This is a low-resolution pdf of the manual, optimized for downloading and screen viewing. A high quality, print-ready pdf is available to purchasers of the PM-1440GT Lathe.

Model PM-1440GT Lathe

High precision gap-bed machine, with coolant system
Short spindle, large bore: 15-1/2 x 2 inch clearance
D1-5 camlock spindle mount
40 in. between centers, 14 in. swing over bed, 20-3/4 in. over gap
12 spindle speeds from 50 to 2000 rpm
Multi-speed gearbox for full-range screw cutting, TPI & mm pitch
Bidirectional power feed for saddle & cross-slide
Weight, including welded stand & coolant system 1750 lb

PM-1440GT *Shown with optional work light, chuck and micrometer saddle stop*

The PM-1440GT lathe is manufactured in Taiwan

PRECISION MATTHEWS

701 Parkway View Drive
Pittsburgh, PA 15205

PM-1440GT

FAQ

My lathe doesn't run at all (1)

POWER light off?

AC power connected?

Circuit breaker in the electrical box tripped?

E-STOP button in? Rotate it, should pop out.

My lathe doesn't run at all (2)

FOOTBRAKE working, not stuck down? If working properly, the footbrake should close the microswitch (inside the LH stand cabinet), opening it when released.

The motor didn't run when power was connected

By design it should NOT run if the Motor Control lever is UP or DOWN when power is connected.

Electrical schematic, Section 5: Move the Motor Control switch to neutral, mid travel, to energise the power-switching contactor KA, thus restoring normal conditions.

STOP ***The 3 gearboxes in this machine (Headstock, Saddle Feed and Apron) may have been shipped empty. They must be filled before use, see Section 4.***

This manual contains essential safety advice on the proper setup, operation, maintenance, and service of the PM-1440GT lathe. Failure to read, understand and follow the manual may result in property damage or serious personal injury.

There are many alternative ways to install and use a lathe. As the owner of the lathe you are solely responsible for its proper installation and safe use. Consider the material contained in this manual to be advisory only. Precision Matthews, LLC cannot be held liable for injury or property damage during installation or use, or from negligence, improper training, machine modifications or misuse.

This manual describes PM-1440GT machines as shipped from November 2016. There may be detail differences between your specific machine and the information given here (with little or no impact on functionality). If you have questions about any aspect of the manual or your machine, please call **412-787-2876** (east coast time), or email us at service@precisionmatthews.com. Your feedback is welcomed!

Section 1 INSTALLATION

THESE ARE THE MAIN POINTS TO WATCH OUT FOR!
But read the following pages for more information

! Check oil levels in all gearboxes before use

- Handling the lathe is at least a two-man job.
- Lifting gear – sling, hoist or forklift – must be rated for at least 1-1/2 tons.
- Working location of the lathe must allow space for removal of the belt cover at left; also, access to the coolant system (back of right hand cabinet) and the electrical box at the back of the headstock.
- Power requirement is 220V, 60Hz, 1φ (3φ optional).
- Extension cord not recommended; if no alternative, use 12 AWG not longer than 20 ft.
- Before connecting power be sure that:
  1. The machine is on a firm footing.
  2. Chuck camlocks tight, no wrench left in chuck.
  3. Saddle and cross slide approx. mid-travel, power feed disengaged (Figure 1-8).
  4. The headstock gear selectors are set for the lowest spindle speed.

SETTING UP THE LATHE

The PM-1440GT is shipped fully assembled in a single packing case. The machine can be lifted in one piece by an overhead hoist or forklift with slings and/or chains, all items rated for a total weight of at least 1-1/2 tons. A suggested setup for lifting is shown in Figure 1-1.

When selecting a location for the lathe, allow sufficient room at the right to allow removal/servicing of the leadscrew, feed shaft and motor control shaft.

Be sure to keep all lifting gear clear of any part of the lathe, especially the 3 shafts at the front. Use at least 2-by spreaders.

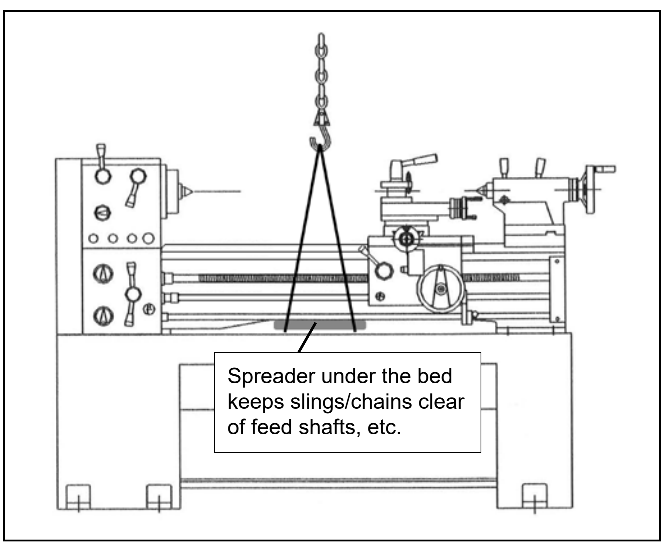


Figure 1-1 **Lifting with slings**

Before lifting, remove the chuck, if installed, then move the tailstock and saddle as far to the right as possible to balance the machine at the point(s) of suspension.

With the machine in its permanent location, lower it so that its height adjustment bolts rest on the six supplied cast iron leveling mounts, Figure 2.

Figure 1-2 **Leveling mount**

Inspect the coolant tank and pump assembly in the RH cabinet, Figure 1-3. The tank may have become dislodged in shipment. Level it if necessary.

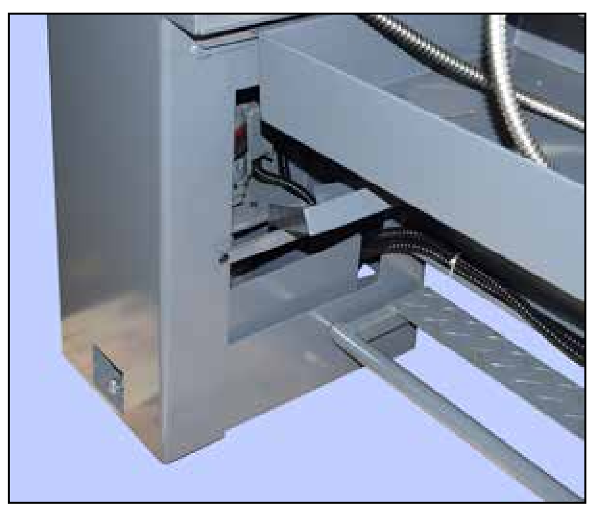


Figure 1-3 **Coolant tank**

CLEANUP

Metal surfaces may have been protected by thick grease and/or paper. Carefully remove these using a plastic paint scraper, disposable rags and a light-oil such as WD-40.

CHIP TRAY

Check that the chip tray, Figure 1-4, can be pulled forward without snagging coolant hoses and worklight wiring. Use cable ties if necessary.

Figure 1-4
Slide-out chip tray

LEVELING

Make sure the lathe is in its permanent location. The following procedure ensures that the lathe bed is in the same state as it was when the lathe was checked for accuracy in manufacture — level from end to end along the bed, and from front to back. In other words, no warping.

Make sure all leveling mounts and/or shims are ***properly weight bearing***, firmly in contact with the floor. Check and adjust level from end to end using a precision machinist's level, if available. If not, use the most reliable level on hand. Check and adjust level front-to-back across the bed using a matched pair of spacer blocks to clear the Vee tenons on the bed ways. The blocks need to be at least 1/4 inch thick, ground or otherwise accurately dimensioned. Alternatively, check for level on the ground surface of the cross slide as the carriage is traversed from end to end. See also "Aligning the Lathe" in Section 4.

FOOTBRAKE & BELT COVER INTERLOCKS

The lathe will not run if the footbrake switch fails to close when the foot treadle is released (brake OFF). This switch is located inside the LH stand cabinet. Check that the D-shape cam operates the switch when the treadle is pressed, Figure 1-5.

Figure 1-5 **Footbrake interlock switches**

POWER CONNECTION

As shipped. the PM-1440GT is set for 220 V single or three-phase.

Read Initial Checks, below, before connecting power

Remove the rear cover from the LH cabinet. If the lathe did not come with a pre-installed power cord, connect the right hand terminals, Figure 1-6, to the power source using 12 AWG (minimum) 3-wire cord through a strain relief bushing sized for the electrical box ports. For a single phase installation, connect the power lines to terminals R and S. For three-phase connection, see Section 5.

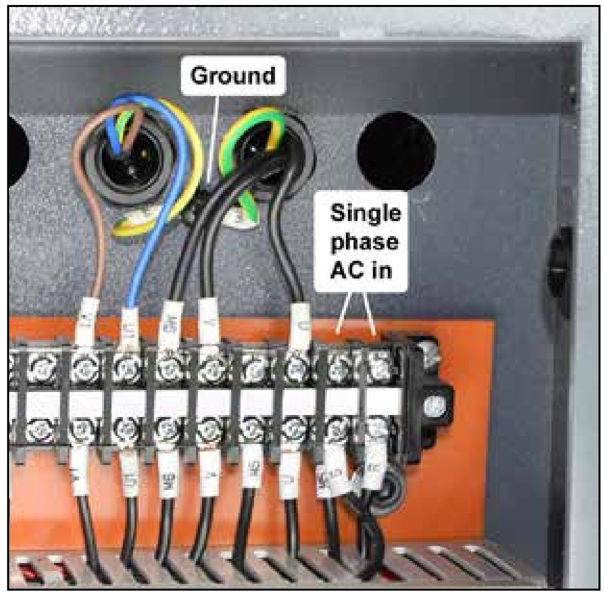


Figure 1-6 **220 Vac input**

INITIAL CHECKS

Read Section 3 if unsure about any item in the following

! ***BEFORE connecting power, do the following:***

1. Visually check the entire machine for possible disturbance in shipping, including the motor, Vee belts and external gears under the belt cover left of the headstock. Replace the belt cover.
2. Check oil level (sight glasses) in the ***headstock***, the ***saddle feed gearbox***, and the ***apron***. See Section 4.
3. If a chuck or faceplate is installed, check tightness of the six Camlocks on the spindle nose, Section 3.
4. Set the speed selector gear levers to the lowest spindle speed, 50 rpm. Make sure the gears are properly meshed by "jiggling while shifting" — rotate the chuck back and forth by hand while moving the levers into position. Make certain that the motor control lever is set to OFF, mid-travel, Figure 1-7.

! ***Do not change speed when the motor is running.***

5. Set the ***Feed Direction knob*** to its center (***neutral***) position, Figure 1-8.
6. Check that there are no clamps or locks on moving parts.
7. Check that the footbrake treadle is released (UP).
8. Set the saddle and cross slide to approximate mid-travel.
9. Connect and switch on 220 Vac power. The power lamp, Figure 1-8, should light, unless a circuit breaker in the electrical box has tripped.
10. Be sure the Emergency Stop (E-Stop) button has not been pushed in (it should pop out when twisted clockwise).
11. Shift the motor control lever DOWN. The spindle should turn Forward, counter clockwise, viewed at the chuck (nose) end. *The control system can be rewired for DOWN = Reverse, see the electrical diagram, Section 5.*
12. Check the emergency function by pressing the E-Stop button. The motor should stop. ***If this doesn't happen, the E-stop function is defective, and needs attention.***
13. Reset (twist) the E-Stop button to restore power.
14. Check that the footbrake stops the motor.
15. Return the motor control lever to OFF, mid-travel.
16. Shift the motor control lever UP. The spindle should Reverse, clockwise rotation, viewed at the chuck (nose) end. *The control system can be rewired for UP = Forward, see the electrical diagram, Section 5.*

Figure 1-7 **Motor control lever**
Mid-travel OFF, DOWN Forward, UP Reverse

Figure 1-8 **Front panel controls**
The Feed Direction knob is shown here in the neutral condition (no feed), leadscrew and feed shaft disengaged.

OPTIONAL TEST RUN PROCEDURE

Run the spindle for a few minutes, forward and reverse, at a selection of the available 12 speeds.

If desired, the saddle feed gearbox may also be run at this time, but first make certain that all components affected have been lubricated, then exercise the saddle and cross slide manually before power-feeding — see Section 3 for power feed directions.

Precision Matthews recommends draining and refilling all three gearboxes (Headstock, Saddle Feed and Apron) after approximately 20 hours of initial run time. Lubricants are specified in Section 4.

ALIGNING THE LATHE

The most important attribute of a properly set up lathe is its ability to "machine parallel", to cut a cylinder of uniform diameter over its entire length. In other words, no taper.

Leveling of the lathe is a part of this, see earlier in this section. Equally important is the alignment of the center-to-center axis with the lathe bed, as seen ***from above***. [Vertical alignment is nowhere near as critical, rarely causing taper unless the lathe is damaged or badly worn.] For more information see the final pages of Section 4, Servicing the Lathe.

Section 2 FEATURES & SPECIFICATIONS

MODEL PM-1440GT Lathe

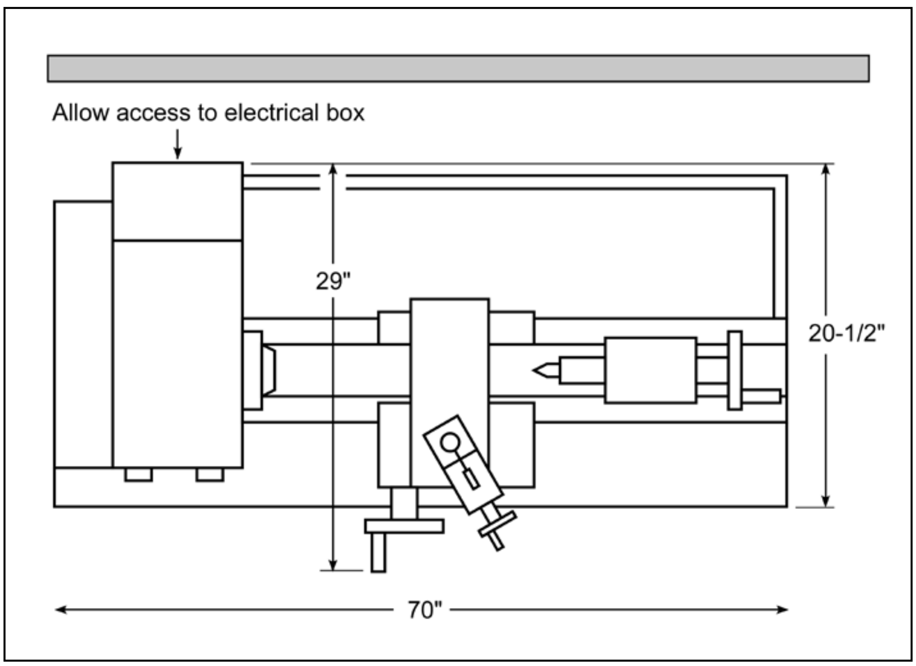
General information

The PM-1440GT is a high precision gap-bed lathe. With an all-up weight of 1750 lb, plus 12 spindle speeds from 50 to 2000 rpm, it is a robust heavy-duty machine designed for day-in, day-out use in production and in the larger model shop. Two motor options are available: 2 HP (220 Vac 1Ø) or 3 HP (220 Vac 3Ø).

All major castings are in Meehanite FC-25 iron for the greatest rigidity and freedom from vibration. The spindle has a 2-inch bore, and is unusually short — just 15-1/2 inches, ideal for through-spindle work such as gunsmithing. Long service life is assured by high precision taper-roller spindle bearings, together with hardened and ground bed ways, shafts and headstock gears. All gears in the machine are oil-bath lubricated.

A saddle-feed gearbox, together will a full set of external change gears, provides for a full range of U.S. threads from 3 to 56 TPI, and metric threads from 0.4 to 7.2 mm pitch. Importantly, for inch threading there is rarely a need to reconfigure the external gears — with just one exception (13 TPI), a single gear setup cuts all UNC and UNF threads from 1/8” (#5) to 4” diameter (44 TPI to 4 TPI).

In addition to the thread-cutting leadscrew the saddle-feed gearbox drives an independent feed shaft that powers both the saddle and cross-slide. A friction clutch allows the saddle to be stopped precisely at any point along the bed. A treadle-operated drum brake stops the spindle instantly, even at the highest speeds. A circulating coolant system is installed in the right hand stand cabinet.



PM-1440GT Floor plan: approximate dimensions (not to scale)

PM-1440GT SPECIFICATIONS

Dimensions, approximate overall, incl. stand	Width 70 in. x Height 47 in. x Depth 29 in. (full range cross slide motion)
	Footprint: 68 in. wide x 16-1/2 in. deep
	Bed length, excluding headstock: 51 in.
	Spindle centerline to floor: 43 in.
	Weight, approximate:1750 lb net

Power requirement	220 Vac, 60 Hz, 1Ø, 13A max (option: 220 Vac, 3Ø, 9A max)
Motor	TEFC type, 1725 rpm, optional 2 HP 1Ø or 3 HP, 3Ø

Work envelope

Headstock center to tailstock center	40 in. max
Swing over bed	14 in. diameter
Swing over cross slide	8-3/4 in. diameter
Swing over gap	20-3/4 in. diameter
Gap insert length	7-3/4 in.
Spindle face to tailstock quill face	44 in. max
Saddle travel	36-1/4 in.
Cross-slide travel	6-1/2 in.
Compound (top slide) travel	3-1/2 in.

Drive system

Belt drive with 12-speed gearbox)	
Low range, rpm	50, 70, 95, 140
Mid range	180, 250, 340, 510
High range, rpm	700, 980, 1350, 2000

Carriage drive, thread cutting	Leadscrew 8 tpi
Inch threads	Choice of 36, from 3 to 56 TPI
Metric threads	Choice of 34, from 0.4 mm to 7.2 mm pitch
Saddle drive, turning operations	Choice of feed rates from 0.0026 to 0.0368 in./spindle rev

Cross slide drive, facing operations	Choice of feed rates from 0.0013 to 0.0184 in./spindle rev

Spindle

Chuck/faceplate attachment	D1-5 Camlock
Internal taper	MT5-1/2
Spindle bore	2 in. diameter
Spindle length, LH end to chuck mounting face	15-1/2 in. overall
Spindle length, LH end to chuck face (typical)	19-1/2 in. approx.

Tailstock

Internal taper	MT3
Quill travel	4 in.

Work holding (typical)

3-jaw chuck, 8 in.	
4-jaw chuck, 8 in.	
Faceplate	
Center rest (steady rest) capacity	Up to 3 in. diameter
Follower rest capacity	Up to 1 in. diameter

Everyday precautions

- This machine is intended for use by experienced users familiar with metal-working hazards.
- Untrained or unsupervised operators risk serious injury.
- Wear ANSI-approved full-face or eye protection at all times when using the machine (everyday eyeglasses are not reliable protection against flying particles).
- Wear proper apparel and non-slip footwear – be sure to prevent hair, clothing or jewelry from becoming entangled in moving parts. Gloves – including tight-fitting disposables – can be hazardous!
- Be sure the work area is properly lit.
- Never leave chuck keys, wrenches or other loose tools on the machine.
- Be sure the workpiece, toolholder(s) and machine ways are secure before commencing operations.
- Use moderation: **light** cuts, **low** spindle speeds and **slow** table motion give better, safer results than "hogging".
- Don't try to stop a moving spindle by hand – allow it to stop on its own.
- Disconnect 220 Vac power from the lathe before maintenance operations such as oiling or adjustments.
- Maintain the machine with care – check lubrication and adjustments daily before use.
- Clean the machine routinely – remove chips by brush or vacuum, not compressed air (which can force debris into the ways).

No list of precautions can cover everything.
You cannot be too careful!

Section 3 USING THE LATHE

What is not in this section ...

The PM-1440GT is a conventional engine lathe that requires little explanation except for details specific to this particular model — speed selection, thread cutting, and the saddle/cross-slide power feed system. Because the user is assumed to be familiar with general purpose metal lathes, this section contains very little tutorial.

MOTOR CONTROLS Figure 3-1

!

Before doing ANYTHING, check the installation instructions and power-up procedure in Section 1

STOP the motor before changing speed

Don't use JOG unless the gears are fully meshed

Figure 3-1 **Main control panel**

Before connecting power to the lathe, be sure the Motor Control Lever on the apron is set to OFF, Figure 3-2. Connect the lathe to a 220 Vac outlet — the POWER lamp should light — then operate the Motor Control Lever to run the spindle in the desired direction.

Check that the E-Stop button and Footbrake interlocks function correctly.

Figure 3-2 **Motor control lever**
Mid-travel OFF, Down FORWARD, Up REVERSE

DRIVE TRAIN

Double-groove pulleys connect the motor to the gearbox, Figure 3-3. Belt tension will not usually require attention. If adjustment is necessary, see Section 4.

Firm finger pressure here should deflect the Vee belt about 1/4"

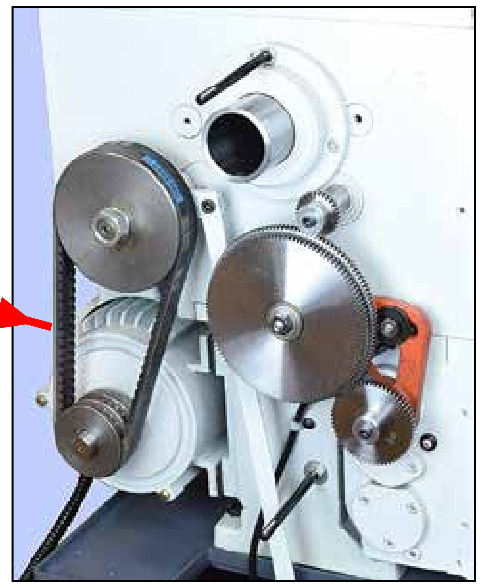


Figure 3-3 **Vee belts & external change gears**

SPINDLE SPEEDS

The PM-1440GT has a twelve-speed headstock gearbox with two shift levers, L-M-H & 1-2-3-4 (Speed Selection), Figure 3-1. Before changing speed, use the Motor Control, Figure 3-2, to ***STOP THE MOTOR***, then move the shift levers to the desired setting. This may need a little patience because it is not always possible to go directly from one mesh to another. Move the spindle back and forth by hand while trying to ease the lever into its detent (meshed) position. ***Don't use the JOG button in this process*** — this may cause gear damage.

	SPINDLE SPEED (RPM)			
	1	**2**	**3**	**4**
H RANGE	2000	1350	980	700
M RANGE	510	340	250	180
L RANGE	140	95	70	50

JOG FEATURE

"Jog" is momentary-type push-button, active only if the Motor Control lever is in the mid-travel (OFF) position, Figure 3-2. Press the button briefly to "nudge" the spindle forward by a few degrees. Jog can be used to reposition the chuck and/or workpiece, especially useful when low spindle-speed gearing makes hand rotation difficult.

The control system can be rewired for "Reverse Jog", see the electrical diagram, Section 5.

