POWERMATIC®

WMH | TOOL GROUP

Operating Instructions and Parts Manual

24” Wood Lathe

Model: 4224

WMH Tool Group
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Part Number: M-0460228
Revision B 11/03

This manual has been prepared for the owner and operators of a Powermatic Model 4224 24" Wood Lathe. Its purpose, aside from machine operation, is to promote safety using accepted operating and maintenance procedures. To obtain maximum life and efficiency from your wood lathe, and to aid in using the machine safely, read this manual thoroughly and follow instructions carefully.

Warranty and Service

WMH Tool Group warrants every product it sells. If one of our tools needs service or repair, one of our Authorized Repair Stations located throughout the United States can provide quick service or information.

In most cases, a WMH Tool Group Repair Station can assist in authorizing repair work, obtaining parts, or perform routine or major maintenance repair on your Powermatic product.

For the name of an Authorized Repair Station in your area, please call 1-800-274-6848, or visit our web site at www.wmhtoolgroup.com.

More Information

Remember, the WMH Tool Group is consistently adding new products to the line. For complete, up-to-date product information, check with your local WMH Tool Group distributor, or visit our web site at www.wmhtoolgroup.com.

WMH Tool Group Warranty

WMH Tool Group makes every effort to assure that its products meet high quality and durability standards and warrants to the original retail consumer/purchaser of our products that each product be free from defects in materials and workmanship as follow: 1 YEAR LIMITED WARRANTY ON ALL PRODUCTS UNLESS SPECIFIED OTHERWISE. This Warranty does not apply to defects due directly or indirectly to misuse, abuse, negligence or accidents, normal wear-and-tear, repair or alterations outside our facilities, or to a lack of maintenance.

WMH TOOL GROUP LIMITS ALL IMPLIED WARRANTIES TO THE PERIOD SPECIFIED ABOVE, BEGINNING FROM THE DATE THE PRODUCT WAS PURCHASED AT RETAIL. EXCEPT AS STATED HEREIN, ANY IMPLIED WARRANTIES OR MERCHANTABILITY AND FITNESS ARE EXCLUDED. SOME STATES DO NOT ALLOW LIMITATIONS ON HOW LONG THE IMPLIED WARRANTY LASTS, SO THE ABOVE LIMITATION MAY NOT APPLY TO YOU. IN NO EVENT SHALL THE WMH TOOL GROUP BE LIABLE FOR DEATH, INJURIES TO PERSONS OR PROPERTY, OR FOR INCIDENTAL, CONTINGENT, SPECIAL, OR CONSEQUENTIAL DAMAGES ARISING FROM THE USE OF OUR PRODUCTS. SOME STATES DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATION OR EXCLUSION MAY NOT APPLY TO YOU.

To take advantage of this warranty, the product or part must be returned for examination, postage prepaid, to an Authorized Repair Station designated by our office. Proof of purchase date and an explanation of the complaint must accompany the merchandise. If our inspection discloses a defect, we will either repair or replace the product at our discretion, or refund the purchase price if we cannot readily and quickly provide a repair or replacement. We will return the repaired product or replacement at WMH Tool Group's expense, but if it is determined there is no defect, or that the defect resulted from causes not within the scope of WMH Tool Group's warranty, then the user must bear the cost of storing and returning the product. This warranty gives you specific legal rights; you may also have other rights, which vary from state to state.

WMH Tool Group sells through distributors only. Members of the WMH Tool Group reserve the right to effect at any time, without prior notice, those alterations to parts, fittings and accessory equipment, which they may deem necessary for any reason whatsoever.

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Warnings

1. Read and understand the entire owner's manual before attempting assembly or operation.
2. This wood lathe is designed and intended for use by properly trained and experienced personnel only. If you are not familiar with the proper and safe operation of a wood lathe, do not use it until the proper training and knowledge have been obtained.
3. Always wear approved safety glasses/face shields while using this machine.
4. Make certain the machine is properly grounded.
5. Before operating the machine, remove tie, rings, watches, other jewelry, and roll sleeves up past the elbows. Remove all loose clothing and confine long hair. Do **not** wear gloves.
6. Keep the floor around the machine clean and free of scrap material, oil and grease.
7. Keep machine guards in place at all times when the machine is in use. If removed for maintenance purposes, use extreme caution and replace the guards immediately.
8. Do **not** over reach. Maintain a balanced stance at all times, so that you do not fall or lean against blades or other moving parts.
9. Make all machine adjustments or maintenance with the machine unplugged from the power source.
10. Use the right tool. Do not force a tool or attachment to do a job that it was not designed to do.
11. Replace warning labels if they become obscured or removed.
12. Make certain the switch is in the **OFF** position before connecting the machine to the power supply.
13. Give your work undivided attention. Looking around, carrying on a conversation and "horse-play" are careless acts that can result in serious injury.
14. Keep visitors a safe distance from the work area.
15. Use recommended accessories; improper accessories may be hazardous.
16. Read and understand warnings posted on the machine and in this manual. Failure to comply with all of these warnings may cause serious injury.
17. Some dust created by power sanding, sawing, grinding, drilling and other construction activities contain chemicals known to cause cancer, birth defects or other reproductive harm. Some examples of these chemicals are:

- Lead from lead based paint.
- Crystalline silica from bricks, cement and other masonry products.
- Arsenic and chromium from chemically treated lumber.
  Your risk of exposure varies, depending on how often you do this type of work. To reduce your exposure to these chemicals: work in a well ventilated area, and work with approved safety equipment, such as face or dust masks that are specifically designed to filter out microscopic particles

18. Do not operate this lathe while under the influence of drugs, alcohol or any medication.
19. Keep tools sharp and clean for safe and best performance. Dull tools can grab in the work and be jerked from the operator`s hands causing serious injury.
20. Check the condition of the stock to be turned. Make sure it is free of knots, warpage, checked ends, improperly made or cured glue joints and other conditions which can cause it to be thrown out of the lathe.
21. Securely fasten spur/live centers to the material being used.
22. Check centers and center sockets in the headstock and tailstock to be sure they are free of dirt or rust and oil lightly before inserting centers.
23. Test each set-up by revolving the work by hand to insure it clears the tool rest and bed. Check the setup at the lowest speed before increasing it to the operating speed.
24. Use the correct cutting tool for the operation to be performed and keep all tools sharp.
25. Use low speeds for roughing and for long or large diameter work. If vibration occurs, stop the machine and correct the cause. See the speed recommendation chart on the next page.

Warnings

SPEED RECOMMENDATIONS			
Diameter of Work	**Roughing RPM**	**General Cutting RPM**	**Finishing RPM**
Under 2"	1500	3000	3000
2 to 4"	600	1500	2300
4 to 6"	450	1100	1500
6 to 8"	450	600	1100
8 to 10"	450	600	850
10 to 12"	450	600	850
12 to 14"	450	450	600

26. When sanding, remove the tool rest from the machine, apply light pressure and use a slow speed to avoid heat build up.
27. When turning large diameter pieces, such as bowls, always operate the lathe at low speeds. See the speed recommendation chart.
28. Do not attempt to engage the spindle lock pin until the spindle has stopped. If leaving the machine area, turn it off and wait until the spindle stops before departing.
29. Make no adjustments except speed changes with the spindle rotating and always disconnect the machine from the power source when performing maintenance to avoid accidental starting or electrical shock.
30. Provide for adequate space surrounding work area and non-glare, overhead lighting.
31. When stopping the lathe, never grab the part or faceplate to slow it down. Let the work coast to a stop.
32. Use only Powermatic factory authorized replacement parts and accessories; otherwise, the warranty and guarantee are null and void.
33. Do not use this Powermatic wood lathe for other than its intended purpose. If used for other purposes, Powermatic disclaims any real or implied warranty and holds itself harmless from any injury that may result from that use.

Familiarize yourself with the following safety notices used in this manual:

CAUTION: (This means that if precautions are not heeded, it may result in minor or moderate injury and/or possible machine damage)

WARNING: (This means that if precautions are not heeded, it could result in serious injury or possibly even death).

⚠ SAFETY: DECALS

Familiarize yourself with the location and content of this decal on your machine.

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SPECIFICATIONS: 4224 Lathe

Distance Between Centers	42"
Swing Over Bed	24"
Spindle Speeds:	
Low speed	0-910 RPM
Medium speed	0-2000 RPM
High speed	0-3500 RPM
Rotation	FWD/REV
Motor	3HP, 220V
Lathe Power Requirements	220V, 3PH or 1PH
Spindle Thread Size	1-1/4" x 8 T.P.I.
Head/Tailstock Taper	#2 Morse
Height to center of spindle	44-1/2"
Weight	950 lbs
Tailstock Quill Travel	4-1/2"
3" Faceplate	standard
14" Toolrest	standard
Drive System	Poly V Belt, Inverter Drive
Spindle Lock	standard
Indexer	24 position
Knock Out Rod	standard
Drive Center	standard
Ball Bearing (live) Center	standard
Hole through tail stock spindle	3/8"
Hole through head stock spindle	5/8"
Footprint of stand	65" L x 24" W

NOTE: The above specifications were current at the time this manual was published, but because of our policy of continuous improvement, Powermatic reserves the right to change specifications without notice and without incurring obligations.

