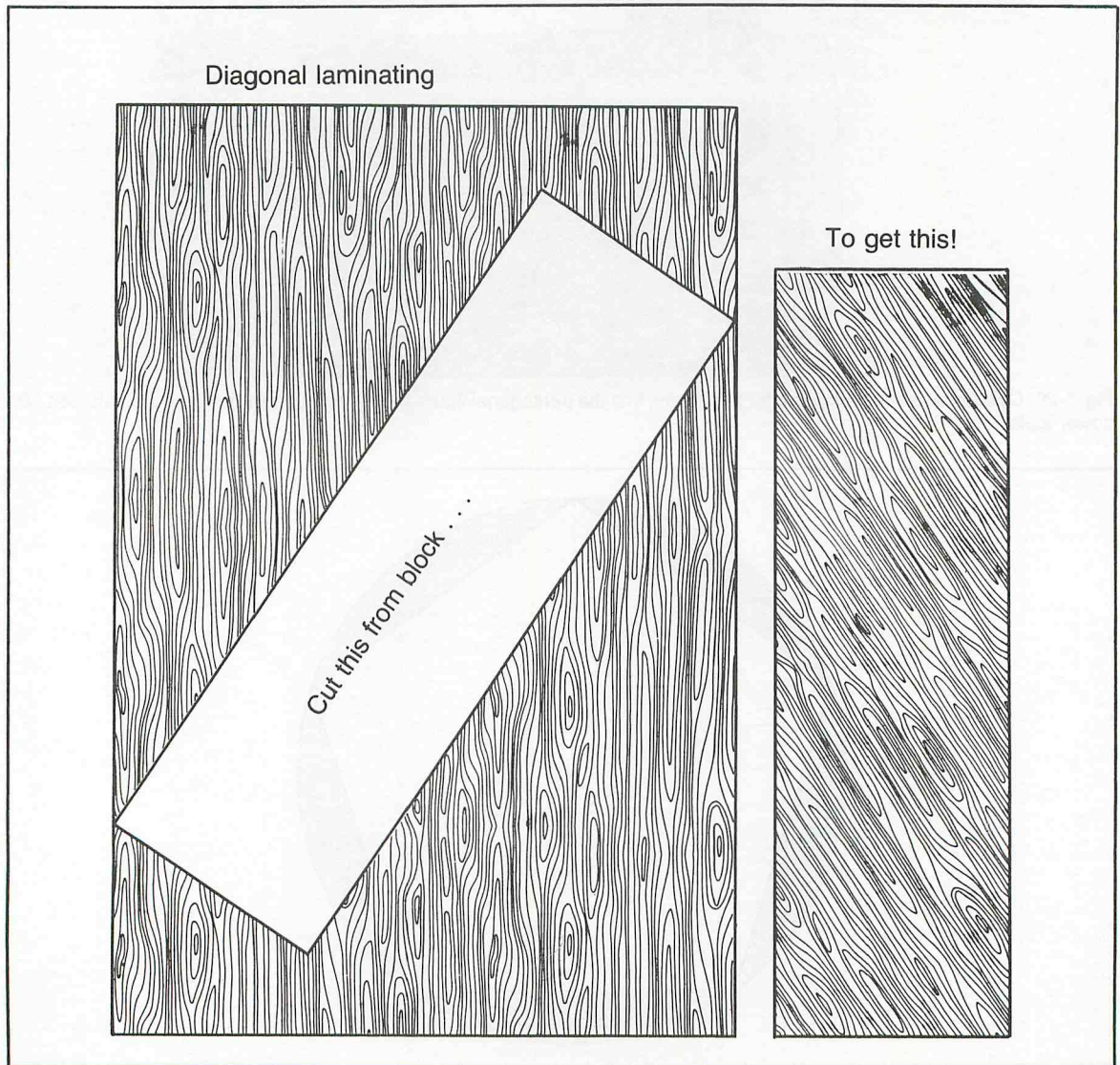


Fig. 5-28. Pieces are glued to make large block. When cut as shown, grain will run on a slant from top to bottom.

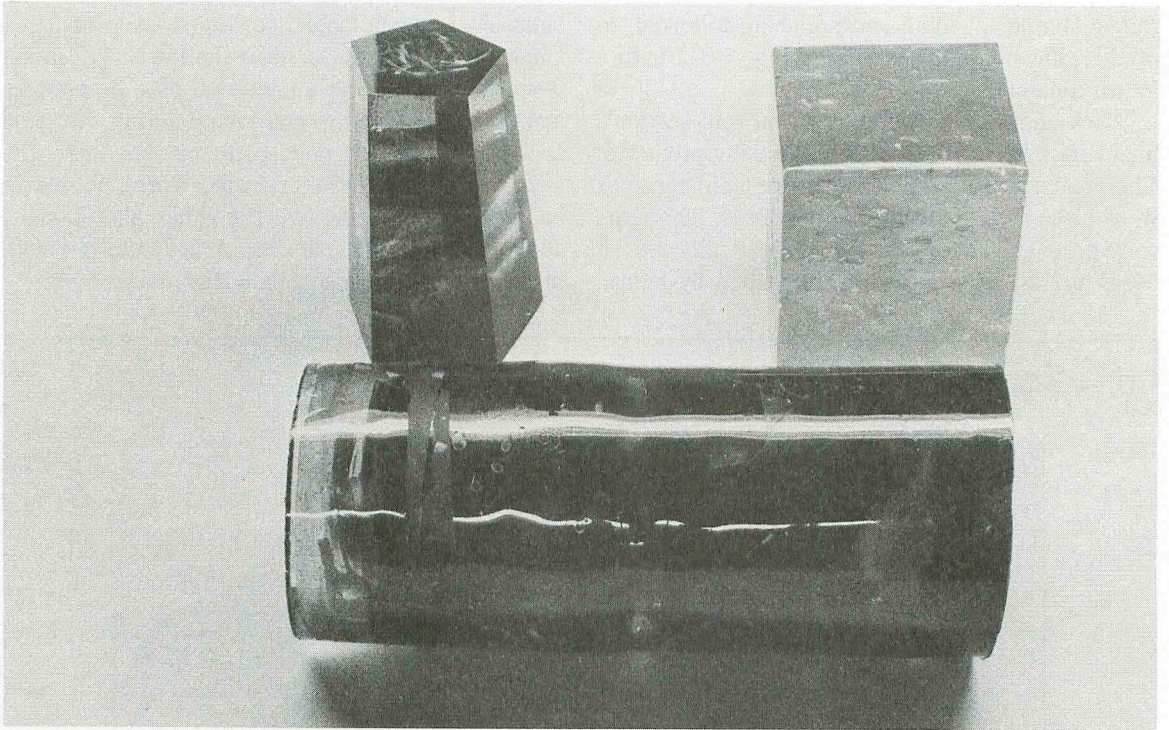


Fig. 5-29. Cylindrical blank (in front) prior to shaping into the pentagonal figure behind it. Lathe turned first, then shaped with power tools.

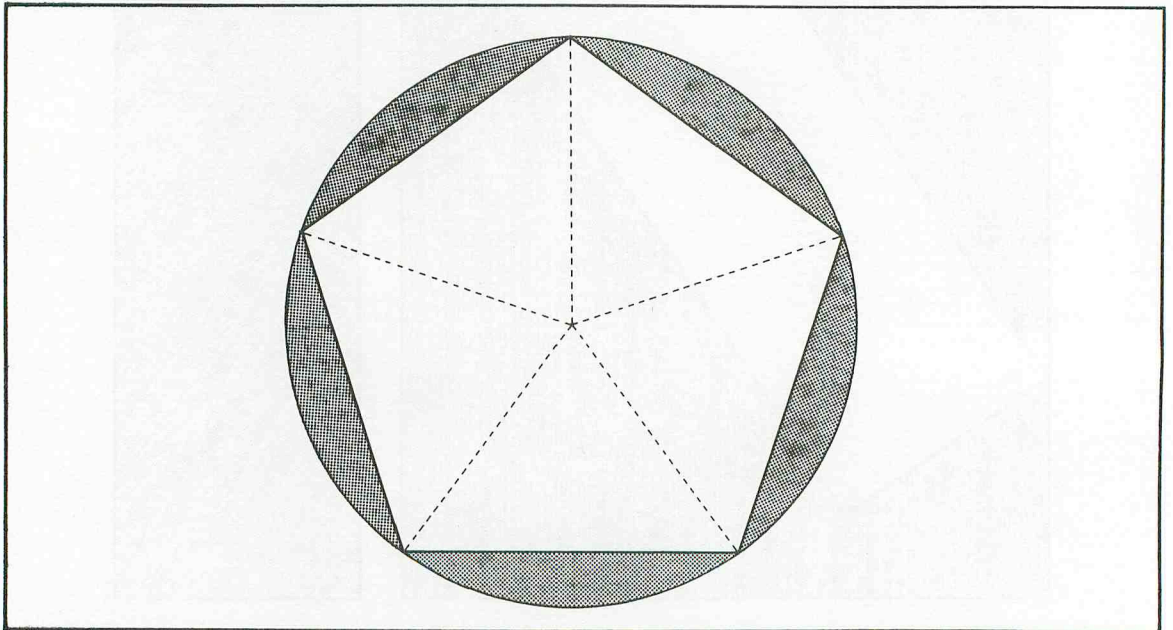


Fig. 5-30. Template for top of pentagonal items. Shaded area is cut away.

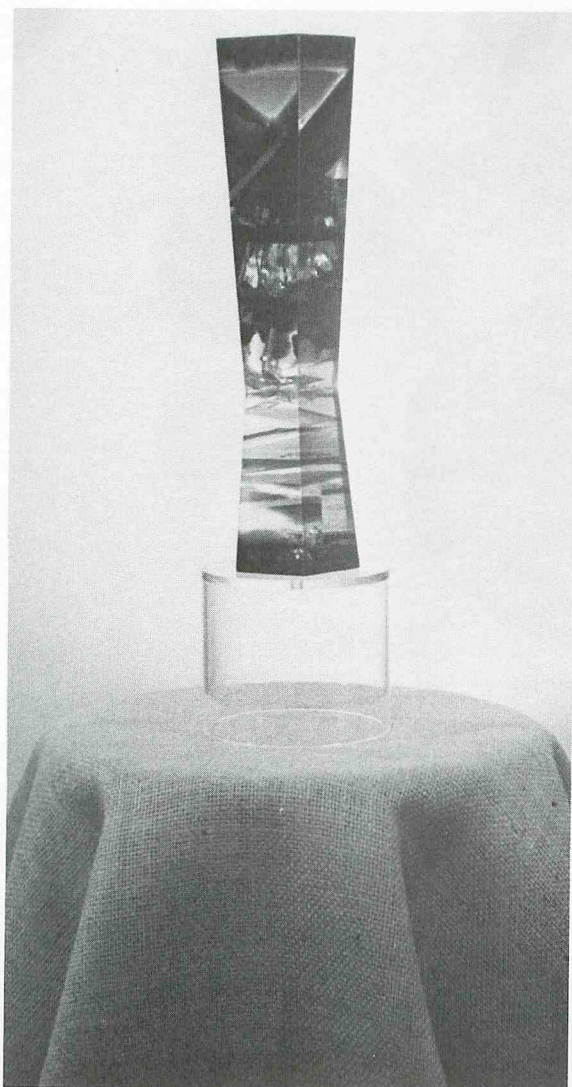


Fig. 5-31. Finished modern sculpture of polyester resin—a combination of turning and power tool work.

TURNING RINGS

Just recently a fine example of a free-standing rings (Fig. 5-34) turned on a spindle cropped up at a flea market. After its purchase for a nominal cost, a big debate arose. Just what was it? A teenager nearby at the moment said it was a voodoo rattle to chase away evil spirits, but although the adults pooh-poohed this suggestion no one knew what it was. Ornamental grooves had been cut in the larger por-

tion, and the head area on which the rings hung had been painted or stained. This portion (on the right in our photograph) had been turned on the tailstock end of a lathe. The impression left in the wood on the other end, however, indicated that an unusually small spur center had held the wood. That was the extent of our detective work, and when the kids finished shaking it and casting spells on each other, it was photographed and set aside.

Some weeks later, while browsing around at



Fig. 5-32. Lamp made up of individual beads, collars, discs, and pegs, all lathe turned. They are held erect by a metal pipe up the middle.

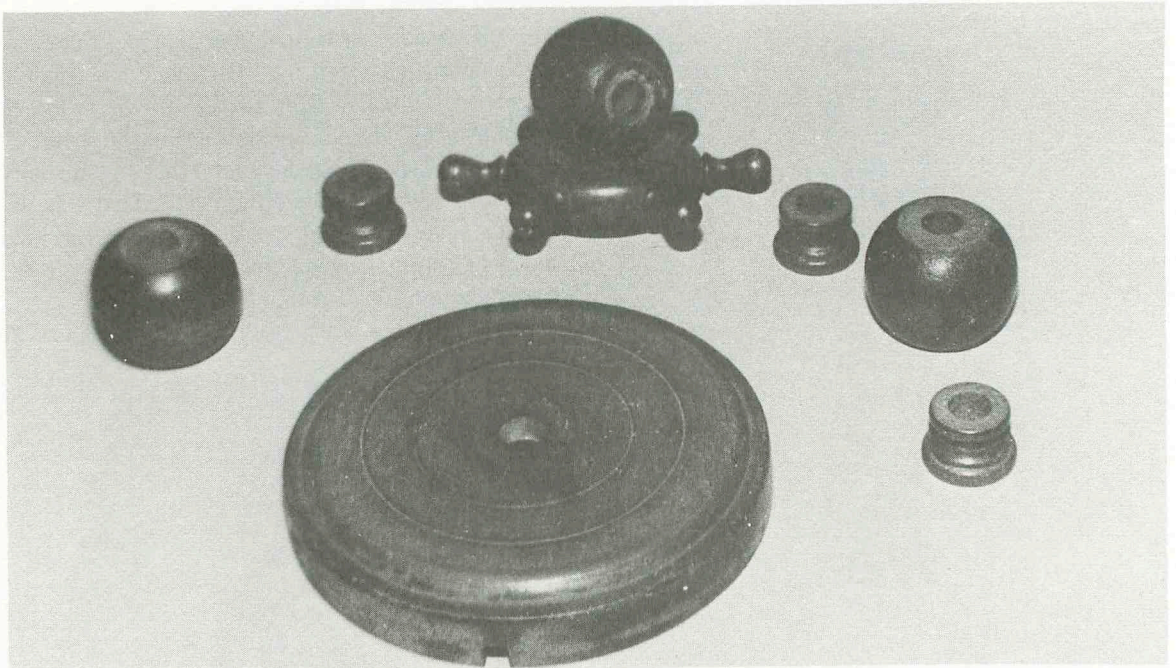


Fig. 5-33. Turned components for lamp (Fig. 5-32) prior to assembly.

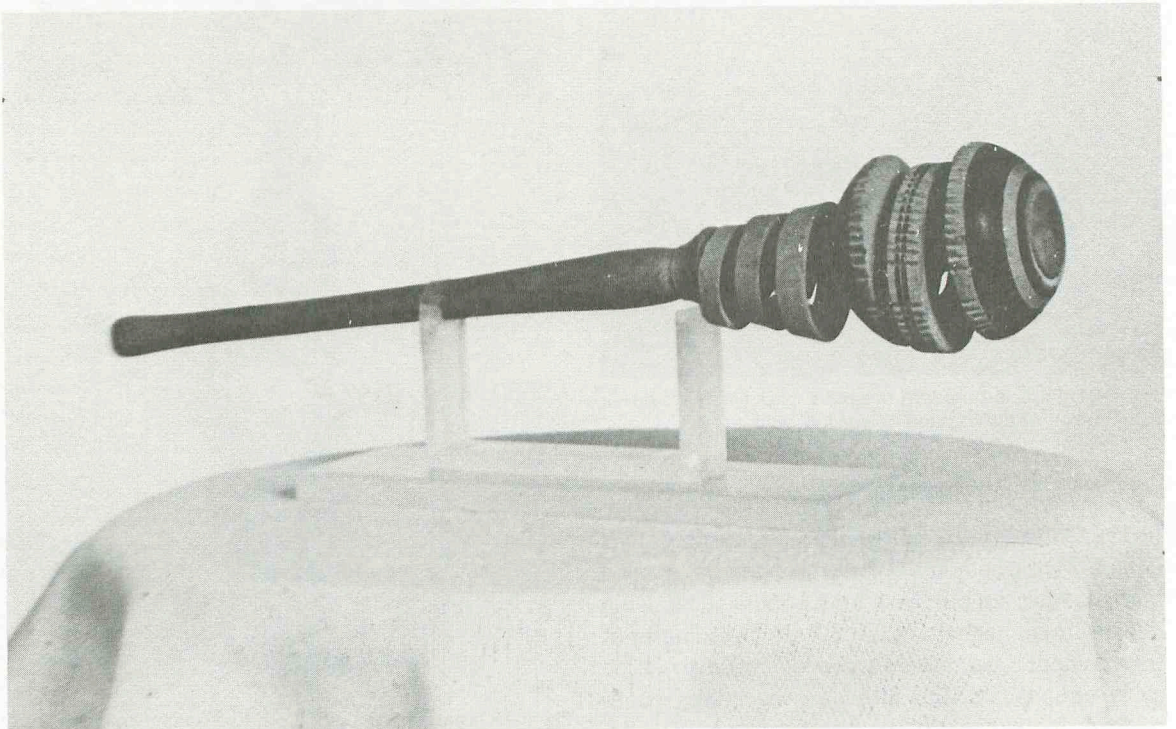


Fig. 5-34. Turned free-standing rings on a chocolate muddler used to stir cocoa for Aztec kings.



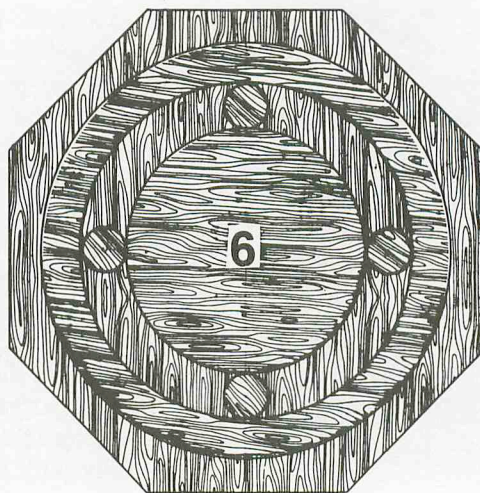
Fig. 5-33. Turned components for lamp (Fig. 5-32) prior to assembly.

another flea market, we passed a table laden with used books for sale. There, on the top of a pile, was a book on exotic cooking utensils with a picture of our “voodoo rattle” right on the paper jacket. Well, everyone gathered around as we leafed through the book, completely ignoring the vendor in our excitement. In the middle of the book, there was another picture with the description of the item beneath it. Our teenager had been so wrong! It was

called a chocolate muddler and was used for mixing ingredients (including melted chocolate) to make hot cocoa for Aztec kings! It was held, rings down, between the palms and rotated vigorously. (Unfortunately, the recipe for the Aztec cocoa was not included in the book, so it does seem futile to turn one of these muddlers as a gift to a dear friend.)

Turning rings is not difficult. Even before discovering the muddler, we had experimented with turning a plastic foam similar to Styrofoam and made a vase-like Christmas decoration (Fig. 5-35) with a ring lying loose between the bowl and the base. Most people, after a quick glance, asked, “How did you get the ring on there?” Actually, the item is turned normally, working from the tailstock end down toward the stem. The foam, incidentally, turns readily with just the aid of a skew chisel. Waste is removed beneath the bowl area and the stem is partially formed. The time to start cutting the ring is when the base area is twice as wide as it should be. Make a slight V-cut dividing this portion in half. Go back and remove the waste between the stem and the inner portion of the ring. Start shaping the base and then, working carefully from the left side, guide the point of a skew in under the ring. Work alternately on either side of the ring until it is cut free.

Turning rings is usually regarded as a faceplate operation. It is discussed in detail in Chapter 6.



Faceplate Turning

NO ONE COULD USE A LATHE FOR ANY LENGTH of time without discovering how necessary a faceplate is. The wood to be shaped is usually fastened to it by four screws. There are usually two sets of screws—one set for securing small workpieces, the other for locking on pieces that go to the outer limits of the lathe. Faceplates generally come in sizes ranging in diameter from 3" or 4" up to 9", all this in the case of woodworking lathes, of course. I have worked with one just 4¼" in diameter for years. The faceplates screw right onto the mandrel, and with the rotation of the mandrel being in the opposite direction to their thread pattern, one could never get loose. Here's the first tip for the use of this device: when screwing a piece of wood onto the faceplate, always draw a line straight out from one hole onto the wood. Should the wood have to be removed it can be remounted as it was originally, and the workpiece will not run out of round.

The first task a novice is suggested to turn on a faceplate is usually an ashtray. This may be because all of the shaping will be done on the face of the

piece and not the back. This precludes his inadvertently bringing the cutting tool in contact with the metal plate.

Wooden bowls (Fig. 6-1) also have high priority with faceplate turners. There was a time, early in the history of lathes, when spindle turning was regarded as a different craft than faceplate work. Imagine! The faceplate chaps back then might have been called The Bowl Boys, although everyone used the product of their labor in one form or another. As usual historically, the law of supply and demand soon made the merger of their talents a matter of survival. Today there is no line of demarcation, and the lathe owner happily switches from one type of turning to the other with no qualms.

Here, again, there are some basic rules of thumb for faceplate work. If the piece is square and not too thick (less than 1½") I usually draw diagonals from the corners. Then, with a compass, draw a circle that almost touches the sides. This serves as a guide to whack off the corners and makes the turning easier from the first moment the lathe is



Fig. 6-1. Wooden bowls in all shapes and sizes were once high on the list of items turned most frequently.

turned on. The faceplate is centered by peering through the screw holes and lining them up with the diagonal lines. The hole in the center is checked and should show an "X" where the diagonal lines crossed. Then, with a hammer and punch, a dent is made right on the line in the center of each hole. Now the screws go in to fasten the wood. Remember, the line to be drawn from one of them out over the edge of the plate and onto the wood for later orientation. The screws should just fit the holes in the faceplate so that there will be no movement later on. Their length should be arrived at carefully to avoid their contacting the gouge from inside the work.

In faceplate work, skews and anything other than scraping tools are almost never used. The reason for this is a valid one. The wood's grain in this type of work goes across the piece and not from end to end, as is the case in spindle turning. As the piece rotates, the edges of the grain (on the circumference) come around and whack at the cutting tool. If a skew is fed into the material it is a positive invitation to disaster.

The four-screw technique is just about the simplest method for mounting, but there are several others worthy of mentioning. The possibility of

the gouge hitting the screws or the faceplate is reduced considerably if a piece of wood is interposed between the faceplate and the workpiece. It could be a bit of plywood, or even a large enough piece of scrap as long as it is not warped. It is advisable to turn it down to match the periphery of the rounded off workpiece. This permits you to bevel the back edge of the work in hand without the tool hanging up on the headstock housing. Nothing is more frustrating! Screws could be run through both the faceplate and the backup piece into the work or if there is an area in the center that is not going to be touched, the screws could go in from the face or front of the piece. General practice has been that the outside of a bowl or similar object be turned first. The screws, coming through from behind the faceplate will then be driven into the waste area. When the outside is finished the piece is removed and its position reversed. It could be glued onto the backup piece with glue and paper or mouted with screws, the holes to be plugged upon completion. There are slight problems inherent in this reversal process pertaining to the proper alignment of the piece, and great pains must be taken to center the piece once again.

One good solution to these problems is to turn

the inside of the bowl first. It is removed from the faceplate and a scrap piece turned to just fit in the rim of the bowl firmly—a press fit. Now the back or bottom of the bowl can be turned.

LAMINATING

The bookends (Fig. 6-2) appearing here are made of stacked or laminated pieces of leather. To the touch they feel as hard as wood. There is no reason why a project such as this could not be turned from wood, with the variations in grain substituting for the effect achieved by combining different grades and shades of leather. Each tier could be one solid piece of exotic wood or, they could be mixed and matched. Inquiries about gluing leather in the manner shown have turned up the fact that Barge Cement is just about the best adhesive. It is no longer sold as a retail item, but shoemakers still use it and they may be able to supply a source.

The concept of piled layers, irrespective of the

material, is of interest here because simple turning is involved to produce a most effective visual impression. The word *lamine* used repeatedly here generally means to cover or construct with layers of paper, fabric, or plywood. Additionally, pieces of wood or other materials are juxtaposed to produce a block (blank) or mass from which the product will be produced. There is no impregnation with resin substances and no heat is applied, although pressure through clamping is employed. A variation on the layered construction is a turned egg and candleholder made of thin sheets of expanded polystyrene, a member of the thermoplastics family. The sheets are frequently used as a substitute for cardboard to back up photographs for mailing.

A white glue (polyvinyl acetate) such as Elmer's is the proper one to use with foams. It is a water-based adhesive, easy to apply, but requiring a longer drying period. It is applied to both pieces, a short time allowed for evaporation, and then

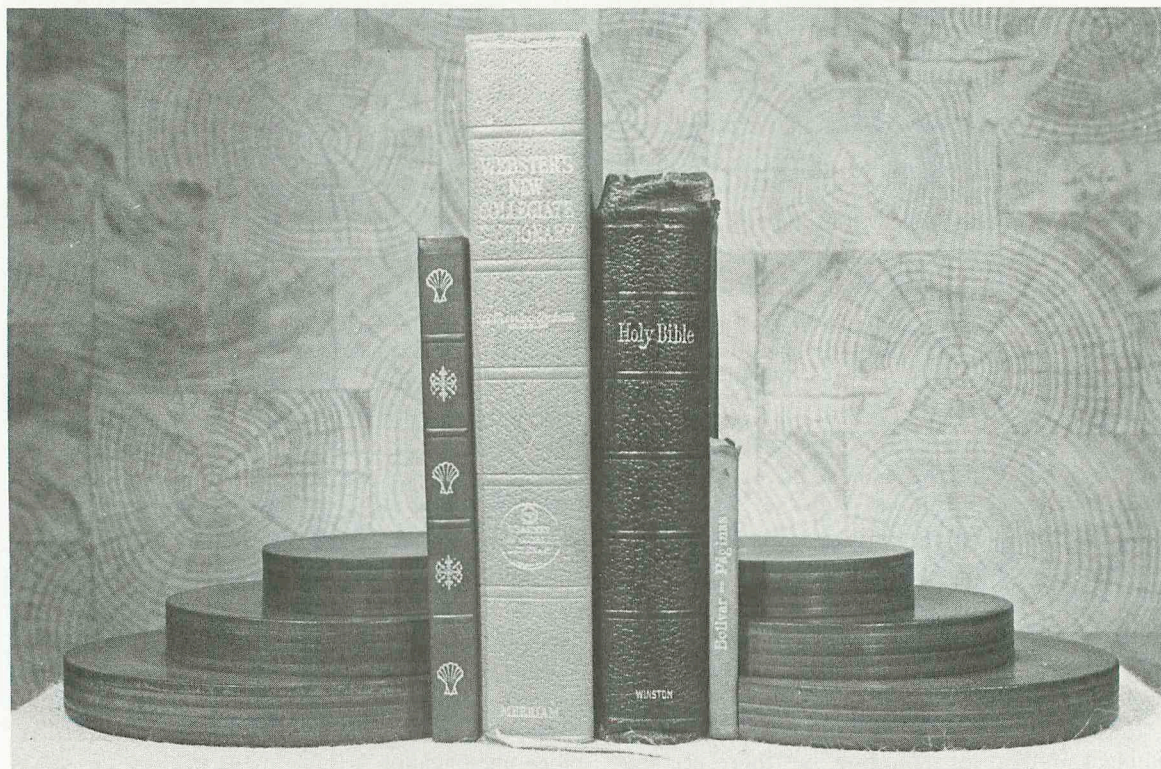


Fig. 6-2. Laminated leather bookends suggest something that might be duplicated in wood.

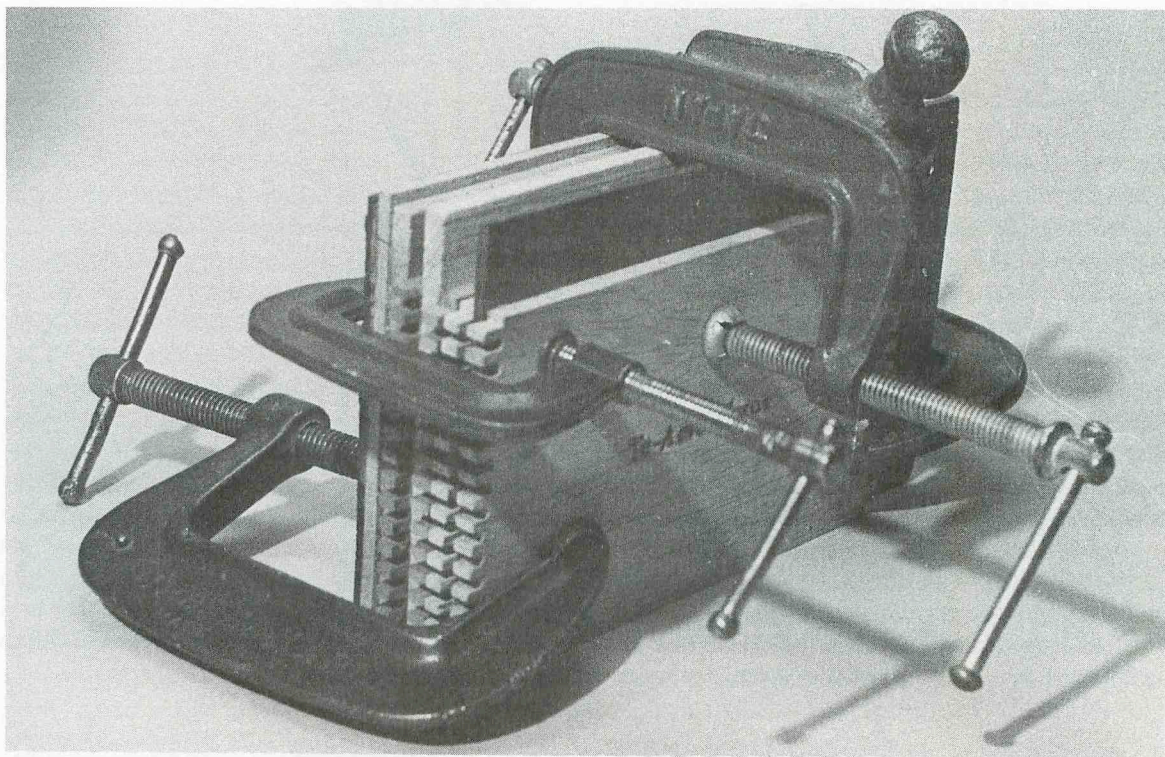


Fig. 6-3. Clamp laminated wood for at least an hour.

pressed together. Clamping (Fig. 6-3) for at least an hour is suggested. Because, in this case and with other plastics, there is no grain, any shape cutting tool may be used for turning including the skew chisels.

Materials other than wood do laminate well, it has been shown, but since availability is often a prime factor in what material is to be used, faceplate turning seems to be done with wood more than anything else. This is changing as the plastics find more acceptance as an art form. It is true that little pieces in so diversified an assortment as pictured here (Fig. 6-4) do not show up in a finished product—there are too many variables! It is difficult to match the hardness of the wood, the overall design suffers, and it may not be possible to have the grain running all in one direction. The base on the faceplate here wound up looking like Joseph's coat of many colors, yet it incorporates ideas that might well be used in a more placid design.

Two holes, for example, about 1" in diameter,

were drilled through the piece forming the cross when viewed from above. A length of dowel was glued and press-fitted straight through one, while two shorter pieces were glued in to butt up against its center. They followed the contours of the turning with a pleasant effect. Tools other than the gouge were used with success. The work is still in progress.

Another work in progress is the laminated pipe holder shown in Fig. 6-5. It was screwed to the faceplate with the usual four screws but with an additional one through the center (as insurance against movement). It was turned with the ball end away from the headstock so that area could be rounded completely. When the shape was right, it was removed, the tip of the ball cut off at an angle and the top portion cut away with a saw. Two cuts were made, one from the left and one from the top right, although traces of this have been removed with a half round file. The rest of the waste will be carved away with rotary cutting tools until the notch

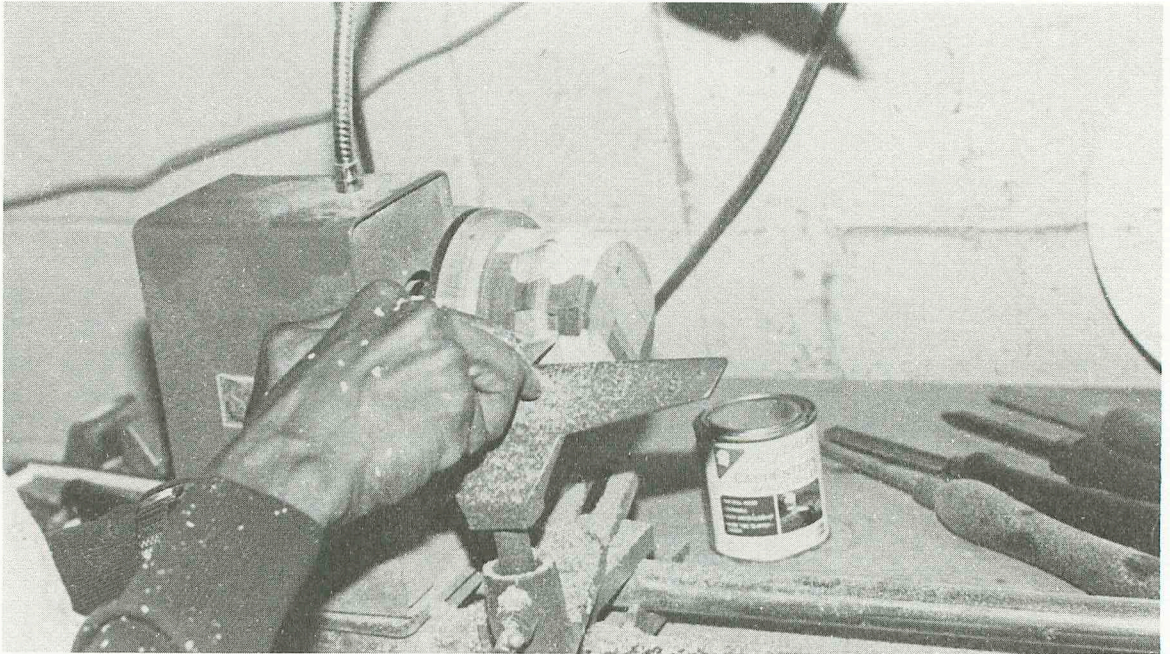


Fig. 6-4. Base laminated of a variety of woods. The special cutting tools can be used here.

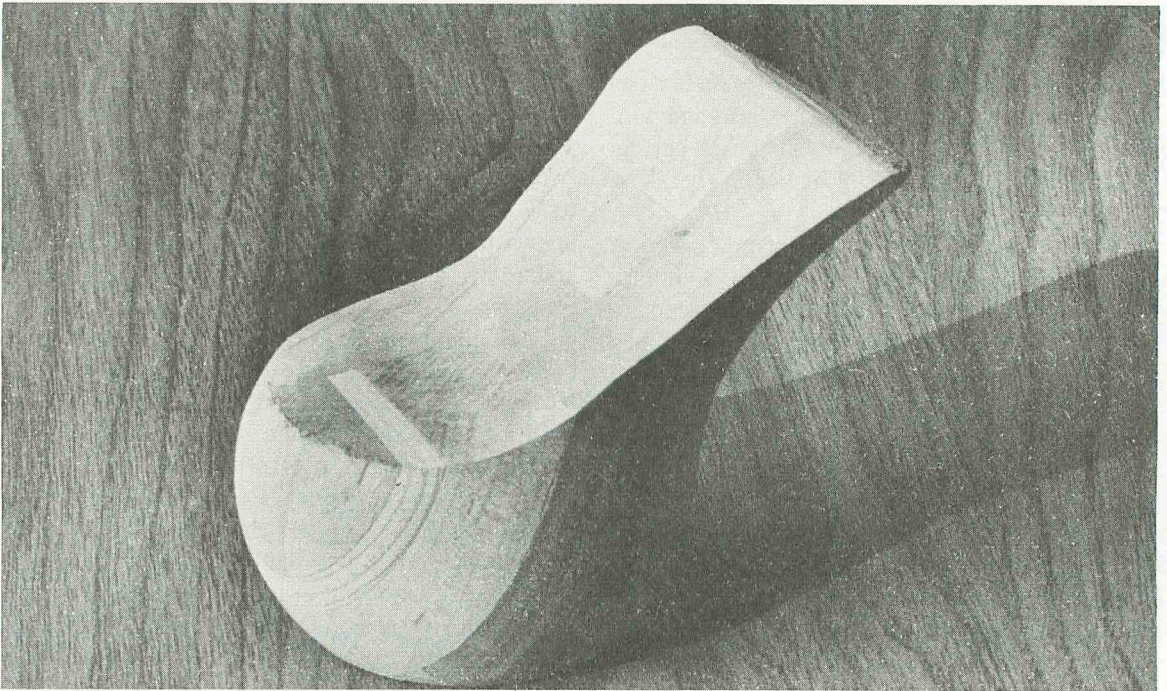


Fig. 6-5. Pipe holder turned from laminated wood. Carving is the next process.

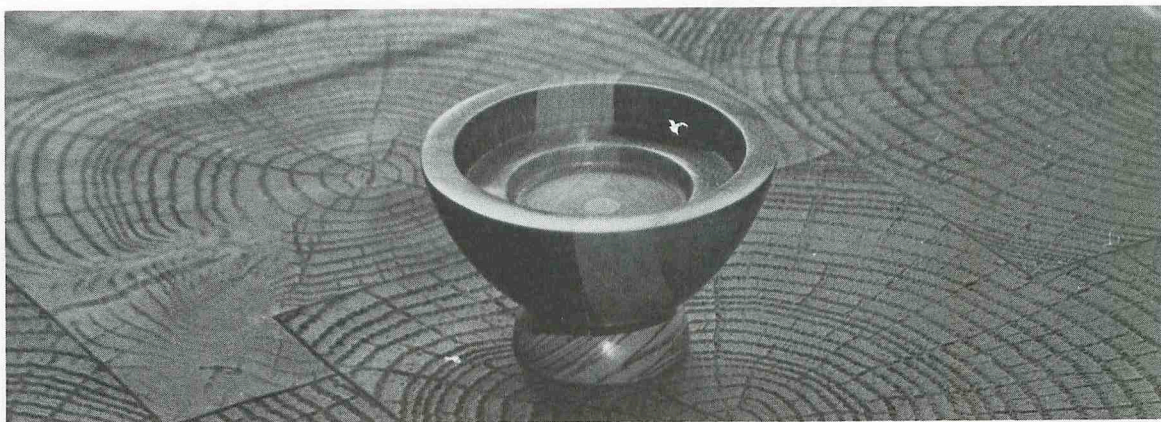


Fig. 6-6. Laminated receptacle made from same piece as pipe holder (Fig. 6-5).

rest for a favorite pipe is brought out. Polishing should enhance the effect of the lamination both inside and out.

Finally, in this group of examples, is a miniature laminated receptacle (Fig. 6-6). To add one more fillip, it was made from two cutoffs from earlier projects—the laminated plywood egg provided the base, and a piece that had been put together around a $\frac{3}{4}$ " square core made up the other end. A bit more emphasis is placed on the turning by the ledge cut inside. An unusual aspect is that the pattern inside is different, because all the pieces show the end grain. Some end grains show a pronounced pepper and salt effect when sanded smooth and polished.

FACEPLATE IN HOROLOGY

Any serious horological treatise generally refers to the lathe in connection with its uses as a spindle machine. The faceplate can offer many uses to the horologist, both in combination with spindle turning or alone. Perusal of books like *The Warner Collector's Guide to American Clocks*, by Anita Schorsch (Warner Books, 1981); *Two Hundred Years of American Clocks and Watches*, by Chris Bailey; or *The Beauty of Clocks*, by Michael Pearson, show innumerable fine examples of split turning, elaborate wooden columns, bezels, bases, finials, and beads. The Europeans and English did quite the same things but more frequently in metal; the Colonists never had enough metal, and styles originat-

ing in that period of American history lasted for many years afterward.

Horology is of ongoing interest to me and the lathe has proven to be the best solution to many little problems that have arisen in the pursuit of this avocation. In restoring the anniversary clock (Fig. 6-7) pictured here, work was halted by the lack of a suitable base. These "100-day" clocks are usually fitted with a brass base and a glass dome. The metal bases are most expensive to replace if one can be found, but the clock, with its slowly oscillating pendulum, could be enjoyed if a suitable substitute was found. Two shelves (Fig. 6-8) from a three-tiered snack dish of beautiful mahogany solved the problem. The larger of the two had a slight elevation in the center that was sanded off. The smaller one was glued inside and both turned on the faceplate to match a brass one that was available for duplication.

SPINDLE AND FACEPLATE COMBINATION

The base just described was a matter of the faceplate to the rescue in a renovation or restoration task. The frying pan clock (Fig. 6-9) is reminiscent of what the English do so often—combine a wooden spindle turning with a stamped brass or copper base in which to house the clock. Elaborating on this was purely a matter of turning the base out of select wood, a cut-off end of two finely matched pieces which must have gone into a beautiful cabinet. A partial ring was turned at the back (Fig. 6-10), and an imitation of a bezel done on the front. The latter

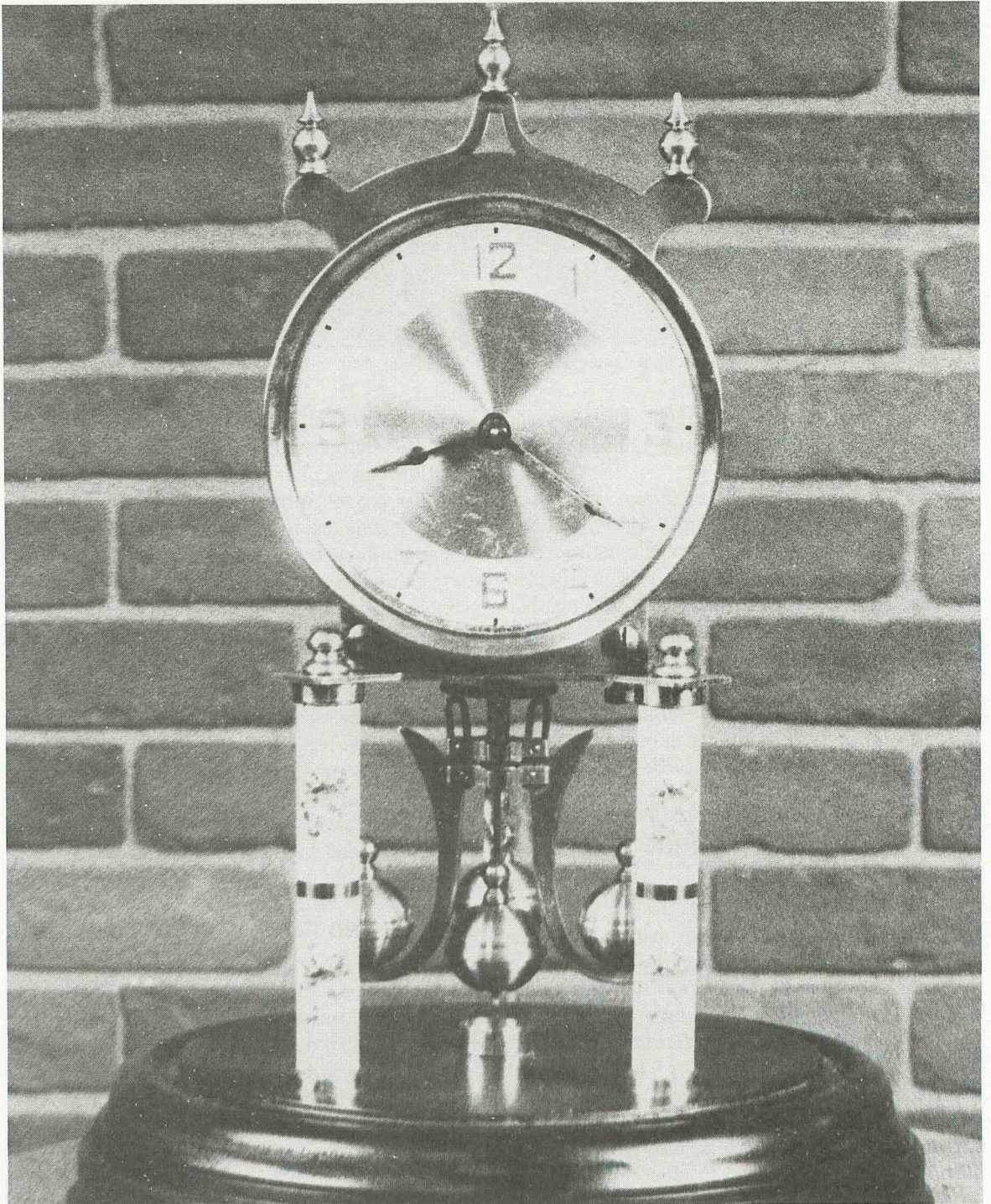


Fig. 6-7. Base turned for anniversary clock.

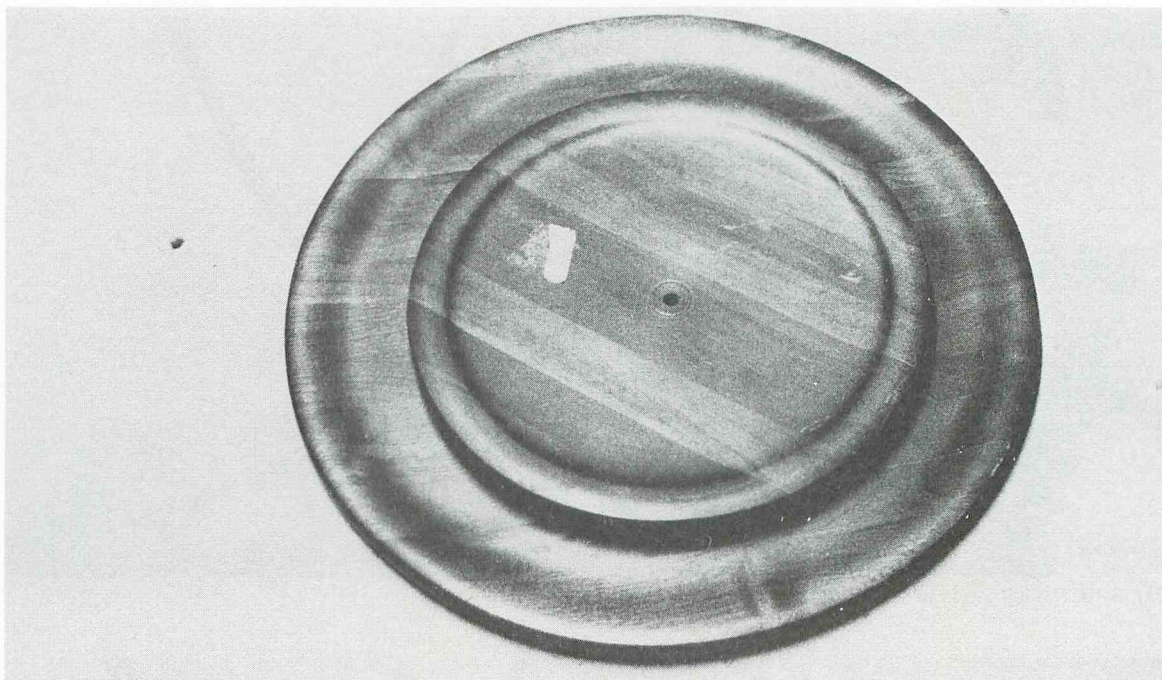


Fig. 6-8. Two wooden plates selected to make base of anniversary clock are glued together prior to turning.

was flattened (Fig. 6-11) because the clock movement had a brass bezel that would rest in the center of this turning. A chuck was attached to the tailstock spindle (Fig. 6-12) and closed down on a drill bit. Letting the headstock spindle rotate slowly and bringing the tailstock up to it drilled an accurate hole right through the center of the turning. This was in preparation for cutting away the waste in the center with a hole cutter. Turning it away would have caused the chisel to contact the mounting screws. It had to be bored through so that the hands could be set from the rear when the movement was installed. In this, and a number of the clocks that follow, a small battery-powered quartz movement is used because of its accuracy and compactness.

WOOD ON WOOD

An attempt to copy proponents of modern design in clock cases yet work completely with wood (except for the hands) is what resulted in this octagonal wall clock (Fig. 6-13). Because some general wood-working is involved, full instructions are given. Plywood is not usually selected as the "prime"

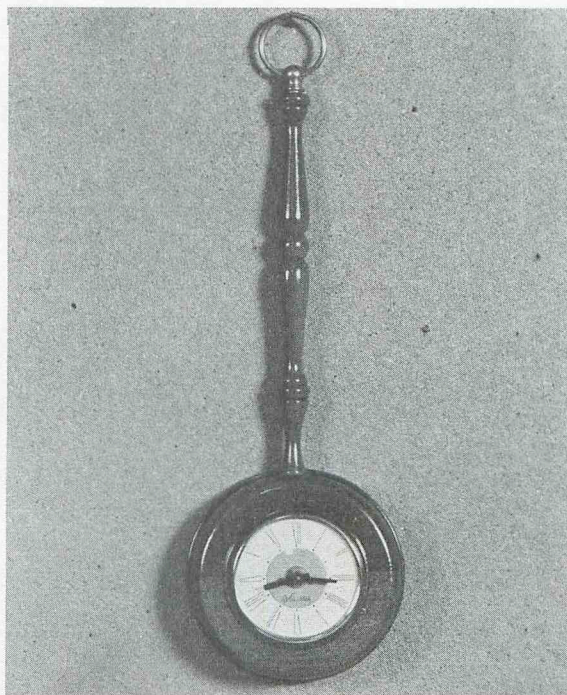


Fig. 6-9. Combination of spindle and faceplate turning.

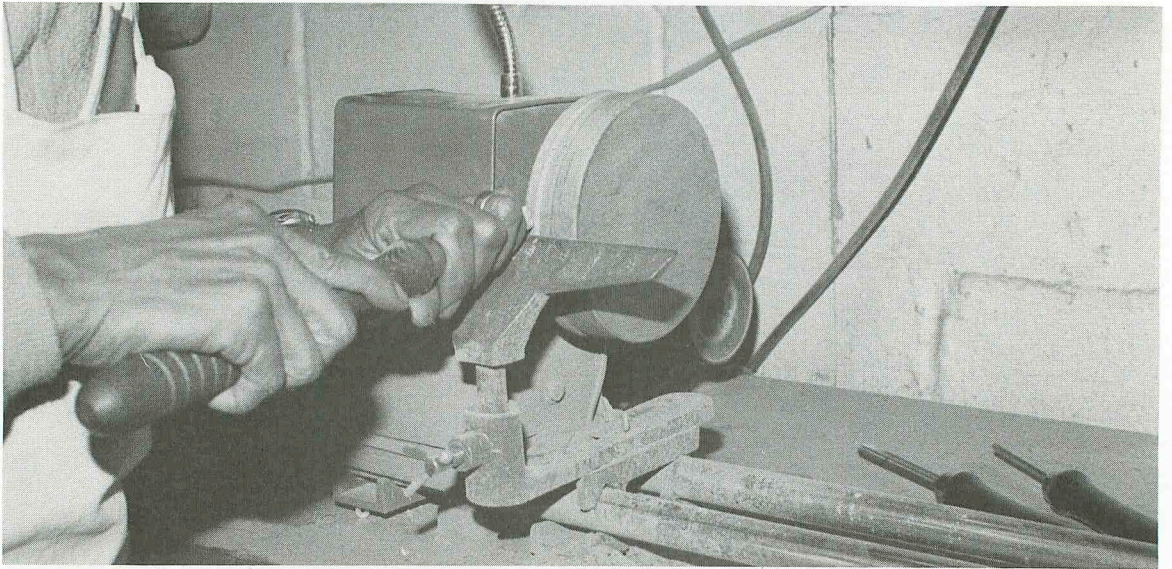


Fig. 6-10. Partial ring is turned at back.

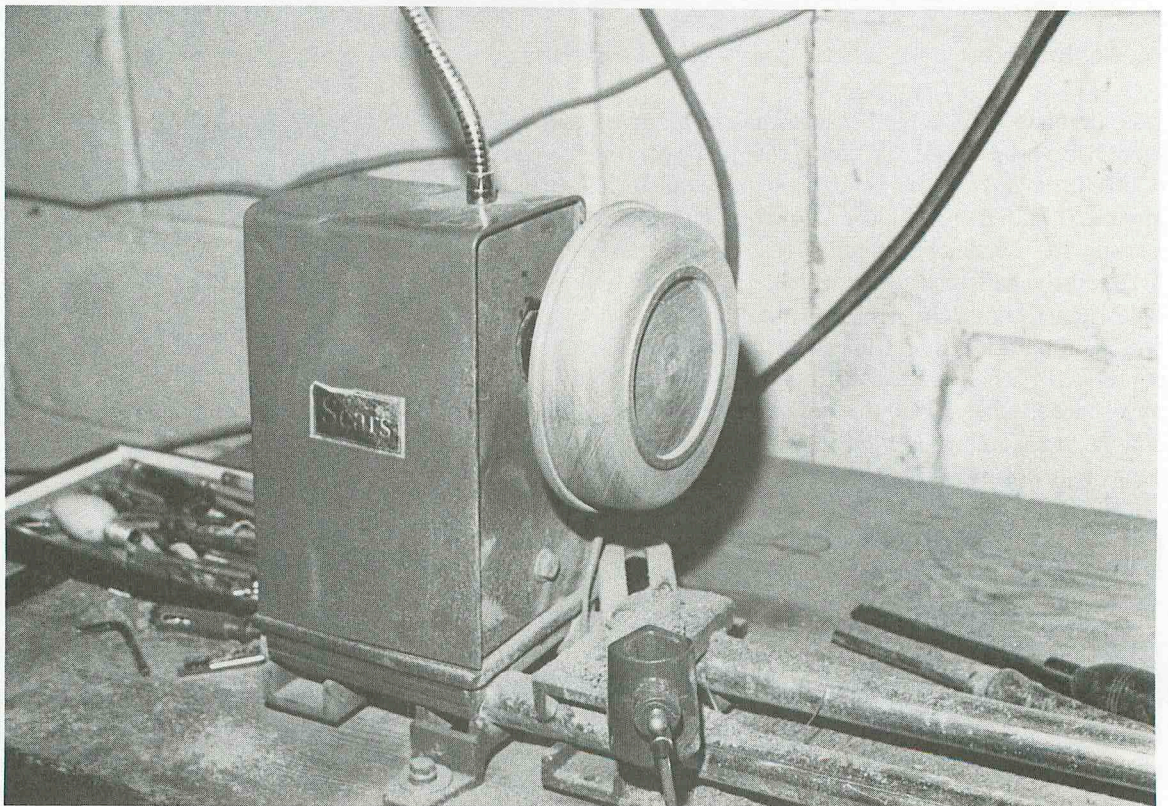


Fig. 6-11. Flat "collar" is turned to accept brass bezel.

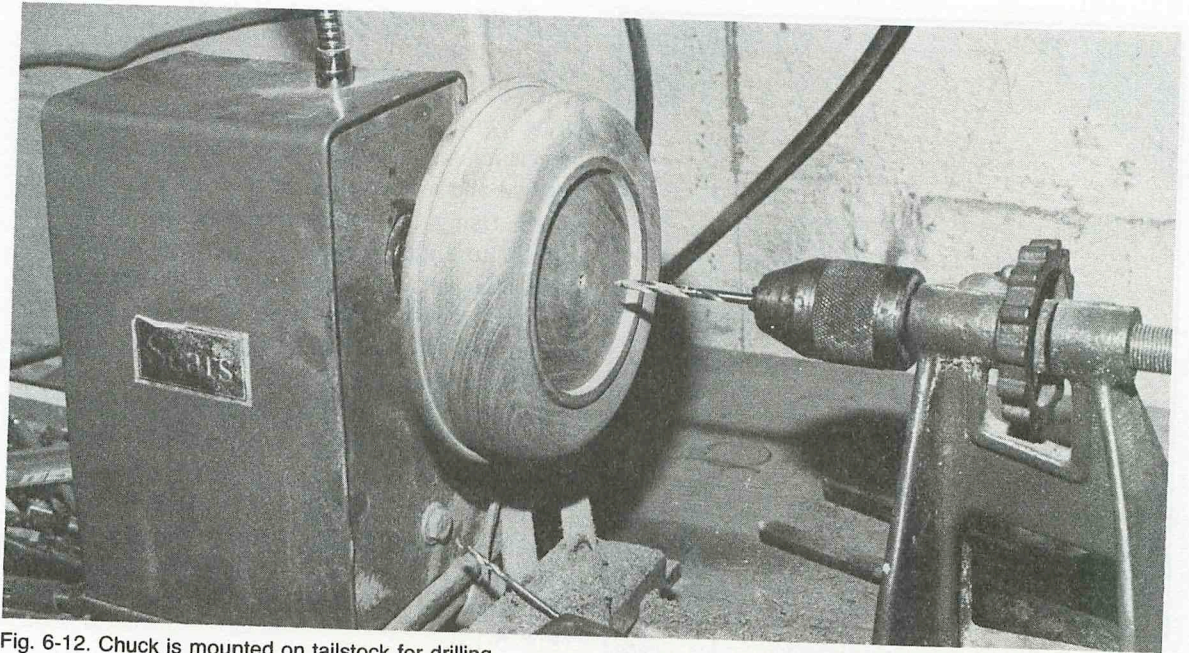


Fig. 6-12. Chuck is mounted on tailstock for drilling.

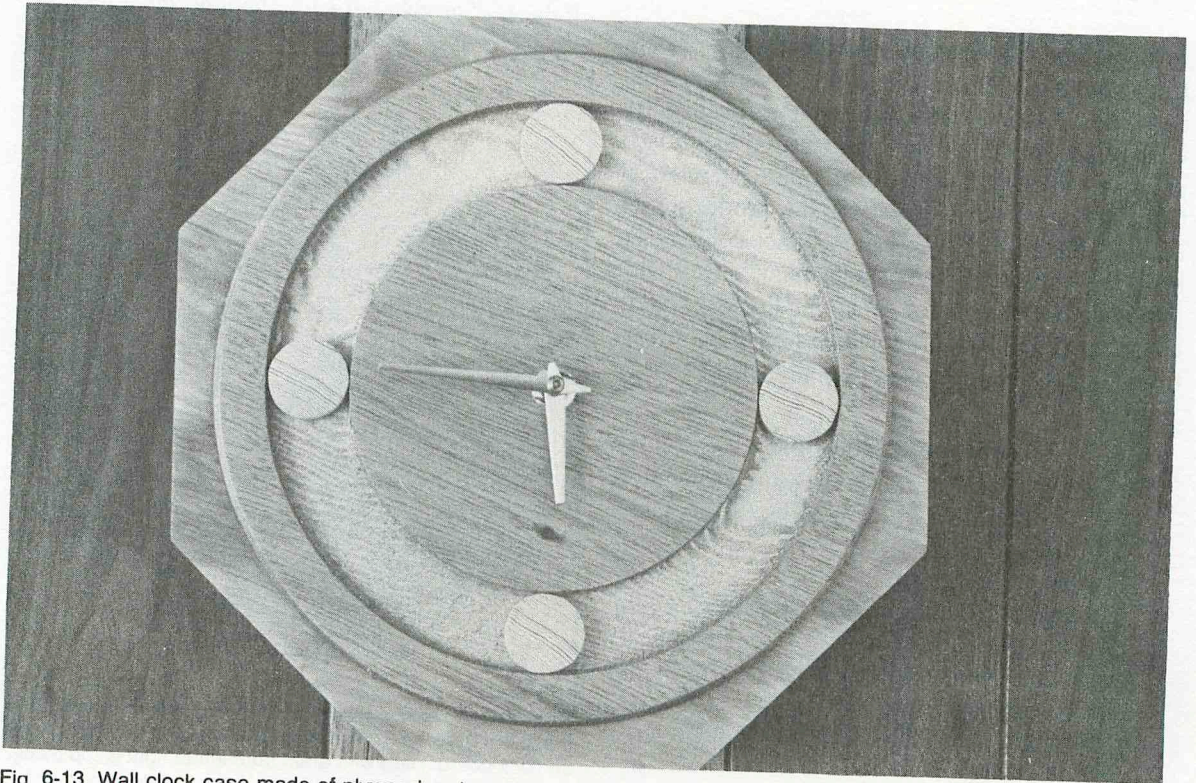


Fig. 6-13. Wall clock case made of plywood, not normally considered good for turning.

