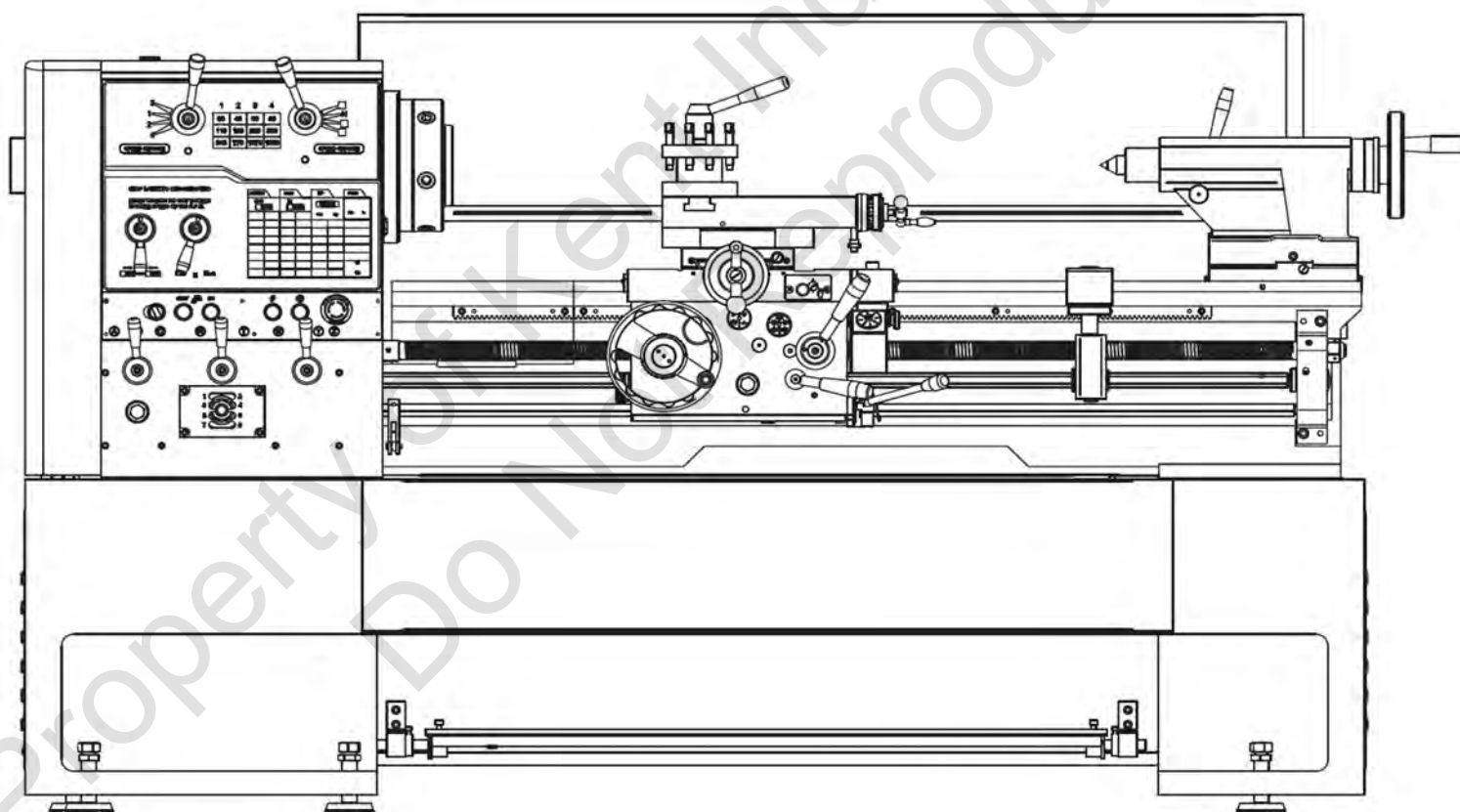




MLX Series 1640/1660/1680/2040/2060/2080 Manual Precision Lathes *Operation and Parts Manual*



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FC Series

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Safety Instructions

ATTENTION

It is essential to read this operation manual and understand the program instructions and maintenance instructions before operating the machine.

This operation manual should be attached to the machine at all time where it is readily available to the operator for reference.

1. **Owner's Manual** : All machinery and machining equipment presents serious injury hazards to untrained users. To reduce the risk of injury, anyone who uses this item must read and understand this entire manual before starting.
2. **Safe Environment** : Operating electrically powered equipment in a wet environment may result in electrocution; operating near highly flammable materials may result in a fire or explosion. Only operate this item in a dry location that is free from flammable materials.
3. **Trained / Supervised Operators Only** : Untrained users can seriously injure themselves. Only allow trained and properly supervised personnel to operate this item. Make sure safe operation instructions are clearly understood. If electrically powered, use padlocks and master switches, and remove start switch keys to prevent unauthorized use or accidental starting.
4. **Work Area** : Clutter and dark shadows increase the risks of accidental injury. Only operate this item in a clean, non-glaring, and well-lighted work area.
5. **Personal Protective Equipment** : Operating or servicing this item may expose the user to flying debris, dust, smoke, dangerous chemicals, or loud noises. These hazards can result in eye injury, blindness, long-term respiratory damage, poisoning, cancer, reproductive harm or hearing loss. Reduce your risks from these hazards by wearing approved eye protection, respirator, gloves, or hearing protection.
6. **Guards / Covers** : Accidental contact with moving parts during operation may cause severe entanglement, impact, cutting, or crushing injuries. Reduce this risk by keeping any included guards/covers/doors installed, fully functional, and positioned for maximum protection.
7. **Entanglement** : Loose clothing, gloves, neckties, jewelry or long hair may get caught in moving parts, causing entanglement, amputation, crushing, or strangulation. Reduce this risk by removing / securing these items so they cannot contact moving parts.
8. **Mental Alertness** : Operating this item with reduced mental alertness increases the risk of accidental injury. Do not let a temporary influence or distraction lead to a permanent disability! Never operate when under the influence of drugs/ alcohol, when tired, or otherwise distracted.
9. **Electrical Connection** : With electrically powered equipment, improper connections to the power source may result in electrocution or fire. Always adhere to all electrical requirements and applicable codes when connecting to the power source. Have all work inspected by a qualified electrician to minimize risk.
10. **Disconnect Power** : Adjusting or servicing electrically powered equipment while it is connected to the power source greatly increases the risk of injury from accidental startup. Always disconnect power before any service or adjustments, including changing blades or other tooling.
11. **Secure Workpiece / Tooling** : Loose workpieces, cutting tools, or rotating spindles can become dangerous projectiles if not secured or if they hit another object during operation. Reduce the risk of this hazard by verifying that all fastening devices are properly secured and items attached to spindles have enough clearance to safely rotate.

Lathe Safety

1. **Clearing Chips** : Metal chips can easily cut bare skin—even through a piece of cloth. Avoid clearing chips by hand or with a rag. Use a brush or vacuum to clear metal chips.
2. **Chuck Key Safety** : A chuck key left in the chuck can become a deadly projectile when the spindle is started. Always remove the chuck key after using it. Develop a habit of not taking your hand off of a chuck key unless it is away from the machine.
3. **Tool Selection** : Cutting with an incorrect or dull tool increases the risk of accidental injury because extra force is required for the operation, which increases risk of breaking or dislodging components, which can cause small shards of metal to become dangerous projectiles. Always select the right cutter for the job and make sure it is sharp. A correct, sharp tool decreases strain and provides a better finish.
4. **Securing Workpiece** : An improperly secured workpiece can fly off of the lathe spindle with deadly force, which can result in a severe impact injury. Make sure the workpiece is properly secured in the chuck or faceplate before starting the lathe.
5. **Large Chucks** : Large chucks are very heavy and difficult to grasp, which can lead to crushed fingers or hands if mishandled. Get assistance when installing or removing large chucks to reduce this risk. Protect your hands and the precision-ground ways by using a chuck cradle or piece of plywood over the ways of the lathe when servicing chucks.
6. **Safe Clearances** : Workpieces that crash into other components on the lathe may throw dangerous projectiles in all directions, leading to impact injury and damaged equipment. Before starting the spindle, make sure the workpiece has adequate clearance by hand-rotating it through its entire range of motion. Also, check the tool and tool post clearance, chuck clearance, and saddle clearance.
7. **Speed Rates** : Operating the lathe at the wrong speed can cause nearby parts to break or the workpiece to come loose, which will result in dangerous projectiles that could cause severe impact injury. Large workpieces must be turned at slow speeds. Always use the appropriate feed and speed rates.
8. **Stopping Spindle by Hand** : Stopping the spindle by putting your hand on the workpiece or chuck creates an extreme risk of entanglement, impact, crushing, friction, or cutting hazards. Never attempt to slow or stop the lathe spindle with your hand. Allow the spindle to come to a stop on its own or use the brake (if equipped).
9. **Crashes** : Driving the cutting tool or other lathe components into the chuck may cause an explosion of metal fragments, which can result in severe impact injuries and major damage to the lathe. Reduce this risk by releasing automatic feeds after use, not leaving lathe unattended, and checking clearances before starting the lathe. Make sure no part of the tool, tool holder, compound slide, cross slide, or carriage will contact the chuck during operation.
10. **Long Stock Safety** : Long stock can whip violently if not properly supported, causing serious impact injury and damage to the lathe. Reduce this risk by supporting any stock that extends from the chuck/headstock more than three times its own diameter. Always turn long stock at slow speeds.
11. **Coolant Safety** : Contaminated cutting fluid is a very poisonous biohazard that can cause personal injury from skin contact alone. Incorrectly positioned cutting fluid nozzles can splash on the operator or the floor, resulting in an exposure or slipping hazard. To decrease your risk, change cutting fluid regularly and position the cutting fluid nozzle where it will not splash or end up on the floor.

Section 1 : Controls & Components

Identification

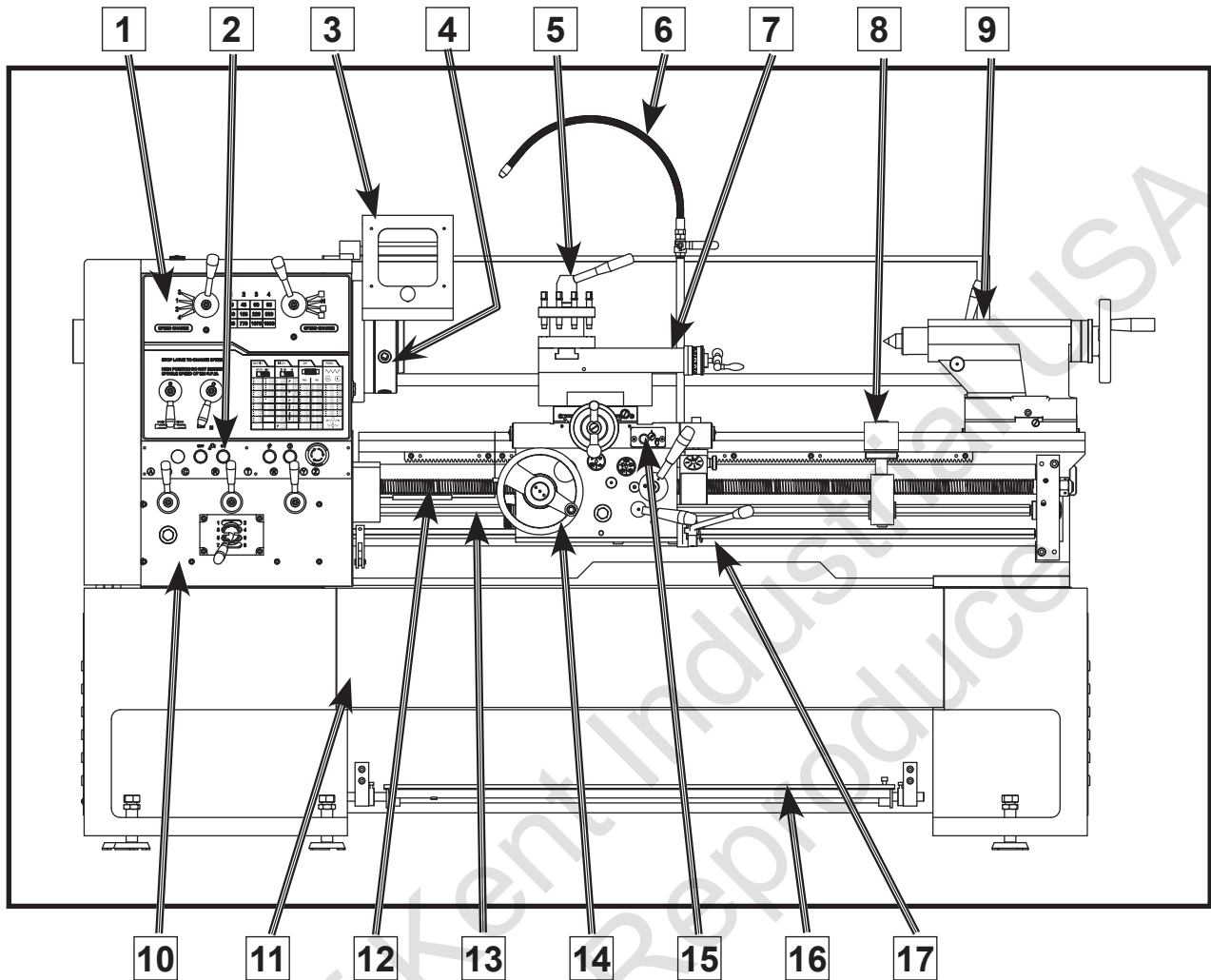


Figure 1. The ML-1760 Lathe.

- | | |
|--|---------------------------|
| 1. Headstock | 10. Gearbox |
| 2. Control Panel | 11. Removable Chip Drawer |
| 3. Chuck Safety Guard | 12. Leadscrew |
| 4. D1-6 Camlock MT#5 Spindle | 13. Feed Rod |
| 5. 4-Way Tool Post | 14. Apron |
| 6. Cutting Fluid Tube and Nozzle | 15. Cross Slide |
| 7. Compound Rest | 16. Brake Pedal |
| 8. Leadscrew & Feed Rod Support
(1760 & 1860 & 2160 only) | 17. Spindle ON / OFF Rod |
| 9. Tailstock | |

Control Panel

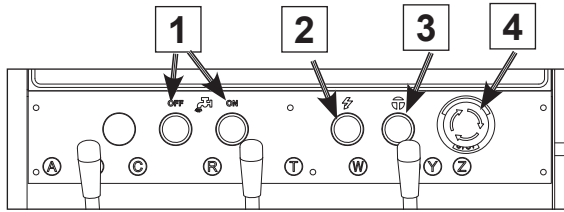


Figure 2. Control Panel.

1. **Cutting Fluid Pump Switch** : Turns cutting fluid delivery ON / OFF.
2. **Power Light** : Illuminates when lathe is receiving power.
3. **Jog Button** : Turns the spindle motor ON while being pressed and held.
4. **Emergency Stop Button** : Stops all machine functions. Twist clockwise to reset.

Headstock Controls

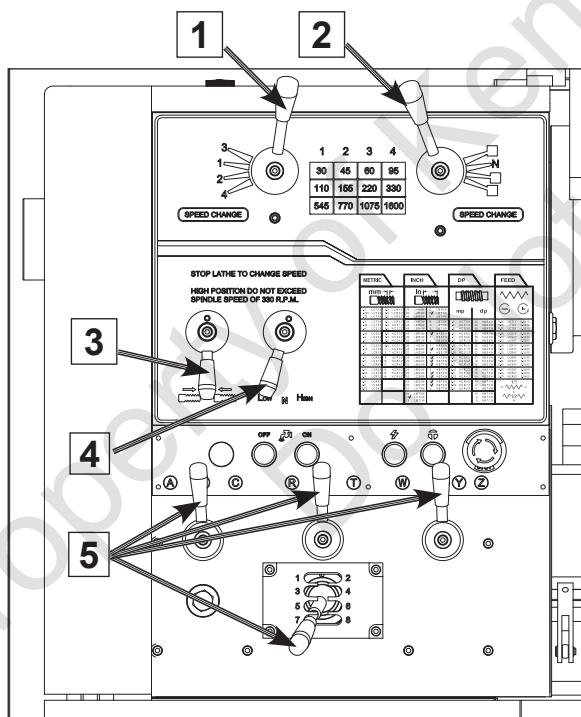


Figure 3. Headstock Panel.

1. **Spindle Speed Lever** : Selects 1, 2, 3 or 4 gear position on the spindle speed chart.

2. **Spindle Range Lever** : Selects A, B or C range of spindle speeds on the spindle speed chart
3. **Feed Direction Lever** : This lever changes the direction that the gearbox is turning at, and as a result the leadscrew and feed rod change direction.
4. **Gearbox Range Lever** : This lever puts the gearbox in high or low range and has no effect on spindle RPM.
5. **Gearbox Levers** : Moves the gearbox gears into particular ratios, which then turn the leadscrew and feed rod for threading and power feed operations.

Carriage Controls

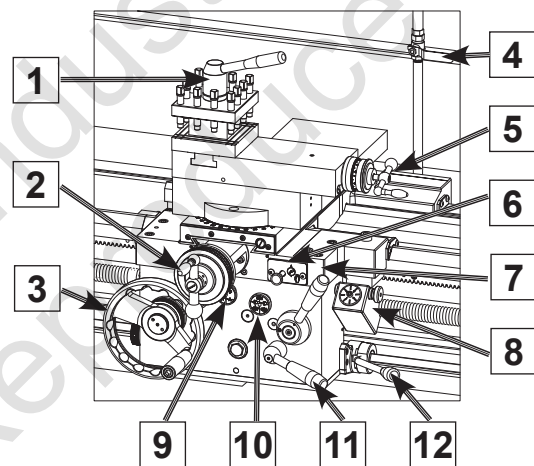


Figure 4. Carriage Controls.

1. **4-Way Tool Post Lever** : Used for locking the rotary tool post in eight possible detents.
2. **Cross Slide Handwheel** : Positions the cross slide in or out.
3. **Carriage Handwheel** : Allows for manual movement of the carriage from left to right along the bed.
4. **Cutting Fluid Flow Control Lever** : Used to vary the flow of cutting fluid out of the nozzle.
5. **Compound Hand Crank** : Used to position the compound along the compound slide.
6. **Manual Carriage Oil Pump** : Draws oil from the apron case and lubricates the carriage and ways through various oil ports.
7. **Halfnut Lever** : Engages and disengages the apron with the leadscrew for threading operations.

8. **Thread Dial** : Indicates when to engage the half nut during threading operations.
9. **Feed Selection Knob** : Selects the carriage or cross slide for power feed.
10. **Apron Feed Direction Knob** : Changes direction of carriage or the cross slide feed without having to stop the lathe and move the headstock feed direction lever.
11. **Feed ON / OFF Lever** : Engages / disengages power feed.
12. **Spindle ON / OFF Lever** : Used to start and stop the lathe during normal operation.
13. **Feed Clutch**: This adjustable clutch helps protect the feed system against broken gears and shafts caused by accidental overloads.
1. **Graduated scale** : Indicates quill movement in increments of 0.001" or 0.02mm.
2. **Tailstock Lock Lever** : Secures the tailstock in place along the bedway.
3. **Quill Lock Lever** : Locks the quill in position.
4. **Quill** : Moves toward and away from the spindle and holds centers and tooling.
5. **Quill Handwheel** : Moves the quill toward or away from the spindle.
6. **Offset Scale** : Indicates the distance of tailstock offset from the spindle center line.
7. **Tailstock Offset Screw** : Adjusts and secures the tailstock offset (1 of 2).
8. **Tailstock Gib Screw** : Adjust the tapered gib to control tailstock offset accuracy.

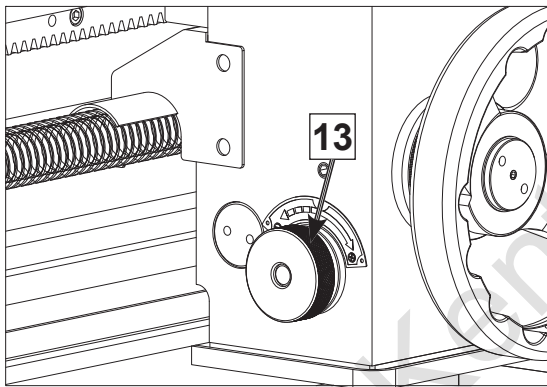


Figure 5. Feed clutch.

Tailstock Controls

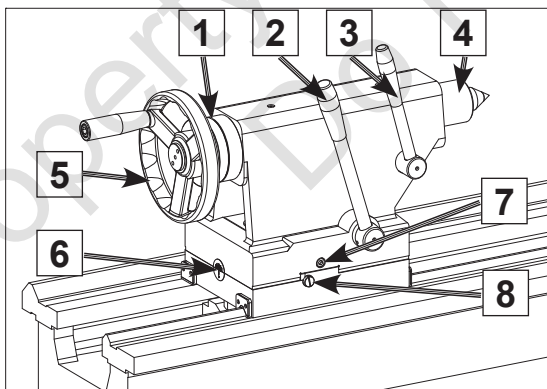


Figure 6. Tailstock Controls.

Foot Brake

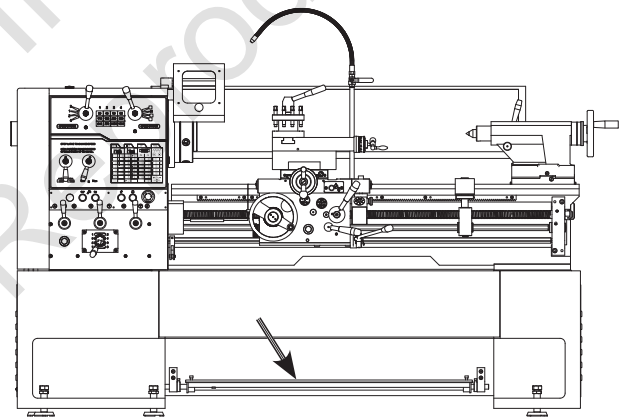


Figure 7. Foot Brake.

This lathe is equipped with a foot brake (Figure 7) to quickly stop the spindle. Pushing the foot brake while the spindle is ON cuts power to the motor and stops the spindle. Once stopped, the spindle lever **MUST** be returned to the neutral position before the spindle can be restarted.

Section 2 : Setup

Physical Environment

The physical environment where your machine is operated is important for safe operation and longevity of parts. For best results, operate this machine in a dry environment that is free from excessive moisture, hazardous or flammable chemicals, airborne abrasives, or extreme conditions. Extreme conditions for this type of machinery are generally those where the ambient temperature is outside the range of 9° ~ 72°C(48.2° ~ 161.6°F); the relative humidity is outside the range of 20–95% (non-condensing); or the environment is subject to vibration, shocks, or bumps.

Electrical Installation

Place this machine near an existing power source. Make sure all power cords are protected from traffic, material handling, moisture, chemicals, or other hazards. Make sure to leave access to a means of disconnecting the power source or engaging a lockout / tagout device.

Lighting

Lighting around the machine must be adequate enough that operations can be performed safely. Shadows, glare, or strobe effects that may distract or impede the operator must be eliminated.

Weight Load

Make sure that the surface upon which the machine is placed will bear the weight of the machine, additional equipment that may be installed on the machine, and the heaviest workpiece that will be used. Additionally, consider the weight of the operator and any dynamic loading that may occur when operating the machine.

Space Allocation

Consider the largest size of workpiece that will be processed through this machine and provide enough space around the machine for adequate operator material handling or the installation of auxiliary equipment. With permanent installations, leave enough space around the machine to open or remove doors/covers as required by the maintenance and service described in this manual.

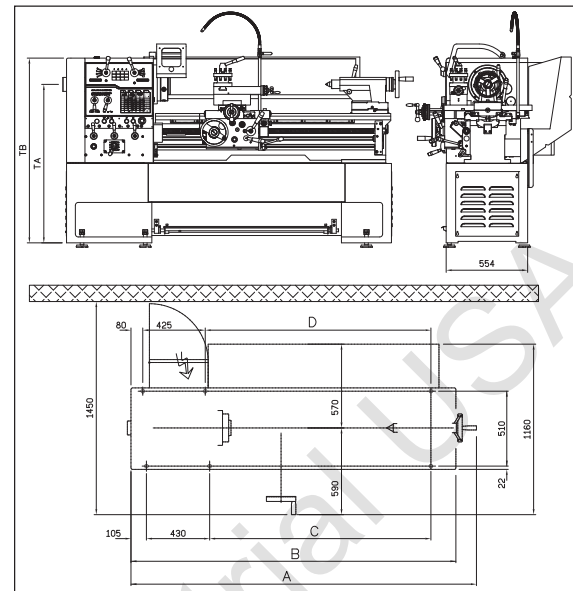


Figure 8. Space required for full range of movement.

Model	TA	TB	UNIT:mm	
1 6 4 0 / 1 6 6 0	1078	1260		
1 8 4 0 / 1 8 6 0	1093	1275		
2 1 4 0 / 2 1 6 0	1133	1315		
Model	A	B	C	D
1640/1840/2140	2377	2210	1505	1535
1660/1860/2160	2877	2710	2005	2035

Lifting & Moving

This lathe is an extremely heavy machine. Serious personal injury or death may occur if safe lifting and moving methods are not followed. Get assistance from a professional rigger if you are unsure about your abilities or maximum load ratings of your lifting equipment.

To lift and move your lathe :

1. Prepare the permanent location for the lathe.
2. Remove the shipping crate top and sides, then remove the small components from the shipping pallet.
3. To balance the lifting load, loosen the tailstock lock lever (Figure 9), move the tailstock to the end of the bedway, then lock it in place.

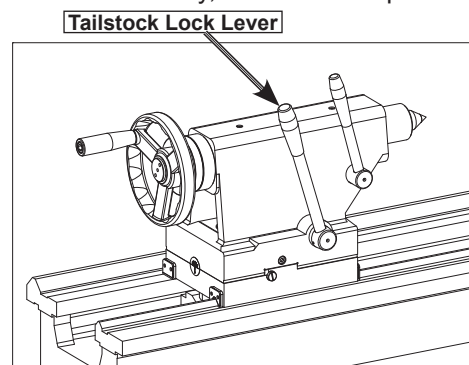


Figure 9. Tailstock lock lever.

4. To further balance the load, loosen the carriage lock bolt, disengage the half nut lever, then use the carriage handwheel to move the carriage next to the tailstock. (Figure 10)

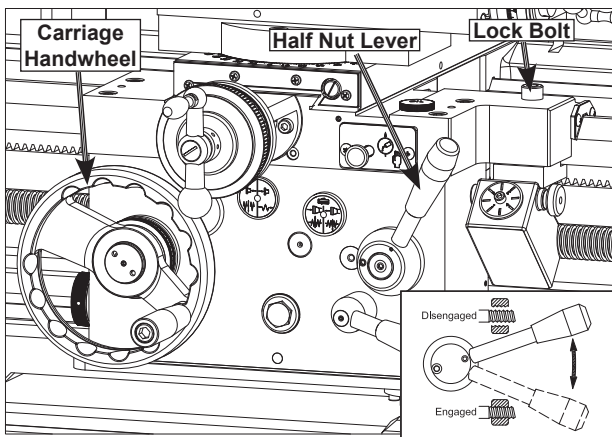


Figure 10. Carriage controls set for moving the carriage.

5. Locking the carriage lock bolt and tailstock lock lever.
6. **Lifting the machine with crane.**
 - a. Make sure that minimum crane capacity is more than 3 tons for security.
 - b. Only an authorized crane operator should use the lift machine.
 - c. Crane work should be cooperatively done by two persons, that is, an operator and a watchman, not to damage projecting on the machine perimeter.
 - d. To put in the jig with wire set inserting to bed way.
 - e. Make sure that two hexagon nuts is fixed.
 - f. Keep the machine's center of gravity at the center of the crane.

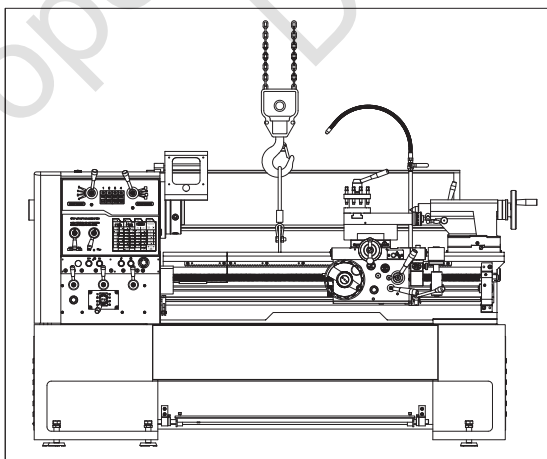


Figure 11. Lifting the machine with crane.