RECEIVING

Remove the lathe from the shipping container and check for damage. Report any damage to your distributor immediately. Accessories are packaged in a separate carton which will be on the shelf of the machine stand. Clean protective coating from the bed, spindles, work rest and face plate with kerosene or a good commercial solvent. Read the instruction manual thoroughly for assembly, maintenance, operation and safety instructions.

INSTALLATION

Install the four leveling screws in the legs, adjust to a stable position and tighten the jam nuts to lock in place.
Insert the guard support rod in the guard mounting bracket at the rear of the headstock. Position a locking collar on each side of the mounting bracket so that the lock pin lines up with the holes in the guard pivot rod, one for guard position and one for load position. The spring loaded lock pin will hold the guard in each position.

Power Connection
The lathe will operate on single phase or three phase 230 volt power supply. A three wire pigtail for use on 230 volt single phase power is attached to the inverter and may be hard wired to the power source or connected to a receptacle plug. Connect the 230 volt supply to the black and white leads and ground the green lead.
If three phase power is used, it will be necessary to replace the pigtail wire with a 12/4 wire and connect the three hot leads to the inverter at R, S and T as shown in the wiring diagram. Always connect the ground lead.
Before connecting to the power source make sure the on/off switch is in the off position and turn the speed dial counterclockwise. If the switch is in the on position when the power is connected, the inverter will trip out. If this happens, disconnect power, turn switch off, wait 30 seconds and then reconnect power.

NOTICE: IF THERE IS A POWER OUTAGE WHILE OPERATING THE LATHE, TURN THE SWITCH TO THE OFF POSITION, DISCONNECT POWER SOURCE, WAIT 30 SECONDS THEN RECONNECT POWER SOURCE AND RESUME NORMAL OPERATION.

Inverter Drive System
The model 4224 lathe utilizes the latest technology in A.C. inverter drives to provide infinitely variable spindle speeds. The inverter controls the speed of the motor by varing the frequency of the voltage supplied to the motor. The inverter provides an acceleration ramp that eliminates the shock of normal across the line starting. Also a braking feature eliminates long coasting periods when the lathe is turned off.

The 3 HP motor is specially designed for use with inverter drives, and is balanced to reduce noise and minimize vibration.
The A.C. Inverter does not require any programming, it is pre-programmed from the factory. **The buttons on the face of the inverter should never be pushed at any time.** Use only the controls on the front of the headstock.

MAINTENANCE

Maintenance on the 4224 lathe should be performed at periodic intervals to ensure that the machine is in proper working order, that all fasteners are tight, and the machine is in adjustment. The more use the machine is subjected to, the more often it should be inspected and maintained. Inspection and maintenance should be performed at least twice a year.

WARNING: To prevent accidental starting or electrical shock, disconnect machine from power source before performing any maintenance.

Periodic cleaning of the lathe is important to keep the lathe in proper working order. The lathe bed should be cleaned and oiled periodically so that headstock, tailstock, and tool support will slide properly. With air hose periodically blow out headstock to keep saw dust and chips from collecting on belt and sheaves, and blow off dust and chips that collect on inverter (DO NOT DISASSEMBLE INVERTER TO CLEAN).

ADJUSTMENTS

Belt Adjustment
The drive belt sheaves are initally aligned at the factory, but if any service is performed that affects their alignment it is very important that they be realigned. To realign them, loosen the two set screws on the spindle sheave and slide it in the proper position. Use of a straight edge along the edge of both sheaves will simplify the positioning. When properly aligned, there should be no pulsing sounds or noise coming from the belt.

Tool Support

The tool support (shown in Figure 5), is designed to allow adjustment for height, position on the bed, and angle to the work. Your 4224 lathe comes standard with the 14" tool support. Other supports are available; consult the "Optional Equipment" list on page 24.

Periodically the tool rest should be disassembled and the parts cleaned and oiled to provide free movement of the parts to ensure good clamp action.

Spindle

The spindle bearing preload is set at the factory for general turning applications. There should be no "end play" of spindle looseness along its axis. If any looseness ever occurs it may be removed by tightening the bearing lock nut on the left end of the spindle. Be very careful not to overtighten the lock nut or the spindle bearings will overheat. It should be tightened just enough to remove the end play and the spindle should rotate very freely.

Speed Range Adjustment

To provide the maximum horsepower to the spindle at the very slow speeds, set the drive belt in the low range.

To change speed ranges, open the access door in front of the headstock, loosen the pivot lock handle located in the motor tension slot, raise the motor up by lifting up on the motor plate handle and relock the lock handle to hold the motor up. There should be sufficient slack in the belt to reposition it to the other step. Loosen the tension lock handle and lower the motor to tension the belt. Do not overtension; a very light pressure on the motor plate handle is adequate to prevent belt slippage.

TABLE 1: WOOD TURNING LATHE SPEEDS

DIAMETER OF WORK	ROUGHING RPM	GENERAL CUTTING RPM	FINISHING RPM
Under 2"	1520	3000	3000
2 to 4"	760	1600	2480
4 to 6"	510	1080	1650
6 to 8"	380	810	1240
8 to 10"	300	650	1000
10 to 12"	255	540	830
12 to 14"	220	460	710
14 to 16"	190	400	620
16" to 20"	175	325	500
20" to 24"	175	260	400

TOOLS

If possible, select only quality, high speed steel turning tools. High speed tools hold an edge and last longer than ordinary carbon steel. As one becomes proficient in turning, a variety of specialty tools for specific applications can be acquired. The following tools provide the basics for most woodturning projects:

Large Roughing Gouge - 1" to 1-1/4", used to eliminate waste wood.
Skews - 1-1/2" and 1" or 1-1/4", used to make finishing cuts and details.
Spindle Gouges - 1/4", 3/8", 1/2", used to turn beads, coves and other details.
Square Scraper - 1/2", used to create square shoulders.
Large Domed Scraper - 1-1/2", used to reduce ridges on interior of bowls.
Parting Tool - 1/8", used to set diameters for sizing.
Deep Fluted Bowl Gouge - 1/4", 3/8" and 1/2", used for turning bowls & plates.

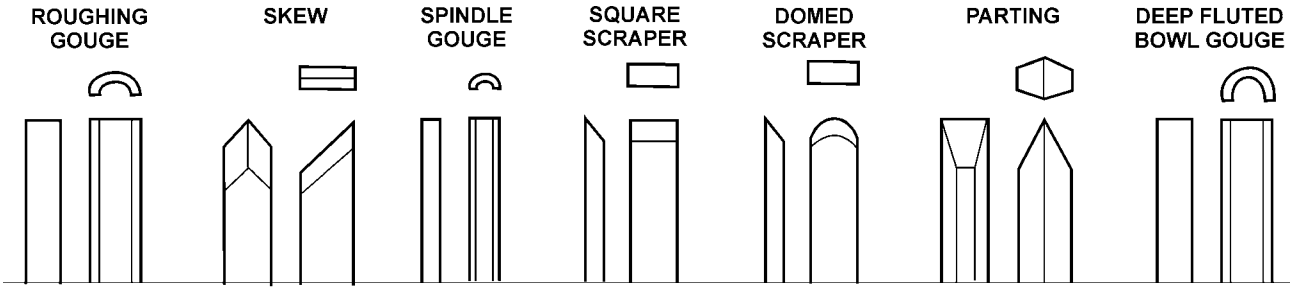


FIGURE 1

For safety and best performance, **keep tools sharp.** If a tool stops cutting or requires excessive pressure to make a cut, it needs to be sharpened. A number of brand name sharpening jigs and fixtures are available, however, a woodturner should learn to sharpen tools freehand. For best results, use a slow speed grinder (1800 rpm) fitted with a 60-grit wheel (for shaping) and a 100-grit wheel (for final sharpening and touchup). The grinder should be located near your lathe and at a comfortable height. A diamond dresser will keep the wheels true and eliminate glazing. Never allow the tool to rest in one place on the wheel, keep it moving and use a light touch.

Carbon steel tools can overheat easily and should be cooled frequently. If the edge turns blue, it has lost its temper and should be ground past the blue area. High-speed steel tools are not as likely to overheat, but can be damaged if allowed to get red hot. High speed steel tools should not be quenched for cooling. Honing with a diamond lap or slipstone will save trips to the grinder and keep the edge fresh.

OPERATING INSTRUCTIONS

Before operating the lathe, check each time that everything is in proper working order:
1. Level your machine: use the adjustable levelers to help reduce vibration.
2. Check bearings: adjust only if endplay exists.
3. Check belts: should be snug but not overly tight.
4. Ways - keep clean, use steel wool and wax to prevent buildup of rust and finishes.
5. Toolrest - use mill file to remove nicks and dings.
6. Spindle tapers - should be clean and free of dust and chips for proper seating of tapers. Clean with scotchbrite or taper cleaner.
7. Tailstock - clean and lubricate ram and locking device.
8. Lighting - proper lighting is essential.
9. Dust extractor - to remove excess sanding dust.
10. Anti-fatigue mat - will help make long hours in front of the lathe more comfortable.