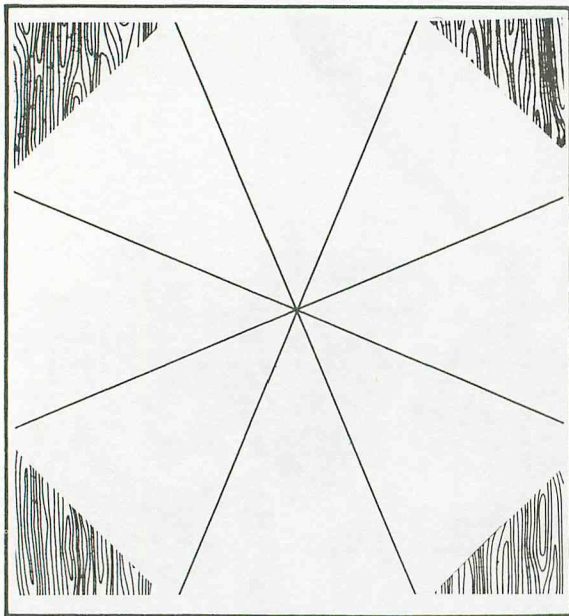


Fig. 6-14. Layout for determining hexagonal sides. Shaded area is sawed off.

wood for the construction of basically flat objects less than 12" in width or diameter. Its utility, even versatility, lies in its strength and in its availability in large sheets (4 by 6 feet and larger). Its surface grain and texture, however, are quite attractive if thought is given to using it for the production of unusual effects. This simple clock face combines a bit of the traditional (the octagonal outer rim) with the modern (omission of Arabic or Roman numerals). Completion time, excluding finishing, is less than 2 hours. Overall measurements are 12" $\times$ 12" $\times$ 1/2".

Tools and Materials

Wood 1 piece exterior plywood; 1 piece interior plywood; 1 piece dowle, 1/4" in diameter, 4" long.

Jigsaw or sabre saw.

Sandpaper, coarse, medium, and fine.

Wood glue.

Clock movement with hands.

Large compass.

Protractor.

Circle cutter.

Lathe with faceplate.

Gold enamel paint, brush, turpentine (optional).

Procedure

Draw a circle on the exterior plywood (Fig. 6-14) piece as close as possible to 12" in diameter. Draw a vertical and a horizontal dead center through the board. Using the protractor, carefully divide the circle into eight wedgelike segments, 45 degrees each. Draw straight lines from one radiating line to the next at the points where they intersect the circle. Saw off the excess wood outside of these lines to produce the octagon.

On the piece of interior plywood draw three circles: 10", 8 1/4", and 6" in diameter. Turn or saw off the excess wood outside of the 10" circle. Center the piece in the middle of the exterior plywood. Mark the position lightly, remove, and coat the back with wood glue. Then reposition. The grain should be positioned to create the most desirable effect (Fig. 6-15).

Mount the composite on the faceplate and turn off the 1 1/4" groove between the innermost line and

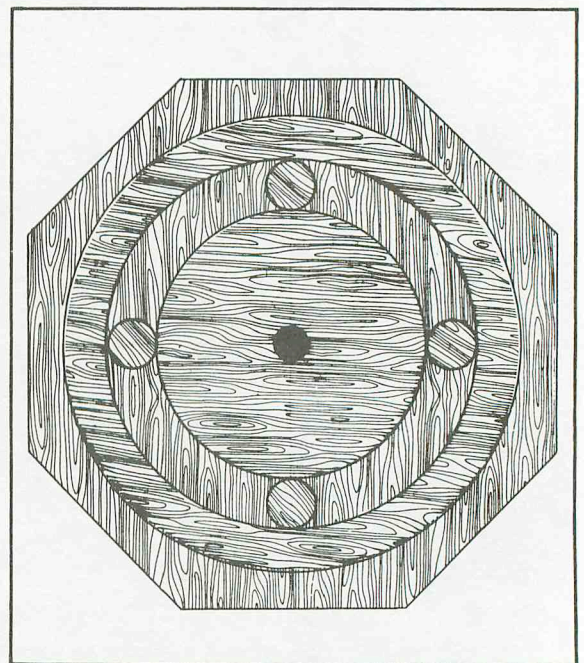


Fig. 6-15. Drawing a clock face. Grain flowing up and down is on back board. Ring with grain from left to right is top piece. Section with discs on it is turned down to backboard.

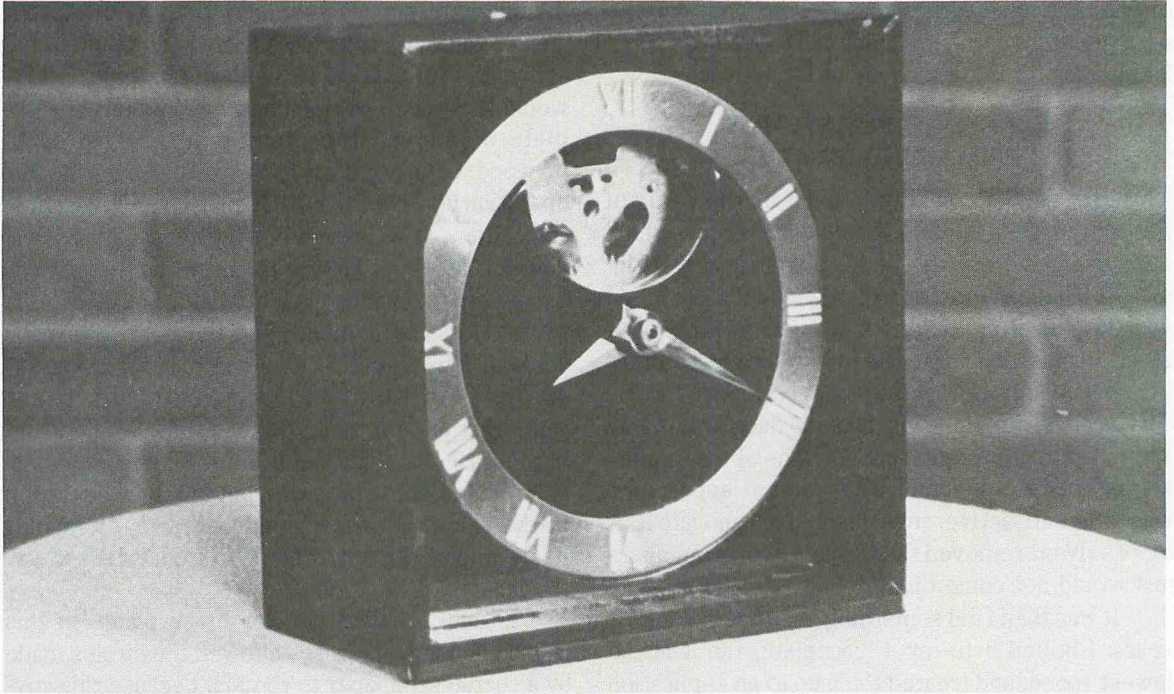


Fig. 6-16. Black acrylic face was grooved so that chapter ring could be inlaid. Center cutout was replaced until groove was cut.

the one next to it. Gouges and skewes can be used but remove only the top piece to the glue surface. Try to avoid lifting any of the surface of the octagonal piece. Sand smoothly and position discs cut from the dowels in the 3, 6, 9, and 12 positions in the groove. Glue in permanently. The gold paint may be applied in the groove with a brush if desired, but the piece has a nice appearance if two or more coats of polyurethane wood finish are applied.

GROOVES FOR INLAYS

The name of this clock case (Fig. 6-16) could be "Brass in Black." It was designed around a French battery powered movement by Bayard. The movement is unique in that it has a number of white plastic cams and eccentric pins. Oddly enough, the hands were situated at the lower portion of the movement, which is why only a 2" hole (somewhat reminiscent of the moon disc on a grandfather clock) was required at the top. The hole to expose the movement was cut before it was decided to turn a groove in the face and inlay a brass chapter ring with

white numerals. The face was mounted on the faceplate with double-sided tape. (This was my first try with this technique, but since 3M came out with their extremely strong "rug" tape I have used it repeatedly.)

In order to reduce the chatter and bumping when the cutting tools crossed over the hole, the piece that had been removed was replaced, also with double sided tape (a temporary measure). It worked admirably—the chisel seemed to glide along at the lathe's lowest speed. The outer and inner limits of the groove had been marked off with the point of a skew while the faceplate rotated. The machine was stopped periodically and the depth of the groove was checked. Toward the end, the chapter ring was laid in the groove to determine its fit. The outer edge of the groove was turned with great care so the final placement of the chapter was a bit of a press-fit. The back of the ring was coated with cyanoacrylate, and it was held in place for a minute or two. The contrast between the black acrylic, the brass hands, chapter ring, and movement showing

through the window is striking. The hands and the adjustment for fast/slow movement are set from a large hole in the back cover of the case.

REMOVING SCRATCHES FROM METAL PLATES

This little vignette is here to point up the verity of the old adage, "Nothing is new under the sun!" Someone gave me the clock pictured here (Fig. 6-17) with the admonition that I could do anything I wished with it as long as it was not returned. Of recent origin, it had an aluminum face with lithographed numerals that had been lacquered over. The hands were missing and the face was badly scratched to the extent that portions of the numerals had been obliterated. The general appearance was rather attractive, and I decided to renovate it. A bit of solvent removed the lacquer but the numbers just would not come off.

It was then I did something I had been doing for years: I bolted it to my 4" faceplate, ran it at the lowest speed, and treated the face to an application of medium sandpaper. The effect was apparent immediately (Fig. 6-18). When all traces of the print-

ing ink were gone, I switched to a fine sandpaper and worked with this. Note that in the photo of the completed renovation some corners are dark. This would have been avoided had I used a larger faceplate or backed the aluminum up with some plywood. Great care has to be exercised during this operation not to let the sandpaper get out in front of the corners. The plate will beat the sandpaper and your hand to death! It was not necessary to go to an extremely fine sandpaper in an effort to polish the plate. After the numbers and the dots have been applied, I treated it to two coats of clear varnish spray. This fills in the circles made by the sandpaper and protects the numerals, which were, in this case, rub-on type. Steel wool will do almost as well in cleaning the plate, but if it touches the nut in the center it will be snatched away, wrapping itself around the nut. This is disconcerting to say the least.

I have polished circular brass plates in this fashion and in some cases allowed the circles made by a coarse sandpaper to remain, because this covers up the deep scratches and is pleasing to the eye. When this method is used, the varnish should be

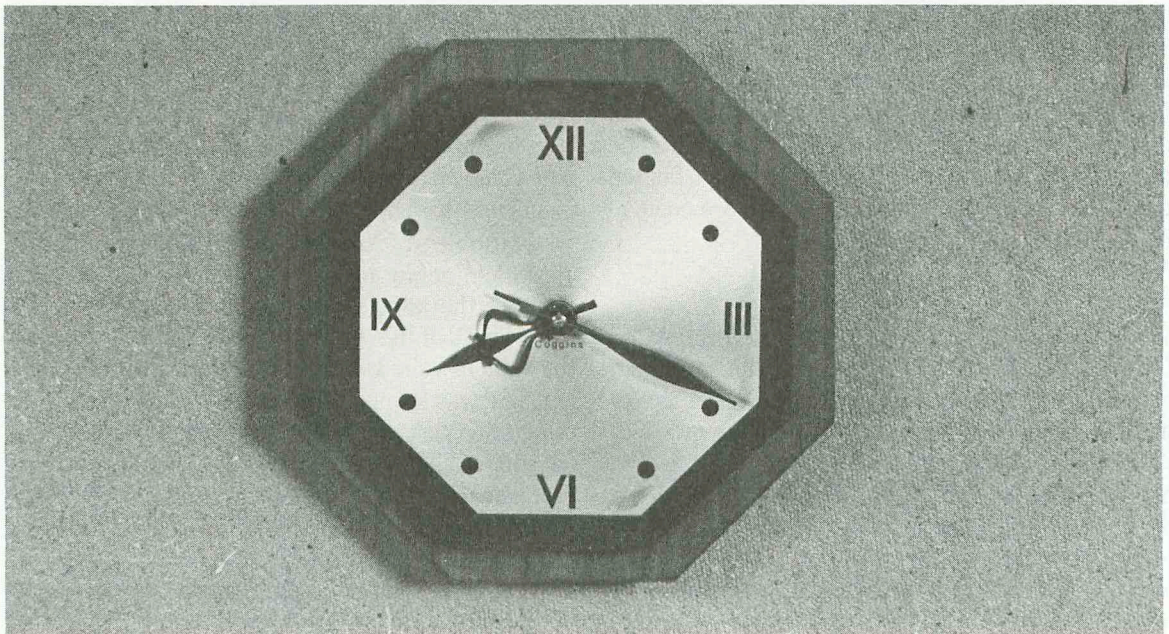


Fig. 6-17. Clock face was refurbished by applying sandpaper to it while it rotated on faceplate.

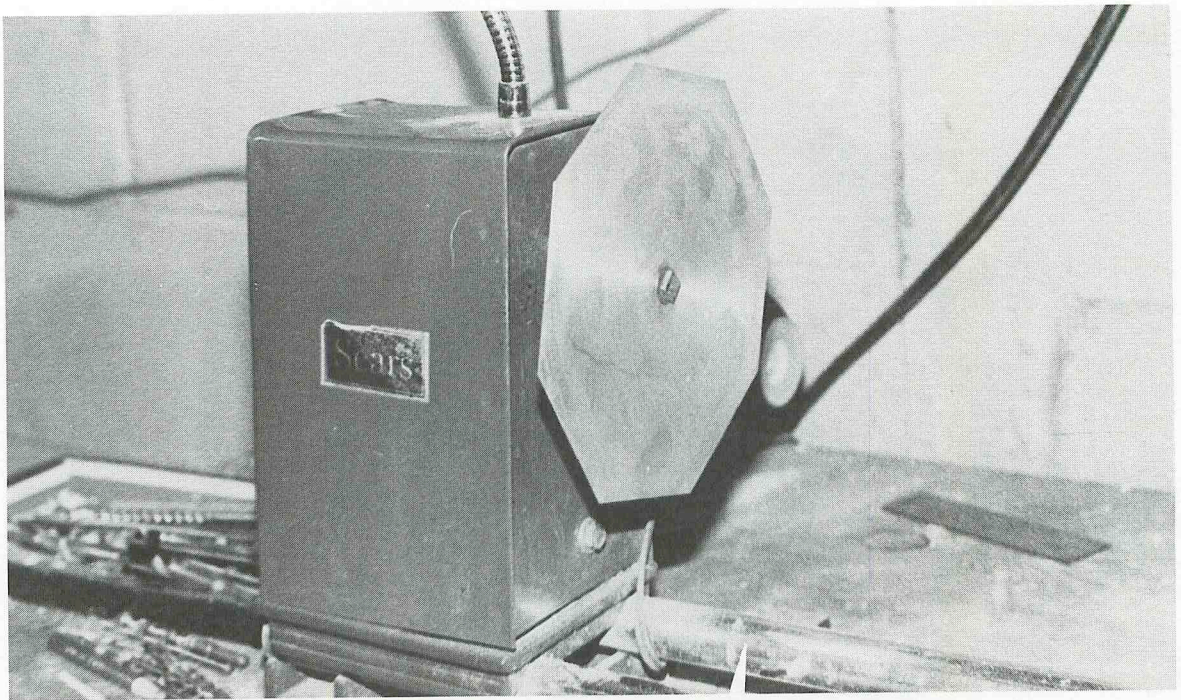


Fig. 6-18. Aluminum face plate with original markings sanded off.

applied very lightly. The reference to “Nothing new . . .” is explained by the fact that, while browsing through an old horological book printed before 1800, I came across the suggestion that scratches be removed from brass plates and dials in this manner!

The face of the black acrylic clock shown next (Fig. 6-19) and its pendulum were turned with coarse sandpaper resting against them. Here, the surface turns whitish after the sandpaper is applied. This will happen with acrylic of any color. After the surface has been abraded sufficiently, it is treated with a plastic polish. Mirror-glaze is one of the best, removing the ashy cast almost immediately.

TURNING CIRCLES

It is obvious that the captain’s wheel clock (Fig. 6-20), could not have been turned on the standard home shop faceplate, which has a swing rarely in excess of 12”. The round portion here is 13” in diameter. I show it to elaborate on the technique of turning rings. Here is a method of turning a circle that is recommended by many authorities.

First, mount the workpiece on a backup piece of wood, and screw this assembly to the largest faceplate available. Shape the perimeter and do the inside, eventually taking the cuts all the way into the backup plate. Remove the backup piece from the faceplate and mount a piece at least 2” thick. Measure the inside diameter of the circle in progress and mark this on the new backup piece. Now cut away the material outside the circle marked until a projection remains in the center. The circle being worked on must fit over this protuberance (normally called a *spindle chuck*) very tightly—a true press-fit. Now the remainder of the waste can be removed from the back of the circle.

In the case of this clock, the back would be flat for hanging on a wall. The curve from the front could be carried around to the back almost out of sight. In the back, remember to turn off a flat on the inner perimeter so that the dial can be mounted securely. This clock is fitted with a quartz battery movement so excess weight is not a problem. The handles are, of course, spindle turnings with a tenon turned on the end with the bead. Many captain’s clocks have

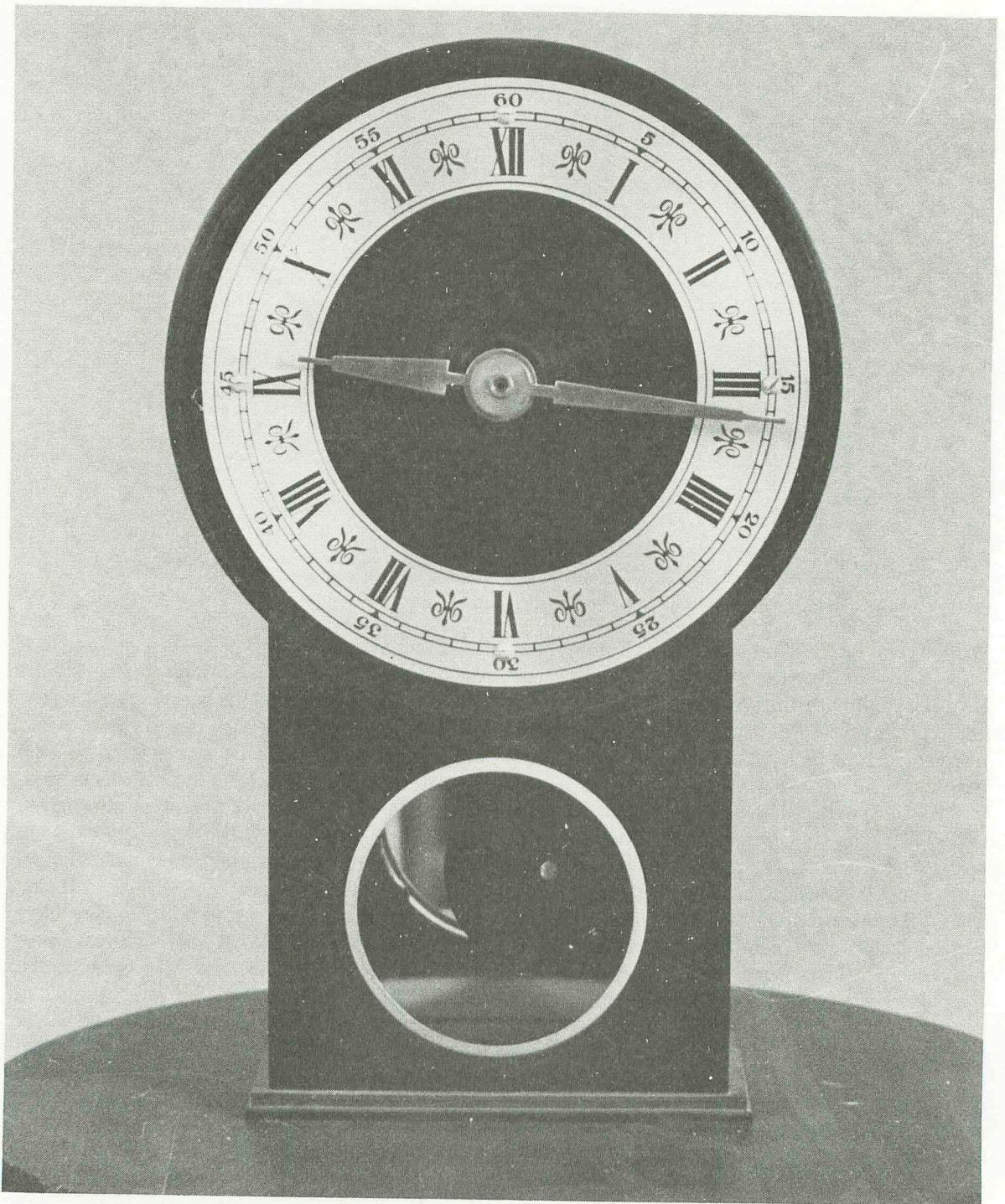


Fig. 6-19. Black dial plate was run on lathe faceplate with medium grit sandpaper held against it to produce concentric whirls. Pendulum bob got the same treatment.

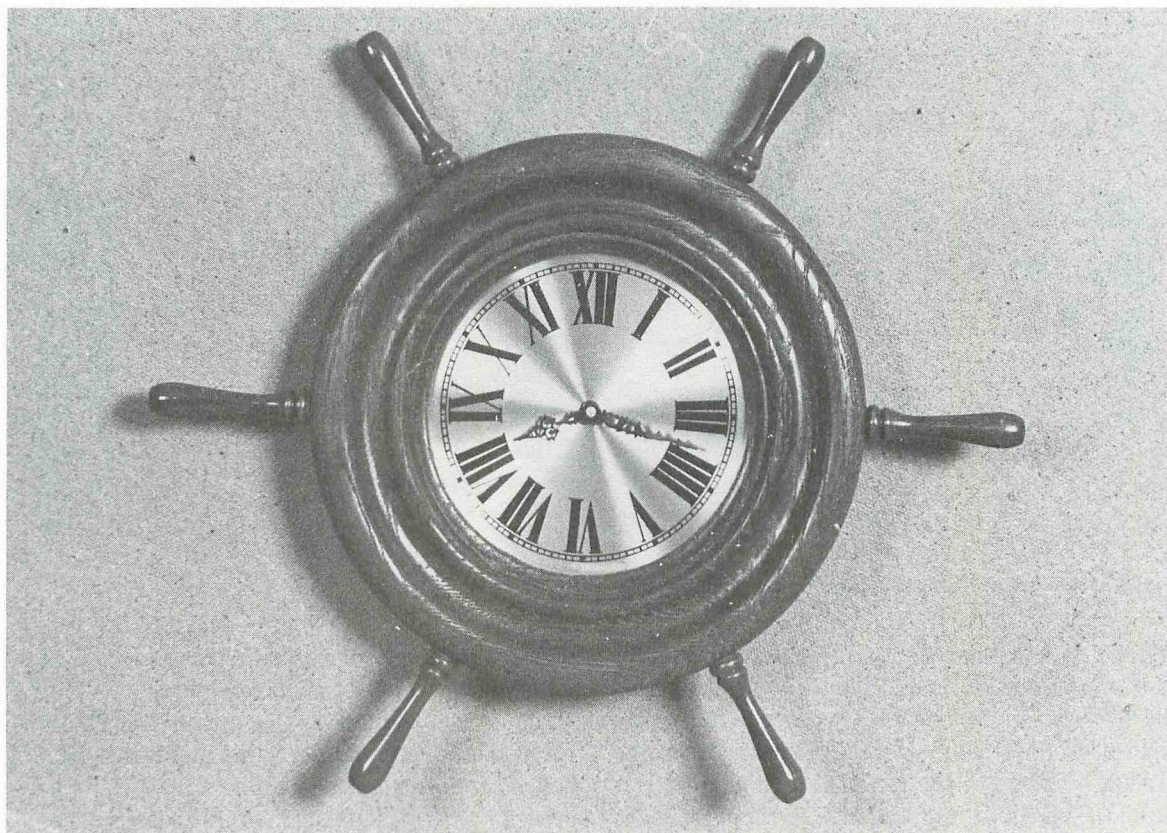


Fig. 6-20 Ship's wheel clock is always a good faceplate project.

eight handles positioned equidistant from each other. If the overall size of this clock was reduced to fit within the swing of the lathe at hand, the length and general diameter of the handles would have to be reduced proportionately. I have a smaller electric clock from the early '20s that is $6\frac{1}{4}$ " in diameter and is fitted with 1" brass handles. This may be a truer relationship of handle length to outside diameter than the example shown here, because I did this one by guess and by golly!

There is still another method that makes use of what is called a *recessed chuck*. Here, a screw center is used to mount the workpiece. A backup board can be used. Just about half of the circle is turned. The outside can be turned almost completely round, but one half the waste must be removed to the backup board on the inside. The piece comes off the faceplate at this point, and a recessed chuck is made up.

Most oldtimers call this a *cup chuck*, and it is best described as a bowl turning with a flat center and absolutely straight inside wall (except when it is made up for turning balls). It must be deep enough to accept the circle being worked on and hold it firmly. The circle must be pressed in so that there is no movement. The circle has been reversed, of course, and it is a simple matter to turn off the waste still remaining inside the center.

DESK CLOCK

There are some similarities between this turning (Fig. 6-21) and the one represented by the frying pan clock except, perhaps, that there was much more work done on the side of this one. The workpiece was about 2" thick and about $4\frac{1}{2}$ " in diameter. It was glued to a backup board with paper interposed and fixed to the faceplate with a screw center

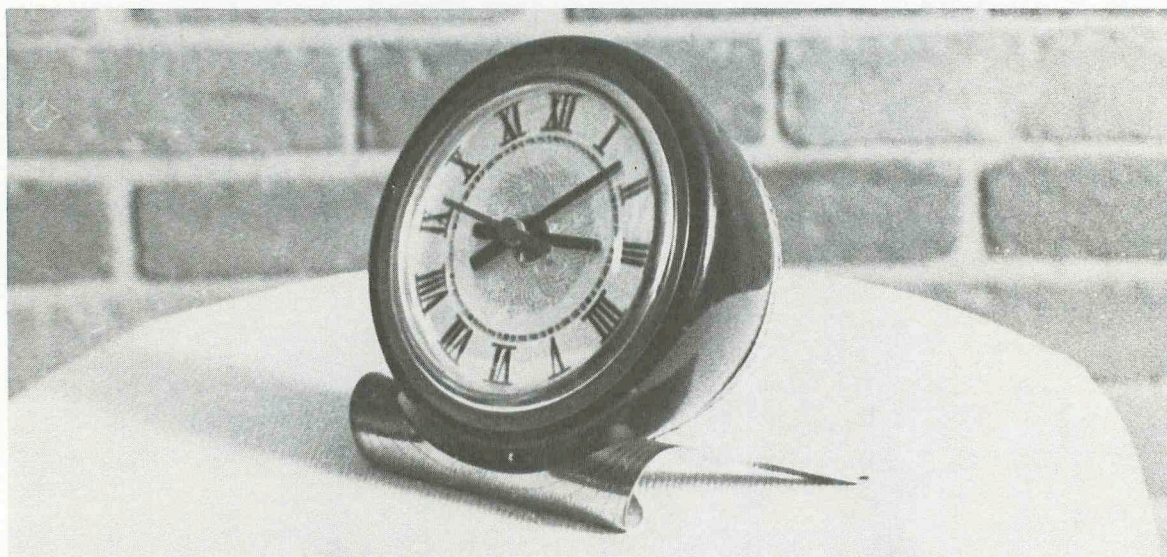


Fig. 6-21. Desk clock with little case turned of mahogany.

and four screws. For some reason, I always prefer to do tapering with the small dimension away from the headstock. A parting tool was used to reduce the right-hand end to the correct diameter, then the gradual slope from the faceplate to the right was turned. The curve from the side to the front plane was very slight and could be worked without reversing the piece on the faceplate. The waste in the center was removed straight through to the back. A compact quartz movement was fitted to the bezel, dial, and dial plate from a Lanshire movement. The assembly is held in the turned case by projections on a collar in back of the bezel. They are twisted away from the collar just enough so that they will retain the movement inside the wooden turning when the bezel is pressed in from the front. The little stand was salvaged from another clock. It is not unusual for desk clocks such as this to be mounted on short lengths of dowel with nicely turned ends and two beads $\frac{1}{4}$ " inboard, front and back, to raise the clock off the desk surface. This is seen more often, however, when the design is a truly vertical one.

ROUNDING OUT A CUBE

The object pictured here (Fig. 6-22) can best be described as a challenge to a turner's infinite pa-

tience, a harbinger of frustration or, when it works, a testimony to his consummate skill. It is a cube within a cube and, because of points on each of the inner planes, it could be called a star-in-a-box. It defies the layman to determine how it could have been turned on a lathe and yet it has been done for more than 100 years in porcelain, ivory, and wood by the Chinese and natives of Singapore. John Jacob Holtzapffel explained the technique and illustrated it profusely in his book, *Hand or Simple Turning* (reprinted by Dover Publications, Inc., New York). I present it for a number of pertinent reasons. First, it is faceplate turning. Second, it was made without the aid of any commercially available accessories. Third, I did it both with clear acrylic (the cube pictured) and with polyester resin. It is a fine example of my earlier discussion about the fourth dimension of plastics, both as an art form and an everyday working medium.

The commercial accessories required to make the project a lot less difficult and time consuming (though not guaranteed to increase the success factor) would be a four-jaw chuck and set of unusual boring bars, the latter not necessarily available at all in the form they were used here. It is my firm conviction that if the step-by-step instructions included here are followed carefully, the cube can be

made by anyone with a little faceplate turning experience.

One debate that might be entered into is the preference of acrylic over polyester resin. Part of the answer lies in their availability at any given moment and in their initial cost. An acrylic cube with 2" dimensions would cost in the neighborhood of \$8 at a plastics supply house; a polyester resin cube could be made from a liquid pouring for \$2 maximum. The acrylic cubes do turn up, however, slightly scratched perhaps, as parts of an unwanted photo cube assembly or as products of an obsolete advertising campaign when they may be purchased for as little as 50 cents. It's an item that could be added to a compilation of items "to be purchased when they are come upon by chance."

Acrylic is intrinsically much clearer when viewed with light behind it. One inherent disadvantage to be considered is that it tends to heat up much quicker than polyester resin when worked and may even craze in areas that have been turned to a thin wall. Polyester resin does not heat up nearly as quickly as the acrylics but unless purchased from a good original source in its liquid form it will gradually turn yellow with age. Polyester made by the Reichhold Company, I have found, will retain its clarity indefinitely. About 15 years ago, a noted restorer of paintings was experimenting with some plastics in his work. He queried the manufacturer as

to how long they would last because archivists and restorers normally think in terms of 75 years elapsing before an object has to be refurbished, barring accidents. "Oh, they'll last a lifetime," he was told. "But how long is a lifetime?," he persisted. "Twenty years!" was the answer. Plastic engineers inform me that he was misinformed in the light of what has transpired in the field in the last 15 years. My experiences confirm this.

All plastics exhibit a definite shrinkage as soon as they are poured, extruded, molded, or rolled. In some the shrinkage ceases completely upon curing, often in as short a period as 48 hours. Others, adhesive-backed sheeting, for example, may shrink as much as $\frac{3}{8}$ " over a period of several years. Acrylic, which can be purchased in sheets, tubes, cylinders, cubes, and many other shapes, is usually completely cured when it reaches retail outlets. Still, a 2" cube may be $\frac{1}{8}$ " short on one dimension, thus requiring careful inspection prior to purchase.

All these factors are worthy of consideration when selecting either of these plastics. Polyester resin, for the layman, has the distinct advantage of accepting coloration in the formative (pour) stage, either by dye or pigmentation. Conversely, colored acrylic sheet can be laminated under heat and pressure noncommercially, which cannot be ignored. In summary, polyester appears to be a bit more accessible to the average turner in a form and for a price

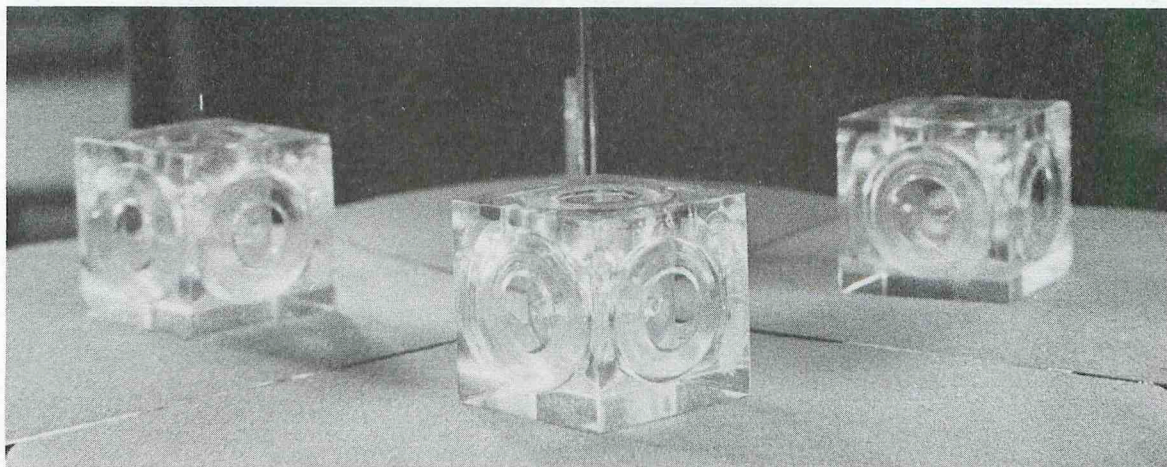


Fig. 6-22. Cube (with mirror images) turned from acrylic. Inner cube has point on each face. Special boring bars are used for hollowing out.

with which he can live and have free rein with color.

STARTING THE CUBE

Using a china marker, mark each plane or face of the cube with diagonal lines. Add vertical and horizontal lines $\frac{3}{8}$ " in from each edge. Put a mark $\frac{3}{8}$ " to both the right and left of center.

A cup chuck (in lieu of a chuck with four jaws) is a prerequisite for this project. Mine was made from two pieces of wood 6" square by $\frac{5}{8}$ " thick (Fig. 6-23). The center was determined by the diagonal line method, and a circle touching the four sides was drawn on one piece. A square, just large enough to allow the cube to be pressed in, was cut in the center of it. The two pieces were glued together and the unit further strengthened by four brads carefully placed close to the outer circumference. The corners were cut off, the unit was mounted on a faceplate, and then turned round.

Another piece of the same wood from which the cup chuck was turned was used to make a *hold-down cover* (Fig. 6-24). A hole $1\frac{1}{2}$ " was cut in it with a circle cutter. The cutter was moved out to within

$\frac{1}{2}$ " of the perimeter and run down into the wood to a depth one half its thickness. The waste was turned off. The chuck on the faceplate is mounted on the mandrel at this point and the cube pressed into it (Fig. 6-25). The white circles which appear on the pigmented cube are the result of drilling into it with a $\frac{5}{8}$ " hole saw. (This method is not as effective as the procedure that follows.) The cover is locked on the cup chuck at this time with two $\frac{1}{4}$ " bolts, preferably flathead (Fig. 6-26). The hole in the cover leaves plenty of room for working with the turning tools. The cover, as shown, (Fig. 6-27) may seem a bit like "overkill" or overdesigning but the tools put a lot of stress on the cube. With the cover, there is no way the cube can be dislodged (Fig. 6-28).

Rest the china marker on the mark to the left of center on the face and turn the lathe on briefly. This will make a circle $\frac{5}{8}$ " in diameter right in the center (Fig. 6-29). Remove the waste to a depth of $\frac{1}{4}$ " in the area bounded by the $\frac{5}{8}$ " china marker circle. Leave a tapered projection right in the middle (for the star point that appears in each plane). Now proceed with a boring bar with a short left-cutting

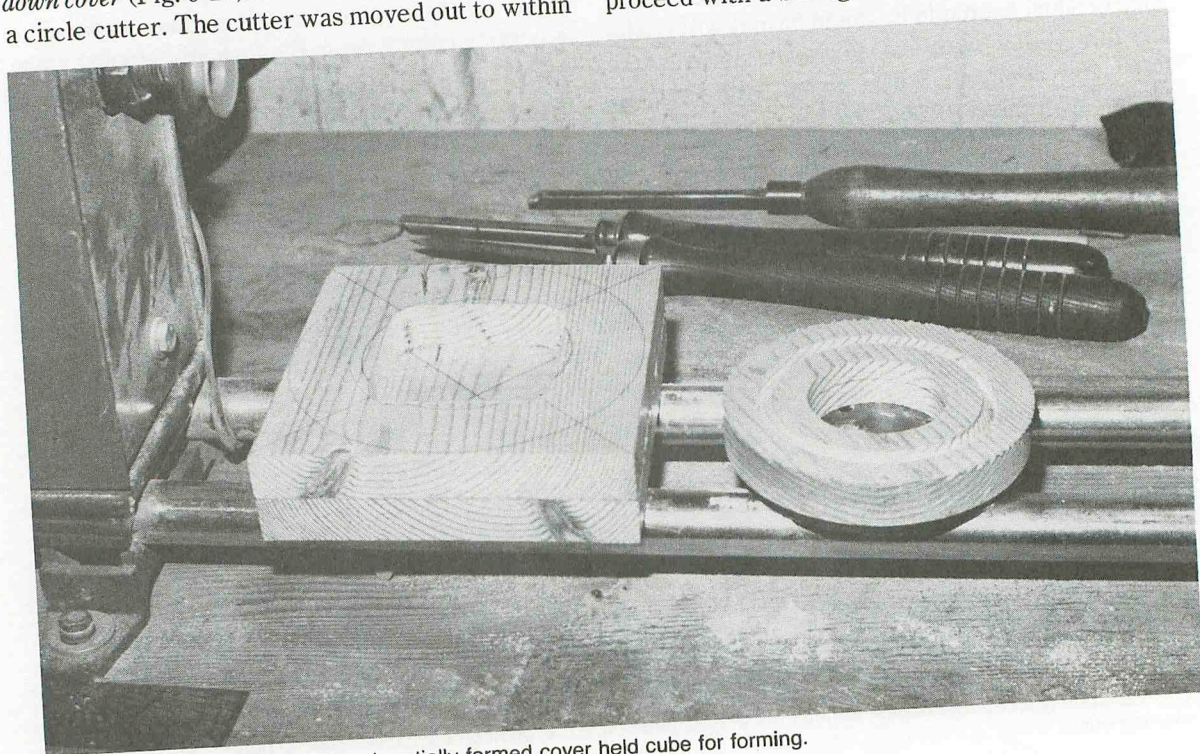


Fig. 6-23. Cup chuck of wood and partially formed cover held cube for forming.

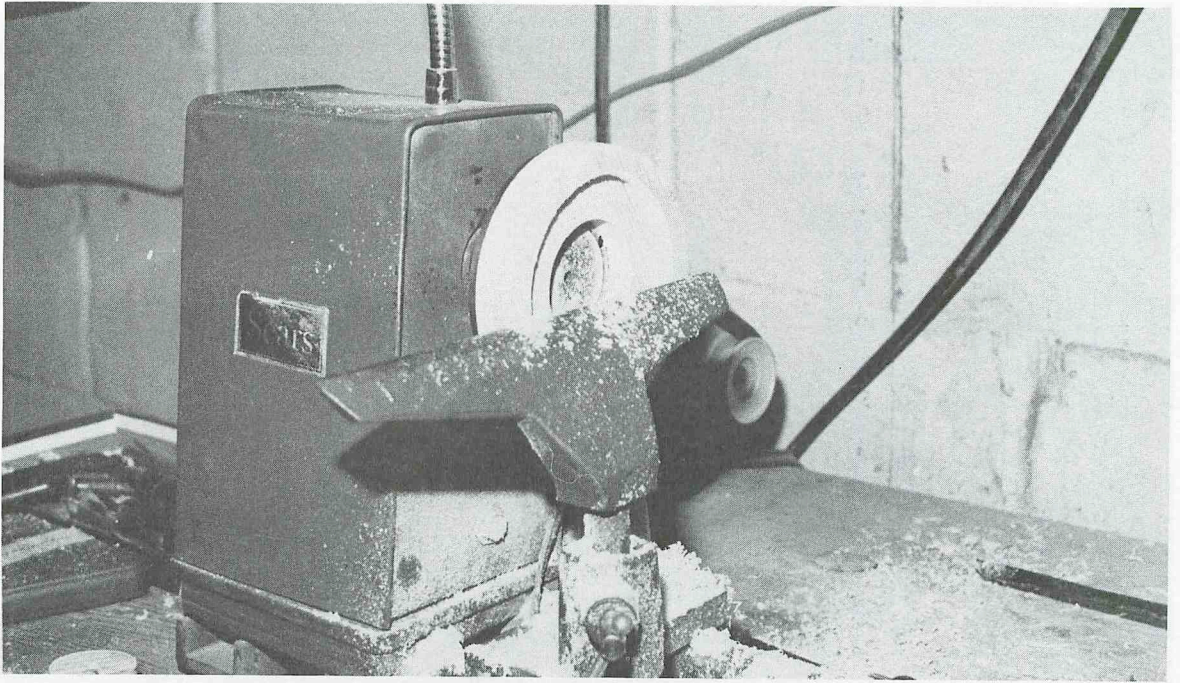


Fig. 6-24. Waste is turned away in center of cup chuck cover.

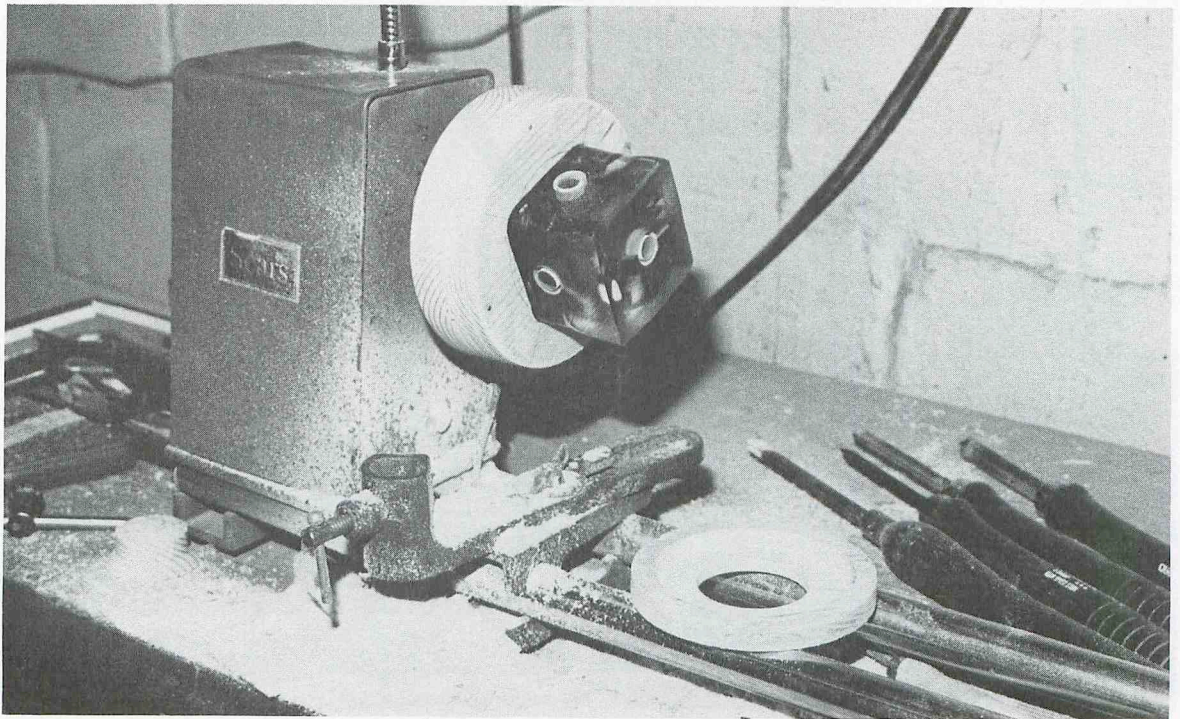


Fig. 6-25. Cube is press-fitted into square aperture in cup chuck. Cover lies on lathe bed.

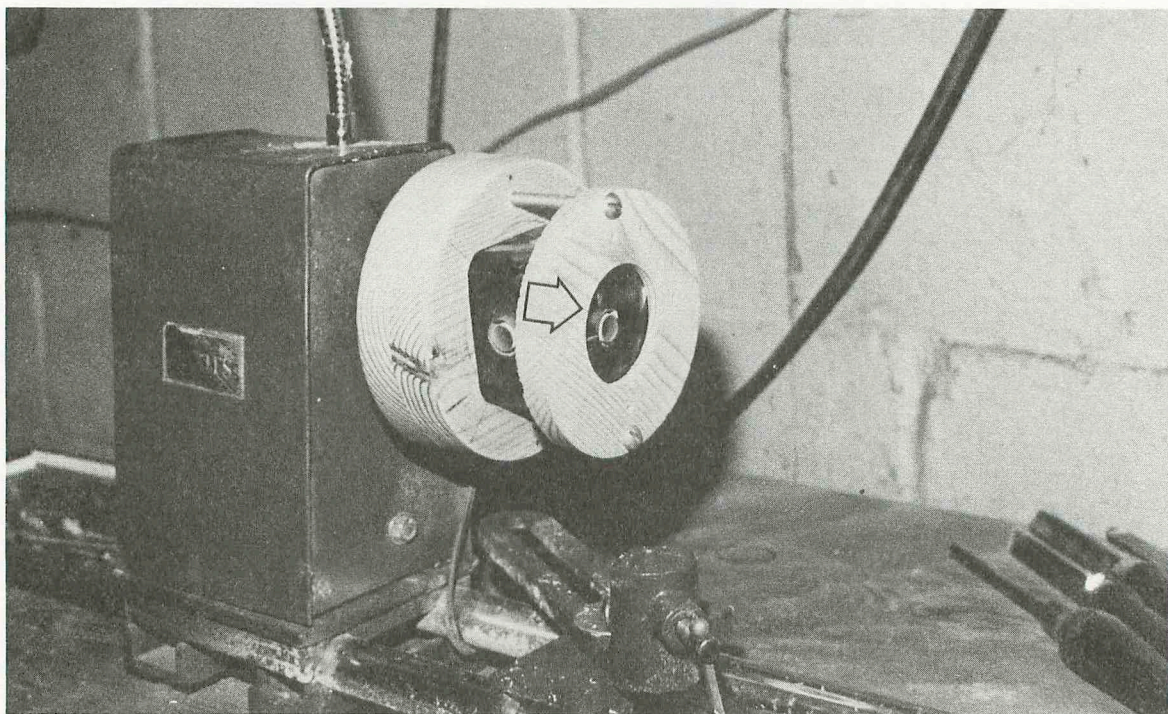


Fig. 6-26. Waste is removed through hole in center of cover (arrow).

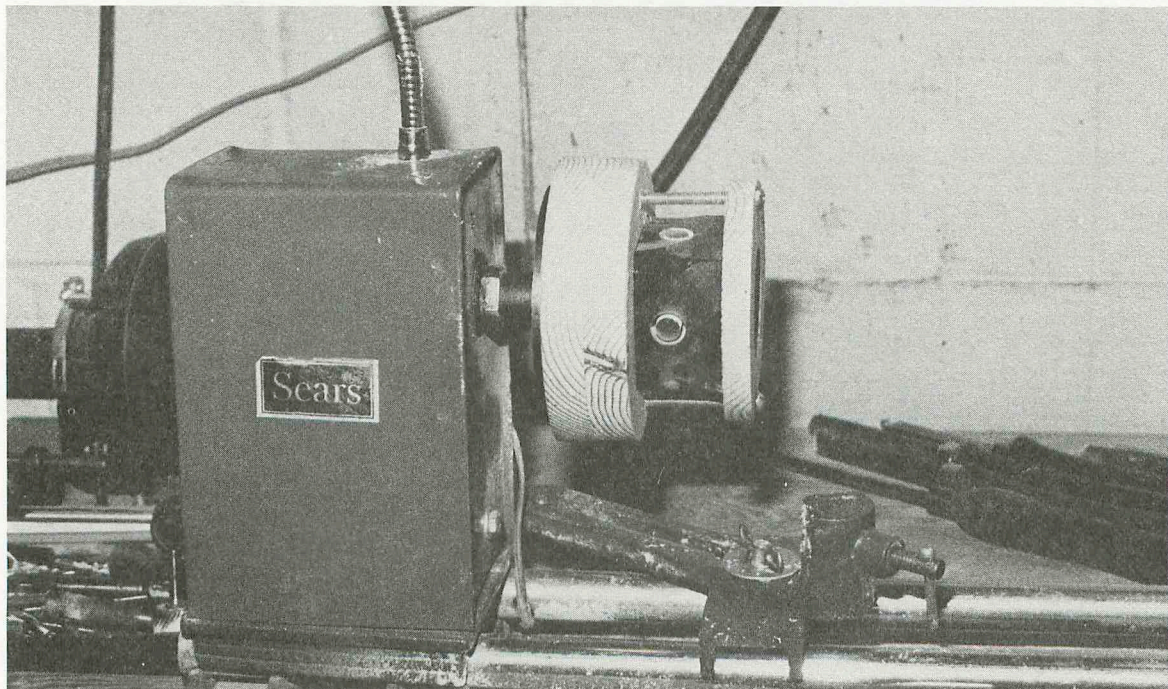


Fig. 6-27. Bolts, through cover, are threaded into cup chuck. Flat-head bolts should be used.

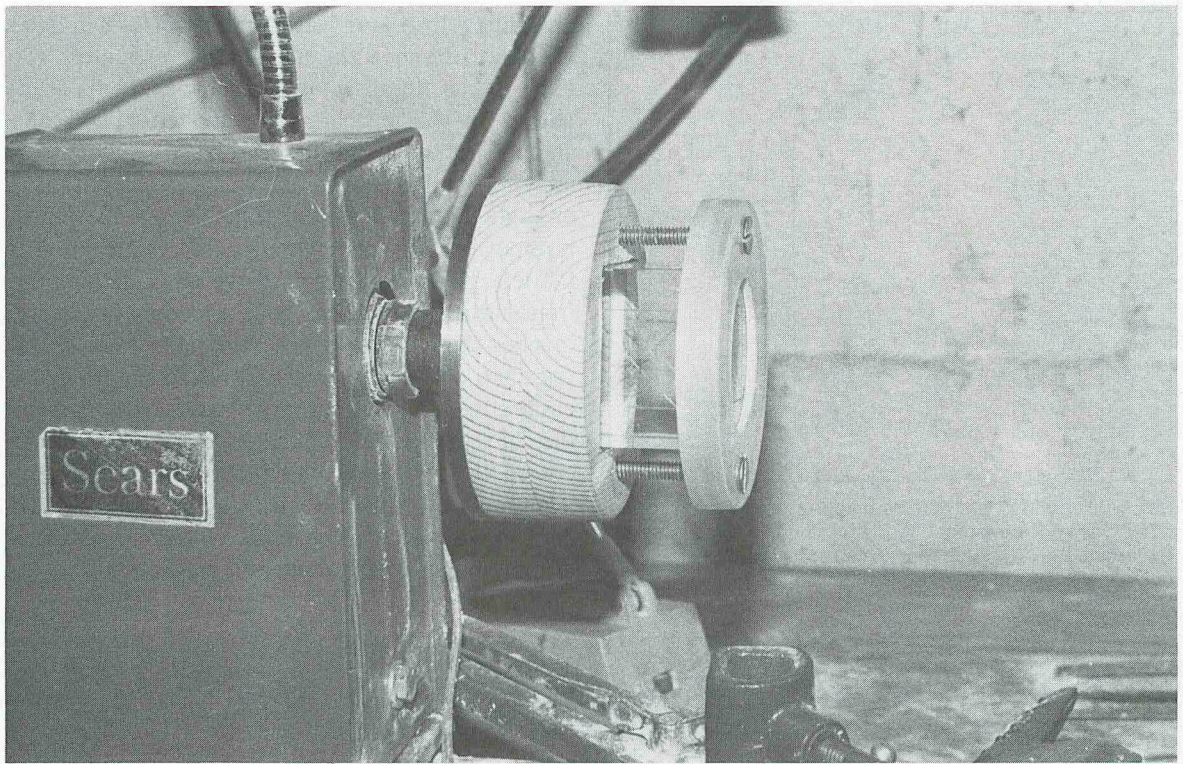


Fig. 6-28. Acrylic cube with guide lines marked on each face.

projection (Fig. 6-30), working it behind the circle about $\frac{1}{8}$ " in from the surface. Work to the left, holding it perfectly level on the tool rest until the shaft touches the lip of the circle. The cutting edge of the tool is ground back underneath quite like an ordinary woodworking chisel but with a much sharper angle (between 45 and 60°). When cutting properly it turns off thin, ribbonlike streamers of waste that must be frequently removed from the orifice. Extreme care must be exercised when removing the tool (Fig. 6-31). It must not be allowed to contact either the projection in the middle or the front plane area from which material has been removed. In the case of polyester, a piece of the lip area may be knocked off or the partially formed point in the center may be lost.

When the shank touches the lip of the circle on the left no more material can be removed. A tool with a longer extension, with the cutting edge farther from the shank, must be substituted.

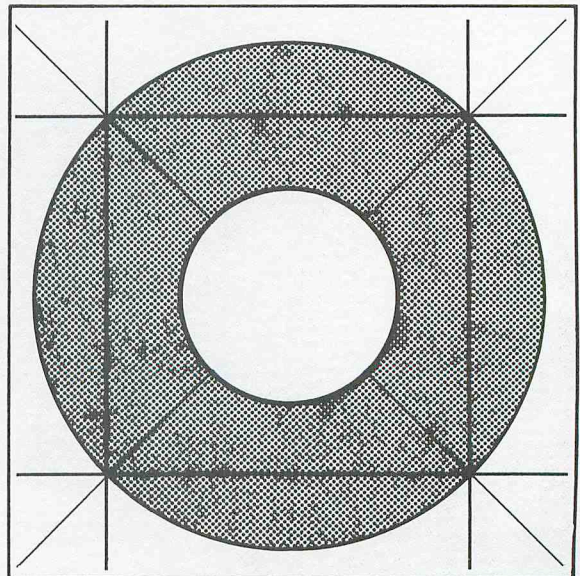


Fig. 6-29. Shaded area is turned away behind each face to depth of $\frac{1}{2}$ ".

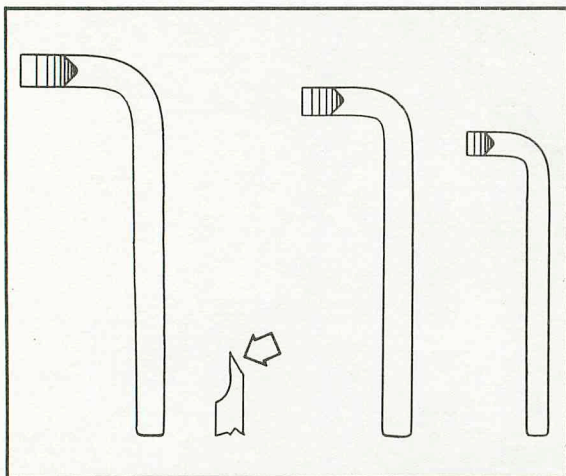


Fig. 6-30. Boring bars can be made of hex wrenches and other steel stock. Distance from tool's cutting edge to shank must increase with each tool used. Arrow indicates top view of cutting edge.

Three tools or left-handed cutters may be needed to remove the material far enough to the left—to the outer guide lines. During this work period, the boring bars are removed periodically and parting tools and narrow bladed skew chisels are employed to remove the waste to a depth of $\frac{1}{2}$ " or slightly more. Manipulate the bar used last until it removes the waste right up to the vertical line of the left. Keep working until the circle behind the front surface, which has been widening gradually, touches the juncture of the vertical and horizontal lines at top left. (Fig. 6-32). Check to see when the circle covers all four corners of the square made by the china marker lines. When this occurs, the lathe can be stopped, the cover removed, and the cube taken out and replaced with the area just worked deep in the cup chuck receptacle. Work on the face directly opposite the one just completed.

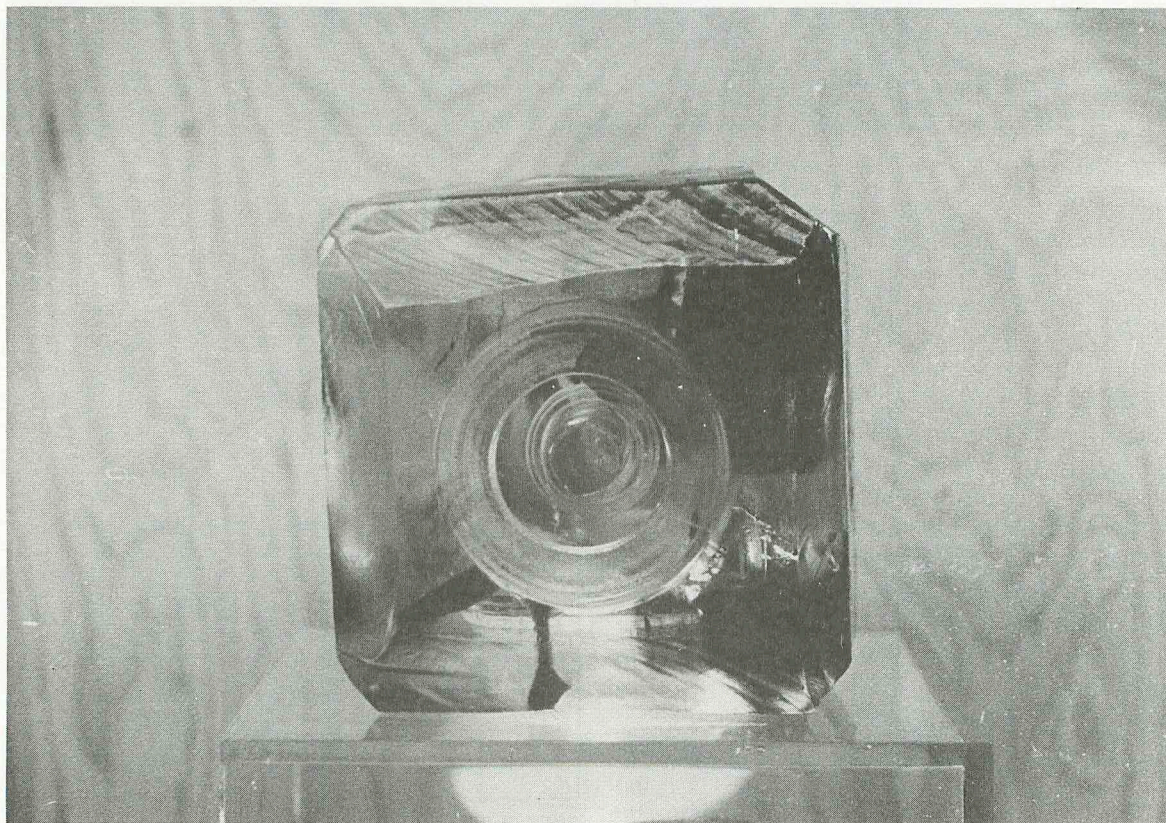


Fig. 6-31. Partially finished resin cube. Beveled edge will be turned away leaving partial ring or bezel on each face.

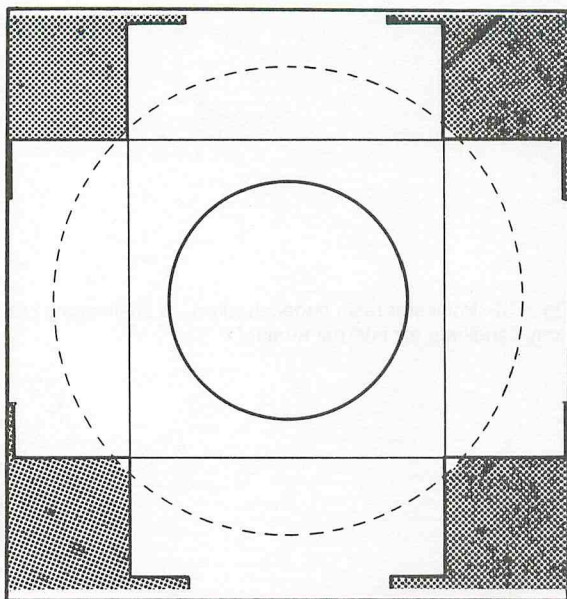


Fig. 6-32. Dotted line is outer limit of waste removal behind each face on cube. Only the shaded area is not removed when cube is completed.