7. **Moving the machine with a forklift.**

- a. Make sure that the minimum forklift capacity is more than 3 tons for security.
- b. Forklift work should be cooperatively done by two persons, that is an operator and watchman, not to damage projecting on the machine perimeter.
- c. To put the fork, use the fork inserting the plinth mid-lift.
- d. Keep the machine's balance of gravity at the center of the forks.

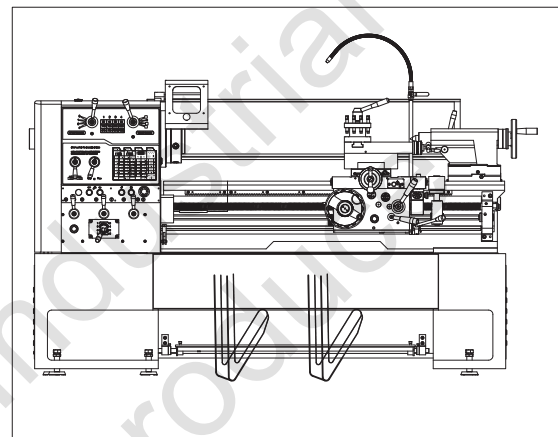


Figure 12. Moving the machine with a forklift.

Leveling

This lathe must be placed on the included leveling studs and cast-iron feet. Complete support at each of the six leveling stud locations is mandatory. The bed cannot be twisted or bent, and the ways must be perfectly level with the floor. If a misalignment condition arises, adjust the leveling studs, or shim the cast iron feet where they touch the floor until the bed and ways are in alignment.

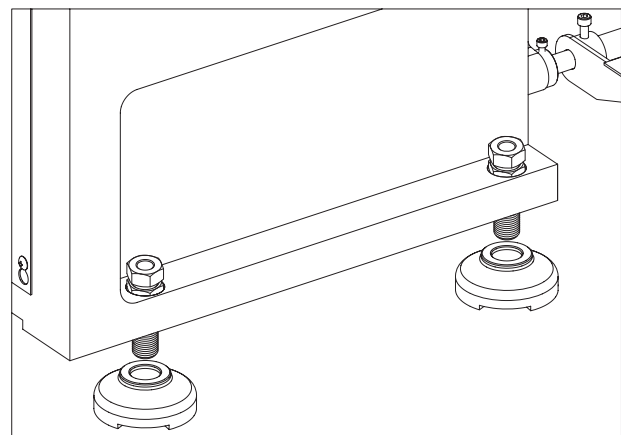


Figure 13. Leveling pads and screws.

To level the machine, use a precision level to make sure the bedways are level from side-to-side and from front-to-back.

Leveling machinery helps precision components, such as bedways, remain straight and flat during the lifespan of the machine. Components on an unlevelled machine may slowly twist due to the dynamic loads placed on the machine during operation.



Figure 14. Example of a precision level.

Test Run

After all preparation steps have been completed, the machine and its safety features must be tested to ensure correct operation. If you discover a problem with the operation of the machine or its safety components, shut the machine down, disconnect it from power, and do not operate it further until you have resolved the problem.

To test run the lathe:

1. Disconnect the lathe from POWER !
2. Make sure that the headstock oil tank, gearbox, apron oil levels are full.
3. Make sure that the chuck and jaws are secure, If a chuck is not installed on the lathe, you do not need to install one for this test.

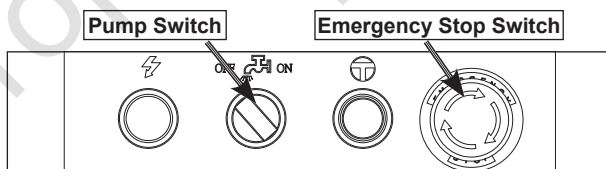


Figure 15. Control Panel.

4. Move the spindle range lever so that the indicator points to the A. (Figure 16)
5. Rotate the spindle speed lever so that the indicator points to the 1. (Figure 16)

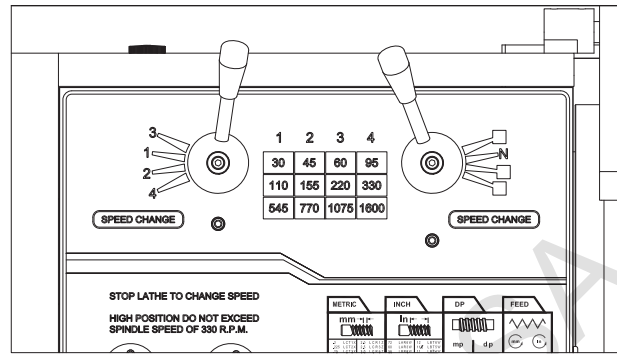


Figure 16. Headstock range lever.

6. Pull up on the half nut and the feed ON/OFF levers as shown in Figure 17.

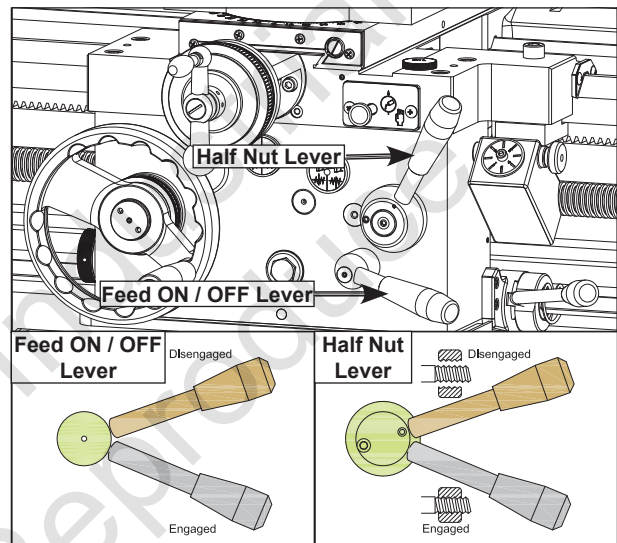


Figure 17. Apron controls for test run.

7. Using a 10mm hex wrench, loosen the carriage lock (Figure 18) so the carriage is free to slide.
8. Move the spindle ON / OFF lever to the OFF (middle) position as shown in Figure 18.

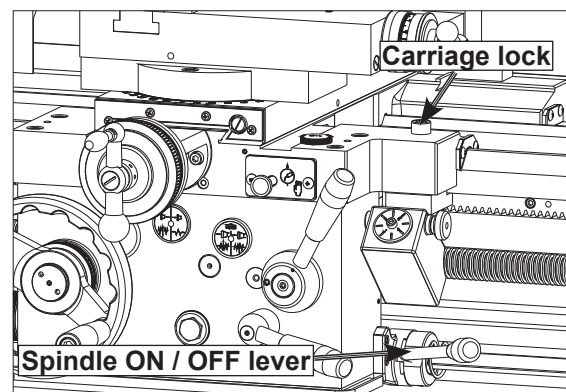


Figure 18. Carriage lock & Spindle ON / OFF lever.

9. Press the STOP button on the control panel to ensure that the lathe does not unexpectedly start when connected to power during the next step.
10. Connect the lathe to power source.
11. Rotate STOP button clockwise until it pops out. The power light on the control panel should illuminate.
12. Move the spindle ON / OFF lever down and the spindle/chuck will rotate.
13. Observe and listen for any abnormal noises or vibration. The lathe should run smoothly with little or no vibration or rubbing noises.
14. Push the foot brake, and the lathe should come to a quick stop.
15. Lift the chuck guard and try to start the lathe again. The cover kill switch should prevent the lathe from starting while the guard is open.

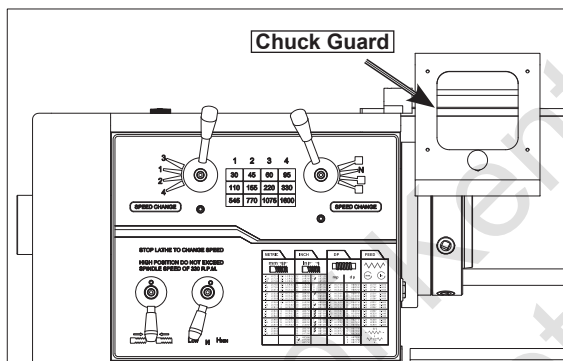


Figure 21. Chuck safety cover.

16. Move the spindle ON/OFF lever to the OFF (middle) position. Remove the lathe end gear cover so the safety switch opens and disables the lathe from starting.
17. Attempt to start the lathe. Should the lathe start, the safety switch is faulty and needs replacement.
18. Push the STOP button in, move the spindle ON/OFF lever to the OFF position, then replace the end gear cover.

19. Point the coolant nozzle down into the chip drawer and verify that there is coolant in the reservoir.
20. Start the lathe, turn the coolant pump on, then open the valve. Verify that the coolant flows from the nozzle, then close the valve and turn the pump OFF.
21. The test run is now finished. Shut the lathe down and begin the Spindle Break-In procedure.

Spindle Break-in

It is essential to closely follow the proper break-in procedures to ensure trouble-free performance. Complete this process once you have familiarized yourself with all instructions in this manual and completed the test run.

To break-in the spindle :

1. Complete the Test Run procedure.
2. Set the spindle speed for 36 RPM.
3. Run the lathe for 10 minutes.
4. Turn the lathe OFF and wait until the spindle is completely stopped.
5. Repeat Steps 2–4 for each of the remaining 11 spindle speeds.
6. Set the spindle speed to 36 RPM and let the lathe run for a final 15 minutes to allow it to cool down, then turn the lathe OFF.
7. Change the oil in the headstock, quickchange gearbox, and apron reservoirs.
8. Check and, if necessary, re-tension the V-belts.

Section 3 : Operation

Chuck

This lathe is shipped with the 3-jaw chuck installed. This is a scroll-type chuck, meaning that all three jaws move in unison when adjusted.

The optional 4-jaw chuck features independent jaws, which are used for square or unevenly-shaped stock.

If neither chuck can hold your workpiece, the cast-iron faceplate has slots for T-bolts that hold standard or custom clamping hardware. With the correct clamping hardware, this faceplate will hold non-cylindrical parts such as castings.

The chucks and faceplate have a D-6 camlock mount. A chuck key is used to turn the locking cams (Figure 19) to secure / release the chuck / faceplate.

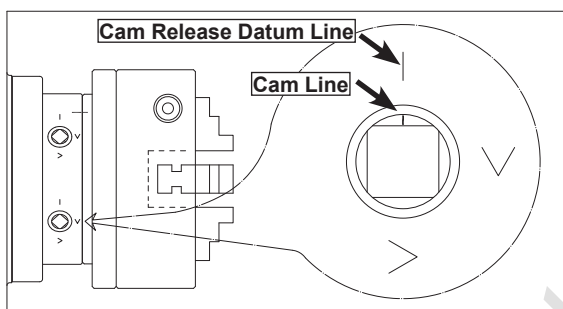


Figure 19. Camlock loosened with the cam line aligned with the datum line.

To install a chuck :

1. Disconnect lathe from POWER !
2. Place a piece of plywood across the lathe ways and position it just under the chuck.
3. Place the chuck on the cradle.
4. Make sure the chuck taper and spindle taper mating surfaces are perfectly clean.
5. Inspect and make sure that all camlock studs are undamaged, are clean and lightly oiled, and that the camlock stud cap screws are in place and snug.
6. If equipped, align the chuck-to-spindle timing marks (Figure 20), and slide the chuck onto the spindle.

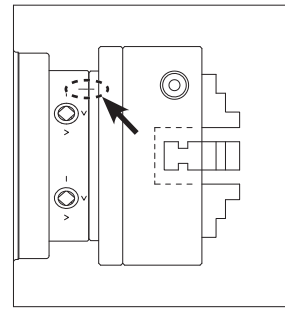


Figure 20. Chuck timing marks aligned.

7. Turn a camlock with the chuck key until the cam line falls between the "V" marks shown in Figure 21.

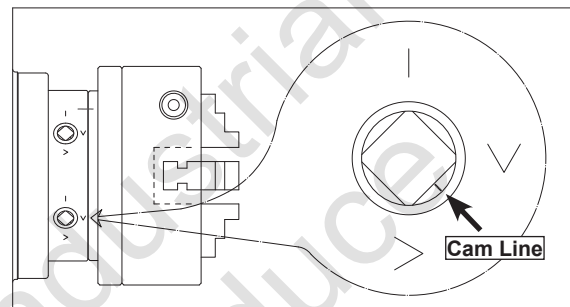


Figure 21. Cam and lines.

8. Lock the other cams in a crisscross or star pattern so the chuck is drawn up evenly on all sides without any chance of misalignment.
 9. Remove the chuck key.
- ### To remove a chuck :
1. Disconnect lathe from POWER !
 2. Place a piece of plywood across the lathe ways to protect the ways, or use a support cradle and position it just under the chuck.
 3. Turn a cam with the chuck key until the cam line aligns with the cam release datum line.
 4. Unlock the other cams in the same manner. Make sure to support the chuck as you align the last cam.
 5. Remove the chuck key.

Installing and Adjusting Camlock Stud

When fitting a chuck or faceplate with camlock studs, or when mounting a new chuck or faceplate, it may be necessary to install or adjust the camlock studs. In order to properly install or adjust one or more camlock studs, you must remove a stud locking cap screw, then thread the camlock stud in or out until the line on the side of the stud is flush with the top of the chuck casting.

3-Jaw Chuck

The 3-jaw scroll-type chuck included with this lathe features hardened steel jaws that center the workpiece. When the operator opens or closes the jaws with the chuck key, the jaws move in unison.

There are two sets of jaws included with the 3-jaw chuck — inside and outside jaws. Use the correct jaws for the size and configuration of the workpiece to hold it firmly and securely on the chuck.

Numbered from 1-3, the jaws must be used in the matching numbered jaw guides, as shown in Figure 22.

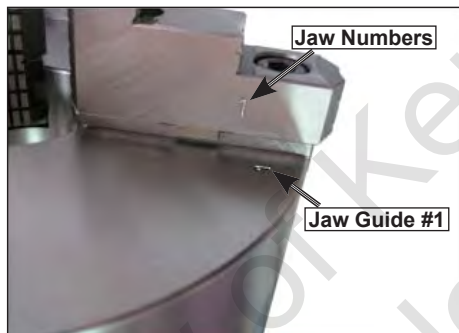


Figure 22. Jaw guides and jaw numbers.

To change the jaw :

1. Disconnect Lathe from POWER !
2. Place a piece of wood over the ways to protect them from potential damage.
3. Insert the chuck key and turn it counterclockwise to back the jaws out and remove them.
4. Clean the jaw mating surfaces and apply a thin film of white lithium grease to the mating surfaces.
5. Set the previously mounted jaws aside in a safe place free of moisture and abrasives.

6. Rotate the chuck key clockwise until you see the tip of the scroll gear lead thread just begin to Insert jaw #1 into jaw guide #1 and hold the jaw against the scroll gear lead thread.
7. Rotate the chuck key clockwise one turn to engage the tip of the scroll gear lead thread into the jaw.



Figure 23. Inserting jaw.

8. Pull on the jaw—now it should be locked into the jaw guide.
9. Repeat the Steps 6–8 on the remaining jaws.

To mount a workpiece in the 3-jaw chuck :

1. Disconnect Lathe from POWER !
2. Place a chuck cradle or plywood on the bedway below the chuck to protect it.
3. Use the chuck key to move the jaws and mount the workpiece to the chuck, similar to one of the methods shown in Figure 24. Make sure the workpiece is mounted firmly on the chuck.

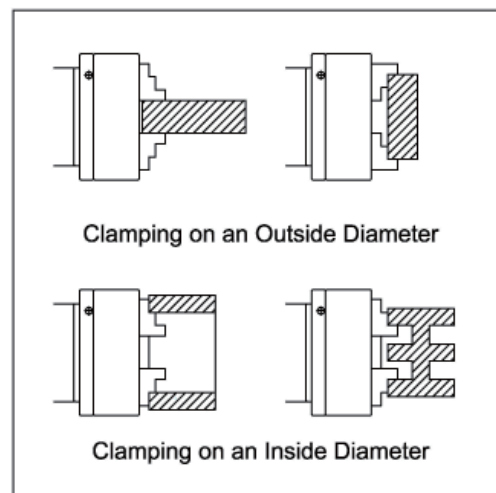


Figure 24. Examples of workpiece mounted in the 3-jaw chuck.

4. Rotate the chuck by hand to make sure the workpiece makes even contact with all three jaws and is centered.

4-Jaw Chuck

The 4-jaw chuck features independently adjustable hardened steel jaws to hold non-cylindrical or off-center workpieces. Each jaw can be removed from the chuck body and reversed for a wide range of work holding versatility.

To mount a workpiece on the 4-jaw chuck :

1. Disconnect Lathe from POWER !
2. Place a chuck cradle or plywood on the bedway below the chuck to protect it.
3. Use the chuck key to open each jaw so the workpiece will lay flat against the chuck face or jaw steps.
4. With help from another person or a supporting device, mount the workpiece centered on the chuck, then turn each jaw until it makes contact with the workpiece.
5. Tighten each jaw in small increments. After you have adjusted the first jaw, continue tightening in an opposing sequence.
6. After the workpiece is held in place by the jaws, turn the chuck by hand and pay attention to the workpiece alignment.

Tailstock

The tailstock on your lathe can be used to support workpieces with the use of a live or dead center.

It can also be used to drill or bore holes in the center of a part or cut shallow tapers by using the offset adjustment.

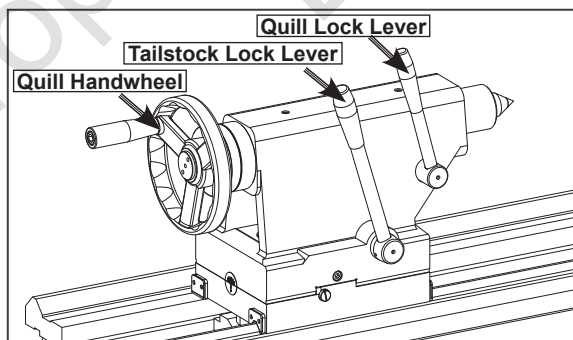


Figure 25. Tailstock and quill lock handles in locked position.

To move the tailstock :

1. Pull back on the lock lever.
2. Slide the tailstock to the desired position.
3. Push the tailstock lock lever forward to lock the tailstock to the lathe bed.

To use the tailstock quill :

1. With the tailstock locked to the bed, release the quill lock lever.
2. Turn the quill feed handwheel clockwise to feed/move the quill towards the spindle, or turn counterclockwise to move the quill away from the spindle.
3. Push the quill lock lever forward to lock the quill in place.

To install tooling in the tailstock :

1. With the tailstock locked, unlock the quill lock lever.
2. Turn the quill handwheel CW to extend quill about 25mm out of the casting.
3. Insert a tapered drill arbor or a tapered drill bit into the quill until the taper is firmly seated and the tang is locked to the quill slot.
4. Turn the quill handwheel CW to feed the drill bit into the rotating workpiece.
5. To remove the tooling from the tailstock, turn the quill handwheel CCW until the tooling is pushed out of the taper.

To offset the tailstock :

1. Lock the tailstock in position.
2. Loosen two nuts of bottom, adjust the left and right jack screws until the scale (Figure 26) indicates the offset you want. See Figure 27 for adjustment direction.
3. When the offset is achieved, snug the jack screws so the tailstock position is locked.

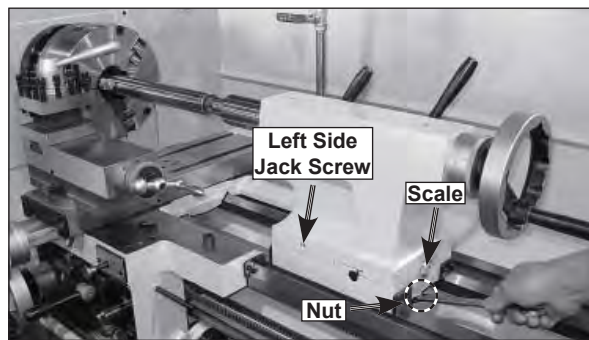


Figure 26. Tailstock offset adjustments.

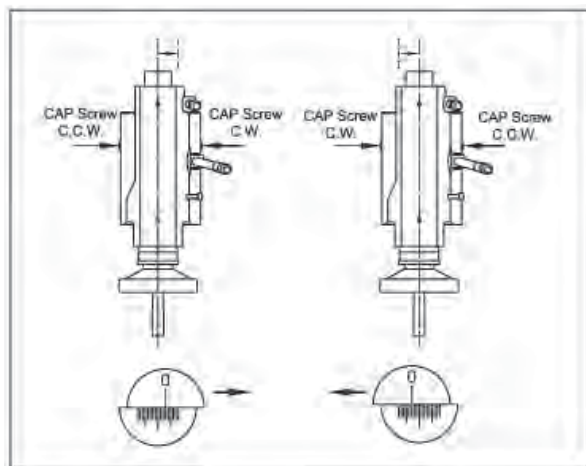


Figure 27. Jack screw adjustment verses tailstock movement.

Centers

Dead Centers

The dead center achieves more accurate results than a live center, but it requires low spindle speeds and a small amount of oil to reduce friction heat that may damage the workpiece.

Use the HSS dead center in the spindle, where the workpiece does not rotate on the tip and does not generate friction.

Use the carbide-tipped dead center in the tailstock where the workpiece will rotate against it and generate friction. The carbide-tipped dead center can better withstand the effects of friction; however, the tip of the center must be lubricated to avoid premature wear and maximize smooth operation. Also, using low spindle speeds will also reduce the heat and wear from friction.

Live Centers

A live center has bearings that allow the center tip and the workpiece to rotate together, and can be installed in the spindle and the tailstock quill for higher speeds, but with a slight bit of accuracy loss.

Mounting Dead Center in Spindle

1. Disconnect Lathe from POWER !
2. Thoroughly clean and dry the tapered mating surfaces of the spindle bore, tapered sleeve, and the center.
3. Insert the center into the sleeve, then insert the sleeve into the spindle bore through the chuck or faceplate.

Removing Center from Spindle

To remove the sleeve and center from the spindle, insert a piece of round bar stock or similar tool through the outboard end (on the left side of the headstock), then tap the sleeve loose.

Mounting Center in Tailstock

Either a dead center or live center can be mounted in the tailstock. Mounting instructions are the same for both.

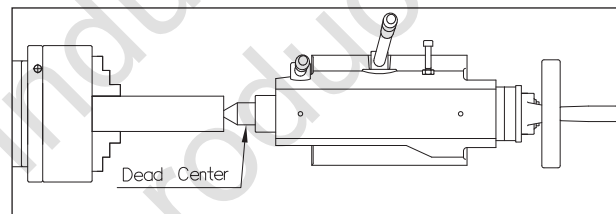


Figure 28. Example of using a dead center installed in the tailstock.

To mount a center in the tailstock :

1. Disconnect Lathe from POWER !
2. Thoroughly clean and dry the tapered mating surfaces of the tailstock quill bore and the carbide-tipped dead center.
3. Use the tailstock quill handwheel to feed the quill out from the casting about 25mm.
4. Insert the center into the tailstock quill.
5. Seat the center firmly into the quill during workpiece installation by rotating the quill handwheel clockwise to apply pressure.

Removing Center from Tailstock

To remove the center from the quill, hold onto it with a rag in one hand, then rotate the tailstock handwheel counterclockwise to draw the quill back into the casting until the center released.

Steady Rest

The steady rest supports long shafts and can be mounted anywhere along the length of the bed.

To install and use the steady rest :

1. Disconnect Lathe from POWER !
2. Thoroughly clean the machined base of the steady rest, then place it on the lathe bedways so the triangular notch fits over the bedway prism.
3. Position the steady rest where required to properly support the workpiece, then tighten the hex nut shown in Figure 29 to secure it in place.

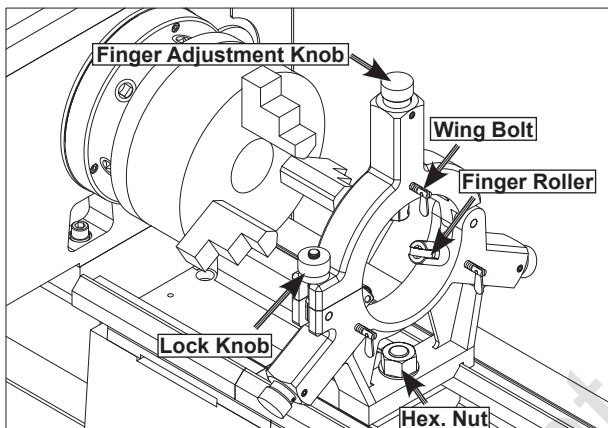


Figure 29. Steady rest components.

4. Loosen the lock knob and open the steady rest so the workpiece can rest on the bottom two finger rollers, as shown in Figure 30.

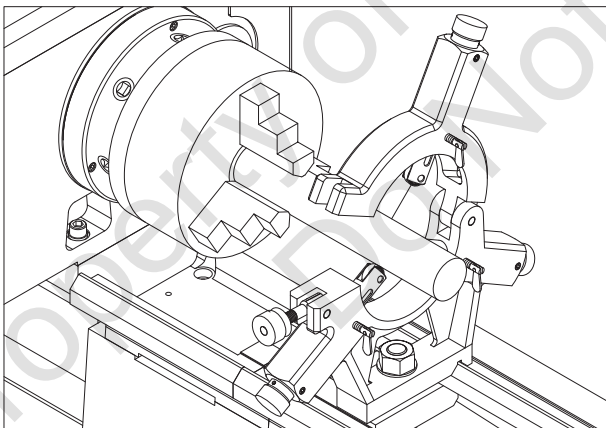


Figure 30. Workpiece mounted in the steady rest.

5. Close the steady rest so that the workpiece is inside the finger rollers, then tighten the lock knob.
6. Loosen the three wing bolts so the finger roller positions can be adjusted.
7. Use the finger adjustment knobs to just touch the finger rollers against the workpiece without causing workpiece deflection.
8. Tighten the three wing bolts.

Follow Rest

The follow rest mounts to the saddle with two cap screws (Figure 31). It is used on long, slender parts to prevent workpiece flexing from the pressure of the cutting tool during operation.

Adjust the sliding finger rollers on the follow rest in the same manner as those on the steady rest.

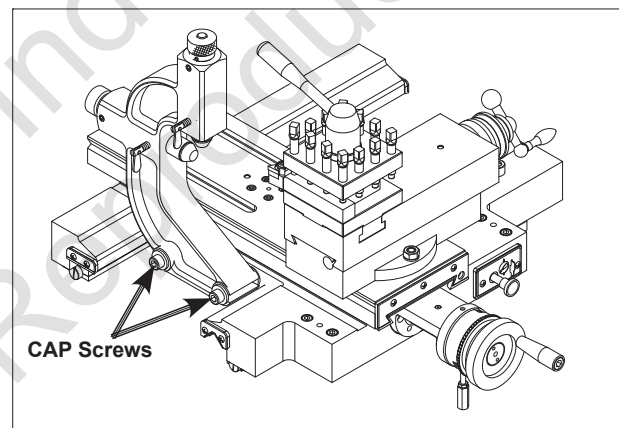


Figure 31. Follow rest attachment.

Compound Slide

The compound slide handwheel has an indirect-read graduated scale. This means that the distance shown on the scale represents the actual distance the tool moves, which of course, will remove twice as much material from the diameter of the workpiece. The base of the compound slide has another graduated scale used for setting the tool to a specific angle.

To set the compound slide at a certain angle :

1. Loosen the three CAP screws at the base of the compound slide (Figure 32).

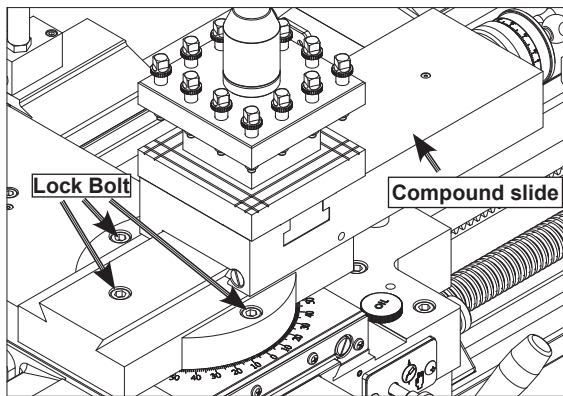


Figure 32. Compound slide set at an angle.