SPINDLE TURNING

Spindle turning takes place between the centers of the lathe. It requires a spur or drive center in the headstock and a revolving or live center in the tailstock. A cup center rather than a cone center will reduce the risk of splitting the stock. Figure 2 shows the basic profile shapes in spindle turning.

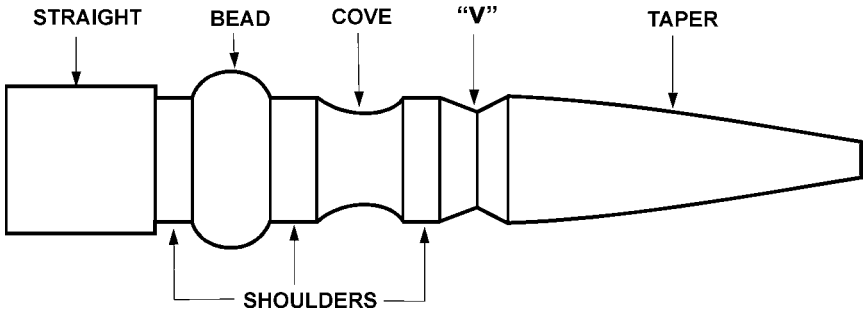


FIGURE 2

STOCK SELECTION

Stock for spindles should be straight grained and free of checks, cracks, knots and other defects. It should be cut 1/8" to 1/4" larger than the finished diameter and may require additional length to remove ends if required. Larger stock should have the corners removed to produce an octagon making the piece easier to rough down to a cylinder.

1. With a combination square or plastic center finder, locate and mark center on each end of stock. Accuracy is not critical on full rounds but extremely important on stock where square sections are to remain. Put a dimple in the stock with an awl or nail, or use a spring-loaded automatic center punch.
2. Extremely hard woods may require kerfs cut into the spur drive end of stock, Figure 3, or may need to have the spur center driven into the stock with a wood mallet or dead blow hammer, Figure 4. **NOTE: Never use a steel face hammer and never drive stock onto spur while it is mounted in the lathe spindle.**

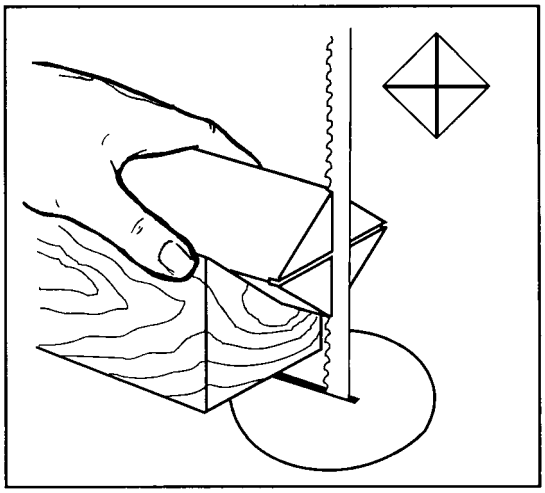


FIGURE 3

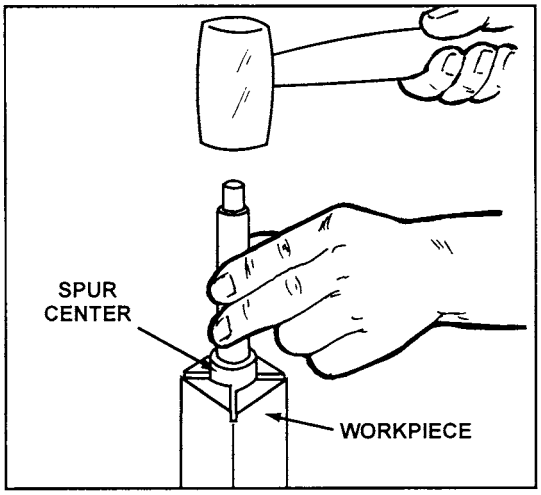


FIGURE 4

MOUNTING STOCK

1. Install workpiece by inserting the attached spur center into the spindle taper on the headstock.
2. Bring tailstock into position, lock it to the bed, and advance the spindle with the handwheel in order to seat the cup center into the workpiece.
3. Move tool support into position. It should be parallel to the workpiece, just below the centerline and approximately 1/8" to 1/4" from the corners of the workpiece to be turned, as in Figure 5. Lock tool support to bed.
4. Rotate workpiece by hand to check for proper clearance.
5. Start lathe at lowest speed and bring it up to the appropriate RPM for the size of stock used (refer to table on page 9).

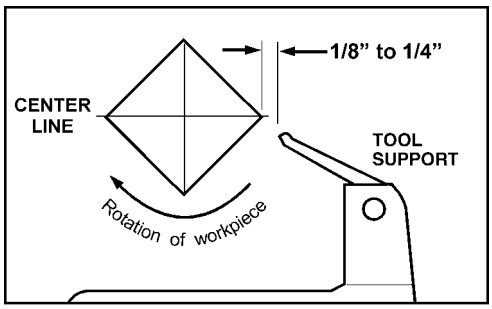


FIGURE 5

CUTTING TECHNIQUES

ROUGHING OUT:

1. Begin with a large roughing gouge. Place the tool on the tool support with the heel of the tool on the surface to be cut.
2. Slowly and gently raise tool handle until cutting edge comes into contact with the workpiece.
3. Beginning at the tailstock end of the workpiece, roll the flute (hollowed-out portion) of the tool in the direction of the cut, Figure 6. Make long sweeping cuts in a continuous motion to rough the piece down to a cylinder. Keep as much of the bevel of the tool as possible in contact with the workpiece to ensure control and avoid catches.

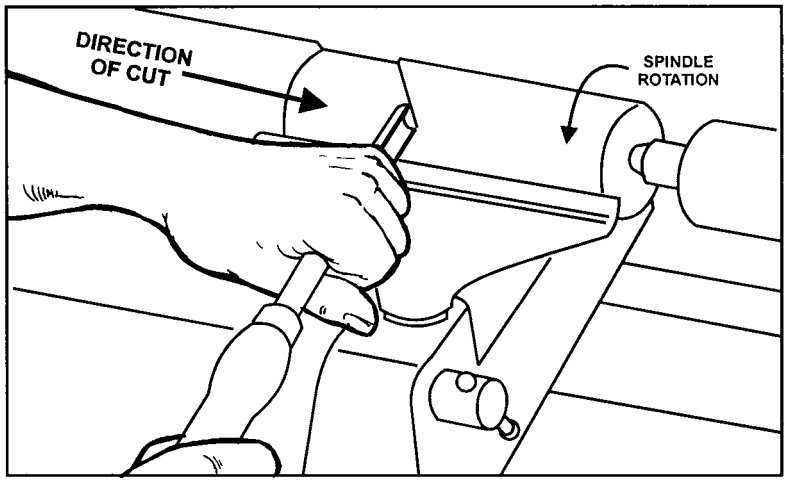


FIGURE 6

NOTE: Always cut down-hill, or from large diameter to small diameter. Always work *toward* the end of a workpiece, never start cutting at the end.

4. Once the workpiece is roughed down to a cylinder, smooth it with a large skew. Keep the skew handle perpendicular to the spindle and use only the center third of the cutting edge for a long smoothing cut (touching one of the points of the skew to the spinning workpiece may cause a catch and ruin the workpiece).
5. Add details to the workpiece with skew, parting tool, scraper or spindle gouge.

BEADS:

1. Make a parting cut for what is to be a bead to the desired depth. Place the parting tool on the tool support and move tool forward to make the full bevel of the tool come in contact with the workpiece. Gently raise handle to make cut to the appropriate depth.
2. Repeat for other side of the bead.
3. Using a small skew or spindle gouge, start in the center between the two cuts and cut down each side to form the bead. Roll the tool in direction of cut.

COVES:

1. Use a spindle gouge. With the flute of the tool at 90 degrees to the workpiece, touch the point of the tool to the workpiece and roll in towards the bottom of the cove, Figure 7. **Stop at the bottom; attempting to go up the opposite side may cause the tool to catch.**
2. Move the tool over the desired width of the cove.
3. With the flute facing the opposite direction, repeat step 1 for other side of cove. Stop at bottom of cut.