SADDLE FEED DIRECTION

The control knob with pointer below the speed selectors, Figure 3-1, determines whether the saddle feed is right to left — the usual direction for turning and thread cutting — or reversed. The selected direction applies to both the leadscrew and the saddle/cross slide power feed. Power feed is OFF when the knob is at 12 o'clock position, as in the photo.

Before changing feed direction, ***STOP THE MOTOR***. Hand-turn (jiggle) the spindle while feeling for the mesh, as above. To disengage the power feed, set the Saddle Feed lever to its mid-position.

More information on the power feed system is provided later in this Section, see ***Saddle Feed Gearbox***.

CHUCKS & FACEPLATE

The spindle nose on the PM-1440GT accepts D1-5 Camlock chucks, faceplates and other work holding devices.

A D1-5 chuck or faceplate is held by six threaded studs, each with a D-shape crosscut to engage a corresponding cam in the spindle nose, Figures 3-4, 3-5. The function of the cams is to pull the chuck backplate inward to locate its internal taper firmly on the spindle nose.

Alongside each stud is a stop screw, the head of which fits closely in a groove at the threaded end of the stud. The function of the stop screw is not to clamp the stud in place, but instead to prevent it from being unscrewed when the chuck is out on the bench.

! ***All stop screws must be present & fully tightened! Camlock action can jam any stud lacking a stop screw — a serious problem.***

Figure 3-4 **D1-5 faceplate**

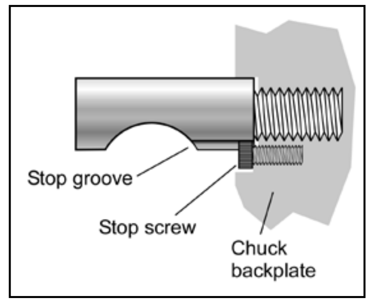


Figure 3-5 **Camlock stud**

TO INSTALL A CHUCK

Disconnect the 220V supply from the lathe!

D1-5 chucks and faceplates are heavy, some more than 30 lb. They will cause serious damage if allowed to fall. Even if a chuck is light enough to be supported by one hand, the lathe bed should be protected by a wood scrap, as Figure 3-6. Some users add packing pieces, even custom-made cradles, to assist "straight line" installation and removal.

Before installing make certain that the mating surfaces of the chuck/faceplate and spindle are ***free of grit and chips***.

The cams on the spindle are turned with a square-tip wrench similar to the chuck key (may be same tool in some cases).

Recommended procedure:

1. Select the highest spindle speed (2000 rpm) to allow easier hand rotation of the spindle. (Alternatively, try moving the speed selection levers between detents to find a "between teeth" condition to disengage the gear train.)

Figure 3-6 **Protect the lathe bed**

2. Turn the spindle by hand, checking that all six cam markers are at 12 o'clock.
3. While ***supporting its full weight***, install the chuck without tilting, see Figure 3-7, then gently turn each of the cams ***clockwise*** — snug, firm, but not locked in this first pass.

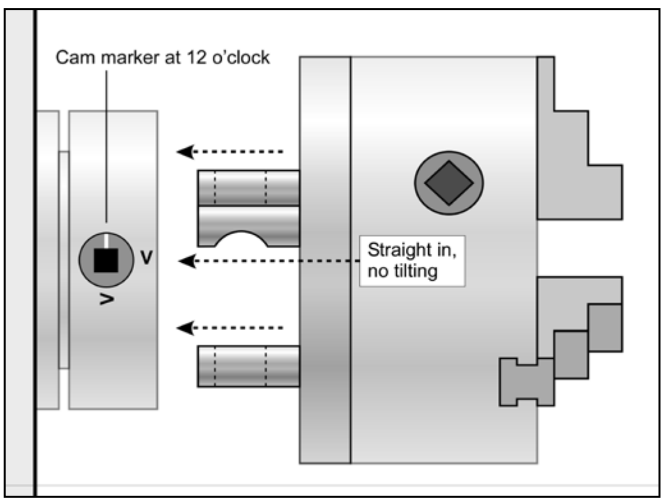


Figure 3-7 **Installing a Camlock chuck**

4. Check that each of the cam markers lies between 3 and 6 o'clock, between the two Vees stamped on the spindle, Figure 3-8.
5. If any cam marker is ***not*** within the Vees, first be sure that there is ***no gap*** between chuck backplate and spindle flange. Also, remove the chuck to inspect the studs — burrs can be a problem, hone if necessary. ***If there are no visible problems, the stud in question may need adjustment as follows:***

- Remove the stop screw from the stud.
- If the cam marker in question can't get to the first Vee (3 o'clock), back the stud **OUT** one full turn, then replace the stop screw.
- If the cam marker goes beyond the second Vee (6 o'clock), screw the stud **IN** one more turn, then replace the stop screw.
- If the markers are correctly aligned, repeat the tightening sequence as step 3, light force. Repeat the sequence two more times, first with moderate force, then fully tighten.

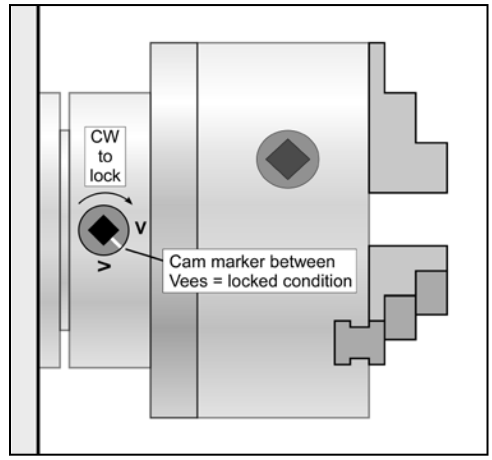


Figure 3-8 **Cam in locked condition**

TO REMOVE A CHUCK OR FACEPLATE

Disconnect the 220V supply from the lathe!

Protect the lathe bed, as Figure 3-6. While supporting its weight, turn each of the cams to 12 o'clock, Figure 3-7, then remove the chuck. If the chuck does not come free, try tapping the backplate gently with a soft (dead blow) mallet.

CROSS SLIDE & COMPOUND

The cross slide and compound have 10 TPI leadscrews, with 100-division graduated collars, Figure 3-9. Each division represents a "true" motion of 0.001". On the cross slide dial, only, this shows as 0.002" per division, meaning that a 0.001" depth of cut reduces the diameter of the workpiece by 0.002".

The collars also have 127-division metric graduations, displaying "true metric" motion of 0.02 mm per division on the compound, 0.04 mm on the cross slide.

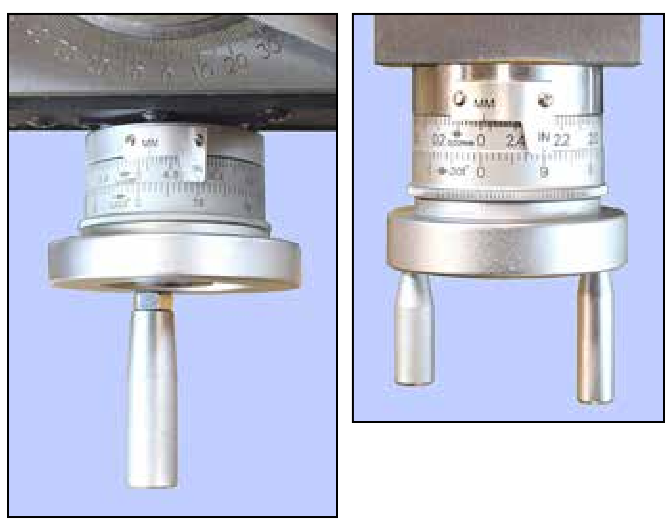


Figure 3-9 **Cross slide and compound dials**

TAILSTOCK

The tailstock leadscrew has a 10 TPI thread, with 4 inch travel. Inch and metric graduated collars on the tailstock handwheel read 0.001” and 0.02 mm per division. A transverse slot at the narrow end of the internal taper (MT3) provides clearance for drills and other devices with tang ends. To remove tooling from the tailstock taper turn the handwheel counter-clockwise (handle end view) until resistance is felt, then turn the handle a little more to eject the tool. Conversely, to install a taper tool make certain that the quill is out far enough to allow firm seating.

For taper turning the tailstock may be offset by adjusting set screws on either side, Figure 3-10. To move the tailstock to the front, for instance, the screw on the lever side would be unscrewed, then the opposing set screw would be screwed in to move the upper assembly. Clamp screws hold the tailstock firmly against a transverse rib in the base casting. Loosen them if necessary to allow offsetting.

A visual indication of the offset is provided by a scale on the back surface, but this is not a reliable measure for precise work. In practice, the only way to determine the offset precisely is to "cut and try' on the workpiece, or scrap stock, homing in on the correct degree of offset in small increments.

The same issues arise when re-establishing "true zero" of the tailstock, in other words returning it to the normal axis for routine operations. One way to avoid cut-and-try is to prepare in advance a bar of (say) 1" diameter quality ground stock, with ***precise center drillings*** at both ends (do this by indicating for zero TIR in a 4-jaw chuck, not in a 3-jaw unless known to be predictably accurate). The prepared bar can then be installed between centers and indicated along its length.

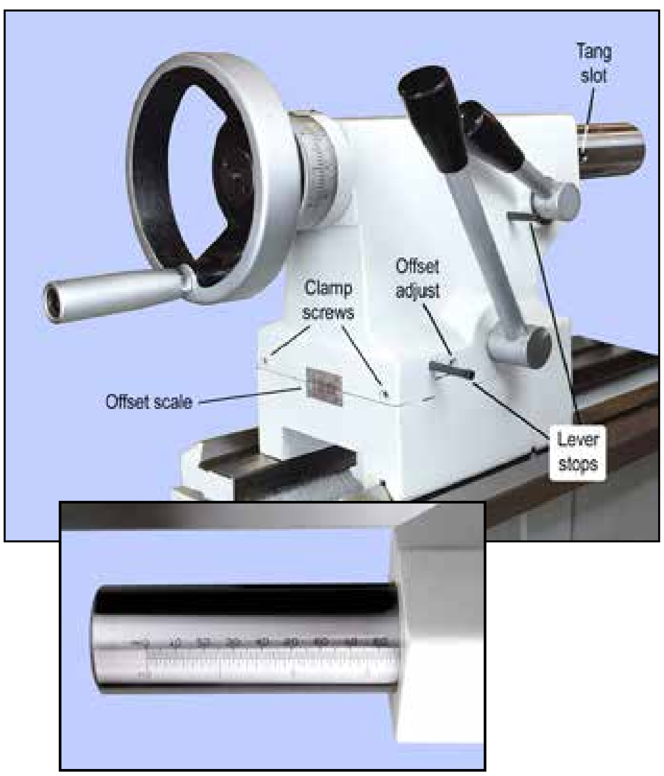


Figure 3-10 **Tailstock**

SADDLE FEED GEARBOX

Stop the motor before changing feed direction or rate

The saddle feed can be to the left, right, or disengaged, as selected by the Saddle Feed knob on the main control panel, Figure 3-1.

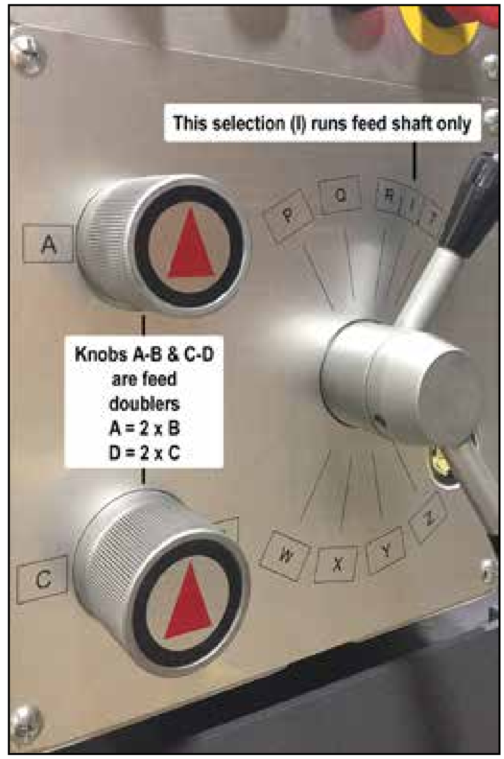


Figure 3-11 **Saddle feed gearbox controls**

ENGAGING THE POWER FEED

To activate the feed shaft set the upper lever on the gearbox, Figure 3-11, to ***LETTER 'I'*** (selections **P-Q-R-T** are used only for thread cutting).

The ***power feed lever*** on the apron, Figure 3-12, is active only when the feed shaft is rotating (the ***split-nut lever*** engages the leadscrew, and is typically used only for thread cutting).

When engaging power feed, ***move the lever gently***, feeling for the gears to mesh as you go. If the gears don’t engage at the first try, use the appropriate handwheel to jog the saddle or cross slide, whichever one you wish to move under power.

The split-nut lever — used for thread cutting — cannot be engaged unless the power feed lever is NEUTRAL, neither up or down.

The rate of power feed relative to spindle speed is set by the lower lever on the gearbox, **W-X-Y-Z**, together with the "speed doubler" knobs **A-B** and **C-D**. Feed rates are listed on the following page.

SADDLE & CROSS-SLIDE FEED RATES

Use the same change gear setup as for TPI thread cutting (30T upper/60T lower, following page

Figure 3-14 lists inches of travel per revolution of the spindle, rounded to the nearest 0.001". Saddle motion is 2 times cross-slide motion. In practice most users stay with only the one gear shift setting, such as I-X, controlling the feed rate by the "doubler knobs", A-B and C-D. For an overall faster feed rate, use I-Y.

Gear shifters → ↓	I - W		I - X		I - Y		I - Z	
	Saddle	**Cross-slide**	**Saddle**	**Cross-slide**	**Saddle**	**Cross-slide**	**Saddle**	**Cross-slide**
A - D	0.021	0.0105	0.0295	0.0148	0.0368	0.0184	0.0226	0.0113
B - D	0.0105	0.0053	0.0148	0.0074	0.0184	0.0092	0.0113	0.0057
A - C	0.0053	0.0027	0.0072	0.0036	0.0092	0.0046	0.0056	0.0028
B - C	0.0026	0.0013	0.0036	0.0018	0.0046	0.0023	0.0028	0.0014

Figure 3-14 **Power feed rates (inches per spindle rev)**

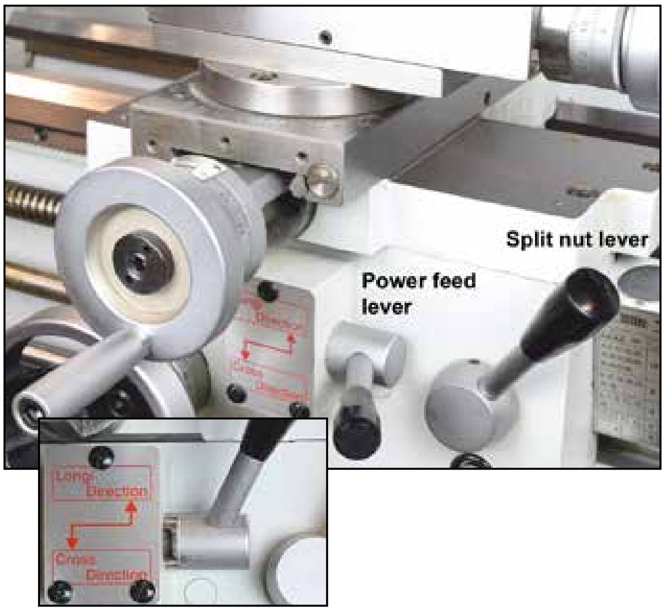


Figure 3-12 **Feed control levers on the apron**
*The split nut lever is used only for thread cutting. In the main photo the power feed lever is in its neutral — disengaged — state. To power the saddle (**Longi**), pull the lever OUT and UP, inset. To power the cross-slide, push the lever IN and DOWN. Test for engagement/dis-engagement by gently jiggling the saddle and cross-slide handwheels.*

SADDLE STOP

The stop assembly, Figure 3-13, has a micrometer-style collar graduated in 0.001 in. divisions. It can be clamped at any point along the lathe bed (two M6 socket head screws on the underside secure the clamp plate to the block). Make certain that the stop rod seats firmly on the saddle casting.

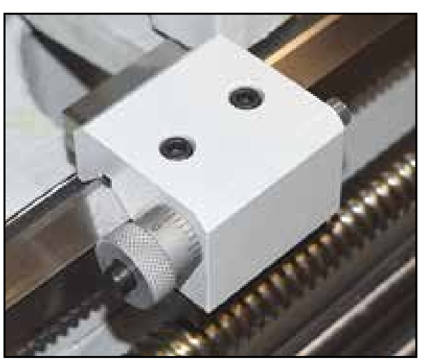


Figure 3-13 **Saddle stop**

FEEDSHAFT CLUTCH

The clutch shown in Figure 3-15 disengages the power feed if the saddle or cross slide hits an obstruction when power feeding, thus minimizing the potential for damage. This could be the result of either an accidental event, or deliberately stopping the saddle at a precise location set by the stop, Figure 3-13.

The clutch comprises a pair of spring loaded steel balls bearing on a detent disc driven by the saddle feed gearbox. Spring pressure is adjusted by two set screws on either side of the feed shaft, arrowed in Figure 3-15. Setting the spring pressure is a process of aiming for the best compromise between too high — damaging feed pressure — and too low, stopping prematurely.

Setting the clutch to work reliably with the micrometer carriage stop is a good example of such a compromise: start with low spring force, then work up in small increments until the carriage stops in the same location (say ± 0.002", assuming a constant depth of cut and feed rate).

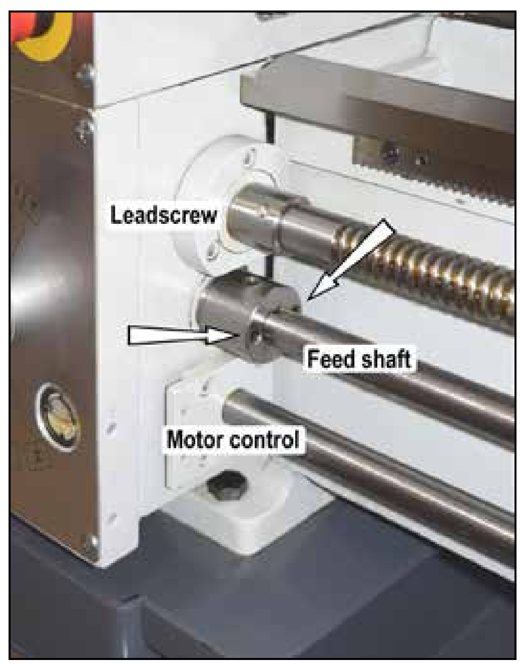


Figure 3-15 **Feedshaft clutch**

THREAD CUTTING

External change gears

The large gears in Figures 3-18 are ***transposing gears***, 120T and 127T. They allow a standard-thread leadscrew, in this case 4 TPI, to cut metric threads. The transposing gears are keyed together.

Figure 3-18 **External change gears**

KEY FACTS TO REMEMBER ...

TPI threads

When configured for inch thread cutting (30T upper, 60T lower), with just one exception the lathe cuts ***all UNC and UNF threads*** from 1/8” (#5) to 4” diameter, 44 TPI to 4 TPI, without the need to change gears. The exception is 13 TPI, which requires 65T as the lower gear.

For inch thread cutting, the 127T larger gear is simply an ***idler***, transferring the drive from the upper gear to the lower gear. In this configuration, the spacer bushing is ***outside*** the lower gear, as Figure 3-18.

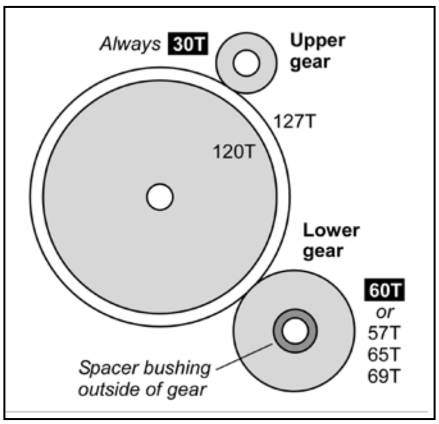


Figure 3-16 **Configuration for TPI thread cutting**
For all TPI threads (U.S.A.) the 127T gear is an idler between upper and lower gears.

	Gear shifters								
	P-X	P-X	Q-X	T-Z	R-X	R-X	Q-Z	P-X	R-W
Lower gear	**60**	**65**	**60**	**60**	**57**	**60**	**60**	**69**	**60**
A-D	3	3-1/4	4	4-1/2	4-3/4	5	5-1/2	5-3/4	7
B-D	6	6-1/2	8	9	9-1/2	10	11	11-1/2	14
A-C	12	13	16	18	19	20	22	23	28
B-C	24	26	32	36	38	40	44	46	56

Figure 3-17 **Threads per Inch (TPI)**

Gear swapping

Any change to the drive train typically calls for one or both of the upper and lower gears to be exchanged for a larger or smaller gear. This will require the transposing gear pair to be repositioned. The procedure for this is:

1. Remove the M6 socket head screws from the upper and lower gear shafts.
2. Remove the gears, washers, keys and bushing (lower gear only).
3. While holding the gear support casting (quadrant) with one hand, use a 19 mm wrench to loosen its anchor nut. Allow the casting to swing downward.
4. Loosen the 19 mm hex nut securing the transposing gears to the support casting.
5. Install the lower gear (for TPI threads the lower gear spacer is outside, for metric threads, inside).
6. Bring the transposing gears into mesh with the lower gear, trapping a scrap of bond paper (letter stock) between the two to hold them at the correct separation.
7. Tighten the transposing gears in position, then remove the paper. Check for working clearance between the gears.
8. Install the upper gear.
9. Swing the gear support casting upward to mesh the 127T gear with the upper gear, again using a paper scrap for separation.
10. Tighten the gear support casting.
11. Lubricate the gears.

Metric threads

With the change gears supplied the lathe cuts all COARSE metric threads from M3 to M36 (pitches 0.5 to 4.0 mm) and all FINE metric threads from M4 to M100 (pitches 0.5 to 6.0 mm).

For metric thread cutting, the lower gear is driven by the 120T transposing gear. In this configuration, not shown, the spacer bushing is ***inside*** the lower gear.

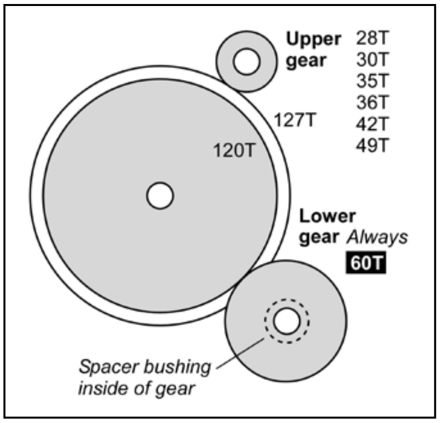


Figure 3-19 **Configuration for metric thread cutting**
For all metric thread pitches lower gear is driven by the smaller (120T) transposing gear.