2. Rotate the compound to the desired angle, as indicated by the scale at the base, then retighten the two CAP screw.

4-Way Tool Post

The four-way tool post is mounted on top of the compound slide, and allows a maximum of four tools to be loaded simultaneously.

The four-way tool post allows for quick indexing to different tools. This is accomplished by loosening the top handle, rotating the tool post to the desired position, then re-tightening the handle to lock the tool into position.

To load the tool post :

1. Choose the desired cutting tool.
2. Loosen the tool post bolts so that the cutting tool can fit underneath them.
3. Firmly secure the cutting tool with at least two tool post bolts, as shown in Figure 33.

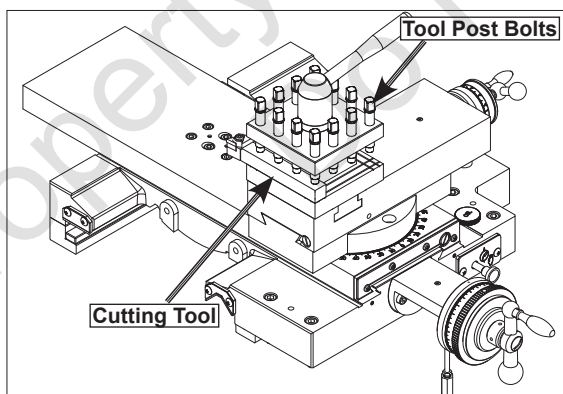


Figure 33. 4-way tool post.

Aligning Cutting Tool with Tailstock Center

For most operations, the cutting tool tip should be aligned with the spindle center line, as illustrated in Figure 34.

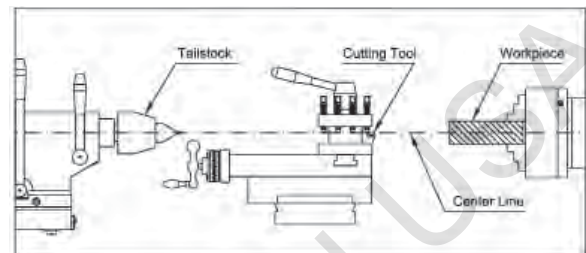


Figure 34. Cutting tool aligned with workpiece center.

There are a number of ways to check and align the cutting tool to the spindle center line. Below are two common methods :

- Align the tip of the cutting tool with a center installed in the tailstock. For this to work, the tailstock must be aligned to the spindle center line.
- Make a facing cut on a piece of round bar stock. If the tool is above/below the spindle center line, a nub will be left in the center of the workpiece. Adjust the height of the workpiece, then repeat the facing cut to check the adjustment. Repeat as necessary until the center of the workpiece is smoothly faced.

To align the cutting tool with the tailstock center :

1. Mount the cutting tool in the tool post, then turn the tool post so the tooling faces the tailstock.
2. Install a center in the tailstock, and position the center tip near the tip of the cutting tool.
3. Lock the tailstock and quill in place.
4. Adjust the height of the cutting tool with a steel shim, so the tip just touches the end of the tailstock center.

Apron Stop

Use the adjustable apron stop collar to set the location where the carriage will be disengaged by the feedrod friction clutch.

When the adjustable apron stop contacts the stop collar during a longitudinal feeding operation, the clutch disengages the feedrod from the apron and the carriage movement stops.

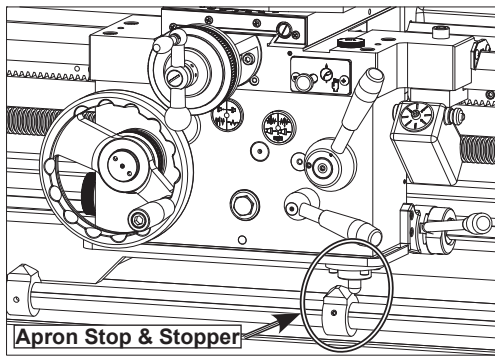


Figure 35. Apron stop and Stopper.

Manual Feed

You can manually move the cutting tool around the lathe for facing or turning operations using the handwheels shown in Figure 36 and described below.

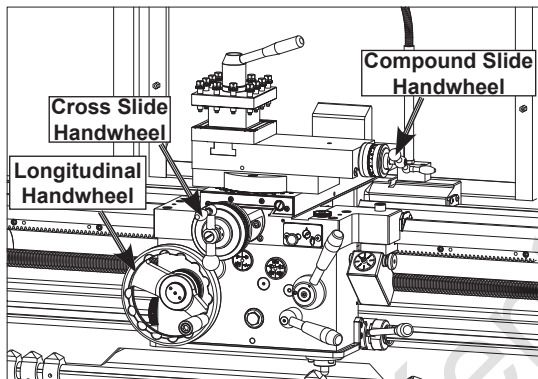


Figure 36. Carriage Controls.

Longitudinal Handwheel

The longitudinal handwheel moves the carriage left or right along the bed. Use this control when setting up the machine for facing or turning.

Cross Slide Handwheel

The cross slide handwheel moves the top slide toward and away from the work. Turning the dial clockwise moves the slide toward the workpiece. Adjust the graduated scale by holding the handwheel with one hand and turning the dial with the other.

Compound Slide Handwheel

The compound slide handwheel controls the position of the cutting tool relative to the workpiece. The compound is adjustable for any angle within its range. The combo inch/metric graduated scale is engraved into a rotatable barrel. Angle adjustment is secured by cap screws on the base of the compound.

Spindle Speed

Using the correct spindle speed is important for safe and satisfactory results, as well as maximizing tool life.

To set the spindle speed for your operation, you will need to :

1. Determine the best spindle speed for the cutting task.
2. Configure the lathe controls to produce the required spindle speed.

Determining Spindle Speed

Many variables affect the optimum spindle speed to use for any given operations, but the two most important are the recommended cutting speed for the workpiece material and the diameter of the workpiece, as noted in the formula :

$$\text{RPM} = \frac{\text{CS} \times 4}{D}$$

RPM = Spindle speed, revolution per minute.

CS = Cutting speed in surface feet per minute (SFM)

D = Diameter of workpiece

EXAMPLE :

If the cutting speed is 40 for a certain alloy steel and the workpiece is 2 inches in diameter, find the rpm as follows :

$$\text{RPM} = (40 \times 4) / 2 = 80$$

After calculating the RPM, use the nearest or next lower speed on the lathe and set the spindle speed.

Cutting speed, typically defined in feet per minute (FPM), is the speed at which the edge of a tool moves across the material surface.

A recommended cutting speed is an ideal speed for cutting a type of material in order to produce the desired finish and optimize tool life.

The books Machinery's Handbook or Machine Shop Practice, and some internet sites, provide excellent recommendations for which cutting speeds to use when calculating the spindle speed.

These sources also provide a wealth of additional information about the variables that affect cutting speed and they are a good educational resource.

Also, there are a large number of easy-to-use spindle speed calculators that can be found on the internet. All of these sources will help you take into account all the applicable variables in order to determine the best spindle speed for the operation.

Setting Spindle Speed

1. Make sure the spindle is turned OFF and it has come to a complete stop.
2. Use the chart in Figure 37 to determine the available spindle speed range closest to your calculated spindle speed.

SPEED				
A	30	45	60	95
B	1130	155	220	330
C	545	770	1075	1600
LEVER	1	2	3	4

Figure 37. Spindle speed range chart.

3. Move the spindle speed range lever to the range that covers your calculated spindle speed.
4. Move the spindle speed lever to your calculated spindle speed.

Power Feed

On this machine, both the carriage and cross slide have power feed capability. The rate that these components move (feed rate) is controlled by how the levers are configured on the gearbox.

Feed rate and spindle speed must be considered together. The sources you use to determine the optimum spindle speed for an operation will also provide the optimal feed rate to use with that spindle speed.

Often, the experienced machinist will use the feeds and speeds given in their reference charts or web calculators as a starting point, then make minor adjustments to the feed rate (and sometimes spindle speed) to achieve the best results.

The carriage can alternately be driven by the leadscrew for threading operations. However, this section covers using the power feed option for the carriage and cross slide components for non-threading operations.

Power Feed Controls

The headstock feed direction lever shown in Figure 45 controls the direction the carriage moves. However, it is important to understand that there is a direction change relationship between the headstock feed direction lever and the apron feed direction knob (Figure 46). The apron feed direction knob and the headstock feed direction lever reverse the feed direction of each other. For example:

- When the apron feed direction knob is pushed-in, the direction of carriage travel shown on the headstock feed direction lever plate is applicable only when threading. For feeding, the directions shown will be opposite.
- When the apron feed direction knob is pulled-out, the direction of carriage travel shown on the headstock feed direction plate is accurate only when feeding. For threading, the directions shown will be opposite.

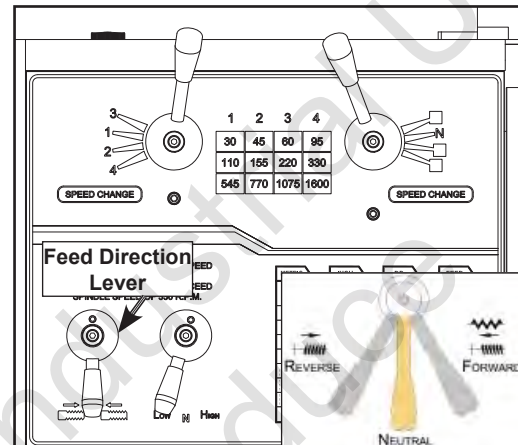


Figure 38 . Feed Direction Lever.

The main benefit of the apron feed direction knob shown in Figure 39 is that it changes the direction of the selected feed without having to stop the lathe, and walk over and shift the headstock feed direction lever.

The feed selection knob shown in Figure 39 engages either the carriage or cross slide feed.

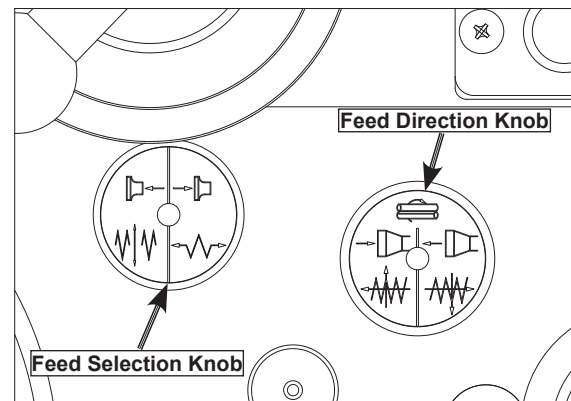


Figure 39. Apron feed knobs.

If the threading or general carriage feed is required, the carriage lock (Figure 40) must be disengaged. If the cross feed will be used for facing, the carriage lock should be engaged and the cross feed gib lock screw should be loose. If it is tight, loosen the cross feed gib lock using a 3mm hex wrench.

To engage the power feed :

1. Make sure the spindle is OFF and has come to a complete stop.
2. Shift the headstock feed direction lever to engage the leadscrew or feed rod. Sometimes you need to slightly rotate the handwheel of the component you are trying to engage, so that the gears can mesh.

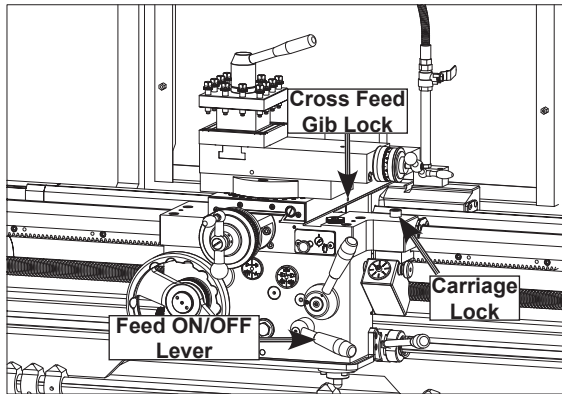


Figure 40. Carriage lock and gib lock.

3. Push down on the feed ON / OFF lever (Figure 40) on the front of the apron to engage power feed for either the carriage or the cross slide.
4. Push the feed selection knob in to select carriage feed, or pull the feed selection knob out to select cross feed.
5. Adjust the feed clutch knob, shown in Figure 41, to set at which point the feed clutch will slip to avoid feed system overload.

Tighten the feed clutch knob completely to seat the clutch. Next, count how many turns it takes to back it off completely.

Then tighten the knob $\frac{1}{3}$ of the distance that was backed-off. If the clutch slips too easily at this conservative setting, the knob can be tightened further. But keep in mind that when the knob is completely tight, the feed clutch is overridden and will not slip in the event of a feed system overload, resulting in feed system damage.

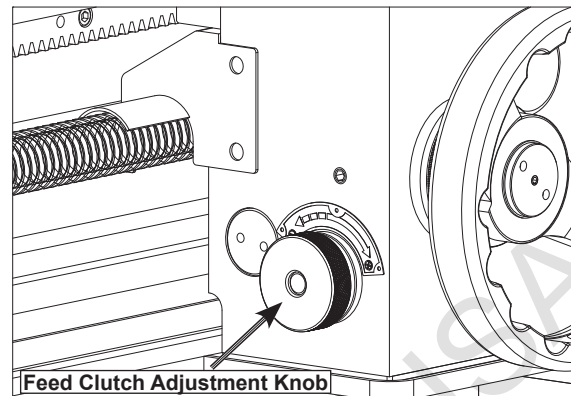


Figure 41. Feed clutch knob.

To use the quick change feed direction knob :

1. While the lathe is running, place the feed control lever in neutral.
2. Push or pull the quick change feed direction knob to change the direction of the feed rod.
3. Re-engage the feed direction lever. The feed rod rotation will now be reversed, causing the engaged carriage or cross slide to move in the opposite direction.

Leadscrew & Feed Rod support

This support bracket was used for protect the Leadscrew and Feed rod to prevent these parts to be out of shape when the apron has been moved toward the chuck side, when the shorter cutting job required.

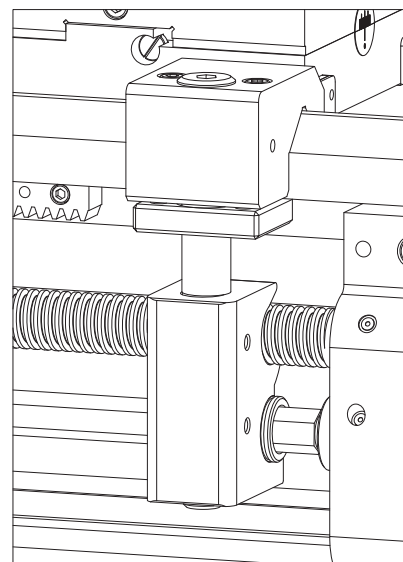


Figure 42. Leadscrew & Feed rod support

Thread & Feed Rate Chart

Figure 43 shows the configurations of gearbox levers that are required to set the available feed rates. This same chart can also be found on the machine.

THREAD AND FEED CHART															
mm				T.P.I.				mod				dp			
C				W				C				W			
.2	LCT1X	2.0	LCR1Z	72	LAR6W	12	LBT6W	.3	HCT6X	44	HBR4W	0.04	LCT1Y	0.0015	
.225	LCT2X	2.5	LCR3Z	60	LAR3W	11½	LBT5W	.4	HCS1X	40	HBR3W	0.05	LCT4Y	0.0020	
.25	LCT3X	3.0	LCR6Z	56	LBR8W	11	LBT4W	.5	HCS3X	36	HBR2W	0.06	LCT8Y	0.0025	
.3	LCT6X	3.5	LCR8Z	54	LAR2W	10	LBT3W	.6	HCS6X	32	HBR1W	0.08	LCS1Y	0.0030	
.35	LCT8X	4.0	HCS1Z	48	LBR6W	9	LBT2W	.7	HCS8X	30	HAS3W	0.10	LCS4Y	0.0040	
.4	LCS1X	4.5	HCS2Z	44	LBR4W	8	LBT1W	.8	HCR1X	28	HBS8W	0.12	LCS8Y	0.0050	
.45	LCS2X	5.0	HCS3Z	40	LBR3W	7½	HAS3W	.9	HCR2X	26	HBS7W	0.15	LCR1Y	0.0060	
.5	LCS3X	5.5	HCS4Z	36	LBR2W	7	HBS8W	1.0	HCS1Z	24	HBS6W	0.20	LCR3Y	0.0080	
.6	LCS6X	6.0	HCS6Z	32	LBR1W	6	HBS6W	1.25	HCS3Z	22	HBS4W	0.25	LCR6Y	0.0100	
.7	LCS8X	6.5	HCS7Z	30	LAS3W	5	HBS3W	1.5	HCS6Z	20	HBS3W	0.30	LCR8Y	0.0120	
.75	LCT6Z	7	HCS8Z	28	LBS8W	4½	HBS2W	1.75	HCS8Z	19	HCS8W	0.35	HCS2Y	0.0140	
.8	LCR1X	8	HCR1Z	27	LAS2W	4	HBS1W	2.0	HCR1Z	18	HBS2W	0.40	HCS4Y	0.0160	
.9	LCR2X	9	HCR2Z	26	LBS7W	3¾	HAT3W	2.25	HCR2Z	16	HBS1W	0.50	HCS8Y	0.0200	
1.0	LCS1Z	10	HCR3Z	24	LBS6W	3¾	HBT3W	2.5	HCR3Z	15	HAT3W	0.75	HCR3Y	0.0300	
1.1	LCR4X	11	HCR4Z	23	LBS5W	3¾	HBT7W	2.75	HCR4Z	14	HBT8W	1.00	HCR6Y	0.0400	
1.2	LCR6X	12	HCR6Z	22	LBS4W	3	HBT6W	3.0	HCR6Z	13	HBT7W				
1.25	LCS3Z	13	HCR7Z	20	LBS3W	2¾	HBT5W	3.25	HCR7Z	12	HBT6W				
1.3	LCR7X	14	HCR8Z	19	LCS8W	2¾	HBT4W	3.5	HCR8Z	11	HBT4W				
1.4	LCR8X	*	*	18	LBS2W	2½	HBT3W								
1.5	LCS6Z	*	*	16	LBS1W	2½	HBT2W								
1.75	LCS8Z	*	*	15	LAT3W	2	HBT1W								
*	*	*	*	14	LBT8W	*	*								
*	*	*	*	13½	LAT2W	*	*								
*	*	*	*	13	LBT7W	*	*								

Figure 43. Thread and feed rate chart.

Positioning Gearbox Levers

To cut a particular thread or establish a particular feed rate, you may need to first swap the gearbox drive gear, depending on where it is currently set.

Once you have confirmed that the end gear is set up properly, you can then move the gearbox levers to the required positions. The arrows going from Figure 43 to Figure 44 show which gearbox levers must be moved to achieve an example feed rate.

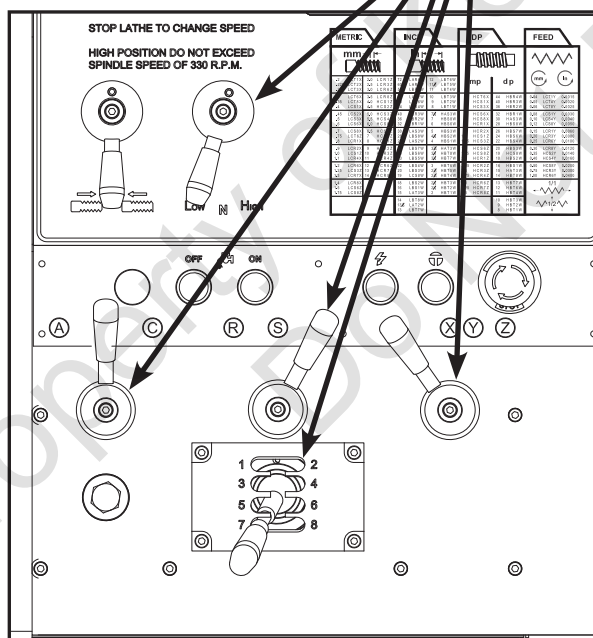


Figure 44. Example for thread and feed rate chart.

End Gear Setup

The gearbox drive gear on this lathe can be configured for the normal position or the alternate position, depending upon the type of operation to be performed. The lathe is shipped with the end gears in the normal position. Gears must be thoroughly cleaned and re-coated in grease before installing, and the backlash must be maintained at 0.127mm (0.005") for correct meshing.

Normal Position (Inch)

The 24T end gear is installed in the top position, the 44T/56T end gears in the middle position, and the 57T end gear in the bottom position, as shown in Figure 45. In the normal position, the 56T and 57T gears are meshed, which allows for inch threading and all general feed operations.

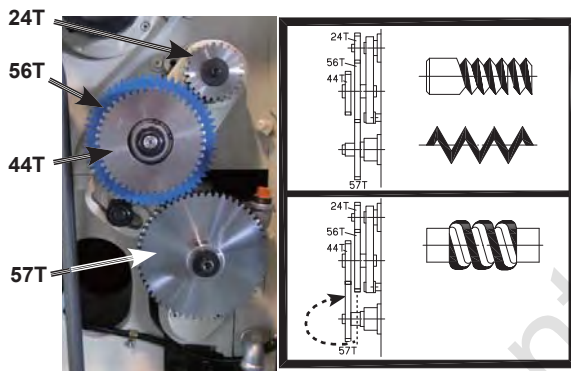


Figure 45. Normal end gear position.

Alternate Position (Inch)

When the 44- and 57-tooth end gears are meshed, you can perform modular and diametral pitch turning.

Configuring the End Gears

1. Disconnect Lathe from POWER !
2. Move the gearbox range lever to "Low" so that the gears will not rotate in the following steps, then open the lathe headstock side cover.
3. **To change the position of the 57T gear :**
 - a. Remove the cap screw and flat washer that secures the gear, then remove the gear.
 - b. Clean away debris and grime from the gear and apply a light coat of machine oil.
 - c. Swap the position of the gear, then align it with the key and insert it on the gear shaft.
 - d. Re-install the flat washer and cap screw.
4. Close and secure the headstock side cover.

Normal Position (Metric)

The 28T end gear is installed in the top position, the 55T/54T end gears in the middle position, and the 64T/22T end gear in the bottom position, as shown in Figure 46. In the normal position, the 55T and 64T gears are meshed, which allows for metric threading and all general feed operations.

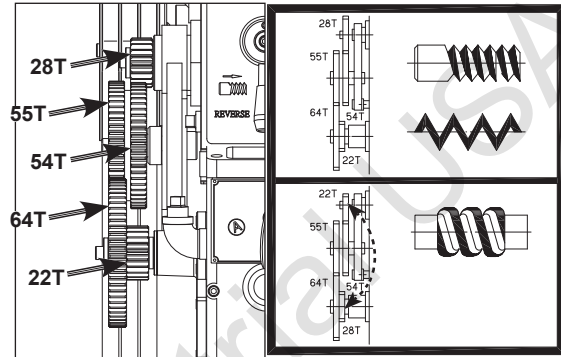


Figure 46. Normal end gear position.

Alternate Position (Metric)

When the 28- and 22-tooth end gears are exchanged, you can perform modular and diametral pitch turning.

Configuring the End Gears

1. Disconnect Lathe from POWER !
2. Move the gearbox range lever to "Low" so that the gears will not rotate in the following steps, then open the lathe headstock side cover.
3. To change the position of the 22T/28T gear :
 - a. Remove the cap screw and flat washer that secures the gear, then remove the gear.
 - b. Clean away debris and grime from the gear and apply a light coat of machine oil.
 - c. Swap the position of the gear, then align it with the key and insert it on the gear shaft.
 - d. Re-install the flat washer and cap screw.
4. Close and secure the headstock side cover.

Threading Controls

If you are unfamiliar with threading procedures on a lathe, we strongly recommend that you read books, review industry trade magazines, or get formal training before beginning any threading projects.

Power Feed Lever

The feed control lever must be in the fully up disengaged position or the internal lockout will prevent the half nut lever from applying the half nut. Also to avoid shearing the leadscrew shear pin, the carriage lock (Figure 47) must be loosened before threading begins.

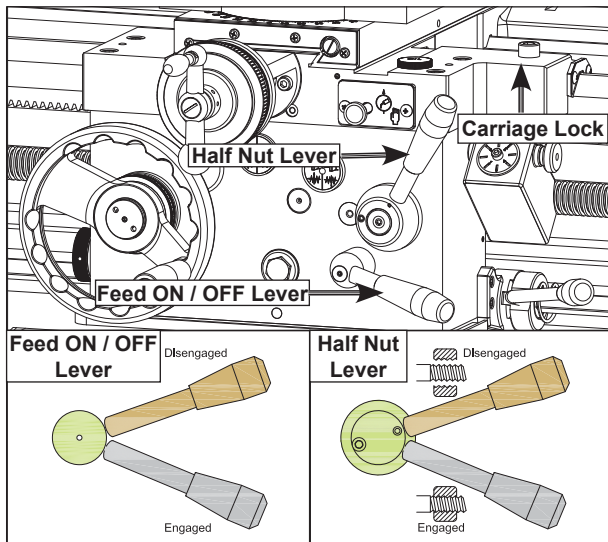


Figure 47. Carriage controls.

Half Nut Lever

The half nut lever engages the carriage with the leadscrew which moves the cutting tool along the length of the workpiece.

Thread Dial & Chart Overview

The numbers on the thread dial are used with the thread dial chart to show when to engage the half nut during inch threading. The thread dial gear must be engaged with the leadscrew for this to work. Loosen the knurled hand knob on the thread dial, pivot the dial gear into mesh with the leadscrew, then tighten the hand knob (Figure 48).

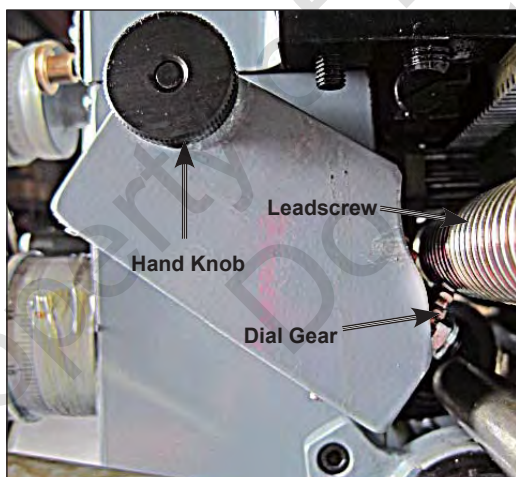


Figure 48. Thread dial engaged with the leadscrew.

Using Thread Dial and Chart (Inch)

Find the TPI (threads per inch) that you want to cut in the left column (Figure 49), then reference the dial number to the right of it. The dial numbers indicate when to engage the half nut for a specific thread pitch. The thread dial chart can also be found on the front of the thread dial housing.

4,8,12,16,20,24, 28,32,36,40,44, 48,56,60,72	ANY POSITION
2,6,10,14, 18,22,26, 30,54	NON NUMBERED POSITION
3,5,7,9, 11,13,15, 19,23,27	NUMBERED POSITION 1,2,3,4
$2\frac{1}{2}$, $3\frac{1}{2}$, $4\frac{1}{2}$, $7\frac{1}{2}$, $11\frac{1}{2}$, $13\frac{1}{2}$	POSITION 1,3 OR 2,4
$2\frac{1}{4}$, $2\frac{3}{4}$, $3\frac{1}{4}$, $3\frac{3}{4}$	POSITION 1 ONLY
<input type="radio"/> $2\frac{7}{8}$ SAME METRIC THREADS CUTTING <input type="radio"/>	

Figure 49. Thread dial chart (Inch).

TPI 4-72 Divisible By 4

Use any line (position) on the thread dial, shown in Figure 50, or threading TPI divisible by 4.

TPI 4,8,12,16,20,24, 28,32,36,40,44, 48,56,60,72	ANY POSITION	
---	-----------------	--

Figure 50. Any position is selected on the dial for threading 4-72 TPI.

TPI 2-54 Not Divisible By 4

Use any of the non-numbered lines on the thread dial for threading the TPI shown in Figure 51.

TPI 2,6,10,14, 18,22,26, 30,54	NON NUMBERED POSITION	
---	-----------------------------	--

Figure 51. Marks are selected on the dial for threading 2-54 TPI.

Odd Numbered TPI

Use any of the numbered lines on the thread dial for threading the TPI shown in Figure 52.

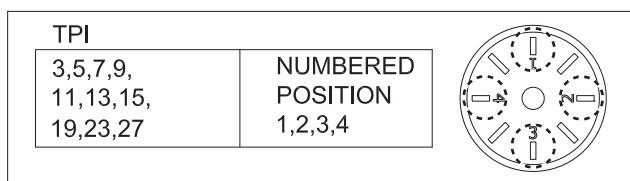


Figure 52. Numbers are selected on the dial for threading odd numbered TPI.