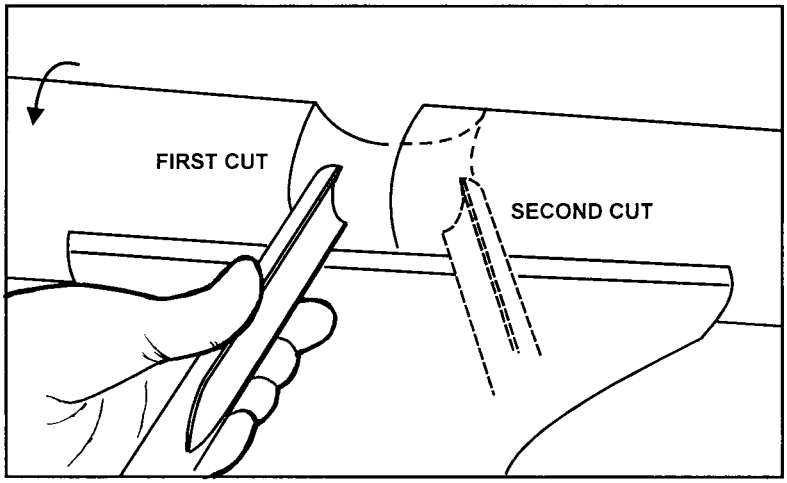


FIGURE 7

"V" CUTS:

1. Use the long point of the skew. (NOTE: Do not press the long point of the skew directly into the workpiece to create the "V"; this will result in a burned or burnished "V" with fibers being rolled up at both sides.)
2. Lightly mark the center of the "V" with the tip of the skew.
3. Move the point of the skew to the right half of the desired width of your cut.
4. With the bevel parallel to the right side of the cut, raise the handle and push the tool in to the desired depth, as shown in Figure 8.
5. Repeat from the left side. The two cuts should meet at the bottom and leave a clean "V" cut.
6. Additional cuts may be taken to add to either the depth or width of the cut.

PARTING OFF:

1. Use parting tool.
2. Adjust lathe speed to lower RPM for parting through a workpiece.
3. Place tool on tool support and raise the handle until it starts to cut and continue to cut towards the center of the workpiece.
4. Loosely hold on to the piece in one hand as it separates from the waste wood.

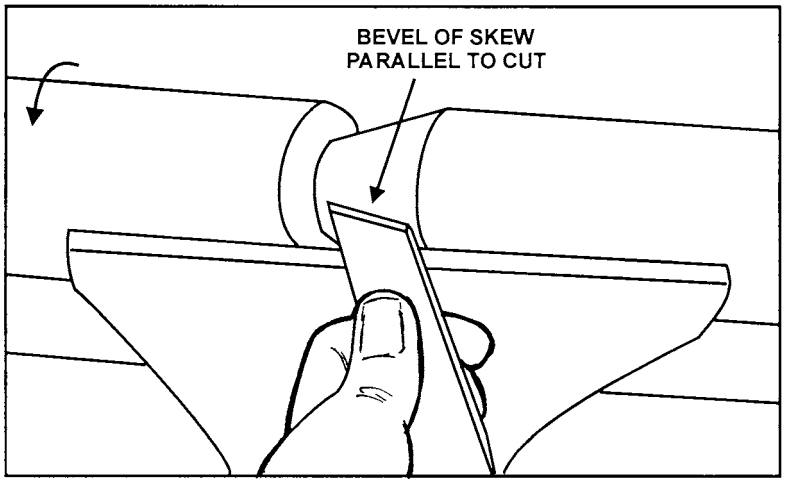


FIGURE 8

SANDING and FINISHING:

Leaving clean cuts will reduce the amount of sanding required. Adjust the lathe to a **low speed**, and begin with fine sandpaper (120 grit or finer). Coarser sandpaper will leave deep scratches that are difficult to remove, and dull crisp details on the spindle. Progress through each grit without skipping grits (e.g., do not jump from 120 grit to 220 grit). Fold the sandpaper into a pad; do not wrap sandpaper around your fingers or the workpiece.

To apply a finish, the workpiece can be left on the lathe. Turn off the lathe and use a brush or paper towel to apply the finish. Remove excess finish before restarting lathe. Allow to dry and sand again with 320 or 400 grit sandpaper. Apply second coat of finish and buff.

FACE PLATE and BOWL TURNING

Face plate turning is normally done on the inboard side of the headstock over the bed. Larger workpieces must be turned on the outboard side (remove tailstock and tool support, and move headstock to opposite end of bed).

MOUNTING STOCK

Use of a face plate is the most common method for holding a block of wood for turning bowls and plates:

1. Select stock at least 1/8" to 1/4" larger than each dimension on the finished workpiece.
2. Always select the largest diameter face plate that can be used for the workpiece to be turned.
3. True one surface of the workpiece for mounting against the face plate.
4. Using the face plate as a template, mark the location of the mounting holes, and drill pilot holes of the appropriate size. Face plates are drilled for No. 12 screws. (Phillips and square drive screws will hold up better than slotted screws. Sheel metal screws are case hardened with deeper and sharper threads than wood screws.)

If the mounting screws on the face plate interfere with the workpiece, a glue or waste block can be used.

5. Make a block the same diameter as the face plate, Figure 9. Both glue block and workpiece should have good flat surfaces for gluing.
6. Glue the block to the workpiece. Avoid using brown paper or newspaper between the block and workpiece. It may work fine if you are using scrapers, but a slight catch with a bowl gouge can separate the two.

NOTE: When using a glue block, be careful with the adhesive you select. Dry workpieces can be bonded with ordinary white or yellow glue but must be clamped to ensure a good bond. Green workpieces require cyanoacrylate (super glue) or a urethane adhesive. Urethanes will require clamping.

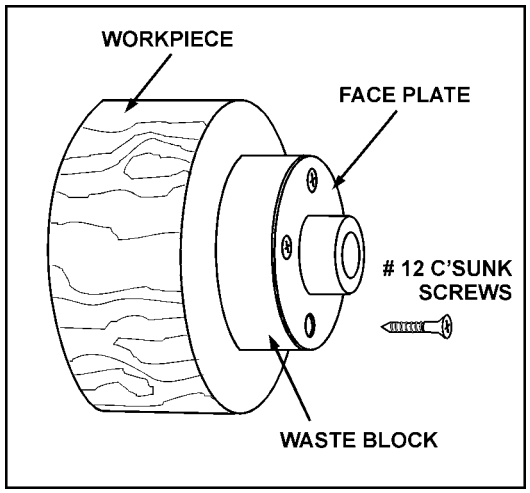


FIGURE 9

FACEPLATE OR CHUCK?

While faceplates are the simplest, most reliable method of holding a block of wood for turning, chucks can also be used. As

there are dozens of chucks to choose from, the woodturner should first consider all the different types of turning that will be done, and read reports or discuss with other turners who own chucks before making a decision. A chuck is not a requirement but is handy when working on more than one piece at a time. Rather than removing screws, you simply open the chuck and change workpieces. The most popular ones are four jaw scroll chucks with a variety of jaws to accomodate different size tenons. Most also come with a screw chuck as well.

WOOD SELECTION

Firewood is the cheapest, most widely available stock to use while learning to turn bowls. Simply waste wood for a while practicing turning techniques. Develop skill with each tool before attempting to make a finished piece. It is best to start with dry wood, without worrying about drying or distortion. Once turning becomes comfortable, try green wood which cuts very easily. As the turner gains experience, he or she will find extraordinary grain and figure in the form of burls, crotches and bark inclusions.

CHECKS & CRACKS

Green wood will check and crack. For best results, leave logs in as long lengths as you can handle. As the material starts to dry, surface cracks will develop on the ends of the log. Cut off two to three inches and you should find good, sound wood. Also cut the log in half along the pith to avoid having it in the finished piece. Most checks radiate from the pith. As you turn bowls from green wood, make sure you maintain a consistent wall thickness throughout the piece. Leaving a piece thick in some areas and thin in others will cause the wood to dry unevenly and promote checks and cracks.

DISTORTION

Distortion is a problem associated with turning green wood. It will vary from one type of wood to the next. Typically, fruitwoods tend to distort more than others do. It also varies with the time of year the tree was cut and how the logs are stored.

TOOLS FOR BOWL TURNING

The deep fluted bowl gouge is the most essential and versatile tool for most bowl and faceplate style turning. The bowl gouge is heavier and easier to control than other types of gouges. It also allows removal of wood much faster and with less vibration than other gouges. Most average sized bowl work can be accomplished with a 3/8" or 1/2" bowl gouge. A 1/4" bowl gouge is best suited for smaller bowls and light finishing cuts. Larger 3/4" and 1" bowl gouges are only used for extremely large pieces.
Large domed scrapers can also be used to help clean up the interior surfaces of bowls. A light touch with the scraper slightly tilted will eliminate some of the ridges occasionally left by an inexperienced bowl gouge.

BOWL TURNING TECHNIQUES

TO SHAPE the OUTSIDE of the BOWL:

1. Odd shaped burls, crotches and other irregular shaped blanks require special preparation before mounting in a chuck or onto a faceplate. Remove the bark, if there is any, from what appears to be the center of the top of the workpiece.
2. Drive spur center into the top of the workpiece with a mallet or dead blow hammer.
3. Slip the spur center into the headstock taper and bring the tailstock with a live or ball bearing center into position. Lock the tailstock to the bed and advance the spindle in order to seat the cup center into the workpiece. Tighten the quill lock.
4. Position tool support below the centerline and about 1/4" from the workpiece. (NOTE: For larger outboard turning, an optional outboard turning stand is used to place the tool support; see your Powermatic dealer).
5. Turn workpiece by hand to ensure proper clearance.
6. Start lathe at lowest speed and bring it up to the maximum safe speed for the size of work to be turned (see table on page 9). If the machine starts to vibrate, lower the speed until vibration stops.
7. Rough out the outside of the bowl with the 1/2" deep fluted bowl gouge, holding the tool firmly against your hip. For best control, use your whole body to move the gouge through the workpiece.
8. As bowl takes shape, work on the bottom (tailstock end) to accomodate attaching a face plate.
9. Turn a short tenon (about 1/8" long) the size of the hole in the faceplate, Figure 10. This will allow centering the workpiece when the faceplate is attached. (NOTE: If you plan to use a chuck, turn a tenon of the appropriate length and diameter to fit your chuck.)