	Gear shifters							
	R-W	Q-W	R-W	Q-W	R-W	Q-X	Q-W	Q-X
Upper gear	**28**	**28**	**42**	**35**	**49**	**30**	**49**	**36**
A-D	3.2	4.0	4.8	5.0	5.6	6.0	7.0	7.2
B-D	1.6	2.0	2.4	2.5	2.8	3.0	3.5	3.6
A-C	0.8	1.0	1.2	1.25	1.4	1.5	1.75	1.8
B-C	0.4	0.5	9.6		0.7	0.75		0.9

Figure 3-20 **Metric thread pitches (mm)**

COMPOUND SETUP FOR THREAD CUTTING

Thread cutting on the lathe is unlike most other turning operations, for two reasons: 1. The cutting tool must be precisely ground with an included angle of 60 degrees for most American and metric threads, and; 2. It is preferable to feed the tool into the workpiece at an angle so it cuts mostly on the left flank of the thread, Figure 3-21. The correct angle relative to the cross slide (zero degrees) is debatable — should it be 29, 29-1/2 or 30 degrees? Many machinists prefer 29 degrees because it holds the cutting tool marginally clear of the right flank of the thread, close enough for cleanup of the flank while at the same time avoiding appreciable rubbing.

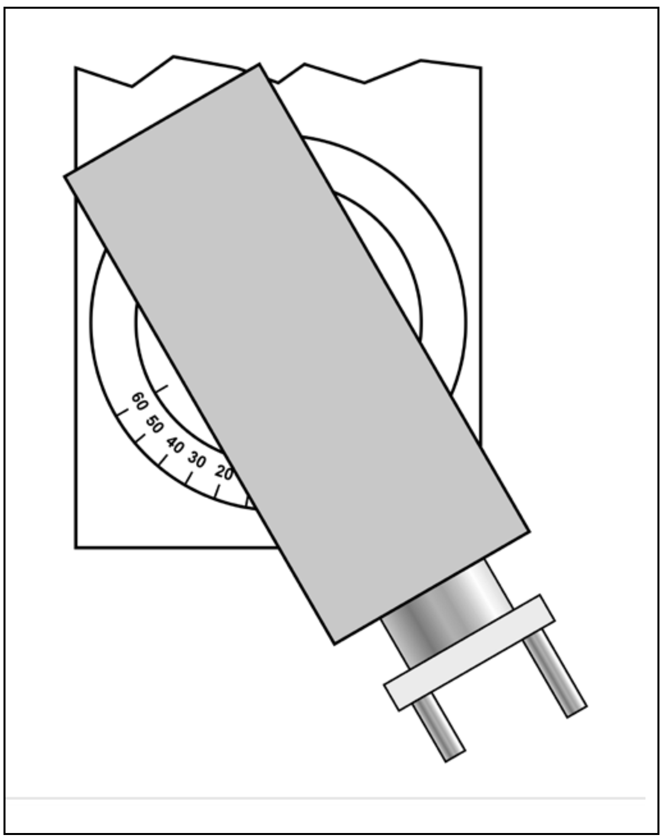


Figure 3-21 **Setting up the compound for 30º infeed**

CUTTING PROCEDURE FOR TPI THREADS

This procedure assumes that a single point thread cutting tool will be used, and that the threading dial assembly, Figure 3-22, has been pivoted forward to engage its worm wheel with the leadscrew.

The threading dial cannot used for metric threads! The split-nut on the apron must be left engaged throughout the entire process.

For metric and UNC/UNF threads the tool is ground to 60º (included angle). It is installed so that its flanks are exactly 30º either side of the cross axis, ideally with the compound offset as Figure 3-21. Single-point threads are cut in 10 or more successive passes, each shaving a little more material off the workpiece.

To make the first thread-cutting pass the leadscrew is run at the selected setting (tables on this, and preceding pages), and the carriage is moved by hand to set the cutting tool at the starting point of the thread. With the tool just grazing the workpiece, the split-nut lever is lowered to engage the leadscrew. This can be done at any point, ***provided*** the split-nut remains engaged throughout the ***entire multi-pass thread cutting process***.

When the first pass is completed, the tool is backed out clear the workpiece (using the cross slide), and the spindle is reversed to bring the saddle back to the starting point. The cross slide is returned to its former setting, then the tool is advanced a few thousandths by the compound for the next pass. Each successive pass is done in the same way, each with a slightly increased infeed setting of the compound.

Many users working on U.S. threads save time by disengaging the split-nut at the end of each cutting pass, reversing the saddle by hand, then re-engaging, usually by reference to the threading dial.

If the TPI number is divisible by 2 re-engagement can be done at ***any line*** on the threading dial.

For all other TPI numbers every engagement, ***including the first***, must at the point where a ***specific line*** on the threading

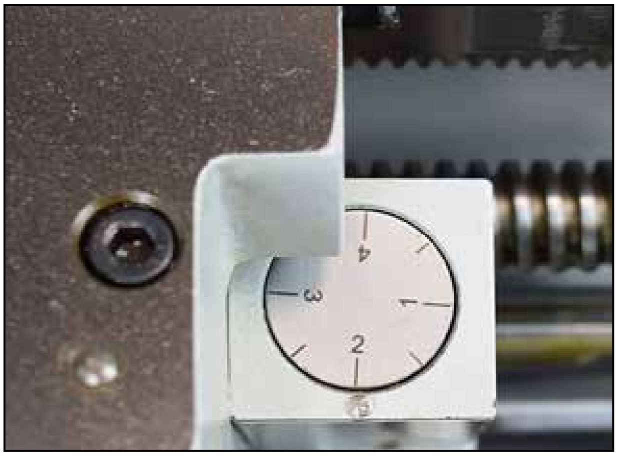


Figure 3-22 **Threading dial**

dial comes into alignment with the datum mark. If not, the second and subsequent passes will be out of sync. In some cases, Figure 3-23, there is a choice of lines for re-engagement, but in every case the process calls for careful timing. [***NOTE:*** Disengagement and re-engagement of the split-nut is not applicable to metric threads].

Typical depths of cut per pass vary from an initial 0.005" or so, to as little as 0.001", even less. A finishing pass or two with increments of only 0.0005" — or none at all, to deal with the spring-back effect, can make all the difference between a too-tight thread and one that runs perfectly.

Assuming that the compound is set over at between 29 and 30 degrees, the total depth of cut is approximately 0.69 times the thread pitch, P (this equates to a straight-in thread depth of 0.6 times P). There may be a need for a few thousandths more in-feed than 0.69P, almost certainly not less.

USING THE THREADING DIAL

Referring to Figure 3-23, the general rules are:

1. Divide the TPI value by 2: If this gives an ***EVEN whole number***, example 12/2 = 6, re-engage at ***any line*** on the dial, also ***mid-way*** between the lines. (This equates to the 16 choices on the dial plate, Figure 3-24.)
1. If the ÷ 2 result is an ***ODD whole number***, examples 10/2 = 5, 14/2 = 7, re-engage at ***any line*** on the dial, but ***NOT*** mid-way between the lines.
2. If the TPI value is a whole number not divisible by 2, example 7, re-engage on the start line, or any line at right angles to it.
3. If the TPI value is fractional, but becomes a whole number when multiplied by 2, example 4-1/2, re-engage only on the start line, or its diametrical opposite.

If in doubt, re-engage on the start line!

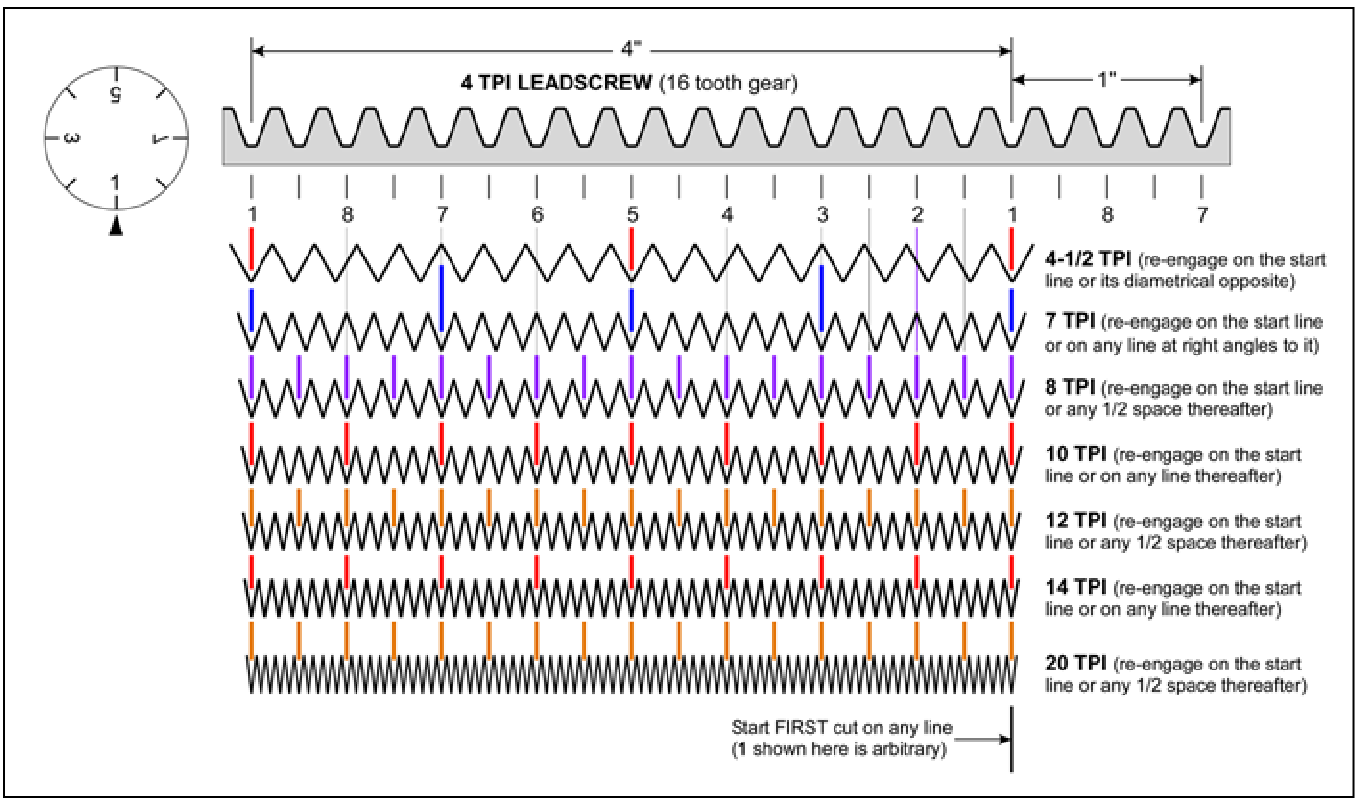


Figure 3-23 **Threading dial visualization for selected U.S. threads**
Minimize wear by swinging the dial indicator assembly away from the leadscrew when not in use

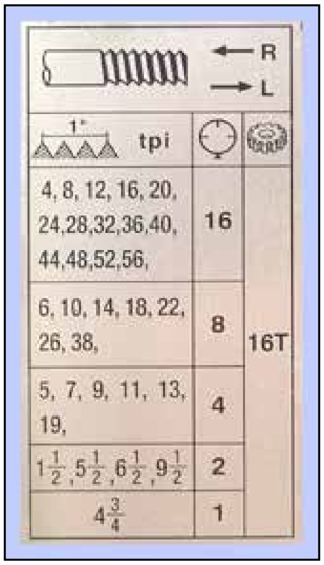


Figure 3-24 **Threading dial plate**

STEADY & FOLLOWER RESTS

The hinge-type steady rest, Figure 3-25, can be mounted anywhere along the lathe bed. It makes possible cutting operations on long, slender workpieces between centers, or held at one end by chuck. The steady rest is often used in combination with the saddle-mounted follower rest, Figure 3-26.

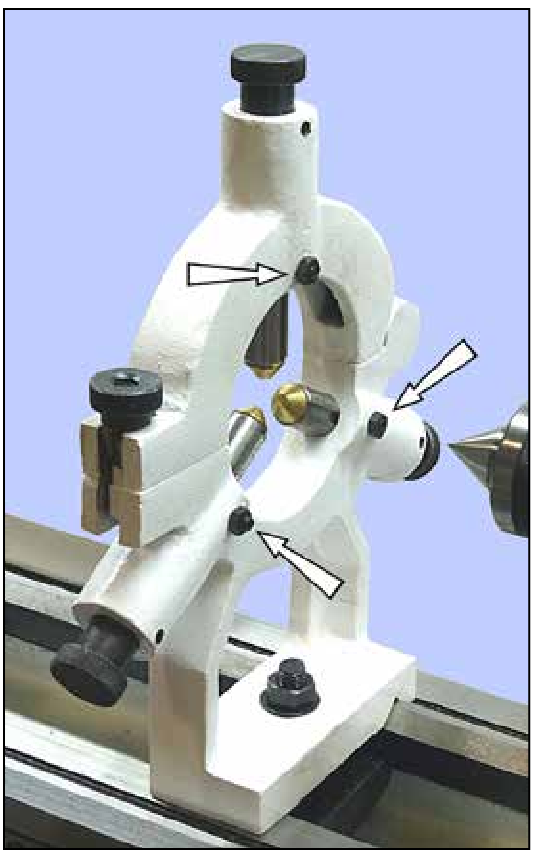


Figure 3-25 **Steady rest** (representative)

To set the fingers on the workpiece, first swing open the upper casting. Make certain that all three fingers are freely adjustable by thumbwheel. If not, loosen and re-lock the set screws (arrowed). Raise the two lower fingers to just touch the workpiece — not deflecting it — then close and secure the upper casting. Lower the top finger to just touch the workpiece, clamp the frame, then apply oil at the point of contact.

The follower rest, Figure 3-26, is secured to the saddle with two 8 mm socket head screws. Adjust the follower fingers as described for the steady rest.

Figure 3-26 **Follower rest** (representative)

LOCKING THE SLIDES

When face-cutting large diameter surfaces, for instance, it is often desirable to lock the saddle. Less frequently it can be helpful to lock, or at least stiffen, sliding motion of the cross slide and compound, Figure 3-27.

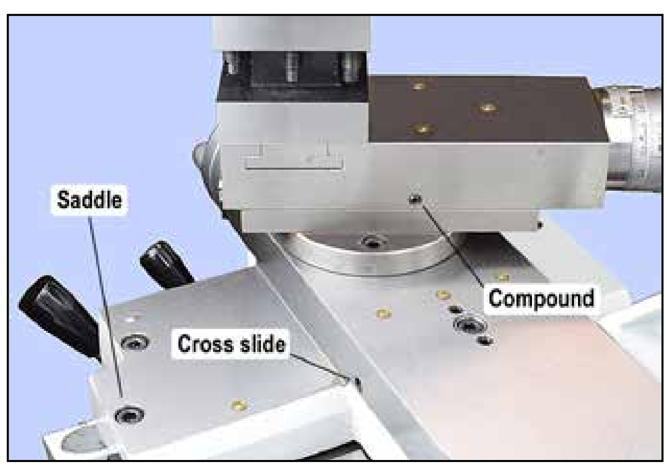


Figure 3-27 **Saddle, cross slide and compound locks**

GAP BED

A 7-3/4 inch long section of the bed at the headstock end can be removed to allow turning of diameters up to 20-3/4 in., Figure 3-28.

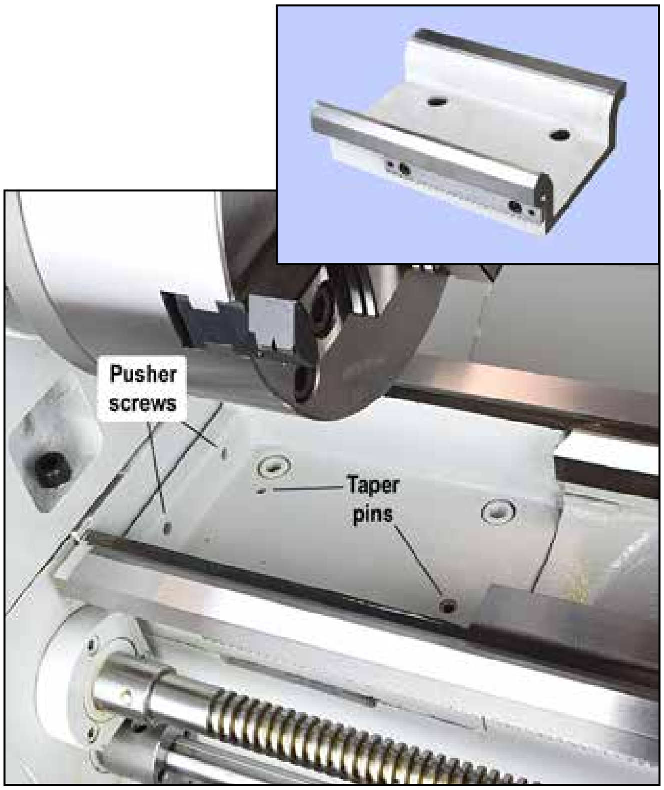


Figure 3-28 **Gap insert**

To remove the gap insert back out the pusher screws one or two turns, then remove the four large socket head screws securing the insert to the bed. To minimize cosmetic damage, cut through the paint and filler along the joint between insert and bed using a sharp knife or pointed scraper.

Jack out the two taper pins using M5 screws and oversize collars. Tap the insert free with a soft-face mallet.

Before re-installing the insert, be certain that all mating surfaces are scrupulously clean. Set the insert in place, lightly tap in the two locating pins, then install the four large bolts (snug, but not fully tightened). Jack the insert to the right with the pusher screws to close the gap, if any, between the ground surfaces of the bed ways at the join (a visible parting line is acceptable, but a discontinuity that snags the saddle is not). If a satisfactory join cannot be achieved, it may be necessary to remove and reinstall the insert from scratch.

COOLANT SYSTEM

The coolant system is typically used with water-miscible (emulsified) cutting fluid. It can also be used with lightweight neat cutting oil straight from the can. Synthetic cutting fluids are not recommended due to their potential for corrosion and other undesirable effects on the lathe and the coolant pump.

If you use water-miscible cutting fluid, bear in mind that the ratio of product to water is important — too much water causes excessive corrosion and other problems. Check the mix from time to time using a refractometer. If this is not available, make up a small batch according to the product directions, then replace with a fresh batch when the old one becomes unusable due to reduced performance, oil/water separation, or bad odor.

Disposal of used cutting fluid can be a problem. It is about 95% water, so its volume can be drastically reduced by evaporation in an open tank. The residue may then be handled like any other waste oil.

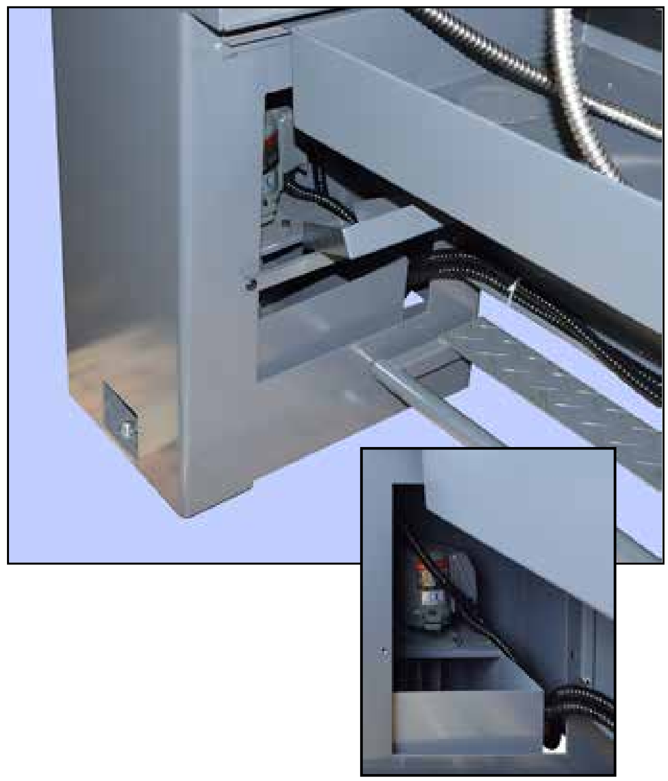


Figure 3-29 **Coolant pump assembly, RH stand cabinet**

PM-1440GT TAPER TURNING ATTACHMENT

This is a toolroom-quality fixture that can be retrofitted to any PM-1440GT lathe manufactured later than 2016. It is a self-contained, center-pivoted design that is attached by a single clamp at any point along the lathe bed. It handles tapers up to 10 inches long, with half-angle from zero to +/- 10 degrees. Taper angle is precisely settable by micrometer-style screw adjustment.

Before installing the attachment, make certain that its two sliding components — Dovetail slide and Follower carriage — move freely without side play. Adjust the gibs and lubricate if neceesary.

Bear in mind that setting up any taper attachment is an iterative, cut and try process. In particular, if you will be using for reference a precision ground bar between centers, first be sure that the tailstock is zeroed accurately — no offset — before working on the taper attachment. The same applies to copying the taper on existing tools, such as taper-shanked reamers, many of which have center holes drilled both ends. [Center-to-center alignment is not an issue if the reference item can be beld in a chuck, in which case it is only necessary to adjust for zero runout at various points along the axis.]

When copying a reference taper, be sure that the indicator probe is exactly at center height.

The taper attachment can remain in place for regular turning operations — simply remove the draw plate and reconnect the cross slide leadscrew. (Alternatively, leave the attachment intact, with the taper guide bar set for zero degrees; in this case use the compound for tool control.)