At this point, only the guidelines indicate whether or not enough waste has been removed in these two faces. The third one turned will definitely show whether the first two are correct. When the bar approaches the outer limits on the third face, it will break through the walls closest to the center and start to form the corners of the inside cube. *This will not happen quietly.* The cutting tool will rap audibly and vibrate against the tool rest as the open areas close to the corners whirl past it. It is crucial that the cutting tool be maintained at maximum sharpness from here on. Keeping a bit less pressure on the tool will reduce the pounding somewhat, although it may increase the time it takes to complete waste removal from in back of the third plane and the others to follow. Removal of the waste behind the fifth plane will really tell the story. The cube with its projections on each face truly will have taken shape. One final decision has to be made here.

Removal of all the waste material behind the sixth face will turn the inner cube loose. It can be made to move around in the shell and one of the projections will drop into a hole and show through

any face held in a downward position. I chose not to remove the waste from behind the last plane on any of the cubes I've turned thus far. I believe the inner cube is much more visible when held in a fixed position. The thought of one of the projections being knocked off by someone idly juggling the cube from one hand to another is an anathema to me. With the last face untouched, the cube can be handled forever without damage unless it is dropped on a hard floor.

A cube was used to demonstrate this technique because it is just about the simplest geometric form with which to work—without a three-jaw chuck, that is. Three croquet balls await my boring bars, although wood will pose difficulties—you could bore through the outer shell inadvertently. With wood you would be working blind and against the grain for a large portion of the time required to turn the object. I'm toying with the idea of casting a polyester ball 3" in diameter, which should pose no problems and doubtless offer lots of pleasure in the process. And the ultimate, of course, the absolute *piece de resistance* would be to do a dodecahedron (Fig. 6-33). A cup chuck could be made to do one, because the dodecahedron has two opposing plane faces. The cover plate would have to be made of aluminum, light and thin, because there would be little space between the entry hole and the pentagonal edges of each plane.

SHAVING SOAP CONTAINER

This shaving soap dish (Fig. 6-34), quite familiar in every bathroom before the advent of aerosol foam, is really a companion piece to the shaving brush (Fig. 5-4). Some nostalgia buffs among us could probably identify the wood from which it is made. With the cover, dishes like these are beginning to be considered collector's items. This one even had the remnants of the original soap still in it. There were two available for sale when I discovered this one, and I regret not having bought the other one. Because this one has the original label in excellent condition, I refrained from using it as practice for my forays into ornamental turning. Does it bring back memories? The design is very plain and simple, yet used as a guide for a bowl turning, it would make a most suitable receptacle for hairpins or paper

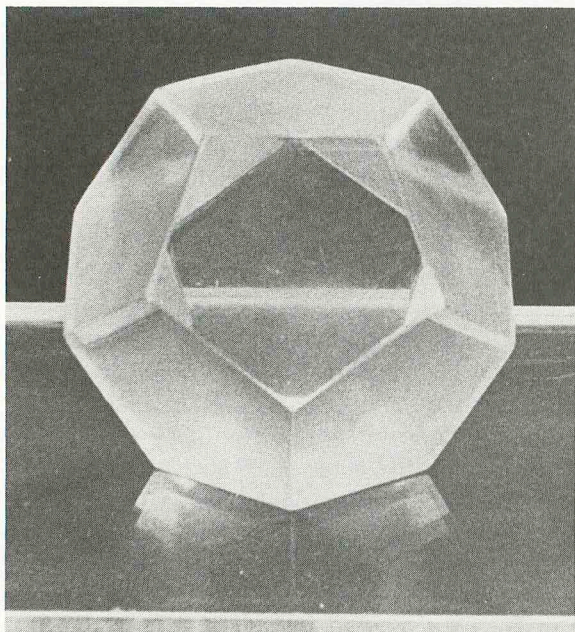


Fig. 6-33. Polyester resin dodecahedron—a challenging but likely candidate for internal turning!

clips. Laminating a blank prior to the turning would produce grain patterns which, with a proper finish, would delight the eye. Perhaps a single wood with a

pronounced grain would suffice without detracting from the simplicity of beads and circular lines scribed on both top and bottom.

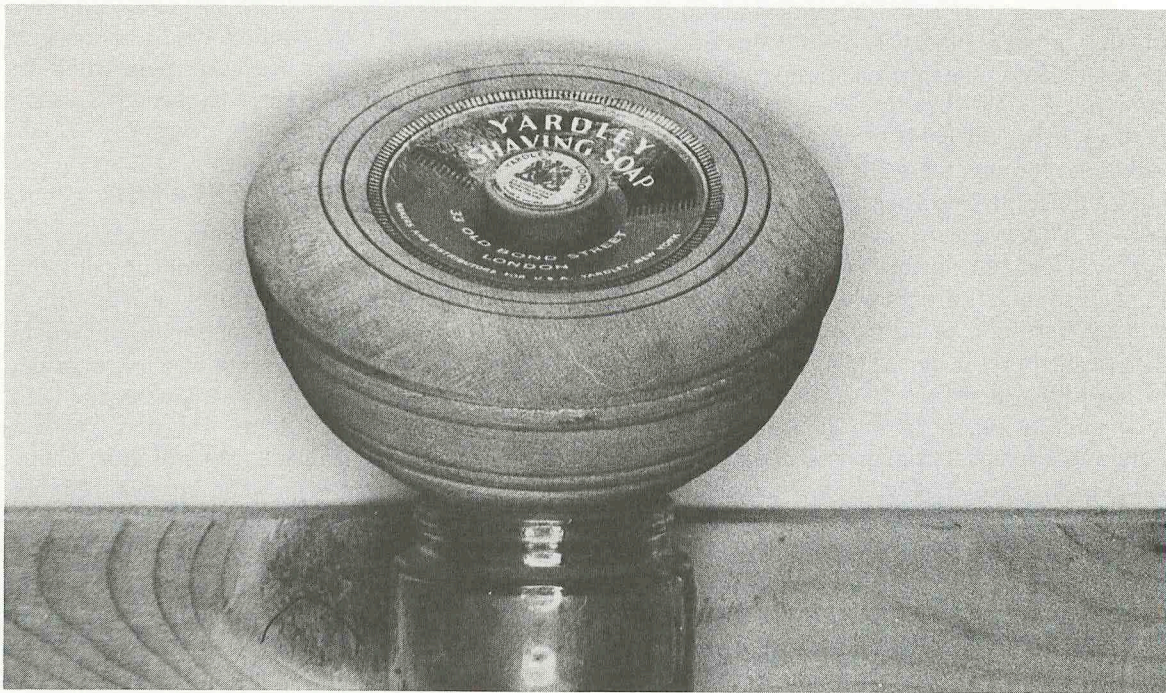
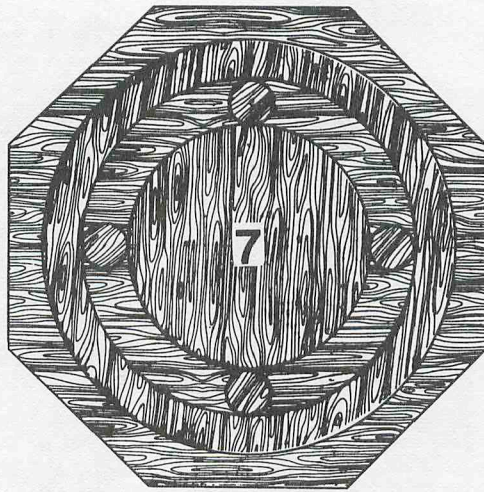


Fig. 6-34. Bowl-shaped shaving soap container, a faceplate turning with matching cover.



Architectural Turning

HOW MANY TIMES HAVE YOU COME DOWN A flight of stairs (indoors or out) and, at the bottom, paused to fondle the ball at the top of the newel post? Unfortunately, unless attention is called to it, few people really notice the artistry, born of the lathe, that embellishes, contributes to the structural support of a house. This use of the turner's work (Fig. 7-1) appeared on American houses as early as in the 1720s. Concomitant with this was the use of railings and balusters on seagoing vessels.

Architectural use burgeoned in the middle of the nineteenth century, and it is regrettable that many fine examples this type of lathe work can be viewed most frequently in the hearts of most of our decaying cities. Not only were there banisters and columns, the period saw an effusion of ornate decorations, frequently in the form of screens and other elements that became known as "gingerbread" (Fig. 7-2).

SCREENS AND SCRIMS

Much of this had its origins in the early African and

Eastern cultures. Some of the most exquisite examples of lathe work decorate mosques. In Arabia, turned wooden latticework was substituted for the window glass that we accept so nonchalantly. Innumerable pieces, made up of discs, dowels, beads, and collars, were fitted together to make these screens, which not only reduced the penetration of sunlight but kept the interiors of rooms inviolate from prying eyes. I made up a specimen of the screens described above with the components of a popular child's plaything known as the "Tinker-toy." The discs are joined by bits of dowel and at the base, collars. This little effort consumed a lot of time yet is extraordinarily plain and simple by Arabian standards. The dowels were often fitted with balls or beads and even what appear to be miniature spindle turnings. The patterns that may be produced are countless, with a lot depending upon how open the latticework was intended to be. The most significant fact is that these elaborate turnings were made on simple, primitive lathes that are still in use.



Fig. 7-1. Columns like these are increasingly rare, despite the trend toward the restoration of old houses.

In discussing the assembly of my little replica, two comments may be made. First and foremost, the simplicity is deceptive in that the dowels, although all of the same size, do not just pop together and remain that way while the assemblage is added to. It comes as a frustrating surprise to be fitting pieces together at one end only to discover that those at the other end have popped loose. Those who did this sort of thing as a livelihood must have been endowed, not only with superior skills, but with indefatigable patience.

Second, it has always been my desire to “make everything go to work and nothing go to waste.” In this context, I used my miniscreen as—what professional photographers call a *scrim*. This is a device that is lighted in such a way that it casts a strong pattern on a background in front of which an object is placed to be photographed. This technique was used quite frequently by commercial photo-

graphers before the advent of backgrounds depicting scenes (beach, mountains, etc.) were flashed on screens, thus bringing a lot of work back into the studio. It was also used in Hollywood. The screen itself, or a similar one, could be used as a background when positioned in back of the prime subject and positioned so as to register in soft focus.

THE RACE TRACK CLOCK

In December, 1976, a clock, designed by the sculptor Barney Bright and located in the River City Mall, Louisville, Kentucky, was officially started (Fig. 7-3). Known as the “Race Track” clock, because mechanical figures race on a miniature track in front of it every day, it is of interest here. The grandstand, resembling a gazebo in shape and design, is embellished with elaborately turned pillars and railings. That the participants in the daily race are representations of Thomas Jefferson, Louis



Fig. 7-2. The pillars are combined with lattice work and extend even to the sides of the house in the old tradition.

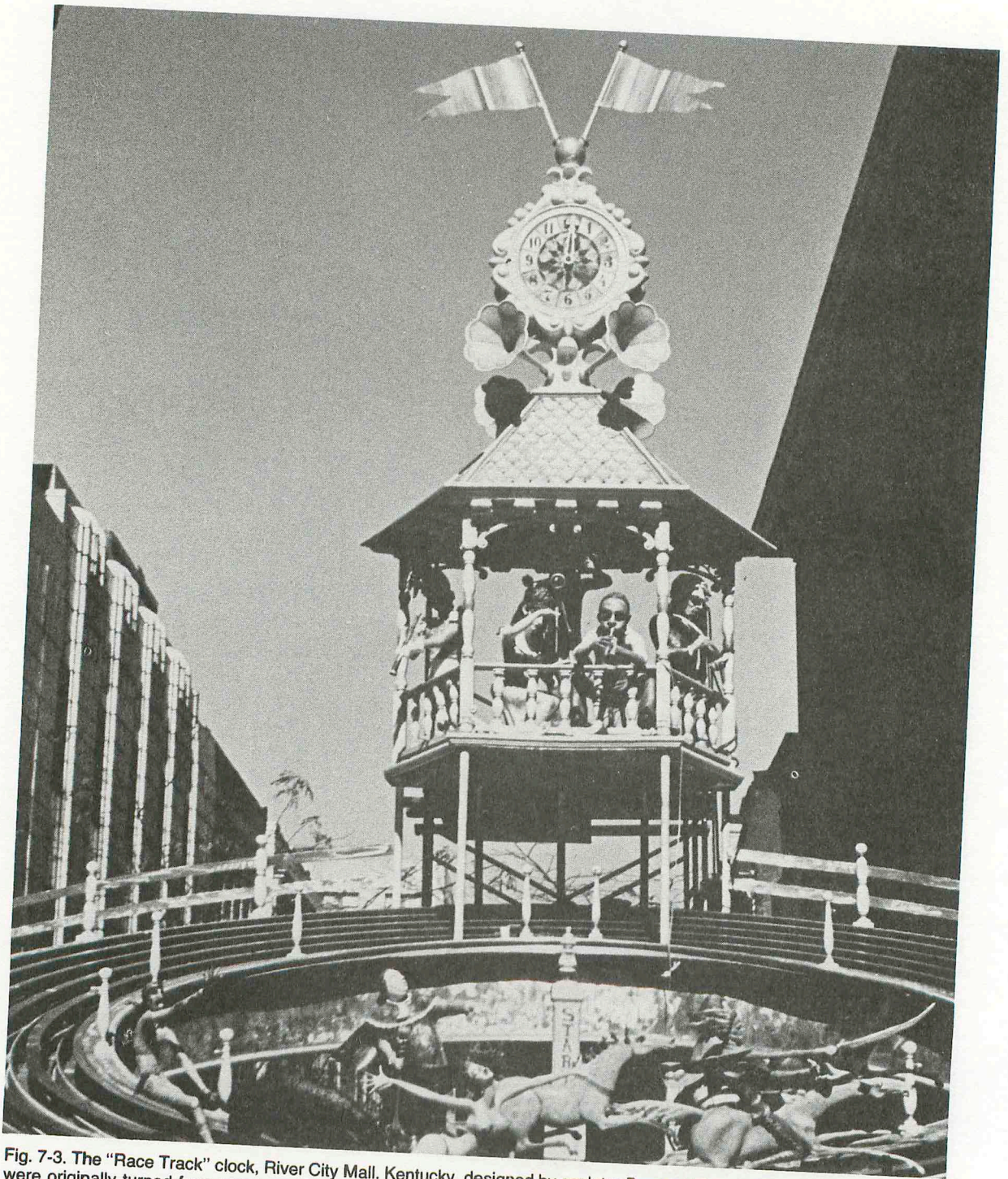


Fig. 7-3. The "Race Track" clock, River City Mall, Kentucky, designed by sculptor Barney Bright. All the pillars and balusters were originally turned from wood, and these turnings were used as patterns for the final aluminum pieces shown. Photo courtesy Charles Springer, Chamber of Commerce, Louisville, Kentucky.



Fig. 7-4. These columns are prevalent throughout New Jersey, indicating that they may be mass produced for small builders.

XVI, Daniel Boone, George Rogers Clark, and a paddlewheel steamboat is not as important as the fact that the clock will find its niche in the annals of horology, American folk history, and architecture. The variety of turnings depicted in this 40-foot-high "sculpture," and the subtle inclusion of faceplate and spindle representations are truly fascinating. Sculptor Bright, with the aid of mechanical and electrical engineers (the race is computerized), has cleverly tied the past and the present together into one homogeneous entity.

PILLARS

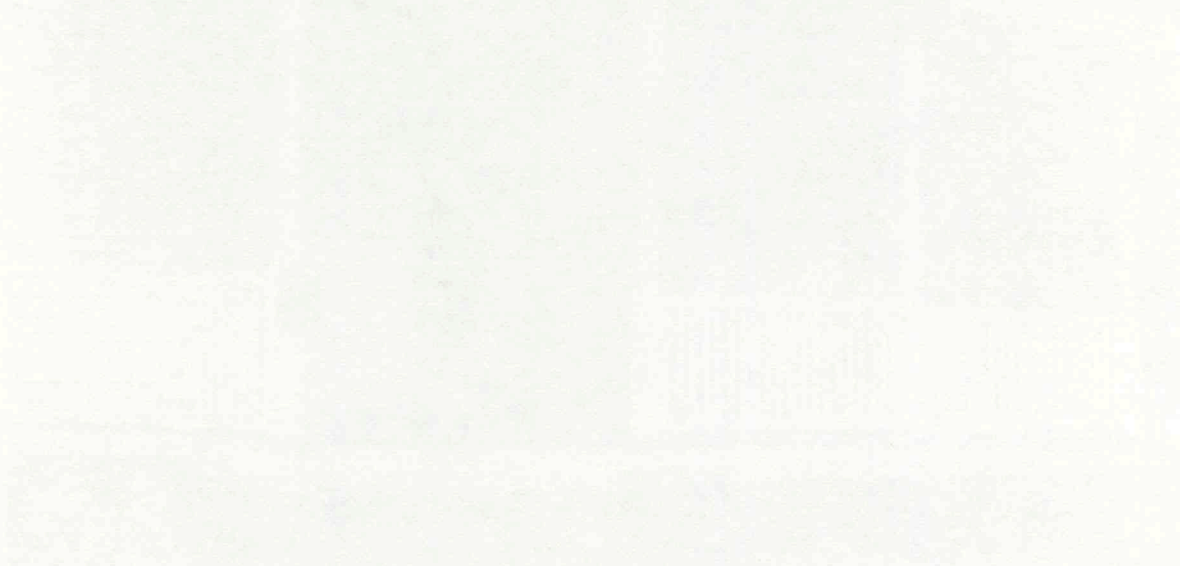
The clock is, in essence, a new monument, harking back to the pillars in monuments like the Parthenon. Attempting to conceive of the time and effort that went into completing a temple or edifice surrounded, and in many instances, supported by such

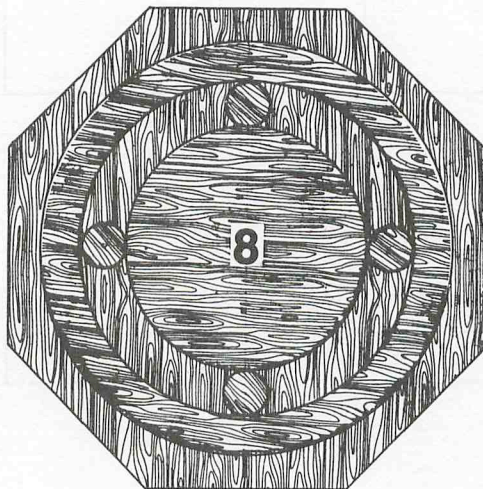
columns boggles the mind. Surprisingly, just how they were shaped is frequently glossed over by the historians and archeologists. That many, many of them were turned is an accepted fact, but there is little more in print about it, except, perhaps that the columns were subjected to a treatment similar to metal turning. A fixed tool in a basketlike sliding tool holder traversed them from end to end from a position underneath. *Balusters*, short columns usually fat in the middle and tapering off to both ends, were, on the other hand, brought to shape (as in the case of wood turning) by hand tools. (There is a saying to the effect that a dentist can never watch TV without noticing the condition of teeth of the persons who appear on the screen. The statement could be paraphrased here by noting that, after all this involvement with the lathe, tourism and sight-seeing would have a totally new dimension.)

No one expects that the reader of this book will become involved in turning pillars or columns to support the porch he contemplates adding to his home. These items are produced in such variety and in such quantities today that one's time would be better spent in other facets of lathework. Yet, once having noticed just how much impact the lathe has had on our national heritage, the interest is sus-

tained.

Pictured here, for example, are three identical square end, center-turned, beaded-type pillars (Fig. 7-4) that I found on houses in totally different communities within a 50-mile radius of my home. The whole family became involved in discovering unusually shaped balusters, columns, and newel posts. It was quite a learning experience.





Turning Balls

A BALL IS NEVER TURNED IN QUITE THE SAME way by any two lathe workers. It is generally considered a between-centers turning, but some authorities maintain that small balls can be turned with ease on a faceplate. The accepted practice is to start with a cylinder $\frac{1}{4}$ " or so larger than the finished ball. Cut the cylinder to a length three times the diameter of ball. Mount this between centers. Mark the center and the outer dimensions (Fig. 8-1) of the ball in progress plus a little extra. Cut the waste on both ends until spindles about one-third the diameter of the ball remain.

Make a template delineating the final contour of the ball being turned. This is an important step, because the use of one increases the accuracy of the finished shape. When a ball not turned perfectly round is rolled across the floor, it will deviate from its course. This is, at best, a belated discovery! Use a piece of pressed board or acrylic sheet about $\frac{3}{16}$ " thick cut as shown. This will reduce the possibility of under or overcutting. Some operators actually rest the template on the tool rest while the chisel cuts, but it may be preferable to constantly

see exactly what the cutting tool is doing. Stopping the lathe and making frequent checks (as with the use of templates on spindle turnings) should suffice. In smoothing the ball after the finishing cuts, sandpaper may be held against it with the template while the lathe is running.

The ball is turned to shape with the newly made template as a guide. A bit of difficulty arises here if the setup has been mounted with the aid of a spur center. The shaping can continue only to the point where further turning would weaken the spindles too much. The sanding and finishing should take place here and then, at a slow speed, the tailstock spindle should be parted off while the ball is held with the free hand. The other spindle is sawed off at this point and the ball given a final sanding and finishing.

The method I prefer requires that the workpiece be initially large enough in diameter to be mounted on a small faceplate. The piece should be of sufficient length that the ball can be turned completely with no possibility of the mounting screws being contacted. When the ball is completed, it can

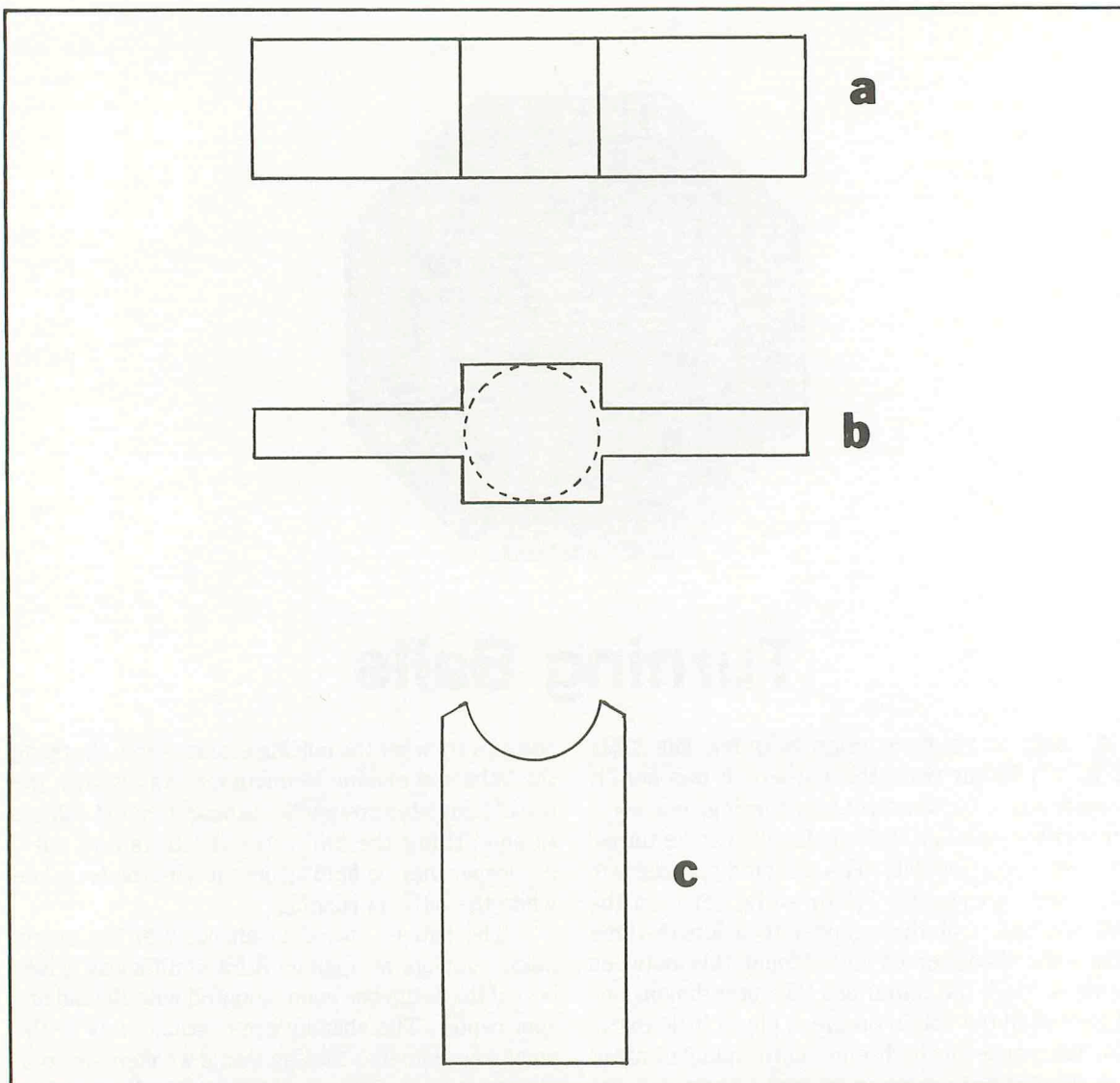


Fig. 8-1. Ball turning: (A) mark off ball area, (B) turn off waste to spindles, (C) make and use template for true roundness.

be parted off at a slow speed with just one area remaining to be finished instead of two. A variation combines this method and the one above. Use the first setup with the spur center. Work the ball to the point where the tailstock spindle is removed. Now mount a thick piece of scrap wood on a small faceplate with a hole drilled in the center just large enough to allow the remaining spindle to be forced into it. The turning is continued and the ball cut or

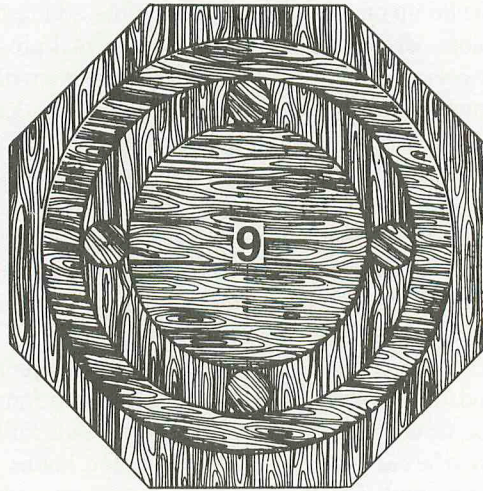
parted off the spindle when appropriate.

Two more methods are available to the ball turner, either of which should work admirably. The first involves the use of a deep cup chuck. The ball is mounted as a faceplate turning (as described above) and as much of the surface as possible turned. Then the cup chuck is turned to match the contour of the ball and to accept it with a tight press-fit. The rest of the finishing is carried on.

A variation on this is to use a shallow cup chuck when the ball is almost finished. This chuck can be mounted on a screw center or turned up on a faceplate. It will not support the ball alone, of course, so a little wooden block is used between the ball and the tailstock center. Both the chuck and the block should be recessed to hold the ball. The depressions need not match the ball perfectly. It is better, in fact, to turn them so that just their outer edge holds the ball. The little block has to be greased so that the ball can revolve easily on it. Petroleum jelly, the old standby, is suggested for this. In this case, the ball should be shifted repeatedly, but never more than a fraction of an inch at a time. A shaper can be ground up to round the ball with a scraping action. A similar shaper is described in Chapter 2. It is ground to conform to the curve of the ball, and the ends should come to a point. For the best effect it should be the same width as the portion of the cup chuck that holds the ball.

Plastic balls, to which there have been several references, can be turned to near perfect roundness by the simple addition of a *tube tool* to the procedure. The normal processing is carried on and the turning then taken with the use of a tube of slightly less diameter than that of the completed ball. It is made of steel or brass with the end ground perfectly straight across. It can be used without the tool rest, which may facilitate matters because its use involves swinging it back and forth and from side to side as the ball rotates. It most certainly eliminates the possibility of a gouge or skew digging in at the last moment.

These techniques are well worth mastering because there are innumerable uses for balls. Remember the heads for walking sticks? Add to these items gearshift knobs, objects for internal turning, adornments for furniture, the ubiquitous newel post, modern clock cases for desk and mantle—the list could go on and on.



Dolls and Other Toys

COME WITH ME ON A WORLD TOUR, FOR A quick look at lathe turning as seen through the eyes of children everywhere . . .

One of the loveliest tales ever written about lathe turning and a child appears in the novel, *The Trustee from the Toolroom* (Queen's House, 1976), by Nevil Shute. It tells of a child who is orphaned when her parents are lost at sea, after being shipwrecked in the South Pacific. Her uncle, who becomes her guardian, makes her a comforting present of a half dozen shiny little steel eggs that he has turned on a metalworking lathe. On pages 49 and 50 in the book, there unfolds a fascinating description of his turning one of the eggs on a $3\frac{1}{2}$ " lathe, including all the steps right up and through the polishing phase. Quiet, unassuming, a most unlikely candidate for the task, he is thrust into a great venture to the South Pacific to retrieve her inheritance, which the parents had carried with them and that lies carefully hidden in the wrecked remains of their yacht.

As soon as it is learned that someone is enamored of the lathe in any form, he is made a present

of this book. It just so happens that the book is an excellent gift selection and everyone who has ever held a skew or gouge should read it. The egg, of course, is but one of many, many items that can be turned to capture a child's fancy.

Turned dolls, for example, are notoriously popular in every country in the world. The first pair (Fig. 9-1) are known as *kokeshi dolls*. These Japanese dolls can trace their origins back 300 years to Tohoku province, in northeastern Japan. The native wood turners paused in their gainful employment of making trays, bowls, and other items to turn these little figures for their daughters. Kokeshi dolls have been handed down from generation to generation, mother to daughter, sometimes long after their colors have faded. They are considered to be such family treasures that in bygone times they may have had some religious significance. Today, according to Loretta Holz, the noted authority and writer who made some of these photographs available, the kokeshi dolls are turned by the thousands and sold as souvenirs both in Japan and abroad.



Fig. 9-1. Kokeshi dolls from Japan. Courtesy Loretta Holz.

A quick glance would make one think that they were milled out as quickly as humanly possible, to which there may be a grain of truth. A closer look, however, shows little pedestals turned on the bottoms, lines cut into the body in two places, and a collar worked just below the neck, the obvious attention to detail. Perhaps each doll was a joint effort (no pun intended) with one turner doing nothing but heads while another turned out bodies.

Here is another kokeshi doll (Fig. 9-2) with far less detail. Many of these were fitted as decorations to the tops of oversized pencils. Two more appear here (Fig. 9-3), from my collection, with a bit of difference in the detailing and the shape of the head. Inspection of the bottom indicates that they may have been turned on a spur center, but just how fast would be hard to tell.

Germany offers this *nutcracker doll* (Fig. 9-4) 15" in height, made from numerous pieces of turned wood all brightly painted. Mrs. Holz photographed it at the United Nations Gift Center, in New York, where she was told that many are still made annually and sold all over the world.

Sweden adds a bit of humor to this version of the turned doll (Fig. 9-5). Note that the arms are separate pieces pinned to the body and that the hand is drilled to hold the little heart mounted with a jump ring. Denmark accents simplicity with this doll (Fig. 9-6), whose ball head is adorned with cornhusk hair. No facial features are added, which never seems to bother young children. The body on this offering from Poland (Fig. 9-7) seems to have been turned against the grain and deliberately left unsanded. This specimen is from the Hercek

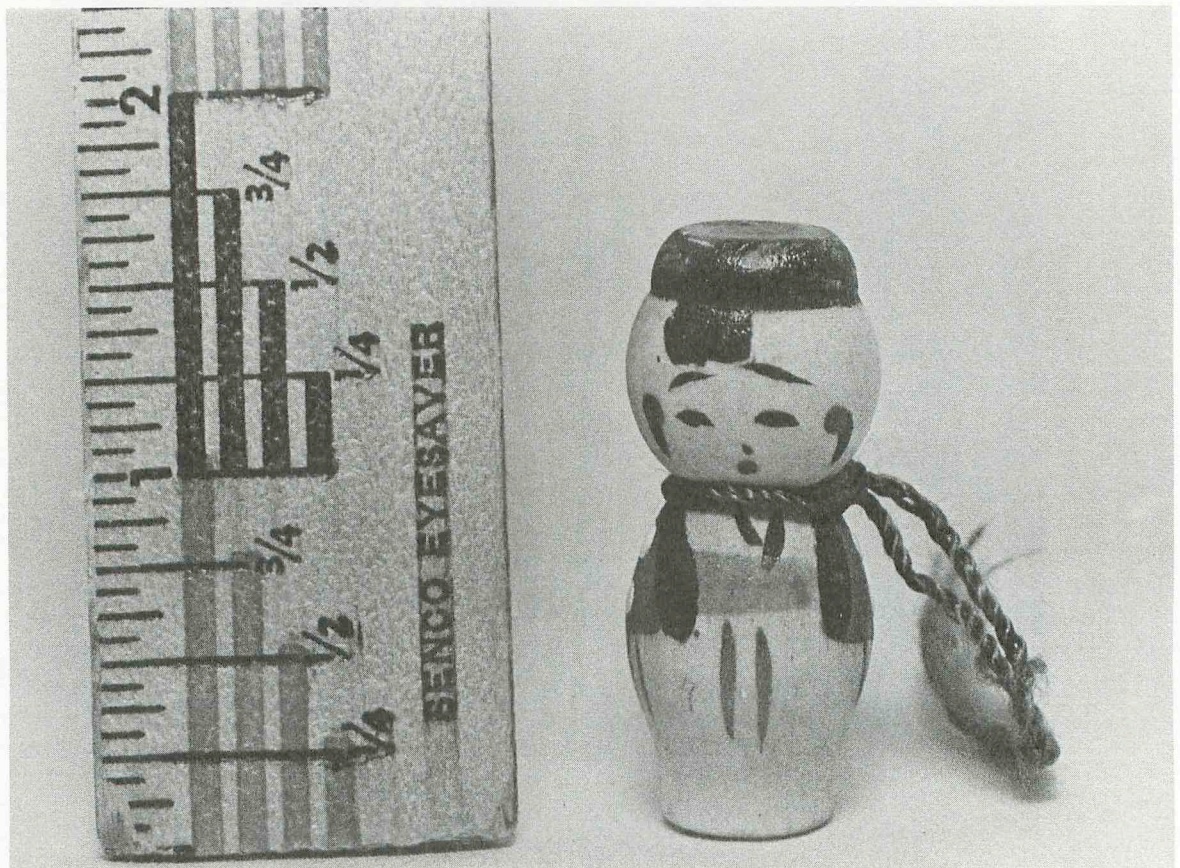


Fig. 9-2. Simpler, smaller version of the Kokeshi doll. Courtesy of Loretta Holz.

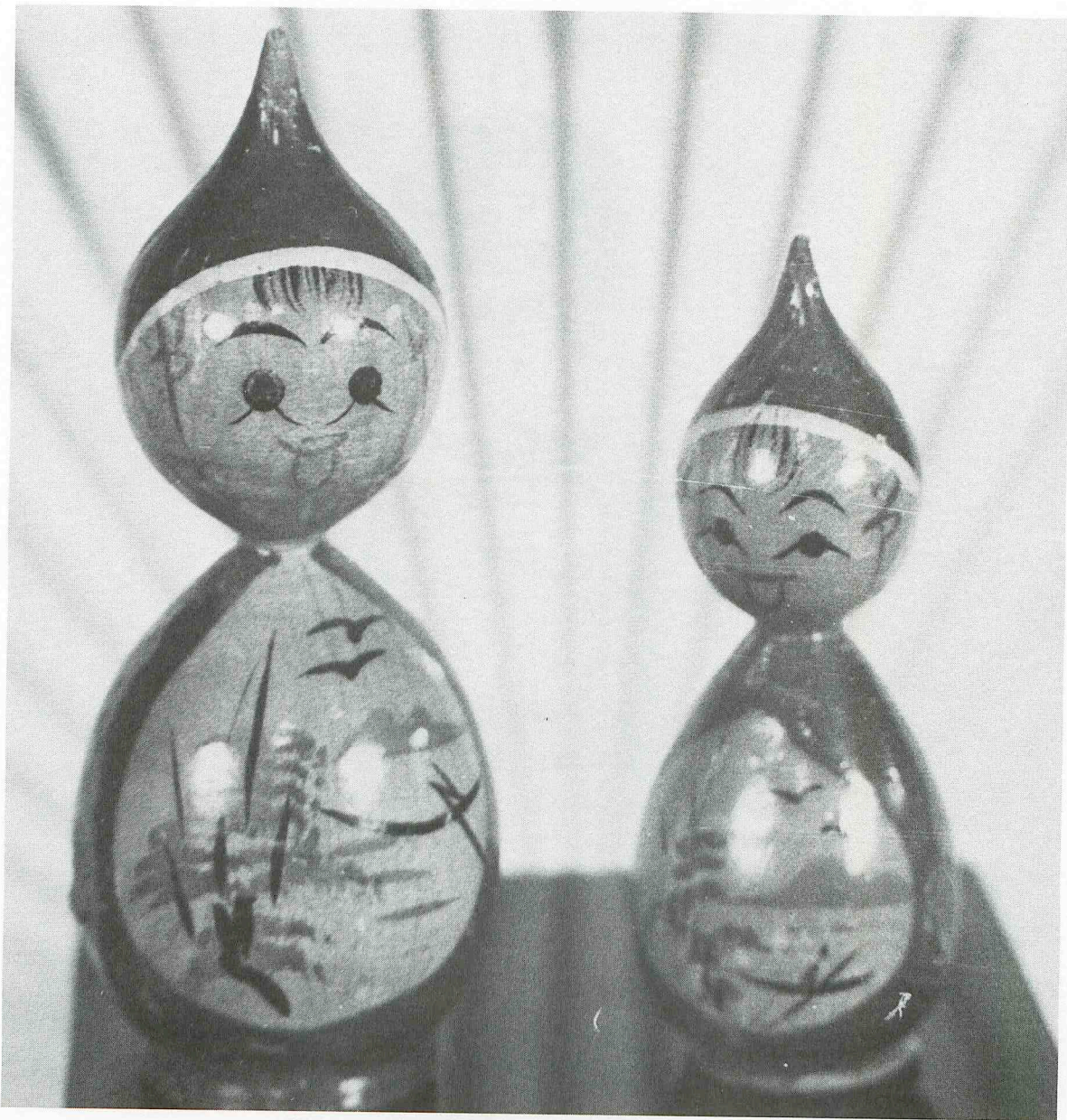


Fig. 9-3. From the author's collection, these examples are a scant 2½" high.

Collection, and Mrs. Holz says in her book, *International Dolls*, that this mustache and crown of hair are separate pieces of darker wood glued into place. The next trio (Fig. 9-8) is representative of Lithuania. The tallest figure is 6" high and exhibits delightfully exaggerated puffed sleeves and nar-

row waist. The smaller ones combine cones with balls, and all include a little turned pedestal for a bit of elevation. They were photographed by Mrs. Holz and are from the Stukas Collection.

Estonia is represented by a 9½" wood-turned figure (Fig. 9-9), basically cone shaped but with



Fig. 9-4. German nutcracker doll some 15" in height. Courtesy of Loretta Holz.



Fig. 9-5. Swedish doll turned with a bit of humor.

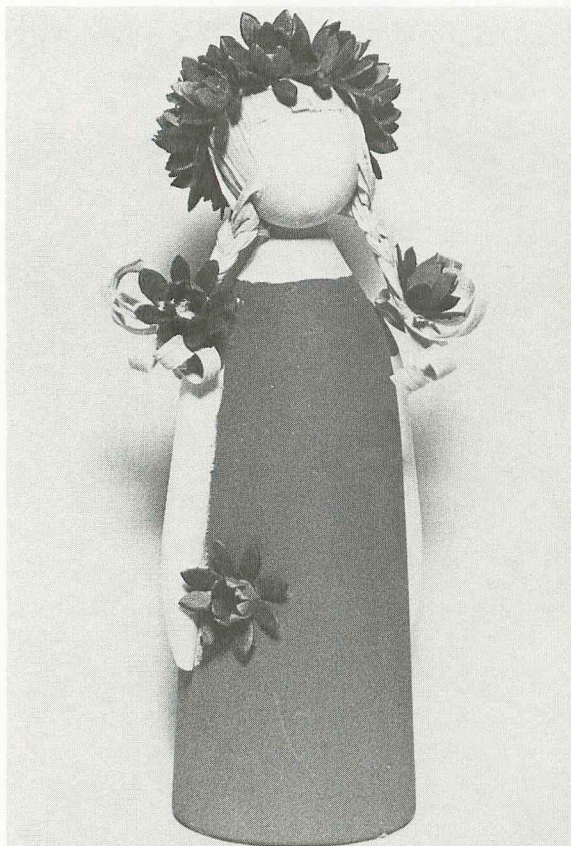


Fig. 9-6. Version from Denmark is wood with cornhusk hair. Courtesy of Loretta Holz.

bright colors added in geometric patterns. The last little doll (Fig. 9-10) may well represent the United States. It is actually a pendant made of little turned pieces of white wood and the ball head covered with flaming red hair. The stubby little arms are attached to a fuzzy pipe cleaner which extends around the back of the little figure. It was purchased at a flea market and photographed by me.

OTHER TOYS

This gentle little mouse (Fig. 9-11) has a Danish flavor. The smooth flow of the body is complemented by the flattened position on the bottom. Here again, a simple piece that is certain to delight a youngster.

The ball and cup game (Fig. 9-12) pictured

here dates back several centuries, when it was quite as popular with adults as with children. This particular specimen was played with by everyone who saw it—young and old—until it was hidden away for fear that it might be misplaced before being photographed. It is simple to make, consisting of a turned handle, a separate cup, and a ball. The measurements can be such that the waste within the cup can be drilled away with a *Forstner bit*, capable of making a hole without leaving a spur center hole or mark. A variation on this game consists of two barrel-shaped cups (Fig. 9-13), one of which is mounted on a flexible length of wood. This version requires a bit more manual dexterity, although not as much arm movement to flip the ball from one cup to the other. Rolling pins (Fig. 9-14), large and small, are good items for turning, as is the little bucket shown here to the left. This is an area usually in the province of the miniaturists, but little owners of doll houses would love these gifts. I made the rolling pin so that it rolled between its handles for an extra bit of realism.

GAMES

There are many, many games whose components can be lathe turned. Checkers is one of the first to come to mind. While it is true you could cut discs from a broom handle to make a set of checkers, pieces embellished with surface rings and a narrow groove, cut on the sides would be more personalized, and the set might be cherished for a long time. In addition to making 12 of a light wood and 12 of a much darker wood, there is the option of making them of one of today's plastics. Half of the pieces, in this case, could be clear while the other half could be dyed, pigmented, or in the case of acrylics, stained.

Chess pieces (Fig. 9-15) are a good suggestion, because they may be turned as simply or with all the elaboration and embellishment one could desire. The English immediately search out such hardwoods as ebony, African blackwood, or partridge wood to make the black men, opting for sycamore or holly for whites. Almost any combination of dark and light woods might be used here. All



Fig. 9-7. Polish turner made the woodgrain work for him in this instance. Courtesy of Loretta Holz.



Fig. 9-8. Trio of turnings from Lithuania. Courtesy of Loretta Holz—from the Stukas Collection.

the pieces might be done in a light wood for that matter and one set stained dark. If the wood selected is too lightweight, it is not a truly difficult matter to add weights to the bottom. A clever, (certainly not new) ploy would be to substitute magnets instead of weights and put metal discs in the board. The trend today is away from elaborate pieces, and a set made as simply as possible would not be considered dated. This statement holds true especially if the turner admits to absolutely no talent in carving. Reiterating the statement that nothing beats simplicity, I offer no real designs for the pieces but offer, instead, hints on how to turn them satisfactorily.

Borrow a sample set of pieces to determine the sizes of the various pieces. Once this is noted,

lengths of wood can be cut to make up all the pawns, for example. These bits of wood should be $\frac{1}{2}$ " longer than necessary so that they can be rapped into the hole of a cup chuck for turning. This may not be necessary, of course, if they are going to be turned between centers. Templates of thin metal or plastic will aid materially in reproducing identical chess pieces. (There are two even of the king and queen.) Pieces like the knight might have to be stylized for simplicity but then, avid chess players do not worry too much about the appearance of the men. There are a number of options worthy of consideration in making the pieces. Three pawns may be made from one length of wood rather than made up individually. A piece may be turned with the head toward the left then reversed so that the

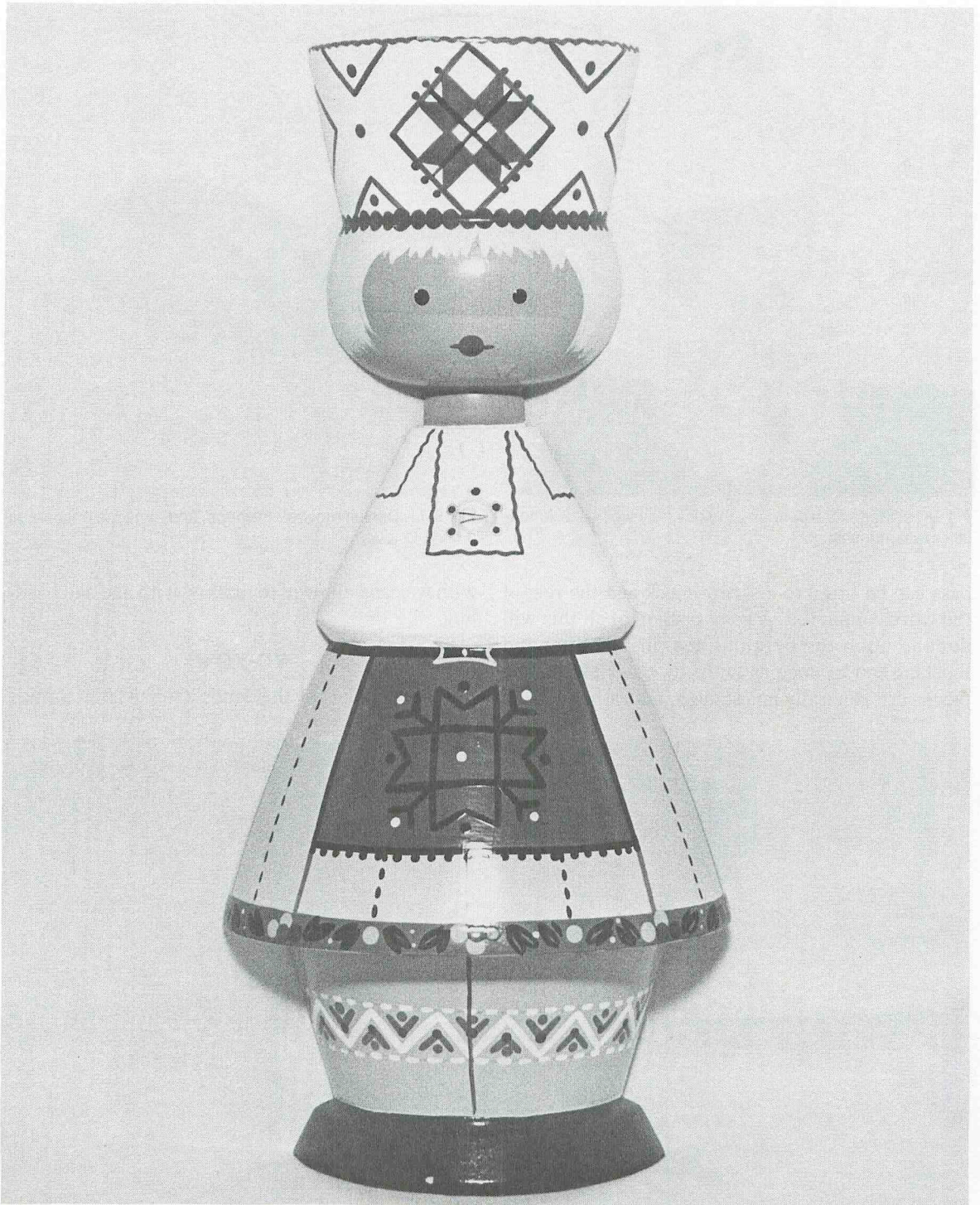


Fig. 9-9. Estonian doll is basically cone-shaped. Courtesy of Loretta Holz.



Fig. 9-10. Made as a pendant, the doll may well be of American craftsmanship.

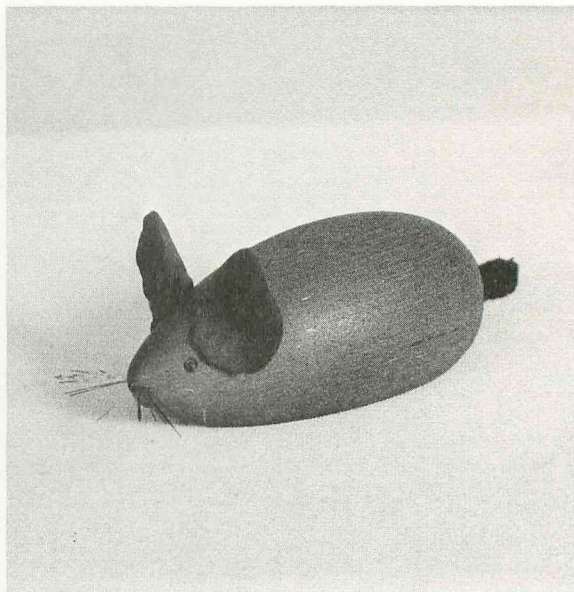


Fig. 9-11. Danish mouse? Perhaps, and turned to encourage a child to touch.

base can be fitted to a screw chuck and the rest of the work completed. A good portion of all this will depend upon the original design. Sanding and finishing can be done as with any other piece. The pieces are generally not stained, but rather rubbed

with wax and allowed to mellow with age and handling.

YO-YO's

Another popular toy that lends itself to lathe turning

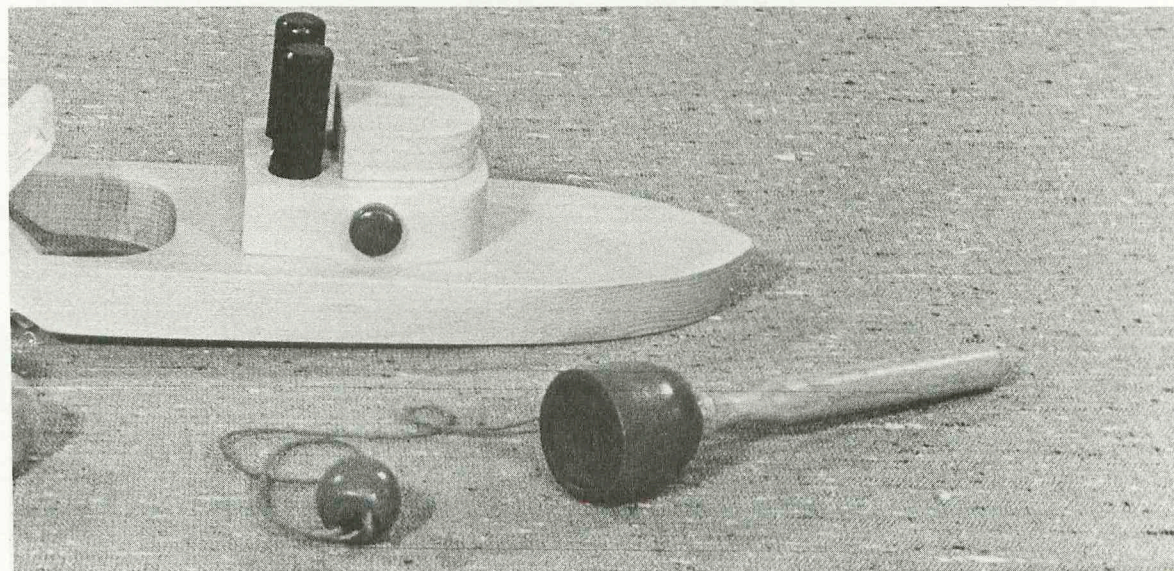


Fig. 9-12. Ball and cup game that everyone will try.

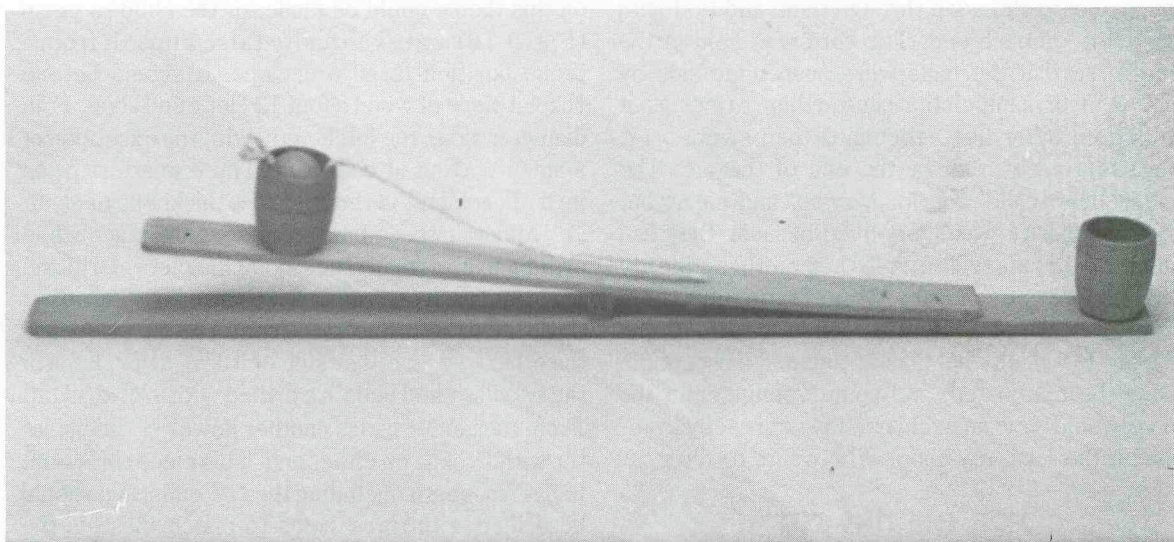


Fig. 9-13. Variation on ball and cup game.

is the yo-yo. Surprisingly, extra care must be exercised in making one of these up as a gift. Kids are very fussy and competitive about their yo-yo's. A Duncan is still considered one of the best—it sleeps or spins at the end of the cord until the user wishes it to roll upward to his hand and gives it a little pull. The finish of a home-turned one will have to match that of those commercially available, and it might be expedient to make it slightly larger in diameter than those readily available. Remember, too, that if the recipient slinks home and puts it away, its quality or finish may have nothing to do with it. It may be that he came up against someone with an electric light in his yo-yo and, rest assured, that is very hard to top

on a lathe! In the normal course of events, its performance will play a big role in how successful the young owner is when he goes up against his peers. Make two separate discs drilled so that a dowel will fit tightly between them. Polish what will be the inside surfaces so that the cord glides smoothly as it passes in and out between them.

BALL TOY

Some years ago, a toy burst upon the scene and swept across the country with a popularity that rivaled the hoola-hoop. Known simply as “clackers,” it consisted of two plastic balls, about 2” in diameter. The balls were drilled and a heavy



Fig. 9-14. Mini-items—buckets, rolling pins—all good for the mini-lathes.

piece of cord threaded through them and tied with big knots on each end. The cord was held in the middle so that the balls were suspended side by side. A bit of manipulation caused them to swing out from each other like pendulums then swing back, impacting each other at the end of the arc. The sound they made was loud, crisp, and clear, but their popularity was short-lived because they had an inherent safety defect—they could suddenly shatter and cause injury. Manufacturer of them stopped. If the balls were turned of hardwood, the danger to which the plastic seemed susceptible would be eliminated, and some youngster in the block would have an exclusive toy not readily available at the local toy shop. Who wants to try it?

FOR THE TINY TOT

Mobiles are high on the list of acceptable items for children. Usually a grouping of light, airy pieces suspended from thread or wire and balanced so as to revolve gently in the slightest breeze, they delight a child who is not yet walking or talking. Anything lathe turned would have to consist of extremely lightweight pieces, all brightly painted. A variation

on this theme could be made for the child to grasp (Fig. 9-16) and eventually raise himself from a prone position to an erect one. It should be one shaped piece of wood about 12" long and about 1" in diameter along the full length, with the exception of a small portion at each end. Three quarters of an inch of each end is reduced to a thickness of about $\frac{1}{4}$ ". Maintain these flats on a horizontal plane while drilling five vertical holes along the piece. Drill one $1\frac{3}{4}$ " from each end (use a $\frac{3}{16}$ " drill bit). The other three are drilled, one in the center of the piece, and the other two on either side of it $1\frac{1}{2}$ " away. Each of the two flattened ends are drilled with a $\frac{1}{4}$ " drill bit. From the center hangs another dowel $\frac{1}{2}$ " in diameter with 1" balls on either end. This piece comes out to $5\frac{5}{8}$ " in length, including the two balls, and should be drilled with three holes to match those in the center of the long dowel. The five holes in the larger piece are drilled out to $\frac{3}{8}$ " two thirds of the way in. This will effectively recess the knots of the cords, which are added in final assembly.

Turn one more ball 1" in diameter and two beads about $\frac{7}{8}$ " at their widest point, tapering off to $\frac{1}{2}$ " at one end. These beads are eventually hung

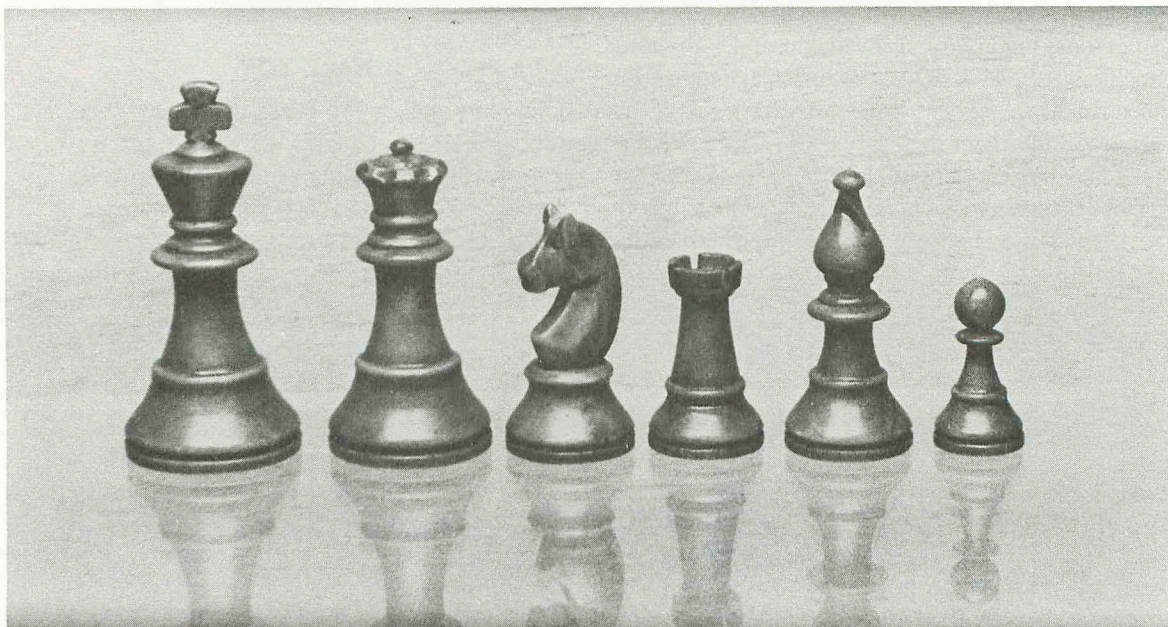


Fig. 9-15. Chess pieces, simple in design, make good turning subjects.