10. Stop the lathe, remove workpiece and attach face plate or chuck (see "Mounting Stock" above).
11. Finish turning the outside of bowl with 1/2" or 3/8" bowl gouge. Leave additional material at base of bowl for support while turning interior. This will be removed later.

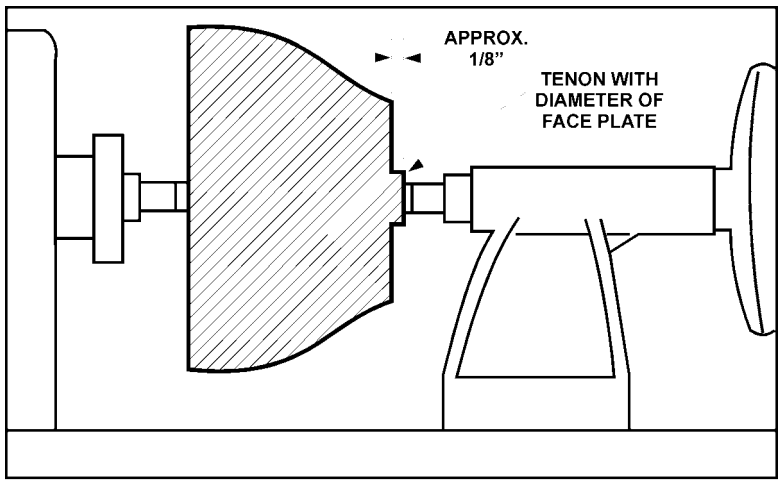


FIGURE 10

TO SHAPE INTERIOR OF BOWL:

1. Stop lathe and move tailstock away. Remove center from tailstock to prevent bumping it with elbow.
2. Adjust tool support in front of the bowl just below centerline, at a right angle to the lathe ways.
3. Rotate workpiece by hand to check clearance.
4. Face off top of bowl by making a light shearing cut across the top of workpiece, from rim to center.
5. Place 1/2" bowl gouge on toolrest at center of the workpiece with the flute facing top of bowl. The tool handle should be level and pointed toward four o'clock, as shown in Figure 11.
6. Use left hand to control cutting edge of gouge, while right hand swings tool handle around toward your body (see Figure 11). The flute should start out facing top of workpiece, and rotate upward as it moves deeper into the bowl to maintain a clean even curve.

As tool goes deeper into bowl, progressively work out toward rim. It may be necessary to turn the toolrest into the piece as you get deeper into the bowl.

(NOTE: Try to make one, very light continuous movement from the rim to the bottom of the bowl to ensure a clean, sweeping curve through the piece. Should there be a few small ridges left, a light cut with a large domed scraper can even out the surface.)

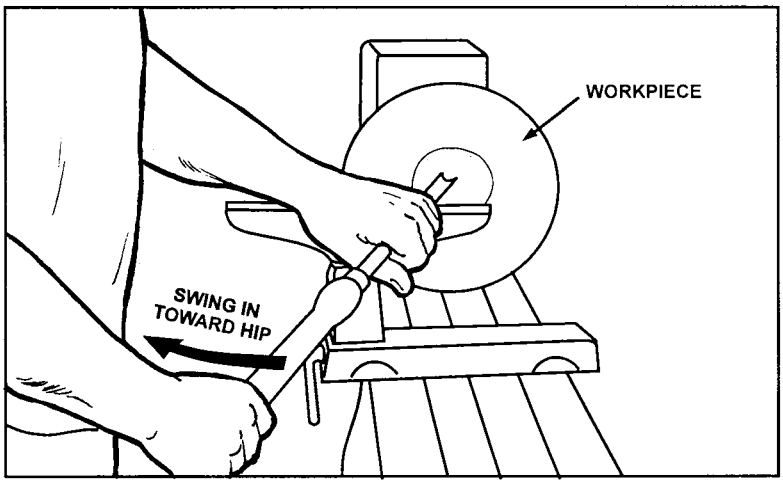


FIGURE 11

7. Develop wall thickness at the rim and maintain it as you work deeper into the bowl (Once the piece is thin toward the bottom, you cannot make it thinner at the rim). When the interior is finished, move tool support to exterior to re-define bottom of bowl. (General rule of thumb: the base should be approximately 1/3 the overall diameter of the bowl).
8. Work the tight area around faceplate or chuck with 1/4" bowl gouge.
9. Begin the separation with a parting tool, but do not cut all the way through yet.

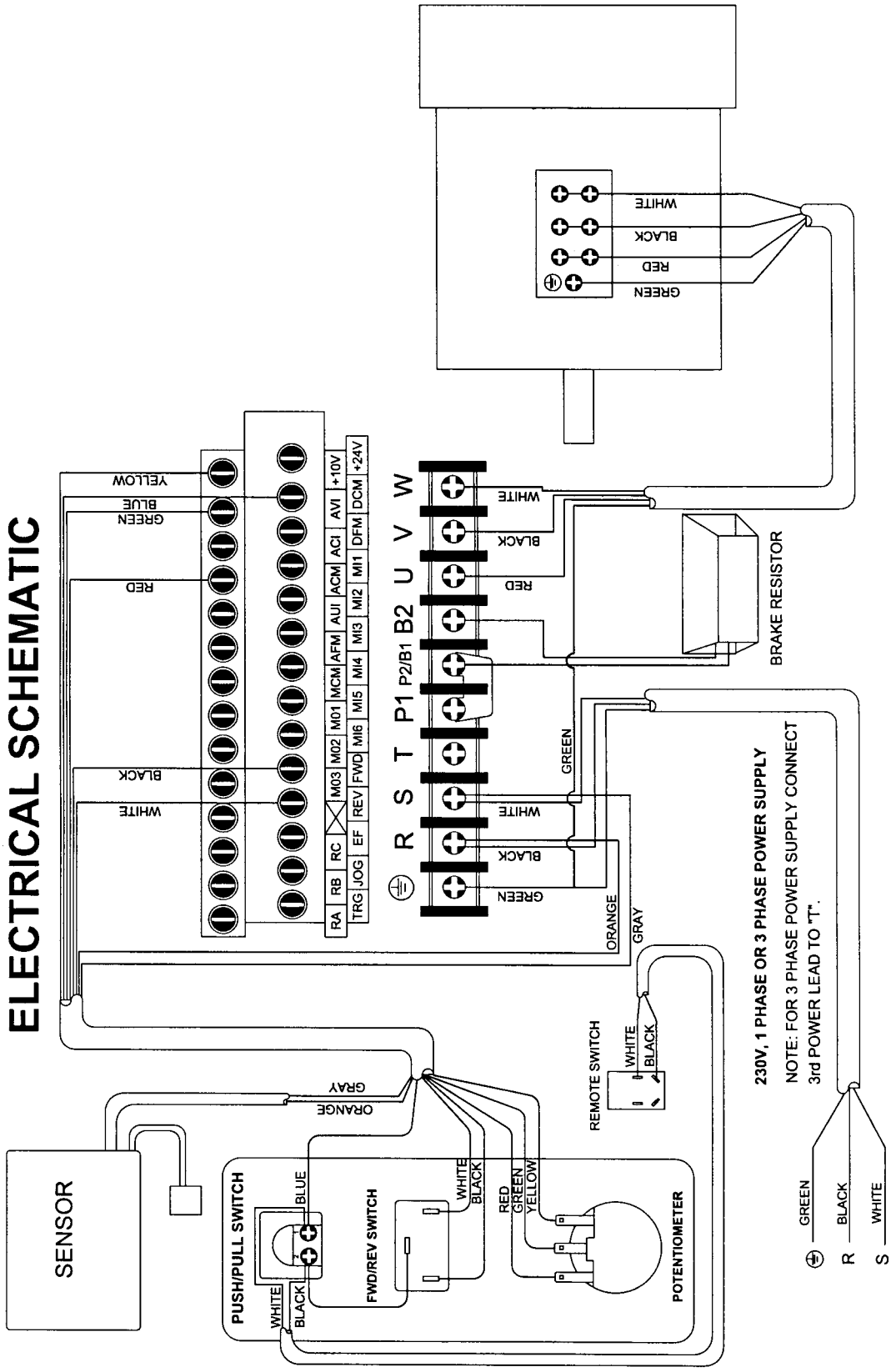
SANDING AND FINISHING:

1. Remove the toolrest and adjust lathe speed to approximately 500 RPM. High speed can build friction while sanding and cause heat check in some woods.
2. Begin with fine sandpaper (120 grit) and progress through each grit, using only light pressure. Coarser sandpaper tends to leave deep scratches that are hard to eliminate. Use power-sanding techniques to avoid concentric sanding marks around your finished piece. Avoid rounding over the rim and foot with sandpaper; try to keep details crisp. Finish sanding with 220 grit.
3. Remove sanding dust with tack rags or compressed air and, with lathe turned off, apply first coat of finish. Let stand for several minutes, wipe off excess. Allow to dry before sanding again with 320 or 400 grit sandpaper.
4. Turn lathe back on and continue the separation cut almost all the way through the base. Stop at about 3" and use a small fine tooth saw to separate the bowl from the waste.
5. Apply second finish coat and allow to dry before buffing.