Install the taper turning attachment as follows:

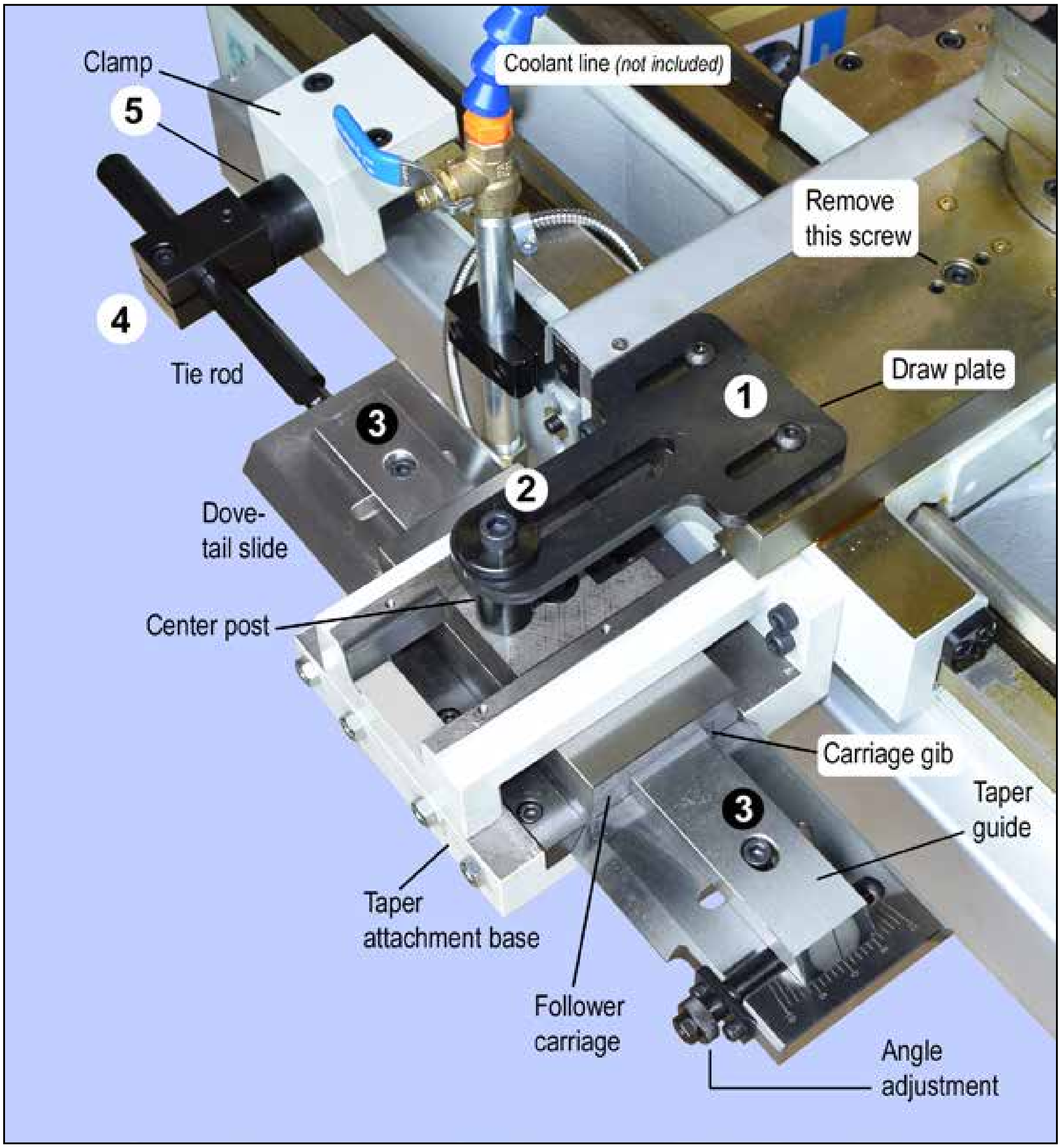


Figure 3-30 **PM-1440GT Taper turning attachment**

1. Remove the socket head cap screw securing the cross slide leadscrew nut to the cross slide body, Figure 3-31. Push/pull the cross slide a few times front to back to be sure the no-longer-captive nut allows free movement throughout the range called for by the taper attachment.

Figure 3-31 **Cross slide leadscrew nut**

2. Make certain that the cross slide gib is properly adjusted for smooth motion without side play.
3. Because the cross slide leadscrew is inoperative, the compound is typically used to infeed the cutting tool. If the infeed needs to be precisely controlled, set the compound to 90 degrees.
4. Install the taper attachment base on the lathe carriage (4 socket head screws).
5. Install the draw plate on the cross slide, with the two round-head socket screws (1) snug but not tight.
6. Check the underside of the draw plate where it meets the center post. It should touch the post with zero gap. Make minor adjustments to the relative height of the attachment base (4 screws), or pack with washers as necessary. (misalignment here can impose a vertical load on the cross slide.)
7. Loosen the tie rod clamp screws, also the set screw securing cam (5). Screw the tie rod into the slide.
8. Set the clamp assembly in the desired location on the rear track of the lathe bed. Rotate the cam to raise or lower the tie rod socket (4) as necessary.
9. Tighten the tie rod and clamp screws, then re-check the center post/draw plate interface.
10. Set the draw plate as desired for the turning operation. Tighten screws (1) and (2). Tighten the cam set screw.
11. Loosen screws (3), set the desired taper angle, see below. Re-tighten the screws.
12. Use the carriage handwheel to run the lathe carriage back and forth a few times, checking for smooth, consistent functioning of both cross slide and follower carriage. There should be no change in load from one end of the taper to the other.
13. With the workpiece installed engage carriage power feed to cut the taper.

Setting the taper angle

No matter what method you use to set the taper angle, bear in mind that all dial indicating should be done ***in one direction only*** to eliminate backlash.

1. If you are using only the angle scale on the attachment to set a taper, the taper guide bar needs first to be zeroed relative to the lathe bed. Do this using a ground bar between centers or in a chuck, see above, with a magnetic-based dial indicator positioned on the cross slide so that its probe runs on the bar. Adjust the taper angle for zero deflection along the length of the bar.

2. To cut a matching taper, use the same setup to indicate the reference item, either between centers or held in the chuck. Aim for zero deflection as the probe traverses the taper. This calls for patience — expect several iterations to achieve this. Be sure the indicator probe is at center height.

Section 4 SERVICING THE LATHE

Disconnect 220V power before any maintenance operation!

Remove all machining debris and foreign objects before lubricating ANYTHING! If need be, any oil is better than no oil – but use the recommended lubricants when you can.

GENERAL

Aside from abrasive particles and machining debris, lack of proper lubrication is the main cause of premature wear. Rotating parts are easy to lubricate, sliding parts are not. Gibs are tightened for the best compromise between rigidity and slideability, which means practically zero gap between the ways. It is not obvious which are the bearing surfaces on the various dovetail surfaces — some of the interfaces look like bearing surfaces, but are simply narrow gaps.

Every few hours of operation: 1. Apply the recommended way-oil with a dedicated short-bristle brush such as the type used for applying flux; 2. Use a similar brush to apply oil or grease to the leadscrews; 3. Apply oil to the ball oilers, see below.

The spindle runs on sealed, pre-lubricated roller bearings requiring no routine attention.

Recommended lubricants

Gearboxes: ISO 68, such as Mobil DTE Heavy/Medium circulating oil. Approximate quantities required:

Headstock 4 quarts
Saddle feed gearbox 2 quarts
Apron 1 quart

Ball oilers: ISO 68 way oil, such as Mobil Vactra No. 2, or equivalent.
Machine ways (dovetails): ISO 68 way oil, such as Mobil Vactra No. 2, or equivalent.
External change gears: light general purpose grease, NLGI No. 2, or equivalent.
Leadscrews: ISO 68 way oil, such as Mobil Vactra No. 2, or equivalent.

BALL OILERS

Use a pump-type oil can, preferably with a flexible spout tipped with a soft tube. The ID of the tip should be large enough to seat on the oiler's brass flange, more than spanning the spring-loaded steel ball. When the oil can tip is firmly pressed onto the brass surface oil pressure will displace the ball, allowing oil to flow into the bearing. Before oiling check that the ball is not stuck – press it lightly with a probe.

HEADSTOCK GEARBOX DRAIN & REFILL

Take time to prepare. 4 quarts is a lot of oil to clean up!

1. Remove the belt cover, left of the headstock.
2. Remove the fill plug on the top surface of the headstock, Figure 4-1.
3. Place a drain pan (2-gallons minimum) on a stool or other support at about the height of the chip tray.
4. Fold a sheet of card stock to make a Vee-shape drain channel. This will be pressed against the headstock below the drain plug, angled downward into the drain pan; trim the upstream end of the Vee so that it seals against the headstock.
5. Run the lathe a few minutes to warm the oil if necessary.
6. With the drain channel in place, remove the drain plug, Figure 4-2.
7. Allow the oil to drain completely. Replace the drain plug, then add just a few ounces of oil.
8. When satisfied that the headstock is oil-tight, add oil to the halfway mark on the sight glass, Figure 4-3 (about 4 qts).
9. Replace the fill plug.

Figure 4-1 **Headstock fill plug**

Figure 4-2 **Headstock drain plug**

Figure 4-3 **Headstock sight glass**

SADDLE FEED GEARBOX DRAIN & REFILL

Make a card-stock Vee channel as described for draining the headstock. Remove the gearbox fill plug, Figure 4-4 (1). Remove the gearbox front panel to expose the drain plug (2), Run the lathe for a few minutes to warm the oil if necessary. With the Vee channel in place, remove drain plug and allow the gearbox to empty completely. Replace the drain plug. To refill the gearbox use a funnel attached to a flexible plastic tube inserted into the fill hole. Add oil to the halfway mark on the sight glass (about 2 qts).

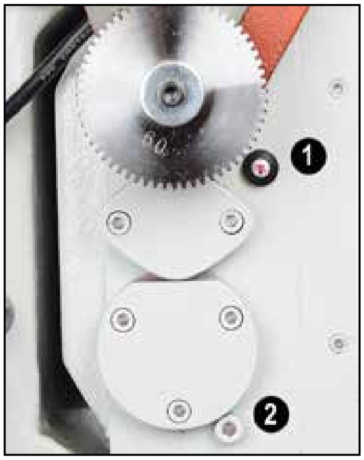


Figure 4-4 **Saddle feed gearbox drain & fill plugs**

Figure 4-5 **Saddle feed gearbox sight glass**

APRON GEARBOX DRAIN & REFILL

Remove the fill plug, Figure 4-6. Remove the drain plug, Figure 4-7,and allow the apron to empty completely. Replace the drain plug. Add oil to the halfway mark on the sight glass (about 1 qt).

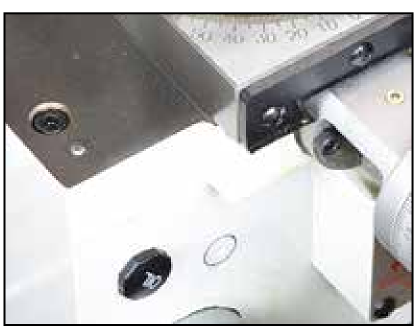


Figure 4-6 **Apron gearbox fill plug**

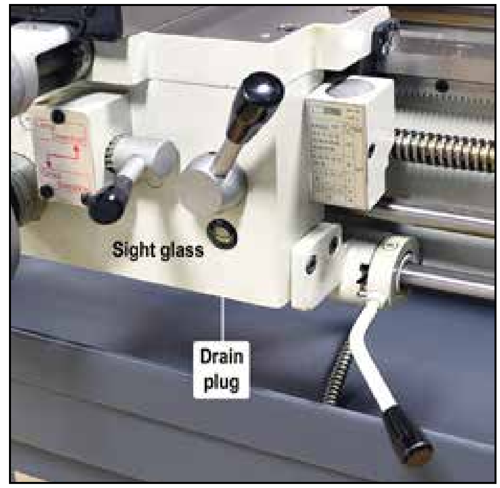


Figure 4-7 **Apron sight glass & drain plug**

BALL OILERS

See the general note on the previous page.

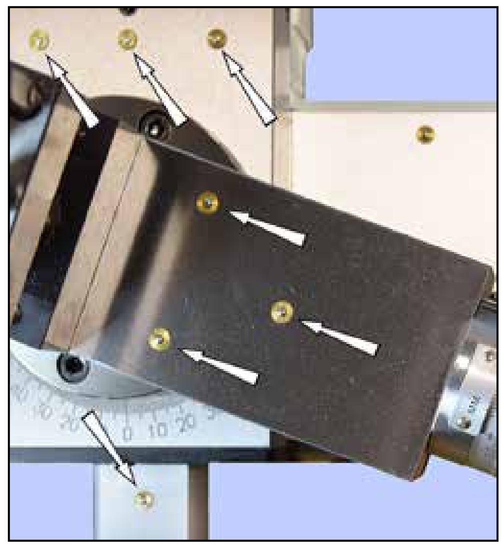


Figure 4-8 **Saddle, cross slide and compound oilers**

Figure 4-9 **Tailstock oiler**

GIB ADJUSTMENT

Gibs on the cross slide and compound, Figures 4-10, 4-11, are gently-tapered lengths of ground cast iron held fast by opposing screws at each end. Adjusting them is a trial and error process that takes time and patience. Aim for the best compromise of rigidity and reasonably free table movement. Too tight means accelerated wear on ways and leadscrews. Too free means instability of the cutting tool, inaccuracies and chatter.

Both screw heads must be tight against the gib ends. If you loosen one, tighten the other.

The saddle gib, Figure 4-12, is not a tapered insert like those on the cross slide and compound. It is a three-part assembly on the underside of the bed way at the back of the lathe. It comprises a support bar, attached to the carriage, and two separate gib strips each with two adjusting screws.

Figure 4-12 **Saddle gib assembly**

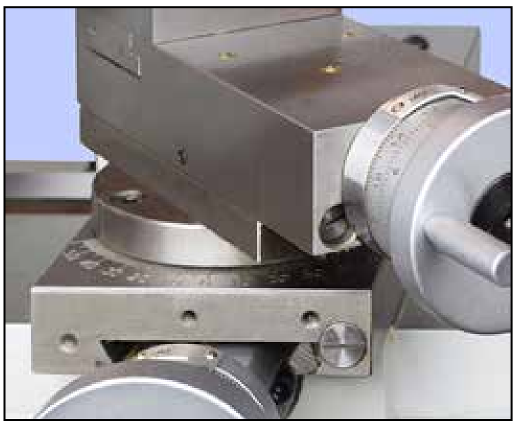


Figure 4-10 **Cross slide & compound front gib screws**

Figure 4-11 **Cross slide & compound back gib screws**

CROSS SLIDE & COMPOUND BACKLASH

When alternating between clockwise and counter clockwise rotation, the cross slide handwheel may move freely a few degrees but the cross slide table stays put. There may also be similar lost motion in the compound. The acceptable amount depends on the user, but 0.005" is generally a good compromise. Smaller numbers are possible, but overdoing it can lead to premature wear of leadscrew and nut.

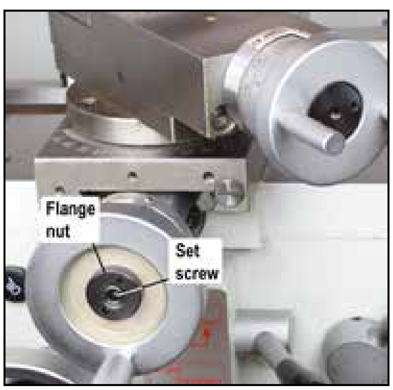
Lost motion is due to two factors: 1. End float caused by insufficiently tight coupling of the leadscrew and thrust bearings. 2. Wear in the leadscrew nut.

Factor #1 is correctable in both the cross slide and compound.

Leadscrew handwheels on the PM-1440GT — cross slide, compound and tailstock — are attached in the same way, Figure 4-13. The handwheel is locked to the leadscrew shaft by a key (not shown). It is held in place by a flange nut screwed into a threaded well in the outer end of the shaft. An internal set screw, bottomed in the well, prevents loosening of the flange nut. To correct backlash due to loose coupling between leadscrew and thrust bearings, back out the set screw a turn or two, then tighten the flange nut using a pin vise or needle-nose pliers. Re-tighten the set screw.

Factor #2 is correctable in the cross slide (only) by compressing the leadscrew nut, Figure 4-14. Remove the compound from the cross slide, then remove the socket head screw securing the cross slide to the leadscrew nut. Turn the cross slide handwheel clockwise to drive the nut backward until it can be worked on at the back. Insert an M6 x 1 socket head screw, approximately 15 mm long, then tighten the screw as necessary. Don't overdo this — a 45 degree turn of the screw represents a backlash takeup of about 0.005".

The compound leadscrew nut is not adjustable.



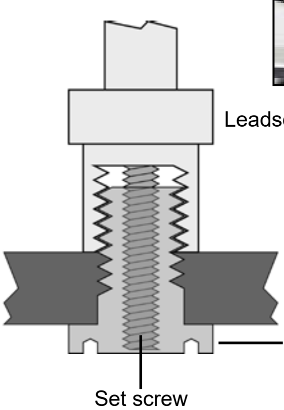


Figure 4-13 **Handwheel attachment**

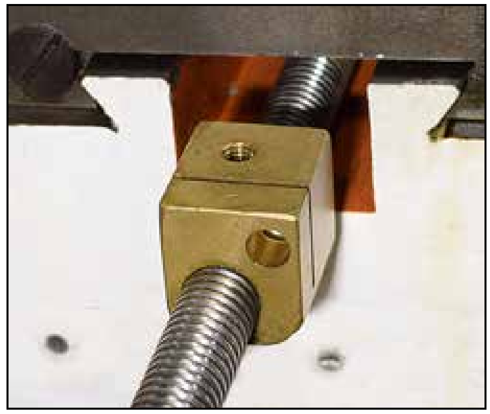


Figure 4-14 **Cross slide leadscrew nut** *(represntative)*

SPLIT NUT ADJUSTMENT

In thread-cutting operations, if the split nut becomes excessively loose — appreciable side to side movement — this may be corrected by adjusting the gib at the right side of the apron. Remove the threading dial, then tighten the two gib screws as necessary, Figure 4-15. ***Overtightening can make disengagement of the split nut difficult.***

Figure 4-15 **Split nut gib screws**

TAILSTOCK CLAMP LEVER

The angular position of the clamp lever is adjustable. Slide the tailstock toward the headstock to expose the threaded stop screw at the right hand end of the bed. Remove the stop screw, then ***very carefully*** slide the tailstock to the right, just far enough to allow access to the hex nut below the tailstock bed plate. Tighten the nut as necessary to achieve sold locking with the lever near-verical.

BRAKE ASSEMBLY

The treadle-operated brake does two things: 1. It disconnects power from the motor, and; 2. It expands brake shoes against the hollowed-out inboard face of the driven pulley.

Inspection of the brake assembly, Figure 4-16, calls for person A to lock the driven pulley while person B removes the hex nut securing the driven pulley.

The inboard face of the driven pulley (the brake drum) should show no gouging or irregularities. Minor damage may be correctable by skimming; otherwise consider replacing the item.

The brake pads should be clean, evenly worn, showing no sign of oil. Minimum pad thickness is 4.5 mm, about 0.18". If necessary replace the pads by separating them — extending the springs — then lifting them clear of the retaining studs.

Figure 4-16 **Brake assembly** *(representative)*

DRIVE BELT ADJUSTMENT

Figure 4-17 **Test for belt tension**

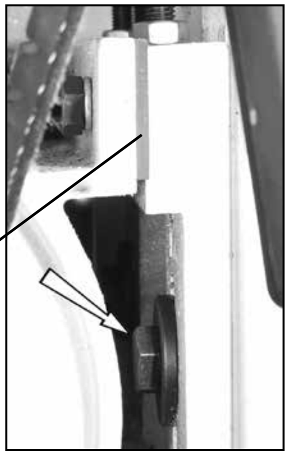


Figure 4-18 **Motor frame bolts**

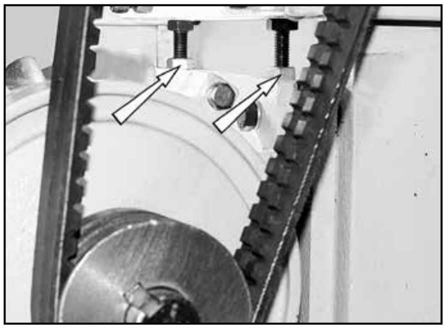


Figure 4-19 **Motor frame pusher screws**

Loosen the two hex-head bolts securing the motor frame to the headstock, Figure 4-18. Loosen the lock nuts on the pusher screws, Figure 4-19, then adjust the screws to achieve the desired belt tension. Re-tighten the lock nuts.

ALIGNING THE LATHE

The most important attribute of a properly set up lathe is its ability to "machine parallel", to cut a cylinder of uniform diameter over its entire length. In other words, no taper.

Leveling of the lathe is a part of this, see Section 1. Equally important is the alignment of the center-to-center axis with the lathe bed, as seen ***from above***. [Vertical alignment is nowhere near as critical, rarely a cause of taper unless the lathe is damaged or badly worn.]

How to align lathe centers
Practically all lathes come with some means of offsetting the tailstock, typically for taper turning. For routine operations, the offset must be zero, Figure A.

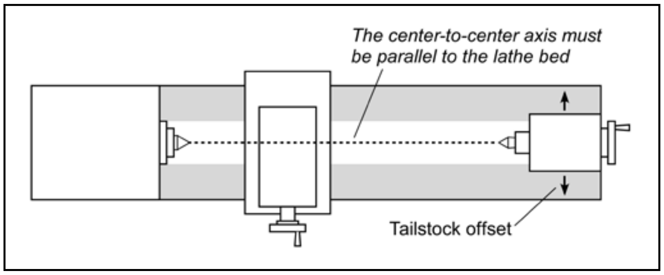


Figure A **Center-to-center axis**

The scale usually provided on the tailstock is not reliable for precision work — think of it as only a starting point. What follows are two methods for aligning centers, one quick and easy, the other more precise.

Quick method
This method works only if the centers are in new condition, sharp and clean.

1. Carefully clean the taper sockets and the tapers themselves. Install the tapers.
2. Move the saddle left as far as it will go, then slide the tailstock left to touch the saddle.
3. Lock the tailstock (this is important — unlocked to locked can mean an offset of several thousandths).
4. Advance the tailstock quill to bring the centers together.
5. Place a scrap of hard shim stock or an old-style double-edge razor blade between the centers, Figure B.
6. Advance the tailstock quill to trap the blade, then lock the quill. If the centers are aligned, the blade will point squarely front to back. If not, adjust the tailstock offset by a series of very small adjustments.
7. If the range of quill motion permits, check the blade alignment at various extensions of the quill. There should be no appreciable variation.

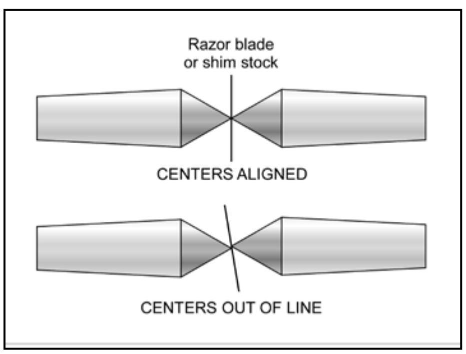


Figure B **Quick alignment check**

Precise method
This method uses a precision ground steel rod at least 10" long. Look for 3/4 or 1 inch "drill rod" with a diameter tolerance of ± 0.001" or less.

Straightness and uniform diameter are both important (absolute diameter is not).

1. Set the rod in a collet chuck, or independent 4-jaw chuck, with the outer end about 1/2 inch clear of the chuck.
2. Use a dial indicator to check for runout. If using a 4-jaw adjust as necessary for minimum TIR (aim for 0.0005" or less).
3. Center-drill the end of the ground rod.
4. Reverse the rod, re-adjust for minimum TIR, then drill the other end.
5. Set the drill rod snugly between centers, as Figure C. Lock the tailstock.
6. Set a dial indicator on the cross slide (to eliminate vertical error use a flat disc contact, not the usual spherical type — if a disc contact is not available, machine a cap to fit over the spherical point).
7. Starting at location (1), note which way the pointer rotates when the cross slide is moved inward. In this setup the pointer is assumed to turn clockwise as the cross slide moves in.
8. Pre-load the indicator by a few thousandths, then traverse the saddle from end to end. In a perfect the setup the pointer will not move at all.