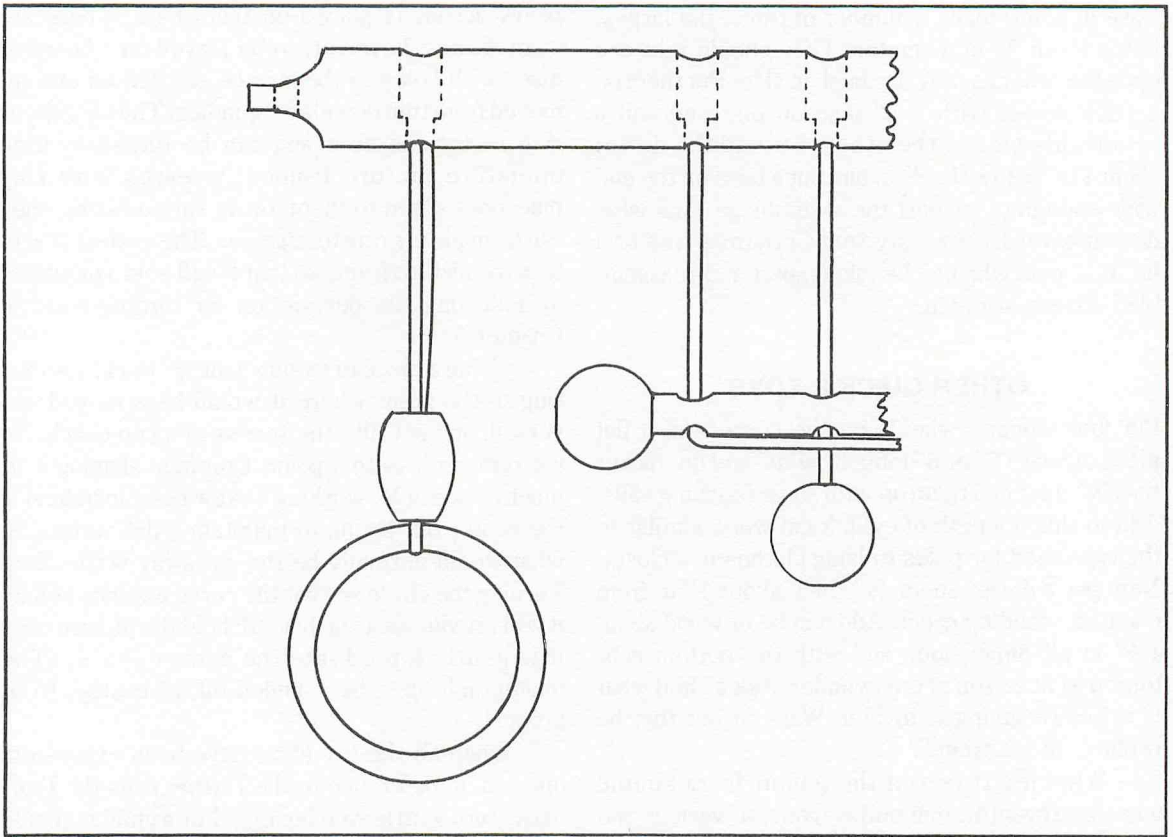


Fig. 9-16. Detail of baby's "crib gym."

with the narrow end down. Two $2\frac{1}{2}$ " diameter rings are required, which may be turned of a fairly close-grained hardwood, but plastic rings may be substituted. Varnish both pieces of wood and paint the ends of the long piece (about $6\frac{1}{2}$ " in), the balls, and the beads in a variety of bright colors. Assembly is fairly simple. Cut three pieces of strong cord 9" long and one just 6". Feed one of the 9" pieces through the second hole in from either end, put one of the beads on it, put it through the circle, back through the bead and the dowel, and knot the two ends together. Repeat this on the other side. Knot one end of the remaining long cord, feed it down through the third hole in from one end, through an outside hole on the short piece, over to the other end of this short piece, up through the hole, and then up through the third hole in from that end in the large piece. Knot the end of the cord. Knot the end

of the 6" piece of cord, feed it down through the center holes on both wooden pieces, and through the remaining ball. Knot the end of the cord.

To put some bounce in this "trapeze/mobile," fit two fairly strong springs about 2" long and about $\frac{3}{4}$ " in diameter on each end of the long turned piece. Add a plastic or leather strap about 2 feet long, after the ends have been attached to the springs.

With a bit of imagination innumerable other toys and games can be turned that allow a child's imagination full play. Oh, that imagination! Parents often comment on the fact that no matter how expensive the purchased toys are, it is not unusual to find a child playing with clothespins. This must be why the simplest of toys (ball heads, cone bodies) are the most popular with the extremely young. Educational toys, it would appear, can have a significant impact right at this time in the child's life.

Case in point: make a number of rings, the largest being about 3" in diameter. They should rest one upon the other as they diminish in size. Put them on a thick dowel with a 3" disc on one end and a removable ball on the other. Extend the dowel about 1½" below the disc, and put a base on the end wide enough to support the assemblage. And what do you have? Either a stylized Christmas tree or a fat little man who can be taken apart and reassembled dozens of times.

OTHER QUICKIE TOYS

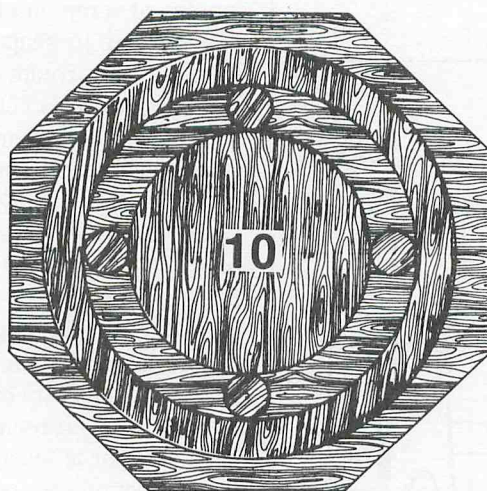
Put four wooden wheels on the corners of a flat piece of board 5" or 6" long, 3" wide, and no thicker than ¾". Just nail them on with some finishing nails. Add to this a length of cylindrical wood similar to the type used for poles to hang clothes in a closet. Now put a dowel about ½" thick about 1" in from one end, standing erect. Add a cube of wood about 1½" in all dimensions and with the bottom contoured to fit on top of the cylinder. Ask a child what it is before giving it to him. Want to bet that he replies, "It's a train!"?

Wheeled toys run the gamut from simple wheelbarrows through pull wagons, to various and sundry cars. Unlike the tiny train engine, the lathe plays but a minor role in building these toys, so no

heavy accent is placed on them here. There are many games, however, to be played on a board or discs with holes in them to be stacked on and removed from thin dowels or spindles. The ubiquitous ring resurfaces here and can be turned to form miniature picture frames, wreaths with tiny pinecones glued to them, or, in various sizes, they can be made for ring toss games. The easiest way to turn the picture frame so that it will hold a picture is by following the description for turning rings in Chapter 5.

Using a piece of wood about ½" thick, turn the ring to the point where it would be removed, reversed, and set into the recess of a cup chuck. *Do not* remove it at this point. Continue shaping it as much as possible, working a skew point in behind in the center but trying to maintain a flat surface on what would normally be the cut-away waste area. Turning the circle so that the curve extends behind it will provide an area that will hold the picture once it is gently forced into the center space. (The photograph must be rounded off, of course, to fit properly.)

When all the toy ideas have been exhausted, one can, in deference to the *Trustee from the Tool-room*, turn a little wooden egg. For a child it should be large enough not be swallowed and be brightly painted and waxed.



Square Turning

THE TITLE OF THIS CHAPTER IS SOMEWHAT OF a misnomer. It is well nigh impossible to turn a square piece of wood and not round it off. Traditionally, quite attractive pieces have been turned with oval “flats” on them. This is the effect, pure and simple, of the cutting tools skipping over the greater portions of the workpiece as they take off the corners (Fig. 10-1). It is a matter of stopping the turning endeavor prematurely—before the piece becomes a proper spindle. The effect, incidentally, can be obtained by the simple expedient of turning a spindle normally and then planing it carefully so that the high areas are reduced to perfectly level. With a bit of care and judicious use of the plane, a post with a combination of curves and flats can be obtained.

It is true that a router, perhaps, could be used. It is fitted with a series of special cutters and taken across the grain on the four faces of a square piece, but this falls into the realm of woodworking—not turning. There is a method employing the lathe, however, which will produce at least a visual appearance of what might be termed *square turning*.

The piece or pieces must be turned as far away from the spindle center as the swing of the lathe will permit. The pieces must, in essence, be mounted on as large a drum as possible. If one were turning pieces 1" square, for example, on a 12" swing lathe, the drum should be no wider in diameter than 10".

The drum would have to be fabricated, of course, preferably of a light solid wood with discs on either end. Some authorities recommend a spindle through the center, one end of which would serve to accept the tailstock center. The use of a faceplate is strongly advised. The drum is made up with the end discs oversized enough to accept the pieces to be turned flush with their outer circumference. The pieces to be turned are cut long enough to allow mounting on the drum. Back in the old days (the 1800s), the pieces were screwed to the drum, which must have been a tedious operation because this particular facet of the operation had to be repeated four times. If the assembly does not approach dangerously close to the lathe bed, semicircular clamps with bolts might be used, but a

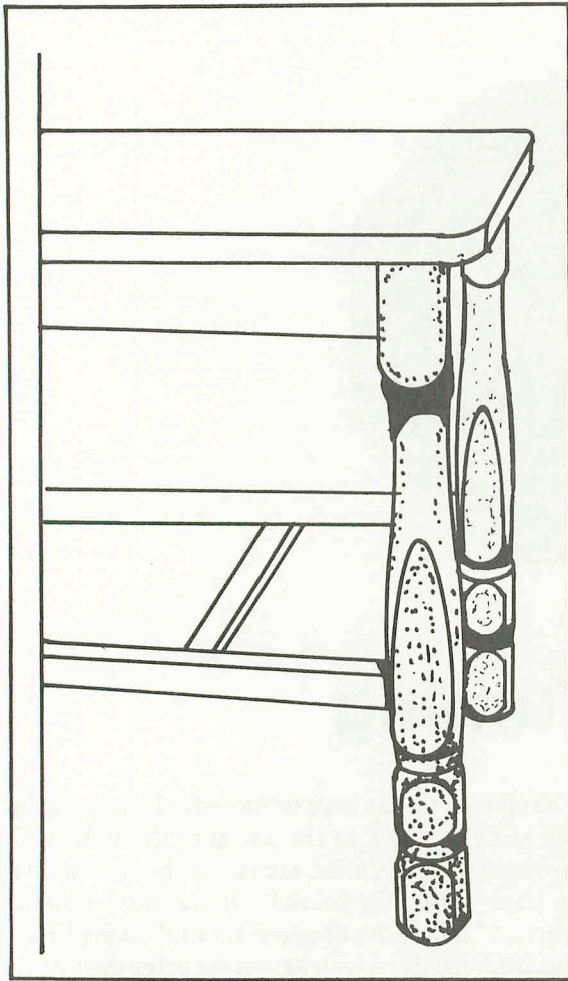


Fig. 10-1. Detail of legs on an old dining room chair showing the turned "oval" flats.

much easier method of mounting would be to utilize automotive hose clamps of the worm action-type. A supply of these various sized clamps should always be available around the shop.

For the best turning effect, the pieces should be laid on the drum completely around its perimeter. The turning affects just the outer face of the piece. If there are gaps between them, the chisel works normally on the edge of the piece that approaches it initially but unless care is exercised, it may split off splinters on the following edge as it comes around. If one is turning pieces for a balustrade, the number required would more than fill the

drum. Should just four pieces be required, thought should be given to protecting each piece by butting lengths of scrap on either side of them.

Turning to shape is begun on the outer surfaces as they rotate past the chisels. When the desired pattern is cut upon the first face, work is halted while the clamps are loosened and the next face is positioned. Turn the pieces so that the work is done from the worked side across the clean face to the unworked area. This will reduce the possibility of tearing up the edge of the side already finished. It will aid, too, in reproducing the design or pattern as the edge of the completed work is visible in front. Obviously, this works for three faces only and extra care will have to be taken with the last one. This technique is not a new one, having been used for at least 100 years. In the early days, the production pace was far more leisurely; turners had the patience and expended the time required to fit bits of wood between the workpieces to prevent edges from splintering. Whether or not today's turner should resort to this is a matter of individual preference.

FACEPLATE TURNING

There is a variation on the method described above that is eminently suitable for turning small lamp bases and similar pedestals. In this case, the finished piece evolves from a true faceplate turning. A large disc is made up, encompassing the full capability of the lathe, preferably in the 10" to 12" range. If work may be turned on the left end of the headstock spindle of the particular lathe, then the diameter of the disk may be increased. (The tool is supported on an independent rest mounted on a stand on the floor.) Another disc at least 3" thick is glued to the first with paper interposed. When dry, the circle is cut through to make three or four openings to accept the workpieces. The pieces should be as wide as the circle is thick (Fig. 10-2). The actual turning, which produces a moulding like effect, is done on the periphery of the circle. The pieces of the circle that have not been cut away are screwed to the original disc to reduce the chances of the workpieces flying out. When one face is completed, the wood is turned to the next face and

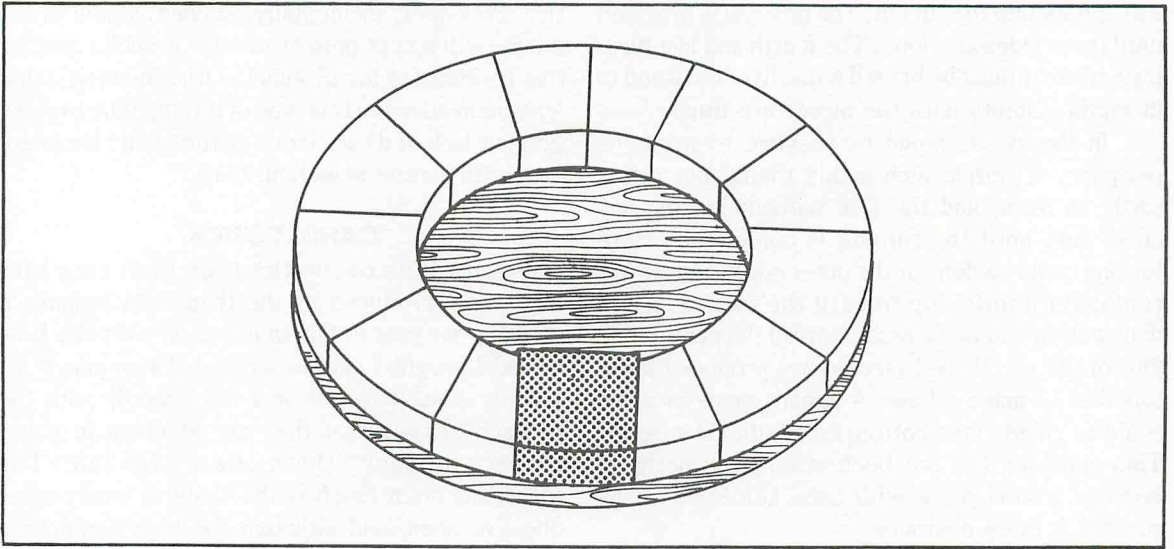


Fig. 10-2. Method of laying up a circle to produce square-turned pieces. Shaded area is workpiece.

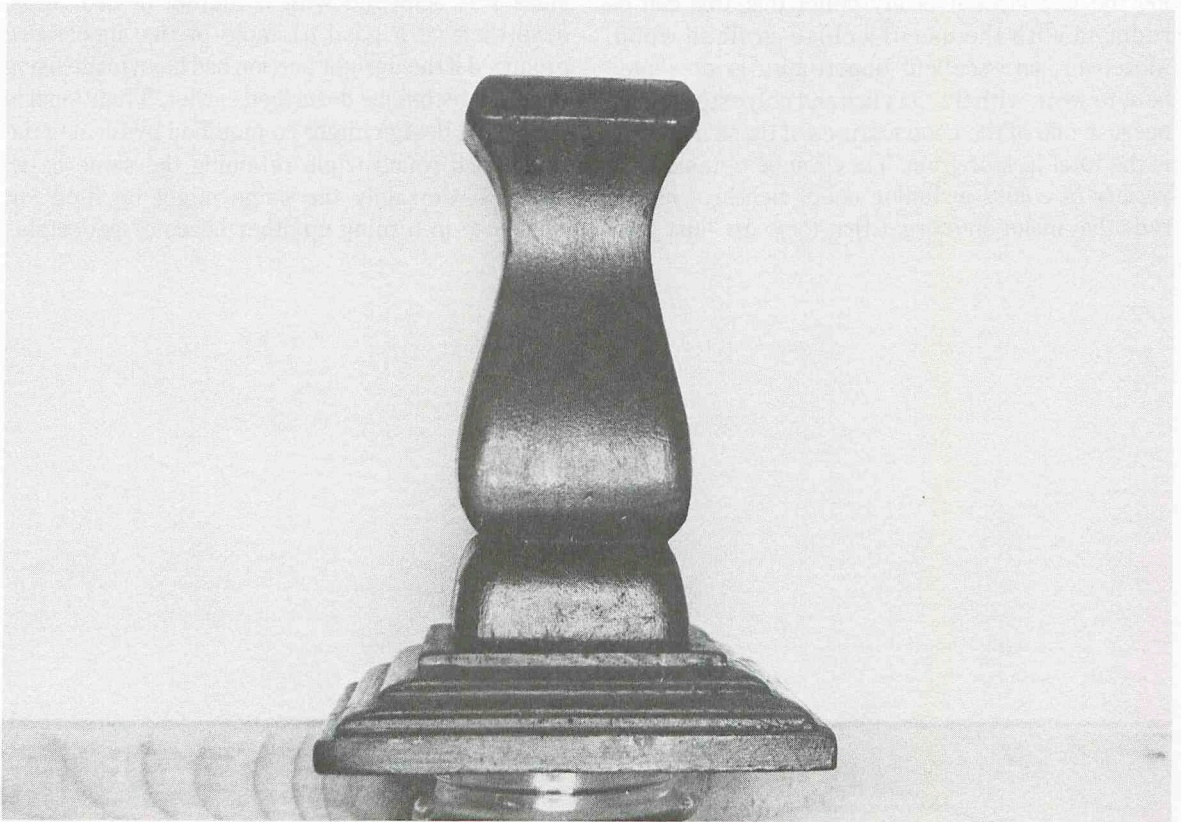


Fig. 10-3. Small candlestick—example of square turning.

thrust back into the cut out. The process is repeated until three sides are done. The fourth and last turning endeavor must be braced with slivers of wood to maintain stability until the pieces are finished.

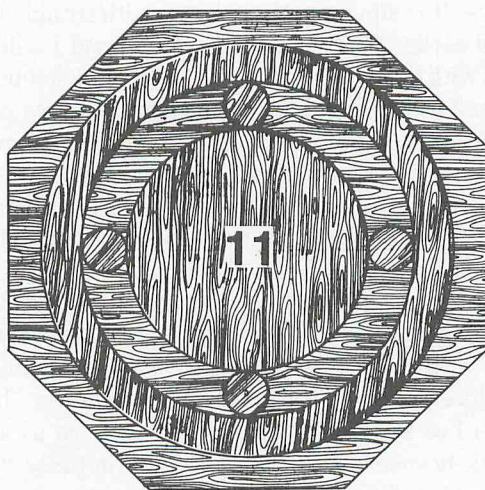
In theory, it should be possible to work the periphery of a circle such as this, though not necessarily as thick, and the face without making any cross cuts until the turning is completed. More turning could be done at the outer edge, with waste removal diminishing toward the center. Then diagonal cuts could be made toward the center, and four of the pie-shaped pieces thus produced fitted together to make a base. A square piece of wood could be glued to the bottom for additional support. This approach has not been attempted, perhaps, because a solid piece with unbroken lines at the corners is more desirable.

Remember, there is always the possibility of knocking off bits and pieces of the wood when turning the last face. It is my belief that this can be reduced with the use of a close-grained wood. Moreover, an excellent opportunity is presented here to work with the acrylics and polyester resins, because one of the good features of these materials is the total lack of grain. They can be obtained in a variety of colors including deep, rich browns and reds that make one forget that they are “just plas-

tic.” Polyester, incidentally, stained yellow in the mixing will accept pure brown dye in such a manner that it simulates tortoiseshell. Other materials that lend themselves to this type of turning (due to close grain or lack of it) are ivory, natural and simulated, and, with careful selection, bone.

CANDLESTICK

This squat little candlestick (Fig. 10-3) must have been mass-produced by the thousands because it turns up for sale at flea markets all over the East Coast! I bought a pair for a nominal sum purely for photographic purposes and discovered, with the passage of time that they are identical in every respect to many others offered for sale. The mahogany stain finish is the same as every other one I've seen, and although the base could have been turned in the manner described above, I lean toward the belief that the molding effect on the four sides was achieved with a routing device. It is, nevertheless, a good example of the appearance produced if the upright portion had been made using the drum technique described earlier. Traditional in flavor, the design might be modified by turning the candlestick round while retaining the same basic contours. Certainly the design might be filed for future use in turning up other bases or pedestals.



Turned Woodware for Gift Giving

THUS FAR, MOST OF THE TURNERY TECHNIQUES commonly in use today and some from bygone eras have been carefully delineated within these pages. In this chapter are gift items that incorporate a few more techniques, plus some in combination and conjunction with carving. Some are functional, others not. Quite frequently, the most exquisite pieces should be admired but touched as little as possible. Exceptions to this rule are turnings like the chess pieces, which become more beautiful with age and handling.

SALAD SPOONS

These are what might be termed “hardy perennials”—salad forks and spoons. The British do these so beautifully that the examples take your breath away. Conversely, they turn more egg cups, napkin rings, and salt and pepper shakers than one would ever hope to use! They also seem to enjoy making up and using more homemade jigs, chucks, and tools than is the custom in this country. It may be the differences between their economy and ours.

In any event, salad forks and spoons are unique in that the handle is turned while the bowl of the utensil is carved. This means that the wood selected for each piece must be a bit wider than the bowl before turning begins. Mark off the area on the piece for the bowl or tines portion, then cut away the excess material on either side of the handle with a jig or band saw. Position the large portion of the spur center and bring up the tailstock to hold the handle. Turning goes on from there as described previously.

Purists may elect to use carver’s chisels and gouges to remove the waste from the bowl when the turning is finished, but my orientation has been toward the rotary and impact cutting tools for years now. They are much easier to use, particularly if one has no real previous carving experience. James B. Meek, one of the best known engravers in the Midwest, points this out in his book, *The Art of Engraving*, published by F. Brownell and Son, Publishers, Inc., Montezuma, Iowa. Meek favors the Gravermeister, manufactured by GRS Corporation,

Box 1157, Boulder, Colorado 80302. The Gravermeister is an impact-type machine using compressed air as the power source. It is similar to the Burgess Vibro-tool mentioned earlier. The Vibro-tool, incidentally, can be fitted with little gouge and veiner blades that actually speed up carving. I prefer the rotary-type, which is normally fitted with a variety of clutters that carve away the waste with alacrity.

Whatever you use, the technique is quite the same. Mark the outline of the inside of the bowl, secure the piece in a vise, and begin carving away the waste. Carve it to shape and sand smooth. Turn it over and mark the outside of the bowl. Effort should be made here to produce a shape that is visually pleasing. No two sets I've ever seen are quite the same, so a bit of artistic license is acceptable. The center of the bowl should be thick and thin out toward the edges. The rotary tools offer a great deal of control, and the total effect should be much better than if you tried to carve the pieces with no previous experience.

The fork will be much easier. Cut the basic shape (three tines). Turn it up erect and cut the top and bottom shapes. Touch it up with the rotary cutter, and sand the whole piece smooth.

I have seen sets with elephants carved on the end of the handles, others with spirals cut along the handle from the end to the bowl, and still others with square ends on the handles. My feeling here is: What is the nature of the exercise, carving or turning? I feel this way, too, about "turning" spirals on spindles. The business of marking the spiral on the spindle, cutting along it with a saw, filing along it with a ground and then a half round file, and finally sanding it have never been enthralling, particularly when the lathe is stopped for about 75 percent of the work time. Ah, but then we all have our eccentricities!

BOXES

Boxes are one of my true loves. I recall having mounted a crystal radio set in a cigar box over 50 years ago and having finished the box so that it looked as if it had been japanned. Since then, I have crafted containers in every conceivable shape and

form and from innumerable materials. In relation to turning, boxes would seem to be nothing more than bowls with straight up sides. There are differences, however, and I will enumerate them here.

Let us establish the premise that a box can come in all shapes and sizes, although it usually has four sides, a bottom, and a top. The word "box" is used loosely here because, without getting into semantics, the difference is frequently in the eye of the beholder. Cookies come in a box, for example, except around Christmas. At that time the box is made of metal and although this shape is identical in many cases, it becomes a "cookie tin." The British have a way of making pretty round boxes and referring to them as "barrels." These items are not nearly as large as a bread box, which is generally made of tin these days.

This all leads up to the introduction of a pretty little box (Fig. 11-1), made in India, which might conceivably be called a covered bowl because of the shape. It is of interest here as an example of artful turning combined with skillful carving. The difference between this and most other boxes is that the inner wall is not straight, top to bottom, but curves in to match the outside contours. This is a prime example of when to bring the bent chisels, similar to our boring bars, into play. The inside received just as much attention in the turning as the exterior, although the fine circles made by the scraper on the bottom were not removed completely. The top is made with a $\frac{1}{8}$ " projection that fits loosely so that it can be replaced easily but would never slip or fall off. It just would not be quite the same without the carving above the center line, but then reeds (or should they be called beads) could be substituted, especially if it were turned of a wood with a pronounced grain pattern.

Boxes are turned on the faceplate. The usual procedure is to screw the workpiece right to the faceplate and fill in the holes when the turning is completed. Some turners prefer to "open up" the center by drilling a hole 1" in diameter. This produces an inner edge on which to work, but a gouge will function whether or not a hole is drilled. A parting tool can be used to penetrate the flat, untouched surface. The special tool suggested in



Fig. 11-1. Turned and carved in India, its shape alone would be satisfying challenge. The contour of the inner wall matches that of the outer one. A bent-shank cutter is in order.

Chapter 2 will work very well for this job.

The walls are usually straight on most boxes, which makes the turning fairly simple. There is nothing unusual about doing the exterior either. The top, however, requires a little planning. Determine how the top is to be fitted—over a lip on the bottom or with a lip that goes into the box. If the former is decided upon, then the lip has to be turned before the box is removed from the faceplate. A bead could be turned just before cutting in to make the lip. Remember, too, that if the lip is an integral part of the box, the walls should be just a bit thicker than usual. The lip is made and the box replaced on the faceplate by the piece from which the top will be formed. Turn the piece until it is the same diameter as the box, including the bead. Don't forget the bead. Now cut out the center deep enough to admit the top of the box (a tight fit) with just a hair extra. If a high dome-type top is planned, now is the time to turn away the waste. When this is completed, the top can be fitted onto the box. It will serve as a chuck for the exterior turning still required. Finish shaping the top. Turning a little knob on it similar to the one on the box shown is worth the effort. It places another accent on the wood grain.

DESK CADDY

Made of monkey wood, this variation (Fig. 11-2) on the box theme is almost 6" high, 3" wide, and serves best as a desk caddy. The wood is fairly dark in color and close grained. This makes it a good choice for carving as well as turning. The length might induce excess vibration while being turned on the faceplate, but bringing up the tailstock and turning the exterior first should eliminate this. The overall appearance is that of a barrel, and this is achieved by rounding the piece carefully from end to end and then turning off $1/32$ ". A 1" band is left untouched about $1\frac{1}{2}$ " from the bottom (the headstock end), and a similar band, $\frac{3}{4}$ " wide is left at what will be the top of the piece. The tailstock can be removed and the tool rest positioned to turn away the waste on the inside. Boring a 1" hole down the length will help in waste removal. The procedure is similar to turning the inside of a deep bowl, except the walls are quite straight in this case. The tool rest must be brought close to work even to the extent of putting one end into the orifice as it is deepened. Scraping tools are considered best for this operation, but with the hole drilled the wall can be eroded easily even with a parting tool.

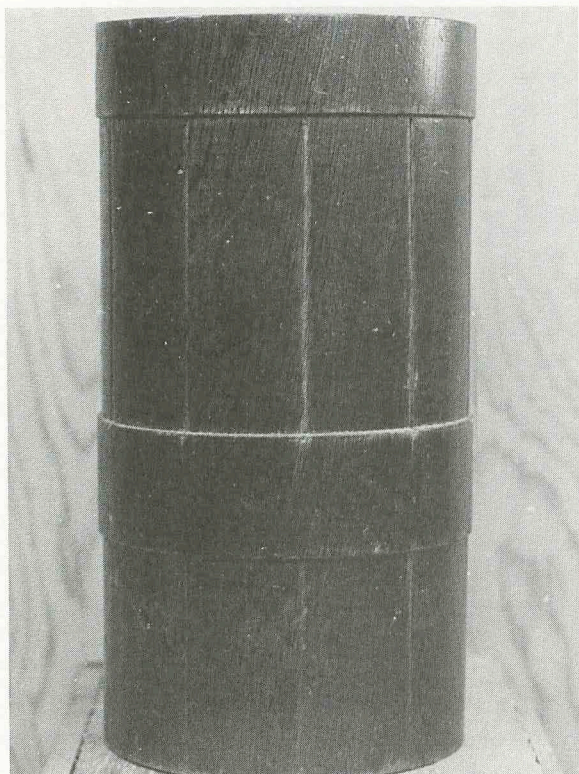


Fig. 11-2. Made of monkey wood, this desk caddy is a true exercise in faceplate turning.

The wall should be about $\frac{1}{4}$ " thick when turned completely, and this dimension could be initially marked off with a pencil or with the point of a skew chisel. The area being worked on is less than 1" in width, so much of the work will be depth penetration as opposed to working from left to center as with a bowl. The inside is turned to a depth of 4". Going in deeper could be difficult, and no effort is made to turn the bottom absolutely flat. In fact, a nice gentle curvature can be turned inside with a narrow gouge. Once the turning is completed, the lathe is stopped, and pronounced lines ($\frac{1}{32}$ ") in depth are incised about 1" apart longitudinally around the circumference. These lines do not cross the raised bands. The barrel effect, in fact, is much more realistic if they are halted a fraction of an inch on either side of the band. With this approach, the appearance is of hoops having been added rather than any portion of the surface having been lowered.

It is shown in use in Fig. 5-1.

BONGO DRUMS

The description of these drums (Fig. 11-3) is not a suggestion that anyone set about making them. They are unique in appearance, it is true, what with the contrast of the light and dark wood. The way the wood is laid up, however, would make them a far from simple project. The individual lengths of wood (10 in all), for example, must have measured about 2" wide by $1\frac{1}{2}$ " high by some 8" long if the unit were to be turned from a true cylinder. Each piece, inspection shows, is beveled its full length on both sides. One drum is 6" in diameter under the skin (on top), and the other is 5" in this dimension. The bottoms are $4\frac{3}{4}$ " and $4\frac{1}{4}$ " respectively.

What is proposed here is that the shape of each one lends itself to the making of a beautiful box, barrel, or drum to be set on a coffee table. Duplicating one calls for some simple arithmetic initially. Here's one way of approaching it.

Lay out a $6\frac{1}{4}$ " circle on paper. Immediately everything becomes a matter of degrees, and the computation is easier. Divide the circle into 10 parts, pointing off every 36 degrees around. It will be seen that the bevels have to be cut 18 degrees on each side (Fig. 11-4). The individual pieces have to be $1\frac{7}{8}$ " wide to form a 6" circle when the bevels are butted against each other. Glue the pieces together alternating light and dark woods, then tie them with heavy cord or with some form of belt clamp until the glue sets. Make up discs for both ends, gluing them with paper interposed. When dry, the piece can be mounted on a faceplate. Bring up the tailstock when mounting it on the lathe.

The piece is turned to a gradual, almost imperceptible cone shape with the smaller end toward the tailstock for better balance. Waste is removed from a 3" section in the center to a depth of $\frac{5}{8}$ ". This is visually perceived as being much deeper, so do not rely upon the eye alone when working this area. The drums shown have a lip cut on the smaller end to accept a metal band. As a box this lip should not be so precipitous. The line from the edge of the curved area to the end (about $1\frac{1}{2}$ ") should be a gradual, smoothly diminishing one.

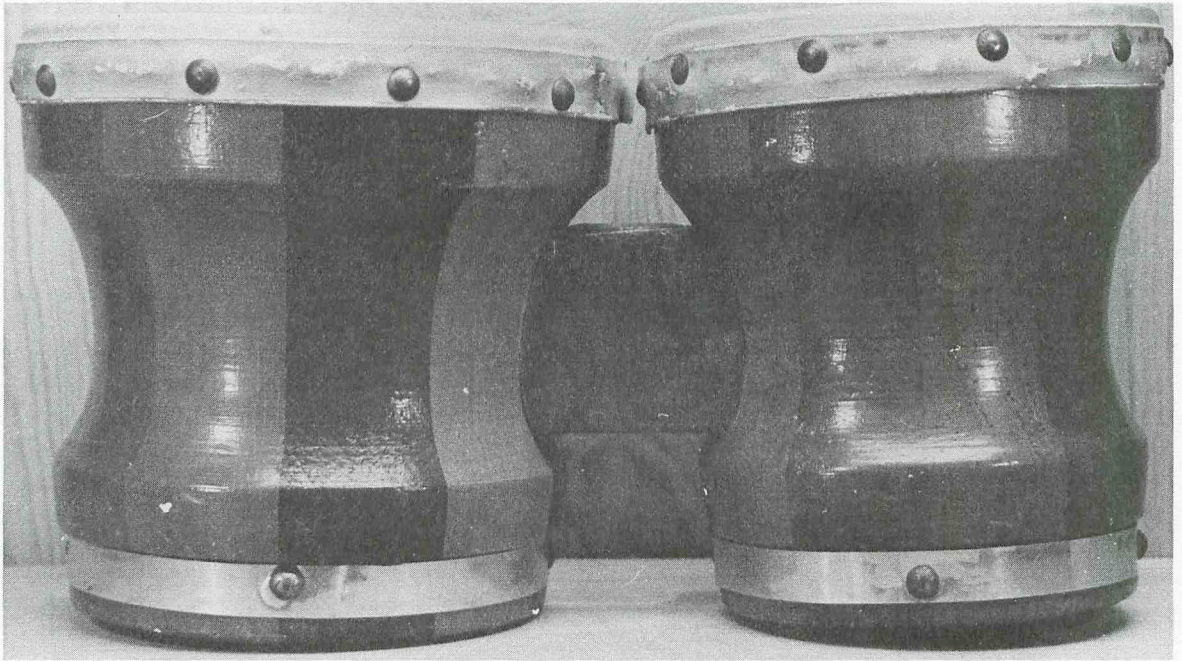


Fig. 11-3. Bongo drums might not be the ultimate in gifts, but ripe for swiping the design for a unique box.

At this juncture, the cover on the tailstock end can be parted off and the tool rest repositioned for turning away the waste inside. The lip on this end should measure about $\frac{5}{8}$ " in thickness. If the lip at the headstock end is to be the same, the waste must be turned off in greater amounts as the tools penetrate from one end to the other. It was probably done this way originally to produce a better sound when held between the thighs and thumped vigorously. While a good sound is not the ultimate goal here, the piece will be lighter if the turning is tapered rather than straight through. This tapering should not be overdone, considering that the wall will be thinnest at the center of the piece where material was cut away on the exterior.

A top or cover should be made for the piece, of course, unless one *has* to have a set of bongo drums! (This brings to mind our youngster's very first Christmas and someone's sheer delight upon gifting her with, of all things, a resounding, reverberating drum!) The cover can be an excellent exercise in laminating. Use the same dimensions as for the top, but this time take the wedges right into the center. Make pieces 2" wide by $4\frac{1}{4}$ " long and $\frac{3}{4}$ " thick. Cut

them to a point on one end. Glue them together and tie them around the circumference, making certain that they lie flat until the glue dries. Mount on a faceplate and turn a lip for a tight fit inside the box. Turn the lip close to the headstock so that the screw holes will be on the inside. Now remove it, press it on to the box, and turn the outer surface to a shape complimenting the box. The British would call this a biscuit barrel, but who would know the difference if they received it as a tobacco humidor? One further step would make the deception complete: line it to reduce the loss of moisture from the tobacco.

HEAD BED

This might best be described as a portable pillow—a rest for one's head (Fig. 11-5) in the Oriental tradition. It is presented here as a possible dual project because, scaled up considerably, it could be used as a sturdy tool or chair without a back. The turning is austere yet simple, yet with a bright bit of tapestry or strongly woven cloth on top and bottom, it becomes an eyecatcher. A stool could be fitted with a strong canvas-type material. The

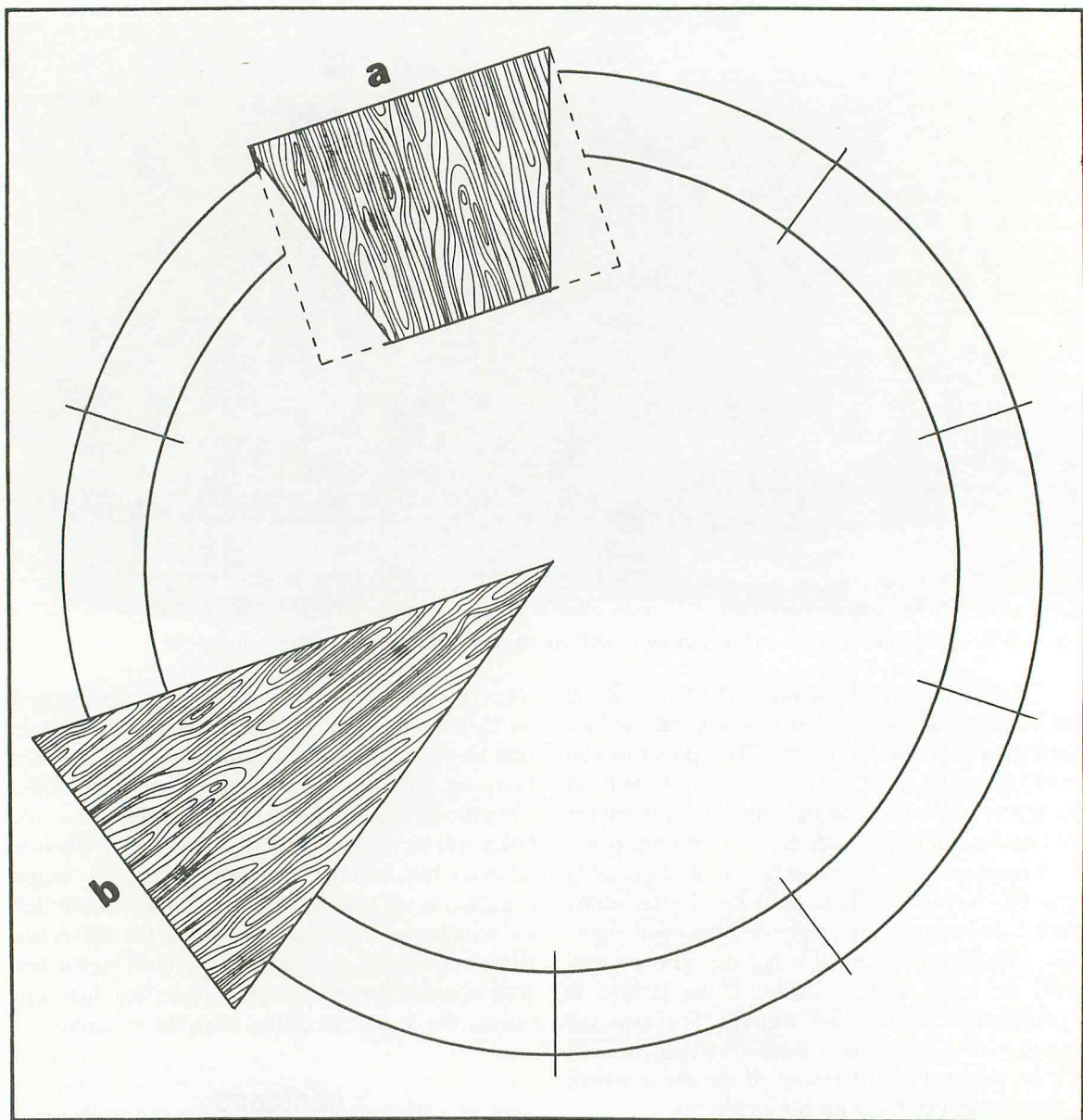


Fig. 11-4. Layout for side and top of "bongo drum" box, top view. (A) shape of side pieces, (B) plan for wedge-shaped top pieces.

bottom could be fitted with two pieces of webbing of the type used in lawn chairs.

Any weight applied to the structure is not straight up and down the length of the supports as it is in a chair. This is not critical in the case of the head bed, but it could be in the case of a stool. The

point is that the legs could be embellished with a few beads, perhaps a cove or two just to break the monotony of the straight lines. The whole thing is held together with five dowels, and there is nothing objectionable about this. Four of them, in fact, are better left smooth because of their function.

In the case of a full sized stool, however, the legs support the weight of the human body and cutting deeply into them might reduce their strength. Embellishment, I believe, should be in the form of gently rounded areas on square stock similar to that on the kitchen chair in Chapter 10. Because the legs rest on the floor or ground at an angle to the perpendicular, the ends should be well rounded—a half ball in shape. The top ends could be turned to much rounder balls and a bead included beneath them. Any stress on them would be minimal in the course of the stool's use. The center dowel, the pivot on which the sides rest when the stool is in the open position, should have two strong bolts with washers fore and aft. These bolts should be fitted with collars so that the threads on the bolts do not wreak havoc on the wood through which they pass. This is indeed a simple project. Either as a head bed or a stool. Dimensions for the stool are not

furnished because this would be a matter of preference. The legs on the head bed pictured are 10" in length.

MISCELLANEOUS ITEMS

Little has been said about turning musical instruments because I believe that more than competency with a lathe is required to make recorders like the ones shown in Chapter 4. Where should the holes go to produce an accurate note? How large a hole should be bored straight through? The answers to these questions and others require some musical knowledge that not all of us possess. It might be possible to turn a toy whistle that would please a child, perhaps, but other than the bongo drums described earlier and possibly drum sticks (which are not really instruments in and of themselves), most of the instruments that could be made require a foreknowledge in another field. The xylophone

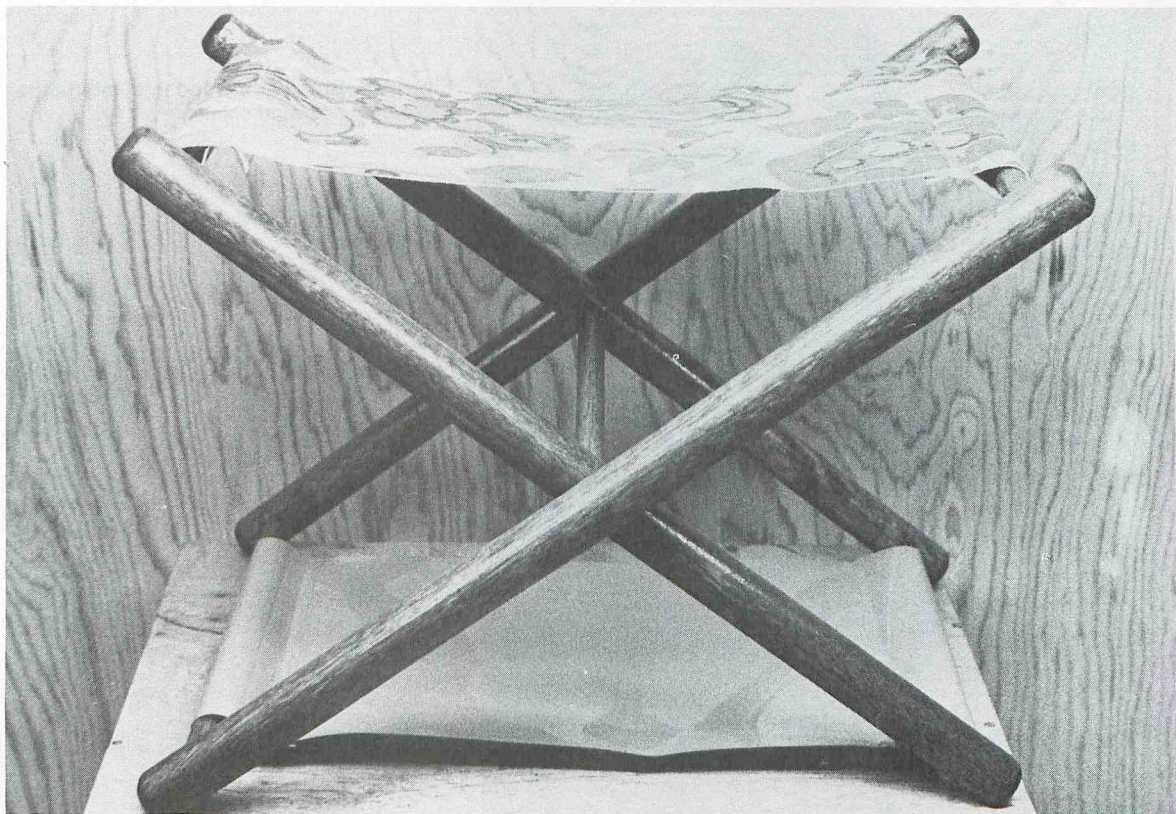


Fig. 11-5. Head bed in this size, stool when scaled up, it's a clever beginning project.

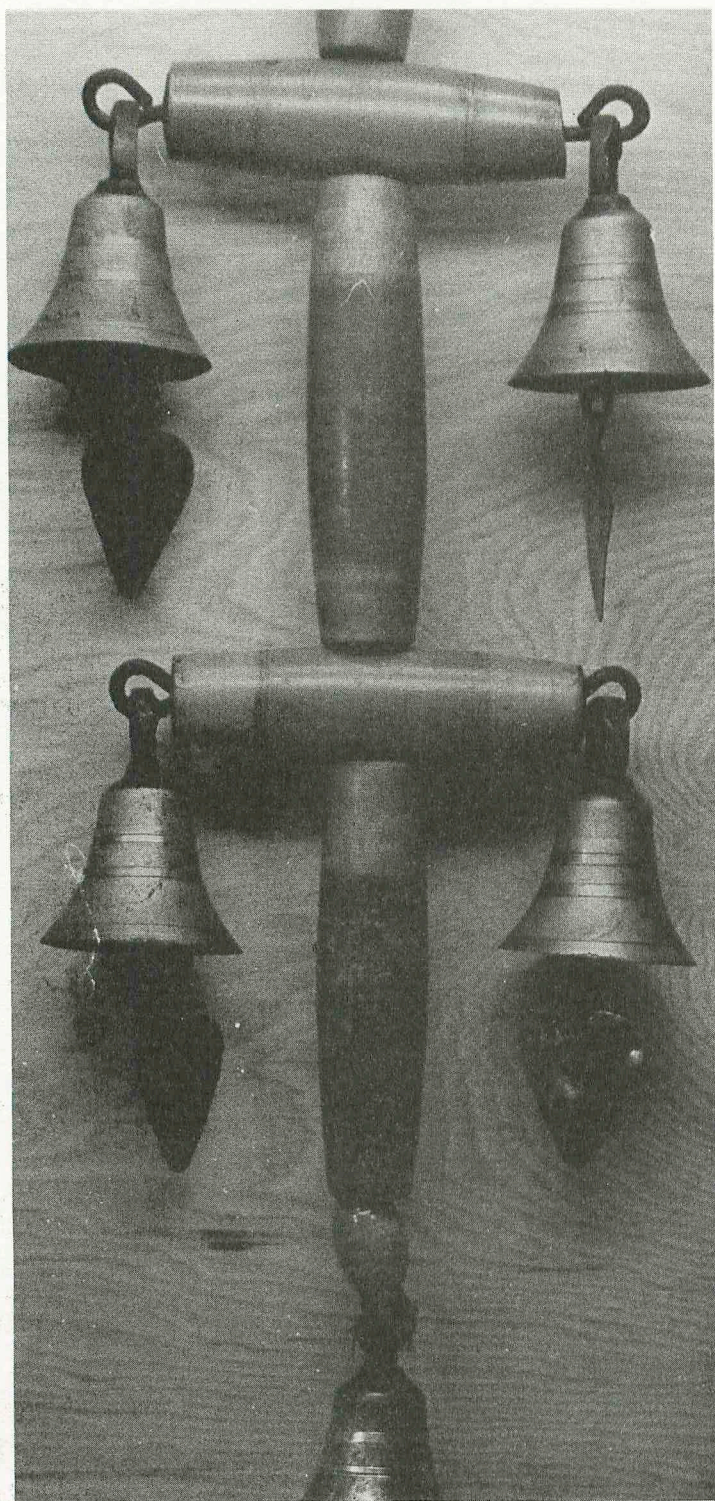


Fig. 11-6. Brass and wood in combination make up these wind chimes.

may come to mind, but the wooden pieces used to make one are usually about ½" thick and rarely, if ever, turned or even rounded off.

It is easy to make wind chimes out of metal tubes or from thin bits of glass; but even a careful choice of South American rosewood (supposed to offer the best tonal quality) cannot be used on the lathe to produce something on which one could play "Yankee Doodle." So, it's no instruments for the novice turner and only a remote possibility of some sort of wind chimes.

Realizing that life is often a compromise, why not take a clue from the natives in India and combine the wood with bells as shown in Fig. 11-6? Beads, spindles, and brass bells with clappers are combined to dance merrily in the slightest breeze.

On a positive note, here are a number of items that can be made using the techniques and methods

previously spelled out: egg cups; napkin rings; napkin holders (Fig. 11-7); knobs of all sorts; rolling pins; legs for tables, chairs, and other furniture; potpourri containers; brackets; pipe stems; bowls and rack; holders for balls of twine or knitting yarn; bracelets; buttons; earrings; mirror frames; letter holders; paper weights; wine racks; bowling balls and pins; and the list could go on with a little thought. For someone who has to take medication in pill or capsule form, an exquisitely turned, compact little pill case may prove a delight (Fig. 11-8).

MINICONDIMENT SET

This little set (Fig. 11-9) consisting of salt and pepper shakers with a small covered mustard pot embodies all the elements of both spindle and faceplate turning. The shakers could be turned

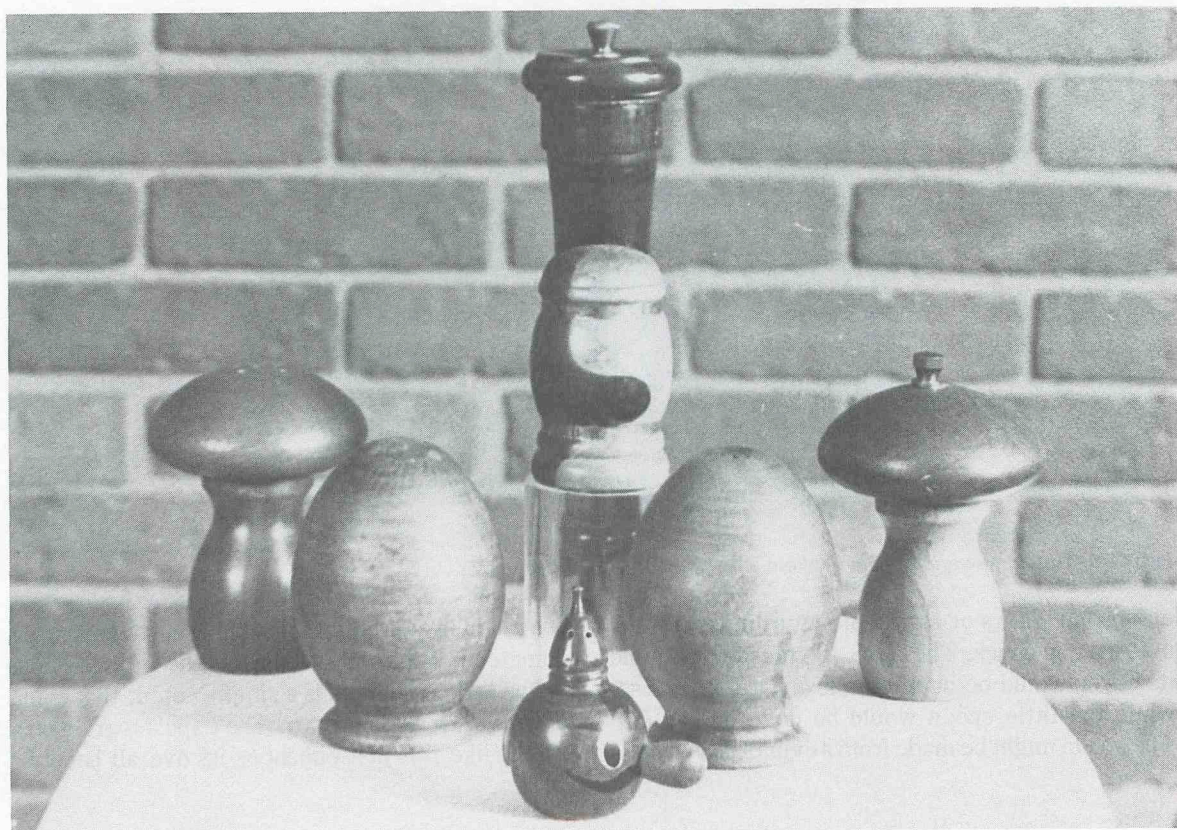


Fig. 11-7. Everyone turns salt and pepper shakers, so who am I not to include some examples?

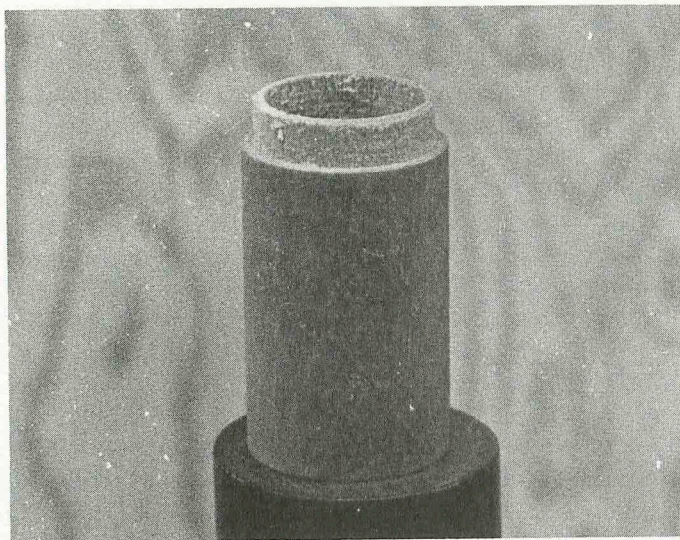


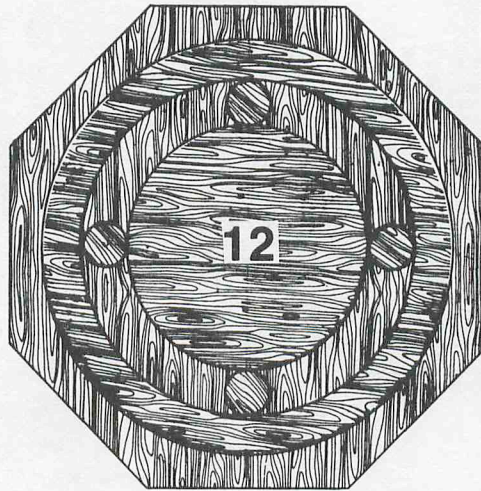
Fig. 11-8. Nucleus for a practical little pill box.



Fig. 11-9. Turned salt and pepper shakers with covered mustard container.

either on centers or as faceplate turnings with the use of a cup chuck. The base, the mustard pot, and its cover would be done on a faceplate, of course, while the little spoon would be done on centers. The spoon might be made from a cylindrical piece of

wood held in a three-jaw chuck, because the largest diameter is far from excessive. The lifting handle for the little ensemble is a simple cutout that could be done with a coping saw. The exposed grain on a project like this just enhances its overall beauty.



Finishing

THERE ARE TWO PERTINENT REASONS WHY the finish on a wood product is so vitally important. First, the wood must be protected; if nothing is done, soiling will inevitably occur and make it most vulnerable to other types of damage. Wood dries out, and this should always be prevented beforehand to avoid warping or shrinking.

Second, the finish selected must not only enhance the wood, but it must be just right for a particular project and for the wood from which it is made.

Retaining and preserving the natural color of wood will entail the use of wax, shellac, lacquer, varnish, or oil—all transparent finishes. Spirit stains, nongrain-raising and pigment oil stains are used generally to accent or emphasize wood's natural grain. Lacquer, varnish, or oil may be used on top of a stain.

Frequently, before use is made of any preservative, finish, or stain it is necessary to fill in the pores and uneven grain that is a natural phenomenon with some woods. These fillers are made of fine sand or silica compounded with oil and a dryer or,

alternatively mixed with a hard-drying varnish. A filler is most effective when applied with a stiff brush and thoroughly worked into the grain. After a surface is worked over with a filler it should be left to harden for 24 hours and then lightly sanded (Fig. 12-1).

WAX

Professionals tend to use wax as a finish more frequently than do laymen. It is actually preferred for work projects that will not get a lot of handling. The “pros” go even a bit farther and recommend carnauba wax. They differ, however, in its method of application. Some suggest an initial thin coat of shellac or a resin sealer. The piece is sanded lightly and three coats of wax are applied, with a healthy buffing between each application. There are those who point out that carnauba is brittle, chips readily and, furthermore, is difficult to acquire a uniform lustre. In the case of the lathe turner, its advantages outweigh the disadvantages. It is best applied manually, with the lathe stopped while it is rubbed on, but the buffing can be done with the lathe in motion,



Fig. 12-1. Small sampling of commercial finishes.

which is guaranteed to save quite a lot of elbow grease.

The surface to be finished must be prepared thoroughly. The surface must be as smooth as possible after the last skew or scraper has been applied. From here on the method differs with the authority. One sage suggests that the initial effort should be to get a good coat of wax on the object without striving for a shine. Manual application is suggested here to avoid wax buildup. A running lathe is not recommended because more wax might be wiped off than applied. There is a 10-minute waiting period after which the wax should be rubbed with a cloth. A fair amount of this rubbing may be done with the lathe running, but for larger segments stopping the lathe will prove better.

All the authorities agree on this: wax polishing can be done with a cloth but only with extreme

caution when the lathe is running. The cloth must not be allowed to be caught up on the wood, which is quite apt to happen. This somewhat dire possibility may be reduced considerably if the cloth is made into a pad with all the edges and corners tucked in. This system, in essence, calls for repeated applications of wax followed by buffing until the desired sheen is achieved.

The English are staunch advocates of the carnauba wax treatment. After the sanding phase, they apply the wax in lump form, held right against the workpiece. They place a flat portion of the lump in the center then slide it to one end, go back to the center and move it to the other end. Then they take gauze (cheesecloth should work), make it into a pad and apply it with a light steady pressure moving it from center to end of spindle, repeating this in the other direction. For a faceplate turning sufficient

pressure is applied to melt the wax in the center but is lightened as the pad moves to the outer area. Frequent inspections determine whether too much wax or too much pressure has been applied and corrections are made—more wax applied or the pad brought in contact with an area showing a wax buildup.

VARNISH

Varnish rates very high with most woodworkers and equally so with other craftsmen. It has earned the reputation of being the most practical and the most durable of the transparent finishes. It is offered as a brush-on, as a spray, and in glossy or satin finish varieties. Today, these finishes are rarely affected by factors such as high humidity or extremely low ambient temperatures in the work area. The glossy varieties provide the toughest finishes. Varnish can be used as a sealer by thinning the first coat with turpentine in a ratio of six parts varnish to one of turpentine. Usually the sealer is sanded with a fine paper or with steel wool followed by three coats of the varnish. A hand-rubbed appearance can be achieved by applying satin finish varnish for the final coat or, as a last resort, applying all glossy coats and rubbing the last one down with a mixture of pumice and water or oil. There are a number of rubbing compounds available that will reduce the gloss also. Rottenstone is most popular. This technique inevitably produces a velvety, truly rich appearance.

Frequently, when the wood is not sealed, the first coat of varnish will tend to raise the grain and there will be a rough feeling when the fingers are passed along the piece. A light sanding will eliminate this but any dust that might accumulate must be wiped off prior to any further applications of the varnish. It is my conviction that a minimum of three coats of varnish are required for the production of an optimum finish. The instructions that come with the varnish should always be read thoroughly because drying times differ with each brand. Often a manufacturer will advise a minimum as well as a maximum drying time, and this is important to the proper application of numerous coats. In general, drying times rarely exceed an hour when the am-

bient room temperature is about 70° Fahrenheit. It is during this period that dust accumulation must be avoided.

Varnishes vary in color from clear through very light in color to some varieties with a faint orange tint. The latter are considered the most durable and toughest.

Available also are products known as *varnish stains*. These have a slight disadvantage in that stain does not penetrate deeply, and the wood surface may be uncovered in the event of bumps, scratches, or accidental chipping. It may be preferable, therefore, to apply the stain separately, before the varnish. Damage to the piece is not as glaringly visible when this method is employed.

Expert woodcarvers and ornamental turners frequently apply no finish whatsoever to their work. They feel that many woods not only do not require it but look better without it. Walnut and cherry wood are examples of "No finish is a good finish." This is probably quite true of many of the exotic close-grained woods, but these are not always available to the turner. I have resorted to three finishes for the preponderance of my work: wax, Damar varnish by Krylon, and polyurethane. Experiments with Simoniz paste wax in the original formulation (round flat can) has produced a finish that lasted years on display items. Unfortunately, this product may not be available without an exhaustive search. No other paste wax I have encountered works as well probably due to their having been formulated for automobile finishes.

The better grades of spar varnish and floor varnish are said to work well if diluted with equal amounts of turpentine. This would seem to make sense, because they are certainly formulated for durability as well as clarity. It happens that the polyurethane varnishes are considered a better choice than everyday spar varnish. They are lighter, tend to dry better, and are applied much more easily. The wood cannot be sealed with shellac if polyurethane is to be used. According to the manufacturers, surfaces should be sealed with a dilute solution of the polyurethane to be used. This may be difficult, of course, if one is using the compact, spray cans available at the retail level. In this

case, two very thin coats should be applied initially to serve as a sealer.