TROUBLE-SHOOTING (4224 Lathe)

PROBLEM	POSSIBLE CAUSE	SOLUTION
Excessive vibration.	1. Defective spindle bearings. 2. Worm or defective belt. 3. Defective motor. 4. Workpiece warped, out-of-round, has major flaw, or was improperly prepared for turning.	1. Replace bearings. 2. Replace belt. 3. Replace motor. 4. Correct problem by planing or sawing, or scrap workpiece.
Motor or spindle stalls.	1. Excessive cut. 2. Defective motor. 3. Excessive belt wear. 4. Improper belt adjustment.	1. Reduce cut depth. 2. Replace motor. 3. Replace belt. 4. Readjust belt.
Motor overheats.	1. Motor overloaded. 2. Improper cooling on motor.	1. Correct overload condition, such as reducing cut depth. 2. Clean sawdust from fan and duct areas of motor.
Motor starts slowly or fails to come up to speed.	1. Low voltage. 2. Defective motor.	1. Request voltage check from power company and correct low voltage condition. 2. Replace motor.
Motor fails to develop full power.	1. Power line overloaded. 2. Undersize wires in supply system. 3. Low voltage. 4. Defective motor.	1. Correct overload condition. 2. Increase supply wire size. 3. Request voltage check from power company and correct low voltage condition. 4. Replace motor.
Tools tend to grab or dig in.	1. Dull tools. 2. Tool support set too low. 3. Tool support set too far from workpiece. 4. Improper tool being used.	1. Sharpen tools. 2. Reposition tool support height. 3. Reposition tool support closer to workpiece. 4. Use correct tool for operation.
Lathe runs at one speed.	1. Electronic AC inverter defective, not programmed properly or loose wiring.	1. Replace electronic AC inverter, reprogram, or check wiring.

ELECTRICAL SCHEMATIC: 4224 Lathe



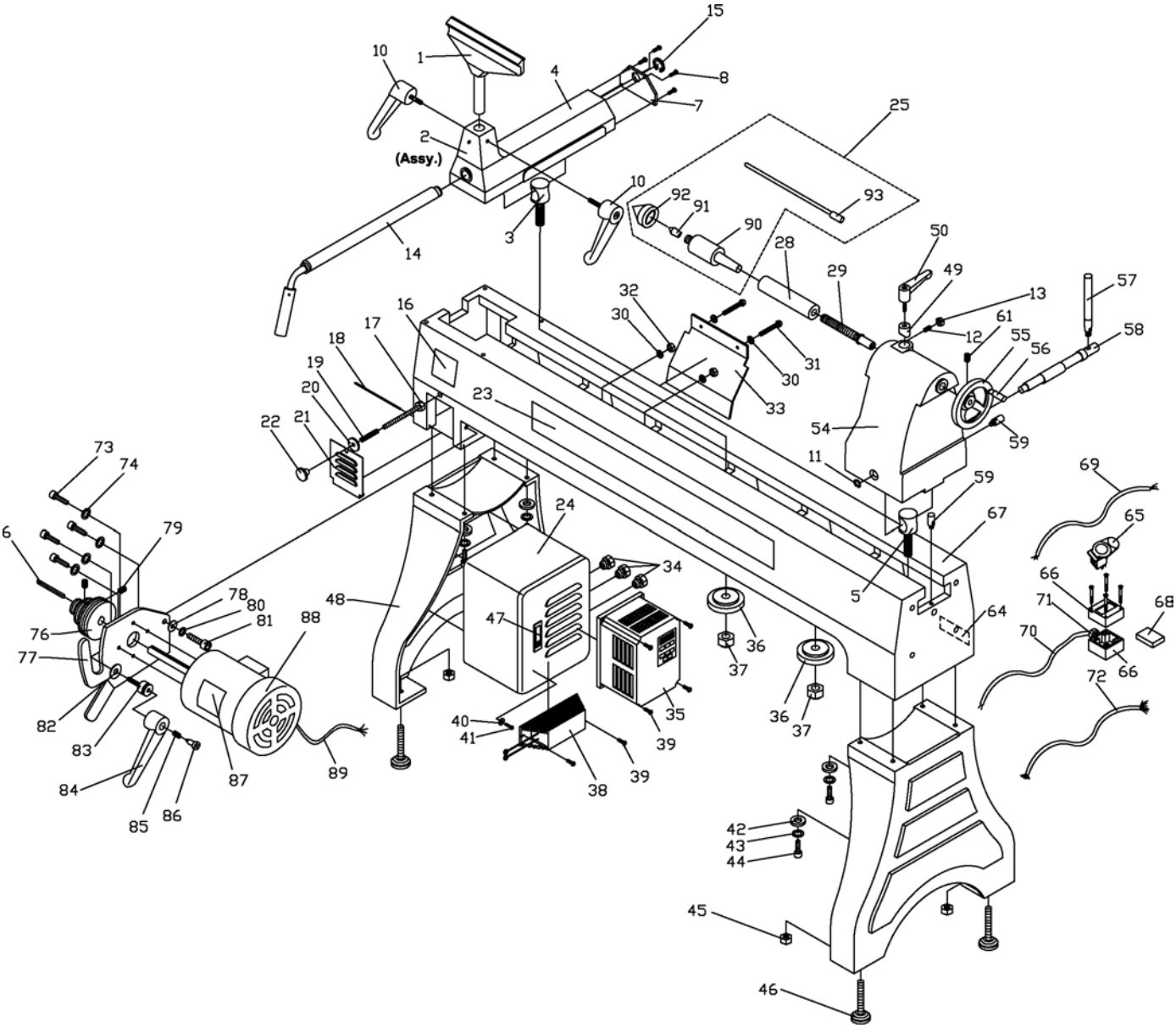
PARTS LIST: **Stand & Bed Assembly** (4224 Lathe)

No.	Part No.	Description	Quantity
1	6294742	Tool Support, 14"	1
2	6294753	Tool Support Assembly (Items 3 thru 10, 14, 15, 36, 37)	1
3	6295851	Tool Support Clamp Bolt (4224)	2
4	6295917	Base Tool Support	1
5	4224-105	Tailstock Clamp Bolt	1
6	6294761	Key, 6 x 6 x 45	1
7	6295702	End Cover	1
8	6295703	Socket Head Cap Screw, 10-24 x 5/8"	4
9	6294764	Support Shaft	1
10	6294763	Tool Support Handle	2
11	6295919	C-Ring	2
12	6295922	Socket Set Screw (Special), 1/4-20 x 1	1
13	TS-0561011	Hex Nut, 1/4-20	1
14	6295709A	Tool Support Rod	1
15	6295710	C-Ring, S-25	1
16	6294773	Warning Label	1
17	6295712	Hex Head Screw	1
18	6295713	Pin	1
19	6295714	Spring	1
20	6295715	Washer	1
21	6295716	Motor Pulley Door	1
22	6295717	Knob	1
23	6294774	Powermatic Label	1
24	6295719	Inverter Box	1
25	6295902	Live Center Assembly	1
28	6295723	Tailstock Spindle	1
29	6295724	Lead Screw	1
30	6295725	Washer	4
31	6295726	Socket Head Cap Screw	2
32	6295727	Nut	2
33	6295728	Chipbreaker	1
34	6295729	Strain Relief	3
35	6295730	Inverter	1
36	6294770	Clamp	2
37	TS-0650081	Lock Nut, 3/4-10	2
38	6295733	Braking Resistor	1
39	6295734	Round Head Screw, 10-24 x 5/16	6
40	6295735	Washer, #10	6
41	6295736	Socket Head Cap Screw, 10-24 x 1/2"	4
42	6295737	Washer, 3/8	8
43	6295738	Spring Washer 3/8	8
44	6295792	Socket Head Screw, 3/8-16 x 1-1/4	8
45	6295740	Hex Nut, 3/8-16	4
46	6295741	Leveler	4
47	6295742	Door Lock	1
48	6295743	Stand	2
49	6295892	Quill Lock Sleeve	1
50	6295893	Tailstock Quill Handle	1
54	6295749	Tailstock	1
55	6295918	Handwheel	1
56	6295751	Handle	1
57	6295848	Tailstock Handle	1
58	6295849	Tailstock Clamping Shaft (4224)	1
59	6295754	Tailstock Stud (4224)	2
61	6715013	Socket Set Screw	1
63	6295758	C-Ring, S-16	1
64	6295759	I.D. Label	1