If the pointer turns clockwise as you go toward the tailstock, as Figure C, the tailstock is biased to the front. This will cause the lathe to cut a tapered workpiece with the larger diameter at the headstock end. Correct this by a series of ***very small*** adjustments to the tailstock offset.

Another important question has to do with headstock/spindle alignment relative to the lathe bed. For turning ***between centers*** this doesn't matter at all; the headstock can be wildly out of square, Figure D, but the lathe will still machine parallel if the centers have been aligned as previously described.

When headstock alignment really matters
Headstock alignment may not matter for center turning, but it's critical when the workpiece is held in a chuck or a collet — often about 90% of the workload in a typical model shop. Assuming no appreciable deflection of the workpiece (too thin, too far from the chuck), taper problems in a chuck/collet setup are due to misalignment of the spindle axis relative to the lathe bed. This is usually correctable by re-aligning the headstock.

Misalignment of the spindle by even the smallest fraction of a degree causes a very measurable taper, even over short lengths of material. For example, a misalignment as small as ***one hundredth of a degree*** will give a taper of 0.001" in 3 inches. If the headstock is (say) 10 inches long, this would be corrected by tapping one end of the headstock forward or back

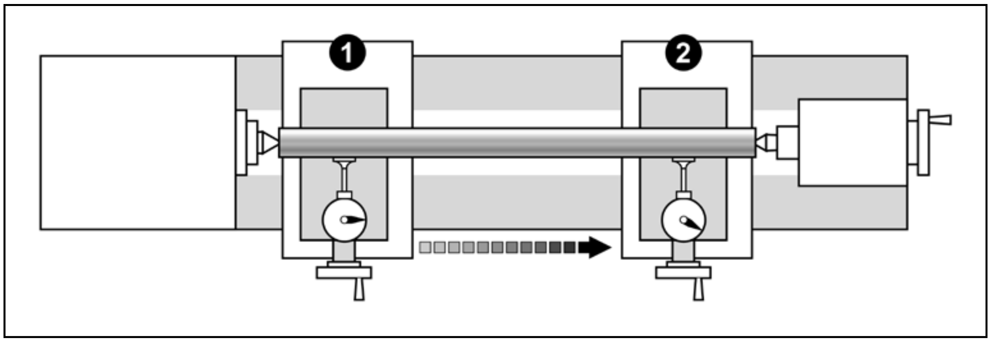


Figure C **Drill rod between centers**

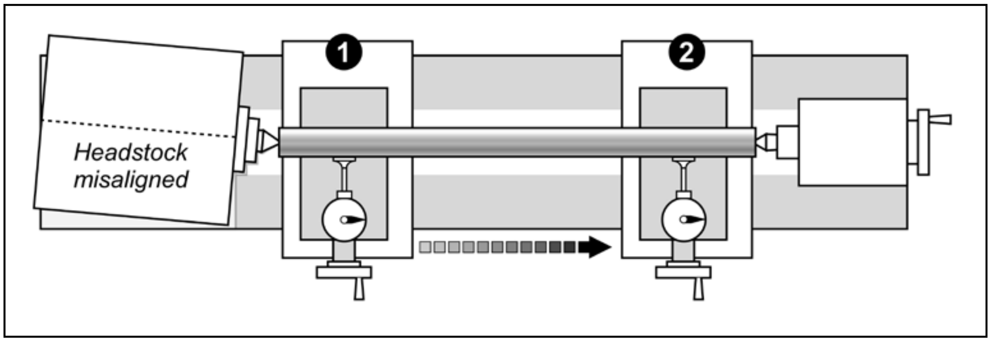


Figure D **Misalignment of the headstock has no effect on center turning**

by as little as 0.002", a tiny amount even if jacking screws are provided. What this amounts to is that headstock adjustment is a ***highly sensitive, iterative procedure*** that should not be attempted casually. What follows is a general outline. Specific instructions for the PM-1440GT follow this section.

HEADSTOCK ALIGNMENT METHODS

Method 1

Make a series of "cut-and-try" passes on scrap material. If the workpiece is thinner at the tailstock end, the headstock needs to be pivoted away from the tool, and vice versa.

Method 2

This uses the 3/4 or 1 inch ground drill rod described in "Precise method" above for center-to-center alignment.

Install the drill rod in a collet or independent 4-jaw chuck with about 5 inches protruding, Figure E. Center drilling is not needed.

1. Adjust the chuck for minimum runout at position (1).
2. Check the runout at (2). Pointer movement when traversing is not a concern at this stage.
3. If the drill rod is perfectly aligned with the spindle axis, there should be no difference in TIR at (1) and (2).
4. If there is a significant difference in TIR* from (1) to (2), try to correct this by loosening, then re-tightening the chuck/collet, while levering the outer end of the rod (gentle tapping with a non-marring hammer can also be helpful). When the runout at (2) has been minimized, re-check at (1), then repeat at (2), etc.
5. When (and only when) the TIR at both locations is the same, or very close, can it be said that the rod is concentric with the spindle.
6. Compare dial indications when traversing from (1) to (2). Ideally, there will no change.

**** Factors that may affect runout***

Straightness and roundness of the drill rod; Chuck installation (check for cleanliness and tightness); "Pointing accuracy" of the chuck (the gripping surfaces of chuck jaws may not be parallel with the axis of the chuck and spindle — especially likely if the chuck is worn).

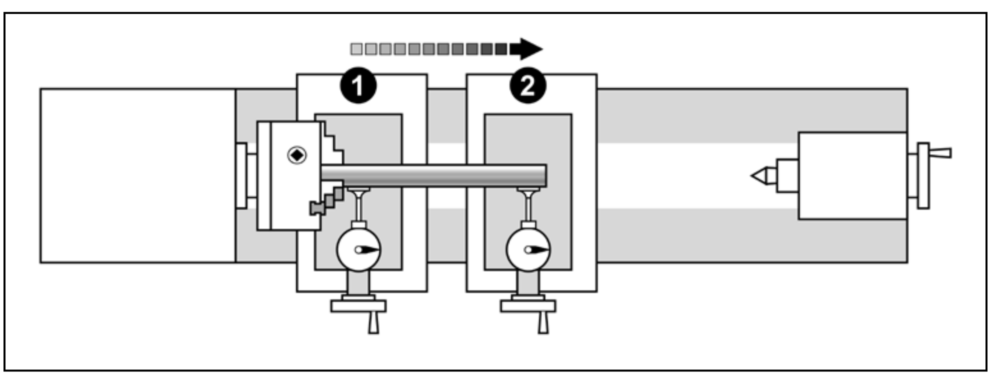


Figure E **Perfect alignment: zero indicator change between locations 1 and 2**

Method 3 - Morse Taper Test Bar

This is a catalog-only item available from many suppliers (depending on the source it may be named differently). The test bar in Figure F has a tapered shank to fit the spindle, and a parallel portion several inches long. The diameter of the parallel portion is unimportant. What matters more is its finish and lack of taper— check before installing. Whatever taper there may be can be allowed for in the alignment test, as Figure E. Runout should be less than 0.0005" TIR.

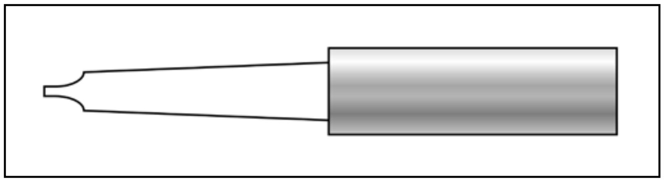


Figure F **Morse taper test bar**

PM-1440GT HEADSTOCK ALIGNMENT

Figure A1 is an exaggerated top-down view of what happens if the spindle is not precisely aligned with the lathe bed. This is correctable by ***slightly*** loosening the attachment screws, Figures A2 and A3, then adjusting the screws set into a tab rail below the headstock, Figure A4.

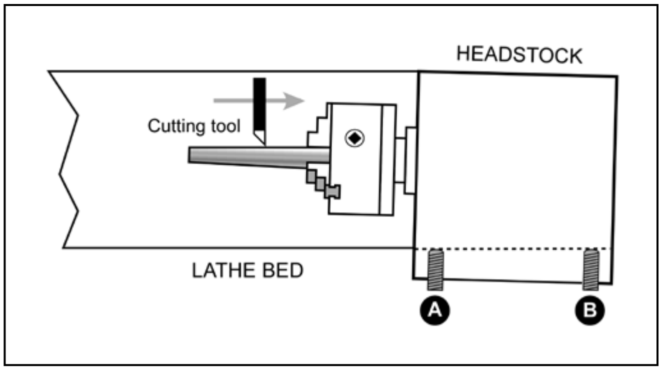


Figure A3 **Misaligned headstock**

In this illustration the workpiece diameter increases as the cutting tool moves toward the chuck. Correct this by screwing in (A) a fraction of a turn to rotate the headstock counter clockwise, moving the workpiece away from the tool. Screw in (B) if the taper is in the other direction, thinner toward the chuck.

CAUTION!

Correcting headstock misalignment is a multi-step process requiring a number of ***extremely small adjustments***, each one followed by an alignment test, either cut-and-try, or one of the other methods previously described.

A scarcely detectable rotation of an adjusting screw can be the difference between perfect alignment and unacceptable taper. In other words, think in terms of thousandths of an inch or less. Simply loosening the socket heads, Figure A4, can be enough to correct a taper problem — or add to it in the wrong direction.

Figure A2 **Headstock attachment screws, RH**

Figure A3 **Headstock attachment screws, LH**

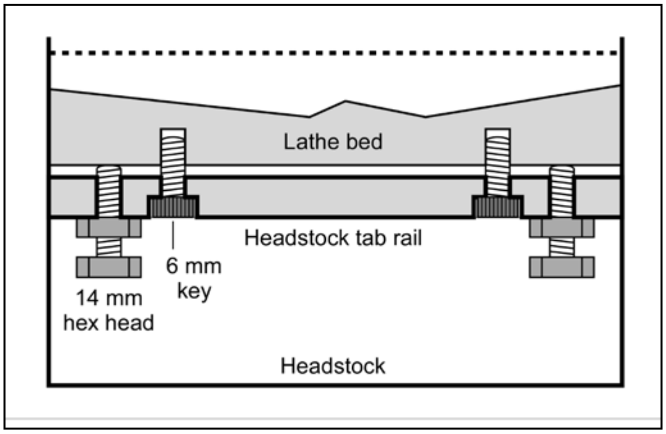
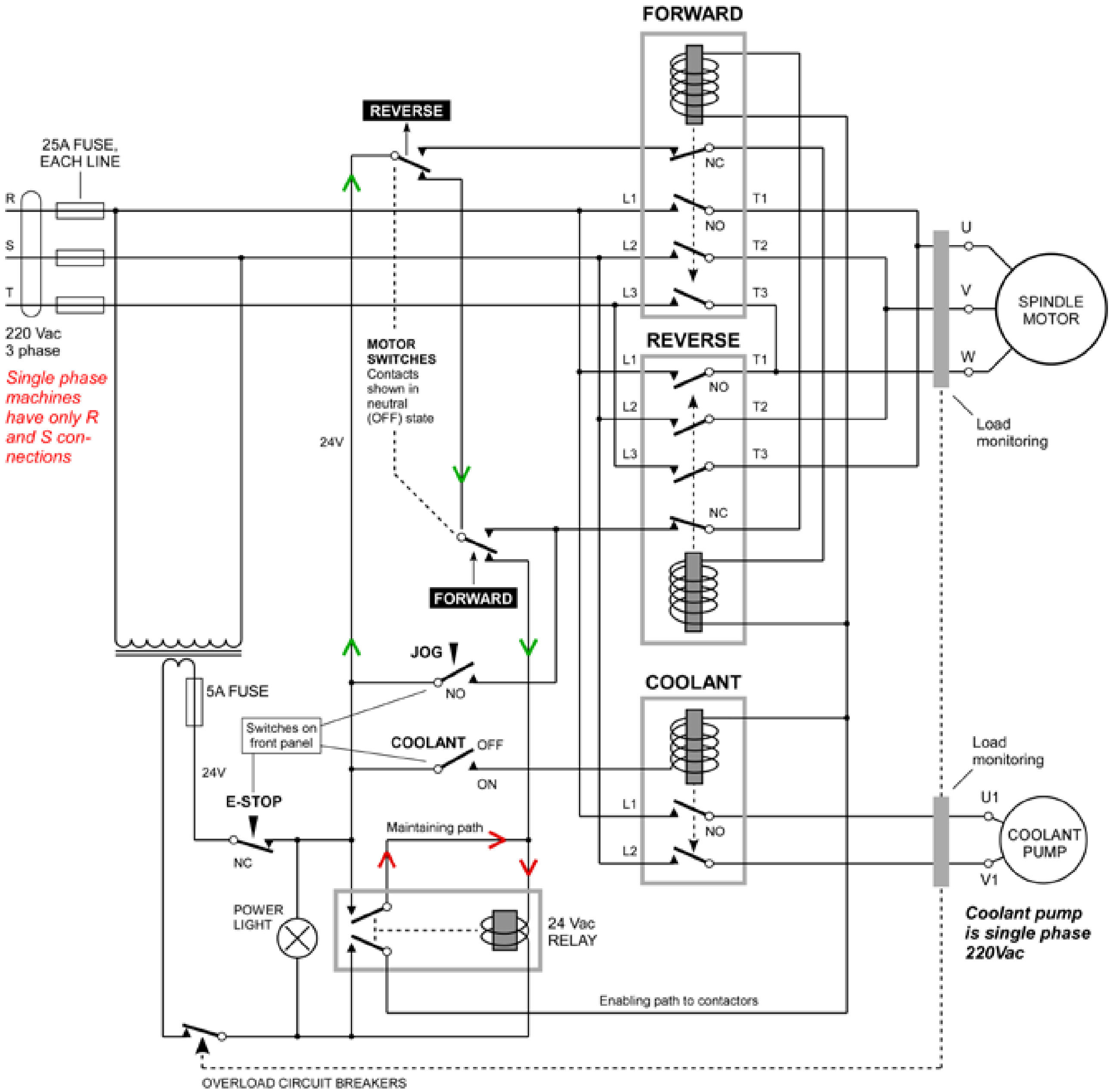


Figure A4 **Adjustment screws below the headstock**

The recessed socket head screws lock the adjustment by pulling the tab rail toward the lathe bed. Loosen the socket heads a fraction before touching the hex heads.

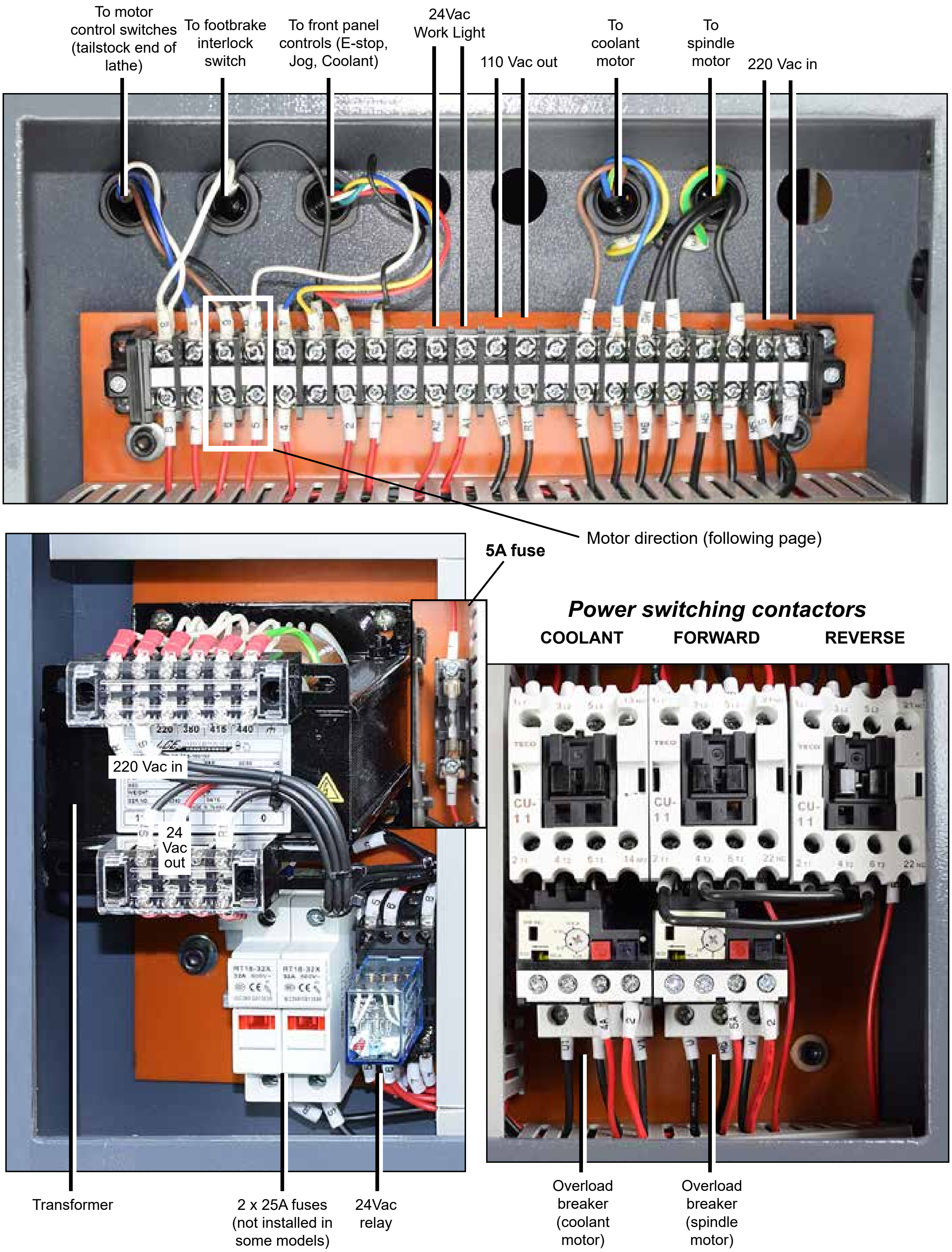


This schematic is a functional diagram only. It does not depict point-to-point wiring.

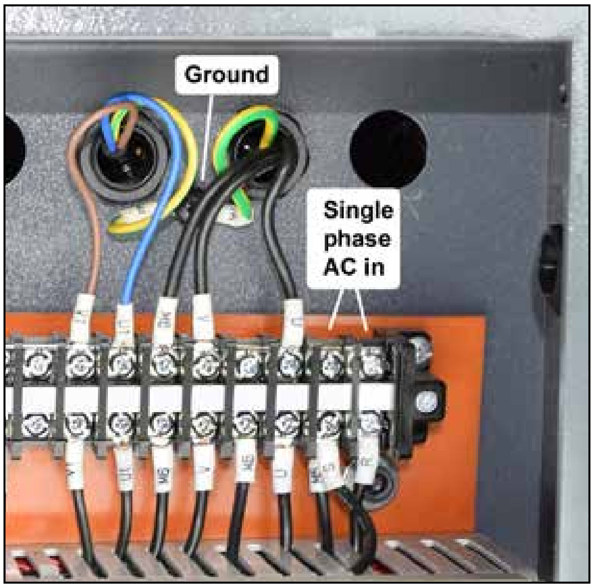
When pushed, the E-STOP button remains in, disconnecting power, until reset by twisting action.

If, and only if, the motor switch lever is in the neutral (OFF) state when the lathe is powered up, the 24 Vdc relay will be energized through the "initial" path (green arrows). One contact of the relay (3-6) keeps the coil energized through the "ma-intaining" path (red arrows), which bypasses the motor switches. The other contact of the relay (2-2) completes the zero volt path to the FORWARD and REVERSE contactors (24 Vac coils).

Model PM-1440GT electrical schematic


To motor control switches (tailstock end of lathe)
To footbrake interlock switch
To front panel controls (E-stop, Jog, Coolant)
24Vac Work Light
110 Vac out
To coolant motor
To spindle motor
220 Vac in
Motor direction (following page)
5A fuse
Power switching contactors
COOLANT
FORWARD
REVERSE
220 Vac in
24 Vac out
220
380
415
440
Transformer
2 x 25A fuses (not installed in some models)
24Vac relay
Overload breaker (coolant motor)
Overload breaker (spindle motor)

ELECTRICAL CONNECTIONS



Single phase 220Vac connections
For three-phase AC, a third wire (T) is connected to the left of R, S.

MOTOR CONTROL WIRING

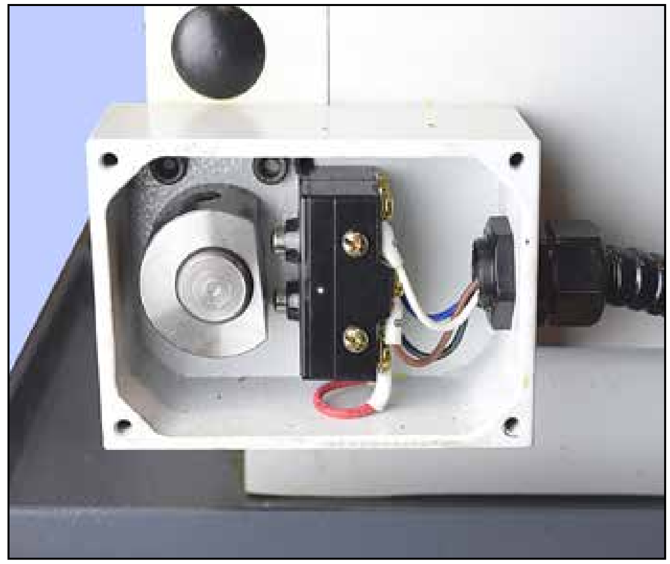
Motor control lever
Mid-travel OFF, Down FORWARD, Up REVERSE

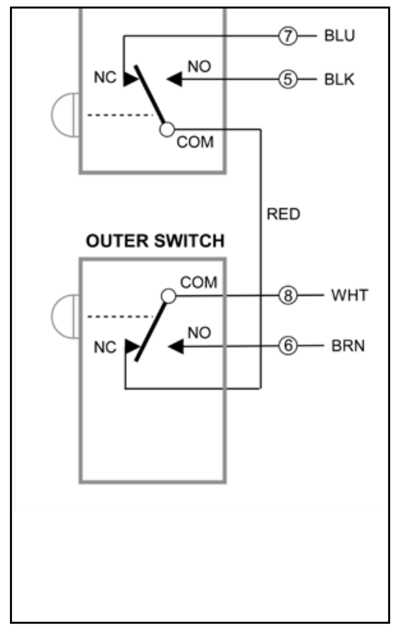
As shipped, the motor control switch is wired to select FORWARD spindle rotation when the lever is DOWN. The JOG push-button is also wired for forward rotation.

To change direction ...

See the previous page photos. For REVERSE rotation when the motor control lever is moved down, swap the black #5 and brown #6 wires; leave the white #5 wire in place for forward jog. For reverse jog, move the white #5 wire to the #6 terminal.