SHELLAC

Shellac, though not as tough as varnish, will produce a glossy, fairly hard surface. Applied with a brush, it is normally thinned with equal parts of denatured alcohol. The 4-pound or 5-pound cut works better if further diluted. Sanding may be necessary after the first coat, because the shellac may raise the grain. It dries rapidly, which means there must be no dawdling in its application, but also that additional coats may be applied every two hours or so. Long strokes should be used, and the brush should be guided into wet surfaces as much as the particular object being coated will allow. Don't expect as beautiful a finish as that produced by varnish, although shellac's low cost may be a contributing factor in its use. Consideration must also be given to the fact that it is definitely not impervious to moisture. A good coat of wax will have to be maintained on the object to protect it. In the case where a wax finish is sought, a couple of preliminary applications of shellac will reduce the number of waxings required to achieve a good final result.

FRENCH POLISHING

Polishing by this method has always been a traditional part of finishing fine furniture and cabinetry. A lot of hand work is normally involved, but much of it is eliminated for the lathe turner who can run his machine during the process. The end results have always been regarded as superior to other glossy finishes, yet one of its drawbacks may be that it is far less impervious to the ravages of heat and moisture.

French polish, as sold commercially, has as its basic ingredient shellac without the resin that is normally a part of it. Application is with a cushion or pad. The pad is nothing more than a wad of cotton charged with the polish and wrapped in a piece of cotton cloth. Make certain not to complicate matters by using cloth that is not lint-free. The polish exudes through the cloth when it is twisted over the cotton wadding. The initial step in the process is to

accumulate an amount of the polish on the turned item being polished. The cloth is twisted forcing the polish out and, with a minimum of pressure, is held against the rotating object. The pad must be moved back and forth so that the shellac is distributed evenly. Do not allow hollows to be filled in with the polish or protruding areas to get just a thin coating. Apply polish to the wadding as frequently as required, noting that there will be immediate hardening of the polish on the wood as a result of the friction-generated heat. If the surface shows irregularities, these may be removed or evened off with the use of very fine steel wool. Use the steel wool with caution, because the idea is to build up an overall coating of the polish, not remove it.

Continue this process but with a reduced amount of polish on the pad. This change in procedure may produce some detectable drag on the workpiece, which is best eliminated by the addition of a drop of linseed oil on the rubbing cushion. One drop is sufficient—an excess will be indicated by visible pad marks on the piece. The whole surface must be treated several times but always with the pad not overly wet and without rubbing too vigorously. Always remove the applicator before stopping the lathe. Now rub the piece once over lightly with polish diluted with alcohol on the pad. Allow the piece to set for a few hours. Finally, the piece is wiped with a bit of alcohol on a new pad. Substitute a clean, dry pad and wipe once again. Set the piece aside for several days before offering it around to be admired.

LACQUER

Speed of application is lacquer's prime attribute although it also offers excellent surface protection. It can be sprayed or brushed on and, on wood, a maximum of six coats are recommended. Additional coats may induce cracking or crazing. Automobile customizers have been known to resort to the application of 20 coats of lacquer with rub downs in between, but this is generally over a base color coat on metal. This would be self-defeating with wood, because "grain's the game" for the lathe turner more often than not! Lacquer is usually sprayed on and is available in satin, dull, and high-gloss va-

rieties. Most often used as a clear cover, it can be obtained tinted. In addition to its advantage of quick drying time (20 minutes or less), it can be used as a sealer. Its is considered a durable finish and will resist moisture with the use of special additives.

One fault always associated with this product is its tendency to produce an orange peel appearance during the spray period. Once this happens, the only recourse is to remove the lacquer and clean the object before further spraying. The cause is not enough thinner in the spray mixture or the use of too much air pressure. With the aerosol-type spray can, the fault lies more in the distance the can is held from the workpiece and the thickness of the coating applied at one spraying. Follow the instructions on the can to the letter—apply thin coats with drying time in between and hold the can 10" to 12" away from the object. Cabinet makers usually advise that completing a lacquer finish is done best by rubbing with pumice, following this with rottenstone and oil and a final, thorough cleaning. For turned objects, I eliminate these steps and finish the lacquering with a good, healthy coat of wax.

OIL RUB

This type of finish is guaranteed to bring out the beauty of the wood to which it is applied. It acts as a sealer and provides a durable finish. Properly used, the oil penetrates the wood cells, saturating and hardening them. I've seen a recommendation for a long, tedious, drawn out procedure that involves an application of drier, boiled linseed oil, and turpentine for one week, then a spacing of the applications to weekly and finally to once a month. This may be fine for large pieces of furniture but many other professionals apply warm thin coats every two days with a fine sanding after each coat is dry. Even the application of 6 to 12 coats, as they suggest, is much faster.

In lieu of all this, the relatively new Danish oils may be tried. They wipe on easily with a rag. A liberal coat is spread on the piece, it is allowed to stand for an hour, then the excess is wiped off and the work allowed to dry overnight. The oil rub method of finishing is at the bottom of the list of favorite methods, however, and it is presented here

simply because it does work and may prove to be a satisfactory alternative for some turners.

STAINS

Staining is always a preliminary to one of the methods of finishing described above. It is used basically to either improve the appearance of a wood, to emphasize its grain, or to match two pieces of different wood. It is not truly effective in the last case because grain pattern differences are immediately apparent to the practiced eye. Staining will not make a poor wood look like an exotic one. It will darken wood, at least intensify the original color, and it is used many times for just this reason. While stains do change the appearance, they offer little protection, hence the suggestion that they be used just before applying another finish. In capsule form, stains break down into these classifications: pigment oil, spirit, and nongrain-raising stains.

Pigment oil stains do not make a deep penetration into wood and have the added disadvantage of being susceptible to fading. Application with a brush is relatively easy. Wiping (with a clean rag) is required immediately after application. Delay in wiping allows the color to strengthen. Each coat should dry for a day.

Spirit stains have excellent penetration capability, but are also prone to fading. They dry with great rapidity, making them somewhat difficult to apply. The best method of application is with clean rags. Allow 15 minutes for drying.

The *nongrain-raising stains* incorporate most of the attributes of the other types with some of the disadvantages. They allow deep penetration, and they dry quickly. They are light-fast and applied easily with either rag or brush. As is the case with some other stains, they are notorious for bleeding through the finish coat if they are not sealed with a wash coat of shellac. Their drying time—four hours—is not the greatest.

The ways of changing the color of wood are legion, many of them having fallen into disuse or simply replaced by the oils and stains cited above. Some of the older formulas sound like witches' brews, or concoctions from alchemy (which some of them actually were). *Dragon's blood*, an East Indian

resin, for example, was used to enhance the color of the pale mahogany and other red woods. Many of these tinctures, as they were called, were used to dye or stain woods such as pine, maple, ash, oak, and pear. Some of them could not be bought today without having to sign a pharmacist's book! Try buying nitromuriate of tin, these days. It was said to produce an admirable crimson purple ideal for imitating many hardwoods.

Surprisingly, there are two known products today, both relatively safe to use which do work well on some woods: ammonia and permanganate of potash. To use ammonia, set the object (made of oak or chestnut) to be treated in a well-ventilated area and brush on the ammonia. It will produce a deep brown color unlike any other stain available. Permanganate of potash, dissolved in water, will produce a medium brown that is inexpensive and safe to use. Before passing on to another subject, here is an old, old formula gleaned from exhaustive research on finishes:

Varnish to Imitate the Chinese. Put 4 ounces powdered gum-lac, with a piece of camphor about the size of a hazelnut, into a strong bottle, with 1 pound good spirits of wine. Shake the bottle from time to time, and set it over some hot embers to mix for 24 hours, if it be in winter; in summertime it may be exposed to the sun. Pass the whole through a fine cloth, and throw away what remains upon it. Let it settle for 24 hours; separate gently the clear part in the upper part of the bottle, and put into another phial; the remains will serve for the first layers or coatings.

Such formulas were actually used in the 1870s and for a while after that. Muriatic acid saturated with lime, for example, applied like whitewash to the ends of boards would attract moisture from the air and prevent them from splitting. Surprisingly, quite in today's tradition, a most attractive red color can be produced on mahogany by the simple expedient of whitewashing it with slaked lime just as homeowners used to whitewash fences in Huckleberry Finn's time. All traces of the lime should be removed with a mixture of boiled linseed oil and turpentine. Any additional finish coats may be applied to the piece after this treatment.

PAINTING

Very little has been or will be said about painting turned objects. Actually there is little difference between painting them and any other wood product. The one exception might be balusters, railings, and newel posts, although in the restoration of old houses usually the first things to have the paint removed are these very items. It is my contention (repeated many times now) that the original wood is its own best salesman, but there are times when painting is judicious, children's toys being a case in point. The brightness is part of the attraction to a child and, more important, the toys are frequently made of scraps of inexpensive wood.

Paint should be bought from one manufacturer consistently. You soon become accustomed to its proper application so that there can be reproducibility, a similarity in results. If a primer is required, a couple of coats of shellac will suffice. There are one or two things to be watched with painting turnings. Grooves and hollows tend to fill up rapidly with paint and this is most undesirable. Blobs may accumulate with the use of a paint brush and runs may occur with spraying. Glossy paints are tougher than the rest of the finishes, and they are much easier to keep clean on toys.

BRUSH CARE

Applying a filler, shellac, or varnish to turnings is probably done more frequently with a brush than with a spray can even in this day of the aerosol proliferation. It is sheer idiocy to use a cheap brush on a piece that has taken hours to turn, and it follows that care of good brushes is additional insurance of satisfactory finishing. As soon as you are finished using a brush, it should be thoroughly cleaned. Stain, varnish, or paint brushes may be cleaned with mineral spirits, kerosene, turpentine, and a number of other thinners. Also available are quite a few cleaners specifically formulated for brushes.

Here are a few additional hints and tips on the care of paint brushes before and after projects.

□ Pour appropriate solvent into a glass jar with a metal screw top. Punch a hole for later inserting the brush (Fig. 12-2). Clip a spring

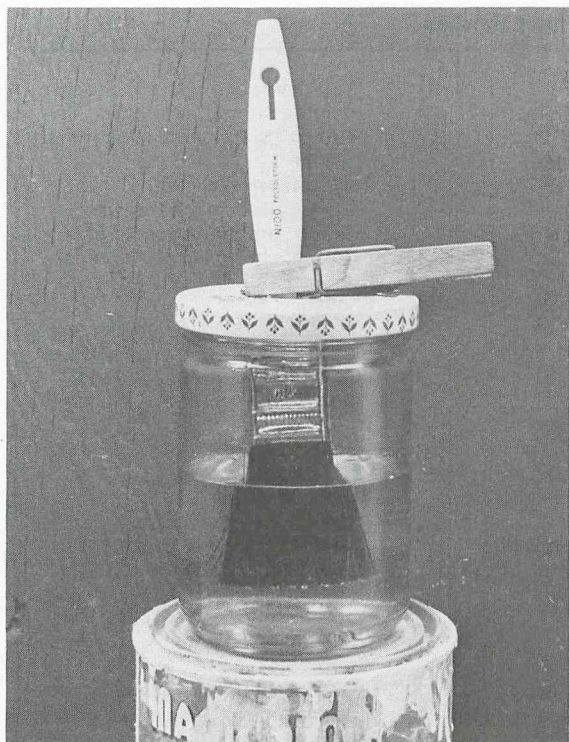


Fig. 12-2. Set up for temporary brush storage.

clothespin to the jar. This jar will be used only for temporary brush storage.

☐ Pour the same clean solvent into another glass jar with a metal screw top.

☐ Before using brush on project, swish it in the jar of clean solvent. Dry brush out on a piece of paper toweling or facial tissue.

☐ After project, clean brush immediately.

☐ If temporarily setting brush aside, insert it through the hole into the solvent jar with the slotted cap. Clip the clothespin onto the handle, so that the brush bristles do not touch the jar's bottom.

☐ When storing the brush permanently, swish it through the clean solvent, then wash with soap and warm water. Rinse and gently shape the bristles with saliva and wrap them loosely in foil or waxed paper.

☐ Store brush upright in a labeled container which has been reserved for brushes cleaned with that solvent only. There should be separate containers set aside—one each for turpentine, paint

thinner, lacquer thinner, paint and varnish remover, and other common solvents.

☐ Shellac brushes are cleaned with denatured alcohol.

☐ A good healthy lathering in detergent and hot water, after the brush is cleaned with a thinner, will remove the remaining vestiges of dirt from the bristles.

SANDING

Sanding is done before a finish coat is applied, sometimes between coats and, on occasion, after the finishing is done. It is usually done with the lathe revolving at a high speed (2800 to 3800 rpm for spindles up to 3" in diameter and 785 to 1080 rpm for faceplate turnings up to 8" in diameter). In essence, the wood must be prepared to accept the selected finish without any inkling of the work that went before showing through. There must be no visible lines from the chisels, certainly no humps or depressions. It has been said that someone especially good with the turning chisels can complete work on the lathe that needs no sanding. How many of us have that kind of skill and expertise?

Yet, when it comes to the selection of the proper sandpaper, it develops that there is more to it than "coarse, medium and fine."

First, the gritty substance glued to sandpaper is rarely sand these days, nor is the paper always just that. There are both natural and manufactured grits used for sanding wood. Some of them work so well that using the wrong one could take off a prominent bead before you could blink twice or gasp in horror. The first clues come in the fact the grading system gaining prevalence now ties the number to the amount of grit—50, for example, indicates that there are 50 grits to the square inch of paper. This is coarse, indeed, but 200 grit paper may work much better on a particular hard wood. I've seen numbers as high as 800, but would not recommend anything higher than 400 or 500 for wood. The term "paper" is a misnomer, too, because cloth is the prevalent backing material used throughout the industry.

Sand *had* been used originally as an abrasive and was followed by powdered glass. Flint was

Table 12-1. Table of Wood Finishes.

Acrylic Gel Medium waterproofs, flexible; also an adhesive	Epoxy rustproofs, waterproofs	finish, preserving finish, one-step polymer finish; example: "Envirotex"; waterproof, alcohol resistant
Acrylic Lacquer	Glaze, Ceramic	
Acrylic Paint makes absorbent materials water resistant; where appropriate, follow with varnish then wax	Household Wax, (Paste) (prime with acrylic or oil)	Polyurethane Varnish also called urethane varnish; water repellent, resistant to grease, chemicals and weather
Acrylic Polymer Base (Gesso) waterproofs, rigid; a sealer	Lacquer not the lacquer of the Far East	Rubber Paint
Acrylic Polymer Emulsion also called polymer medium, acrylic sealer; example: "Magic Art," also an adhesive	Latex	Shellac substitute: "Mod Podge"; a primer and sealer; if orange, an antiquer
Acrylic Spray Coating example: Krylon acrylic spray coating; sealer for any porous materials	Latex Enamel also called acrylic-based enamel, vinyl enamel	Shellac and Denature Alcohol (follow with wax)
Aluminum Paint wood (as a sealer)	Leather Balm water resistant	Tung Oil sealer, finish
Antiquing Glaze, Oil-Based	Linseed Oil, Boiled wood sealer and finish	Vinyl Finish
Antiquing Paste example: "Rub 'N Buff"	Liquid "Metal" comes in brass, lead and steel colors; example: American Handicrafts "Art Metal"	Wax Base Paint (for raw wood first prime with shellac or another sealer)
Bronze Powders follow with wax	Metal Antiquing Chemicals ammonium chloride, butter of antimony, liver of sulfur	White Glue and Water sealer; substitute for clear acrylic, substitute for varnish
Carnauba Wax	Metallic Powder	Whitewash
Caseln	Metallic Wax wood (primed)	Wood Filler good for open grain woods such as mahogany, maple, oak; does not work well on close grain woods such as birch, pine
Enamel prime with recommended undercoater	Mineral Oil, White (Clear) background, filler, sealer, finish	Wood Stain prime with filler and sealer, follow stain with varnish
Enameling Enamel enamel undercoating	Oil Paint prime with enamel undercoater	
	Polymer Compound (Reactive) also called: high gloss polymer finish, mirror finish, crystal clear	

substituted eventually. The British still recommend glasspaper as a wood abrasive, and it is good. Garnet papers work especially well, as do aluminum oxide and silicon carbide. Aluminum oxide is usually available in the finer grits and should be used for "fine tuning" a finish rather than attacking bare wood. Silicon carbide is supposed to be best for finishing and experience has proven this to be true. It will "load up" rapidly on bare wood. Yet, for another pertinent reason, I am never without it in our studio: it can't be beaten for working plastic! Sand a polyester resin piece with 120, 220, and 320 grit in that order and it is ready for minor buffing. I like 3M brand best. The grit is attached to a cloth back with waterproof glue. This is *wet-and-dry* paper, which means it can be dunked in water before sanding. Used wet, the dust just flows away, permitting it to operate in a clean cutting mode

constantly. Surprisingly, I rarely use it wet because this is messy around the lathe but even dry it beats just about every other paper I've used.

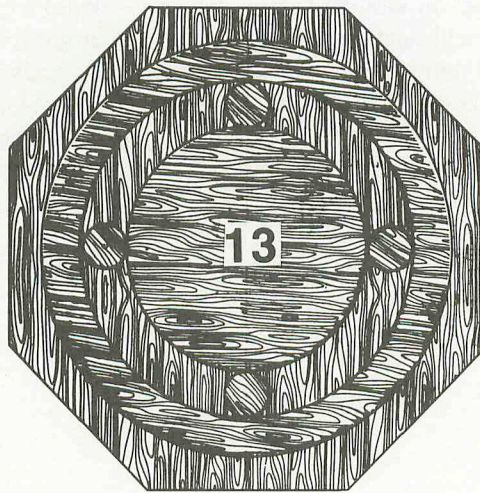
Most papers come in 9" x 11" sheets. I used to cut them up into four equal pieces because they fit an orbital sander that way. The same pieces are good for lathe sanding when placed in the palm of the hand and held under the rotating workpiece. The paper has to be moved around under the work because some heat is generated that may melt the adhesive. If this, with the grit, transfers to the wood it is extremely difficult to remove. You might have to go back to a 120 grit and then to a 220 before it is all cleaned off. Cutting a long strip and holding it by the ends with both hands so that it cradles the work from beneath is another method of sanding that is very effective. One end and then the other can be raised and lowered so that the paper does not wear

out in one spot. It can be moved from left to right simultaneously.

Another method often used on straight spindles involves the use of a handheld sanding disc. It is rested on the workpiece and moved from left to right. This is a great leveler. Some professionals recommend steel wool, but I have had it snatched from my hands and rarely use it for sanding on the lathe. It can penetrate into grooves where paper

cannot, but it is right there that it is even more prone to get caught. Cutting thin strips of sandpaper (about $\frac{1}{4}$ " wide) will frequently solve the problem of sanding in grooves and crevasses.

A good supply of several grades and grits of sandpaper is a valuable asset to the lathe turner. The fact to remember, however, is that they should be relied upon to produce a finish on a piece, not to bring wood to an acceptable shape. See Table 12-1.



Woods for Turning

MUCH OF THE DISCUSSION ON WOODS THUS far has centered on “found woods” and on those commonly used and readily available varieties. You would have to be a long standing member of the International Wood Collectors Society to be completely familiar with all the woods best suited for turning. Woods are usually broken down into two categories: softwoods and hardwoods. There are even further subdivisions. The hardwood, mahogany, for example, differs in character in relationship to its origin. It is available from Central and South America, Africa, the West Indies, and from Honduras with differences peculiar to each point of origin. The United States Forests Products Laboratory, Department of Agriculture, Washington, D.C., offers complete tables of native and imported woods. A perusal of these tables is suggested for the valuable information on ease of cutting, hardness, durability, and the other qualities and classifications of wood. Needless to say, some woods are easier to work than others. A number of the more popular woods are listed in the order of

their workability from difficult to easy. This listing is not for turning alone by encompasses wood-working in general. Some woods do lend themselves to turning, and I include a few here with brief hints on how they might be finished to best advantage (Table 13-1).

TEAK

Although teak is porous, it is also quite hard and very durable. It is close to the color of nutmeg and is rarely bleached. Shellac or sealers are never recommended for this wood because the natural oils of the teak fight with the shellac gums—they are incompatible. A water-white lacquer or oil is suggested for a natural finish. Black is the most popular stain for teak and this can be made up by a mixture of 1 part dark walnut stain, 1 part dark mahogany stain, and ½ part black stain. Work up highlights by using a very, very fine sandpaper so that a bit of the natural color comes through. A lacquer or wax finish completes the job.

MAHOGANY

This wood spans a color range from a pinkish brown (relatively dark) to a pale claret. It is usually stained rather than left natural. Today bleached mahogany is "in" and this is accomplished by bleaching, flushing well with water, and then sanding until a pinkish cast is evident. Apply a colorless wood filler and then clear lacquer.

PINE

Another softwood, but with a close grain that needs no filler. It turns well (this from experience) and looks especially good when used with wood of a contrasting color. It will accept most stains but should have a good shellac wash coat prior to staining. It can and should be lacquered after staining.

WALNUT

This is a hardwood frequently used for carving, veneering, and sculpting. It has a texture that can be accented by refraining from the use of a filler. It is sometimes presented with an antique gray bleached finish. Bleach first with a commercial wood bleach

then sand, stopping only when the natural color is brought out. Apply a gray filler and finish with varnish or lacquer.

HICKORY

An extremely hard wood and heavy as well, hickory is a prime choice for turned handles for tools. In this case, the tendency is to allow the natural color to show through so the handles can be finished in clear lacquer, waxed to develop a patina from handling, finished with a sealer and rubbed with linseed oil.

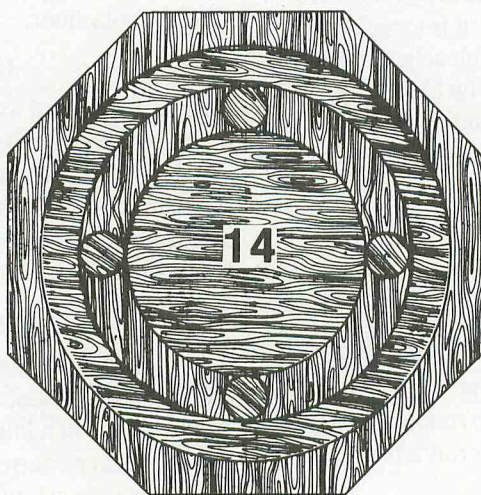
LIGNUM VITAE

A Central American wood considered to be one of the world's heaviest and hardest woods. Greenish gray in color, blending from light to very dark with a marked grain pattern, it has been used for propeller shaft bearings on large ocean liners because marine worms will not attack it. When it is used for turned objects, no finish is applied except, perhaps, a little wax. It is highly prized for ornamental and decorative turning.

Some of the other woods of special interest to the lathe turner are discussed in Chapter 14.

Table 13-1. Workability of Various Woods.

(from difficult to easy)	
Hardwoods	Softwoods
Lignum Vitae	Douglas fir
Hickory	Spruce
Maple, sugar	Pine, Western yellow
Oak, red	Redwood
Oak, white	Pine, Eastern white and sugar
Beech	Fir, balsam
Birch, yellow	Cedar
Teak	
Walnut	
Cherry	
Mahogany	
Sycamore	
Elm, American	
Ash, commercial white	
Holly, American	
Yellow poplar	
Willow	
Basswood, American linden	



Ornamental Turning

THE AMERICAN CRAFT MUSEUM II PRESENTED an exhibition in New York early in 1983 entitled "The Art of Wood Turning." It ran for 12 weeks and featured the work of some of the country's top lathe turners. I had the pleasure of meeting and talking with the noted Master Turner Frank Knox and his apprentice Richard Miller. I spent two exciting days observing ornamental turning and learned that not only has there been a revival of turning in this country and abroad, but that there are a very few people quietly pursuing a hobby that, from the 1700s through the 1800s, have been the exclusive province of royalty. They are creating the most exotic pieces of ornamental turnery that sell today for close to \$10,000.

Ornamental turnery is, according to Frank Knox, "one of the most unique, exacting, and little known art forms the world has ever known. It is the production of delicately contoured and intricately decorated surfaces on objects of art produced on a special kind of turning lathe."

The ornamental turning lathe is most unique and differs from ordinary lathes in several aspects.

It is fitted with an overhead drive somewhat similar to a dentist's drill assembly. This drive powers minute cutting tools held in a variety of cutting frames that mount in a compound slide rest. The salient difference between this and other lathes is that both the cutting tool and the headstock are powered and capable of running simultaneously or separately at the operator's will.

One of the first treatises on ornamental turnery was written by Charles Plumier in 1701. About 17 years later, Peter the Great is reputed to have sent his master turner off to the Court of Frederick Wilhelm to instruct the King of Prussia in the craft. There are ornamentally turned objects by Peter the Great on exhibit in the Copenhagen Museum today. Objects by other members of royalty are shown in Florence, Italy, and in museums throughout the world.

John Jacob Holtzapffel formed a tool company in 1794 and began producing a much improved ornamental turning lathe. He, his son, Charles, and eventually his grandson, John Jacob II, manufactured and delivered on special order about 2,000 of

these lathes during a period extending right up to 1914. The select owners of these lathes (particularly the British) were so enamored of them that they took them along to far corners of the Empire. It follows that many never went back to England and were lost to posterity. Less than 300 of them can be accounted for today.

Fortunately, Holtzapffel was not the only manufacturer of these lathes. The one exhibited and demonstrated at the Craft Museum was an Evans, and it is this one that I photographed at the home of Richard Miller, its present owner. It is through his courtesy and consideration that I am able to explain the intricacies of these lathes as well as present some of his fine work.

DESIGN AND FUNCTION OF THE ORNAMENTAL LATHE

The Holtzapffel and Evans (Fig. 14-1) lathes are quite similar, the main differences being in the mounting of the overhead drive. The Holtzapffel has a balanced arm extending from the left of the machine on which small pulleys are mounted. The Evans has two uprights toward the back of the machine, between which the pulleys and a large roller are fitted on a pole. The cords from the motors go up to the pulleys, around them, and back down to the headstock mandrel and to the cutting tool. Both lathes were powered originally by a treadle and flywheel pulley which, Frank Knox informed us, required 45 pounds of pressure to operate. This mechanism on both lathes is still operational today, although it has been bypassed in both cases. (Dick Miller reports that someone here in the United States still operates his lathe by foot power. A sturdy man, indeed!)

Another difference is that the Holtzapffel lathe has a longer bed than the Evans. The rest of the working "bits and pieces" are very similar, so nothing is lost in describing those made available to us on the Evans lathe. Three separate and clearly differentiated types of motion are well within the lathe's capability. It operates just like any wood-turning lathe with the workpiece held between centers for spindle turning or with a faceplate or chuck for bowl turning. Waste removal is possible either

with regular hand-held chisels or by the tiny ornamental cutting tools held in the slide rest. So thorough and meticulous were the Holtzapffels that they provided dozens of the chisels or plain turning tools and hundreds of the cutters. Dick Miller confided, in one of our many interviews, that he had acquired at auction one box containing 750 of these cutters and another containing 150.

Another motion is possible with the mandrel maintained in a static position, locked by a pin in the pulley face, which now serves as an indexing head. The pulley face has on it a series of holes set in circles in which the spring-loaded pin is fitted. The largest ring has 360 holes, the next 212, the third 120, and the smallest 96 holes. Dick Miller says the outside ring of holes (the 360) is seldom used. The overhead drive is utilized to power the cutting tools held in the sliding rest while the work is held immobile. The tools move in any direction—vertically, horizontally, at in-between angles relative to the work, in varying diameter circles, or simply straight forward as a drill. The moving tools can also be worked laterally along the piece as with a metal working lathe. Cuts in this mode may be kept down to one 2/100th of an inch.

The third and perhaps most fascinating action is a combination of exaggeratedly reduced speeds on the headstock mandrel with the lateral movement of the revolving cutters. The almost painfully slow motion of the workpiece allows a long spiral to be cut in the workpiece. It is after a cut such as this (once around the work in 7") that the indexing pin is advanced one hole in the pulley and another spiral is cut immediately beside the previous one.

Add to these three movements the various cutting directions permitted by the cutting frames and the infinite variety of cuts produced by (in the case of Frank Knox) more than 600 little cutters, and it is evident that chalices, bowls, vases, boxes, and plates could be made by all the operative lathes currently extant in the world today without any hint of similarity ever cropping up. Creativity is encouraged to run rampant here, with the operator cranking the tool reset laterally with one hand and moving the speeding cutter away from him with the other. Some of the feats of the practiced ornamental

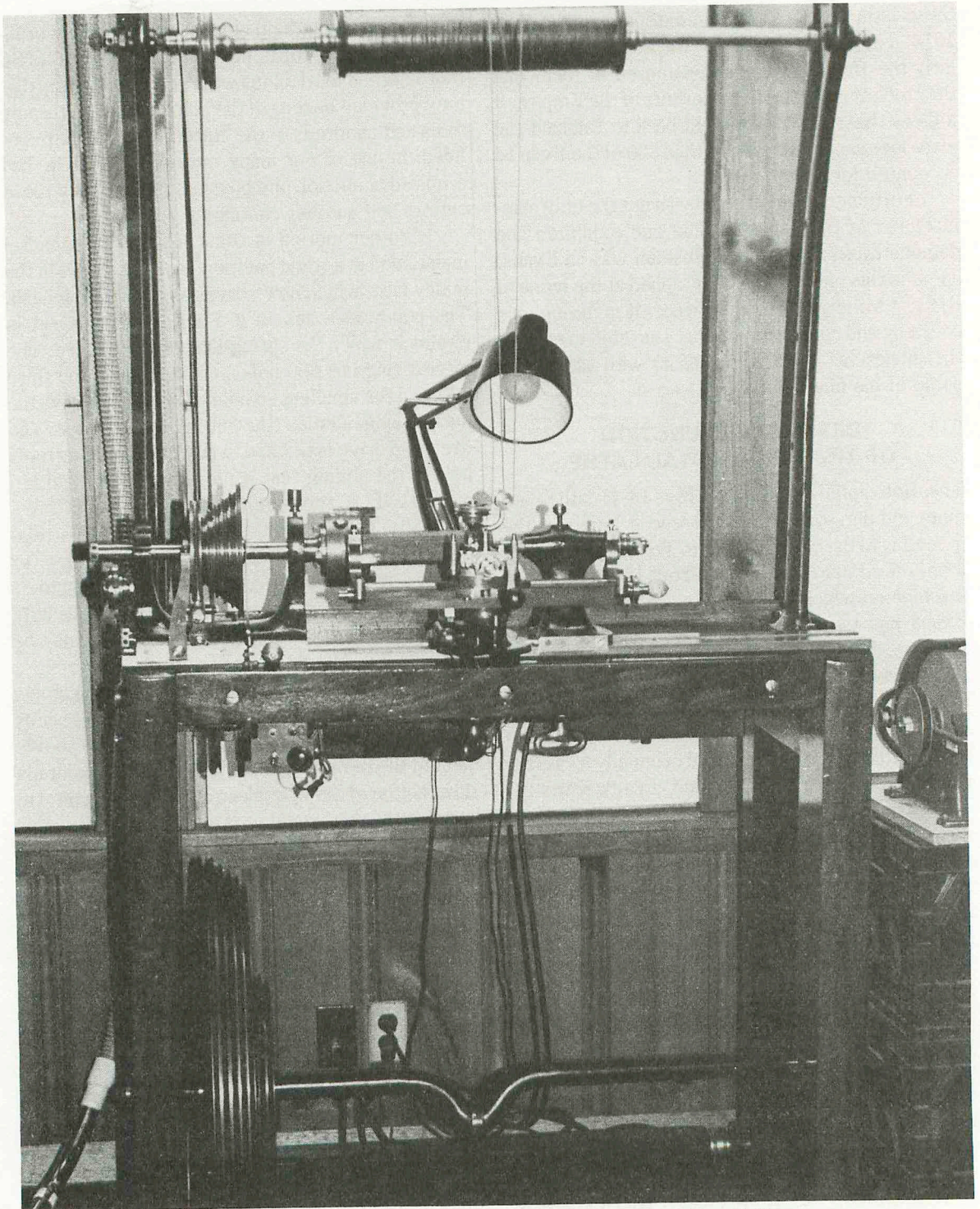


Fig. 14-1. Evans ornamental turning lathe with disconnected treadle and flywheel visible at bottom.

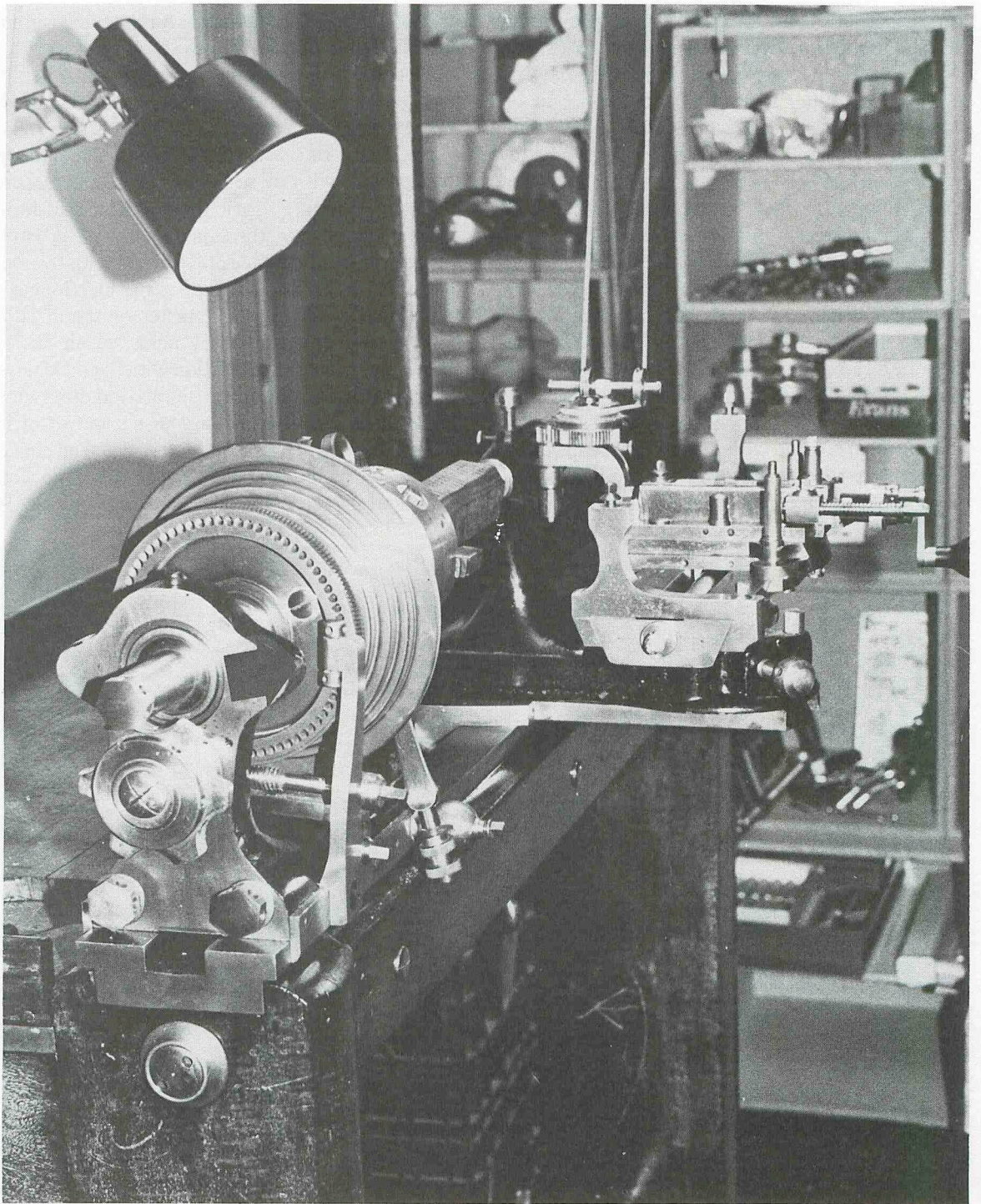


Fig. 14-2. Headstock pulley with mechanism for rotating lathe by hand (arrow).

turner border on the sleight-of-hand. Just imagine turning a pill box with a removeable top *inside* an ivory ball! Frank Knox could do it every day if he chose, Dick Miller is not far behind him, and who knows who else is out there somewhere working with overhead pulleys whirring and tiny cutters going “snick, snick” at segments of the rarest and most expensive woods in the world?

The lathes themselves are truly ornate, in keeping with the tradition of the period in which they were made. The stand is of dark mahogany, the lathe of polished brass and machined steel. On the left of the five-step pulley is a disc (Fig. 14-2) perforated around the periphery and with horizontal teeth on the circumference so that it looks like a large gear. Beneath it is a helical gear on a shaft, the end of which is fitted with a hand crank. All of this is intended by the designer to permit infinitesimally slow speeds, which the operator cranks into the

machine completely by hand. An indexing pin fits into the holes on the side of the disc so that the movement of the workpiece can be controlled by hand quite like it is by the lever and pin on the right side when under power.

A staggering assortment of attachments and fittings came with these lathes. There were screw or prong chucks, elliptical, eccentric and dome chucks, cup chucks, three-jaw chucks (Fig. 14-3), and metal-holding faceplate chucks up to 9" in diameter. Frank Knox describes the functioning of the eccentric chuck “. . . mounted on the mandrel nose, it affords an auxiliary nose, which can be thrown out of center in relation with the main nose. This provides for eccentric spirals and other cuts. The slide holding the auxiliary nose is moved by its own mainscrew, 10 threads to the inch, and adjustable to cuts as fine as 1/200th of an inch. The work is rotated by the tangent screw, engaging the 96

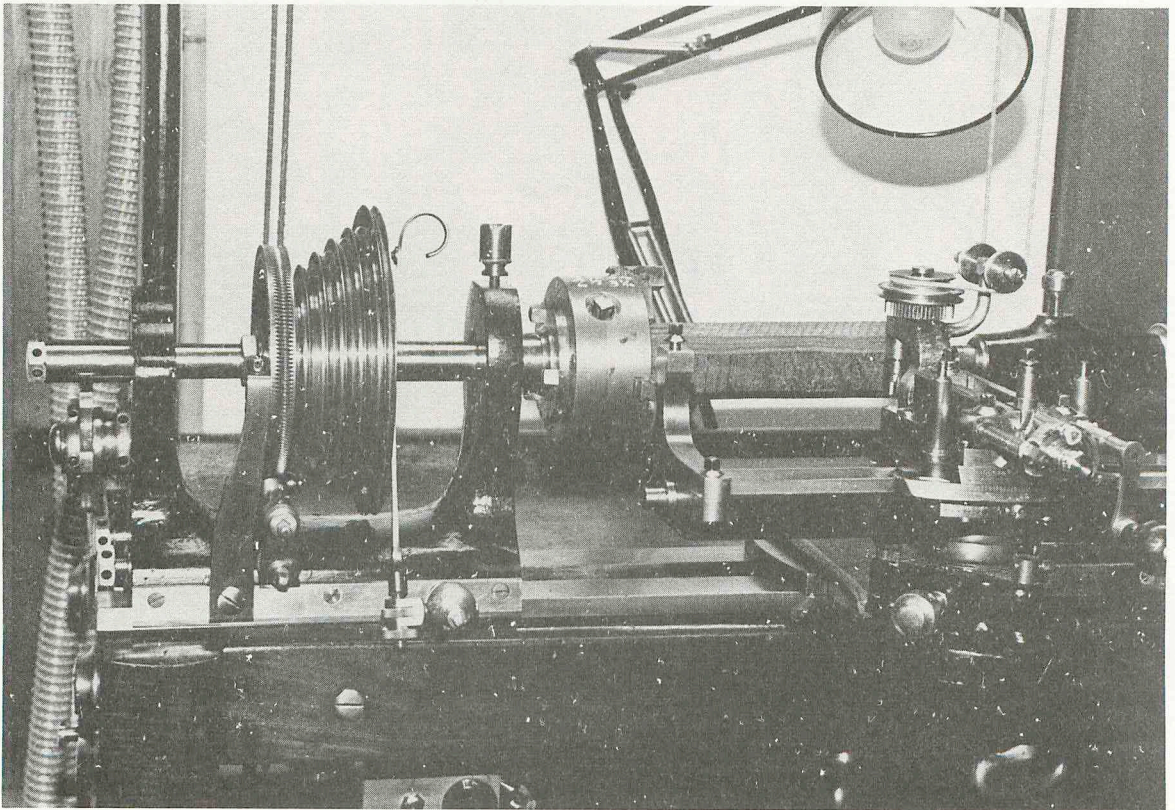


Fig. 14-3. Three-jaw chuck mounted on headstock mandrel.

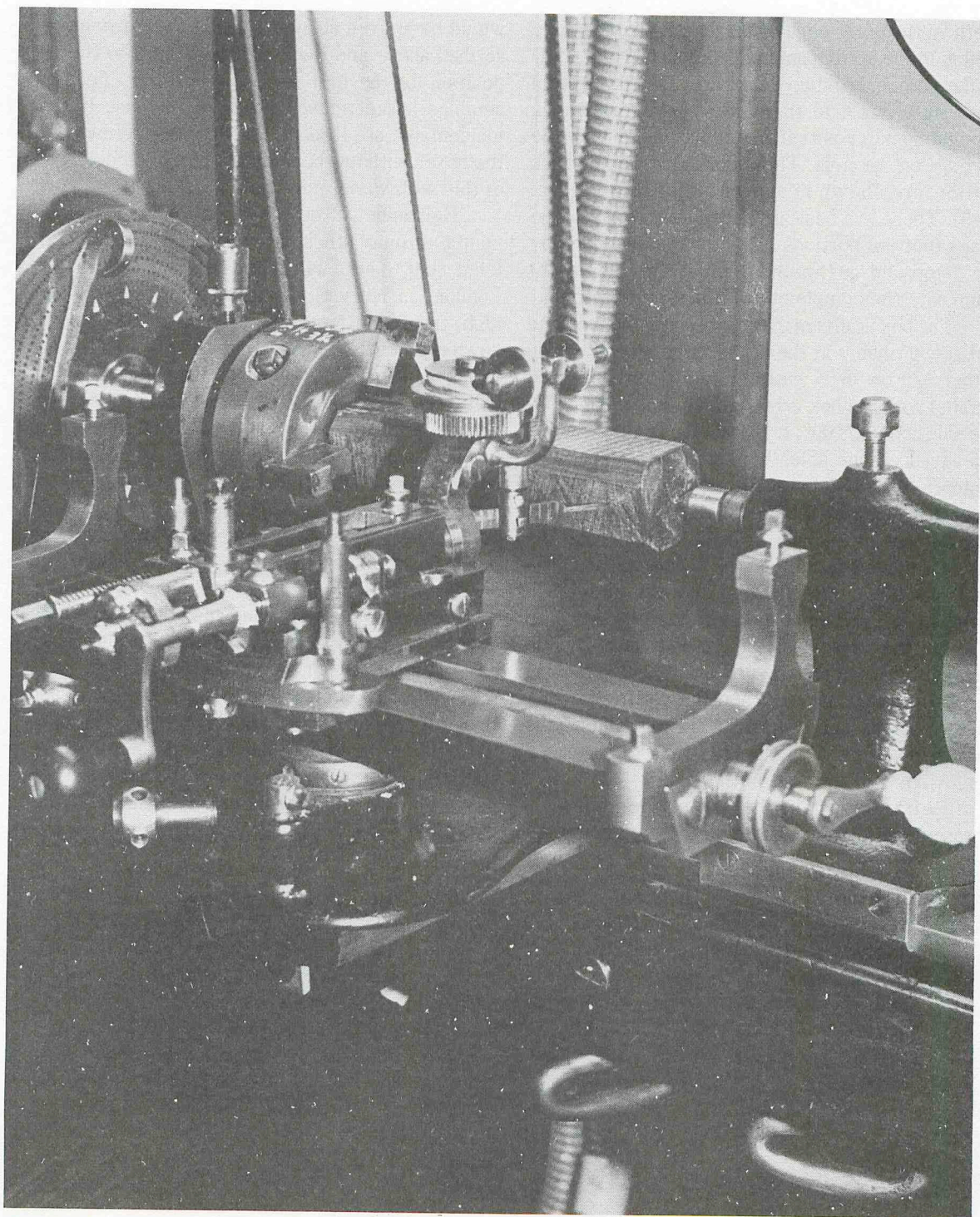


Fig. 14-4. Compound slide reset with tool carrier. Note size and shape of tailstock.

teeth on the outer edge of the worm wheel." Quite visible in the accompanying photograph (Fig. 14-4) is the compound slide rest with the cutting tool reaching forward to the workpiece, the tailstock brought up into position, and the hand crank for the carriage on the right. Three boxes, crafted by Dick Miller, are shown in another photograph (Fig. 14-5). These are basically faceplate turnings. The bases (bottom portions of the boxes) are done by the "stop and go" method, which only serves to illuminate the complexity of this type of turning.

The box is affixed to the faceplate, the indexing pin set, probably in the circle of holes numbering either 120 or 96. A cutter rotating vertically and parallel with the box is brought up to it and fed into the side about $2/100''$. It is backed off, and the index pin advanced one hole. This rotates the box a few degrees, exposing untouched wood. The cutter is advanced again and the process repeated until a full ring of these incisions is made around the box. The cutter is moved laterally to the right a fraction of an inch, the index pin moved so that the cutter will make its first incision in the second row a bit out of line with the incisions in the previous row. The full second row is cut and the process repeated moving gradually to the right. When the cutting is completed and the box set upright, the overall effect is that of a series of slightly twisted columns (see center box and the one on the right).

Refraining from the use of technological phraseology, the decoration on the box on the left

would be arrived at by producing two rows as described above and then "backpedalling" to the pin position for the first row. The ultimate effect resembles basketweave. The tops of these boxes, incidentally, are threaded so that they screw on to the boxes without the slightest hint of binding—all of this with wood, mind you.

Holtzapffel, it develops, not only made ornamental turning lathes but used them with unparalleled skill. There is, in the Science Museum in London, an ivory Gothic church tower about 21" high, turned by him. It is thought to be a scaled down reproduction of Westminster or Chartres and includes the classic arch windows and the elaborate trim. He, as do many turners today, considered ivory one of the best materials for ornamental turning. The tower shown here (Fig. 14-6) from the collection of Dick Miller is also lathe turned and representative of the delicacy and the variety of effects capable on these lathes. Use of the special dome chuck is evident. This accessory offers an auxiliary nose on which the workpiece is mounted in a vertical position. Fluting and other cuts can be applied to hemispherical objects with surprising ease with the use of this dome chuck.

There are similarities between the tower and this urn on its elaborate stand (Fig. 14-7). The lip of the urn is rimmed with beads, as is the top of the stand (just below the bottom of the urn). All are produced with still another uniquely shaped cutter that rotates like a drill bit to do the rounding off of

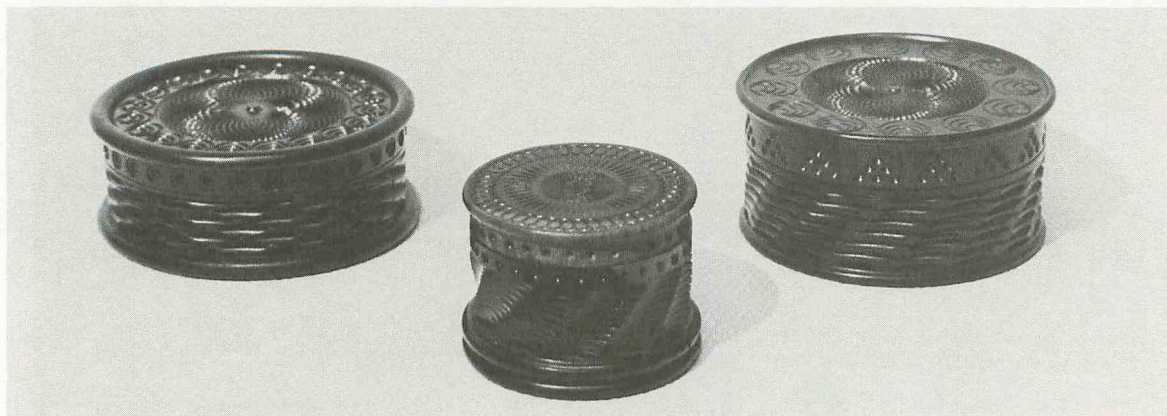


Fig. 14-5. Three boxes turned by Richard Miller, of New Jersey, all with beautiful screw-on tops.

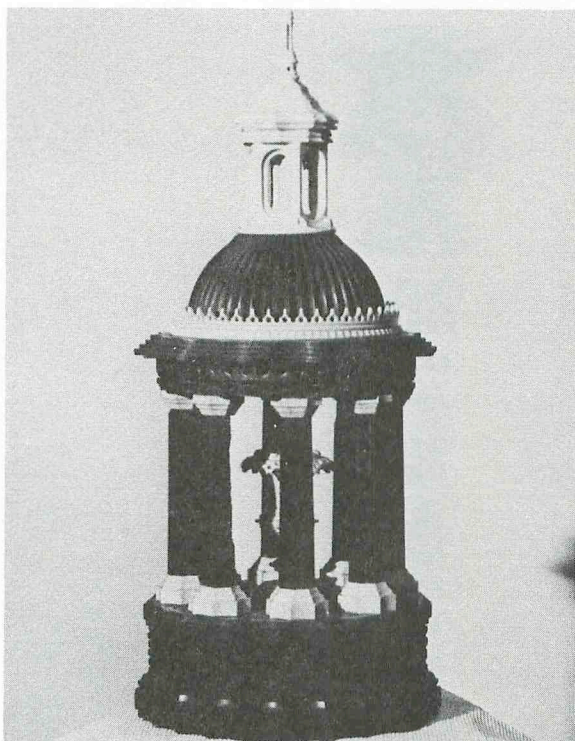


Fig. 14-6. Pagoda or tower from the collection of Richard Miller.

each bead. The Holtzappfel lathe has a handle mounted on top of the slide rest that thrusts the cutter forward a precisely controlled distance and retracts it when the bead is turned—all with a slight motion of the wrist. The slide rest and the carriage are fitted with an abundance of stops which, once set, will prevent overcutting in any direction whatsoever.

INTERNATIONAL WOOD COLLECTORS' SOCIETY

So much of the beauty of these turned pieces is in the wood that it is almost inevitable many turners would belong to the International Wood Collectors' Society. Through its members, the opportunity to acquire pieces of the most sought after woods is increased many times over. Frequently, a turner will include a number of different woods in one project and even incorporate bits of ivory as in the case of the candlesticks in (Fig. 14-8). (It is illegal to

import ivory, making it difficult to obtain in any sizeable quantities. Bits and pieces are available, however, for rings like those on the candlesticks.)

Remember, the woods are not only sought after for their beauty but for the density and weight as well. Through the auspices of the International Wood Collectors Society turners here in America have been able to get some of the world's rarest, most exotic woods including mottled kauri from New Zealand, red bush willow and hardekool from South Africa, caviuna, pernumbuco, kelobra, catin-guera, tiger eye, bloodwood, and beefwood. These are the very dense woods. Others that turn well are totara burl, kingwood, bocote or canalette, olive, rosewood, bubinga, Nigerian Ebony, and, of course, lignum vitae, which every turner yearns to use at least once in his career.

Four additional pieces from Dick Miller's collection are shown in (Figs. 14-9 and 14-10). They are illustrative of the turnery of which these lathes are capable. The mallet or "honorary" gavel in Fig. 14-11 features a medallion beautifully ringed by beads, circles of coin-like discs, and reversed cabachon-type depressions. The eye soon detects the fact that the regularly spaced projections ring-



Fig. 14-7. Spirals, flutes, beads, and finials are all incorporated into this piece owned by Richard Miller.

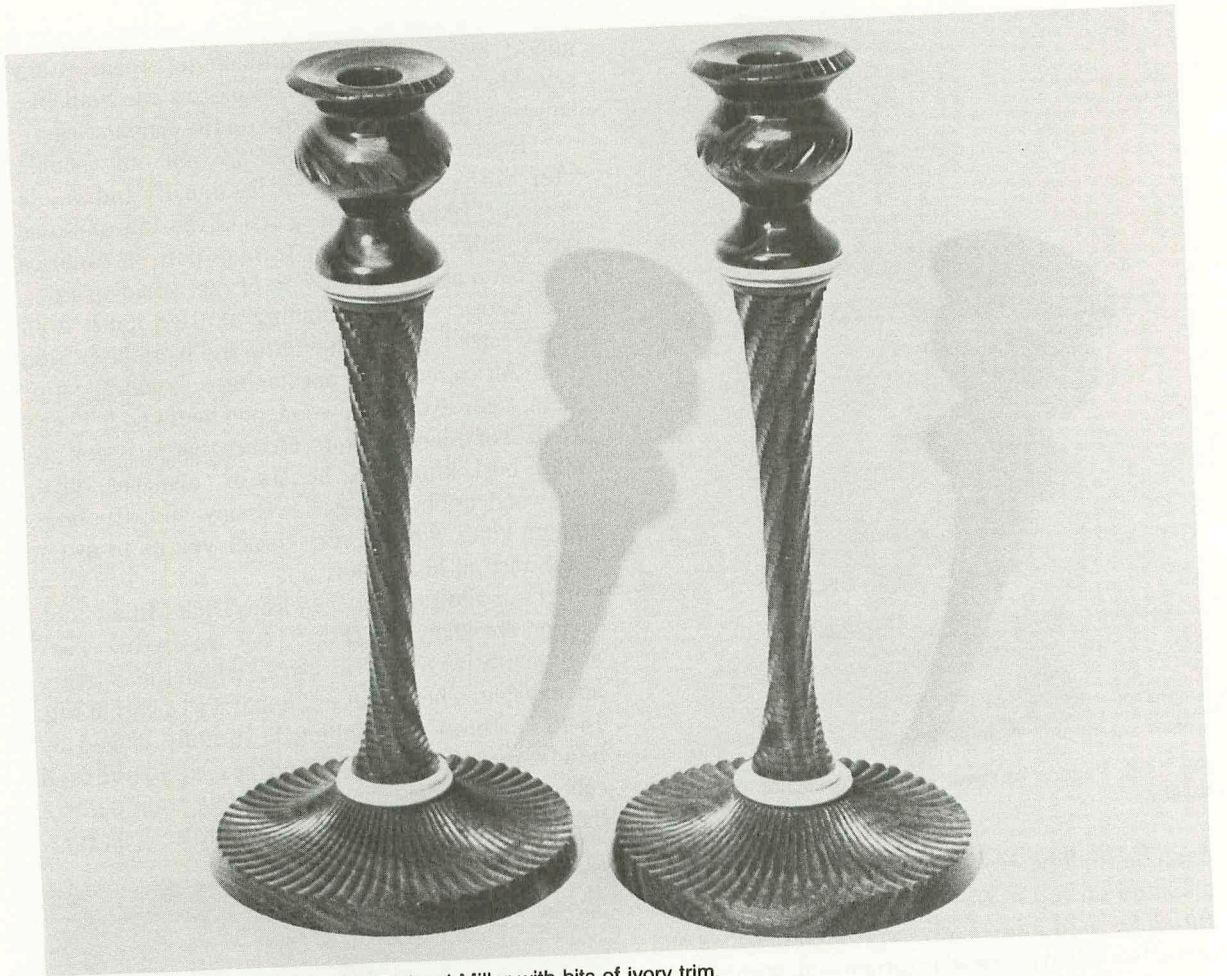


Fig. 14-8. Candlesticks turned by Richard Miller with bits of ivory trim.



Fig. 14-9. Pair of elaborate cups in dark wood are part of Miller's prized collection.

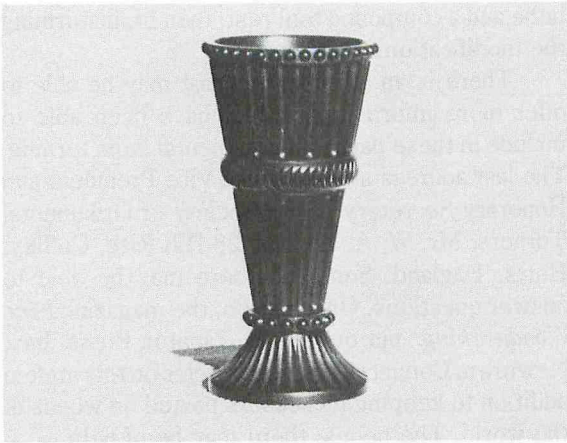


Fig. 14-10. Small vase or urn embellished with beads and flutes, also from the collection of Richard Miller.

ing the cylindrical piece are the outer projections of curved incisions carefully spaced. The cutter used is probably similar to the one which worked the two boxes described above, and the difference in patterning lies in the placement of the indexing pin. The initial planning probably involved some mental gymnastics like this: "Now, let's see. First, we'll put the pin in every fourth hole on the 96-hole circle. This should give us 24 perfectly spaced incisions which ought to look just beautiful on this piece. Then maybe we'll switch to the second and fifth holes which should stagger the cuts just right! Yep, that ought to do it." This must be an exciting part of this type of turning.

MODIFYING EXISTING LATHES

All of the foregoing discussion must certainly be like dangling a carrot in front of the rabbit's nose. There are about 30 of these lathes in the country—many of them not being used, yet not for sale or barter. What are the chances of ever getting to turn even the simplest of the items shown and discussed? The possibility is not absolutely remote. At the museum, a discussion came up as to whether or not a modern lathe could be modified so that it would perform some, if not all of the intricate maneuvers so much a part and parcel of the ornamental turning lathe. Frank Knox said he thought not, confirming a conviction he had voiced in writing at least

seven years earlier. There are other authorities in the field who believe, just as emphatically, that such a conversion or modification is far more than a possibility.

You would have to start with a metalworking lathe, of course, because it is already fitted with a compound slide rest and is built from the outset with the necessary rigidity. The first addition would have to be an indexing arrangement. Some metalworking lathes have this capability manufactured into them at the very outset. It can be added to others as an accessory and could even be home built in many, many instances. The speed of the headstock would have to be able to be reduced drastically at will and this, too, is already built into some machines. As mentioned in an earlier chapter, there are electronic speed reducers on the market that would take all the pain out of "slowing down."

Current slide rests and tool holders are designed to hold the tool stationary, but with lateral as well as backward and forward movement. The holder, I am convinced, could be modified or simply bypassed in favor of a flexshaft or, in more extreme cases, a Dremel Moto-Flex tool. The latter has the distinct disadvantage of being restricted to holding cutters $\frac{1}{8}$ " in diameter and no larger. Both alternatives only rotate clockwise, so skillful maneuvering would be necessary to position the cutting blade to produce some of the incisions that the ornamental

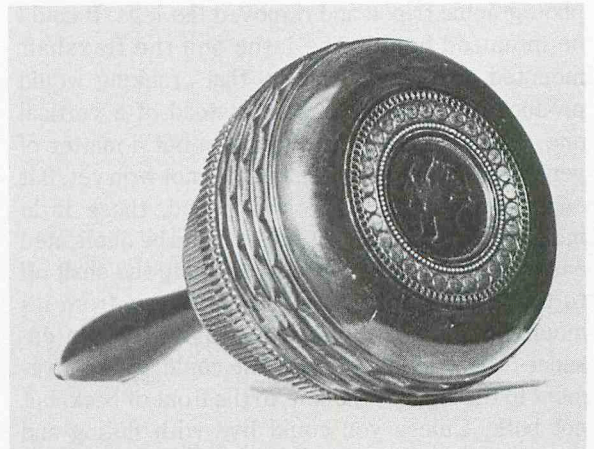


Fig. 14-11. Mallet or "honorary" gavel is exquisite with its medallion surrounded by coin-like discs.

turning lathe makes routine. There would be other restrictions, it is true. You would have to give up the thought of ever doing anything like engraving epicycloidal curves on the work which Holtzapffel's geometric chuck makes little more than child's play, but long spiral flutes would be well within the province of such a cobbled up modification. Combine the indexing head and proper positioning of a flex-shaft, and you could duplicate the appearance of the sides on Dick Miller's boxes. The cutting tools would be entirely different it is obvious, but once some satisfactory setup was achieved enough could be done to keep one happy for months—even years. After all, what difference does it make if the cutter rotates vertically or horizontally as long as it takes a bit of the wood off just as the operator wished?

The metalworking lathe comes to mind initially because it is never sloppy in its action unless it is terribly worn. I can envision some small facets of this work being done to the operator's complete satisfaction on a good woodworking lathe, however. After all, the techniques described in Chapter 7 for fluting and reeding are considered normal procedure, and they involve the use of both the indexing head and the flexshaft. Now, if that flexshaft could be made to move from left to right with a certain amount of fluidity and without having to build platform board guides to direct its lateral movement, this would be a step in the right direction, certainly.