1/2 Fractional TPI

Use any opposing number pairs—2 or 4, or 1 or 3 on the thread dial for 1/2 fractional TPI (Figure 53). For example, to cut a 3 1/2 thread, select 1 on the dial, then start threading.

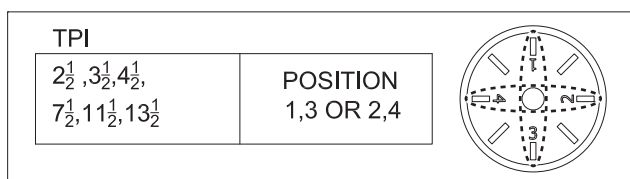


Figure 53. Opposing number group are selected on dial for cutting 1/2 thread TPI.

Other Fractional TPI

Use position 1 on the thread dial for cutting the TPI shown in Figure 54.

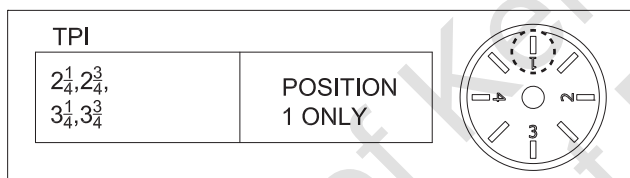


Figure 54. Position for 1/4 or 3/4 fractional TPI.

2 7/8 TPI

Use any numbered or non-numbered line on the thread dial to cut the TPI shown in Figure 55.

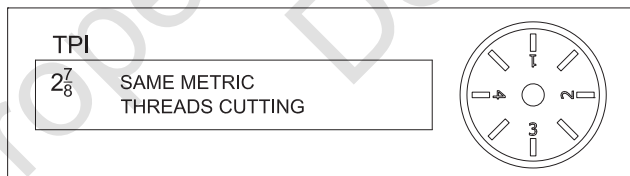


Figure 55. Half nut stays engaged for 2 7/8 TPI.

Using Thread Dial and Chart (Metric)

Find the length of each thread that you want to cut in the left column (Figure 56), then reference the dial number to the right of it. The dial numbers indicate when to engage the half nut for a specific thread pitch. The thread dial chart can also be found on the front of the thread dial housing.

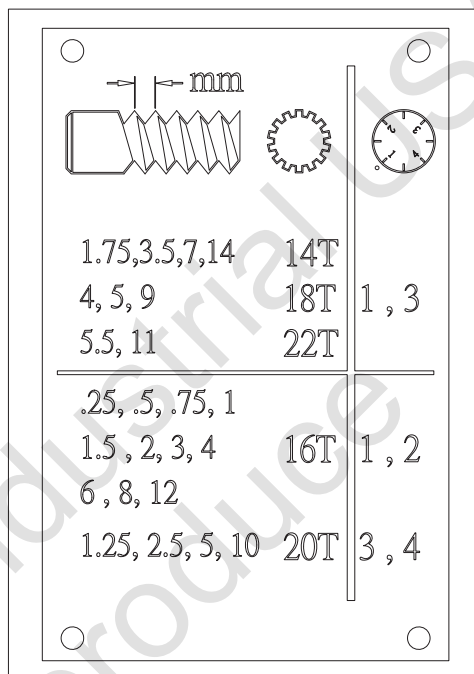


Figure 56. Thread dial chart (Metric).

Length of each thread 1.75, 3.5, 7, 14

Select position 1, 3 on the thread dial and use the 14T gear on the bottom of thread dial for threading length of each thread 1.75, 3.5, 7, 14. (Figure 57 - 58)

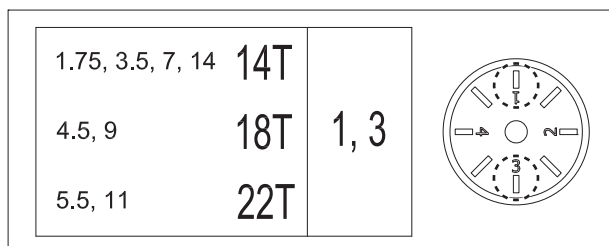


Figure 57. Thread dial chart of numbered position 1, 3.

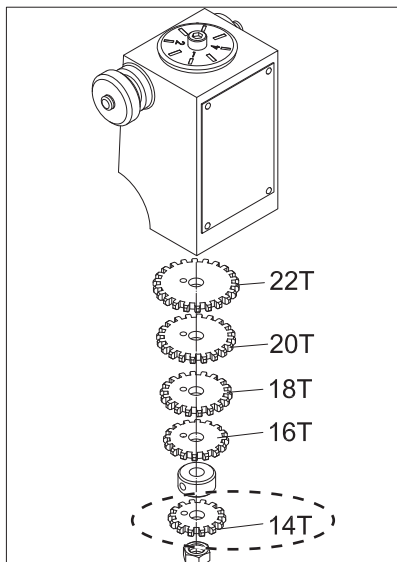


Figure 58. Example of thread dial - 14T.

Length of each thread 4.5, 9

Select position 1, 3 on the thread dial and use the 18T gear on the bottom of thread dial for threading length of each thread 4.5, 9. (Figure 57 - 58)

Length of each thread 5.5, 11

Select position 1, 3 on the thread dial and use the 22T gear on the bottom of thread dial for threading length of each thread 5.5, 11. (Figure 57 - 58)

.25, .5, .75, 1	16T	1, 2
1.5, 2, 3, 4		
6, 8, 12	20T	3, 4
1.25, 2.5, 5, 10		

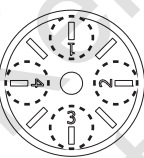


Figure 59. Thread dial chart of numbered position 1, 2, 3, 4.

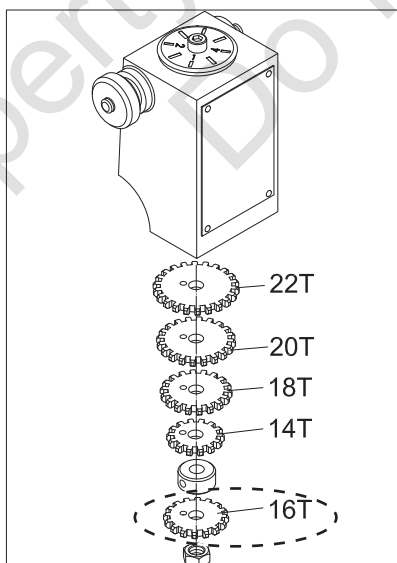


Figure 60. Example of thread dial - 16T.

Length of each thread 0.25 - 12 divisible by 0.25

Select position 1, 2, 3 or 4 on the thread dial and use the 16T gear on the bottom of thread dial for threading length of each thread 0.25 - 12 divisible by 0.25. (Figure 59 - 60)

Length of each thread 1.25, 2.5, 5, 10

Select position 1, 2, 3 or 4 on the thread dial and use the 20T gear on the bottom of thread dial for threading length of each thread 1.25, 2.5, 5, 10. (Figure 59 - 60)

Cutting Fluid System

The cutting fluid system delivers cutting fluid through a positionable nozzle and is controlled by the control panel cutting fluid pump switch and the valve lever near the base of the nozzle hose.

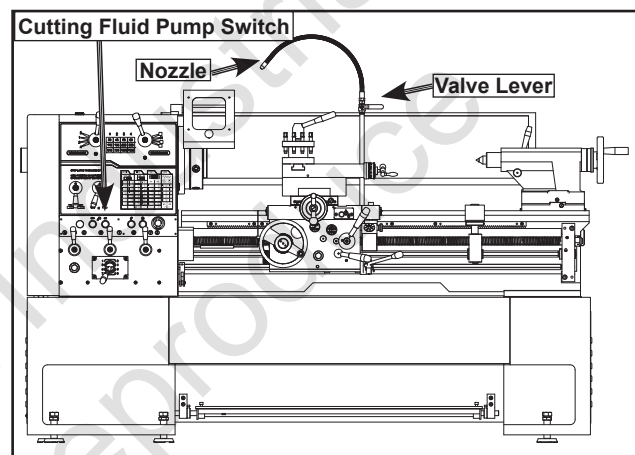


Figure 61. Coolant system controls and components.

Always use high quality cutting fluid in your coolant system and follow the manufacturer's instructions for diluting.

Refer to Cutting Fluid System on Page 28 for detailed instructions on how to add or change cutting fluid. Check the cutting fluid regularly and promptly change it when it becomes overly dirty or rancid.

To use the cutting fluid system on your lathe :

1. Make sure the tank is properly serviced and filled with cutting fluid, and that you wear the necessary personal protection equipment.
2. Position the cutting fluid nozzle for your operation.
3. Use the control panel cutting fluid pump switch to turn the coolant pump ON.
4. Adjust the flow of cutting fluid by using the valve lever near the base of the nozzle hose.

Section 4 : Maintenance

Schedule

Each operator of this machine is responsible for ensuring proper care of the equipment. We strongly recommend all operators make a habit of following the daily maintenance procedures.

For optimum performance from this machine, this maintenance schedule must be strictly followed.

Ongoing

To maintain a low risk of injury and proper machine operation, if you ever observe any of the items below, shut the machine down immediately and fix the problem before continuing operations :

- Loose mounting bolts or fasteners.
- Worn, frayed, cracked, or damaged wires.
- Guards removed.
- Limit/kill switches bypassed.
- Emergency stop button not working correctly or not requiring you to reset it before starting the machine again.
- A reduction in braking speed or efficiency.
- Headstock oil not flowing against sight glass.
- Cutting fluid not flowing out.
- Any other unsafe condition.

Daily, Before Operations

- Check / add gearbox oil.
- Check / add apron oil.
- Check cutting fluid level.
- Lubricate the ways.
- Put oil in the ball oilers.
- Check / add leadscrew & feedrod bearing oil.
- Clean / lubricate the leadscrew.
- Move the power feed lever on the apron to neutral (to prevent crashes upon startup).
- Ensure carriage lock bolt is loose.

Daily, During Operations

- Verify headstock oil flows when power is turned ON.
- Verify electrical box cooling fan is operating.
- Verify headstock oil temperature is under 138°C (280° F).

Daily, After Operations

- Vacuum/clean all chips and swarf from bed, slides, and chip drawer.
- Wipe down all unpainted or machined surfaces with an oiled rag.
- Depress emergency stop button and shut OFF the main power switch (to prevent accidental startup).

Monthly

- Drain and clean the cutting fluid tank, then add new cutting fluid.
- Remove electrical box air filter and clean with compressed air or a vacuum.

Annually (or Semi-Annually with Hard Use)

- Drain and clean the headstock oil reservoir, then add new oil.
- Change the apron oil.
- Change the gearbox oil.

Cleaning

Regular cleaning is one of the most important steps in taking good care of this lathe. Each operator is responsible for cleaning the machine immediately after using it or at the end of the day. We recommend that the cleaning routine be planned into the workflow schedule, so that adequate time is set aside to do the job right.

Typically, the easiest way to clean swarf from the bed ways and chip drawer is to use a wet/dry shop vacuum that is dedicated for this purpose only. The small chips leftover after vacuuming can be wiped up with a slightly oiled rag. Avoid using compressed air to blow off chips, as it may drive them deeper into moving surfaces and could cause sharp chips to fly into your face or hands.

All visible swarf should be removed from the lathe during cleaning. Remember, personal neatness gives you personality.

Lubrication

Headstock

Checking & Adding Oil

Before operating the lathe, please check the status of the oil inside of the headstock from the oil sight glass. To replenish it up to the center line of the oil sight glass when it is lower than this center line.

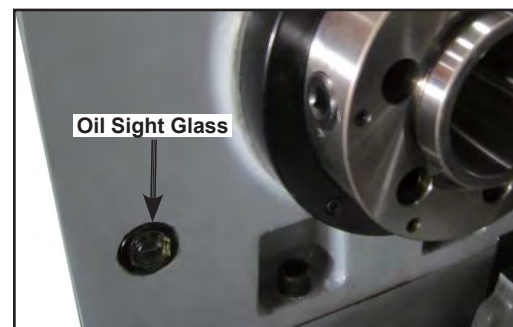


Figure 62. Location of the headstock oil sight glass.

Changing Oil

The headstock oil must be changed after the break-in period and then annually (or every six months with heavy service or extreme working conditions). The fill and drain plug is shown in Figure 63.

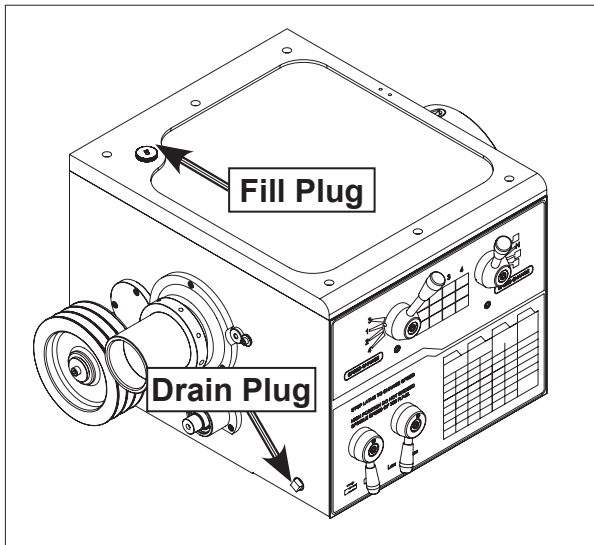


Figure 63. Location of headstock fill and drain plugs.

Gearbox

Checking & Adding Oil

The sight glass shown in Figure 64 shows the oil level in the gearbox. At the maximum level, the oil fills approximately 3/4 of the sight glass. At the minimum level, the oil only fills 1/4 of the sight glass.

Check the oil level daily. When the oil approaches the minimum level, add enough oil to bring it up to the maximum level.

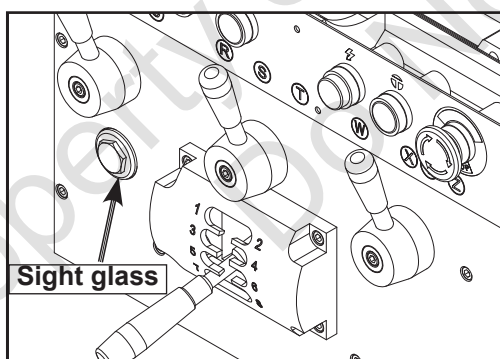


Figure 64. Gearbox sight glass location.

Changing Oil

The gearbox oil must be changed after the break-in period and then annually (or every six months with hard service or extreme working conditions). Figure 65 shows fill and drain plugs used when changing the gearbox oil.

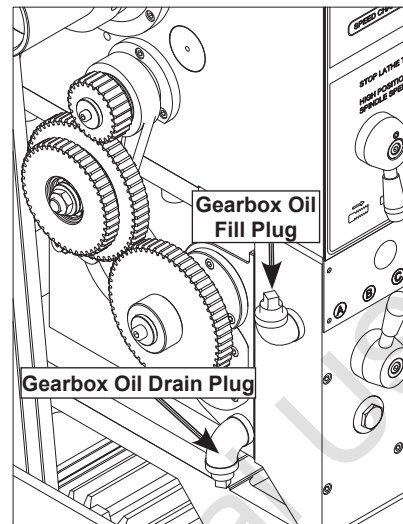


Figure 65. Location of gearbox fill and drain plugs.

Apron

Checking & Adding Oil

The sight glass shown in Figure 66 shows the oil level in the apron. At the maximum level, the oil fills approximately 3/4 of the sight glass. At the minimum level, the oil only fills 1/4 of the sight glass.

Check the oil level daily. When the oil approaches the minimum level, add enough oil to bring it up to the maximum level. This oil is also used by the way pump to lubricate the ways and slides.

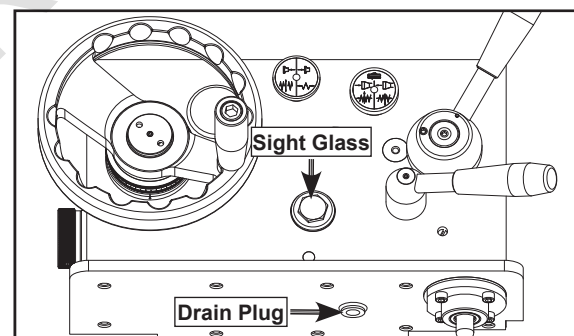


Figure 66. Location of apron drain plug & sight glass.

Changing Oil

The oil in the apron reservoir must be changed after the break-in period and then annually (or every six months with hard service or extreme working conditions). The drain plug is shown in Figure 66 and the fill plug is shown in Figure 67.

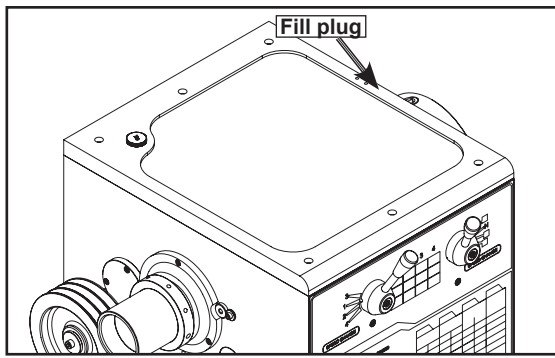


Figure 67. Location of fill plug for apron oil reservoir.

Lead Screw

Before lubricating the leadscrew, clean it first with mineral spirits. A paint brush works well to help clean out the threads. Make sure to move the carriage out of the way, so you can clean the entire length of the leadscrew.

Apply oil along the length of the leadscrew. Use a paint brush to make sure the oil is evenly applied and down in the threads.

Ways & Slides

The way pump shown in Figure 68 lubricates the saddle and cross slide way guides with the oil from the apron reservoir.

To use the way pump to lubricate the ways, pull the pump knob out for two or three seconds and then push it in. The pump draws oil from the apron reservoir and then forces it through drilled passages to the way guides.

Repeat this process and move the carriage left/ right and the cross slide forward/backward to distribute oil along the way guides.

Lubricate the guides once before and once after operating the lathe. If the lathe is in a moist or dirty environment, increase the lubrication interval and make sure to keep the oil level full.

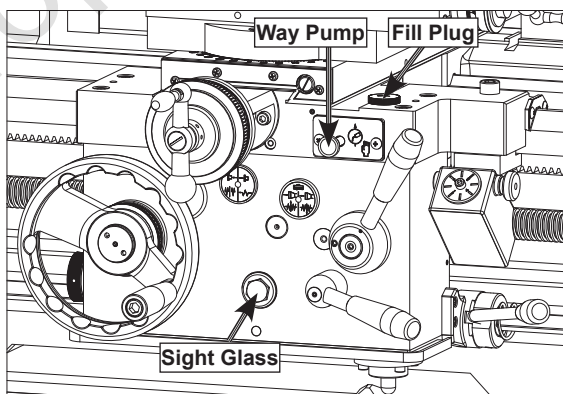


Figure 68. Location of way pump, fill plug and sight glass on the apron.

Unpainted & Machined Surfaces

Besides the ways and leadscrew, all other unpainted and machined surfaces should be wiped down daily to keep them rust-free and in top condition. This includes the top of the saddle, the cross slide, compound slide, tool post, chuck, feedrod, and any other surface you can find that could be vulnerable to rust if left unprotected (this especially includes any parts that may be exposed to water soluble cutting fluids). Typically with these parts, a thin film of oil is all that is necessary for protection.

Ball Oilers

Proper lubrication of ball oilers is done with a pump-type oil can that has a plastic or rubberized cone tip. We do not recommend using metal needle or lance tips, as they can push the ball too far into the oiler, break the spring seat, and lodge the ball in the oil galley.

Lubricate the ball oilers before and after machine use, and more frequently under heavy use. When lubricating ball oilers, first clean the outside surface to remove any dust or grime. Push the rubber or plastic tip of the oil can nozzle against the ball oiler to create a hydraulic seal, then pump the oil can once or twice. If you see sludge and contaminants coming out of the lubrication area, keep pumping the oil can until the oil runs clear. When finished, wipe away any excess oil. (Figure 69 - 70)

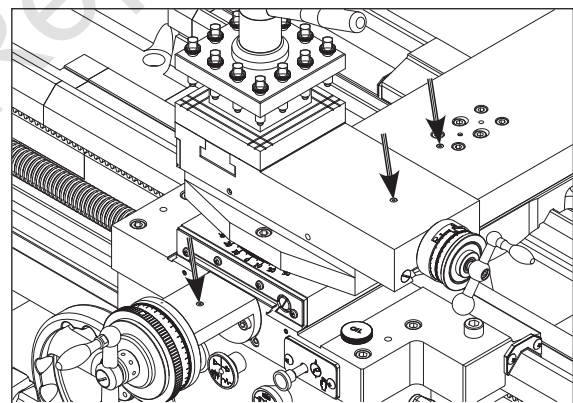


Figure 69. Carriage ball oiler .

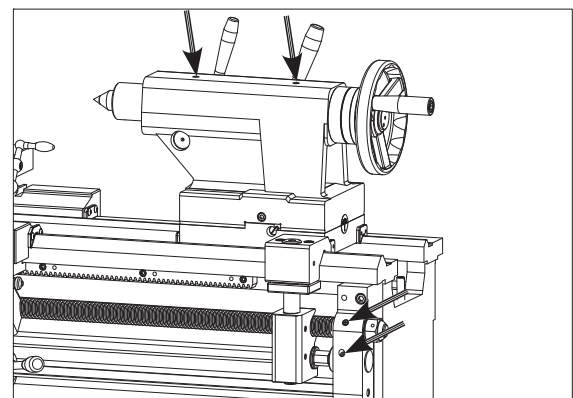


Figure 70. Tailstock and Leadscrew end ball oiler.

End Gearing

The end gears, shown in Figure 71, should always have a thin coat of heavy grease to reduce the minimize/prevent corrosion, noise, and wear. Care must be taken to avoid over-greasing because excess grease may be flung onto the V-belts, which will reduce optimal power transmission from the motor.

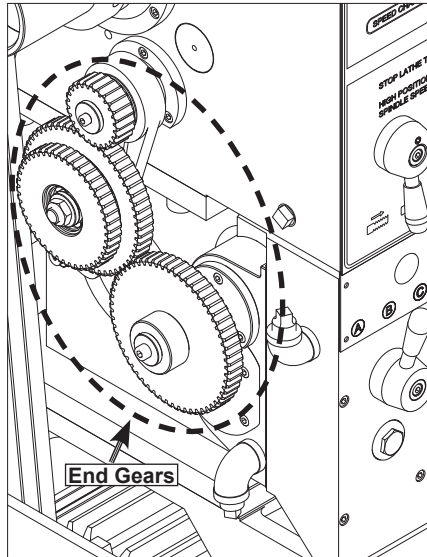


Figure 71. Location of end gears that require grease.

Handling & Care

Make sure to clean and lubricate any gears you install or swap. Unless you are very careful during handling and storage, the coating of grease on the gears will easily pickup dirt or debris, which can then spread to the other gears and increase the rate of wear.

Make sure to the cover remains installed whenever possible to keep the gears free of dust or debris from the outside environment.

Lubricating

1. Disconnect Lathe from POWER !
2. Remove the headstock side cover and all the end gears.
3. Clean the end gears thoroughly in mineral oil to remove all the old grease. Use a small brush if necessary to clean between the teeth.
4. Clean the shafts from which the end gears were removed, and wipe up any old grease splatters in the vicinity and on the inside of the headstock cover.
5. With clean hands, apply a thin layer of grease on both sides of the gears. Make sure to get grease between the gear teeth, but not so much that it fills the voids between the teeth.

6. Install the end gears and mesh them together with an approximate backlash of 0.127mm. Once the gears are meshed together, apply a small dab of grease in the crux of where the gears mesh together—this grease will spread around when the gears start moving and re-coat any areas scraped off during installation.

Annual Maintenance

Once a year, remove all the end gears, clean them thoroughly, and apply a new coating of grease. Even if the headstock side cover has been kept in place throughout the year, it is still possible for dust from the V-belts to build-up in the grease, and the grease may also start to break down with extended or heavy use.

Cutting Fluid System

The cutting fluid system consists of a fluid tank, pump, and flexible nozzle. The pump pulls fluid from the tank and sends it to the valve, which controls the flow of cutting fluid to the work area. When the valve is opened or closed, the fluid comes out of the nozzle and drains through the chip drawer and into the catch tray and then into the tank where it is picked up again by the pump. Figure 72 shows many of these components and their locations.

Although most swarf from machining operations falls into the chip tray and stays there, some small chips drain into the tank. The pump uses a screen to prevent it from picking up the small swarf that ends up in the tank.

Since the swarf is spread throughout the coolant system, cleaning the system on a regular basis is a requirement to maintain the life of the pump.

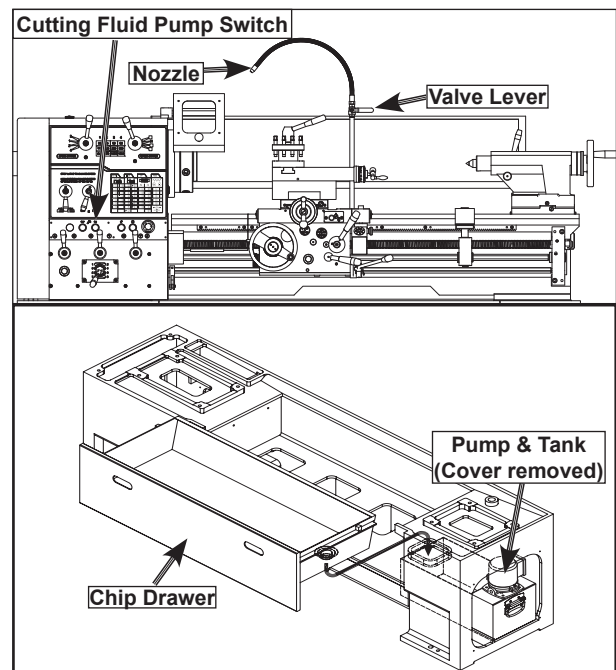


Figure 72. Cutting fluid system components and locations.

Hazards

As some cutting fluid ages, dangerous microbes can proliferate and create a biological hazard.

The risk of exposure to this hazard can be greatly reduced by replacing the old cutting fluid on a monthly basis, as indicated in the maintenance schedule.

The important thing to keep in mind when working with the cutting fluid is to minimize exposure to your skin, eyes, and respiratory system by wearing the proper PPE (personal protective equipment), such as splash-resistant safety glasses, long-sleeve gloves, protective clothing, and a NIOSH approved respirator.

Adding Fluid

1. Disconnect Lathe from POWER !
2. Remove the vented cover and slide the tank out, as shown in Figure 73.
3. Pour cutting fluid in the tank until it is nearly full.
4. Slide the tank back into the base and replace the vented cover.

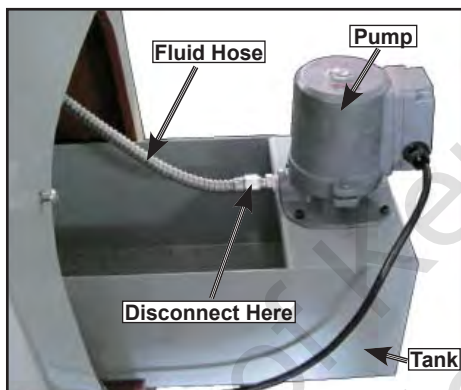


Figure 73. Cutting fluid pump and tank.

Changing Cutting Fluid

When you replace the old cutting fluid, take the time to thoroughly clean out the chip drawer, catch tray, and chip tray while you are at it. The entire job only takes about a 1/2 hour when you are prepared with the proper materials and tools.

To change the cutting fluid :

1. Position the coolant nozzle over the splash guard, so it is pointing behind the lathe. If you have the optional hose, connect it to the end of the coolant nozzle now.
2. Place the 5-gallon bucket behind the lathe and underneath the coolant nozzle. If you have the optional hose, place the hose in the bucket. Otherwise, you may need to hold the bucket up to the coolant nozzle to prevent coolant from splashing outside of the bucket.
3. Turn cutting fluid the pump ON (or have another person turn it ON if you are holding the bucket), and pump the old cutting fluid out of the tank. Turn the pump OFF immediately after fluid stops flowing.
4. Disconnect Lathe from POWER !
5. Remove the vented cover and slide the tank half way out of the base, as shown in Figure 73.

If necessary, disconnect the fluid hose from the pump, where shown in Figure 73.