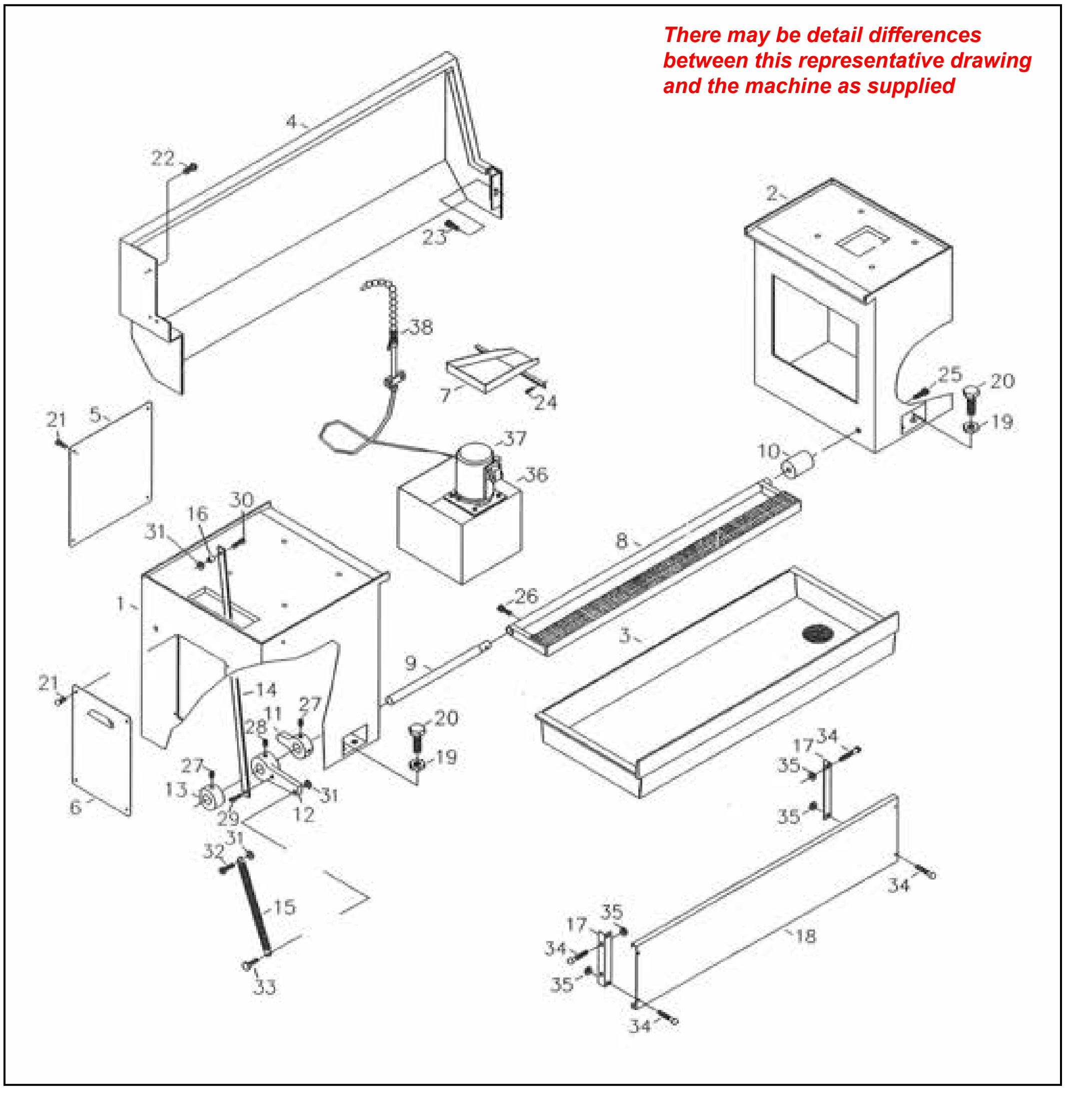
DRO power
Low-wattage 110Vac power is available at R1, S1 on the upper terminal strip, preceding page.





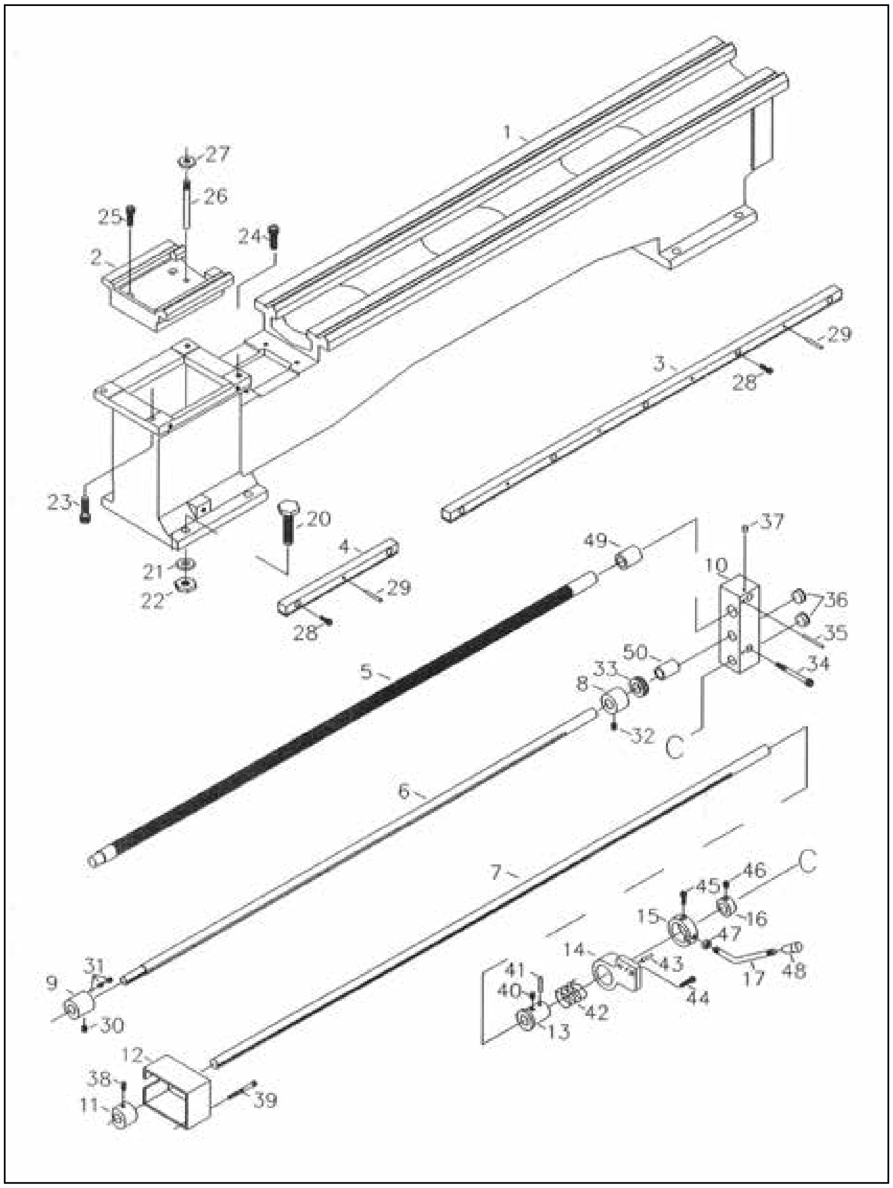
Motor control switches

Cabinets, panels & coolant system



Ref	Mfr#	Description	Qty
1	2701	Left cabinet, head-stock end	1
2	2702	Right cabinet, tail-stock end	1
3	2704	Chip tray	1
4	2705	Splash guard	1
5	2709	Rear cover plate	1
6	2708	End cover plate	1
7	2707	Coolant chute	1
8	2703	Footbrake treadle	1
9	2715	Footbrake connec-tor shaft	1
10	2716	Bushing	1
11	2714	Lever	1
12	2713	Lever	1
13	2712	Collar	1
14	2711	Brake pull bar	1
15	2745	Expansion spring	1
16	2730	Washer	1
17	2719	Support bracket	2
18	2718	Front panel	1
19	2710	Nut	2
20	2732	Screw 1/2" x 2"	6
21	2741	Screw M6 x 12	8
22	2737	Cap screw M6 x 12	3
23	2736	Cap screw M8 x 20	1
24	2735	Cap screw M6 x 16	2
25	2734	Cap screw M8 x 20	1
26	2733	Cap screw M8 x 20	2
27	2742	Set screw M I0 x 20	2
28	2743	Set screw M I0 x 40	2
29	2731	Cap screw M8 x 10	1
30	2740	Screw M8 x 10	1
31	2746	Nut	3
32	2738	Cap screw M8 x 25	1
33	2739	Screw M8 x 30	1
34	2747	Screw M6 x 16	8
35	2748	Nut	8
36	2706	Coolant tank	1
37	2717	Coolant pump, 1/8 HP	1
38	2720	Coolant hose as-sembly	1

Lathe bed components

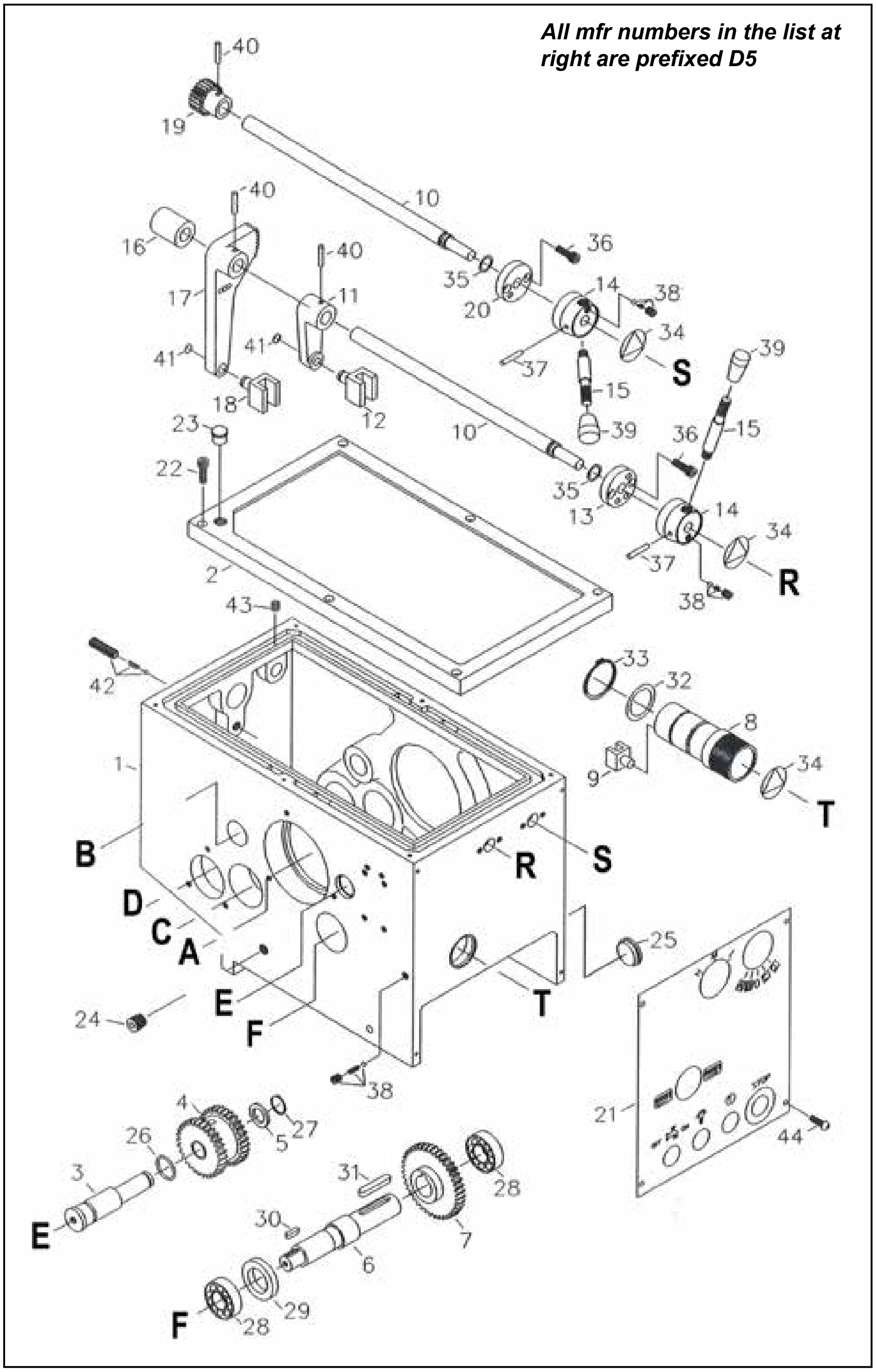


There may be detail differences between this representative drawing and the machine as supplied

Ref	Mfr #	Description	Qty
1	2601	Bed	1
2	2602	Gap filler	1
3	2603	Rack, long	1
4	2604	Rack, short	1
5	2605	4 TPI leadscrew	1
6	2606	Feed shaft	1
7	2607	Motor control shaft	1
8	2609	Bushing	1
9	2608	Bushing	1
10	2617	End block	1
11	2611	Collar	1
12	2610	Switch box	1
13	2612	Collar	1
14	2613	Motor control bracket	1
15	2614	Collar	1
16	2615	Collar	1
17	2616	Motor control lever	1
20	2634	Cap screw 1/2-13 x 2"	6
21	2621	Washer	6
22	2622	Nut	6
23	2623	Cap screw M10 x 40	2
24	2624	Cap screw M10 x 35	2
25	2632	Cap screw M10 x 35	4
26	2633	Taper pin	2
27	2627	Nut	2
28	2636	Cap screw M6 x 20	6
29	2635	Pin 5 x 28 mm	4
30	2637	Set screw M8 x 12	1
31	2638	Steel ball & spring pair	2
32	2639	Set screw M8 x 10	1
33	2640	Thrust bearing 51104	1
34	2651	Screw M8 x 60	2
35	2650	Pin 5 x 50 mm	2
36	2658	Plug	2
37	2649	Plug	1
38	2642	Set screw M8 x 10	1
39	2641	Cap screw M6 x 16	2
40	2628	Set screw M6 x 16	1
41	2629	Pin 5 x 28 mm	1
42	2643	Spring	1
43	2646	Pin 5 x 28 mm	1
44	2644	Cap screw M6 x 20	2
45	2645	Cap screw M6 x 10	1
46	2648	Set screw 8×8	1
47	2647	Nut	1
48	2630	Knob	1
49	2617A	Bushing	1
50	2617B	Screw M6×16	1

Headstock body & controls

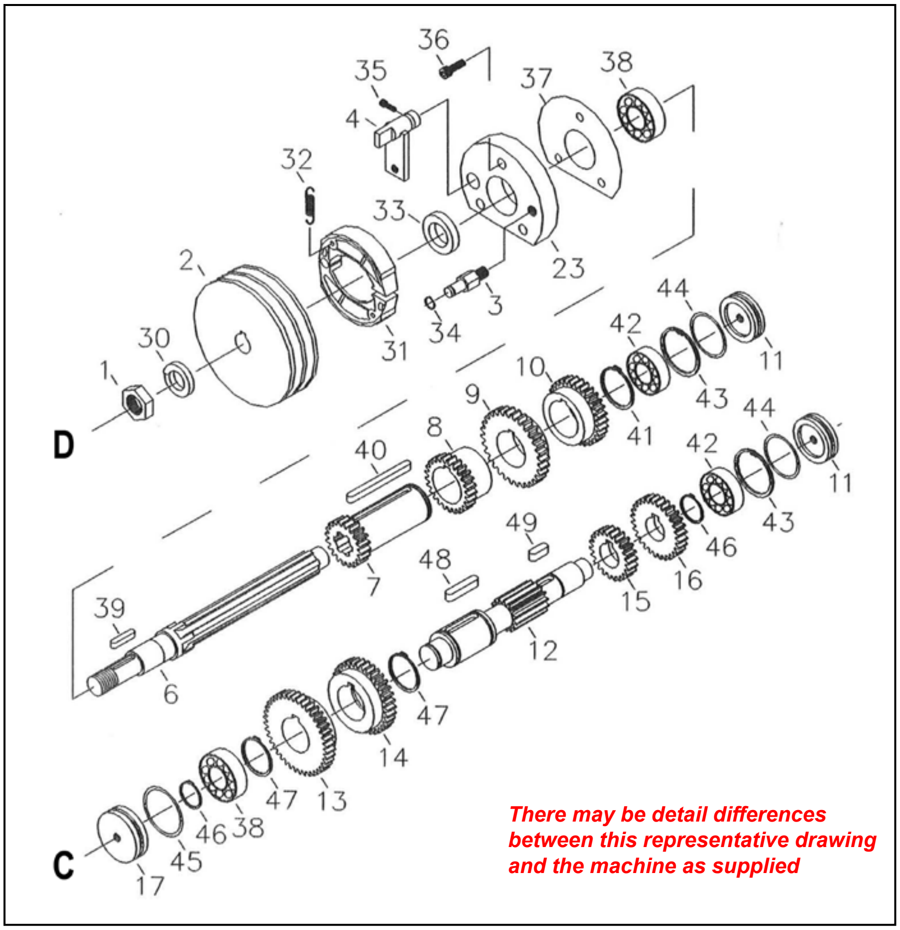
All mfr numbers in the list at right are prefixed D5



Ref	Mfr #	Description	Qty
1	2101	Headstock casting	1
2	2147	Headstock cover	1
3	2129	E Shaft	1
4	2130	Gear M2: 42T+42T,	1
5	2131	Washer	1
6	2132	F Shaft	1
7	2133	Gear M2: 42T	1
8	2134	Feed dir'n control T	1
9	2135	Shift fork	1
10	2136	Shaft	2
11	2137	L-M-H shift arm	1
12	2138	Shift fork	1
13	2139	Flange	1
14	2140	Hub	2
15	2141	Lever	2
16	2142	Bushing	1
17	2143	1-2-3-4 shift arm	1
18	2144	Shift fork	1
19	2145	Gear M1.5: 22T	1
20	2146	Flange	1
21	2901	Front panel	1
22	2151	Cap screw M6 x 25	6
23	2152	Filler plug	1
24	2153	Drain plug	1
25	2154	Sight glass	1
26	2155	O-ring	1
27	2156	Retaining ring	1
28	2157	Ball bearing 6005	2
29	2158	Oil seal 30 x 47 x 8	1
30	2159	Key 5 x 18 mm	1
31	2160	Key 8 x 45 mm	1
32	2161	O-ring	1
33	2162	Retaining ring	1
34	2163	Indicator disk	3
35	2164	O-ring	2
36	2165	Cap screw M6 x 16	4
37	2166	Roll pin 5 x 40 mm	2
38	2167	Ball-spring-screw	3
39	2168	Knob	2
40	2169	Roll pin 5 x 25 mm	3
41	2170	Retaining ring	2
42	2171	Ball-spring-screw	1
43	2172	Set screw M6 x 8	1
44	2173	Screw	4

There may be detail differences between this representative drawing and the machine as supplied

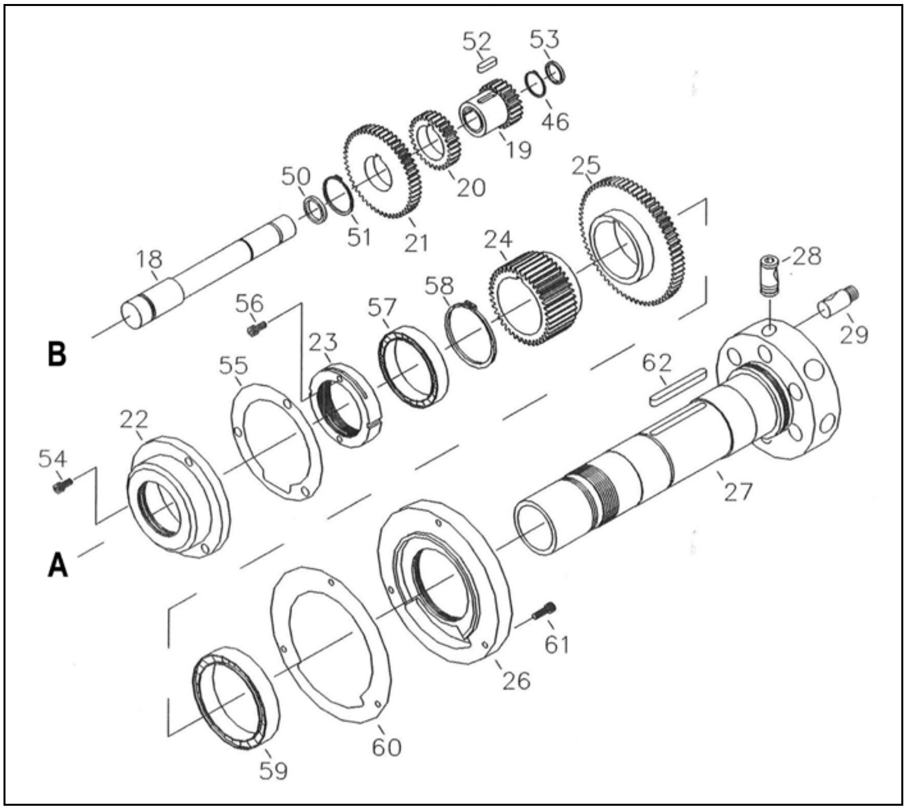
Headstock components



All mfr numbers in this list are prefixed D5

Ref	Mfr #	Description	Qty
1	2128	Nut	1
2	2127	Vee-belt pulley	1
3	2126	Pivot stud	1
4	2125	Brake actuator	1
6	2119	D shaft	1
7	2120	Gear M2: 22T	1
8	2121	Gear M2: 27T	1
9	2122	Gear M2: 38T	1
10	2123	Gear M2: 32T	1
11	2118	Plug	2
12	2112	Pinion shaft M2: 15T	1
13	2113	Gear M2: 40T	1
14	2114	Gear M2: 35T	1
15	2115	Gear M2: 24T	1
16	2116	Gear M2: 30T	1
17	2117	Plug	1
23	2106	Flange	1
31	2177	Brake shoe assembly	1
32	2178	Spring	1
33	2179	Bushing	1
34	2180	Retaining ring	1
35	2181	Cap screw M6 x 12	1
36	2182	Cap screw M6 x 25	3
37	2183	Gasket	1
38	2184	Ball bearing 6205	2
39	2185	Key 6 x 30 mm	1
40	2186	Key 7 x 75 mm	1
41	2187	Retaining ring	1
42	2188	Ball bearing 6204	2
43	2189	Retaining ring	2
44	2190	O-ring	2
45	2191	O-ring	1
46	2192	Retaining ring	3
47	2193	Retaining ring	2
48	2194	Key 8 x 40 mm	1
49	2195	Key 8 x 22 mm	1