PARTS LIST: **Stand & Bed Assembly** (4224 Lathe) continued

No.	Part No.	Description	Quantity
	6294733	Remote ON/OFF Switch Assembly (Items 65, 66, 68, 70, 71)	1
65	6295760	On/Off Switch	1
66	6295761	Switch Box	1
67	6295762	Bed	1
68	6295763	Magnet	1
69	6295764	Power Cord	1
70	6295765	Control Cord	1
71	6295766	Strain Relief	1
72	6295767	Signal Cord	1
73	6295768	Hex Socket Screw, 5/16-18 x 1	4
74	6295769	Lock Washer, 5/16	4
76	6295771	Motor Pulley	1
77	6295772	Motor Assembly Plate	1
78	6295773	Washer, 7/16	1
79	6295774	Set Screw, 1/4-20 x 3/8	2
80	6295775	Lock Washer, 7/16	1
81	6295776	Hex Socket Screw, 7/16-14 x 1-1/4	1
82	6295777	Large Washer	1
83	6295778	Stud	1
84	6295779	Handle	1
85	6295780	Spring	1
86	6295781	Stud	1
87	6295782	Motor Label	1
88	6295783	3 HP Motor	1
89	6295784	Motor Cord	1
90	6295903	Live Center Body	1
91	6295904	Live Center Tip	1
92	6295905	Live Center Cap	1
93	6295906	Live Center Rod	1

Stand & Bed Assembly (4224 Lathe)



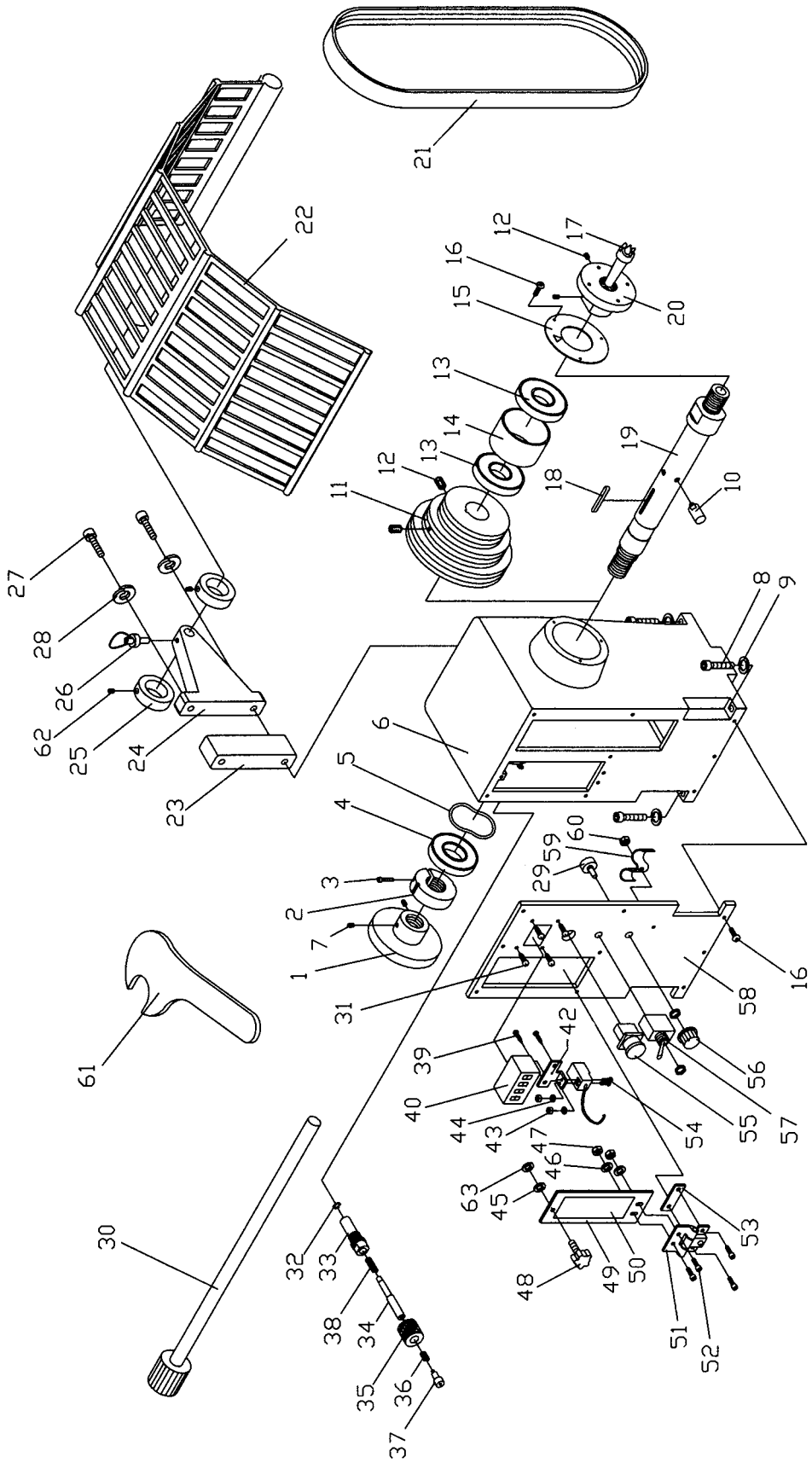
PARTS LIST: **Headstock Assembly** (4224 Lathe)

No.	Part No.	Description	Quantity
1	6295785	Handwheel	1
2	6295786	Nut, Lock	1
3	6295787	Socket Cap Screw, M6 x 25	1
4	6295788	Bearing, 63208	1
5	6295789	Wave Washer	1
6	6295790	Headstock	1
7	6714160	Set Screw, 1/4-20 x 1/4	2
8	6295792	Socket Cap Screw, 3/8-16 x 1-1/4	4
9	6295793	Spring Washer, 3/8	4
10	6295794	Stud	4
11	6295795	Spindle Pulley	1
12	6295796	Set Screw, 1/4-20 x 38	4
13	6295797	Bearing, 6209LB	2
14	6295798	Bushing	1
15	6295799	Front Plate	1
16	6295800	Hex Socket Round Head Screw, 10-24 x 1/2	13
17	6294725	Spur Center 1", MT2	1
18	6295802	Key, 6 x 6 x 50	1
19	6295803	Head Spindle	1
20	6294736	Face Plate, 3"	1
21	6295805	Belt, V-550J	1
22	6294747	Guard Assembly	1
23	6295807	Bracket	1
24	3064711	Lathe Guard Bracket	1
25	6143004	Retaining Collar	2
26	6644005	Plunger	1
27	6295850	Socket Cap Screw, 3/8-16 x 3	2
28	6861300	Spring Washer, 3/8	2
29	6295915	Control Pot Assembly	1
30	6294743	Knockout Rod	1
31	6295815	Tap Screw, M3 x 10	4
32	6295816	E-Ring, E-7	1
33	6295817	Index Bushing	1
34	6295818	Index Shaft	1
35	6295819	Index Knob	1
36	6295820	Spring	1
37	6295821	Bolt	1
38	6295822	Spring	1
39	6295823	Tap Screw, 1/4 x 1/2	2
40	6295824	Speed Indicator & Sensor Assy.	1
42	6295826	Fixed Plate	1
43	6295827	Nut	2
44	6295828	Washer	2
45	6295829	O-Ring	1
46	6860704	Lock Washer	2
47	6508007	Nut	2
48	6295832	Knob	1
49	6295833	Door Panel	1
50	6295834	Speed Label	1
51	6365012	Door Hinge	1
52	6708019	Socket Cap Screw, 8-32 x 5/8	4
53	6295837	Pad	1
54	6295838	Round Head Screw, M3 x 20	2
55	6295839	Push/Pull Switch	1
56	6295840	Control Panel Knob	1
57	6295841	Fwd/Rev Switch	1
58	6295842	Headstock Plate	1

PARTS LIST: **Headstock Assembly** (4224 Lathe) Continued

No.	Part No.	Description	Quantity
59	6295843	Clamp	1
60	6295844	Nut, #10-24	1
61	6294744	Faceplate Spanner	1
62	TS-0270011	Socket Set Screw, 5/16-18 x 1/4	2
63	6295923	Clamp Washer	1

Headstock Assembly (4224 Lathe)