6. Pour out the old cutting fluid into your 5-gallon bucket and close the lid.
7. Flush the tank with hot soapy water, making sure the intake screen at the bottom of the pump intake pipe (inside the tank) is clean, and wipe up any remaining fluid residue.
8. Slide the tank partially into the base and reconnect the fluid hose.
9. Refill the tank with new cutting fluid, then slide the tank completely into the base.
10. Connect Lathe to power.
11. Open the valve on the cutting fluid nozzle.
12. Turn the cutting fluid pump ON to verify that fluid cycles properly, then turn it OFF.

Machine Storage

If the machine is not properly prepared for storage, it may develop rust or corrosion. If decommissioning this machine, use the steps in this section to ensure that it remains in good condition for later use.

To prepare your machine for short-term storage (up to a year) :

1. Pump out the old cutting fluid, and flush the lines and tank.
2. Disconnect Lathe from POWER !
3. Thoroughly clean all unpainted, bare metal surfaces, then apply a liberal coat of way oil.
4. Lubricate the machine as outlined in the lubrication section.
5. Cover and place the machine in a dry area that is out of direct sunlight and away from hazardous fumes, paint, solvents, or gas. Fumes and sunlight can bleach or discolor paint and make plastic guards cloudy.
6. Once or twice a month, depending on the ambient humidity levels in the storage environment, wipe down the machine as outlined in Step 3.
7. Every few months, start the machine and run all gear-driven components for a few minutes. This will keep the bearings, bushings, gears, and shafts well lubricated and protected from corrosion, especially during the winter months.

To prepare your machine for long-term storage (a year or more) :

1. If the machine has oil-lubricated gearboxes, bring the machine to operating temperature and drain and refill the all gearboxes with fresh oil.
2. Pump out the old cutting fluid, and flush the lines and tank.
3. Disconnect Lathe from POWER !
4. Thoroughly clean all unpainted, bare metal surfaces, then apply a liberal coat of way oil, a heavy grease, or rust preventative. Take care to ensure these surfaces are completely covered but that the rust preventative or grease is kept off of painted surfaces.
5. Lubricate the machine as outlined in the lubrication section.
6. Loosen or remove machine belts so they do not become stretched during the storage period. Be sure to also affix a maintenance note on the machine as a reminder that the belts have been loosened or removed.
7. Place a few moisture absorbing desiccant packs inside of the electrical box.
8. Cover and place the machine in a dry area that is out of direct sunlight and away from hazardous fumes, paint, solvents, or gas. Fumes and sunlight can bleach or discolor paint and make plastic guards cloudy.

Section 5 : Service

Backlash Adjustment

Compound Leadscrew

Backlash is adjusted by tightening the set screws shown in Figure 74. When these screws are adjusted against the leadscrew nut, they offset part of the half nut to remove play between the nut and leadscrew.

If you end up adjusting the half nut too tight, loosen the set screws, tap the compound a few times with a rubber or wooden mallet, and turn the handle slowly back and forth until it moves freely.

To readjust the backlash, rock the handle back and forth, and tighten the screws slowly until the backlash is at approximately 0.025mm as indicated on the handwheel dial.

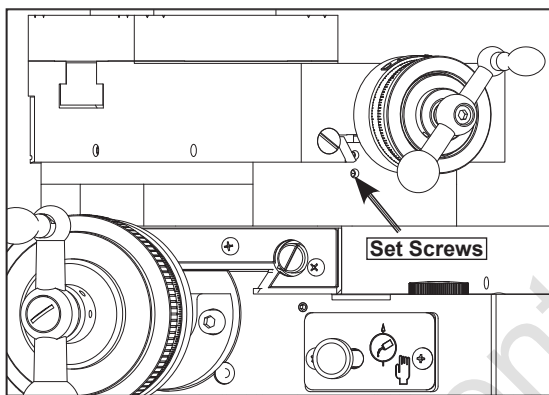


Figure 74. Compound slide backlash adjustment set screws.

Cross Slide Leadscrew

Backlash can be felt by turning the cross slide handwheel in one direction, then turning the handwheel the other direction, then noticing the amount the handwheel moves while the cross slide does not. When the cross slide begins to move, the backlash has been taken up.

Backlash is adjusted by loosening all four cap screws shown in Figure 75, and then tightening the center set screw, which pushes down on a wedge and forces the half nut apart, taking up lash in the half nut and leadscrew. If you end up adjusting the half nut too tight, loosen the set screw, tap the cross slide a few times with a rubber or wooden mallet, and turn the handle slowly back-and-forth, until the handle turns freely.

To re-adjust the backlash, rock the handle back and forth and tighten the set screw slowly until the backlash is at approximately 0.025mm as indicated on the handwheel dial.

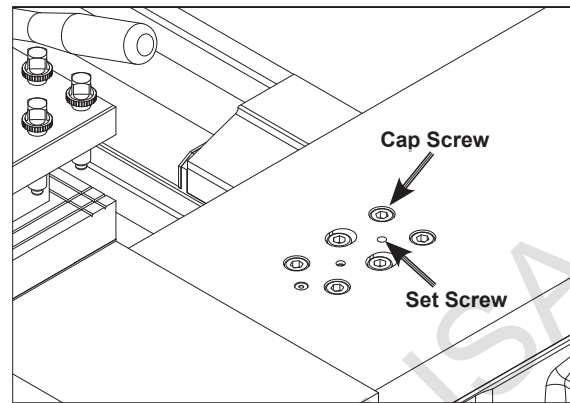


Figure 75. Cross slide backlash adjustment screws.

Leadscrew End Play Adjustment

After a long period of time, you may find that the leadscrew develops a small amount of end play. This lathe is designed so that leadscrew end play can be easily removed with adjustment.

To remove leadscrew end play :

1. Disconnect Lathe from POWER !
2. Remove the two cap screws and end cover.
3. Loosen both retaining nut set screws shown in Figure 76.

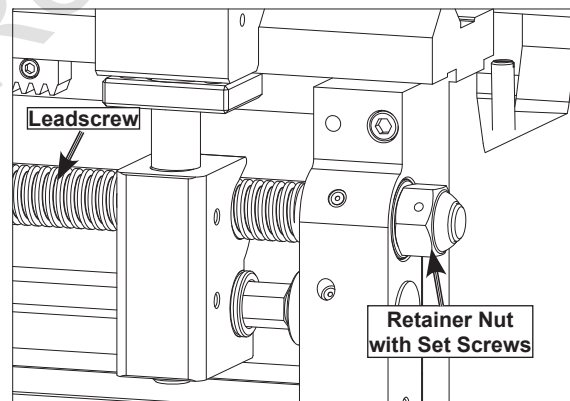


Figure 76. Leadscrew end play adjustment.

4. Engage the half nut lever.
5. Rotate the carriage feed handwheel back and forth slightly and tighten the retaining nut at the same until the end play is removed.
6. Tighten both set screws and reinstall the cover.

Gib Adjustment

The goal of adjusting the cross slide, tailstock, saddle, and compound gib screws is to remove sloppiness in the ways without over-adjusting them to the point where the slides become stiff and difficult to move.

In general, loose gibs cause poor finishes and tool chatter; however, over-tightened gibs cause premature wear on the slide, leadscrew, and half nut, and are difficult to operate.

The gibs have a tapered shape and are held in position by screws at opposing ends of the slide. When the opposing screws are turned in the opposite directions from each other, the taper fills the void between the sliding components.

The gib adjustment process usually requires some trial-and-error. Typically, you make a slight adjustment to the gib screw, then check the feel of the adjustment by turning the handwheel.

You then repeat this process as necessary until you find the best balance between loose and stiff movement. Most machinists find that the ideal gib adjustment is where a small amount of drag or resistance is present yet the handwheels are still easy to move.

Figures 77 – 79 show the location of the screws for each gib on this machine.

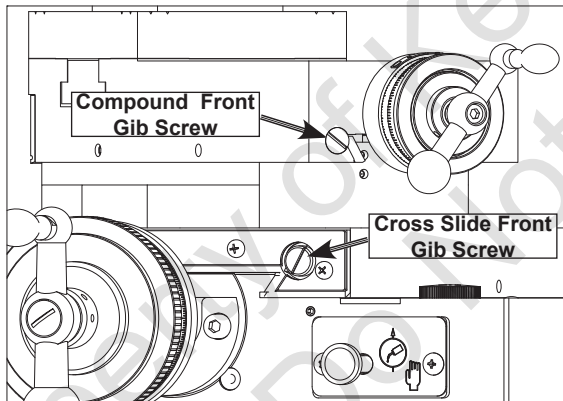


Figure 77. Compound and cross slide gib screw.



Figure 78. One of two front saddle gib screws.

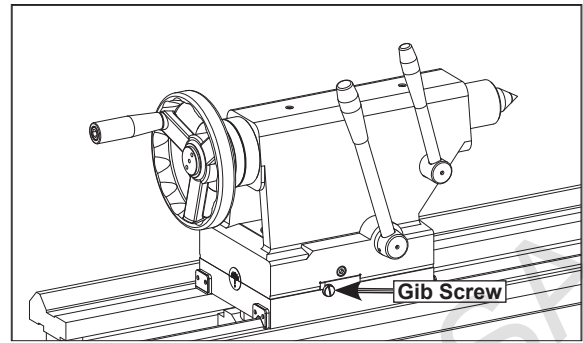


Figure 79. One of two tailstock gib screws.

V-Belts

V-belts stretch and wear with use, so they should be checked on a monthly basis to ensure optimal power transmission. Replace all the V-belts if any of them show signs of glazing, fraying, or cracking.

To adjust or replace the V-belts on the lathe :

1. Disconnect Lathe from POWER !
2. Remove the cover.

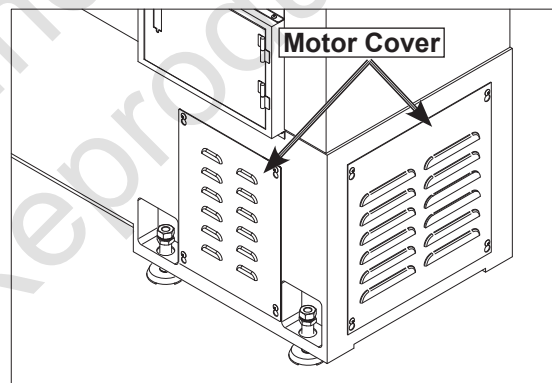


Figure 80. Location of motor cover.

3. Turn the hex nuts on the motor mount bolts shown in Figure 81 to move the motor mount plate up or down and adjust the V-belt tension. When correctly tensioned, each belt should have about 19mm deflection when pressed firmly.

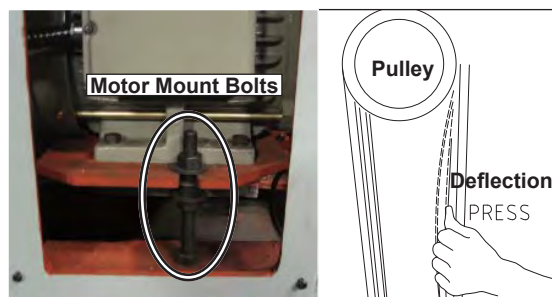


Figure 81. V-belt adjustment.

4. Firmly tighten the hex nuts (loosened in the previous step) against the motor mount plate to prevent it from moving out of adjustment during operation, then reinstall the motor cover.

Brake & Switch

As the brake lining wears, the foot pedal develops more travel. If the brake band is not adjusted to compensate for normal wear, the limit switch will still turn the lathe off, but the spindle will not stop as quickly. It is especially important that the brake is kept properly adjusted so you can quickly stop the spindle in an emergency.

To adjust the brake and brake switch :

1. Disconnect Lathe from POWER !
2. Put on a respirator and eye protection to protect yourself from hazardous brake dust.
3. Remove the motor cover.
4. Measure the remaining brake band lining at the thinnest point, which is usually at the 8 o'clock position, as shown in Figure 82.

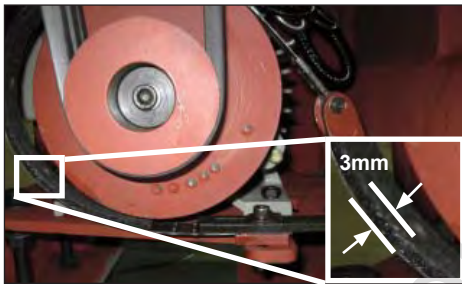


Figure 82. Minimum brake band lining thickness.

When the brake band is new, the lining is approximately 6mm thick. If the lining thickness wears to 3mm or less, the brake band must be replaced; otherwise, the rivets that secure the lining to the band will soon grind into the brake hub. If the hub becomes damaged, it must be replaced, which will substantially increase the cost of repair, compared to just replacing the brake band.



Figure 83. Brake linkage adjustments.

5. Remove pedal stop shown in Figure 84.
6. Move the brake band to the right one hole, and reinstall the pedal stop, tightening it until it is just snug.
7. Firmly push the pedal lever to the right until it stops and the brake band is fully clamped around the brake hub.
8. Tap the pedal stop into position so there is approximately a 25mm gap between the pedal lever and the stop.

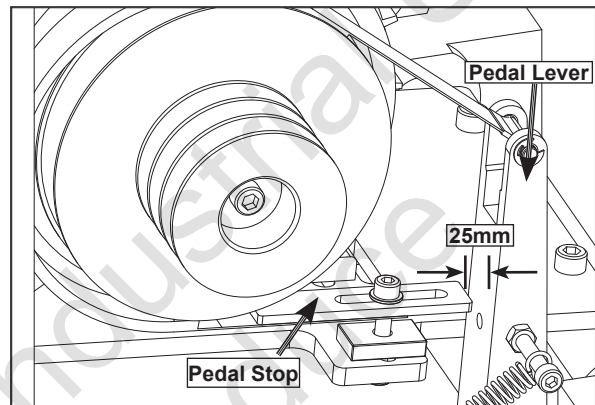


Figure 84. Pedal travel adjustment.

9. Tighten the cap screw on the pedal stop.
10. Locate the motor kill switch (Figure 85) at the tailstock end of the lathe.

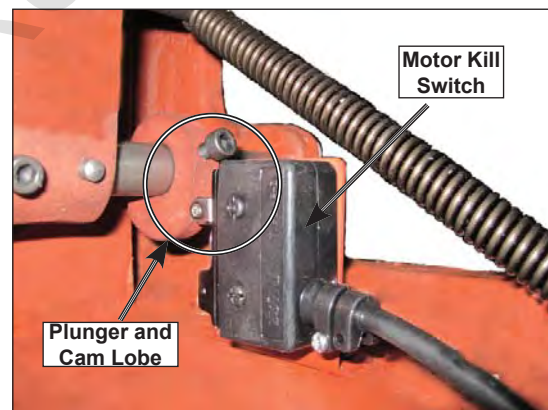
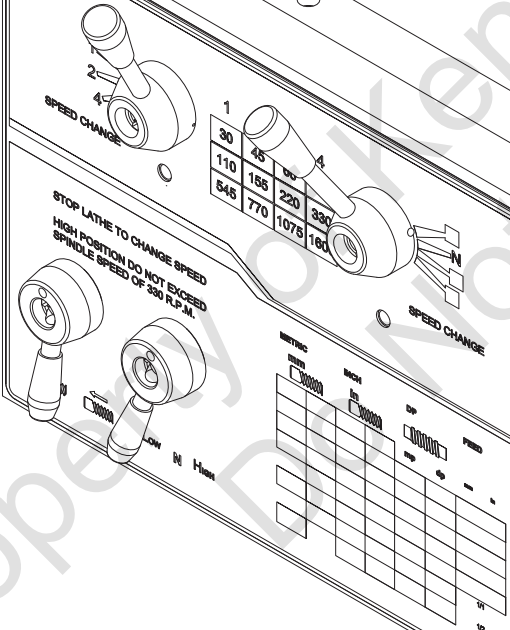
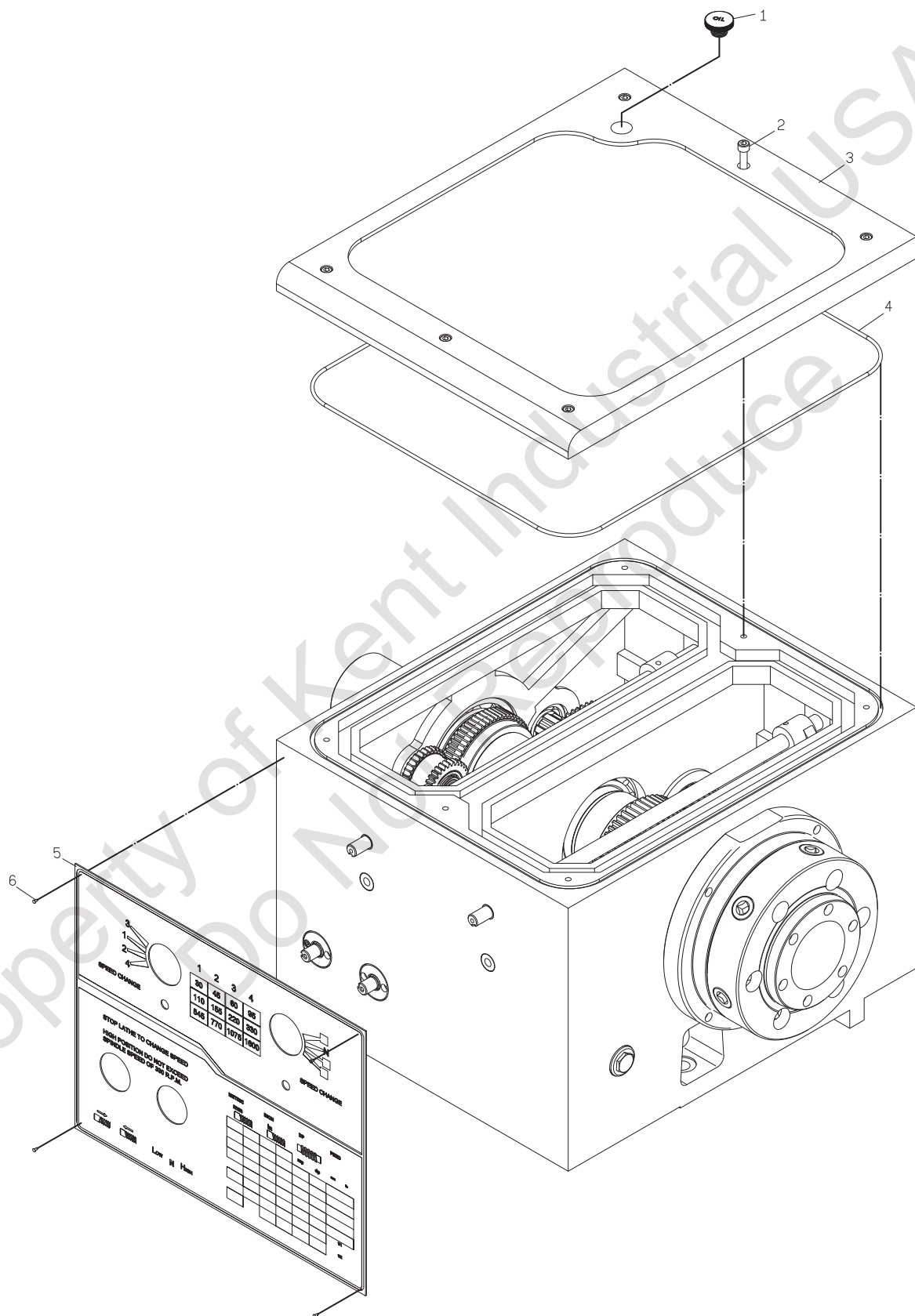


Figure 85. Motor kill switch.