Now, think of this: what if you took a crank-up photographic tripod and removed the legs. It could be mounted beside the lathe and the flexshaft mounted on the tilt-head so that cranking would produce a lateral movement instead of a vertical one. There! Already the fluting is but a matter of gently turning a crank. Ah, but all's not won yet. If it could be positioned across the bed, those little incisions on Dick Miller's boxes could be duplicated easily—but for one row only. Backing the shaft off to the right would entail loosening it from its mounting and retracting it $\frac{1}{8}$ " and $\frac{1}{16}$ ". In essence, the tripod arrangement could give movement to the right or the left, to the front or back, but not both! Unless you could live with fluting and reeding for the rest of your life, serious thought would have to be given to acquiring a metalworking

lathe and a compound tool rest, then brainstorming the modifications from there.

There is an organization that may be able to offer more information than I have been able to include in these pages on ornamental lathe turning. The last address available was Vice President and Honorary Secretary of the Society of Ornamental Turners, Mr. W. A. Bourne, 28 Hill Rise, Cuffley, Herts, England. Someone there may be able to answer questions. On occasion, the magazine *Fine Woodworking*, put out by the Taunton Press, Inc., Newtown, Connecticut, does articles on this craft in addition to keeping its readers posted on woods of the world. The people there may be of help.

RESTORATION AND USE OF AN ORNAMENTAL LATHE

In the months that passed after the above material was written, my acquaintance with Dick Miller ripened into friendship built on a mutual interest in ornamental turnery. Much to my surprise, I found that I had been inducted into that small group of persons so devoted to this avocation.

One day Dick entrusted me with the restoration and use of a genuine Holtzapffel lathe he had discovered and acquired in Paris.

The lathe arrived at my studio completely disassembled (Figs. 14-12, 14-13, 14-14). Fortunately, every bolt and every hole in the frame was numbered. In one of the boxes of parts, I found a card from the point of purchase antique shop in France attesting to the fact that the lathe was Holtzapffel's No. 2333, which had been sold over 100 years ago to one Palmer Chapman. A cursory inspection revealed that it was in excellent shape, basically, and the restoration would not involve more than the expenditure of good, healthy energy. The massive mahogany base had a finish that had darkened over the years, but there were no serious dents or even scratches. Dick had suggested attacking it with Formby's Refinisher. I secured a kit immediately and set about revitalizing the exterior finish. It took several applications of the refinisher to clear away the century old film and numerous coats of tung oil before everyone was satisfied with the appearance

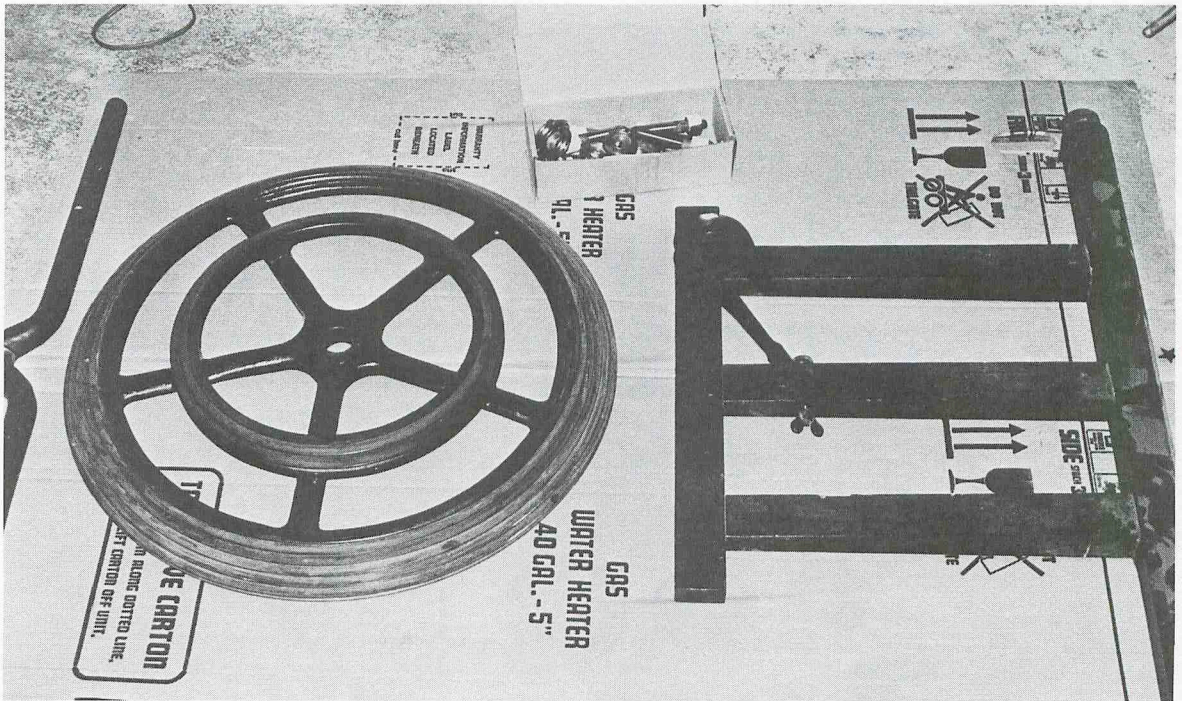


Fig. 14-12. Lower pulley and treadle.

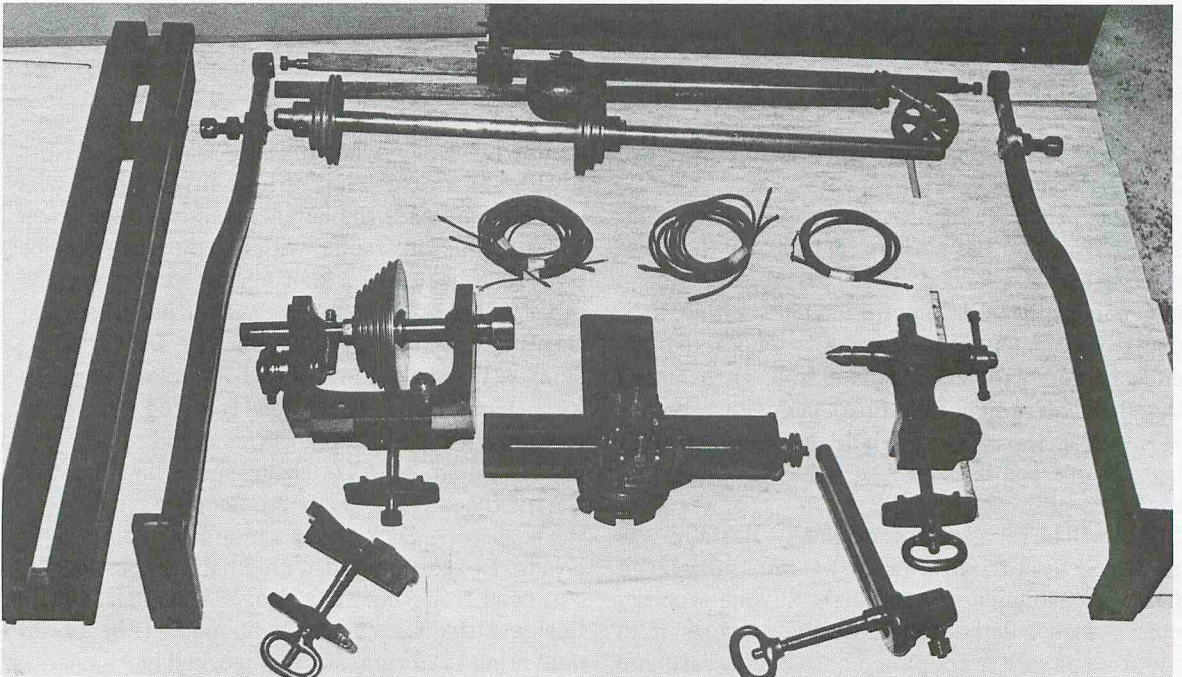


Fig. 14-13. Parts of Holtzappfel lathe including ways at left, headstock, slide rest (center), tailstock, overhead assembly, and tool rest for plain turning.

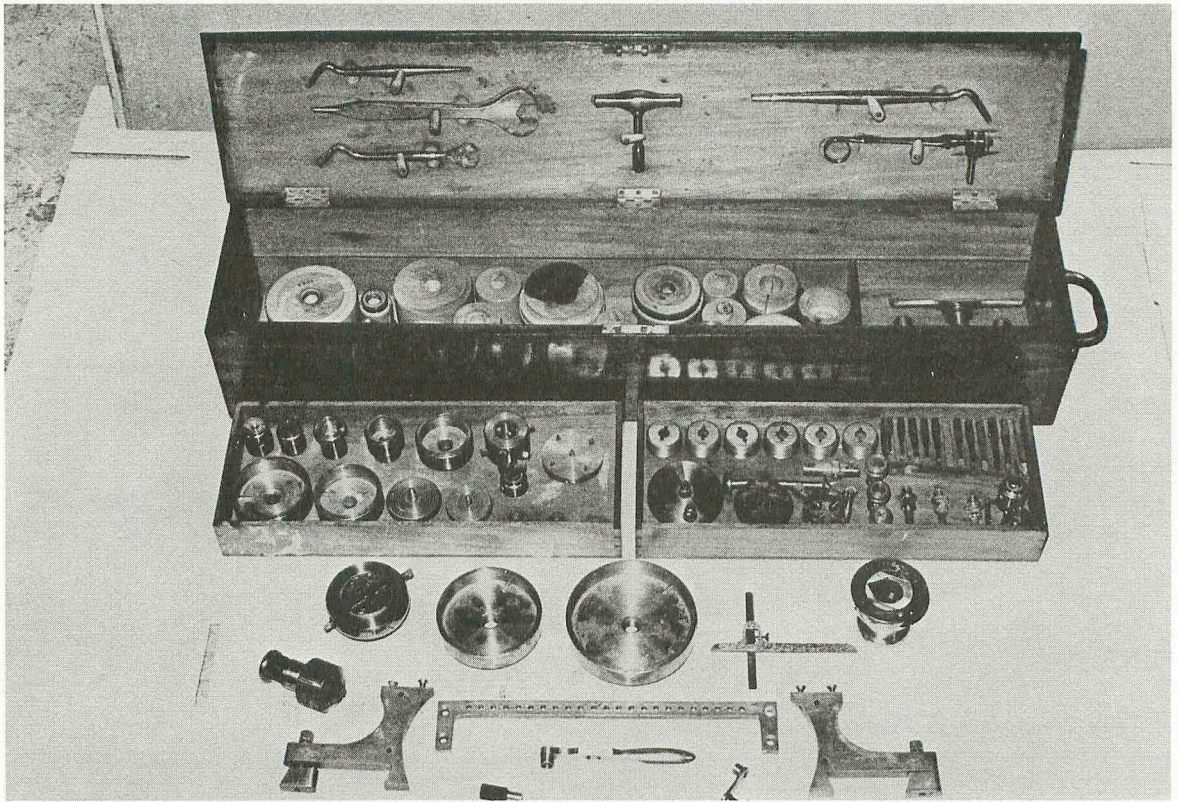


Fig. 14-14. Assortment of wrenches (in box lid), wooden cup chucks (in box), and numerous accessories including rectilinear assembly at bottom.

of the wood. Now the assembled base or lathe stand looked elegant.

I had thought, at first, that the uprights (Fig. 14-15) that hold the stepped pulleys for the belts were not to be touched, so they were erected and new polyurethane belting fitted. This belting, incidentally, comes in rolls. It is cut to length, the two ends heated with a household iron, then butted together whereupon they fuse. The joint becomes as strong as the rest of the belt and after months of use not one has broken. The lathe was just about ready for use.

It will be recalled that, originally, the lathe was powered by a treadle (Fig. 14-12) and a large flywheel (weighing 75 pounds). Anyone who acquires such a lathe automatically converts it to electric power (except an occasionally rare and hardy purist) because it takes 45 pounds of pressure to work the treadle. Because there were no electric

motors in the days when the lathe was designed, the problem arose as to just how big a motor was needed to operate the lathe correctly. Frank Knox had fitted his Holtzapffel with two motors—one for powering the headstock for normal turning and the other for use with the overhead train of pulleys that activated the rotating cutters in the slide rest assembly. I never did find out what horsepower they were. A mutual friend, who had gone to England and brought back a Holtzapffel from an old castle, also used two motors—a 1/10 horsepower one to power the overhead train and a 1/2 horsepower motor for the headstock. Dick used a single 1 hp motor on his Evans. I experimented with small motors for the overhead train, but they proved unsatisfactory. I finally settled for a single 1/2 hp motor (Fig. 14-16) delivering 1725 rpm, and this worked like a charm. The cutting frame speeds could be varied by adjusting the belts on the overhead step pulleys and on



Fig. 14-15. Supports for overhead assembly before refinishing.

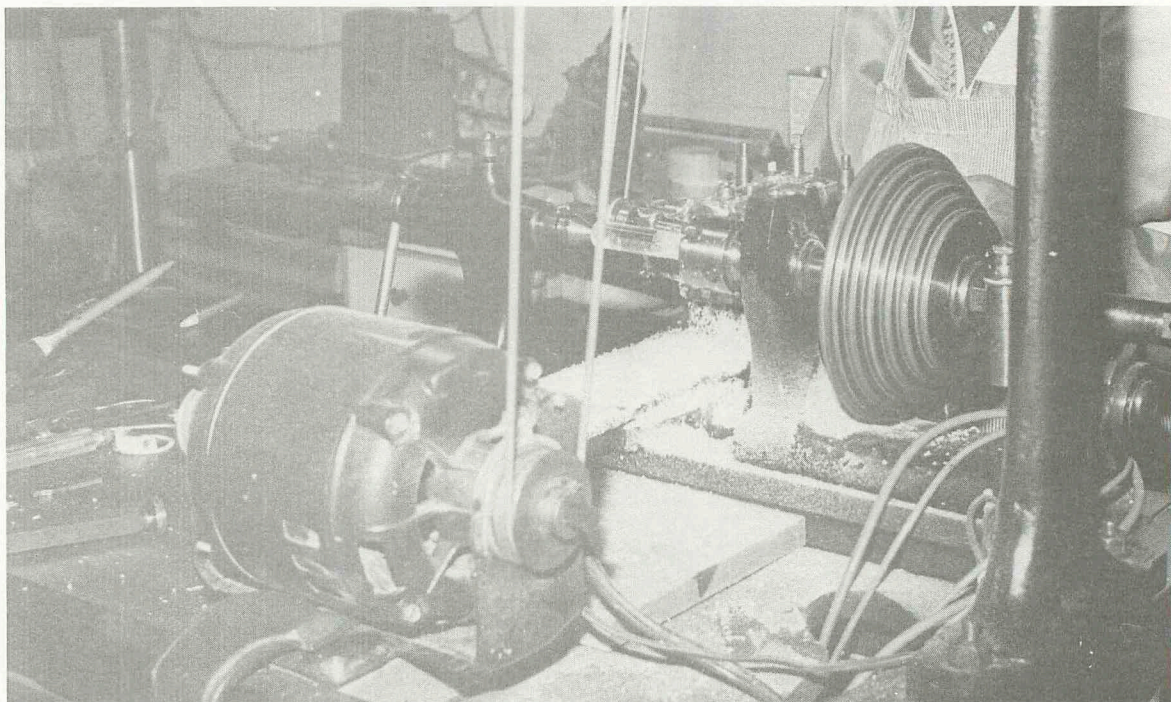


Fig. 14-16. Half-horsepower motor clamped to lathe table with polyurethane belting running up to overhead train.

the big pulley on the mandrel. The motor was designed to run a modern lathe and had two shafts, one on each end. I fitted one shaft with a 2" pulley and the other with one slightly smaller—a bit larger than 1" in diameter. I soon developed a knack for switching the motor from powering the headstock to motivating the overhead train with a minimum of effort and found that I got all the speed and power I needed from the smaller pulley on the motor shaft. I stopped using the 2" pulley.

I sorted out all the bits and pieces eventually. There was a beautiful wooden box (Fig. 14-14) about 3 feet long, laden with all manner of wooden cup chucks, T-shaped tool rests, spear shaped drill bits, arbors, adapters, and solid brass cup chucks. In a cardboard carton reposed a dome chuck, an eccentric chuck, a two-jaw disc chuck some 9" in diameter, and several cutting frames (Fig. 14-17). It soon developed that of the four cutting frames that I might have used, not one really worked. It was possible that they might not have been made to fit my lathe. There was a drilling frame, but it accepted

tapered drill bits about $\frac{3}{16}$ " in diameter, with which I had not been supplied at the outset. There was eccentric cutting frame, but the pulleys on the end were too large and struck the back edge of the slide rest when advanced to the cutting position. There was a vertical cutting frame, too, but it only accepted little cutters with triangular shaped bodies and there was but one of those. The universal cutting frame required a great deal of study before it could be used, and I only had one weird shaped cutter for that one. I studied everything in the boxes for days. I found a brass chucklike device that would accept a workpiece about the size of a pencil in diameter and no larger. There was a standard Jacobs chuck on a brass adapter or arbor bearing the Holtzapffel No. 2333, but when mounted on the lathe it did not run true. The tapered end of the arbor was out of line. In essence, all I could use was the big brass two-jaw chuck and the vertical cutting frame with its one triangular cutter.

I was dying to use the lathe in the way it was intended, so I mounted the big disc chuck and the

vertical cutting frame, cleaning and oiling everything as I went along. As a test piece, I had turned the finish off an old pepper mill I found lying around the studio. Worthy of mention right here is the fact that I had been reading religiously not one but *two* of Holtzapffel's five volume book on the lathe. (Volume V is on ornamental turning.) I gleaned enough from this reading to start a spiral pattern: 12 cuts around the circumference, moving the indexing head eight dots after each cut. Advance the cutter a distance the width of its cutting edge by traversing the compound slide rest to the right or left. Move the indexing plate nine dots for the next cut and eight after that around the workpiece. I was going along swimmingly, delighted with my progress when suddenly the idler wheels on the frame contacted the workpiece, and I could go no further! What to do? I had been heading into a depression on the pepper mill—the middle where it was much narrower than at the top and bottom. I just skipped over about 1" of the work area and positioned the cutter to function as it climbed out of the depression. I determined to put flutes on the untouched

area when I got around to it.

I talked to Dick about this phenomenon with which, it developed, he was completely familiar. It was a matter of considering the limitations of the machine, he confided. Limitations, indeed! This came as a surprise. It was no wonder that the turned objects in museums and in collections had been made in so many pieces. Some of the cutting frames were so cumbersome that they could not negotiate any radical, sudden curves or deep depressions because they were traversed from left to right or vice-versa. The wood in the pepper mill and other specimens I tried at first was too soft and the cutters, not the sharpest in the world, broke off the fibers and produced a shaggy look to the piece. The cutters must be absolutely razor sharp, and the hardest of woods, such as *lignum vitae*, should be used.

All was not lost, however, because one of the chaps who had helped me get the lathe into the studio worked at a lumber mill and brought over two big, heavy pieces of *lignum vitae*, along with some purple heart, teak, and zebrawood. The next piece I

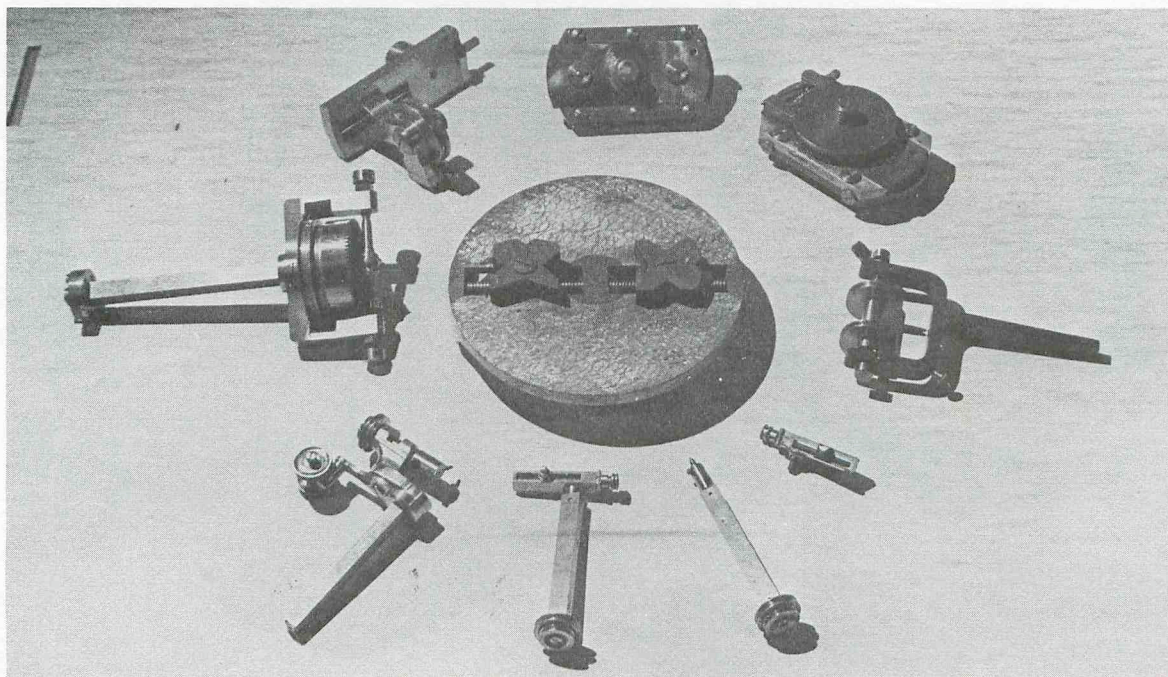


Fig. 14-17. Various cutting frames with dome and eccentric chucks at top of photo and two-jaw self-centering chuck in center.

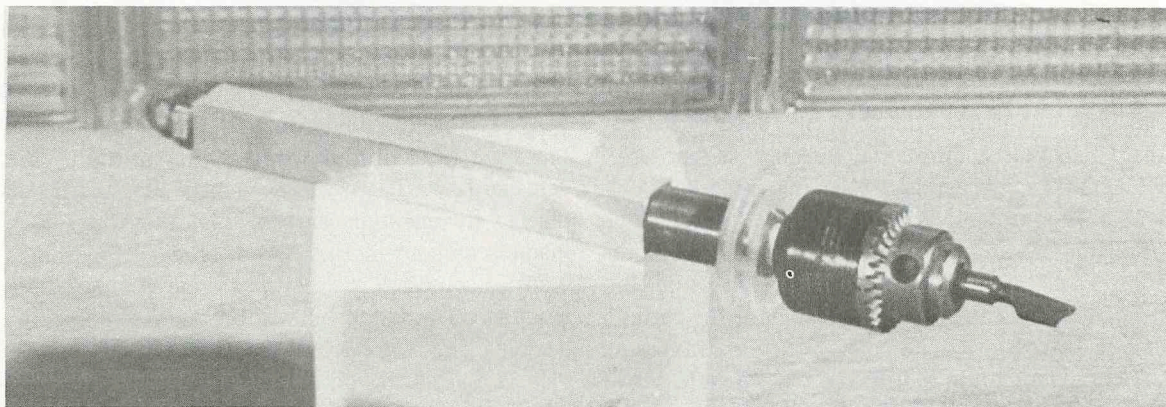


Fig. 14-18. Drilling frame with modern chuck and small pulley.

attempted was much more successful.

I gleaned from my reading and from conversations with Dick and others that the drilling frame was extremely versatile. Because the one with the lathe limited me to cutters with which I had not been supplied, I decided to make one. I scrounged

up a $\frac{1}{4}$ " chuck, a length of steel rod $\frac{1}{4}$ " in diameter, and made up a pulley out of acrylic on the lathe. I had a length of aluminum about 4" long and $\frac{9}{16}$ " square drilled out to accept the rod. A small arbor with a $\frac{3}{8}$ " thread screwed into the chuck, allowing enough room for the pulley. The whole thing went together

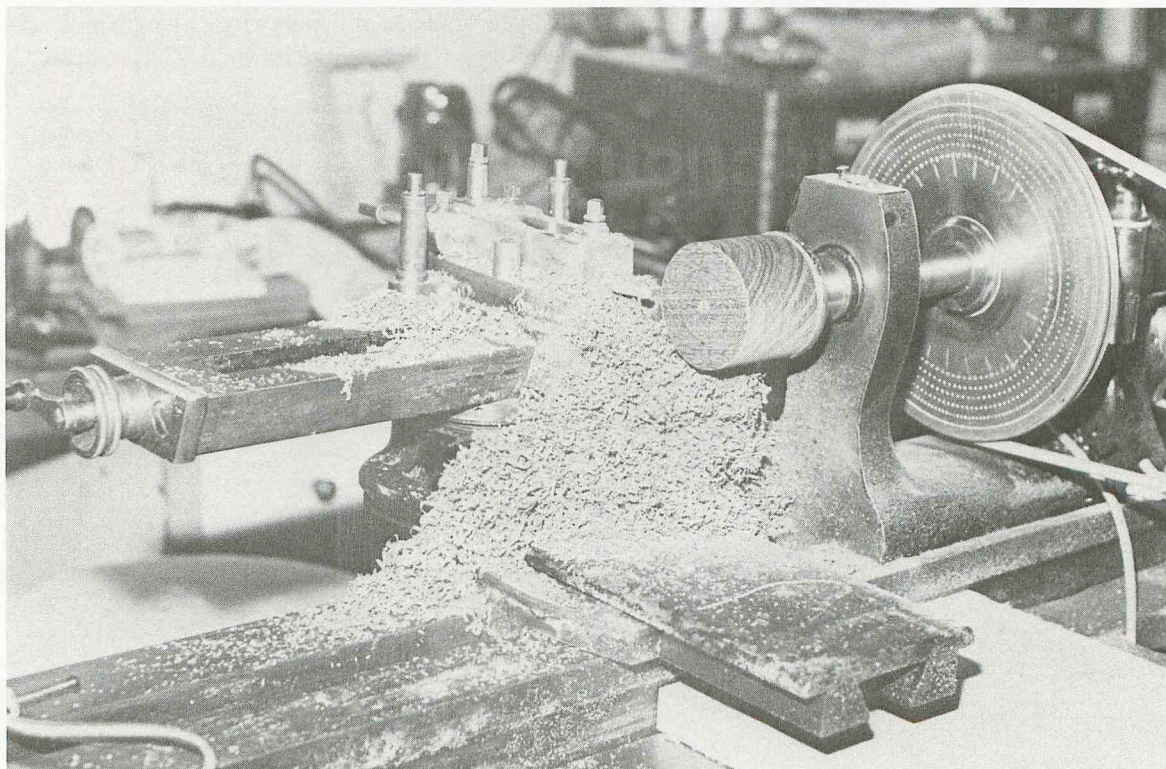


Fig. 14-19. Purple heart wood just prior to being rounded off with eccentric cutting frame.

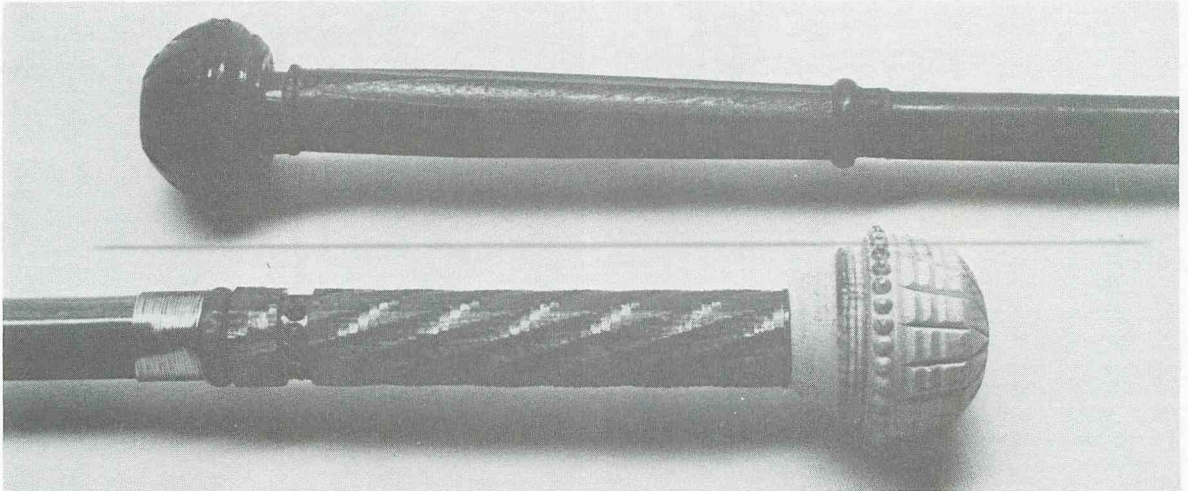


Fig. 14-20. Upper lengths of walking sticks turned on the ornamental turning lathe.

beautifully (Fig. 14-18). I ground pieces of old drill bits to make cutters of various shapes, resembling the cutters meticulously drawn and described in the Holtzapffel book (Vol. No. 5) mentioned above. It was right about this time that Dick produced some

extra cutters he had—small ones for the universal and eccentric frames and larger ones for centers turning. He permitted me to cut some of them down for the universal frame.

So, with the capability afforded by the use of

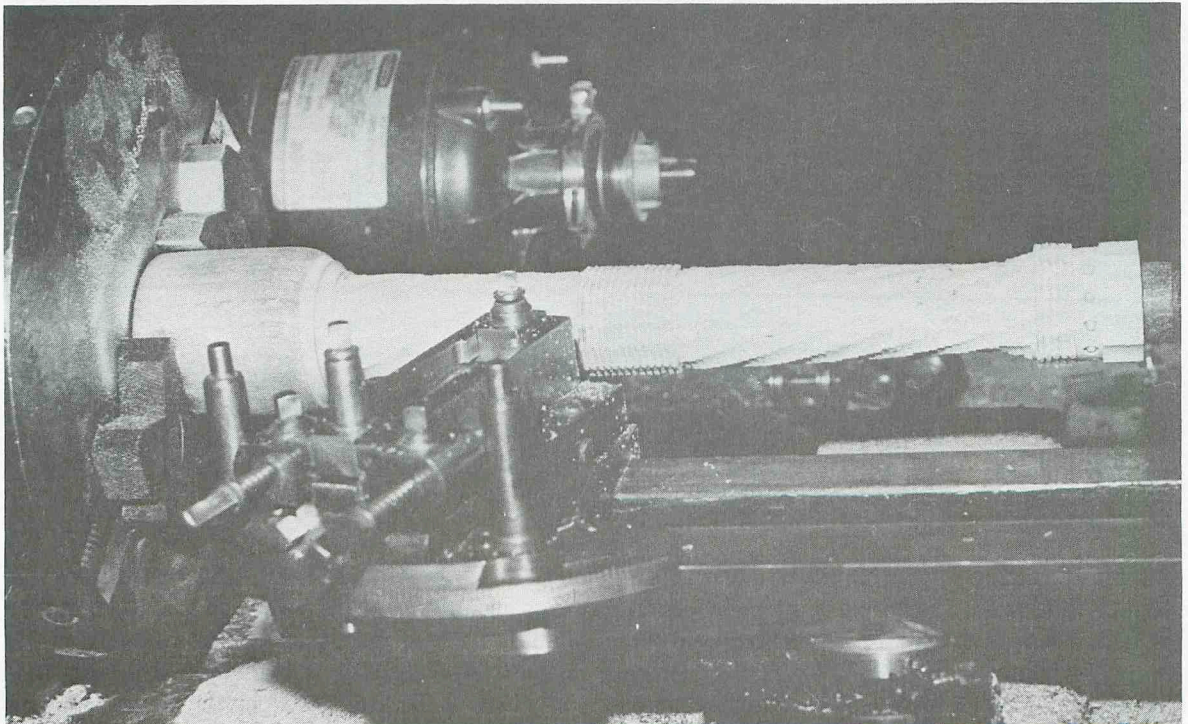


Fig. 14-21. Long pepper mill held with two-jaw chuck on headstock mandrel.

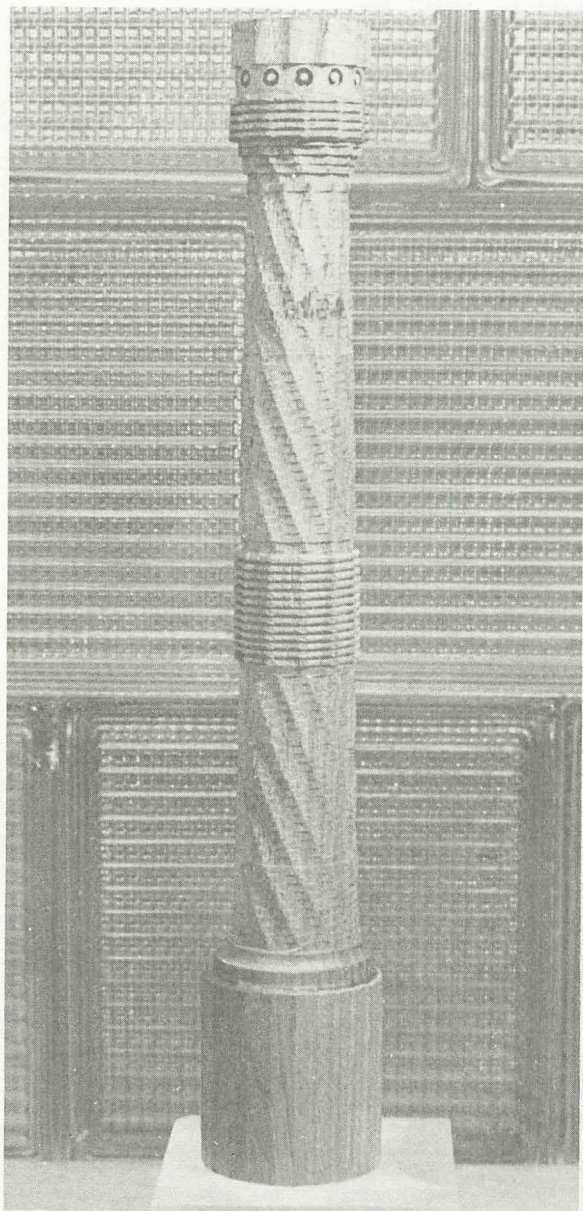


Fig. 14-22. Dark spot near top of pepper mill is oil from freshly lubricated cutting frame.

just three cutting frames, some satisfying objects could be produced. The purple heart wood was used to make a cane head (Fig. 14-19). With the aid of the eccentric frame, short lengths for the top portions of two canes were turned from lignum vitae and purple heart (Fig. 14-20). I made a towering pepper

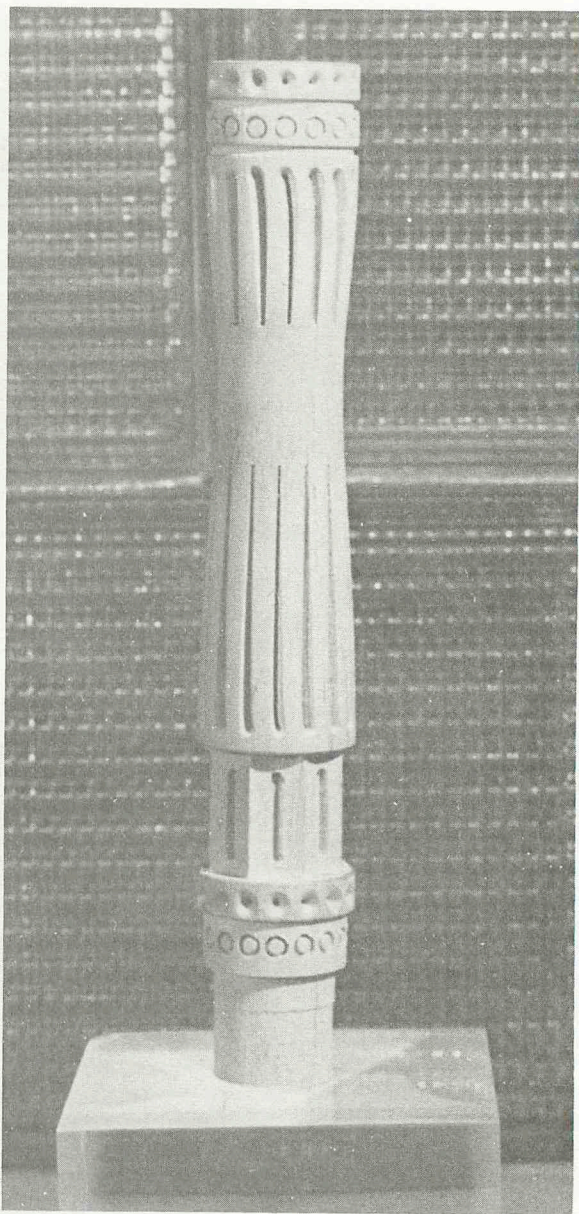


Fig. 14-23. Stem of candlestick made from table leg.

mill (Figs. 14-21 and 14-22). I took one of the legs from a lamp/table (Fig. 4-28) and made a stem for a candlestick (Fig. 14-23). This piece was ornamented solely with the homemade drilling frame.

One of the projects along the way was a split turning (Fig. 14-24). Following established

techniques, a piece of wood about 1¼" square was sliced down the center and then glued back together with a piece of brown wrapping paper in between. When the ornamentation was complete, the piece was removed from the lathe, split in two, and the

brown paper sanded off. It made the two sides of the picture frame shown here. Another piece done in the same fashion made the top and bottom pieces of the frame.

My interest in lathes is coupled with my inter-

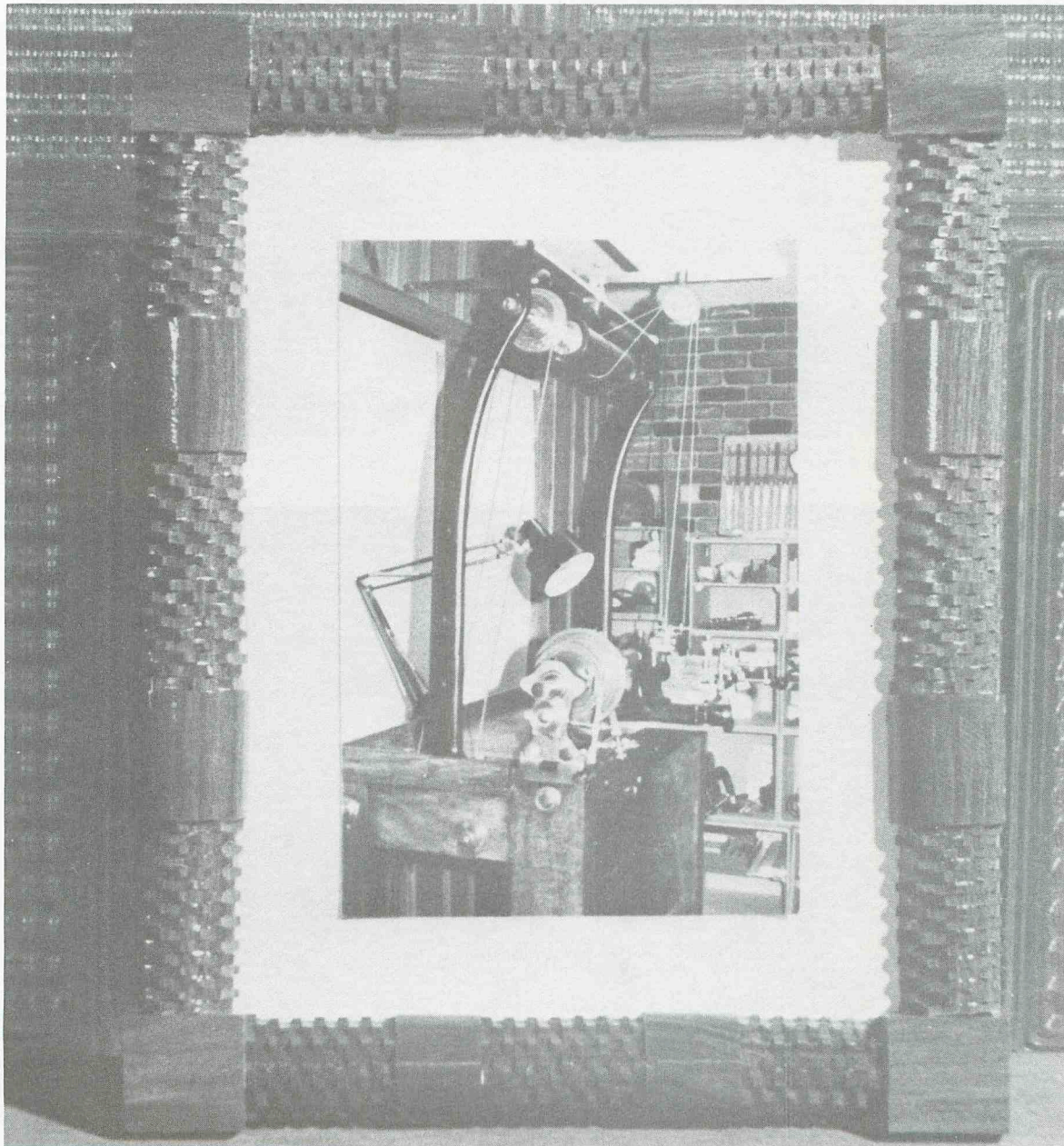


Fig. 14-24. Picture frame is an example of split turning. Lathe in framed photo is an old Evans.

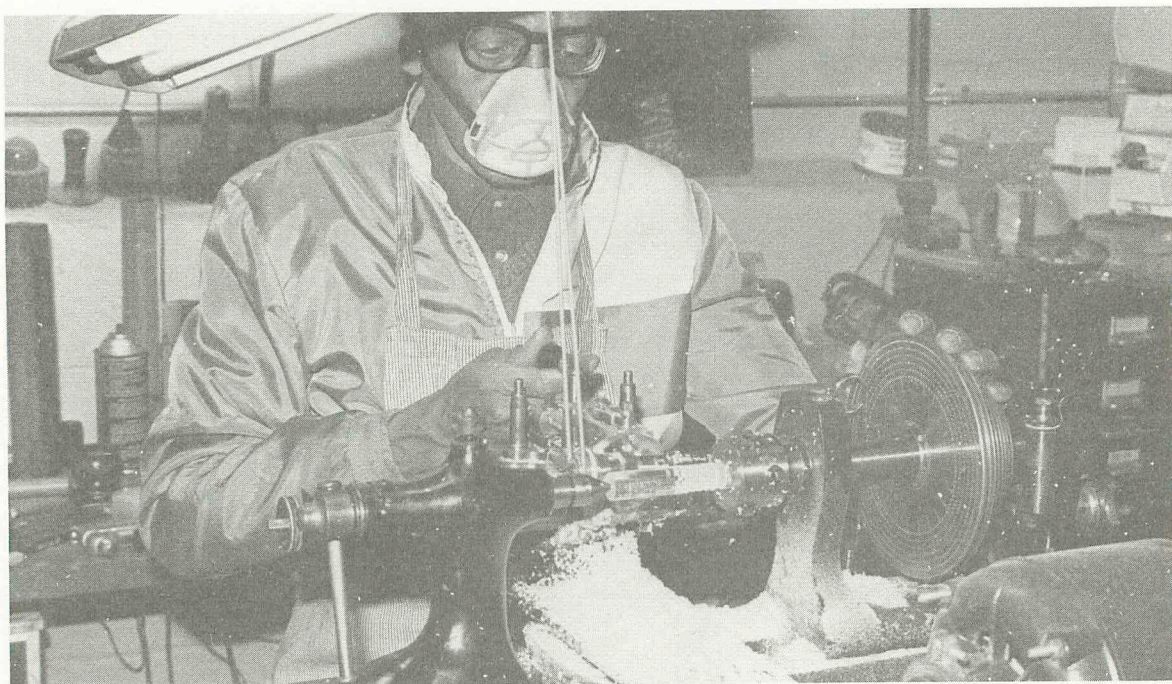


Fig. 14-25. Turning clear acrylic for screwdriver handle.

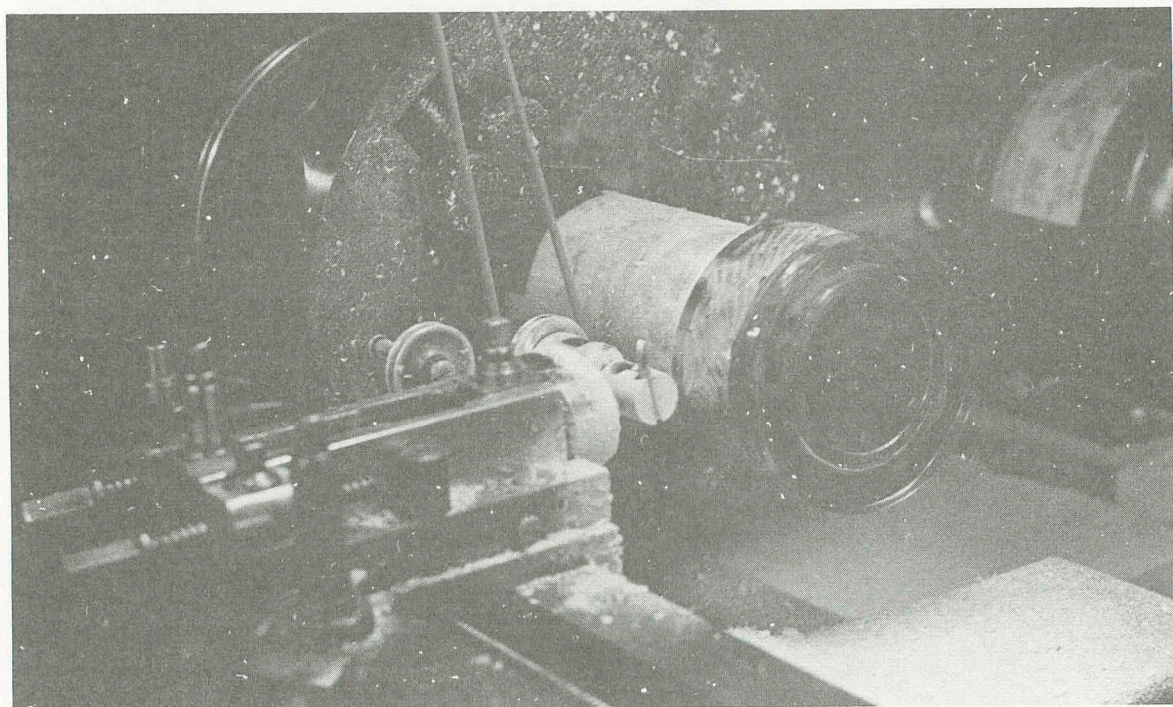


Fig. 14-26. Horizontal cutting frame turned on its side to ornament polyester bowl.

est in working with plastics. It was not long before experimentation with the acrylics and the polyester resins began. A screwdriver handle (Fig. 14-25) and a colorful bowl (Figs. 14-26 and 14-27), both of polyester, were ornamented. Care has to be exercised with polyester. The cutters must be sharp or there will be fracturing. Just as the wood fibers are raised with dull cutters, so will chipping of the plastic occur.

At this writing, all three cutting frames, in addition to my homemade one, are in use. The various phases of ornamental turning have been explored in depth. Surface ornamentation with the drilling frame, the eccentric cutter, the vertical cutting frame (Fig. 14-28), and a special cutter (designed by me) for the drilling frame have been attempted successfully. Work in progress includes lamp and clock bases of acrylic, which will glow when a light placed above them is turned on.

There are still some problems. The lathe did not have a three-jaw chuck as an accessory, and it is difficult to fit one at this stage because the thread on

the mandrel is an unusual $9\frac{1}{2}$ threads per inch rather than 10 per inch as is the case with the rest of the lathe. A special backing plate will have to be made up to mount such a chuck with the mounting hole threaded to match the mandrel. Some sort of three-jaw or four-jaw chuck is a vital necessity.

The restoration continues even during periods of use. Each accessory part for the lathe must be thoroughly cleaned, any rust removed, and it must be carefully lubricated. Oiling is a constant part of using the lathe, and this must be done judiciously particularly in the case of the cutting frames, overhead and idler pulleys, and other moving parts. Oil can be thrown up on the workpiece and back at the operator. Furthermore, use and cleansing revealed hidden wear on mechanical parts. Some was serious enough to require fabrication of new parts. Renovation of the compound slide rest, for example, turned up such free play or backlash that, with certain cutting frames, fluting stops had to be used to prohibit deviations of the slide assembly from right to left. All of this is complicated further by the fact that

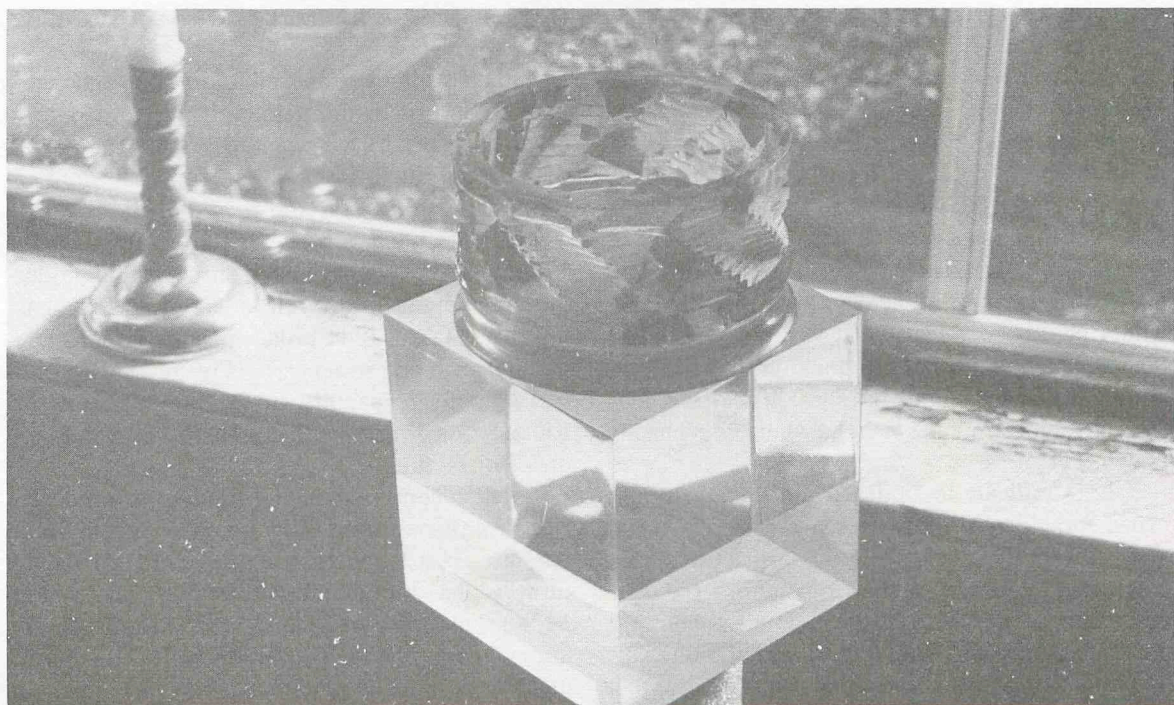


Fig. 14-27. Ornamented polyester bowl with spiral gons cut from top to bottom.

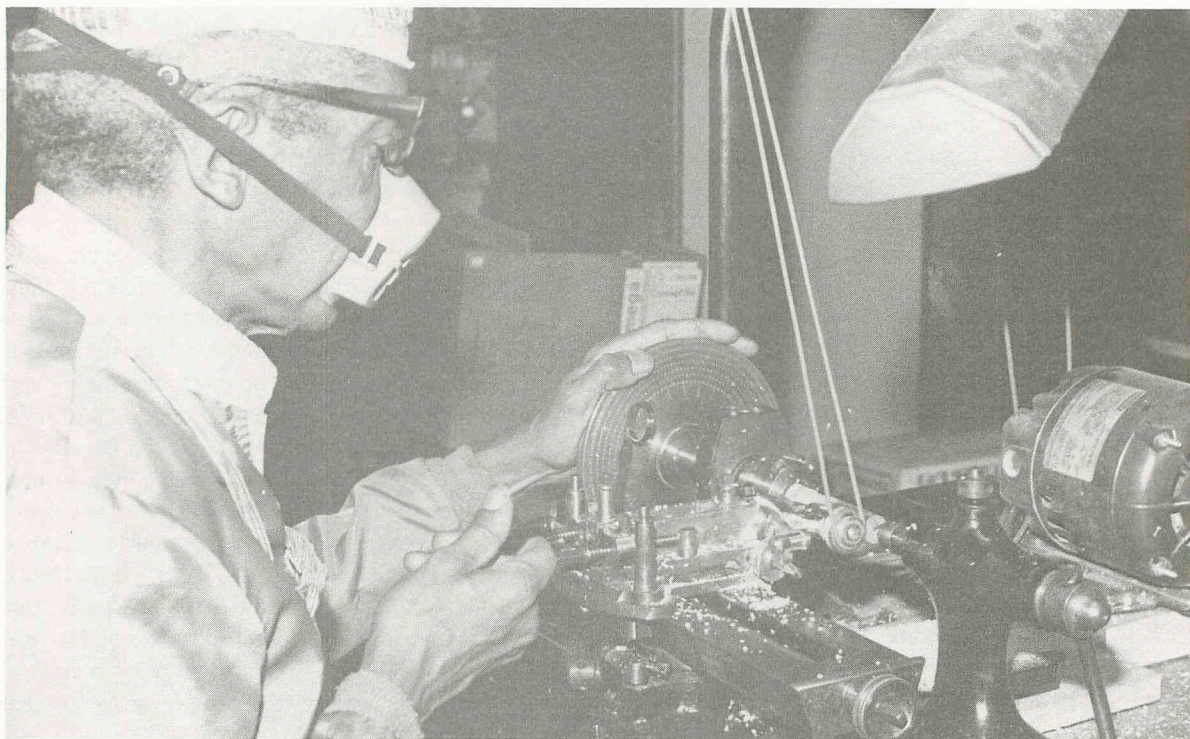


Fig. 14-28. Cutter is fed into workpiece with the handle on the guide screw until checked by the depth screw on the right.

there is almost no interchangeability of parts between any of the lathes now in existence. Each screw was made to fit a certain hole and will not fit in the hole of another. I found little idler pulleys with the center holes so worn that they could be tilted on their shafts to an angle in excess of 30 degrees from the perpendicular! The cost of having many of these parts made up by a machine shop would be astronomical. Many owners are investigating the possibility of personally acquiring metal turning and metalworking skills. This is actually the theme around which the whole next chapter is centered.

It is difficult to find a complete, restorable ornamental turning lathe. Because of this, you may want to modify a relatively modern lathe with a compound slide rest. Some Holtzapffel lathe owners admit to perpetuating a mystique about the apparatus, even to the extent of discouraging anyone from doing certain operations on anything other than an authentic antique lathe. I believe that it will

be difficult, almost impossible, to keep the rising interest in ornamental turning from spreading to other woodturners who want to do fancy things with their lathes. Input in this area will come from engineers, machinists, and tool-and-die makers. There have been reports of turners here in the United States who have been successful in producing ornamental turnery on lathes of current manufacture. I fabricated a crude apparatus from a Dremel flexshaft and scrap parts (Fig. 14-29) that gave me a limited capability in the production of ornamentation not unlike that achieved with an Evans or a Holtzapffel.

Just recently, someone brought to my attention a device commonly used by metal lathe operators that lends itself admirably to ornamental turnery. It is the ubiquitous *tool-post grinder* (Fig. 14-30). This apparatus comes in all sizes and shapes and, when purchased commercially, can cost as much as \$700. The one shown here was made up from scrap parts by a tool-and-die-maker at a cost of

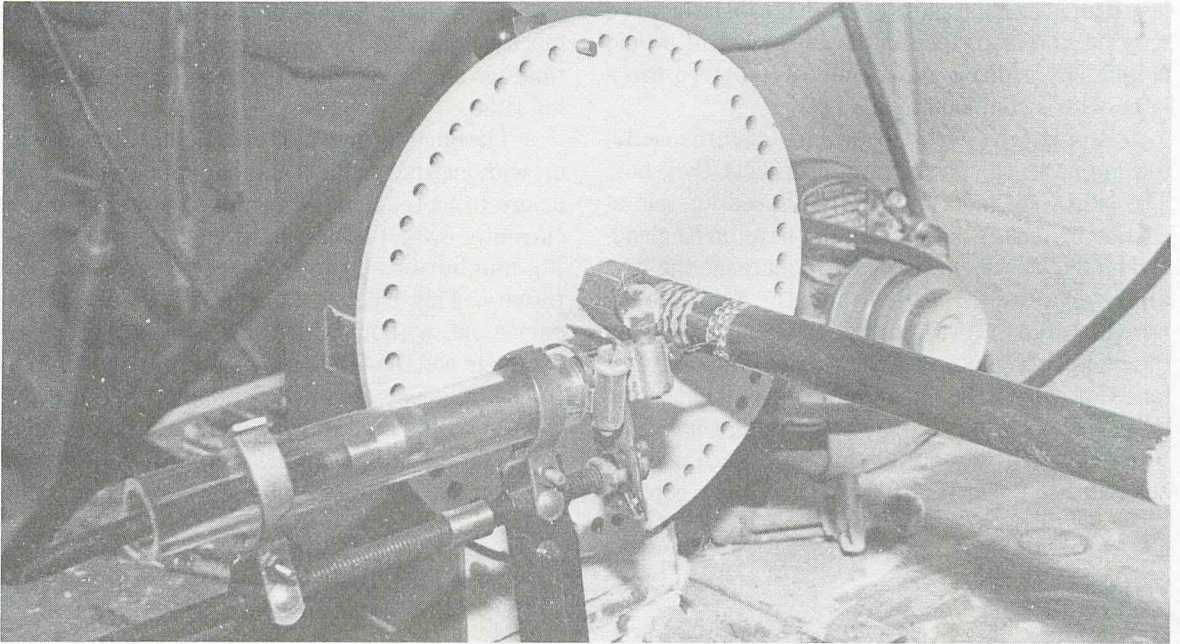


Fig. 14-29. Experimental assembly for ornamental turning on simple woodworking lathe.

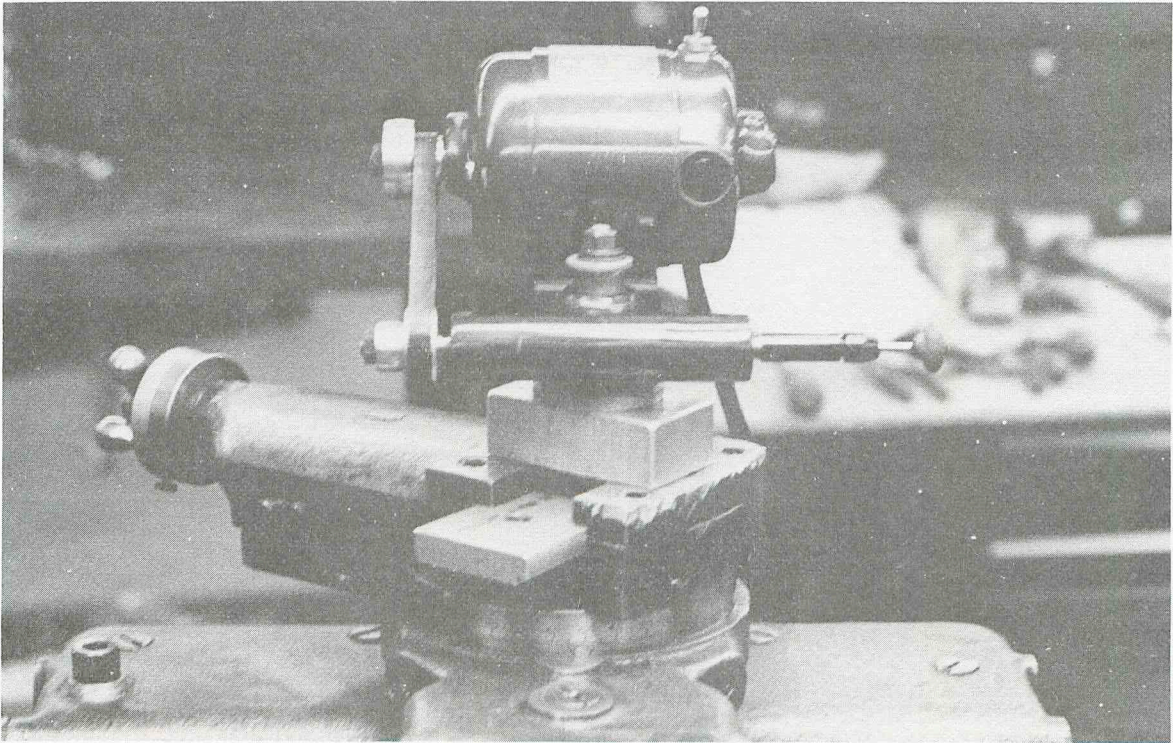


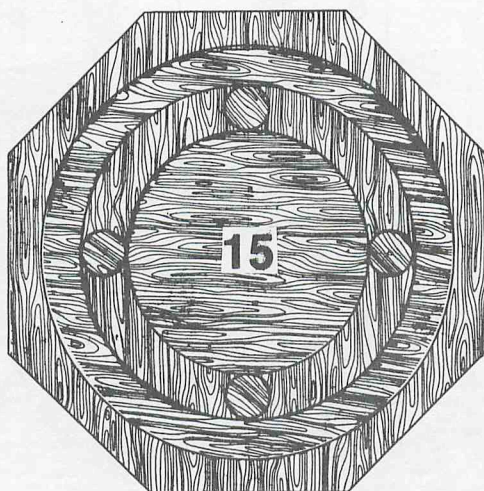
Fig. 14-30. Tool post grinder, which could be used as cutting frame with proper cutters.

less than \$15. This, and still another tool he devised to grind a precise taper on the end of a shaft, would delight any aspiring ornamental turner who had a lathe with a compound slide rest.