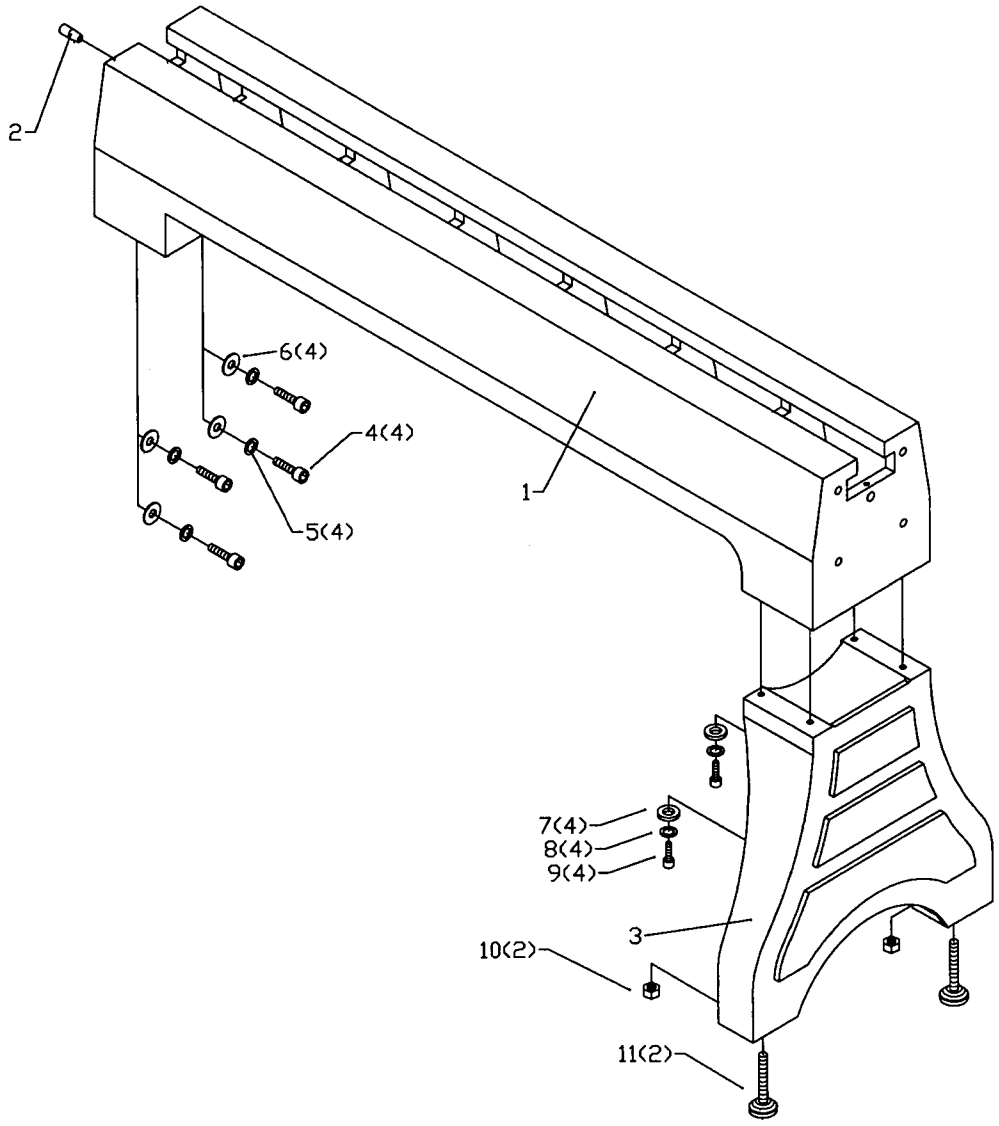
OPTIONAL ACCESSORIES (4224 Lathe)

Part No.	Description
6294730	Metal Spinning Tool Support, 12"
6294731	Tool Support, 26"
6294734	Adapter, 1-1/4" to 1-1/2"
6294739	Tool Support, 6"
6294740	Bowl Turning Tool Support (RH)
6294741	Tool Support, 16"
6294745	Ball Bearing Center
6294747	Guard Assembly
6294736	Face Plate, 3"
6294737	Face Plate, 4"
6294738	Face Plate, 7"
6294751	Bowl Turning Tool Support (LH)
6295845	Short Outfeed Bed Extension, 20"
6295846	Tool Rest Base Assembly, 24"

65" Bed Extension Assembly (Optional - 4224 Lathe)

No.	Part No.	Description	Quantity
	6295847	65" Bed Extension Assembly (Items 1-11)	1
1	6295901	65" Bed Extension	1
2	6295861	Pin	1
3	6295743	Stand	1
4	6295862	Hex Socket Cap Screw, 5/8-11 x 2	4
5	6295859	Lock Washer, 5/8	4
6	6295860	Washer, 5/8	4
7	6295737	Washer, 3/8	4
8	6295738	Lock Washer, 3/8	4
9	6295739	Hex Socket Cap Screw, 3/8-16 x 1-1/4	4
10	6295740	Hex Nut, 3/8-16	2
11	6295741	Leveler	2

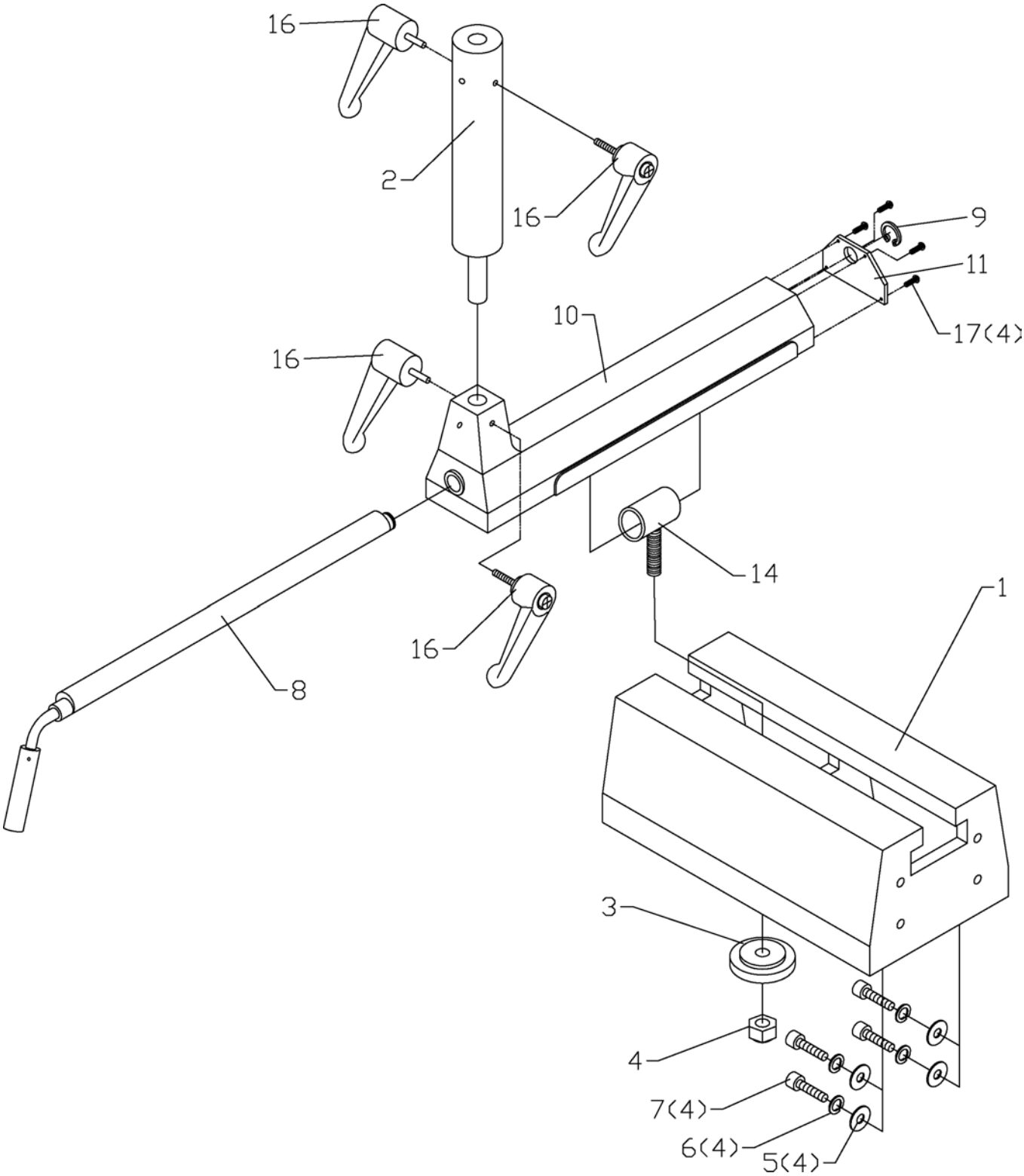
65" Bed Extension Assembly (Optional - 4224 Lathe)



PARTS LIST: **Outboard Turning Assembly** (Optional - 4224 Lathe)

No.	Part No.	Description	Quantity
	6295858	Outboard Turning Assembly (Items 1 thru 17)	1
	6295845	Short Outfeed Bed Extension Assembly (Items 1, 5, 6, 7)	1
	6295846	Tool Rest Base Assembly (Items 2, 3, 4, 8 thru 17)	1
1	6295852	20" Bed Extension	1
2	6295853	Extension Rod	1
3	6294770	Clamp	1
4	TS-0650081	Lock Nut, 3/4-10	1
5	6295860	Washer, 5/8	4
6	6295854	Lock Washer, 5/8	4
7	6295855	Hex Socket Cap Screw, 5/8-11 x 1-1/2	4
8	6295856A	Rod	1
9	6295710	C-Ring	1
10	6295857	Tool Support Base	1
11	6295702	End Cover	1
12	6294761	Key 6 x 6 x 45	1
13	6294762	Bushing	1
14	6295851A	Tool Support Clamp Bolt	1
15	6294764	Support Bracket	1
16	6294763	Tool Support Handle	4
17	6295703	Hex Socket Cap Screw, 10-24 x 5/8	4

Outboard Turning Assembly (Optional - 4224 Lathe)



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