Headstock components

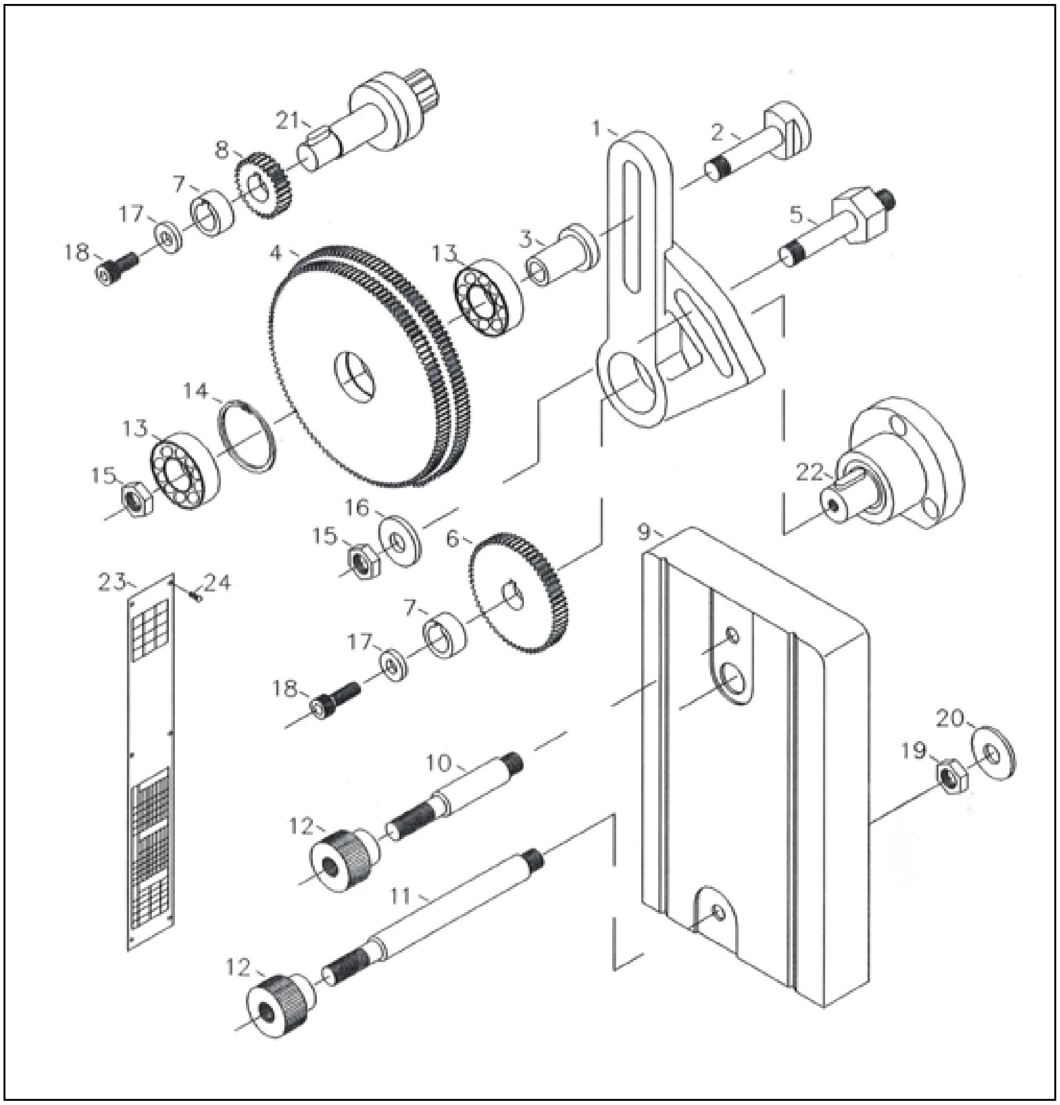


There may be detail differences between this representative drawing and the machine as supplied

All mfr numbers in this list are prefixed D5

Ref	Mfr #	Description	Qty
18	2108	B shaft	1
19	2109	Gear M2: 22T	1
20	2111	Gear M2: 29T	1
21	2110	Gear M2: 49T	1
22	2107	Flange	1
23	2106	Nut	1
24	2105	Gear M2: 42T	1
25	2104	Gear M2: 69T	1
26	2103	Flange	1
27	2102	Main spindle (A)	1
28	2174	Camlock cam	6
29	2175	Camlock stud	6
46	2192	Retaining ring	3
50	2196	O-ring	1
51	2197	Retaining ring	1
52	2198	Key 7 x 25 mm	1
53	2199	O-ring	1
54	21100	Cap screw M6 X 25	3
55	21101	Gasket	1
56	21102	Cap screw M6 X 15	2
57	21103	Roller bearing 32013	1
58	21104	Retaining ring	1
59	21105	Roller bearing 32014	1
60	21106	Gasket	1
61	21107	Cap screw M6 X 25	1
62	21108	Key 8 x 80 mm	1

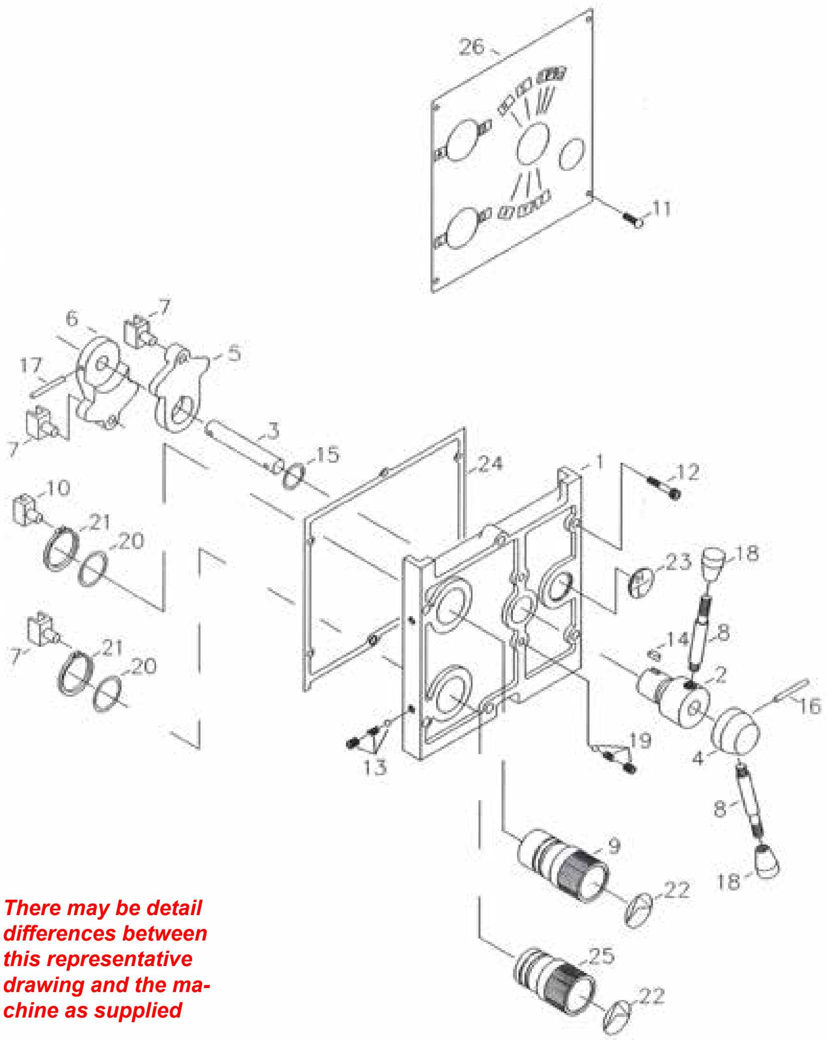
External change gears



There may be detail differences between this representative drawing and the machine as supplied

Ref	Mfr #	Description	Qty
1	2801	Gear quadrant	1
2	2802	T-bolt	1
3	2803	Bushing	1
4	2804	Gear assembly M1.25: 127T/120T	1
5	2805	Quadrant anchor stud	1
6	2808	Lower change gear M1.25: 60T	1
7	2806	Spacer	1
8	2807	Upper change gear M1.25: 30T	1
9	D5-2821	End cover	1
10	2822	Stud	1
11	2824	Stud	1
12	2823	Nut	2
13	2833	Ball bearing 6202Z	2
14	2836	Retaining ring	1
15	2835	Nut	2
16	2837	Washer	1
17	2839	Washer	2
18	2840	Cap screw M6 x 16	2
19	2838	Nut	1
20	2831	Washer	1
21	2830	Key 5 x 18	1
22	2841	Key 5 x 18	1
23	2827	Data plate (US)	1
24	2817	Screw	6
		Following are alternate upper gears	
		Change gear M1.25: 28T,	1
		Change gear M1.25: 35T	1
		Change gear M1.25: 36T	1
		Change gear M1.25: 42T	1
		Change gear M1.25: 49T	1
		Following are alternate lower gears	
		Change gear M1.25: 57T	1
		Change gear M1.25: 65T	1
		Change gear M1.25: 69T	1

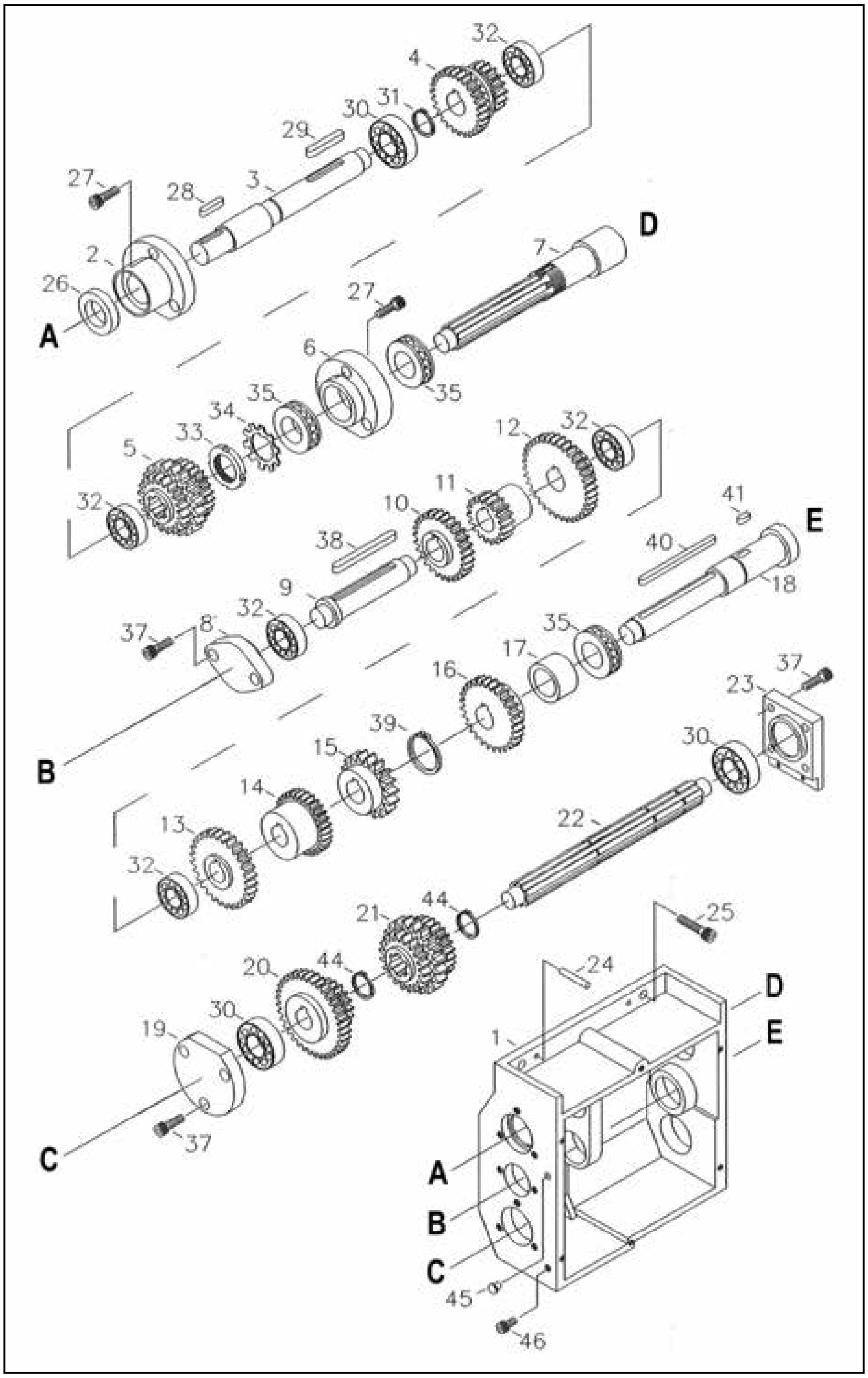
Saddle feed gearbox controls



There may be detail differences between this representative drawing and the machine as supplied

Ref	Mfr #	Description	Qty
1	2224	Front casting	1
2	2225	P-Q-R-T inner hub	1
3	2226	W-X-Y-Z shaft	1
4	2227	W-X-Y-Z outer hub	1
5	2228	P-Q-R-T shifter plate	1
6	2229	P-Q-R-T shifter plate	1
7	2230	Shifter fork	3
8	2231	Lever	2
9	2233	A-B selector knob	1
10	2234	Shifter fork	1
11	2241	Screw	4
12	2248	Cap screw M6 x 30	6
13	2247	Ball/spring/set screw	2
14	2251	Key 5 x 10 mm	1
15	2244	O-ring	1
16	2243	Roll pin 5 x 40 mm	1
17	2242	Roll pin 5 x 30 mm	1
18	2250	Knob	2
19	2253	Ball/spring/set screw	2
20	2246	O-ring	2
21	2245	Retaining ring	2
22	2249	Indicator disk	2
23	2252	Sight glass	1
24	2254	Gasket	1
25	2232	C-D selector knob	1
26	2240	Front panel	1

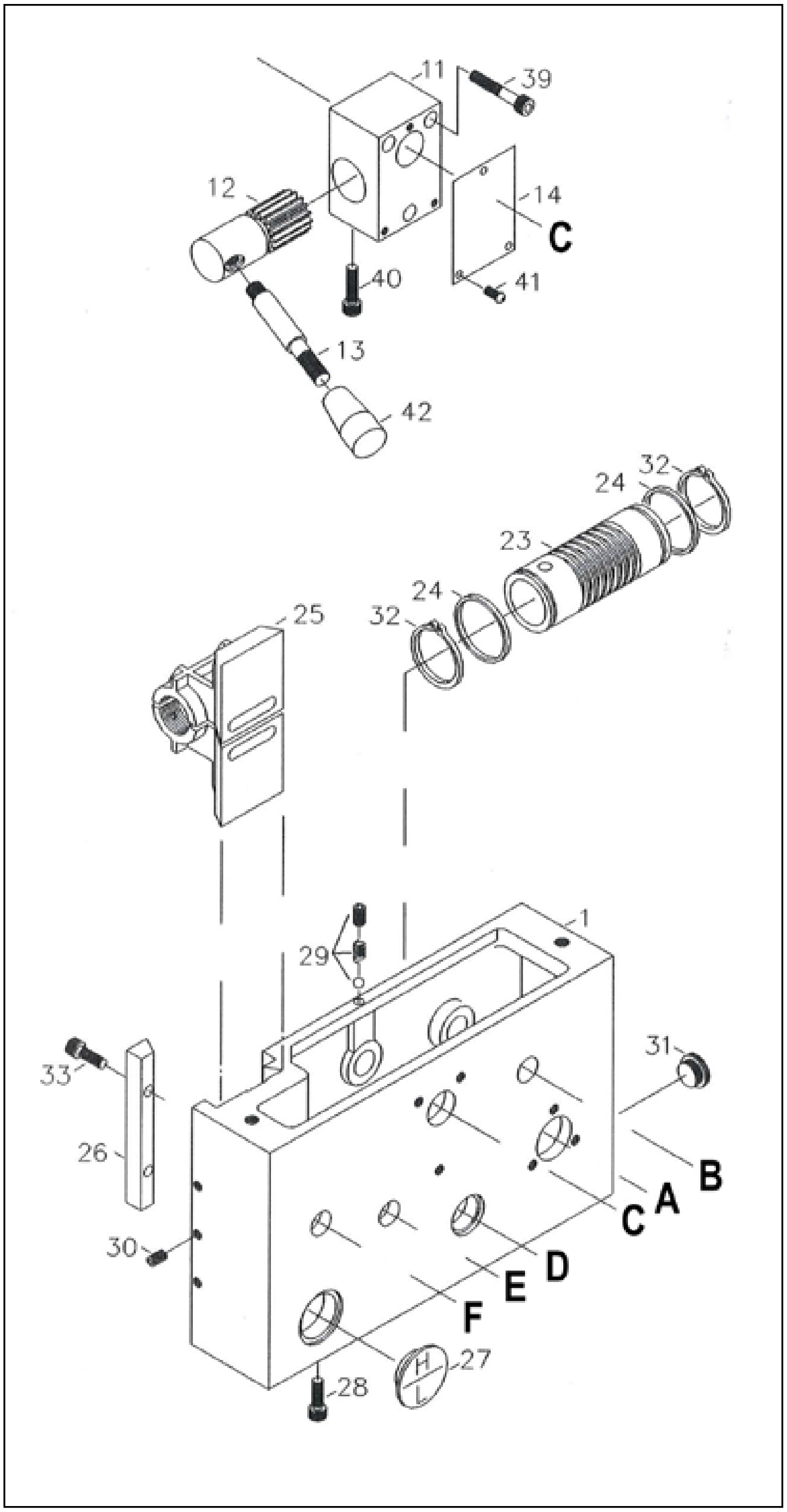
Saddle feed gearbox components



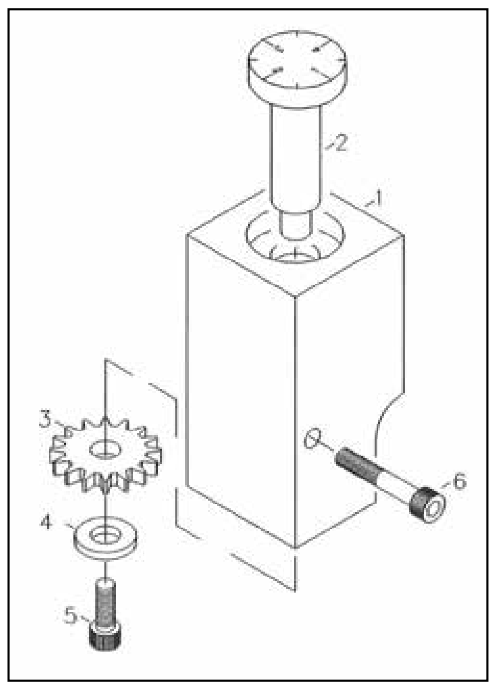
There may be detail differences between this representative drawing and the machine as supplied

Ref	Mfr #	Description	Qty
1	2201	Gearbox casting	1
2	2204	Flange	1
3	2202	A shaft	1
4	2203	Gear assy M2: 27T/18T	1
5	2236	Gear assy 14DP: 27T/30T + M2.25: 21T	1
6	2205	Flange	1
7	2206	D shaft	1
8	2218	Cover plate	1
9	2208	B shaft	1
10	2209	Gear M2: 27T	1
11	2210	Gear M2: 18T	1
12	2211	Gear M2: 36T	1
13	2217	Gear M2.25: 28T	1
14	2216	Gear M2: 30T	1
15	2215	Gear 14DP: 24T	1
16	2237	Gear 14DP: 33T	1
17	2212	Spacer	1
18	2213	E shaft	1
19	2222	Cover plate	1
20	2220	Gear assy M2: 36T/18T	1
21	2235	Gear assy 14DP: 24T/30T + M2.25: 20T	1
22	2219	C shaft	1
23	2223	Flange	1
24	2272	Pin 5 x 28 mm	2
25	2273	Cap screw M8 x 30	3
26	2256	Oil seal 22 x 35 x 7	1
27	2255	Cap screw M6 x 20	6
28	2267	Key 5 x 18 mm	1
29	2258	Key 6 x 40 mm	1
30	2259	Ball bearing 6004	3
31	2260	Retaining ring	1
32	2261	Ball bearing 6003	5
33	2262	Nut	1
34	2269	Tabbed washer	1
35	2263	Thrust bearing 51105	3
37	2275	Capscrew M6 x 20	9
38	2268	Key 6 x 55 mm	1
39	2266	Retaining ring	1
40	2264	Key 5 x 60 mm	1
41	2265	Key 5 x 12 mm	1
44	2274	Retaining ring	2
45	2276	Oil fill plug	1
46	2277	Cap screw M8 x 10	1

Apron



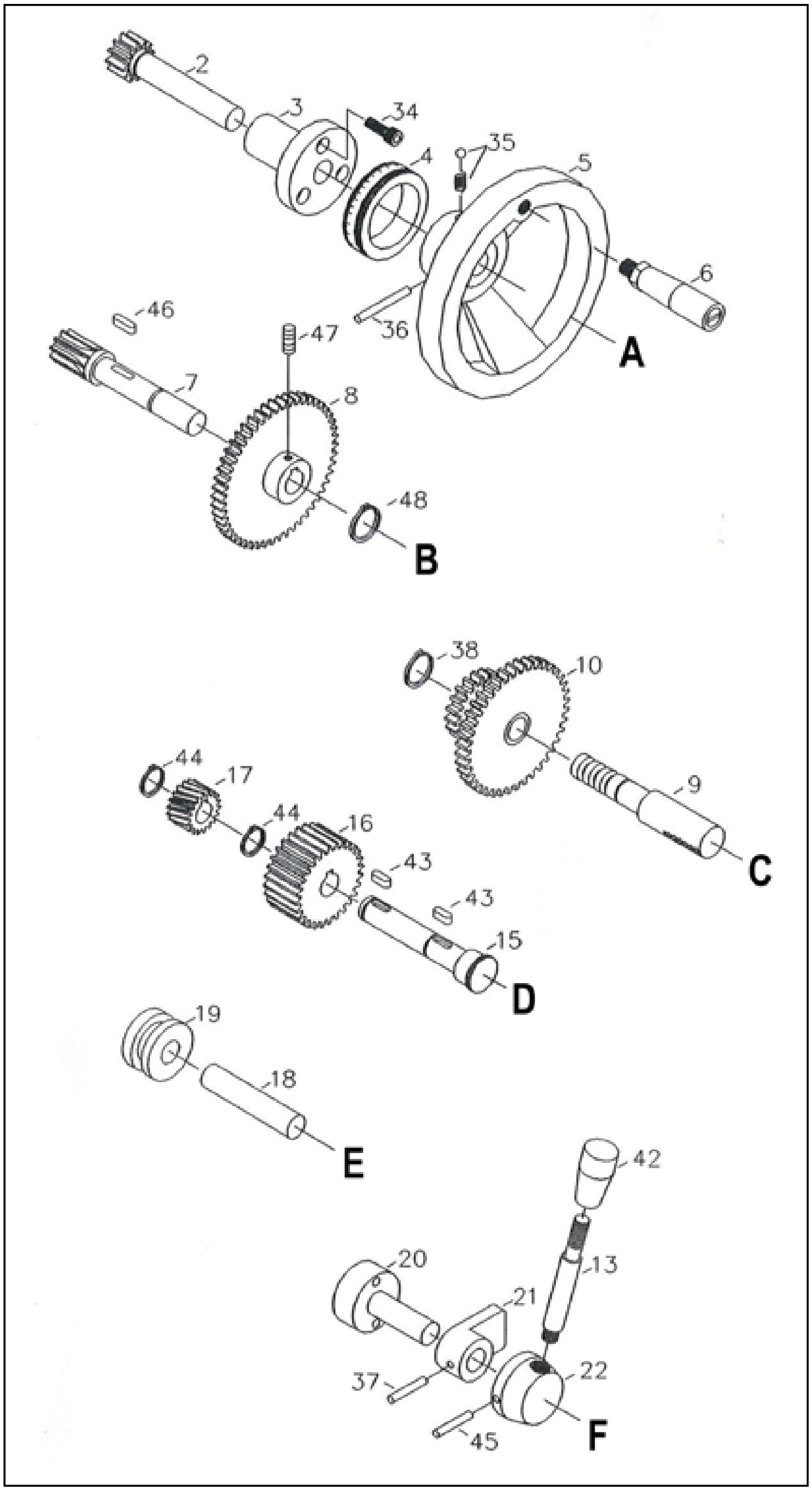
Ref	Mfr #	Description	Qty
1	2301	Apron casting	1
11	2316	Power feed control box	1
12	2317	Control selector M1.5: 16T	1
13	2318	Power feed lever	2
14	2362	Front plate	1
23	2309	Worm	1
24	2310	Spacer ring	2
25	2325	Split nut assembly	1
26	2326	Split nut gib	1
27	2358	Sight glass, 29 mm	1
28	2357	Cap screw M8 x 10	1
29	2355	Steel ball, screw & spring set	1
30	2354	Set screw M6 x 10	3
31	2356	Plug	1
32	2352	Retaining ring	2
33	2353	Cap screw M6 x 20	2
39	2363	Cap screw M6 x 40	4
40	2360	Cap screw M8 x 25	1
41	2361	Screw	3
42	2359	Knob	1



Ref	Mfr #	Description	Qty
1	2327	Indicator body	1
2	2328-2	Threading dial (inches)	1
3	2329	Gear 16T	1
4	2366	Washer	1
5	2365	Cap screw M6 x 12	1
6	2364	Cap screw M6 x 45	1

There are differences between this representative drawing and the lathe as supplied — example: the leadscrew split-nut 25 is on the right in U.S. machines. All other shaft locations, A through F, are similarly flipped left to right.