People who want to acquire an ornamental turning lathe should be careful of what they buy. The lathes are most frequently offered for sale at auction by the top antique houses here, in England, and on the Continent. In order to increase the revenue garnered from such sales the auctioneers have resorted to "breaking up" the lathes. They put the slide rest and other parts in boxes some distance away from the lathe. Someone will bid on the lathe, and upon high bid or, regretfully, some time afterward, will discover that he cannot use the apparatus. Vital parts of "his" lathe have gone to

another bidder. Someone bid successfully on a much sought after Holtzapffel spiral apparatus some time ago only to discover that it would not couple to his lathe.

The ongoing quest for ornamental turnery with or without the original lathes, coupled with the desire to increase the capability and versatility of currently owned lathes, have encouraged increasing numbers of lathe fanciers to turn to metal turnery. This facet of lathe work, therefore, becomes one without which this book would not be complete and the following chapter is devoted to it. If what follows reads like fiction it is because this writer's "hands-on" involvement has been one of total fascination, delight, accomplishment, and satisfaction.



An Introduction to Metal Turning

A CALL CAME THROUGH TO ME, ONE DAY while compiling this work, from Dick Miller, the owner of one Evans and two Holtzapffel ornamental turning lathes. It turned out that he wanted to acquire as much information and practical experience about running a metal-turning lathe as he could in as short a time as possible. He owned a manufacturing plant with a large tool room that housed a huge South Bend lathe (Fig. 15-1) in addition to a Bridgeport milling machine, a screw cutting machine, a surface grinder, and various other equipment. He had placed an ad in the New York Times for a part-time tool-and-die-maker and had selected one from five respondents. The man would conduct class in the tool room two afternoons a week, and I was invited to participate. The total enrollment would be three persons. I accepted, of course, and thereupon embarked on a learning adventure the likes of which I had never experienced. (Further inducement was this book-in-process and the possibility of getting step-by-step pictures of the many techniques involved in the manipulation of the metal-turning lathe).

Casual conversation had elicited the information that a 40-year-old South Bend lathe, smaller than the one shown here, had sold for \$900. It was in perfect condition because it had never been used to turn anything but wood. Another one of similar vintage, but not in as good condition, had changed hands for \$500. These lathes had gone to private owners not involved in commercial ventures and seemed to accent that quest for lathes with compound slide rest capability. Two other lathes came up for sale, but they each have a story and will be discussed later.

So off to class I went on Monday and Wednesday afternoons. I missed the first two sessions, which was fine because the instructor was checking out the lathe and making it operable. It had not been used for years. A man from the South Bend Company had been brought in to check out the gears and set the lathe up before the instructor took over. The South Bend was running the first time I saw it. At the first session I attended, I formally met the instructor, Bill, the other two "students," Dick, and a man who was an artist just establishing a reputa-

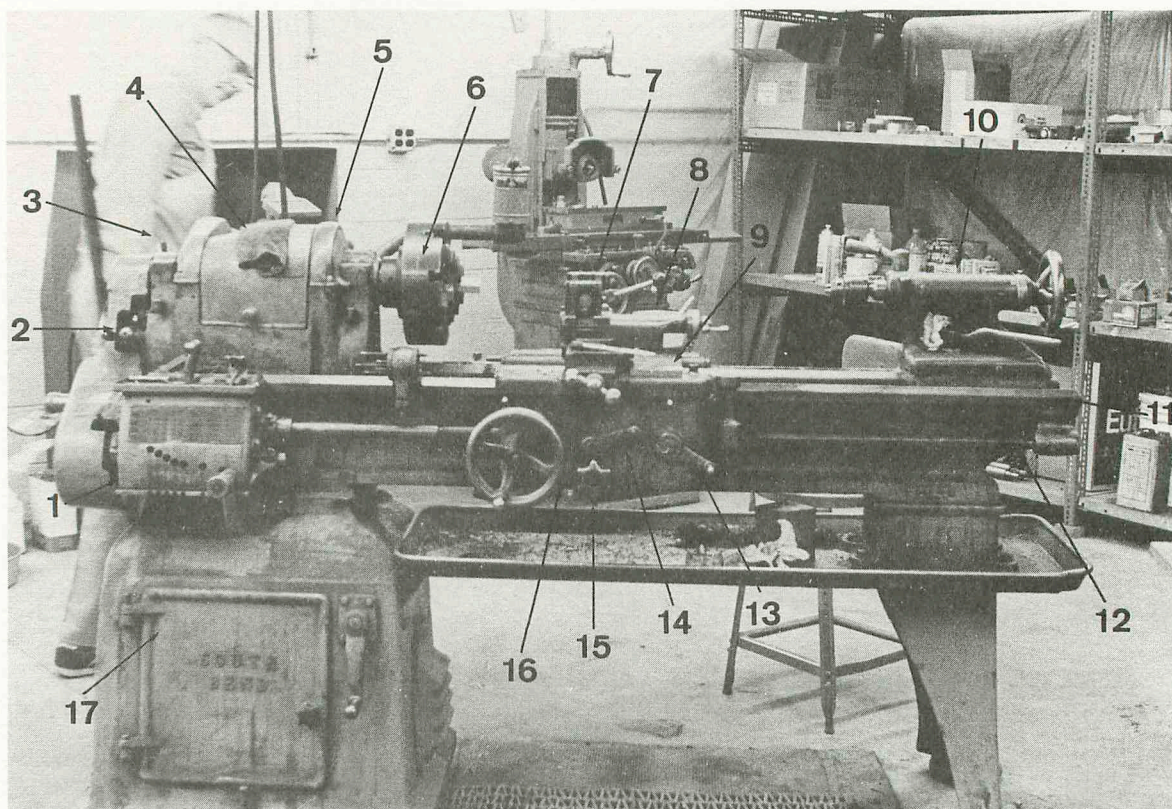


Fig. 15-1. South Bend metal-turning lathe suitable for tool room or manufacturing use. Metal lathe components: (1) gear change levers, (2) feed reverse lever, (3) back gear lever, (4) belt drive under protective cover, (5) headstock, (6) four-jaw chuck, (7) quick-set tool holder, (8) compound slide rest, (9) saddle or carriage, (10) tailstock, (11) lathe bed, (12) lead screw, (13) half-nut lever, (14) feed selector, (15) power feed clutch, (16) hand-feed wheel, (17) motor in leg.

tion. He owns at least four lathes, including a Myford.

The instructor, Bill, had worked more than 50 years as a tool-and-die maker with two of the largest companies in the country. He was a gentle man and, we discovered over the ensuing months, extremely knowledgeable. He knew the South Bend and probably innumerable other lathes intimately. He exhibited infinite patience and although we all knew something about lathe components, he opened new worlds in the area of metal turning. He manipulated the South Bend's handwheels and levers with an ease borne of great familiarity and long use. Gradually, we too, became familiar with them. The South Bend was completely equipped with a three-jaw chuck, a four-jaw chuck, Jacobs chucks, and many *collets* (Fig. 15-2) in various sizes.

BASIC USAGE

The first task on the agenda was one of Dick's favorite projects. He wanted two drilling frames similar to the one shown in Fig. 14-18, but his frames had to have bearings at each end of the casing where the shaft entered and exited. Bill was equal to the task, of course, and cut a length of square steel stock the right length. The four-jaw chuck was mounted on the lathe with bits of masking tape on each of the jaws to protect the stock. He mounted a dial gauge in a quick-set tool holder (Fig. 15-3) and demonstrated how to center the piece.

The end of the dial gauge or indicator is brought up to the workpiece until it just touches. The needle is set at zero and the chuck is rotated slightly until the needle shows the high and low

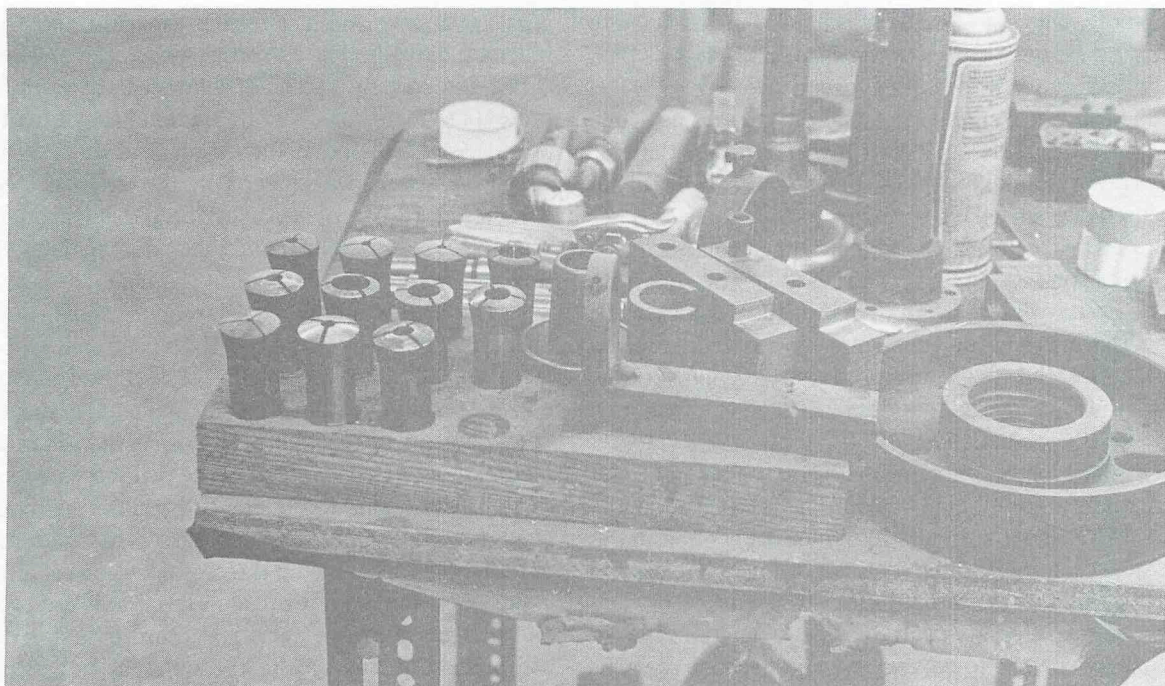


Fig. 15-2. Collets (left), faceplate (right), and other accessories for South Bend lathe.

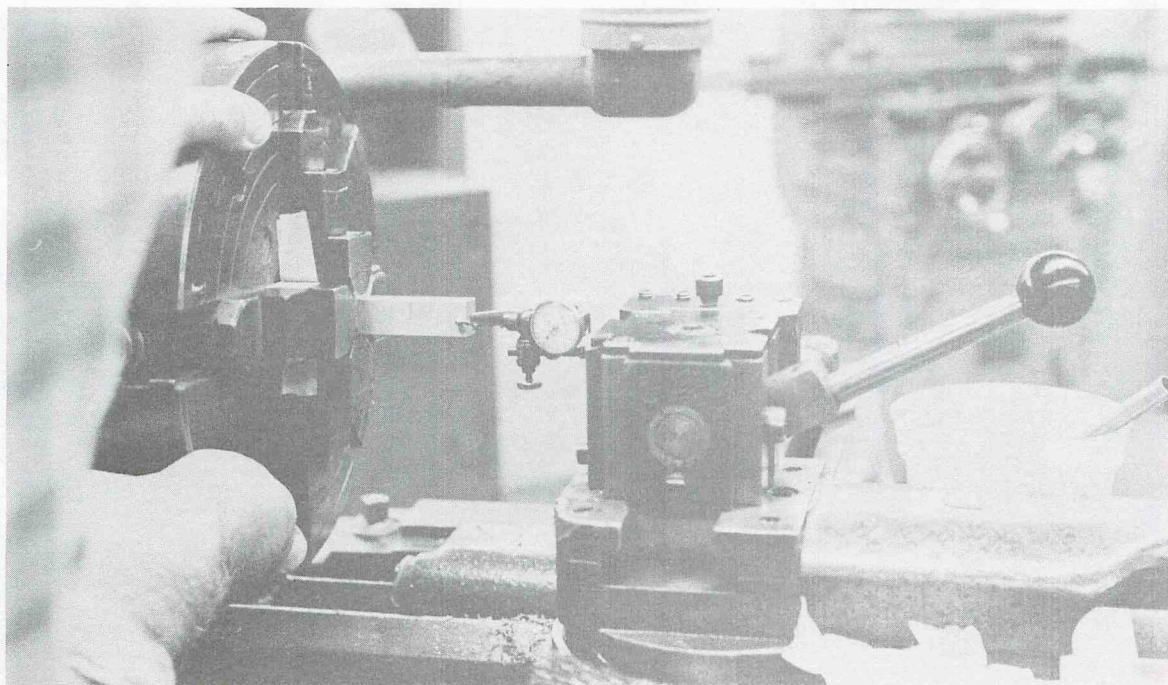


Fig. 15-3. Centering piece of stock with dial gauge in quick-set toolholder.

points. The jaw should be tightened or loosened to bring the needle back to the zero. The gauge is then withdrawn and the chuck turned 180 degrees. The indicator is brought up against the piece once again. Adjustments are made with the jaw until there is little or no movement of the indicator. Several adjustments may have to be made with these two jaws to bring the needle movement down to less than a couple of thousandths of an inch. When there is little or no movement of the needle, the gauge can be withdrawn and the chuck moved just 90 degrees so that the other two jaws can be worked on. After this, all the jaws are tightened and checked one final time with the gauge.

"A couple thousandths," Bill would say as he withdrew the dial indicator. "That's close enough!"

The next step was to mount the tool bit in the quick set tool holder and cut a little indentation (Fig. 15-4) to mark the center of the workpiece. The hole for the shaft was to be drilled, and all of these operations had to be very precise because the drilling would have to be done from both ends. The drill, mounted in a Jacobs chuck on the tailstock,

was advanced about 1" with the ram and the tailstock moved right up to the workpiece and secured. Interposing a piece of shim stock (Fig. 15-5) protects the workpiece while the final adjustments are made. The lathe is turned on, and the drill is advanced into the workpiece with the tailstock feed wheel (Fig. 15-6). Oil is brushed onto the drill bit as it penetrates for cooling, and the drill is withdrawn repeatedly to clear the hole of the chips.

The drill would not go through completely in one operation, of course, so the chuck had to be released gently and the workpiece reversed end for end. The dial indicator came out again, adjustments of the jaws were made until it was certain that the piece was properly centered. The drilling was continued. All of this was under Bill's close and constant scrutiny. Once he was sure what was required, he took over with the certainty born of long experience and did not relax until the finished project met his extremely critical requirements. He had been concerned about the tailstock not being absolutely on center (there were some telltale brass shims between it and the lathe bed). If it was

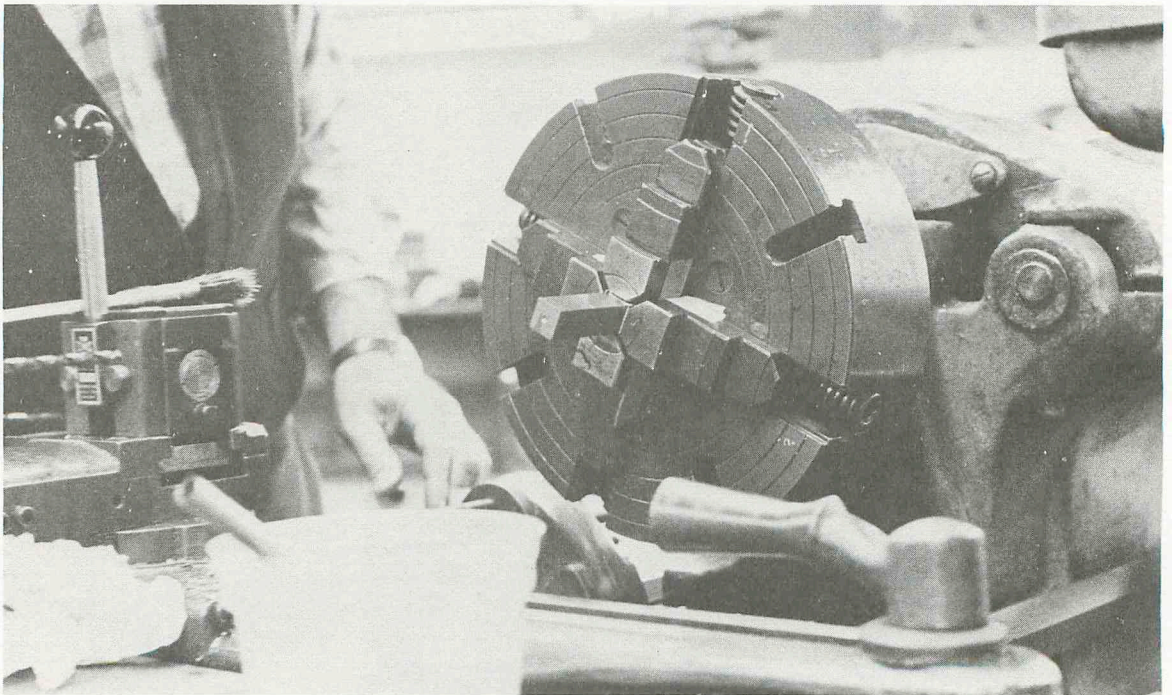


Fig. 15-4. Workpiece with center marked for drilling.

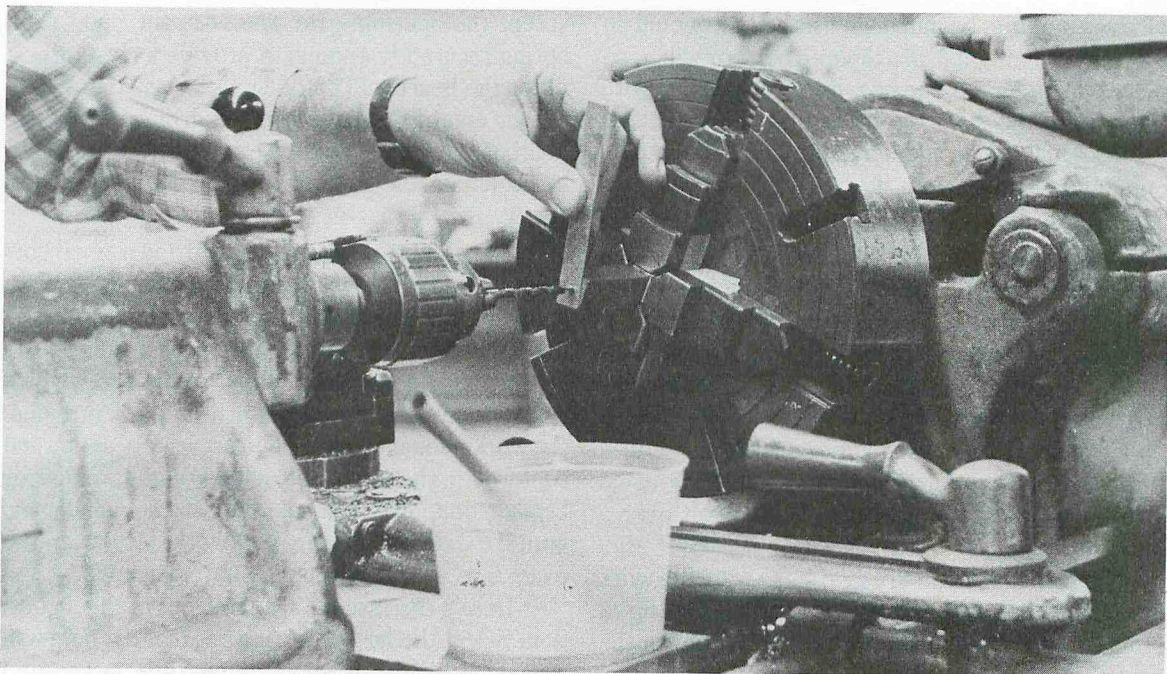


Fig. 15-5. End of workpiece is protected while drill bit in tailstock is brought up.

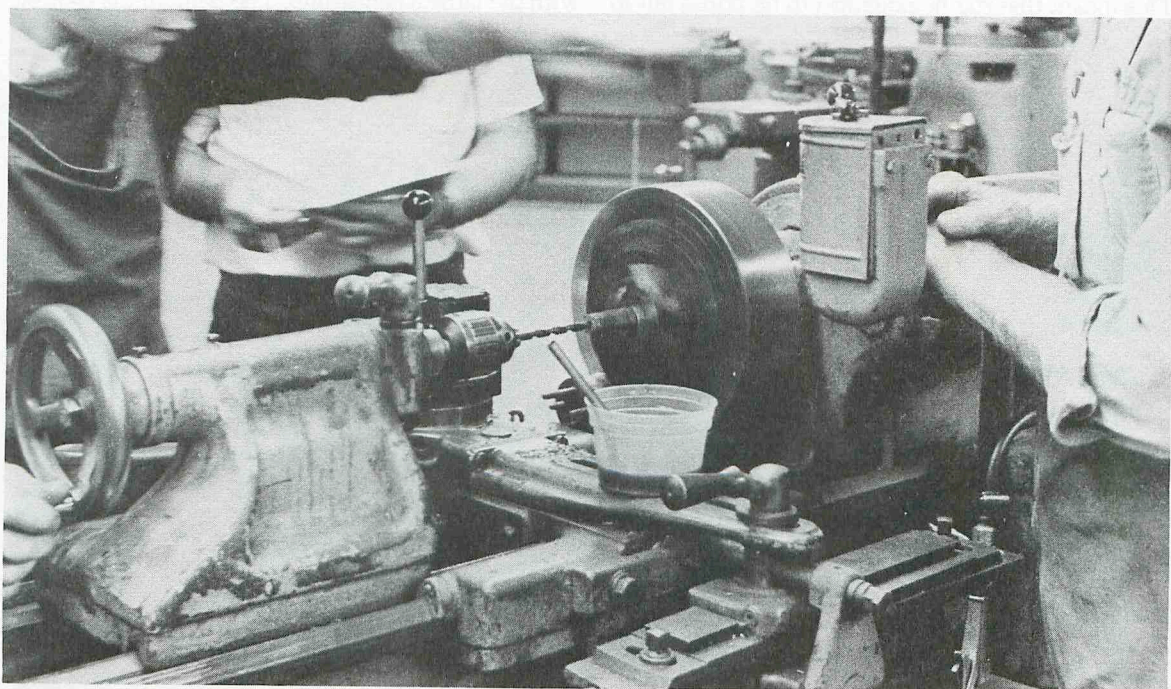


Fig. 15-6. Drill bit is fed into rotating workpiece with tailstock feed wheel. Drill bit is withdrawn frequently to remove chips.

off even slightly, he informed us, the lathe could do two things: it might drill a tapered hole, or when the piece was reversed, the hole might not line up with the one drilled from the other end. The tailstock was off a hair, he decided, but only be a "millinostrous." We could go with it.

He was also a stickler for cleanliness. After every operation, all the chips had to be brushed away. This included the jaws of the chuck and even extended to the threads of the mandrel and those in the back of the chuck whenever it was removed. He recommended a 3" paint brush for this, which was always kept close by. A chip on one of the jaws of the chuck, he reminded everyone continually, could throw all our careful calculations off. They could also be very damaging to the lathe itself over a period of time.

So the chips were brushed away from the work area down into the chip pan (a shelf with a high lip all around it just below the lathe), and the setup for the next operation was begun. Bill had insisted on tiny roller bearings to support the shaft that would carry the chuck on one end and the pulley on the other. This meant that the housing had to be bored out to

accept the bearings. He was adamant, too, about boring accurately enough to provide a close press-fit for the bearing. The tailstock was withdrawn to the far end of the lathe and the drill bit removed. Sharp pointed dead centers or drill bits were never to be left in the tailstock for obvious reasons of safety.

The slide rest was positioned and a small boring bar fitted in the quick-set tool holder. There are a number of reasons for boring the hole out to the final diameter. In this case, the enlarged area for the bearing should not have a taper at the back, which would have resulted with a drill bit. Even though the workpiece may have been accurately set up and centered in the lathe, the drill bit could wander or become dull, leaving a hole that was not concentric with the exterior. Boring will work, too, when the exact size drill or reamer is not available.

Here's the lesson that came out of this operation. Select the largest boring bar that the hole will accept. Mount it as short as possible in the tool holder to reduce or eliminate any chatter that might occur. Make certain that the bar is level and parallel with the lathe's centerline. The point of the tool-bit

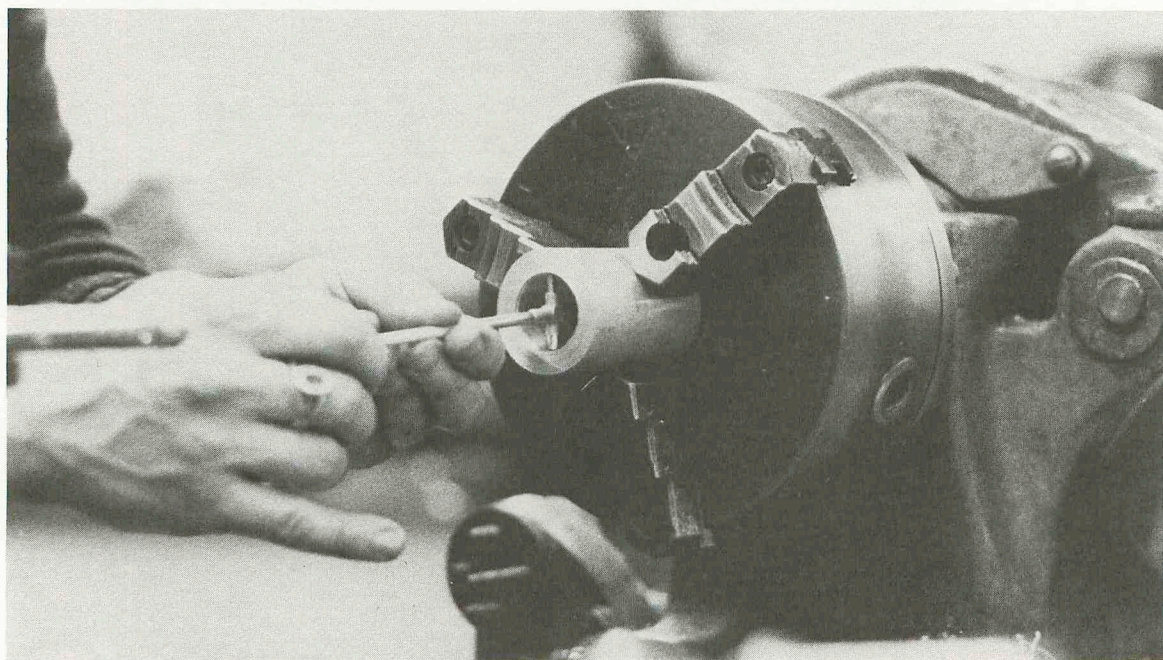


Fig. 15-7. Bored hole is measured with telescoping gauge.

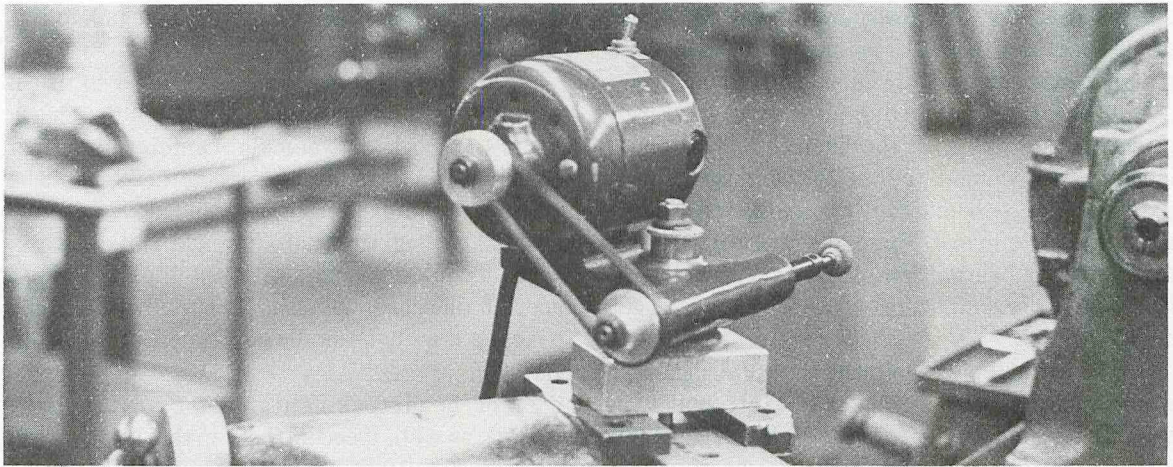


Fig. 15-8. Small tool post grinder mounted on compound rest.

should be set a hair above center to allow for the bit springing down as it cuts. The lathe speed (about 1200 rpm) remains the same and a feed about .008 is selected for the initial boring. The lathe is started and the crossfeed handle turned counterclockwise until the point of the cutter just touches the inside edge of the hole. Now a trial cut, .004 or .005 deep, is run in no more than $\frac{1}{4}$ ". The lathe is stopped and the diameter of the area just bored is measured. We used a telescoping gauge for this (Fig. 15-7). The photo shows use of the gauge during the same procedure, but on another project. The hole is usually left a bit undersize, about .010 for a finish cut, but Bill chose to remove a few thousandths at a time and fit the bearing repeatedly. When it seemed that the hole was right, the piece was removed from the lathe and the bearing pressed in place with an arbor press. A length of steel rod with the same diameter as the shaft that would be fitted was tried in the bearing and it would not turn freely. Everybody looked at Bill as if he had betrayed us!

"Well," he said simply after studying it a bit. "It seems as if we've crushed the bearing a bit. The hole is too small. We'll have to take out the bearing and grind the hole a little. We'll use a tool-post grinder."

Now, while the tool room where these unique classes were held was well equipped, it did not boast a tool-post grinder among all the equipment. Bill admitted upon questioning that such a piece of

machinery could be expensive, depending upon the size and capability. But, he added, he had one at home that could do this particular job, and he would bring it in for the next session. It turned out to be a neat, compact little device when he demonstrated it two days later. It consisted of a motor on one end of a bracket (Fig. 15-8) with a housing for a shaft on the other. The motor was coupled to one end of the shaft with two-step pulleys so that the speed could be varied. The other end of the shaft had a collet arrangement similar to a Dremel MotoTool or a small flexshaft into which little grinding wheels could be fitted. The pulleys had crowns on them instead of flanges, and a flat belt was used. This is mentioned because a flat belt tends to run on the highest portion of the pulley and therefore would run to the center with little or no possibility of slipping off. Bill had acquired the device at one of those auctions and liquidation sales that are held periodically in highly industrial areas. A lot of machinery, tools, and equipment can be purchased inexpensively this way if you haunt the sales. They are listed in the Sunday edition of large newspapers like the New York Times.

The grinder was set up in place of the normal tool-post holder and lined up with the lathe's centerline. With a small, cylindrical grinding wheel (about $\frac{1}{4}$ " in diameter) chucked into the collet, the grinder was advanced into the hole with the lathe turning at slow speed. This maneuver caught me by

surprise because I was not aware that you could grind something that was moving. Just goes to show you that one can't possibly know everything! In any event, the hole was ground out with repeated pauses for checks with the bearing and finally it looked as if it would fit perfectly when run through the arbor press. It did. Bill was delighted. "Now, that's the cat's meow," he exclaimed rotating the test rod in the bearing. "Just look at that!" And then he regained his composure and said, "Well, let's get on with it."

The next step was to make the steel shaft that would hold the chuck on one end and the pulley on the other. A length of tool-steel rod was selected and mounted on the lathe on centers. The three-jaw chuck was used this time, but a center was chucked into it and the workpiece was fitted with a standard bent tail lathe dog. Mounting the workpiece in this manner must be done carefully to avoid damage to it or to the lathe centers. First the tailstock is adjusted so that the spindle extends about 2" beyond the tailstock. The lathe dog is put on the left-hand end of the work without tightening it on the workpiece. The tailstock is brought up and the right end

of the work is put on the center, then the tailstock is locked in position.

The tail of the lathe dog is adjusted so that it rests loosely against one of the jaws of the chuck. Check the work between the centers for proper tension. When the setup is correct, there should be no end play and the lathe dog should move freely. If it should hang up anywhere, it might pull the workpiece off center, raising the possibility of turning a taper. In this case, the shaft (Fig. 15-9) was turned to size, a few thousandths at a time, without difficulty.

The headstock center must run true, the tailstock as well, if eccentricity in the workpiece is to be avoided. If just a center is used in the mandrel, all surfaces must be clean, especially the headstock spindle taper and that of the centers shank. Pains should be taken to remove any chips from both surfaces. The center should be placed in the headstock with a snap and then it should be checked once again for trueness. The use of a dial indicator is the most positive way to do this checking. Attach it to the cross-slide or the tool post. Bring it in close to the center so that it indicates about one-quarter of a

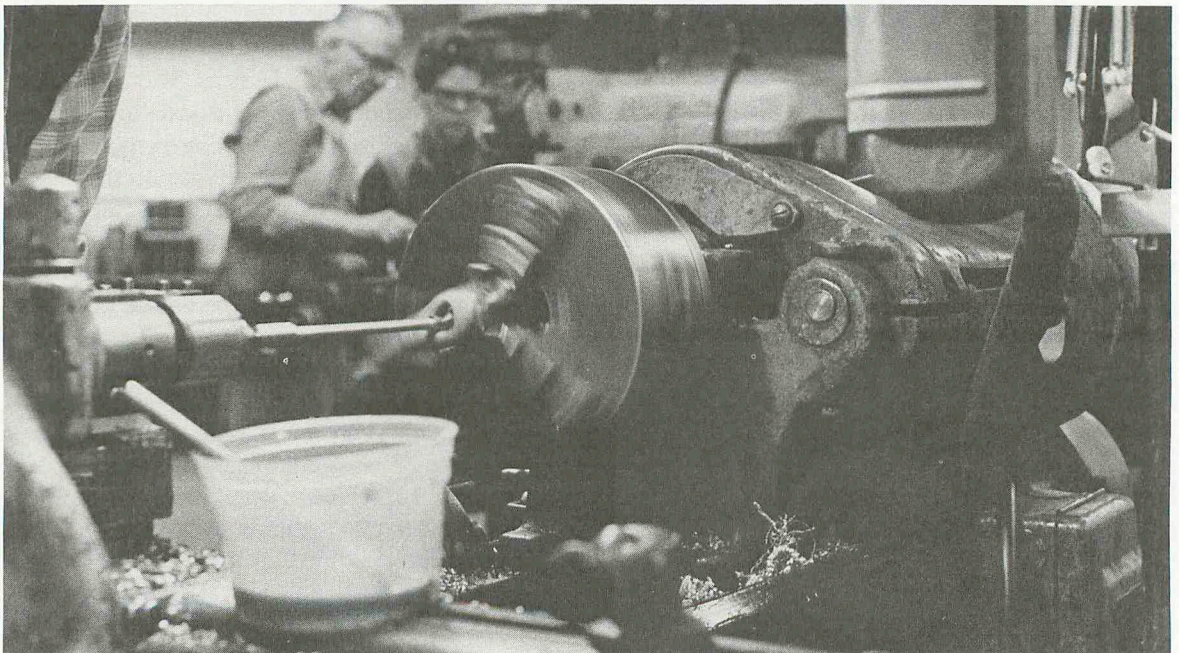


Fig. 15-9. Turning rod between centers.

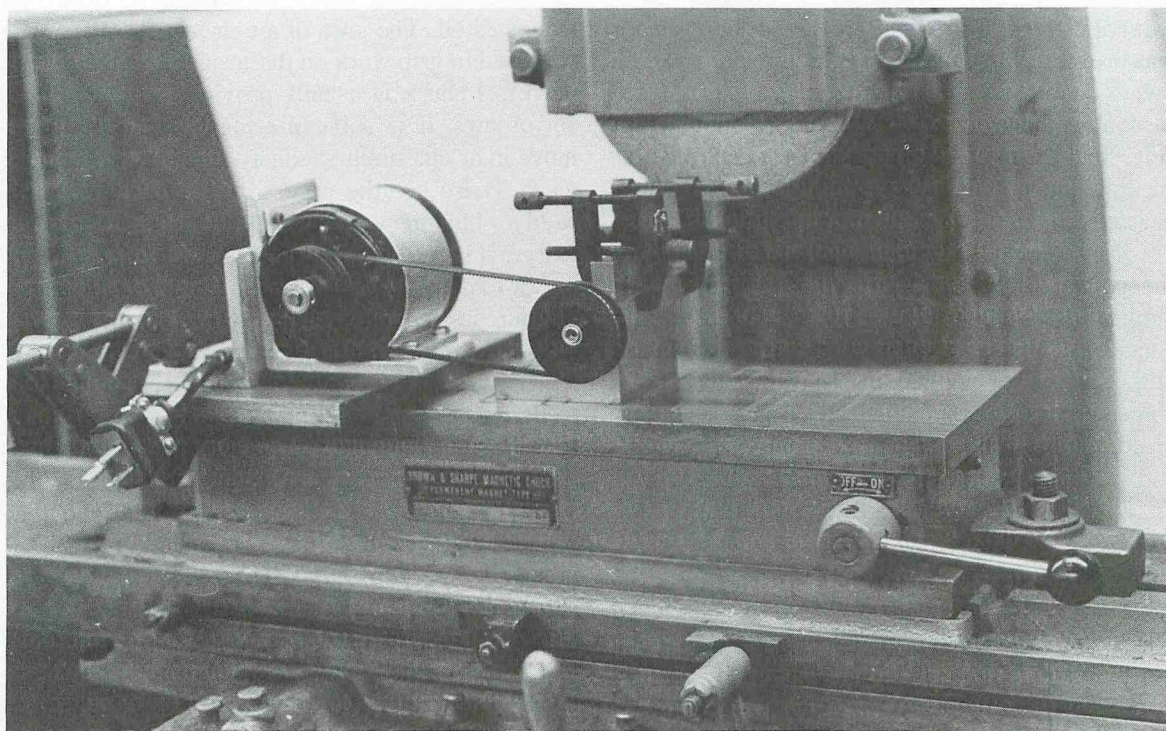


Fig. 15-10. Device for turning taper on a shaft with surface grinder.

turn. Turn the spindle by hand while watching the needle. The pointer will show any runout immediately.

Once the workpiece is properly set up, attention should be turned to the cutting tool and the tool holder. A general rule of thumb is to set the tool post on the left-hand side of the T-slot on the compound rest. Fit the tool holder close to the tool post (no more than 1" away). This is to prevent any chattering that might arise from excess overhang. The tool holder should be pointed straight across the axis of the lathe's centerline or slightly towards the tailstock. When set up in this manner, there is far less chance of the cutting tool digging into the workpiece. Make certain that the tool post's screw is tightened securely so that it does not move under cutting pressure.

The next procedure was to turn a taper on the chuck end of the shaft. It could have been turned on the South Bend under normal circumstances, but lathe had not been completely renovated at this

point. There are several ways of turning a taper on the lathe: by adjusting the compound slide rest to the angle of the taper; by setting the tailstock in an offset position, or by using a taper attachment. Bill opted to use a method with which the taper could be turned on a surface grinder. It is included here because Bill worked up a little machine of his own design and incorporated it into the procedure. The technique may prove valuable to the reader at some future date.

He mounted a little motor (Fig. 15-10) similar to the one on his tool-post grinder on the magnetic chuck of the surface grinder and coupled it to the shaft to be tapered and its housing with a belt and pulley. There was a lot of talk just prior to the setup about determining the proper angle with sine bars, but none were available. He had worked out all the mathematics, which are not included here because this step does not include the lathe. Now he set up angle blocks, measured with a plane protractor, and locked the spindle in position with a couple of

parallel clamps. The wheel of the surface grinder was dressed with a diamond point dresser and then lowered into position. The little motor was plugged in, contact made with the revolving grinding wheel (Fig. 15-11), and in a very short time he had his accurate taper. It fit the taper of the Albrecht chuck perfectly.

Now all that remained was the fabrication of the pulley. Dick wanted a two-step brass pulley similar to the ones on the Holtzapffel lathe. Bill considered this a job that could be accomplished with ease. They looked in the scrap bins for a suitable brass billet. Machine shops and metal manufacturers offer bits and pieces of aluminum, brass, and steel for sale periodically and small shop owners watch for these sales religiously. Just the right piece of brass was found.

Fabrication of the pulley was a job for the three-jaw chuck, although it should be mentioned that in any emergency the four-jaw chuck could be used. The latter will take round, square, octagonal, hexagonal, and even weird-shaped pieces. For work that must be centered precisely, the four-jaw chuck

is suggested. The jaws of a four-jaw chuck can be reversed to grip work on the inside. The three-jaw universal chuck is usually provided with an extra set of jaws. It is self-centering because the jaws move in or out simultaneously when the wrench is used. These are the accessories most frequently used for holding work, and a lathe owner is limited to a great extent if he doesn't possess one. They are rather expensive to purchase as an accessory, and the purchase of a used lathe should be made very hesitantly if one is not included with it.

As I recall it, some months after the pulley was made, a hole of the proper diameter to fit the drilling frame shaft was drilled through the center and the piece was faced. Facing is usually done for one of several reasons: to reduce the workpiece to the proper length, to smooth and square its end, and to produce a smooth, flat area from which to take measurements. When the facing is done in a chuck, as in this case, either a facing toolbit or one ground for general purpose use may be mounted in the tool holder (Fig. 15-12). Bill was always concerned about the angle at which the compound rest was set.

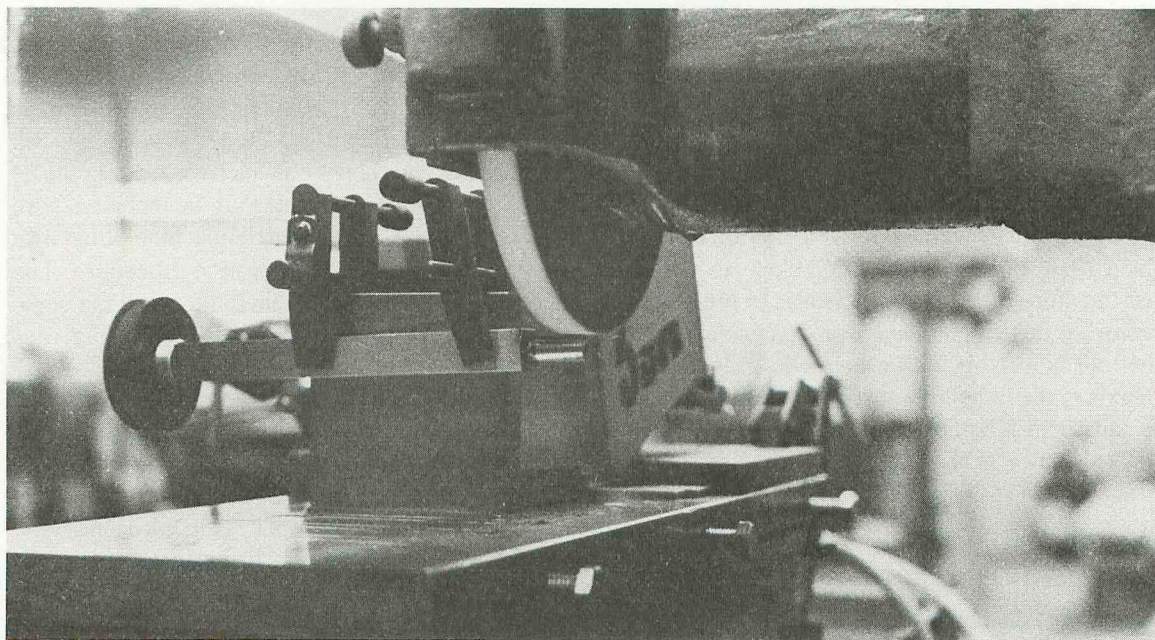


Fig. 15-11. Wheel contacts rotating shaft to grind taper.

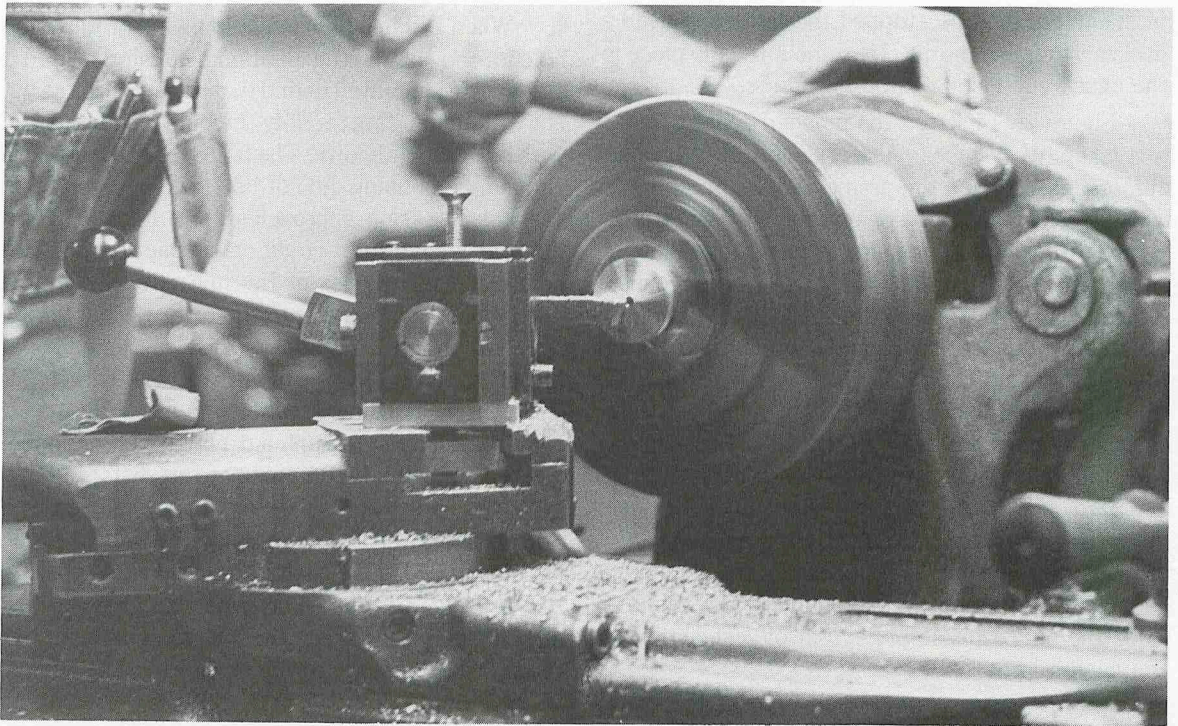


Fig. 15-12. Facing end of brass billet for pulley.

Two methods are applicable and I cite them both here.

The Rest at a 30° Angle. Work is said to be faced with great accuracy by using the micrometer on the compound rest, which should be set at a 30° angle to the cross-slide. The tool post is moved to the left side of the compound rest to reduce the possibility of its contacting the chuck jaws or any part of the lathe. The tool is set to center and checked against the lathe's center line, then brought up close to the surface to be worked. The carriage should be locked in position to prevent movement during the cutting cycle. The compound rest screw is fed in until a light cut begins and the surface is faced at this point. When the rest is positioned at the 30° angle, the side movement of the cutter is just one-half of the amount fed. This means that when the amount of material to be removed is calculated, the compound rest screw should be fed twice that amount.

The Rest at a 90° Angle. When the com-

pound rest is set at this angle to the cross-slide, conditions are optimum for producing shoulders or steps, the exact requirement here (Fig. 15-13). After setting the rest to this angle, the cutting tool is brought to center. All the shoulders are rough turned to close to the necessary length. The cutting tool is then set to face the shoulder (pulley steps). The top slide has to be withdrawn a sufficient distance to allow enough travel to cut all the steps.

The tool is set to take a light cut off the right-hand shoulder—the end of the workpiece—and the carriage is locked. Work each shoulder to the desired length by moving the compound rest. The grooves for the pulley belt can be cut as intermediate steps in the process above. All that remains is to cut off the piece with a parting tool. A cardinal rule is never to cut all the way through with a parting tool when the workpiece is being turned on centers. Bill applied this rule here and in other cases even when the work was in a chuck. The waste was removed until the stock was less than ½"

in diameter, then he stopped the lathe and used a hacksaw to finish the cut. He remounted the piece in the chuck and faced off the back side.

Figure 15-14 shows the finished drilling frame resting on two V-blocks. It worked beautifully. The differences between this frame and the one I made up (Fig. 14-18) about the same time with Bill's help are numerous. Dick's housing is steel while mine is aluminum. A much more expensive Albrecht chuck is fitted to the one shown here and is placed directly on the end of the tapered spindle while mine has an adaptor that locks onto the shaft with a hex screw. The pulley is held in place by being snubbed up tight against the chuck with the $\frac{3}{8}$ " thread on the adapter. Note that the pulley on the one shown here is at the outboard end of the shaft. I patterned mine after one that Frank Knox, the master turner, uses constantly primarily because all the parts except the aluminum housing were immediately available in the studio. I made the single phase pulley out of acrylic on the Holtzapffel lathe.

When Bill had finished helping me produce the hole for the shaft in the aluminum housing, I tried it and was disappointed to find that it went through but not without binding terribly. It could only be turned with extreme difficulty. The holes drilled from both ends of the housing did not line up. The end of that particular session approached, and I asked Bill if there was anything I could do to free up the shaft before the next session. He suggested working a fine lapping compound into the orifice and twisting the shaft until it rotated freely. He cautioned about turning it so rapidly by any means whatever that it seized in the housing. I looked around the studio for some fine lapping compound but there was none. There was a small container of rottenstone, however, and I felt that it was worth a try. I put some on a heavy sheet of paper, mixed it with a light machine oil, put the end of the shaft into it, and worked it into the housing. Gradually, it penetrated deeper and after a relatively short time it went all the way through and began to turn more freely. I locked the

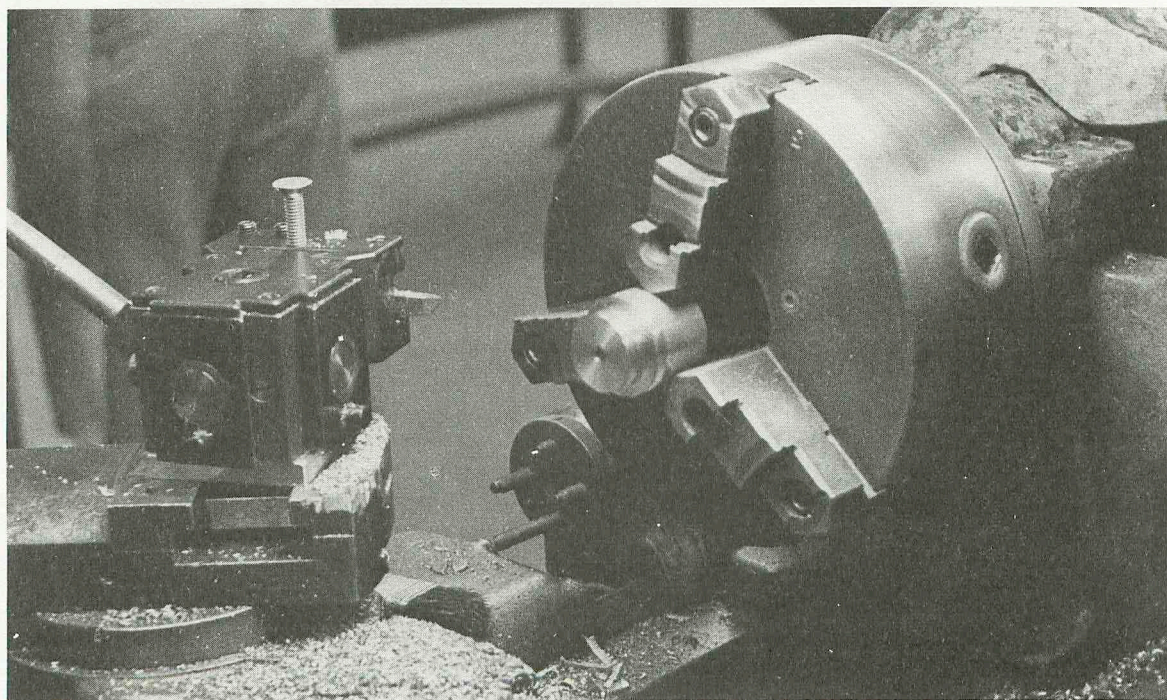


Fig. 15-13. Either a facing tool bit or one ground for general purpose use can be used for facing.

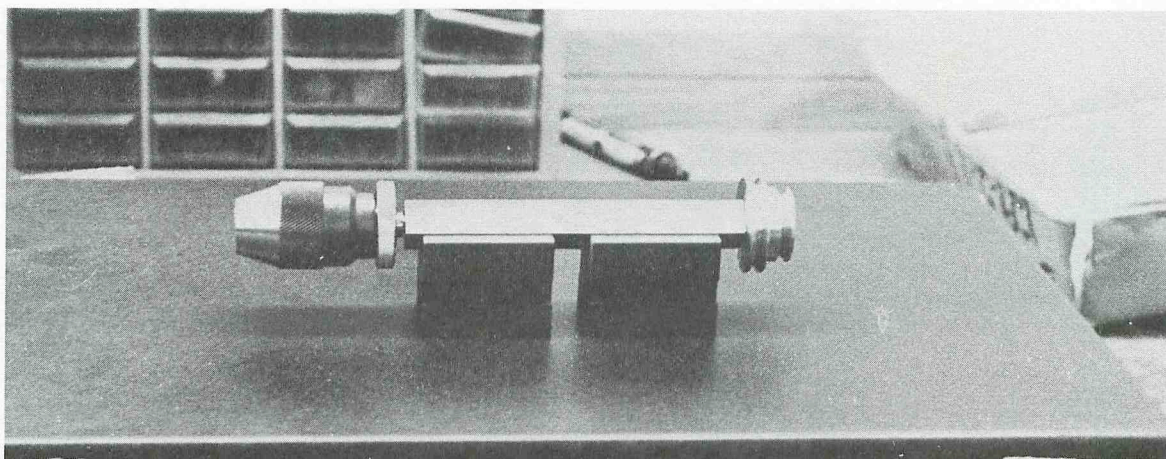


Fig. 15-14. Finished drilling frame on polished granite surface.

housing in a drill press vise and chucked the shaft in the drillpress. Running the drill at a very slow speed, I worked the shaft up and down until it revolved quite readily and with perfect smoothness. The rottenstone had worked admirably! Here the shaft got a good cleansing to remove the pastel-like oil and rottenstone mixture and clean oil was substituted. The whole unit was assembled and tried out in the lathe. Only one problem surfaced. The set screw that held the shaft in the arbor kept working loose. The fix was easy enough, fortunately. Another similar arbor with a hex set screw, which could be tightened down far more effectively than the screw with a slot, was substituted. The whole assembly works like a charm. It may not be quite as accurate as the one with the bearings and the expensive chuck but it is something anyone reading this can make up quickly and inexpensively.

When I showed Bill how successful I had been, his eyes lit up and at the mention of the rottenstone, he exclaimed: "That's it! That's it! You did it! You know, we used to call that Turkeybone years ago and that's just what it was used for—a fine lapping compound."

We all got practical lessons on the proper use of large and small boring bars, the various methods of chucking, facing, and putting reference marks on the workpiece. The artist/student in our midst wanted to make a *goniostat*, a device for grinding

and setting turning cutters and tools. Under Bill's supervision, he carefully and accurately turned all the pieces, including the circular receptacle shown here (Fig. 15-15) and a hollow cylinder that would be part of the elevating mechanism of the goniostat (Fig. 15-16). He was shown, too, how to mount a dial indicator with a magnetic holder so that the penetration of a boring bar could be controlled to within thousandths of an inch. Dick had to make a backing plate for mounting a three-jaw chuck on the Holtzapffel lathe, and he learned how to precisely position the plate in the lathe with the dial indicator so that it was absolutely true in all planes, vertically, and on true center (Fig. 15-17).

Sometimes it was quite like a schoolroom but with just three students. At one point, a project involved the removal of a couple of thousandths of material from the underside of a number of long cutting tools that did not fit properly in the frame holder in one of the Holtzapffels. Bill demonstrated how to set them up properly on parallel blocks on the surface grinder's magnetic chuck (Fig. 15-18). The procedure involved the use of three control wheels on the grinder: one to advance the table, one to move it from left to right, and a third to lower the grinding wheel a few thousandths of an inch at a time. There were dozens of the cutters that had to be modified, and we all took turns to get the feel of the machine. Bill wandered away to do something

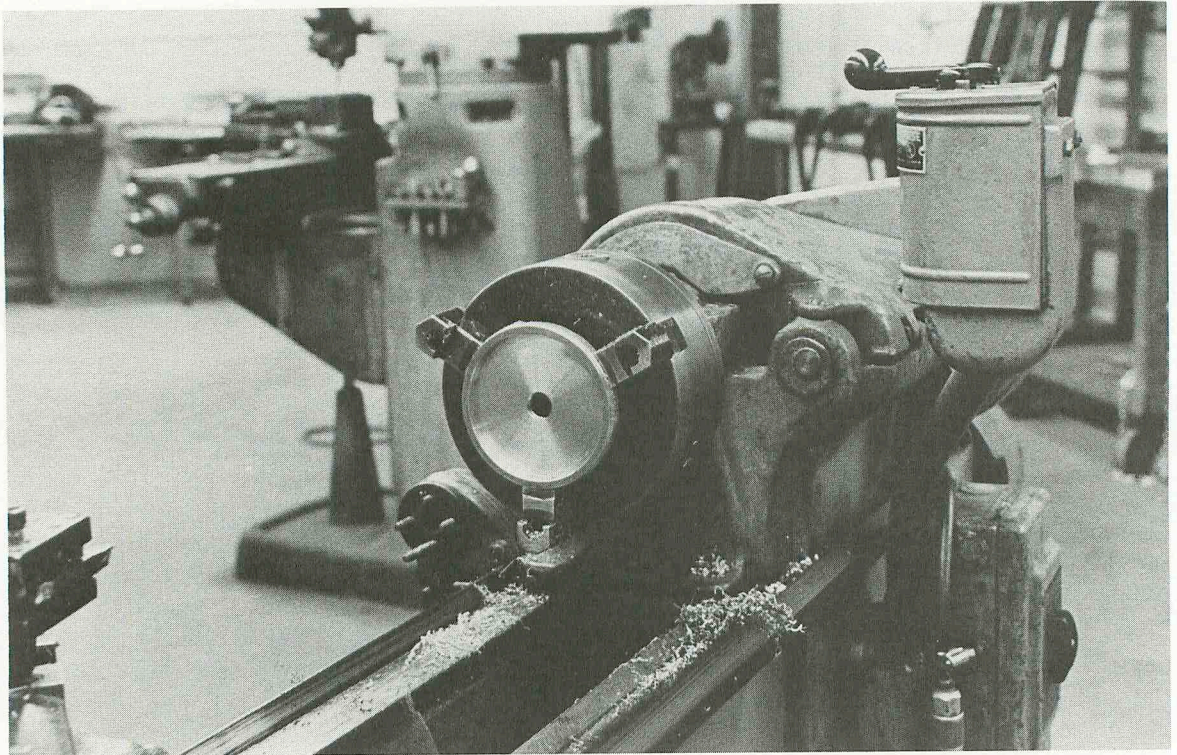


Fig. 15-15. Turned receptacle for goniostat stone.