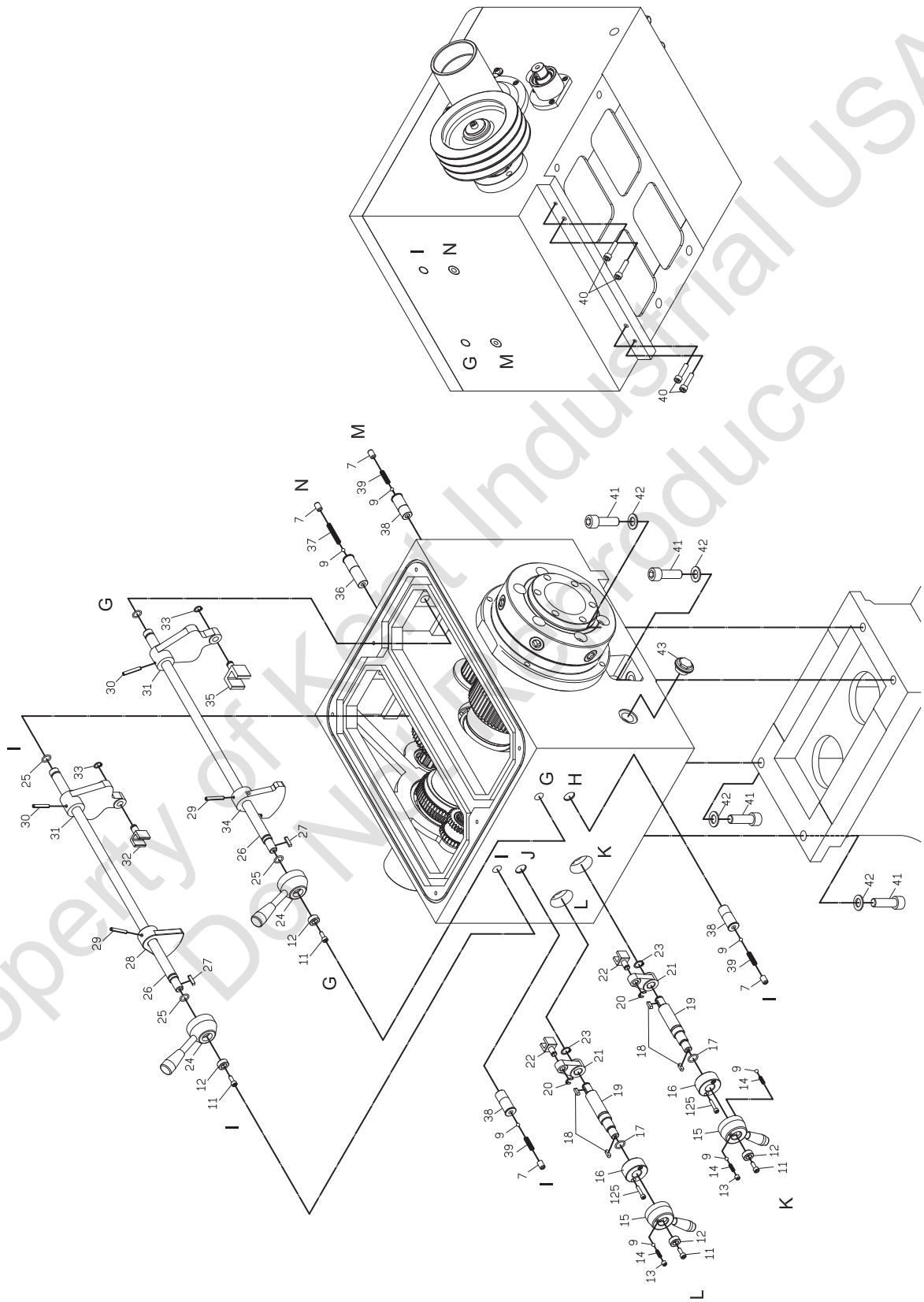
Headstock



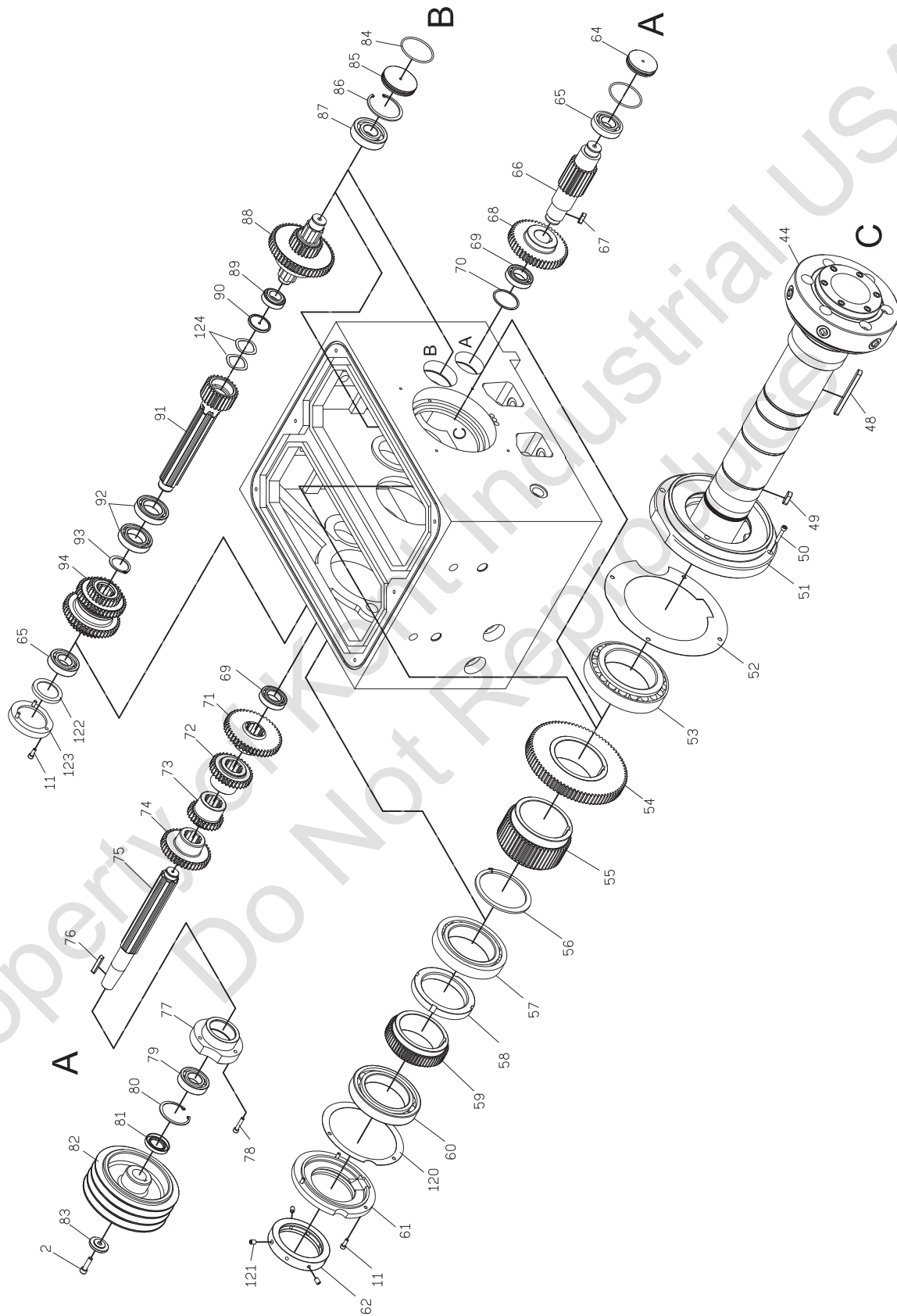
Headstock



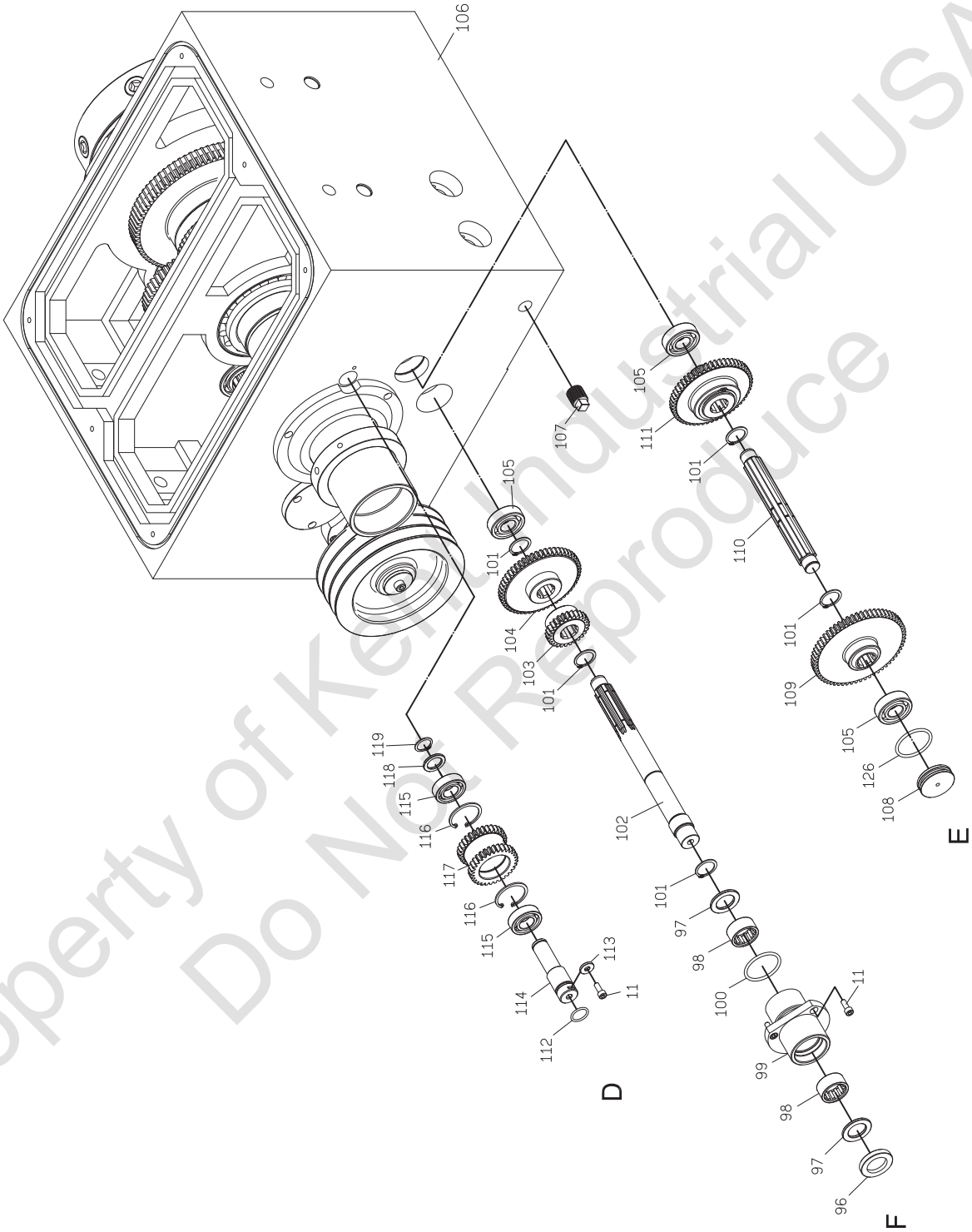
Headstock



Headstock



Headstock



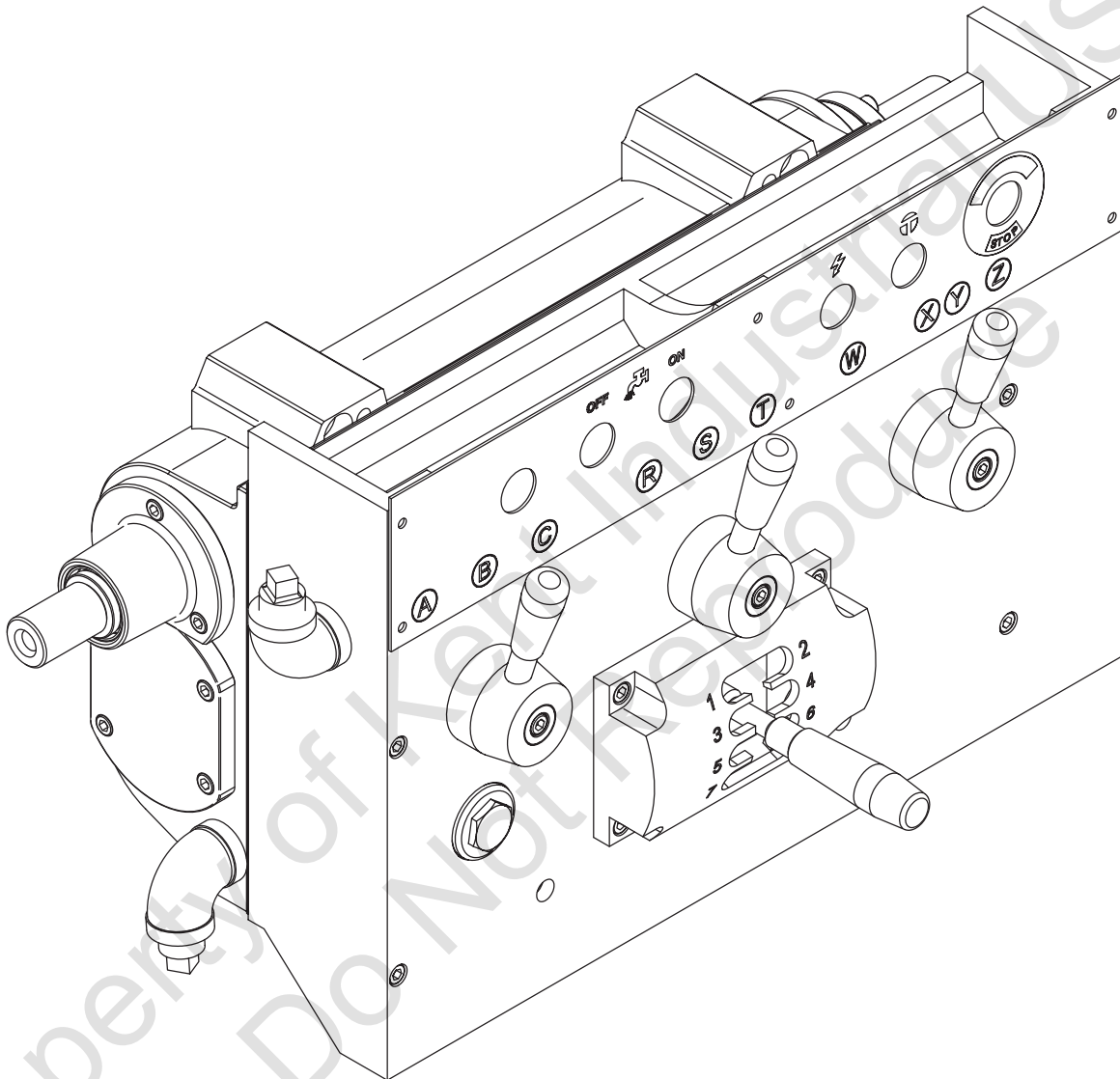
Headstock

No.	Part No.	Part's name	QTY	REMARK	No.	Part No.	Part's name	QTY	REMARK
1		Oil Cover	1	3/4"	40		Hex. socket head bolt	4	CAP 8x35
2		Hex. socket head bolt	7	CAP 8x30	41		Hex. socket head bolt	4	CAP 16x50
3	10002	Headstock cover	1		42		Washer	4	M16
4		O ring	1	Ø4x1840	43		Oil sight	1	3/4"
5	17-61001	Name plate	1		44	10090-D8	Set screw	6	
	18-61001					10003-D8	Spindle	1	
	21-61001					10089-D8	Spring	6	
6		Rivet	4	Ø2		10091-D8	Cams	6	
7		Set screw	4	SET 10x16	48		Key	1	12x8x120
					49		Key	1	12x8x30
9		Steel ball	7	Ø1/4"	50		Hex. socket head bolt	3	CAP 6x35
					51	10038	Front bearing cover	1	
11		Hex. socket head bolt	20	CAP 6x16	52	10038-P	Packing F	1	
12	10045	Washer	4		53		Taper roller bearing	1	32024XU
13		Set screw	2	SET 8x8	54	10019	Gear	1	82T
14	10081	Spring	3		55	10020	Gear	1	53T
15	10053	Hub	2		56		Clip	1	S105
	10054	Handle	2		57		Taper roller bearing	1	32020X
		Spring pin	2	Ø3x25	58		Nut	1	YSR100
16	10061	Collar	2		59	10021	Gear	1	62T
17		O ring	2	P16	60		Ball bearing	1	6019
18		Key	4	5x5x16	61	10040	Outside cover	1	
19	10055	Shaft	2		62	10064	Balance ring	1	
20		Clip	2	E8	63		Set screw	2	SET 6x8
21	10056	Lever	2		64	10035	Cover	1	
22	10057	Fork	2		65		Ball bearing	2	6206
23		Clip	2	S15	66	10014	Gear shaft	1	20T
24	10043	Hub	2		67		Key	1	8x7x25
	10044	Handle	2		68	10015	Gear	1	47T
		Spring pin	2	Ø3x25	69		Ball bearing	2	6006
25		O ring	4	P14	70	10065	Collar	1	
26	10046	Rod	2		71	10008	Gear	1	46T
27		Key	2	5x5x22	72	10007	Gear	1	33T
28	10047	Lever	1		73	10006	Gear	1	27T
29		Spring pin	2	Ø6x36	74	10005	Gear	1	39T
30		Spring pin	2	Ø6x40	75	10004	Shaft	1	
31	10050	Lever	2		76		Key	1	7x7x45
32	10051	Fork	1		77	10033	Flanged bearing	1	
33		Clip	2	S12	78		Hex. socket head bolt	3	CAP 6x30
34	10048	Lever	1		79		Ball bearing	1	5206S
35	10052	Lever	1		80		Clip	1	R62
36	10066	Bush	1		81		Oil seal	1	TC306212
37	10083	Spring	1		82	10031	Pulley	1	
38	10067	Bush	3		83	10032	Washer	1	
39	10084	Spring	3		84		O ring	1	G65

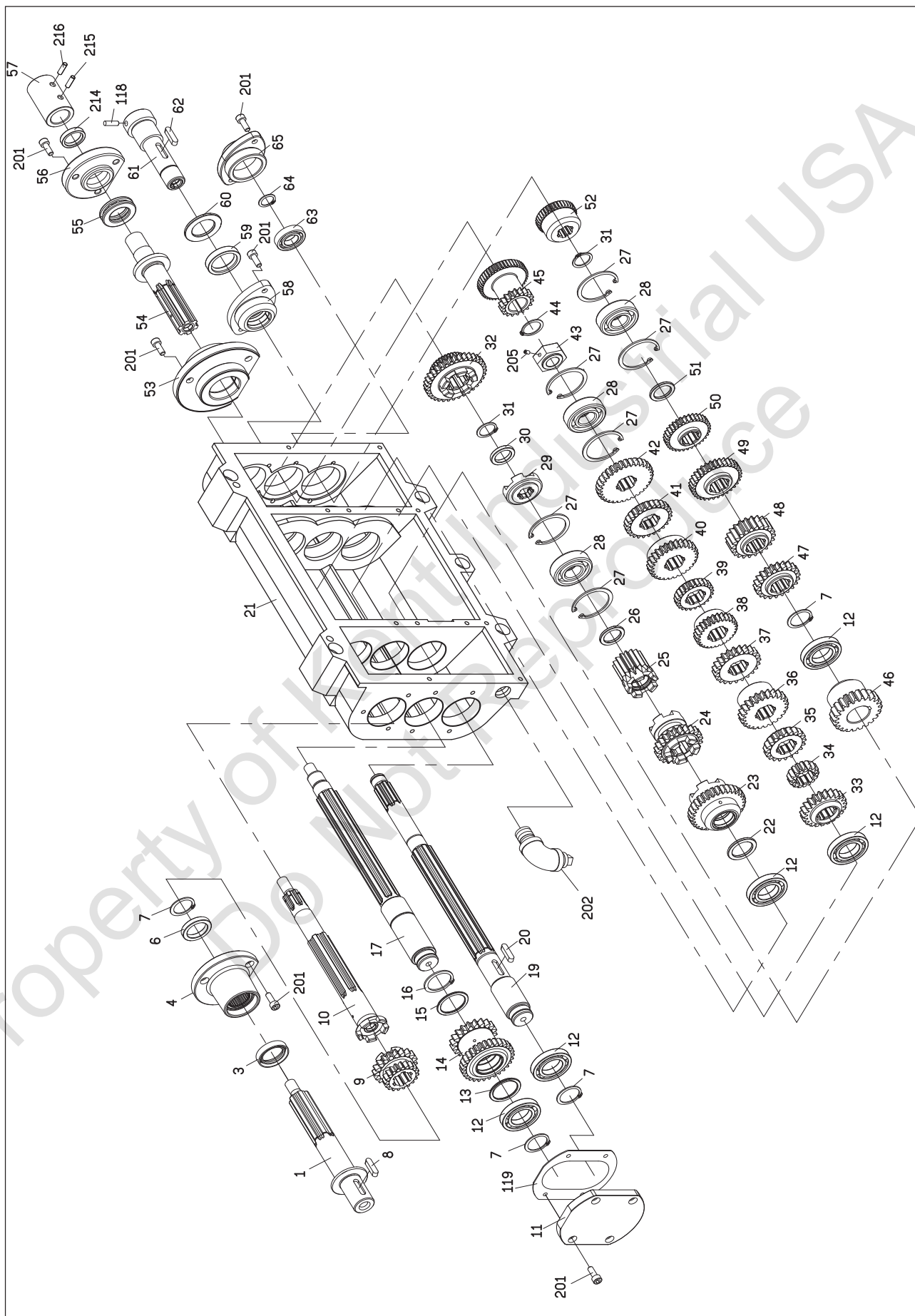
Headstock

No.	Part No.	Part's name	QTY	REMARK	No.	Part No.	Part's name	QTY	REMARK
85	10037	Plug	1		116		Clip	2	R42
86		Clip	1	R72	117	10023	Gear	1	31T
87		Ball bearing	1	6306	118	10059	Washer	1	
88	10017	Gear	1	23T	119		Clip	1	S20
	10018	Gear	1	2 5 T / 5 2 T	120	10040-P	Packing	1	
		Key	2	8x7x25	121		Set screw	3	SET 8x12
		Clip	1	S50	122	10087	Washer	1	
	10016	Shaft	1		123	10034	Cover	1	
89		Taper roller bearing	1	32005XJ	124		Spring Washer	2	
90	10036	Washer	1		125		Hex. Scket head bolt	4	CAP 5x25
91	10009	Gear shaft	1	25T	126		O ring	1	P41
92		Ball bearing	2	6008					
93		Clip	1	S38					
94	10010	Gear	1	26T					
	10011	Gear	1	39T					
	10012	Gear	1	45T					
	10013	Gear	1	33T					
		Key	1	8x7x70					
		Clip	1	S55					
96		Oil seal	1	TC28x44x7					
97	10060	Washer	2						
98		Needle bearing	2	RNA6904					
99	10042	Flanged bearing	1						
100		O ring	1	P44					
101		Clip	5	R25					
102	10028	Shaft	1						
103	10029	Gear	1	27T					
104	10030	Gear	1	54T					
105		Ball bearing	3	6204					
106	17-10001	Head stock	1						
	18-10001								
	21-10001								
107		Square head plug	1	PT 1/2"					
108	10041	Cover	1						
109	10025	Gear	1	62T					
110	10024	Shaft	1						
111	10026	Gear	1	27T					
	10027	Gear	1	54T					
		Key	1	7x7x20					
		Clip	1	S45					
112		O ring	1	P20					
113	10058	Washer	1						
114	10022	Shaft	1						
115		Ball bearing	2	6004					

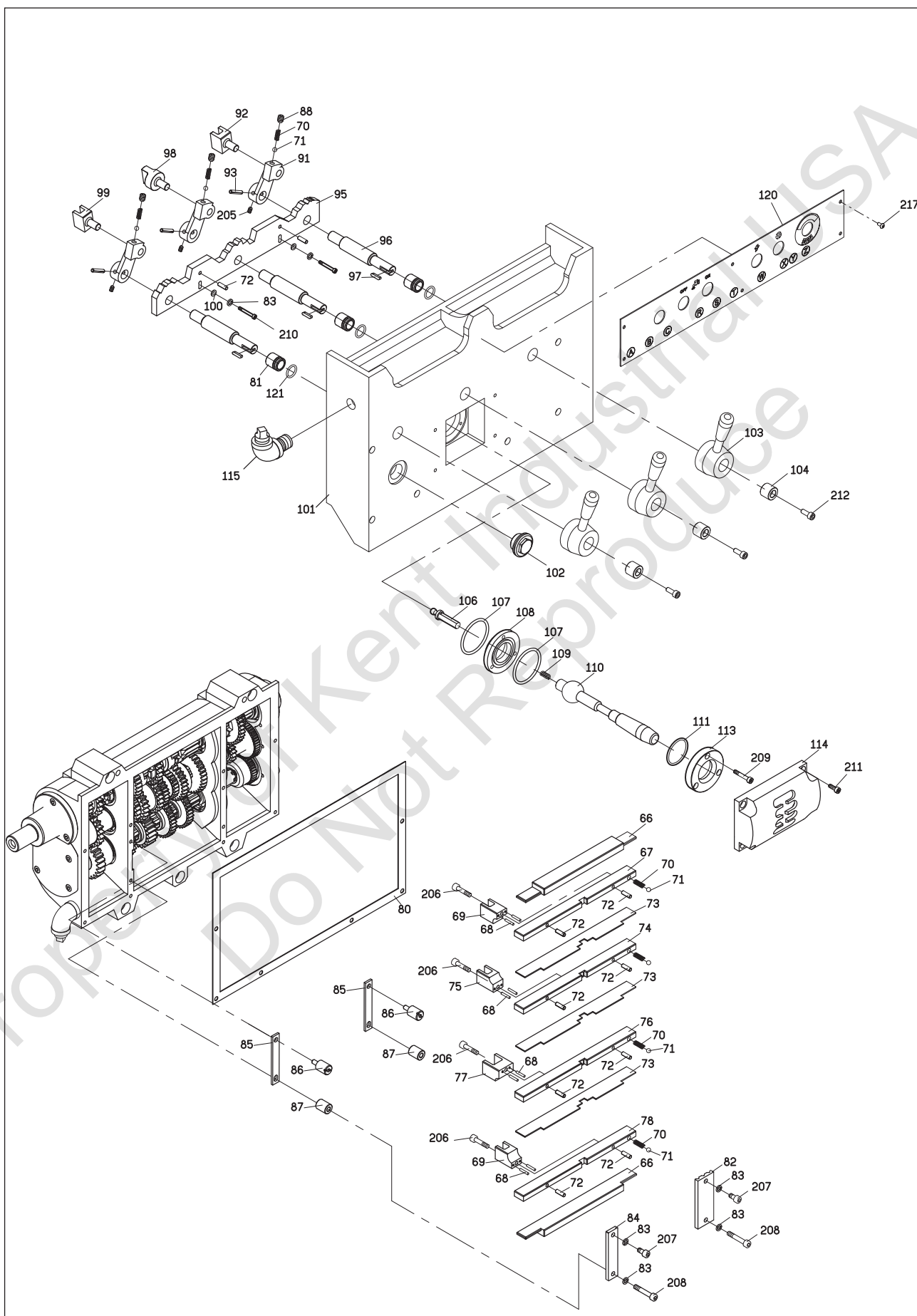
Gearbox



Gearbox



Gearbox



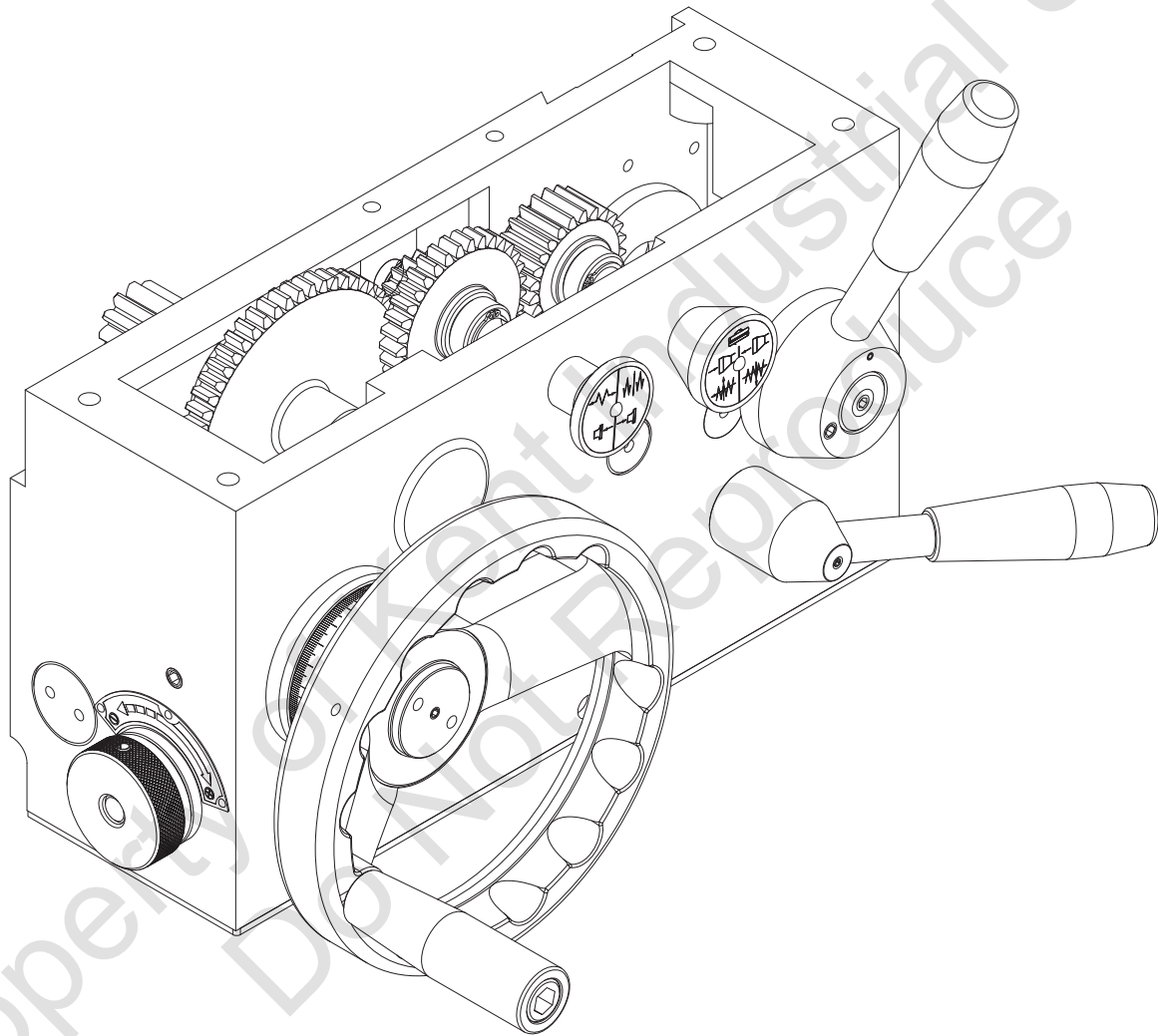
Gearbox

No.	Part No.	Part's name	QTY	REMARK	No.	Part No.	Part's name	QTY	REMARK
1	30003	Shaft	1		45	30037	Gear	1	18T/45T
					46	30040	Gear	1	22T
3		Oil seal	1	25x37x08	47	30041	Gear	1	22T
4		Bearing	2	TAF25/20	48	30042	Gear	1	22T
	30004	Flanged bearing	1		49	30043	Gear	1	33T
					50	30044	Gear	1	22T
6	30019	Washer	1		51	30005	Washer	1	
7		Clip	4	S25	52	30045	Gear	1	36T
8		Key	1	7x7x30	53	30020	Flanged bearing	1	
9	30006	Gear	1	19T/19T	54	30016	Shaft	1	
10	30007	Shaft	1		55		Bearing	1	51105
11	30021	Cover	1		56	30018	Flanged bearing	1	
12		Bearing	5	16005	57	63006	Sleeve	1	
13	30013	Washer	1		58	30038	Flanged bearing	1	
14	30023	Gear	1	30T/20T	59		Oil seal	1	28x40x05
15	30024	Washer	1		60	30090	Washer	1	
16		Clip	1	S30	61	30036	Shaft	1	
17	30022	Shaft	1		62		Key	1	5x5x35
					63		Bearing	1	16003
19	30039	Shaft	1		64		Clip	1	S17
20		Key	1	6x6x25	65	30046	Flanged bearing	1	
21	30001	Gearbox body	1		66	30059	Upper plate	2	
22	30008	Washer	1		67	30060	Fort support	1	
23	30009	Gear	1	32T	68		Spring pin	8	Ø3×16
24	30010	Gear	1	23T	69	30058	Fork	2	
25	30011	Gear	1	16T	70		Spring	7	Ø4×19
26	30012	Washer	1		71		Steel ball	7	1/4"
27		Clip	6	R47	72		Spring pin	10	Ø5x16
28		Bearing	3	6204	73	30061	Partition	3	
29	30014	Clutch	1		74	30062	Fort support	1	
30	30015	Washer	1		75	30056	Fork	1	
31		Clip	2	S20	76	30063	Fort support	1	
32	30017	Gear	1	35T	77	30057	Fork	1	
33	30025	Gear	1	22T	78	30064	Fort support	1	
34	30026	Gear	1	16T					
35	30027	Gear	1	20T	80	30002-P	Seal	1	
36	30028	Gear	1	24T	81	30054	Spacer	3	
37	30029	Gear	1	23T	82	30069	Reverse-stop	1	
38	30030	Gear	1	27T	83		Spring washer	6	M6
39	30031	Gear	1	24T	84	13-30086	Shoulder plate	1	
40	30032	Gear	1	28T	85	30065	Fixed plate	2	
41	30033	Gear	1	26T	86	13-30084	Partition nut	2	
42	30034	Gear	1	32T	87	13-30085	Spacer	2	
43	30035	Nut	1		88		Set screw	3	SET 8x8
44		Clip	1	S22					