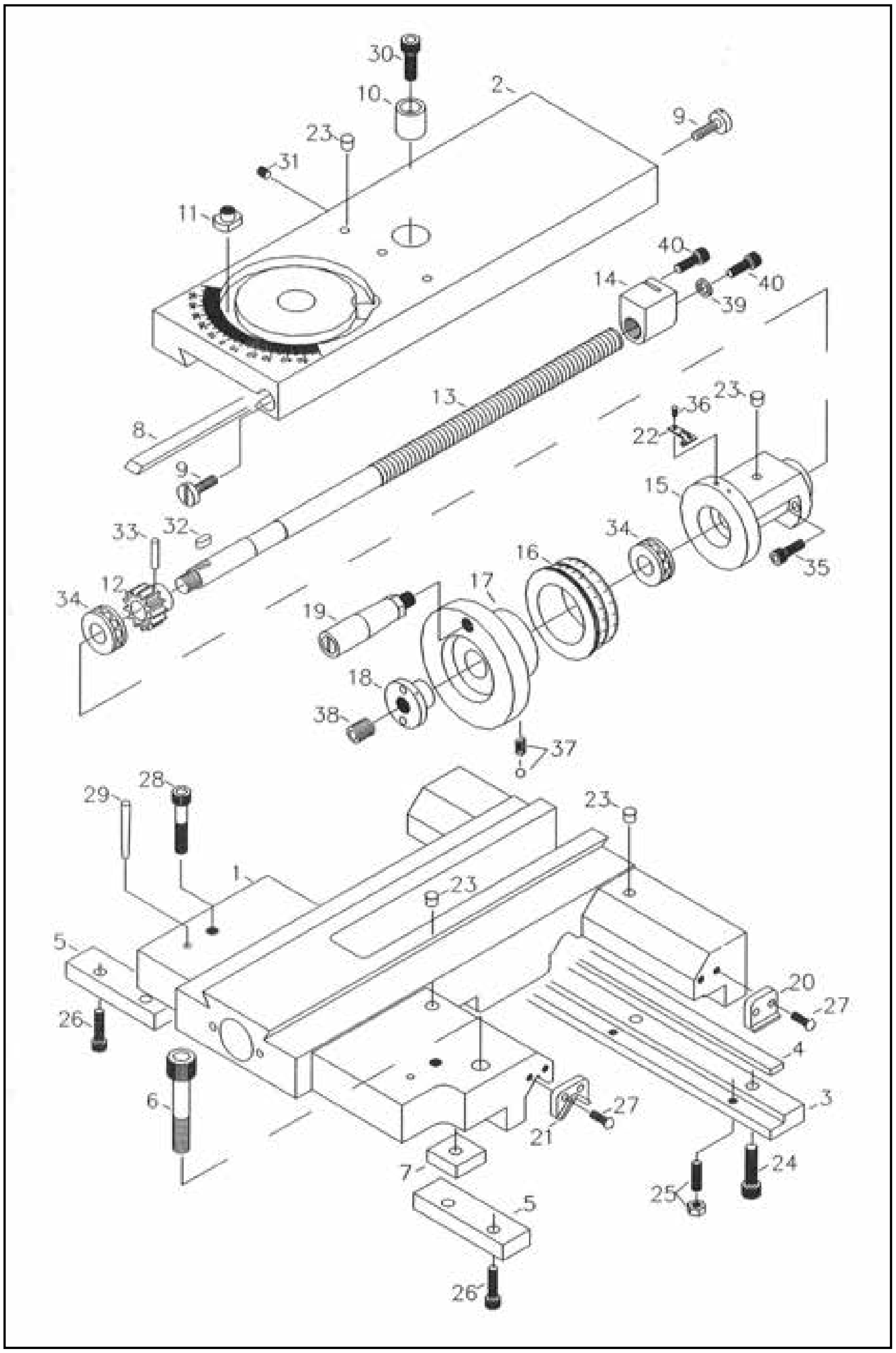
Apron



Ref	Mfr #	Description	Qty
2	2302	Gear shaft M2: 12T	1
3	2303	Flange	1
4	2304	Graduated collar	1
5	2305	Handwheel	1
6	2306	Handle	1
7	2307	Gear shaft M1.5: 13T	1
8	2308	Gear 50T, M2	1
9	2314	Shaft	1
10	2315	Gear assembly M2: 22T/44T	1
15	2311	Shaft	1
16	2312	Gear M2: 22T	1
17	2313	Gear M1.5: 18T	1
18	2319	Shaft	1
19	2320	Bushing	1
20	2321	Split nut shaft	1
21	2322	Split nut actuator	1
22	2323	Hub	1
34	2342	Cap screw M6 x 16	3
35	2341	Steel ball & spring pair	1
36	2342	Pin 5 x 50 mm	1
37	2343	Pin 5 x 30 mm	2
38	2344	Retaining ring	1
43	2348	Key 5 x 14 mm	2
44	2346	Retaining ring	2
45	2351	Pin 5 x 40 mm	1
46	2352	Key 5 x 18 mm	1
47	2353	Set screw M8 x 10	1
48	2354	Retaining ring	1

There may be detail differences between this representative drawing and the machine as supplied

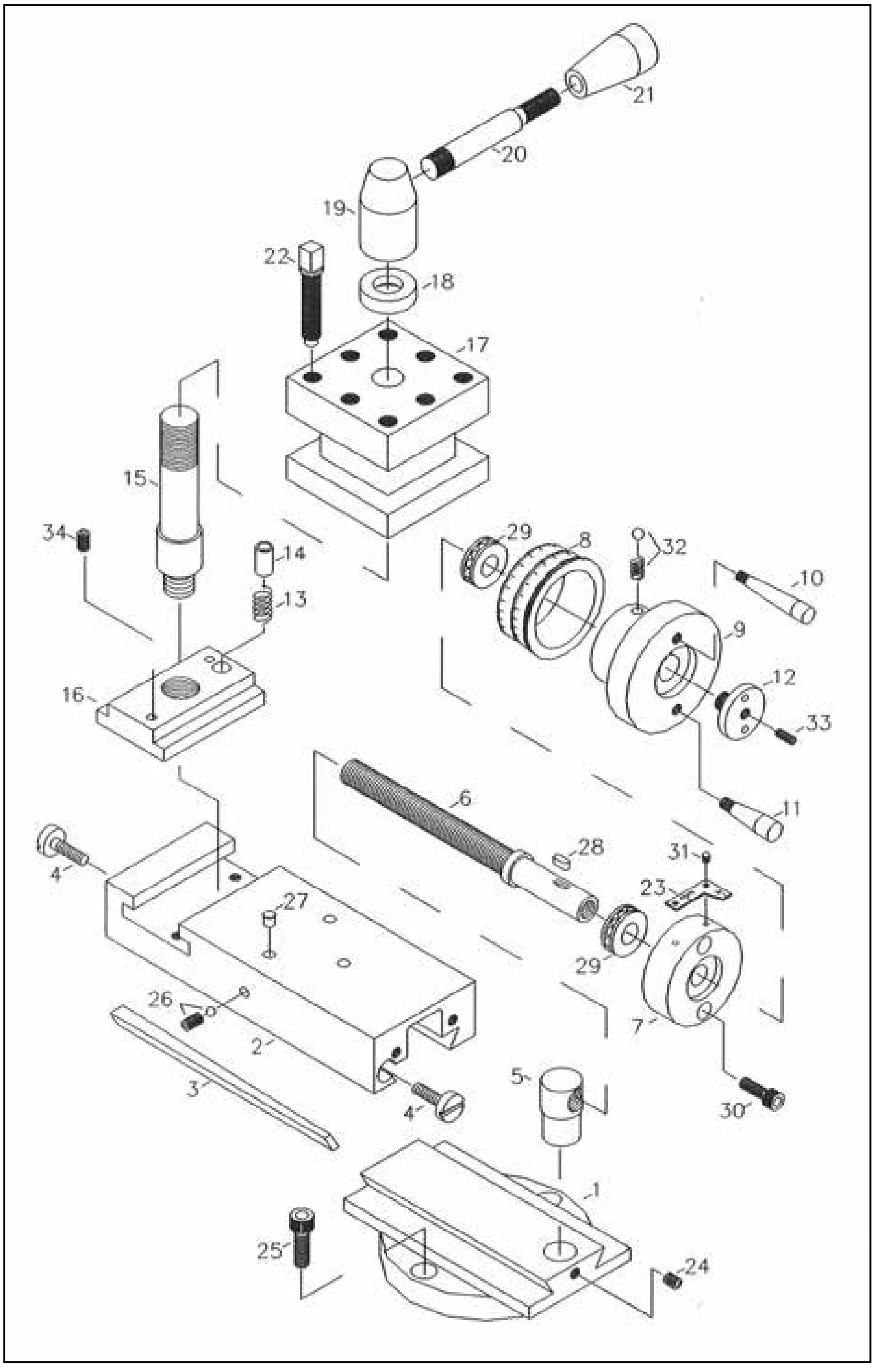
Saddle & cross slide



There may be detail differences between this representative drawing and the machine as supplied

Ref	Mfr #	Description	Qty
1	2401	Saddle casting	1
2	2402	Cross slide	1
3	2403	Gib support bar	1
4	2404	Saddle gib, rear	1
5	2405	Saddle gib, front	2
6	2406	Salle lock screw	1
7	2407	Saddle lock plate	1
8	2408	Cross slide gib	1
9	2409	Gib screw	2
10	2410	Bushing	1
11	2419	T-nut	2
12	2411	Gear M2: 13T	1
13	2412	Leadscrew	1
14	2413	Leadscrew nut	1
15	2414	Support flange	1
16	2415	Graduated collar	1
17	2417	Handwheel	1
18	2416	Locknut	1
19	2418	Handle	1
20	2439	Wiper, rear	2
21	2440	Wiper, front	2
22	2465	Index tab	1
23	2450	Oiler	5
24	2454	Cap screw M8 x 20	3
25	2453	Set screw & nut	5
26	2451	Cap screw M8 x 16	4
27	2452	Screw	8
28	2466	Cap screw	2
29	2467	Pin	2
30	2462	Cap screw M8 x 20	1
31	2461	Set screw M8 x 16	1
32	2460	Key 5 x 12 mm	1
33	2459	Pin 5 x 22 mm	1
34	2457	Thrust bearing 2902	2
35	2458	Cap screw M6 x 25	2
36	2446	Rivet	2
37	2456	Steel ball & spring	1
38	2455	Set screw	1
39	2464	Washer	1
40	2463	Cap screw M6 x 12	2

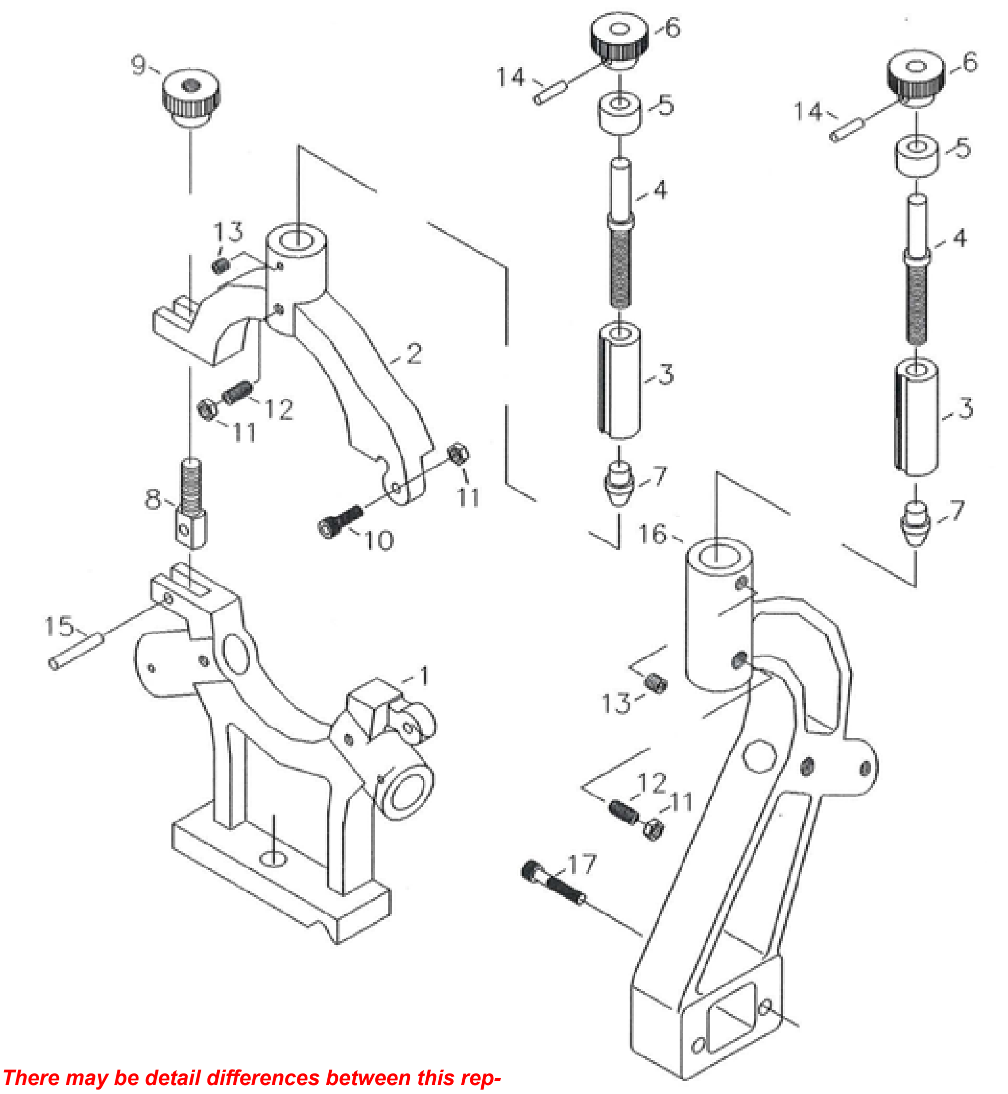
Compound



Ref	Mfr #	Description	Qty
1	2420	Swivel base	1
2	2421	Compound slide	1
3	2422	Gib	1
4	2423	Gib screw	2
5	2424	Leadscrew nut	1
6	2425	Leadscrew	1
7	2426	Flange	1
8	2427	Graduated collar	1
9	2428	Handwheel	1
10	2429	Handle	1
11	2430	Handle	1
12	2431	Locknut	1
13	2442	Spring	1
14	2431	Detent plunger	1
15	2432	Toolpost stud	1
16	2441	T-nut	1
17	2433	4-way toolpost	1
18	2434	Washer	1
19	2435	Hub	1
20	2436	Lever	1
21	2437	Knob	1
22	2438	Clamp screw	8
23	2443	Index tab	1
24	2463	Set screw M6 x 12	1
25	2462	Cap screw M8 x 16	2
26	2445	Steel ball & set screw	1
27	2469	Oiler	3
28	2450	Key 4 x 10 mm	1
29	2464	Thrust bearing 51101	2
30	2465	Cap screw M6 x 25	2
31	2466	Rivet	2
32	2446	Steel ball & spring	1
33	2467	Set screw M6 x 16	1
34	2455	Set screw M6 x 16	2

There may be detail differences between this representative drawing and the machine as supplied

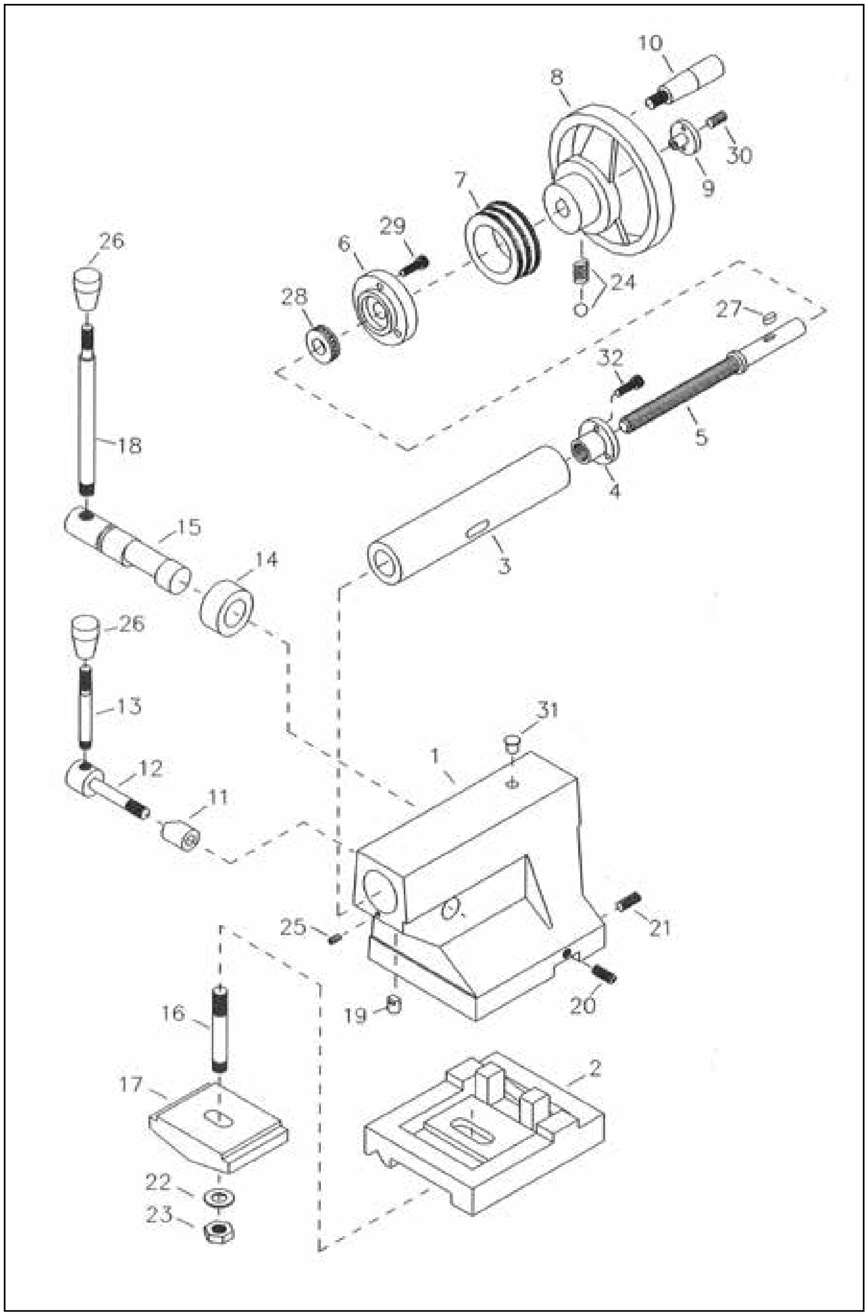
Rests



There may be detail differences between this representative drawing and the machine as supplied

Ref	Mfr. #	Description	Qty
1	2917	Steady rest casting	1
2	2918	Hinge casting	1
3	2919	Plunger	5
4	2920	Adjusting screw	5
5	2905	Collar	5
6	2921	Thumb nut	5
7	2922	Cone point	5
8	2923	Hinge clamp screw	1
9	2924	Thumb nut	1
10	2925	Hinge pivot	1
11	2930	Lock nut	5
12	2926	Set screw	5
13	2927	Set screw	5
14	2928	Roll piin	5
15	2929	Roll pin	1
16	2915	Traveler casting	1
17	2916	Screw	2

Tailstock



1	2501	Tailstock casting	1
2	2502	Base	1
3	2503	Quill	1
4	2504	Flange nut	1
5	2505	Feed screw	1
6	2506	Flange	1
7	2507	Graduated collar	1
8	2508	Handwheel	1
9	2509	Locknut	1
10	2510	Handle	1
11	25 I I	Quill clamp block	1
12	2512	Quill clamp shaft	1
13	2513	Quill clamp lever	1
14	2514	Tailstock clamp collar	1
15	2515	Tailstock clamp camshaft	1
16	2516	Tailstock clamp stud	1
17	2517	Clamp base	1
18	2518	Tailstock clamp lever	1
19	2519	Key	1
20	2520	Set screw M8 x 30	2
21	2521	Set screw M8 x 30	2
22	2522	Washer Ml2	1
23	2523	Nut M12	1
24	2524	Steel ball & spring	1
25	2525	Set screw M5 x 10	1
26	2526	Knob	2
27	2528	Key 5 x 12	1
28	2529	Thrust bearing 2902	1
29	2530	Cap screw M6 x 20	3
30	2531	Set screw M6 x 16	1
31	2527	Oiler	1
32	2532	Cap screw M5 x l6	3

There may be detail differences between this representative drawing and the machine as supplied