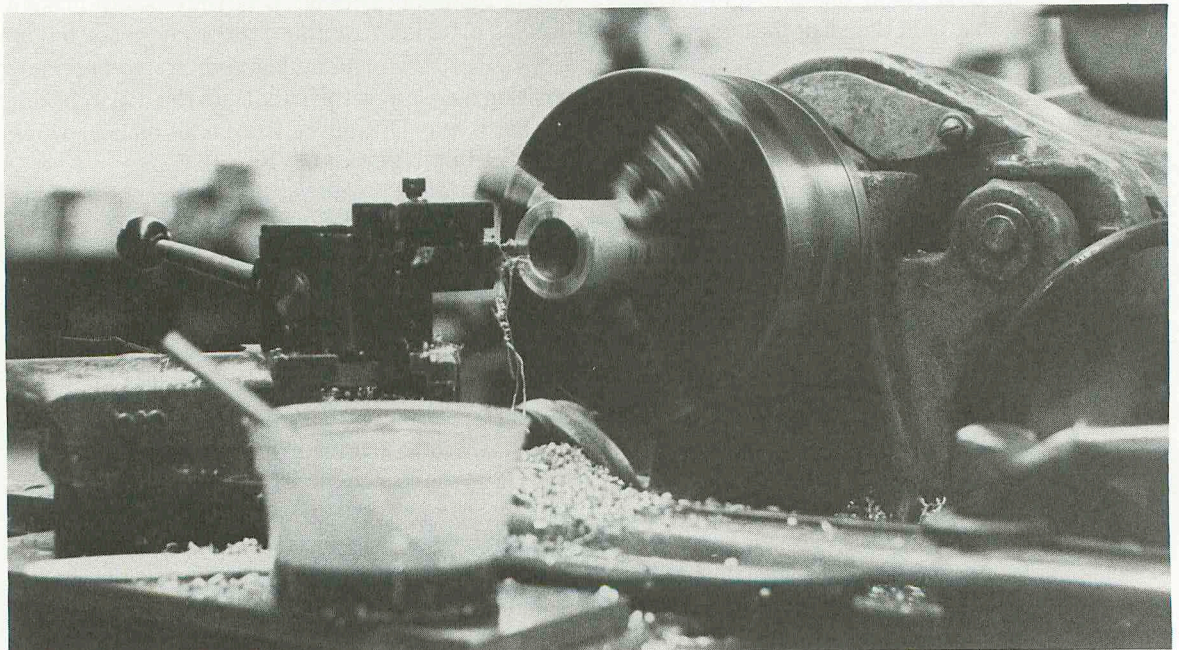


Fig. 15-16. Cutting a chamfer on rim of newly bored hole.

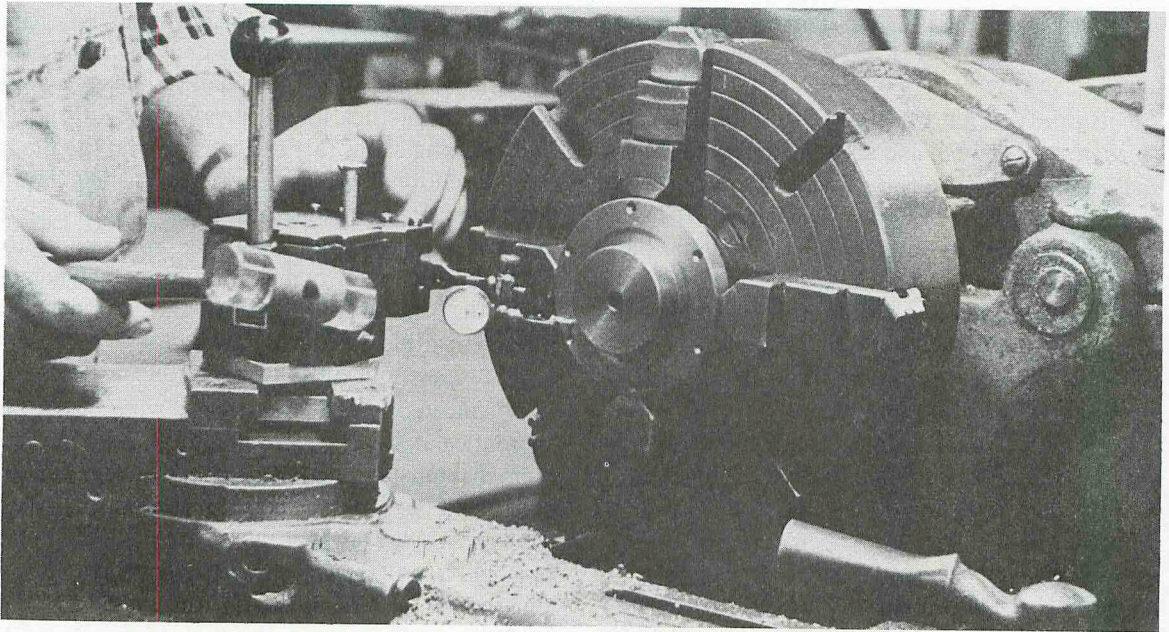


Fig. 15-17. Using dial gauge to position plate in a truly vertical plane.

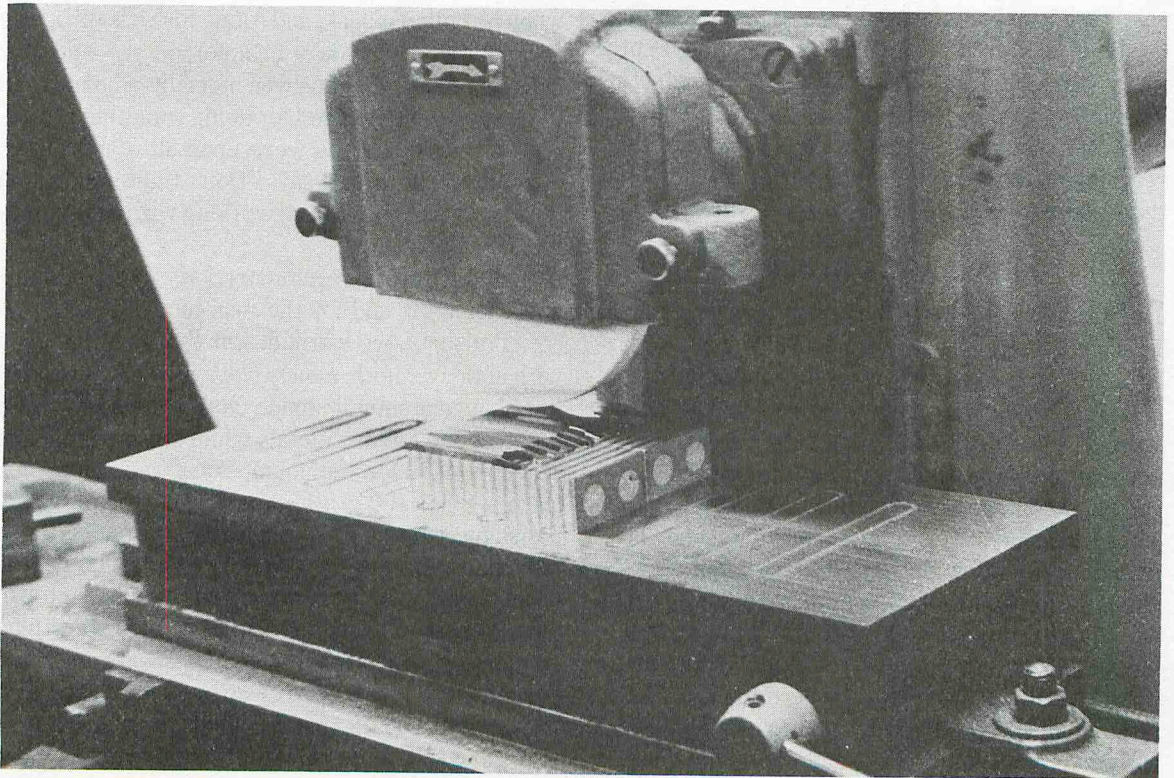


Fig. 15-18. Surface grinder set up to remove thousandths of an inch from backs of special cutters.

else. Dick said, "You know. This machine has an automatic feed, I think. Let's see if we can activate it."

He moved a stop here, flipped something there, turned a knob, and sure enough the machine started to run by itself. Back and forth it went and gradually the chuck moved away from us. We had so much respect for Bill that we all felt like mischievous schoolboys, and we watched him out of the corner of our eyes as he worked across the room. And would you believe it? He stopped what he was doing, listened for a moment, then came over. He sized up the situation in a glance.

"Well," he said. "All right, but you know what you are doing? Let me get there for a moment."

He shut the grinder down and picked up one of the cutters.

"When you run over them fast like that you heat them up and cause distortion in their shape."

He held one up and laid his 6" rule along the length of it. Light was visible under the center of the rule; the piece had such a curve in it that, magnified by the stress of the moment, it reminded one of a swaybacked horse. From then on we ran the machine manually, cranking one wheel with the left hand and the other with the right hand, and then reaching up periodically to the wheel that lowered the grinding wheel. Another lesson was learned!

FILING AND POLISHING

Bill was also most particular about how a piece was finished off. He could not abide any burrs or extremely sharp edges. He was quite adept with a file and tried to teach us how to use one correctly. We learned that filing while the lathe is running, in addition to removing burrs and keen edges, can reduce the diameter or remove cutting-tool marks. There are a number of files that can be used. They include the long-angle lathe file, the mill file, the shear file, and files for aluminum and brass. The one I used most often was the mill file. It always has to have a handle because the rotating work tends to push the file toward the lathe operator. Long strokes should be taken with pressure applied on the forward stroke. There should be no pressure on the back stroke, nor should the file be lifted. Some

authorities recommend filing with the left hand holding the handle of the file and the right hand steadying it, because this takes the hands away from the headstock area. Surprisingly, Bill never said anything about this and always held the file in the conventional manner—with the handle in his right hand. He never increased the spindle speed, which is another helpful hint. He did use a file to reduce the diameter of a piece, especially when he found that the lathe tended to turn a taper. He warned that this was not a good practice, because it could produce out-of-round areas on the work.

"You know," he said once, "when I was an apprentice many, many years ago I worked in a tool room that must have been five times the size of this one. And if the foreman heard an apprentice make a file squeak away down at the other end of the room, he would trot all the way down there, no matter how long it took, and ream the guy out good."

Whoever was using a file at that moment would attempt to lengthen his stroke, not press on the file when he pulled it back, and rotate his wrist properly so that the file made a chamfer on the end of a cylinder. Each one of us was mortally embarrassed if we were gently chided for doing something incorrectly, and Bill's eyes were upon all of us!

"Hey!" he would say. "Don't tighten down on that anvil like that! You're working with a micrometer, not a C-clamp!"

And with each remonstrance came a new respect for tools and for the man himself.

Polishing, we learned, was the act of finishing with abrasive cloth. *Emery cloth*, Bill always called it, although aluminum oxide cloth is generally used for steel and ferrous metals while silicon carbide is recommended for aluminum, brass, and nonferrous metals. 80 or 100 grit is considered good for rough polishing, while 200 or finer grit is used for finish polishing. There were a variety of grits in our tool room suspended in racks on long rolls, but Bill always seemed to choose the fine grit for everything he did. Noticing his shiny rule in his pocket one day, I asked him about how to clean one I had at home. It had gotten so dark that I couldn't read it. "Rub it with a piece of emery cloth," he said simply. And it worked. When he wanted to polish a cylinder on the

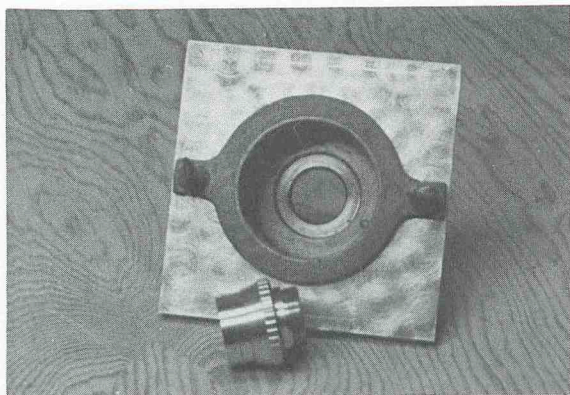


Fig. 15-19. Special mounting lens holder with several operations in its fabrication done on a turret lathe.

lathe, he would take a length of emery cloth, pass it around the diameter, and hold it against the cylinder by pulling gently on both ends and moving it back and forth all the while. For end work, he took a narrow strip, folded it several times, and applied it to the workpiece. I've never seen him hold a piece of the cloth under the file and apply it to the work although this is said to allow more pressure to be applied.

MY METAL-TURNING LATHE

After a while, the artist stopped coming to class. He had commuted some 30 miles, and it had gotten to be a hassle. Besides, he was skilled in the ancient art of granulation and had gotten a commission to produce a number of pieces for a large gallery in New York City. He began working on the Holtzapffel lathe 12 and 14 hours a day. So now there were two of us. Dick, of course, owned the place so he would *always* be there. I, as the saying goes, "had gotten his pictures" and could have dropped out, too. But now the venerable old South Bend was not as busy, and I could use it more frequently. Bill had designed a special broach so that Dick could enlarge several hundred rectangular holes in boxes used to hold cutting tools for the ornamental lathe, and they were busy fabricating it. There were a number of things I wanted to make, and I began to feel the need once again for a metal-working lathe in my own studio where it would be available whenever I wanted to use it. Right about

this time, a sad thing happened to which the old adage could be applied; "One man's misfortune is another man's fortune."

A friend of mine had as his hobby, and as a source of extra income, a complete tool-and-die making shop in his basement. Although I had never visited it, he made a number of little items that I needed in my photographic pursuits. When I wanted to recess a lens in the bellows of an enlarger, for example, he made a special holder for the lens (Figs. 15-19 and 15-20) on his lathe. One morning his wife went upstairs to get him up for breakfast and couldn't wake him. He had died peacefully during the night. He left his immaculate little shop in the basement with two well-cared-for Atlas turret lathes (Figs. 15-21 and 15-22), a drill press, a horizontal milling machine, a grinder, and various other pieces of equipment. After a bit of time had elapsed, I asked his wife whether or not she proposed to sell his equipment. She would be more than happy to, she informed us, but she had no idea what to ask for them. I took Bill to see them, and he gave her an idea of what a fair price would be. On the spot I offered to buy the slightly larger of the two lathes and help her find a buyer for the rest of the equipment. She agreed and I became the proud owner of a good lathe with a three-jaw chuck and all manner of accessories. I found buyers for all the rest of the equipment. I can't see that the turret tailstock will get much use considering how we plan to use the lathe, but it also has a conventional tailstock for

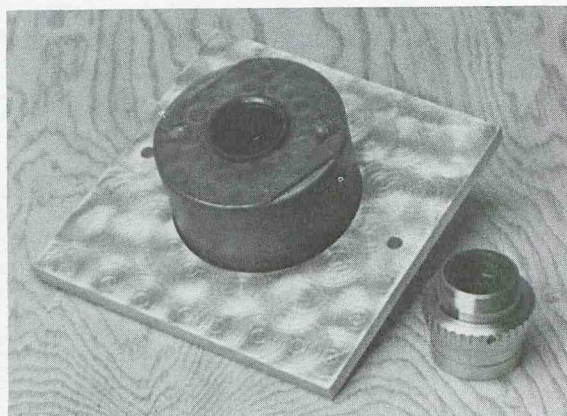


Fig. 15-20. Reverse side of special lens holder.

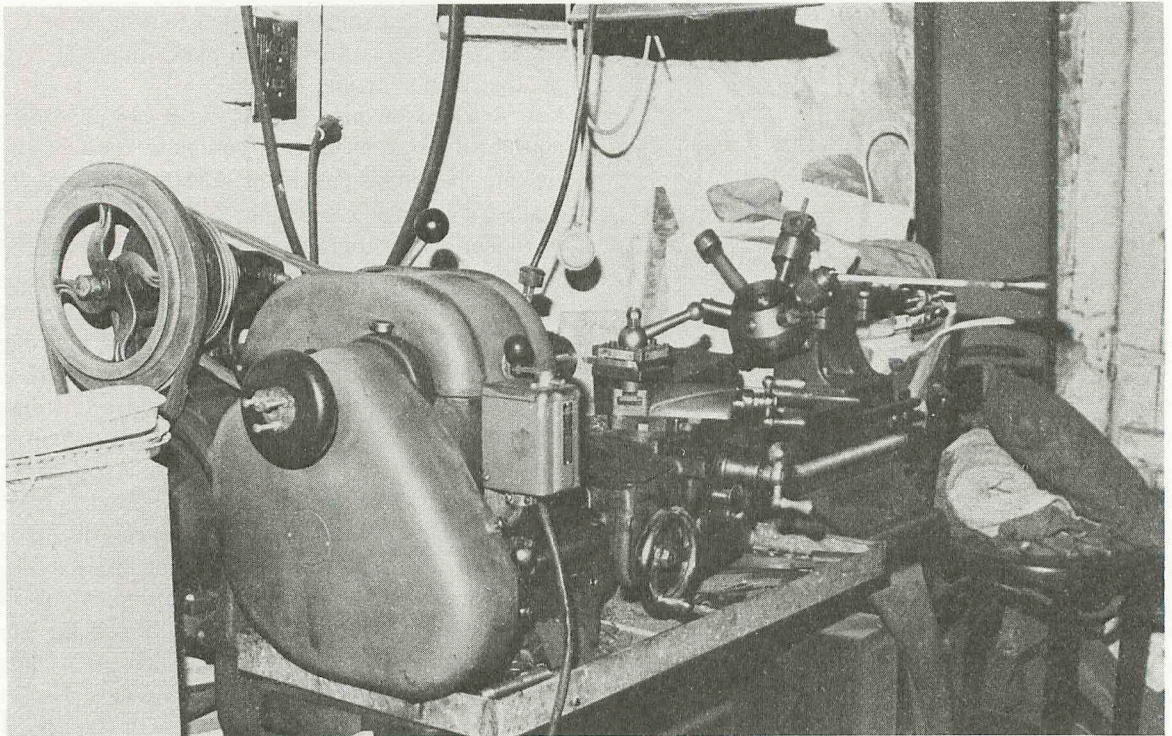


Fig. 15-21. Author's turret lathe with quick-set tool holder on compound rest.

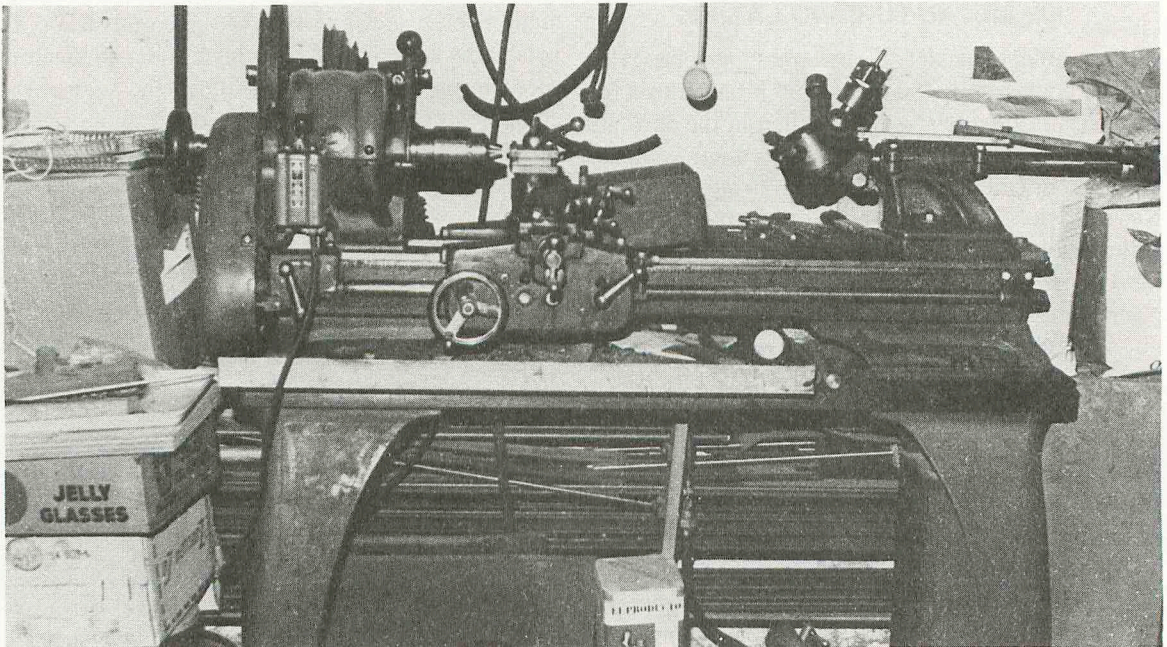


Fig. 15-22. Jacobs chuck is fitted to headstock mandrel for special jobs.

interchangeability. While it doesn't have a quick-change gearbox, it does have automatic feed. Much of the work to be done on it will be of a craft nature rather than one of production where series of duplicate pieces have to be gotten out.

All of the above is cited primarily as an informal guide on what to look for in a lathe with slide rest capability. The condition of the lathe rather than the brand name should weigh heavily in one's final decision. Unless money is no object, it would seem inadvisable to expend sums reaching up into four digits just to be able to cut an occasional thread.

TIPS ON LATHE BUYING

Here are some additional hints about the purchase of a home workshop lathe. Generally, one with 9" or 10" swing will prove quite adequate. Quick change gears are an asset in that they save time but are not a prerequisite to good lathe work. Bench-type lathes are used quite successfully by nonprofessionals, but there is a bit of an advantage to having one with its own stand. Excessive vibration will be avoided without the necessity of providing extra support. The length of the bed will be determined by the items that will be turned most frequently. I have never had occasion to turn anything in excess of 30"—at least in my woodworking experience to date—walking sticks and items of that length have been done in sections.

Normally, a faceplate comes with the lathe if it is bought brand new. In shopping for a used one, it is advisable to look for one that has been fitted with at least a three-jaw chuck. As has been mentioned, this capability will be missed sorely as one's involvement in metal turning increases. If the price includes collets, a four-jaw chuck, and a faceplate, the offering may be considered a definite bargain. A Jacobs chuck for the mandrel is well worth having, but one may be acquired after the purchase of the lathe. A taper attachment is used but rarely and can be done without especially if the tailstock can be offset. What should be an absolute requirement is a compound slide to accommodate the tool holder. It can be set at any angle and will increase the versatility of the lathe.

Tool bits can be acquired piecemeal and

ground to your own specifications. In home shop lathes, 1/4" square stock is most frequently used for these tools, and it is readily available. These cutters may have to be shimmed up for center, however, if the lathe has been fitted with a tool holder of the quick-set type that takes larger cutters. Such an eventuality should not be a negative factor when considering a particular lathe. Self-hardening high speed tool bits are generally recommended for normal use, but the tool holder plays an important part in the whole scheme of things. The standard tool post (Fig. 1-17) accepts three types: a right-hand offset tool holder, a left-hand offset, and a straight tool holder. These differences are obvious visually. When held in the hand, the right-hand tool holder points to the right while the left-hand one points to the left. The straight tool holder has no bend in either direction.

LEARNING TO USE THE METAL-TURNING LATHE

Once the lathe has been selected and set up in the shop, complete familiarization with it is the next step on the agenda. I was lucky in having Bill for my indoctrination, otherwise I would have audited a night school course on the subject. There are a number of excellent books on the subject that will prove invaluable, but they are not enough in and of themselves. Most of them treat the lathe as just a facet of metalworking. This means they can be no more comprehensive on the subject than I can in this book, which touches on all kinds of lathes. If attending a class is not immediately possible, find someone who has a metal-turning lathe, and who will be able to offer some help with the basics. It will be found that most people who embrace the lathe as a hobby or even those who become semi-professional, will be more than happy to share their interest. The burgeoning interest in the lathe is a great leveler, I have found. Because of this mutual interest, my friends and acquaintances include doctors, engineers, tool-and-die makers, artists, factory owners, and a number of other professionals. I covered a woodturning seminar recently at which a high school manual training teacher demonstrated how to make a rolling pin on a venerable Rockwell

Delta lathe. More than 70 people of all ages attended, many of whom not only had either wood or metal lathes but were quite experienced in their use. Their reason for attending was two-fold: they hoped to learn how to do fancier work and, as mentioned above, they hoped to find people with similar interests. Not only did they sit through the first session on spindle turning with rapt attention, but they turned out in larger numbers for the second session on faceplate turning. This was a more rewarding session for those who were not novices, because the instructor specialized in turning exotic laminated bowls and was quite adept at it. I am certain that some fast friendships were firmed up at these seminars.

In any event, now that the lathe is all ready to go here are some further tips. Most smaller metal-turning lathes have a threaded mandrel to which the chuck or faceplate is screwed. I would suggest using the three- or four-jaw chuck first because workpieces are easier to mount with them. If the piece is short in length, the tailstock need not be brought up and pressed into use. With a good three-jaw chuck, centering is just about automatic and centering with the four-jaw has been described previously. It is here that the tool bits come into play. They can each be ground with a different one of seven shapes depending on the work to be done, roughing or finishing, and on the metal to be turned. There are three left-cutting tools for facing, roughing, and finishing, a round-nose for general cutting and three right-cutting tools for facing, roughing, and finishing. They have a face (the top plane of the bit) and a cutting edge, which is the side in the direction of travel. The foremost point is called the *nose*, and it is usually rounded slightly. The face slopes back. The amount it slopes is called the *back rake angle*. The front and sides are ground back, too, to produce a *side rake angle*, an *end clearance angle*, and a *side clearance angle*. In addition to all of this there is a cutter called a parting tool, which is similar in configuration and use to that employed in wood turning. It would be impossible to acquire all of this just by reading a chapter or two in a book. Much of it will come from practical experience, more will come from diverse sources such as the

relatively new magazine, *The Home Shop Machinist*, published by Village Press, Inc., 2779 Aero Drive, Traverse City, Michigan, 49684.

Centering the workpiece, it will be recalled, is not quite as simple as in the case of the woodworking lathe. Once the true center has been determined, it has to be drilled to accept the tailstock cone. Any old drill will slip and slide and perhaps ride up over a punch mark so a center drill is used. These are actually a combination of a center reamer and drill and come in various sizes with a drilling point on each end. They are short, stubby, and tend to make the hole with little or no deviation. There is a bit of a technique to using them. The hole cannot be drilled too deeply or the tailstock center will ride on the lip of the hole. If the surface is just punctured or the hole drilled too shallow, the tailstock cone will bridge it and the point of the cone could burn off. When done properly the tailstock center fits just right. There is a bit of space in the back of the hole made by the point of the drill that serves as an oil sink. Finding the true center, initially, is done much the same as with wood: with a hermaphrodite caliper, with a combination set center head, dividers, or a Bell center punch.

One of the prime capabilities of the metal-turning lathe is that irregular workpieces can be turned on it. For this, the faceplate is used. A mandatory rule is that two or more clamps must be used in mounting anything to the plate to prevent slippage. Mounting or clamping is done with steel bars $\frac{1}{2}$ " thick, $1\frac{1}{2}$ " wide, and about 4" long. Drill them to accept $\frac{1}{2}$ " bolts. It is a good idea to maintain a collection of these bolts with the proper nuts and washers. Attention is called once again to the placement of the tool holder on the compound slide (on the left, remember?) to avoid its impacting any of the clamps or protrusions on the workpiece. Bill always ran the carriage over to the faceplate and checked by rotating it slowly to see if all was clear. In the event that the work cannot be bolted to the faceplate, angle blocks will have to be used. These blocks can be homemade; they may have to be made up on the spot for some jobs, in fact. Just get some scrap from a local machine shop or a scrap metal house. The size of the legs should vary: 3" $\times$ 4", 4"

× 6", 4" × 4", etc. Make certain that they are perfectly smooth or shims may have to be used to get everything true. Any time an odd shape is mounted in this manner, there may such an imbalance that stress will be put on the lathe. In this event, a counterweight must also be clamped to the faceplate. All of this may engender some hesitation at first but with the proper precautions the work will go well.

Other methods of mounting work include collets, arbors, and mandrels, the latter being ground and hardened shafts usually about 8" long with a slight taper. Arbors and mandrels are not used frequently but collets are. Their function is to grasp small parts quickly for machining. They are considered quite accurate for mounting, but this accuracy can be thrown off if certain rules are not followed. The surface of the work and the inside of the collet has to be free of all chips. Stock should not be forced into a collet that was designed to accept smaller material. And one should never be tightened without something in it.

Most collets are fitted to the lathe with the aid of a drawbar. The collet is inserted in the mandrel. The drawbar is fed through the headstock mandrel from the left end until it touches the collet. Then the thread on the end of the drawbar is partially turned into the collet. The work is placed in the collet with the equivalent of just three times its diameter extending. (This last does not hold true if the work is to be supported by the tailstock.) When everything is in order, the handwheel on the drawbar is turned to tighten the collet.

LATHE MAINTENANCE

This is indeed a brief summary of the fascinating metal-turning lathe, but it should not be concluded without addressing the method of maintaining one. Proper care is of vital importance in maintaining the accuracy of the machine over a very long period of time. Constant and correct lubrication is a positive must. Chips stemming from waste removal during turning are certain death on a lathe and should be removed frequently. Never use a rag. Use a paintbrush instead. A brush is suggested, too, for applying oil to a workpiece as the turning operation

proceeds. Always shut the lathe down before doing any cleaning. Be very careful about the chips. They frequently come off the workpiece in long spirals. If allowed to collect in the chip pan beneath the lathe, one just coming off the workpiece could become entangled with a whole mass of the others, pick them up, whirl them around madly, and perhaps thrash the operator soundly or, at least, scratch him so severely he would look worse than if he had been caught in the middle of a cat fight!

Once the brushing up has been accomplished with the lathe turned off, then, and only then, can a cloth moistened with a bit of oil be used to wipe all the surfaces that must be protected from rust. Then comes the real lubrication. Dick, with all of the ornamental turning lathes, was a great stickler for lots of oil. He would squirt oil on the top surfaces of the ways and rub it out into a thin film with his hand. He felt that it prevented unnecessary wear, reduced friction, and reduced heat. Bill was always encouraging the operator to "Put a little oil on it. Knock off the chips. That's it. Now put a little more oil on it. You got it!"

Before the machine is started up, all the reservoirs should be checked for proper levels. If the lathe was not purchased new and the owner's manual did not come with it, the manufacturer's recommendations for oiling will be missing. In general, a 30-weight oil will do an excellent lubrication job. There are many places on the lathe that are prone to wear, and some of them may be adjusted to compensate for this wear. Usually there is a *gib adjustment* with an adjusting screw that takes up the play between two sliding parts. Thorough cleaning should precede any such adjustment.

TOOLS

The tools discussed in Chapter 2 are used primarily with the wood working lathe. Because work with metal is done with far more accuracy than with wood, a number of additional tools, especially for measuring, come into play here. Some of them have been mentioned briefly in this section but just to give an idea of many of the tools a well-equipped shop might have, I made a list of all the items Bill had Dick order during the course of the classes. The

Table 15-1. Metalworking Tools.

Arkansas stone slips	Taps and dies
Center lube for dead center	Center reamers
12" adjustable wrench	Combination squares
Adjustable wrenches in other sizes	Vises
Drill bits in numbered and lettered sets	Edge finder
Center gauge	V-blocks
Safety glasses	Demagnetizer
Silver solder	Dial gauges
5" sine bar	Jacobs chuck
Mirror	Angle plates
Center punches	Surface gauges
Center drills	Loupes
Magnetic parallels	Plastic-tipped hammer
Parallel clamps	Screwdrivers
Kant twist clamps	Scriber
Masks	Emery paper
Micrometers	Abrasive rolls
Telescoping gauges	Files
Calipers, inside and out	Tool chests
Hex wrench sets	Thread pitch gauge
Snap ring pliers	Center gauge

list that follows is not all-inclusive, but a quick check of a brand new tool box and a cabinet that had been added to the tool room just as the sessions started helped with the compilation of the list shown in Table 15-1.

Other items, constituting an important miscellany, included work aprons with a "hanging pocket" on the upper left-hand portion of the bib. Introduced by Bill, these aprons created quite a bit of excitement when they arrived and were worn with a pride amounting to ritualistic fervor! I did not get one at the time they were ordered and, not to be outdone, had my wife put just such a pocket on a sturdy canvas apron with Formby's Refinisher emblazoned on it. The purpose of the hanging pocket, incidentally, is to prevent an expensive tool like a micrometer, (Fig. 15-23), which we all carried, from falling to the hard concrete floor and being damaged beyond repair. Simply put, when the apron's wearer bends forward the pocket swings forward, and the contents are retained within.

There were absolutely smooth granite blocks (Fig. 15-14) upon which angle blocks, V-blocks, height and dial gauges were employed to align workpieces with the utmost of accuracy. Strategically placed on clean work tables scattered

throughout the tool room were 9 × 11 lined writing tablets that Bill called "talking paper." These got constant use in computing the distance the table on the Bridgeport milling machine should be advanced, in thousandths of an inch, to center a piece of stock for slot cutting and similar problems. Bill believed firmly that milling attachments on a lathe were a poor substitute for the real thing. Considering the initial cost of "the real thing" and the number of times such a piece of equipment would be used in a small shop, I am inclined to disagree with him. But then, books could be (and have been) written about attachments for the metal-turning lathe. The English are past masters at fabricating milling attachments, drilling frames, and small grinders for the metal lathe. Their enthusiasm for exchanging such ideas, complete with plans, drawings, and photographs in little magazines like *The Model Engineer* borders on fetishism. Many of these ideas and concepts, it should be pointed out, are not to be scoffed at and a number of them are included in a book called *Milling in the Lathe*, by E.T. Westbury, originally published by Model & Allied Publications, Warford, Herts, England. It makes fascinating reading for someone interested in the metal lathe. This book, and a number of others are available here in the

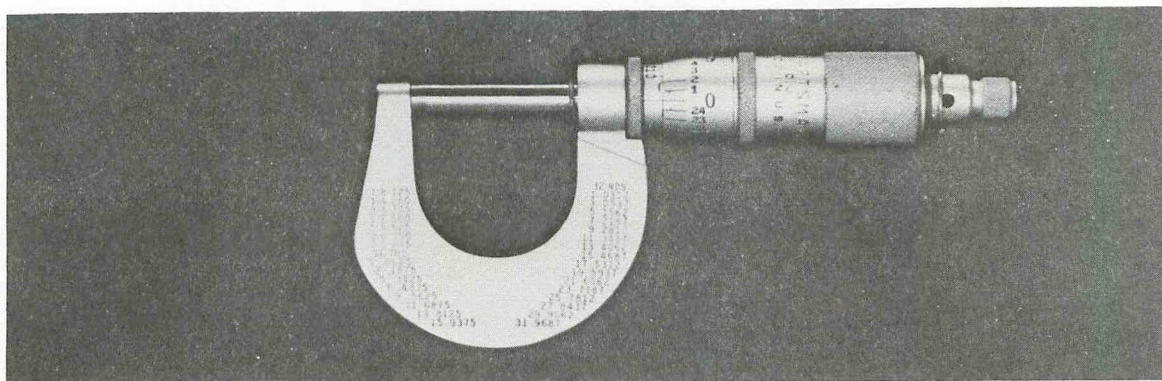


Fig. 15-23. Micrometer is one of the most important tools used in metal turning.

United States from Adams Brown Company, 26 North Main Street, P.O. Box 357, Cranbury, New Jersey, 08512.

There are facets of metal turning that may seem to have been treated casually within these pages, among them being thread cutting, special form turning, taper turning, and eccentric turning. If they have been dealt with lightly, it is solely because one is not called upon to employ any of these techniques very often. This statement might, perhaps, exclude thread cutting. Yet all during those sessions around the South Bend in our tool room, only one attempt was made to cut a thread. It was done in conjunction with making a backplate Dick wanted for coupling a three-jaw chuck to his Evans lathe. Bill made up a special boring bar and a unique cutter because the thread required was an odd-ball one—9.5 threads to the inch. The South Bend did not have the gears to produce such a thread. After the bar and the tool were made to Bill's satisfaction, we all adjourned to Dick's house so that the thread could be cut on the Evans. Dick had turned innumerable threads on ivory and exotic hardwood workpieces so he had the lathe all set up when we arrived.

The operation could not be performed with the motor running. The lathe's headstock had to be turned by hand while the tool was advanced, cutting slowly within the hole that had to be threaded. Bill elected to "power" the headstock while Dick fed the

cutter into the hole with the slide apparatus. It required a great deal of physical effort on Bill's part, and we all wound up taking a crack at turning the headstock. It was painfully slow because there was some noticeable spring in the boring bar/cutter arrangement. The whole operation fell apart when the tip of the cutter broke off. The whole mission was aborted at that moment and everything held in abeyance until the tool could be reground in the tool room and the South Bend could be set up in some manner to continue cutting the thread. The feat was accomplished eventually. The thread was cut, and the backplate mounted on the three-jaw chuck. It fit on the mandrel perfectly and ran like a dream, but right up until this writing there has never been another call to cut a thread.

Suffice it to say that thread cutting is actually not that difficult. It can and has been done on a woodworking lathe, which might have posed problems because one has to learn to manipulate chasing tools. A lot of the pain is taken out of the operation on the metal lathe with the accuracy and ease of use of the compound slide rest. A few serious attempts by our readers will bear this out. Here again it must be stated that a definitive discourse on this technique is beyond the scope of this book but material on the subject abounds in bookstores and libraries. The fee for attending a course on metal turning might be well spent just to have an instructor's guidance while this particular skill is acquired.

Appendix A

SUPPLIERS

American Machine and Tool Company, Inc., Fourth and Spring Streets, Rogersford, PA 19468.

BenchMark Tool Company, 315 Ellis Boulevard, Jefferson City, MO 65101.

Caldwell Industries, 603-609 East Davis Street, Luling, TX 78648.

Campbell Tools Company, 2100 Selma Road, Springfield, OH 45505.

Dremel Manufacturing Company, 4915-21st Street, Racine, WI 53406.

Machinex Industries, Division of American Edeltaal, Inc., P.O. Box 206, Brooklyn, NY 11232.

Rockwell International, Power Tool Division, 400 North Lexington Avenue, Pittsburgh, PA 15208.

Sherline Products, Inc., 170 Navajo Street, San Marcos, CA 92069.

Shopsmith Inc., 750 Center Drive, Vandalia, OH 45377.

The Stanley Works, 195 Lake Street, New Britain, CT 06050.

Taig Tools, 15048 East Proctor Avenue, Industry, CA 91746.

Glossary

arbor—A shaft, rod, or spindle in lathe work for holding some of the accessories.

auger—A drill utilizing a long, spiral shaped bit. The auger bit is frequently held in a chuck on the tailstock for lathe drilling.

bead—Curved portion turned completely around a spindle.

beading tool—A special U-shaped tool for turning beads.

bed—The base of a lathe to which the headstock, tool rest, and tailstock are attached. Proprietary lathes may have a metal bed, often cylindrical or diamond-shaped in section.

between centers—The spindle method of turning with work supported at the headstock and at the tailstock.

bit—A tool used for boring holes, usually held in a Jacobs chuck.

blank—Material before being worked on.

boring—Making a hole, usually manually and not with a drill.

bulbous turning—Leg, or other turning, which is larger at the center than at the ends.

caliper—A tool for measuring or comparing diameter(s) of work being turned.

center—Predetermined at both ends of the wood so workpiece will run true when mounted on the lathe.

centering—Marking the center. Setting up work between centers so that it runs true.

center punch—A punch with conical point. Used to make a seating for the point of a drill.

chisel—A hand turning tool. Both sides are beveled, making an included angle of about 43°. It may be ground square or at an angle.

chuck—A device for holding either the work or a drill bit while being rotated.

chucking—The operation of holding the work or drill bit in a chuck.

circumference—The outside of a cylinder.

cone pulley—Pulley with steps for varying speeds.

countersink—A bevel or angle cut on the mouth of a hole. A tool used for this purpose.

cove—A concave molding.

cup chuck—A hollow wood or metal chuck into which irregular shaped wood can be forced for driving between centers.

distance between centers—The lengthwise capacity of a lathe.

dividers—Similar to compasses with two sharpened steel legs that are used for stepping distances around circles, along spindle work, around turnery, or to mark the diameter at end of work to be hollowed.

dowel—A short piece of rounded wood, usually serving to fit two pieces of wood together, often with the aid of glue. Sometimes referred to as a peg. In this book, it may refer to any straight broomsticklike wood up to approximately 1½" in diameter.

drill chuck—A self-centering chuck, more generally known as the Jacobs chuck, for holding drills.

faceplate—Circular plate screwed to the headstock mandrel, having equally spaced screw holes for holding work of a large diameter and shallow depth.

finial—The ornament that forms the upper extremity of a piece of work.

flute—A groove or curved section usually running the length of a spindle or turning.

french polish—A layer of shellac on wood.

gap bed—A lathe bed with a hollow below the mandrel nose to accommodate large work.

gauge—A testing instrument of a fixed size for measuring and comparing distances.

gouge—Hand-turning tool with curved cross-section—half-round, deep, shallow, square, nose ground—with flat bevel. Widths range from ¼" up to 2".

graver—Handheld tool for turning metal, such as ferrules.

handrest—Tool rest.

headstock—The main casting at the left-hand side of a lathe in which the mandrel or spindle revolves. It supports and drives the work.

horizontal plane—Level with the horizon.

indexing head—A plate with a ring of drilled holes with spring loaded pin that positions the work accurately.

Jacobs chuck—A self-centering chuck for holding bits and drills, called by the maximum size drill it will hold and sometimes fitted with a Morse taper to fit into mandrel.

jig—A device made for the purpose of controlling the tool or work to enable exact cutting or boring to be done. Usually attached to an awkward shape.

laminating—Building up wood in layers, usually by gluing and clamping until set.

mandrel—The main spindle revolving in the headstock, threaded externally for the faceplate and certain chucks. The hollow spindle in the tailstock is also referred to as a *mandrel*.

morse taper—Standard taper for plug-in tools such as centers and some drills, progressing in sizes from No. 0 upwards.

nonferrous metals—Metals other than iron and steel.

offset turning—Turning done on centers offset from the original true centers.

parting off—Cutting off work in the lathe.

parting tool—Narrow, deep tool slightly splayed at the cutting edge so that it does not bind as it sinks deeply into the work; for cutting off work or making narrow grooves as a guide for other tool work.

periphery—The circumference or outside of a cylinder.

pilot hole—A small hole drilled initially to guide a larger drill.

pitch—Distance from the top of one thread to the top of the next in a screw or twist turning.

poppet—Part of the tailstock controlled by the hand wheel. Supports the work by means of the dead center. Also called the *tailstock mandrel*.

proud—Said of a surface standing above an adjoining one.

pulley—Any wheel with a grooved rim used to transmit power by means of a band, belt, or the like.

radial—On a line from the center.

radius—Half the diameter of a circle and 1/6th of its circumference.

rake—Angle back from the cutting edge of a tool to the surface of the work.

reed—A type of molding, a plane, or curved, narrow projecting surface used for decoration.

revolving center—Tailstock center fitted with ball bearings that revolves with the work.

right angle—An angle of 90°.

roughing—Removing the bulk of the waste, usually with a gouge that leaves a rough surface.

roughing gouge—Gouge with its end sharpened straight across or rounded on the end.

rpm—Abbreviation for revolutions per minute, which is the way to state the speed of a lathe or other machine.

sanding disc—Circle of abrasive paper mounted on a wood or metal disc.

scraper—Tool with obtuse cutting edge of various shapes, presented to the work with a negative angle. Because the metal is of the right hardness, old files with serrations ground away are often used as scrapers.

screw center—Fitting for the headstock that uses a screw instead of a point. It's usually employed in turning knobs, finials, and other small objects.

skew chisel—A long cornered chisel with its cutting edge other than a right angle to its side.

sleeve—A hollow cylinder.

slip—A shaped oilstone for sharpening inside gouges.

spindle—The headstock shaft or mandrel, or work turned round.

spindle turning—Turning wood with its grain parallel with the lathe bed and supported between the headstock and tailstock.

split turning—Turning two pieces temporarily joined, usually with paper and glue between the pieces, which will be mounted on their flat sides as decorations.

spur center—A headstock fitting for centering with two or three projecting blades, the center one is usually longer than the others.

square turning—Square work that has a turned appearance in profile.

steady—Support for slender work.

swing—The largest diameter that can be turned in a lathe.

tailstock—The movable main assembly at the right-hand end of the lathe in which the dead or stationary mandrel is fitted.

template—A gauge, pattern, or mold, commonly a thin plate or board, used as a guide in achieving desired shape.

terminal—Similar to a finial but usually at the bottom of a workpiece.

transverse—In a crosswise direction.

T-rest—A tool rest, usually T-shaped.

vertical plane—At right angles to the ground.

way—One side of a lathe bed.

whip—Bending of slender work.

Bibliography

- Blandford, Percy. *The Woodturner's Bible*. Blue Ridge Summit, Pennsylvania: TAB Books, Inc., 1980.
- Buckwalter, Len. *The Homeowner's Handbook of Power Tools*. New York: Funk & Wagnalls, 1976.
- Choate, Sharr. *Creative Casting*. New York: Crown Publishers, Inc., 1966.
- DeCristoforo, R.J. *Power Tool Woodworking for Everyone*. Vandalia, Ohio: Shopsmith Inc.
- Griswold, Lester and Kathleen. *The New Handicraft Processes and Projects*. New York: Van Nostrand-Reinhold Co., 1972.
- Holtzapffel, John Jacob. *Hand or Simple Turning—Principles and Practice*. New York: Dover Publications, Inc., 1976.
- Holtzapffel, John Jacob. *The Principles and Practice of Ornamental or Complex Turning*. New York: Dover Publications, Inc.
- The Home Workshop*. Chicago: Time-Life Books, Inc., 1980.
- How To Do More with Your Wood Lathe*. Chicago: Sears, Roebuck, and Co., 1972.
- Kobayashi, Akira. *Machining of Plastics*. New York: McGraw-Hill Book Co., 1967.
- Marshall, Percival. *The Beginners' Guide to the Lathe*. Herts, England: Model & Allied Publications, Ltd., 1972.
- Mason, L.C. *Using the Small Lathe*. Herts, England: Argus Books Ltd., 1980.

Seale, Roland. *Practical Designs for Wood Turning*. New York: Sterling Publishing Co., Inc., 1982.

Toller, Jane. *Turned Woodware for Collectors*. South Brunswick, New Jersey: A.S. Barnes and Co., 1976.

Westbury, E.T. *Lathe Accessories*. Hertfordshire, England: Argus Books, Ltd., 1981.

Westbury, E.T. *Milling on the Lathe*. Herts, England: Argus Books, Ltd., 1981.

Wooldridge, W. J. *Woodturning Techniques*. New York: Sterling Publishing Co., 1982.

Index

Index

A

Acrylic, 62, 89, 148
Acrylic cube, 95, 99
Acrylic cube, starting the, 96
Acrylic, cutting, 60
Acrylic, turning, 27, 172
Arbor, 201
Arbor, commercial, 13
Architectural turning, 103
Auger, 201

B

Balls, turning, 109, 110
Balusters, 107
Base, turned, 37
Bead bed, 135, 137
Beading tool, 201
Beads, 35, 36, 40, 47, 75, 159, 201
Bed, 201
Bezel, 100
Bezel, brass, 86
Blank, 67, 201
Blank, cylindrical, 74
Bookends, 80
Bowl, ornamental polyester, 173
Boxes, 132, 158
Brass and wood, 138
Brush care, 146
Brush storage, 147

C

Calipers, 201

Calipers, inside, 25
Calipers, outside, 25
Candleholders, 38
Candlestick, 6, 69, 129, 130, 160, 170
Cane handle, 54
Cane island, 49
Cane stand, 45
Canes, 39, 46, 48, 62
Center, 201
Center punch, 201
Chamfer, cutting a, 190
Chess pieces, 124
Chimes, wind, 138
Chisel points, 21
Chisel, square-nose, 26
Chisels, 6, 22, 201
Chisels, use of the various, 22
Chuck, 201
Chuck, cup, 65, 202
Chuck, drill, 202
Chuck, Jacobs, 194, 202
Chucks, eccentric, 167
Circles, turning, 91
Clock case, 87
Clock face, 88
Clock spring release tool, 6
Clock, anniversary, 84
Clock, desk, 93, 94
Clock, ship's wheel, 93
Clock, the race track, 104, 106
Collets, 179
Components, lathe, 4

Condiment set, 139
Cone pulley, 201
Countersink, 202
Cove, 202
Cube, rounding out a, 94
Cup chuck, 65, 98, 202
Cup chuck cover, 97
Cup chucks, 164
Cup holder, 38, 39
Cups, 160
Cutting action, tool, 20
Cutting frame, eccentric, 168
Cutting frame, horizontal, 172

D

Desk caddy, 133, 134
Desk clock, 93
Dividers, 202
Dolls, 115, 116, 117, 120, 121, 122
Dolls and other toys, 112
Dolls, Kokeshi, 113, 114
Dowel, 202
Dremel Moto-Lathe, 5, 6, 7, 10
Dremel Moto-Tool, 11, 67
Drill chuck, 202
Drums, bongo, 134, 135, 136

E

Enamel, 148

F

Faceplate, 92, 102, 132, 179, 202

Faceplate and spindle combination, 83

Faceplate in horology, 83

Faceplate lathe, 14

Faceplate turning, 128

Files, 22, 26, 35

Filing and polishing, 192

Finials, 159, 202

Finishes, commercial, 142

Flexshaft, 48

Flute, 202

Flutes, 45

Frame, cutting, 168, 172

Frame, drilling, 189

Frame, picture, 171

French polish, 202

French polishing, 144

G

Games, 118, 122, 123

Gap bed, 202

Gauge, 202

Gauge, telescoping, 182

Gifts, 131

Gouge, 20

Gouge, position of, 24

Gouge, round-nose, 20, 23

Gouge, square-nose, 20

Grinder, using a, 191

Grooves for inlays, 89

H

Handles, 55

Headstock, 12, 148, 155, 163

Headstock mandrel, 156, 169

Hickory, 151

Hold-down cover, 96

Horology, faceplate in, 83

J

Jacobs chuck, 18, 194

Jewelry holder, 38, 40

Jig, 202

K

Kew chisel, 203

L

Lacquer, 144, 148

Laminate, 80

Laminated wood, 81, 82

Laminating, 80, 202

Lamp base, turned, 33

Lamp, swag, 38

Lamp/table combination, 49, 50

Lathe bed, 97

Lathe buying, tips on, 195

Lathe chisels, 21

Lathe components, 4

Lathe maintenance, 197

Lathe selection, 1

Lathe size and capacity, 1

Lathe speed for pulleys, 3

Lathe speed for workpieces, 3

Lathe supports, 165

Lathe, design and function, 153

Lathe, Evans, 171

Lathe, faceplate, 14

Lathe, Holzapple, 163

Lathe, homemade, 11

Lathe, mechanic's, 15

Lathe, metal-turning, 178, 193, 195

Lathe, ornamental, 153, 154, 162

Lathe, ornamental turning, 169

Lathe, Shopcraft wood, 16

Lathe, turret, 17

Lathe, wood-turning, 4

Lathe, woodworking, 2

Lathes, combination, 8

Lathes, cross-sliding turret, 18

Lathes, fixed-center turret, 18

Lathes, modifying existing, 161

Lathes, shopbuilt, 10

Letter opener handles, 56

Letter opener handles, turned, 53

Lignum vitae, 151

M

Mahogany, 151

Mandrel, 202

Mandrels, 5

Materials, 88

Metal plates, removing scratches from, 90

Metal turning, 177

Metal-turning lathe, 193

Metals, nonferrous, 202

Micrometer, 199

Morse tapers, 5

O

Offset turning, 202

Oil rub, 145

Ornamental lathe, 153, 162

Ornamental turning, 152, 175

P

Paint, 148

Painting, 146

Parting off, 202

Parting tool, 26, 202

Pigment oil, 145

Pill box, turned, 140

Pillars, 105, 107

Pilot hole, 202

Pine, 151

Pitch, 203

Plastic for turning, 56

Poppet, 203

Pulley, 187, 201, 203

Pulley and treadle, 163

Pulleys, 3

Pully setup, 3

R

Rack, recorder, 38

Radial, 203

Radius, 203

Rake, 61, 203

Ram slide, 18

Reed, 203

Resin, 68, 75, 102

Resin cube, 100

Resin pourings, 67

Revolving center, 203

Right angle, 203

Roughing, 203

rpm, 203

Rubber stamps, 53

S

Safety and the workplace, 29

Safety goggles, 30

Safety mask, 30

Sanding, 147

Sanding disc, 203

Scraper, 203

Scraping action, 21

Screens and scrim, 103

Screw center, 203

Scrim, 104

Scrim and screens, 103

Shaving brush handle, 54

Shaving soap container, 101

Shearing action, 21

Shellac, 144, 147, 148

Skew, 20, 24, 25

Sleeve, 203

Spindle, 35, 57, 203

Spindle and faceplate, 85

Spindle and faceplate combination, 83

Spindle turning, 31

Spindle, acrylic, 28

Spindles, 41

Spirals, 159

Spools, thread, 55

Spoons, salads, 131

Square turning, 127, 203

Stain, wood, 148

Stains, 145

Stains, nongrain-raising, 145

Stains, spirit, 145

Stains, varnish, 143

Steady, 203

Stock, mounting, 59

Supports, lathe, 165

Swag lamp, 38

Swing, 203

T

T-rest, 203

Table/lamp combination, 49, 50

Tailstock, 5, 12, 17, 18, 87, 157, 181, 203

Teak, 150

Template, 32, 34, 35, 74, 203

Tenon, 47, 61
 Terminal, 203
 Tool bit, facing, 188
 Tool cutting action, 20
 Tool post grinder, 175
 Tool, beading, 201
 Tool, parting, 20, 25, 26
 Tools, 20, 88, 197
 Tools, metal-working, 198
 Toy, ball, 123
 Toys, 112, 118, 119, 125
 Toys, other quickie, 126
 Transverse, 203
 Turned base, 37
 Turned components, 76
 Turned objects, 71
 Turned pill box, 140
 Turned walking sticks, 43
 Turned woodware, 131
 Turning balls, 109, 110
 Turning circles, 91

Turning metal, 177
 Turning, architectural, 103
 Turning, bulbous, 201
 Turning, faceplate, 78, 128
 Turning, more centers, 52
 Turning, off-center, 57
 Turning, offset, 202
 Turning, ornamental, 152
 Turning, oval, 57
 Turning, plastic for, 56
 Turning, spindle, 31, 203
 Turning, square, 127, 203
 Turning, woods for, 150

V

Varnish, 143, 146
 Varnish, polyurethane, 148
 Vertical plane, 203

W

Walking sticks, 44

Walking sticks, turned, 43
 Walnut, 151
 Wax, finishing, 141
 Way, 203
 Whip, 203
 Wood, 85
 Wood collectors' society, international, 159
 Wood finishes, 148
 Wood objects, nonfunctional, 63
 Wood, laminated, 54, 71, 81
 Wood, using recycled, 53
 Woods for turning, 150
 Woods, workability of various, 151
 Woodworking lathe, 2
 Workplace, safety and the, 29
 Wrenches, 164

Y

Yo-yo's, 122

OTHER POPULAR TAB BOOKS OF INTEREST

Transducer Fundamentals, with Projects (No. 1693—\$14.50 paper; \$19.95 hard)

Second Book of Easy-to-Build Electronic Projects (No. 1679—\$13.50 paper; \$17.95 hard)

Practical Microwave Oven Repair (No. 1667—\$13.50 paper; \$19.95 hard)

CMOS/TTL—A User's Guide with Projects (No. 1650—\$13.50 paper; \$19.95 hard)

Satellite Communications (No. 1632—\$11.50 paper; \$16.95 hard)

Build Your Own Laser, Phaser, Ion Ray Gun and Other Working Space-Age Projects (No. 1604—\$15.50 paper; \$24.95 hard)

Principles and Practice of Digital ICs and LEDs (No. 1577—\$13.50 paper; \$19.95 hard)

Understanding Electronics—2nd Edition (No. 1553—\$9.95 paper; \$15.95 hard)

Electronic Databook—3rd Edition (No. 1538—\$17.50 paper; \$24.95 hard)

Beginner's Guide to Reading Schematics (No. 1536—\$9.25 paper; \$14.95 hard)

Concepts of Digital Electronics (No. 1531—\$11.50 paper; \$17.95 hard)

Beginner's Guide to Electricity and Electrical Phenomena (No. 1507—\$10.25 paper; \$15.95 hard)

750 Practical Electronic Circuits (No. 1499—\$14.95 paper; \$21.95 hard)

Exploring Electricity and Electronics with Projects (No. 1497—\$9.95 paper; \$15.95 hard)

Video Electronics Technology (No. 1474—\$11.50 paper; \$16.95 hard)

Towers' International Transistor Selector—3rd Edition (No. 1416—\$19.95 vinyl)

The Illustrated Dictionary of Electronics—2nd Edition (No. 1366—\$18.95 paper; \$26.95 hard)

49 Easy-To-Build Electronic Projects (No. 1337—\$6.25 paper; \$10.95 hard)

The Master Handbook of Telephones (No. 1316—\$12.50 paper; \$16.95 hard)

Giant Handbook of 222 Weekend Electronics Projects (No. 1265—\$14.95 paper)

Introducing Cellular Communications: The New Mobile Telephone System (No. 1682—\$9.95 paper; \$14.95 hard)

The Fiberoptics and Laser Handbook (No. 1671—\$15.50 paper; \$21.95 hard)

Power Supplies, Switching Regulators, Inverters and Converters (No. 1665—\$15.50 paper; \$21.95 hard)

Using Integrated Circuit Logic Devices (No. 1645—\$15.50 paper; \$21.95 hard)

Basic Transistor Course—2nd Edition (No. 1605—\$13.50 paper; \$19.95 hard)

The GIANT Book of Easy-to-Build Electronic Projects (No. 1599—\$13.95 paper; \$21.95 hard)

Music Synthesizers: A Manual of Design and Construction (No. 1565—\$12.50 paper; \$16.95 hard)

How to Design Circuits Using Semiconductors (No. 1543—\$11.50 paper; \$17.95 hard)

All About Telephones—2nd Edition (No. 1537—\$11.50 paper; \$16.95 hard)

The Complete Book of Oscilloscopes (No. 1532—\$11.50 paper; \$17.95 hard)

All About Home Satellite Television (No. 1519—\$13.50 paper; \$19.95 hard)

Maintaining and Repairing Videocassette Recorders (No. 1503—\$15.50 paper; \$21.95 hard)

The Build-It Book of Electronic Projects (No. 1498—\$10.25 paper; \$18.95 hard)

Video Cassette Recorders: Buying, Using and Maintaining (No. 1490—\$8.25 paper; \$14.95 hard)

The Beginner's Book of Electronic Music (No. 1438—\$12.95 paper; \$18.95 hard)

Build a Personal Earth Station for Worldwide Satellite TV Reception (No. 1409—\$10.25 paper; \$15.95 hard)

Basic Electronics Theory—with projects and experiments (No. 1338—\$15.50 paper; \$19.95 hard)

Electric Motor Test & Repair—3rd Edition (No. 1321—\$7.25 paper; \$13.95 hard)

The GIANT Handbook of Electronic Circuits (No. 1300—\$19.95 paper)

Digital Electronics Troubleshooting (No. 1250—\$12.50 paper)

TAB

TAB BOOKS Inc.

Blue Ridge Summit, Pa. 17214

Send for FREE TAB Catalog describing over 750 current titles in print.

The Woodturner's Handbook

Frank W. Coggins

**Discover exciting new woodworking skills
while you make a variety of practical and useful turned wood objects!**

If you've admired fine hand-turned wooden candlesticks, jewelry, and children's toys that sell for high prices in exclusive shops and gift catalogs . . .

If you've wished you had the woodworking skills to produce professional-quality ornamental woodcraft for your home, as gifts for family and friends, *or* as a source of extra income . . .

Then this could be the most important woodworking guide you'll ever purchase!!

Written by a well-known professional craftsman, this guide to woodturning and lathe work provides an expert introduction to needed techniques and tools. Plus it includes a wealth of exciting projects to make while you perfect your woodturning skills *and* dozens of ideas to get you started creating your own original designs. Just some of this book's highlights include:

- A complete look at available lathes and woodturning tools, with step-by-step directions for making many needed tools right in your own shop!
- Hands-on instructions in spindle turning, faceplate turning, inlay techniques, ornamental turning and more!
- Tips on turning plastics and metals as well as various types of wood!
- Dozens of turning projects ranging from balls, dolls, and toys to gift items, tableware, jewelry, and more!
- More than 225 detailed drawings and photographs illustrating the woodturner's craft!
- A listing of lathe sources and material suppliers!

Frank W. Coggins is an experienced photojournalist and editor whose articles on crafts and woodturning have appeared in numerous national magazines. He has also designed craft items for several major manufacturers of craft supplies.

TAB TAB BOOKS Inc.

Blue Ridge Summit, Pa. 17214

Send for FREE TAB Catalog describing over 750 current titles in print.

FPT > \$12.95

PRICES HIGHER IN CANADA

ISBN 0-8306-1769-8

1245-0285