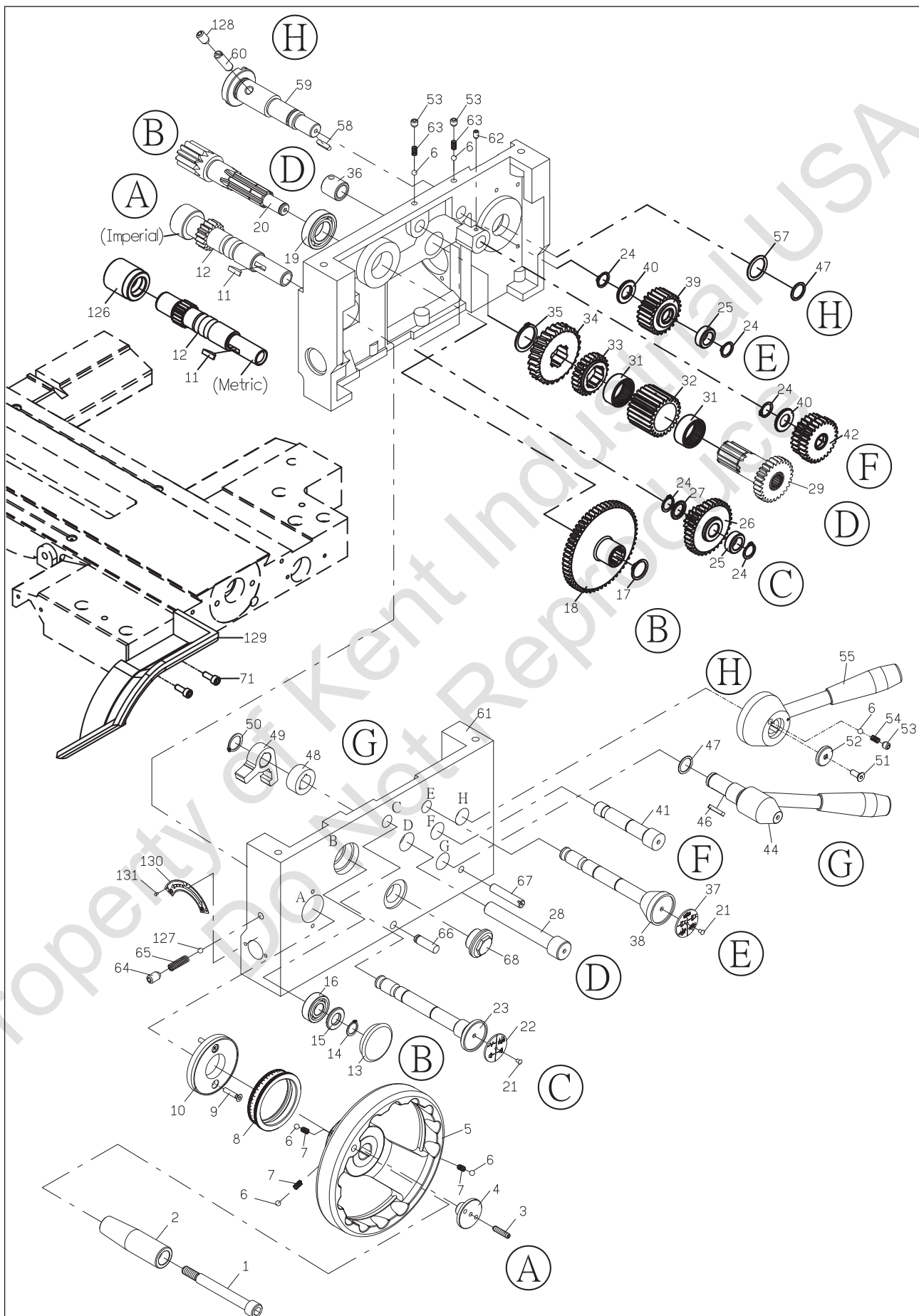
Gearbox

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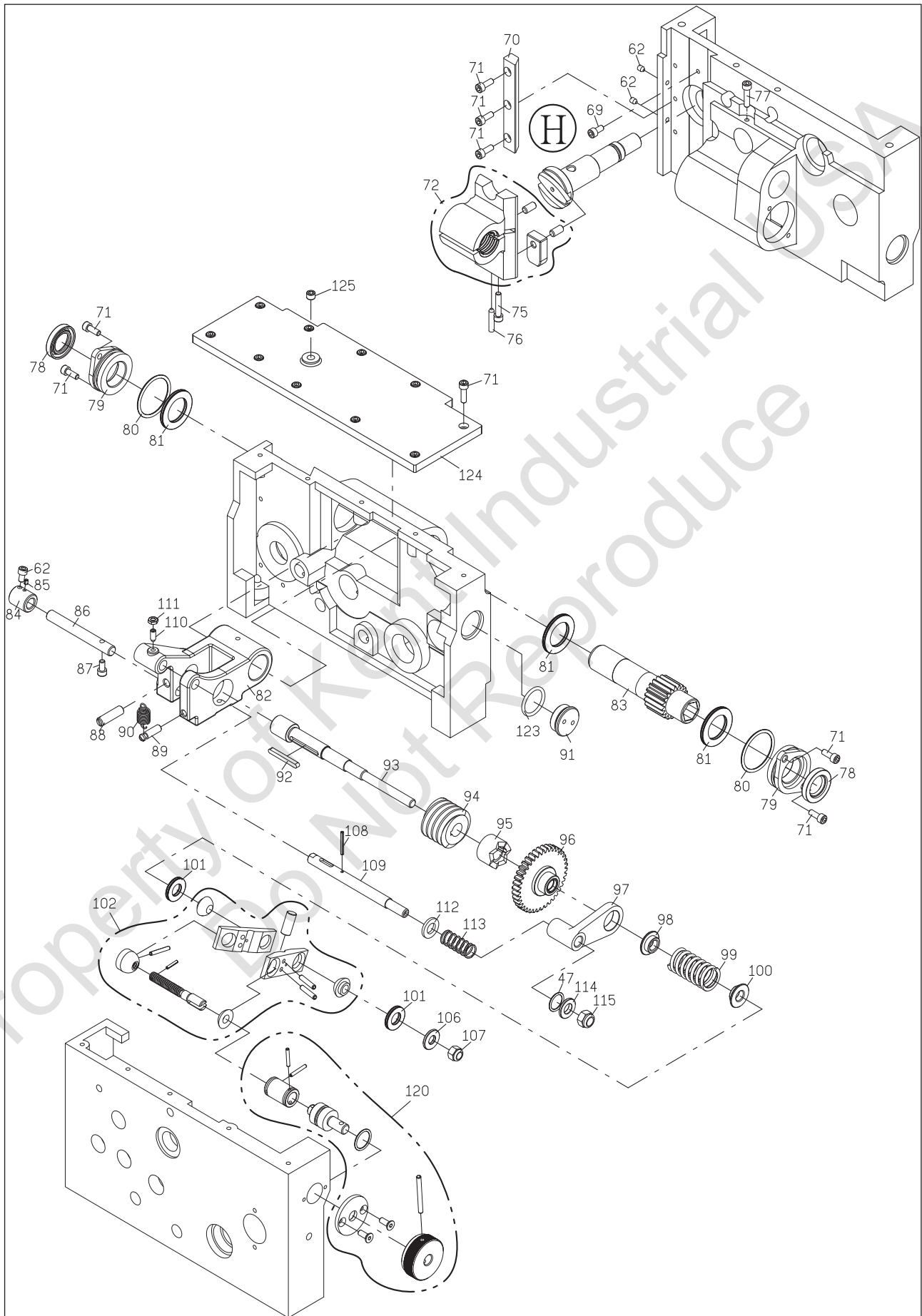
Apron



Apron



Apron



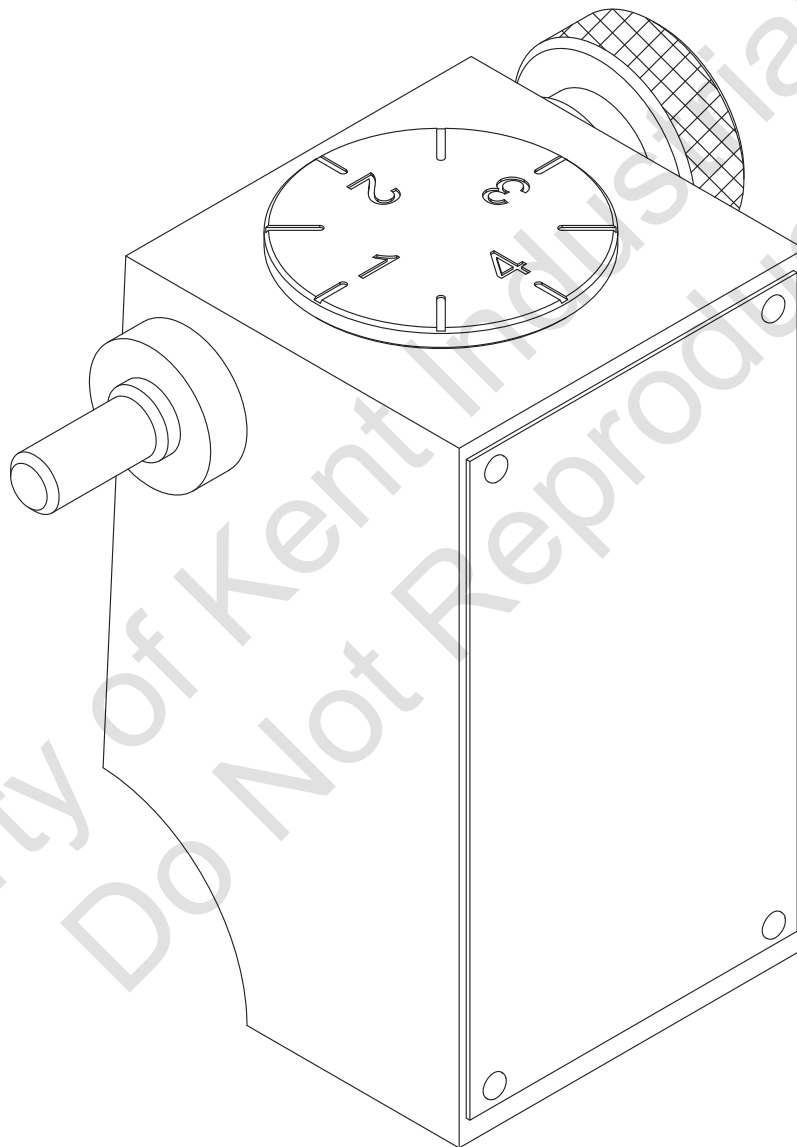
Apron

No.	Part No.	Part's name	QTY	REMARK	No.	Part No.	Part's name	QTY	REMARK
1	40012	Screw	1		37	40035	Name plate	1	
2	40011	Handle	1		38	40034	shaft	1	
3		Set screw	1	SET 6×25	39	40036	Gear	1	24T
4	40014	Bolt	1		40	40024	Collar	2	
5	40010-L	Hand wheel	1		41	40037	shaft	1	
	40010-R				42	40038	Gear	1	24T/26T
6		Steel ball	6	1/4"					
7	40004	Spring	3				Spring pin	1	Ø4×24
8	40007-I	Index ring	1		44	40081	Handle	1	
	40007-M					40080	Sleeve	1	
9		Flat hexagon screw	2	5×12	46		Key	1	4×4×25
10	40005-IL	Shaft liner	1		47		O ring	3	P18
	40005-IR				48	40122	Pad	1	
	40005-ML				49	40113	Elasticity pole	1	
	40005-MR				50		Snap ring	1	S18
11		Woodruff key	1	Ø5×19	51		Flat hexagon screw	1	M6×16
12	40003-IL	Gear shaft	1		52	40045	washer	1	
	40003-IR				53		Set screw	3	SET8×8
	40003-LM				54	20022	Spring	2	
	40003-RM					40042	Handle	1	
13	40120	Plug	1			40041-L	Lead nut lever	1	
14		Snap ring	1	S15			Spring pin	1	Ø4×24
15	40025	Collar	1			40042	Handle	1	
16		Ball bearing	1	6202LR		40114-R	Lead nut lever	1	
17		Snap ring	1	S22			Spring pin	1	Ø4×24
18	40020-I	Gear	1	56T	57		O ring	1	P21
	40020-M			82T	58		Key	1	5×5×18
19		Ball bearing	1	6005LU	59	40040-L	Cam shaft	1	
20	40017-I	Gear shaft	1			40112-R			
	40017-M				60		Set screw	1	SET 10×40
21		Rivet	2	Ø2.8×10	61	40001-L	Apron	1	
22	40023	Name plate	1			40001-R			
23	40022	shaft	1		62		Set screw	4	SET 6×8
24		Snap ring	5	S16	63	40006	spring	1	
25	40027	Collar	2		64		Set screw	1	SET 10×16
26	40026-I	Gear	1	15T/33T	65	40083	spring	2	
	40026-M			18/33T	66	40087	Pin	1	
27	40021	Collar	1		67	40084	Pin	1	
28	40028	shaft	1		68		Oil sight	1	3/4"
29		Needle bearing	2	TLA1616	69		Hex. socket head bolt	1	CAP 6×12
	40029	Gear shaft	1		70	40049	Adjust plate	1	
					71		Hex. socket head bolt	19	CAP 6×16
31		Needle bearing	2	TLA3016		40047	Pin	2	
32	40030	Gear	1	24T		40048	Slide plate	1	
33	40031	Gear	1	24T		40046-I	Half nut	1	
34	40032	Worm wheel	1		72	40047	Pin	2	
35		Snap ring	1	S30		40048	Slide plate	1	
36	40033	Collar	1			40046-M	Half nut	1	

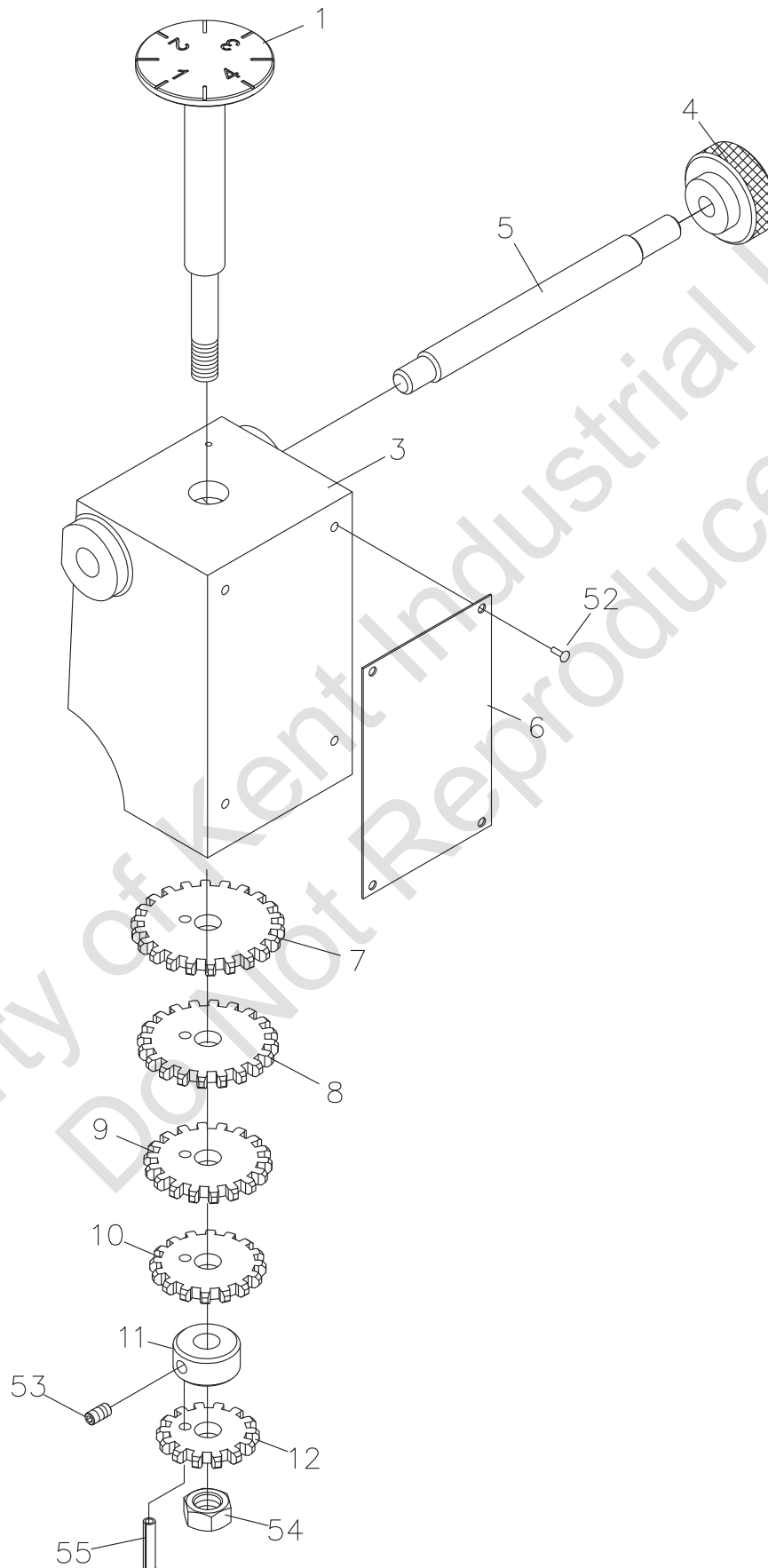
Apron

No.	Part No.	Part's name	QTY	REMARK	No.	Part No.	Part's name	QTY	REMARK
75		Hex. socket head bolt	1	CAP 6×30	120	40074	Flat hexagon screw	2	M6×16
76		Set screw	1	SET 6×30			Spring pin	2	Ø3×24
77		Hex. socket head bolt	1	CAP 6×25			Coupling	1	
78		Oil seal	2	30×40×5			Shaft	1	
79	40053	Sleeve	2				O ring	2	P21
80		O ring	2	G40			Washer	1	
81		Thrust bearing	3	NTB3047/AS2			Spring pin	1	Ø5×36
82	40055-L 40108-R	bracket	1				Sleeve	1	
83	40054A	Pinion	1						
84	40119	Spacer	1		123		O ring	1	P21
85		Spring pin	1	Ø4×20	124	40089-L	Plate	1	
86	40090	Pin	1			40110-R			
87		Hex. socket head bolt	1	CAP 5×25	125		Hex. socket head plug	1	PT1/4"
88	40085	Pin	1		126	40019-M	Spacer	1	
89	40086	Pin	1		127		Steel ball	1	3/8"
90	40088	spring	1		128		Set screw	1	SET 10×10
91	40091	Nut	1		129	18-40126	Handle wheel guard	1	
92		Key	1	5×5×45	130	40079	Plate	1	
93	40057	shaft	1		131		Rivet	3	Ø2
94	40058	Worm	1						
95	40059	Clutch	1						
96	40056	Clutch gear	1						
97	40060	Lever arm	1						
98	40063	washer	1						
99	40064	spring	1						
100	40065	washer	1						
101		Thrust bearing	2	NTB1528/AS2					
102	40066	Flanged bearing	2	Ø5×28					
		Spring pin	2						
	40070	Pin	1						
	40068	Plate	2						
	40071	Nut	1	Ø3×16					
		Spring pin	1						
	40073	Rod	1						
	40072	Washer	1						
106	40115	washer	1						
107		Nylon jam nut	1	M10					
108		Spring pin	1	Ø4x24					
109	40061	Trip rod	1						
110		Set screw	1	SET 6x16					
111		Nylon jam nut	1	M6					
112	40116	Washer	1						
113	40062	Spring	1						
114	40117	Washer	1						
115		Nylon jam nut	1	M12					

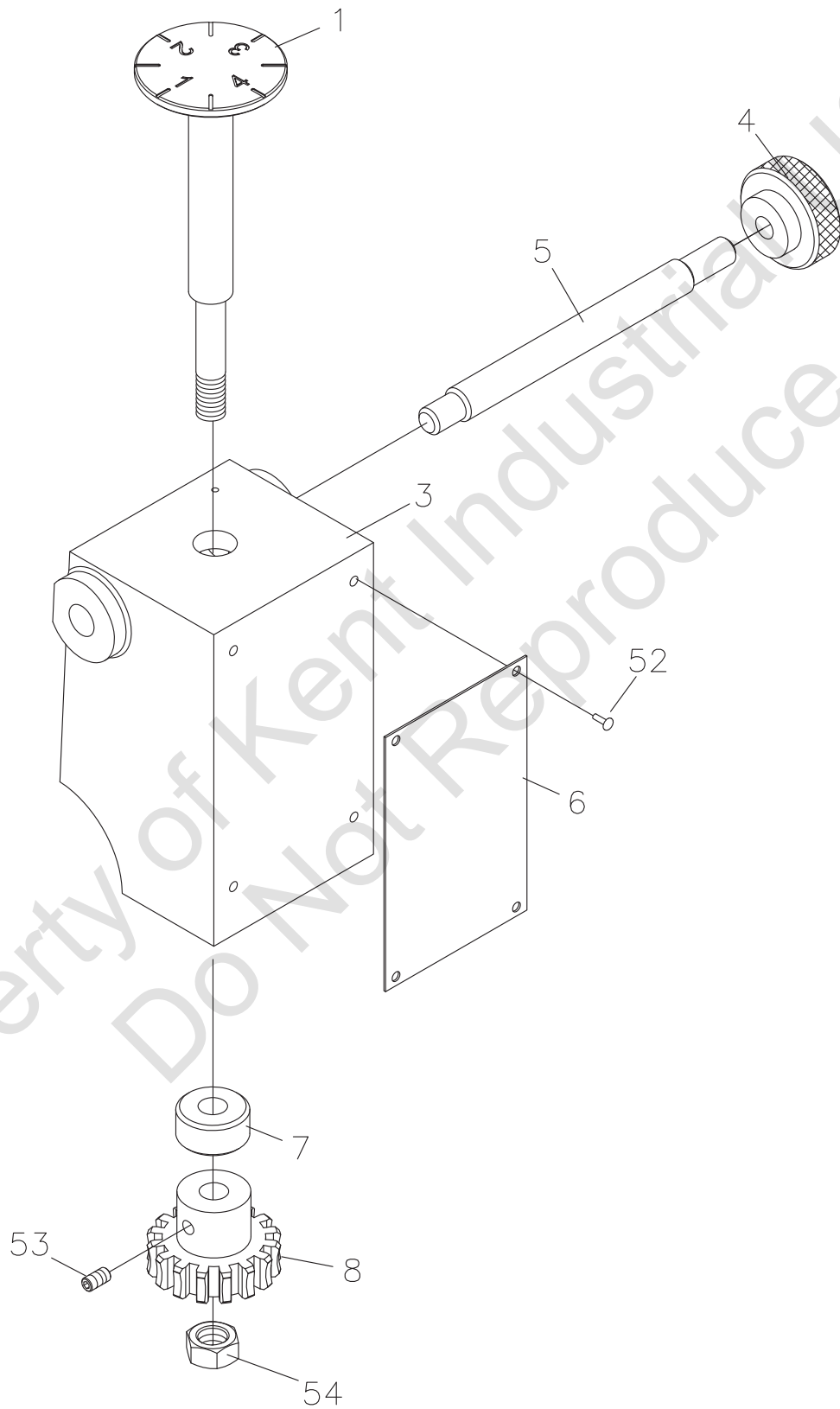
Dail Indicator



Dial Indicator METRIC



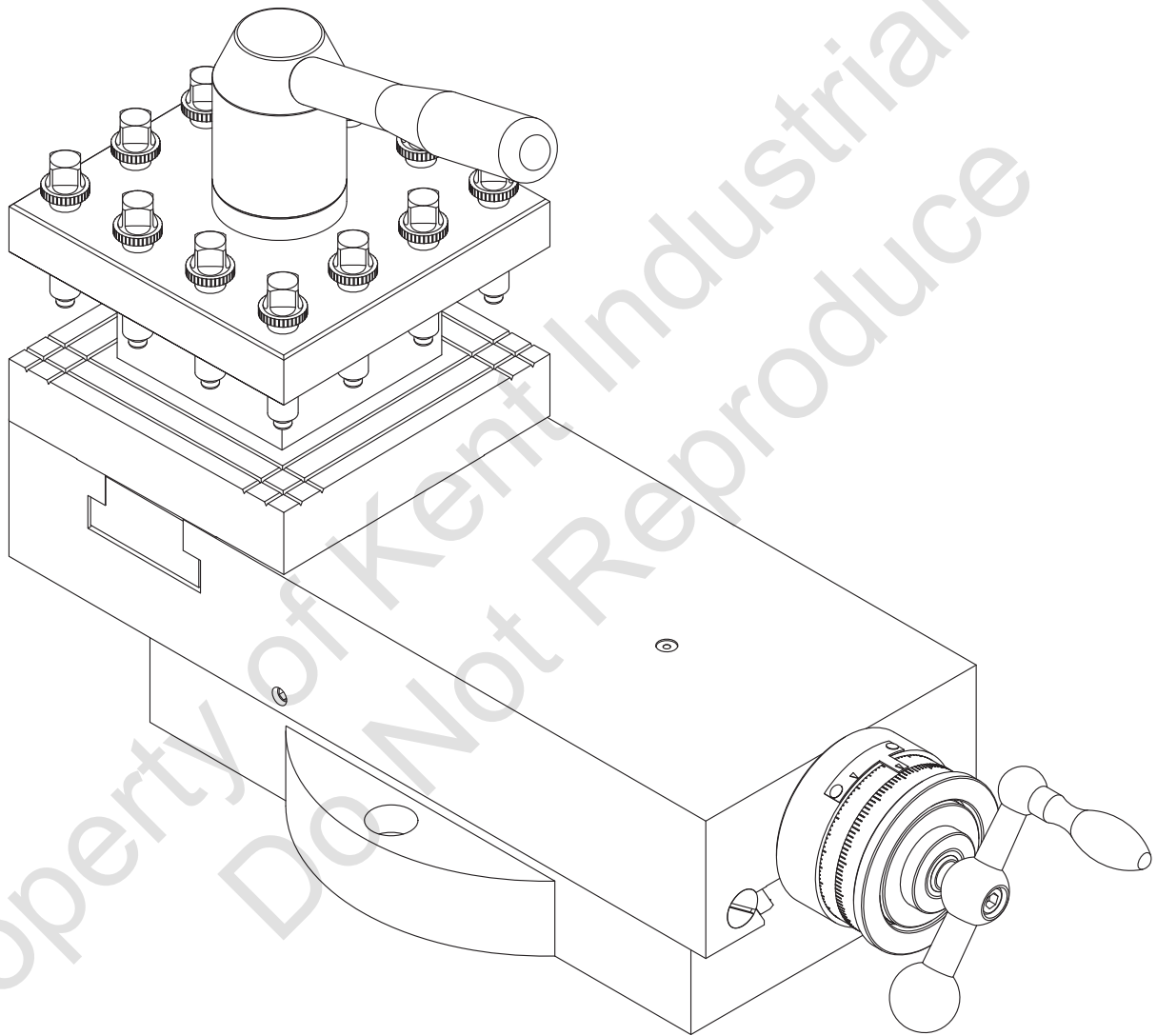
Dial Indicator IMPERIAL



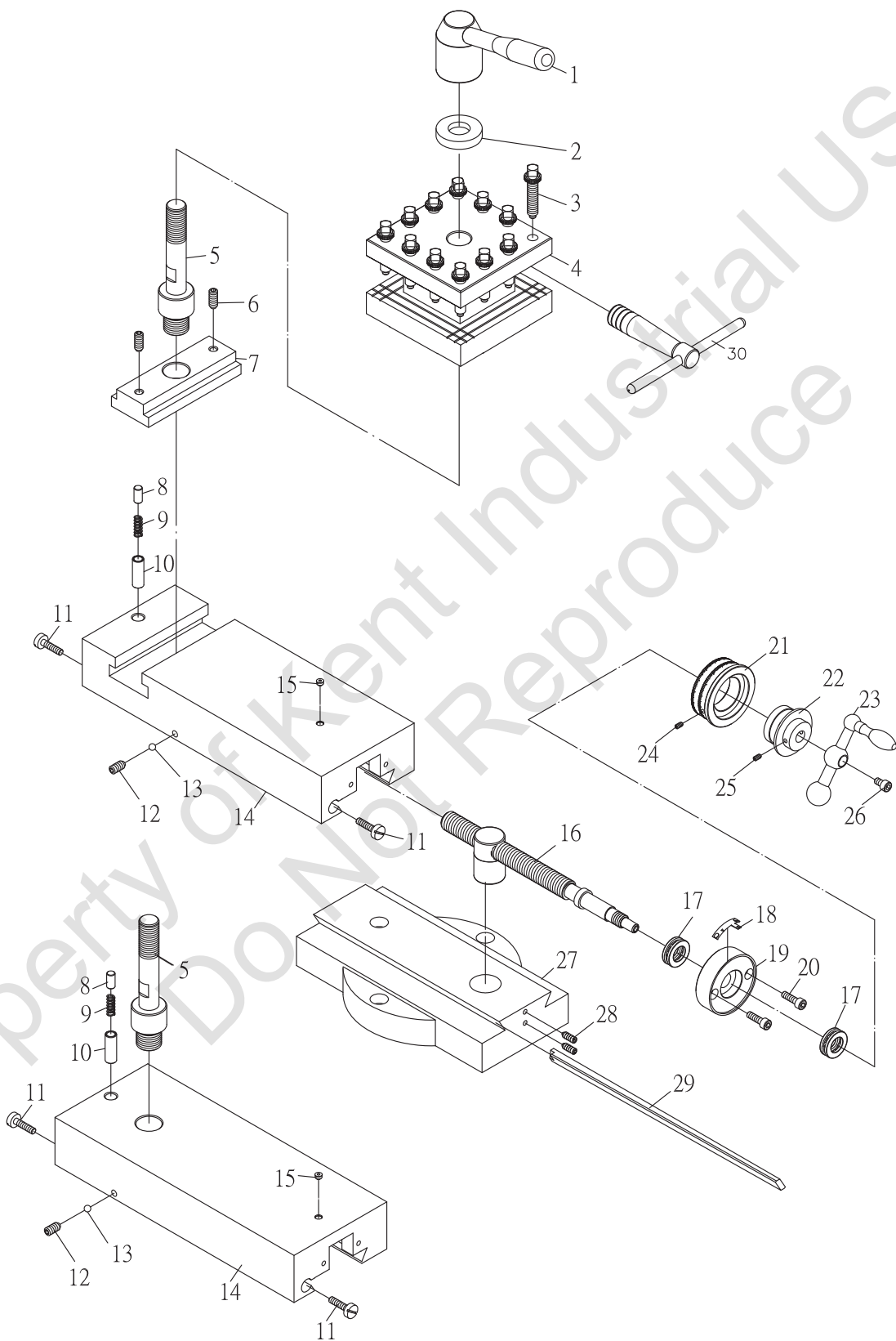
Dail Indicator

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Compound Rest & Tool Post



Compound Rest & Tool Post

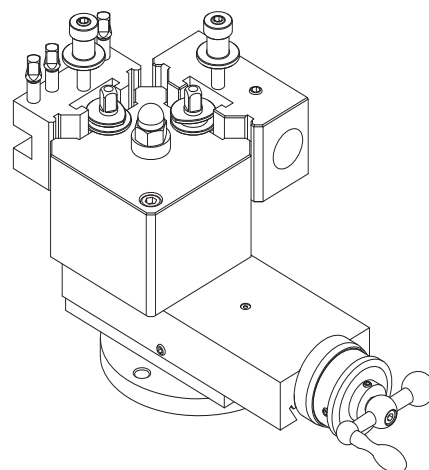
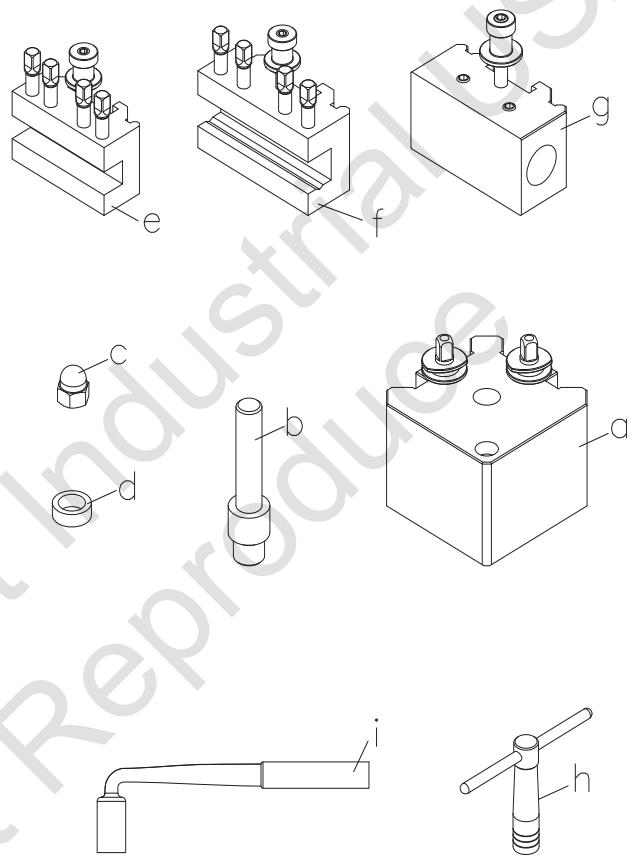


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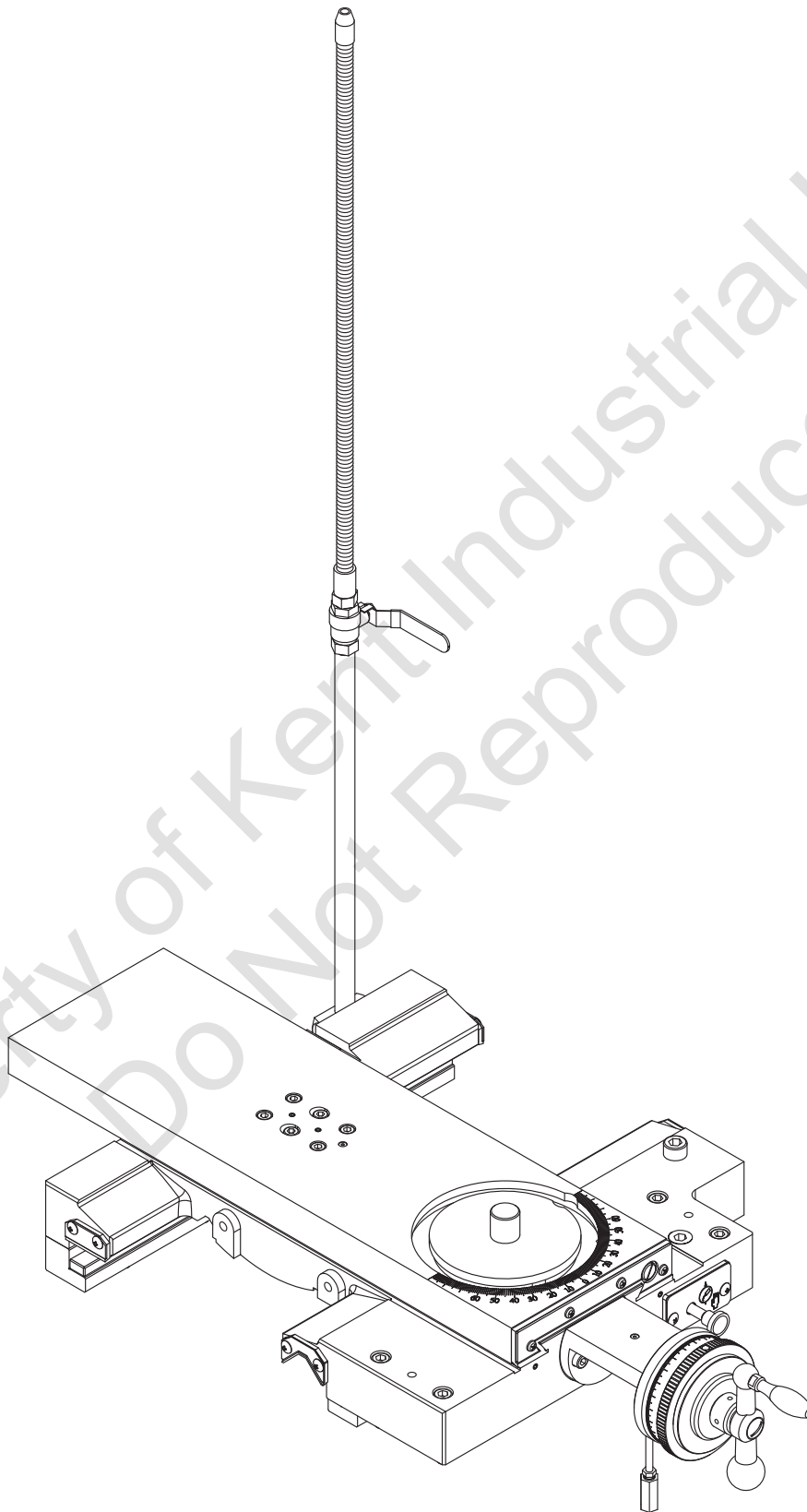
-57-

QUICKCHANGE TOOL POST SET (OPTIONAL)

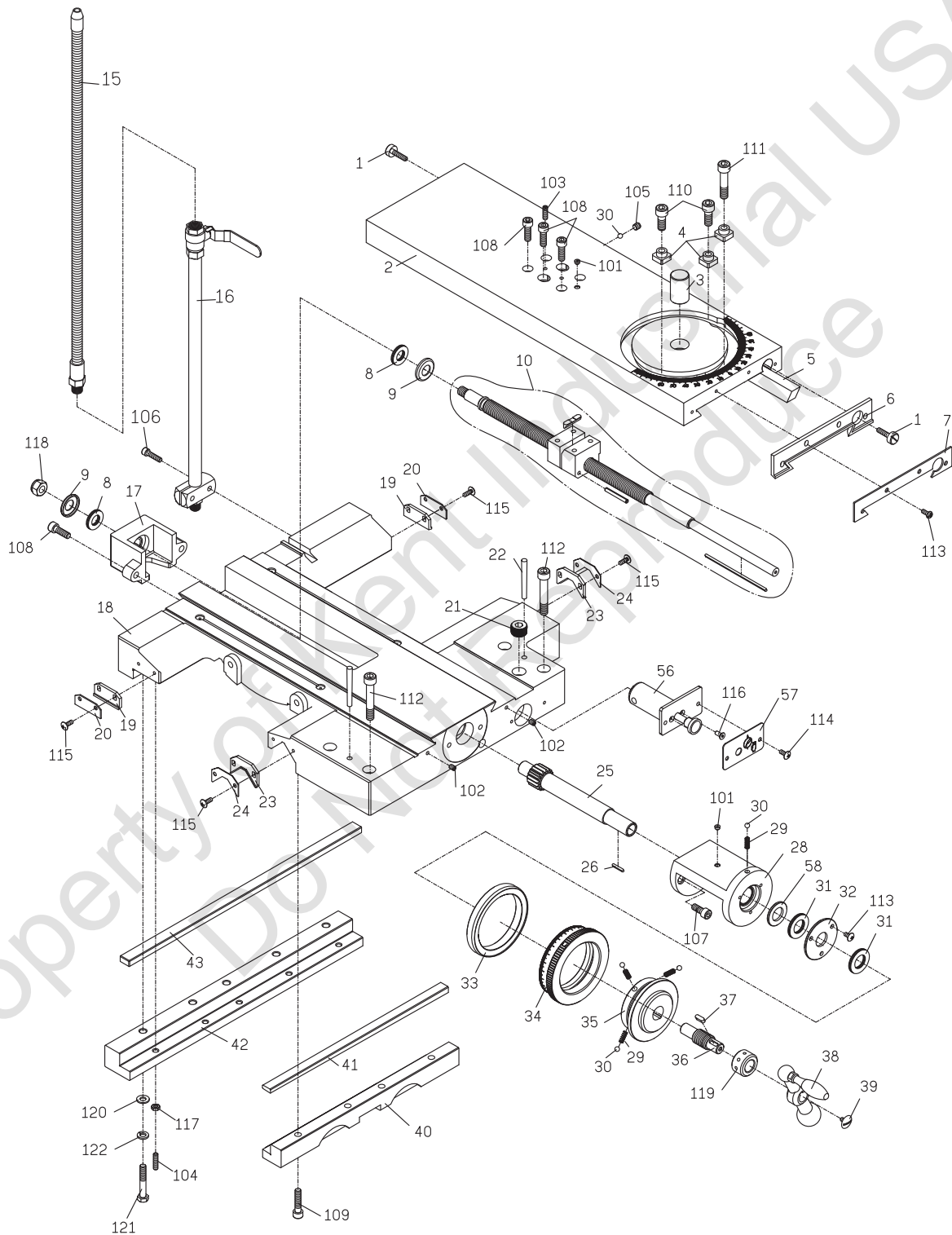
KEY NO.	PARTS NAME	QTY
a	TURRET BODY (SPECIFICATION-120)	1
b	TURRET SHAFT	1
c	HEXAGON CAP NUT	1
d	WASHER	1
e	STANDARD TOOLHOLDER	1
f	VEE TOOLHOLDER	1
g	PLAIN BORE TOOLHOLDER	1
h	T WRENCH	1
i	L WRENCH	1



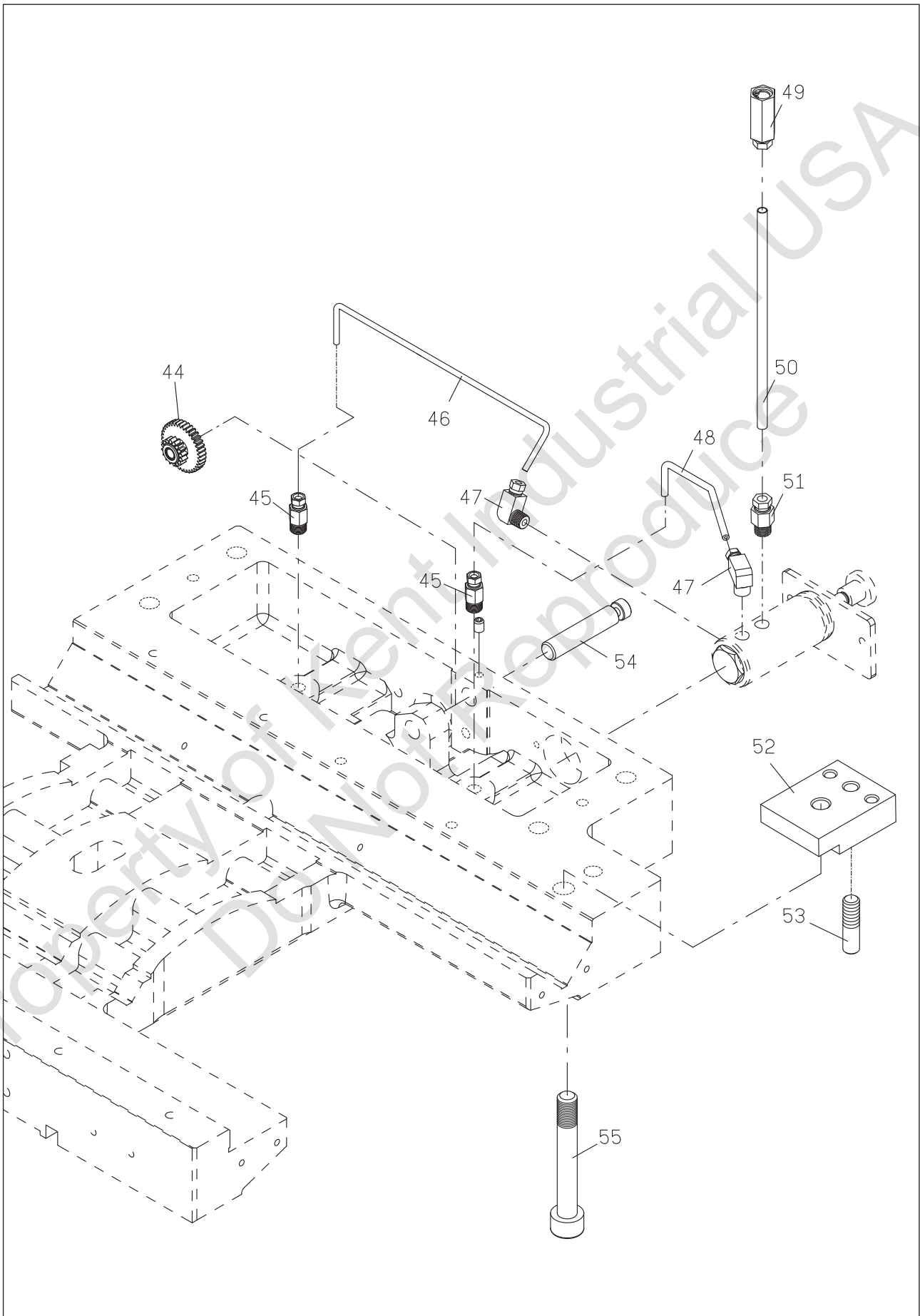
Saddles



Saddles



Saddles



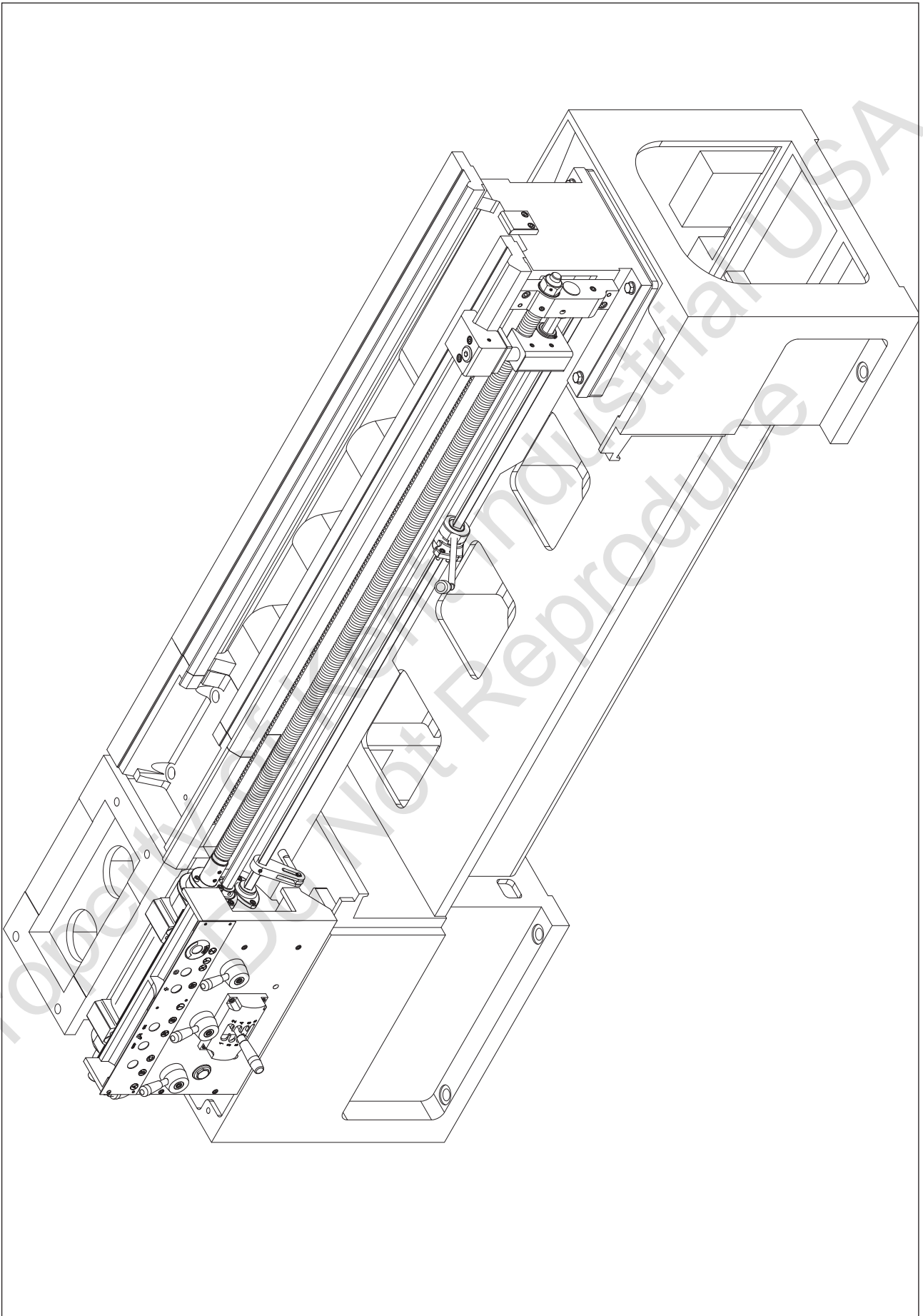
Saddles

No.	Part No.	Part's name	QTY	REMARK	No.	Part No.	Part's name	QTY	REMARK
1	50054	Adjust screw	2		34	50025-I	Dual	1	
2	50003	Cross slide	1			50025-M			
3	50032	Pivot	1	Ø25x35		50025-X			
4	50033	T bolt	3		35	50029-I	Bush	1	
5	50018	Gib-X	1			50029-M			
6	50078	Wiper-X	1		36	50028	Shaft	1	
7	50077	Plate -X	1		37		Key	1	5x5x20
8		Thrust bearing	2	NTB/AS2 1528	38	50027	Handwheel	1	
9	50020	Cap collar	2			50031	Handle	1	
10	50016	Pin	1		39	50103	screw	1	
	17-50011-SI	Screw	1		40	50051	Front anti-floater	1	
	18-50011-SI				41	50050	Gib-Z	1	
	21-50011-SI				42	50049	Rear anti-floater	1	
	50014-5I	Nut	1		43	50052	Gib-Y	1	
		Key	1		44	50008	Gear	1	16T/36T
		Spring pin	2		45		Straight adapter	2	Ø4x1/8
	50016	Pin	1		46		AL. tube	1	Ø4x258
	17-50011-SM	Screw	1		47		Elbow adapter	2	Ø4x1/8
	18-50011-SM				48		AL. tube	1	Ø4x121
	21-50011-SM				49		Oil filter	1	Ø6
	50014-5M	Nut	1		50		AL. tube	1	Ø6x170
		Key	1		51		Straight adapter	2	Ø6x1/8
		Spring pin	2		52	50056	Clamp plate	1	
15		Spraying pipe	1	PT3/8 x 24"	53	50057	Bolt	1	
16		Valve & junction assy.	1	PT3/8	54	50007	Short shaft	1	
17	17-50012	Rear bracket	1		55		Hex. socket head bolt	1	CAP12x85
	18-50012				56		Lubricator assy.	1	
	21-50012				57	50066	Plate	1	
18	50001	Saddle	1		58	50023	Washer	1	
19	50047	Wiper F	2						
20	50048	Plate F	2						
21		Hex. socket head plug	1	PT 1/2"	101		Oil ball	2	1/4"
22		Taper Pin	2	#6x70L	102		Set screw	2	SET 6x8
23	50045	Wiper V	2		103		Set screw	1	SET 6x20
24	50046	Plate V	2		104		Set screw	5	SET 6x25
25	17-50009	Gear	1	16T	105		Set screw	1	SET 8x8
	18-50009				106		Hex. socket head bolt	2	CAP 5x35
	21-50009				107		Hex. socket head bolt	2	CAP 8x20
26		Key	1	3x3x20	108		Hex. socket head bolt	8	CAP 8x25
28	17-50010	Front bracket	1		109		Hex. socket head bolt	4	CAP 8x35
	18-50010				110		Hex. socket head bolt	2	CAP 10x25
	21-50010				111		Hex. socket head bolt	1	CAP 10x45
29	50030	Spring	4	Ø6x15 L	112		Hex. socket head bolt	4	CAP 10x60
30		Steel ball	5	1/4"	113		Dome cross screw	3	M5x10
31		Thrust bearing	2	NTB/AS2 2035	114		Dome cross screw	2	M5x12
32	50024	Washer	1		115		Dome cross screw	4	M5x15
33	50021-M	Dial ring	1		116		Flat hexagon screw	2	M5x12
	50022-I				117		Nut	5	M6

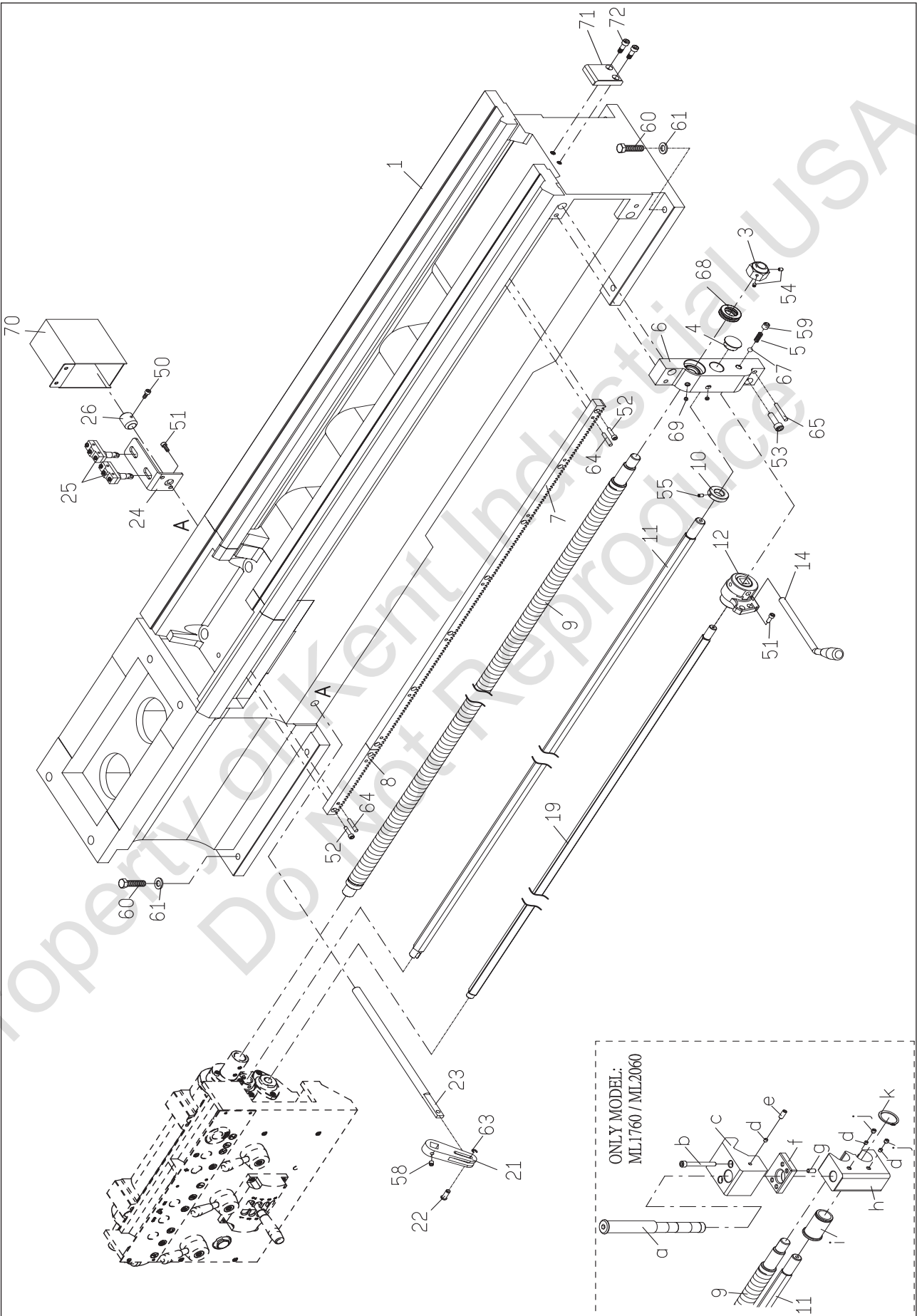
Saddles

[illegible]

Bed & Shafts



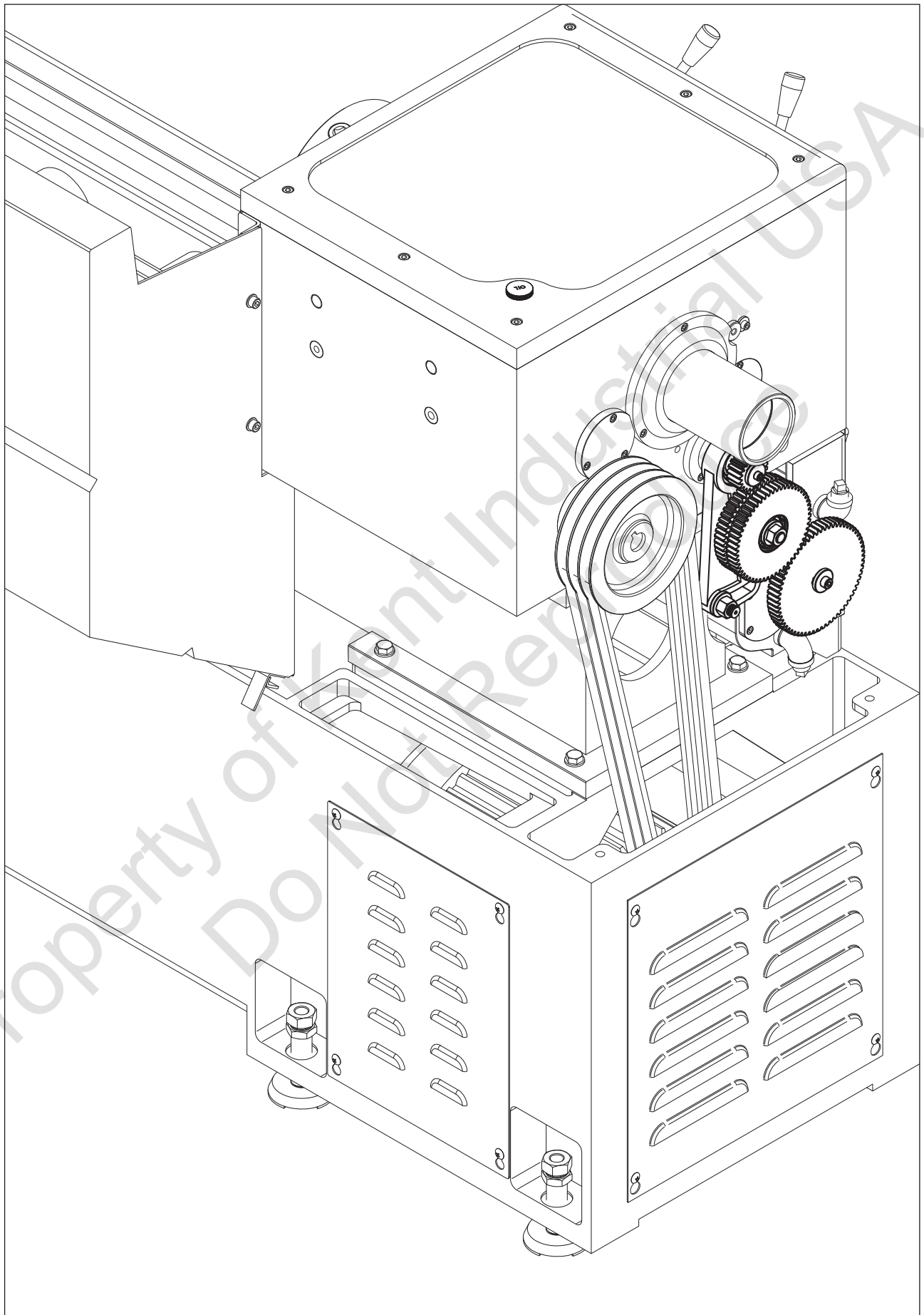
Bed & Shafts



Bed & Shafts

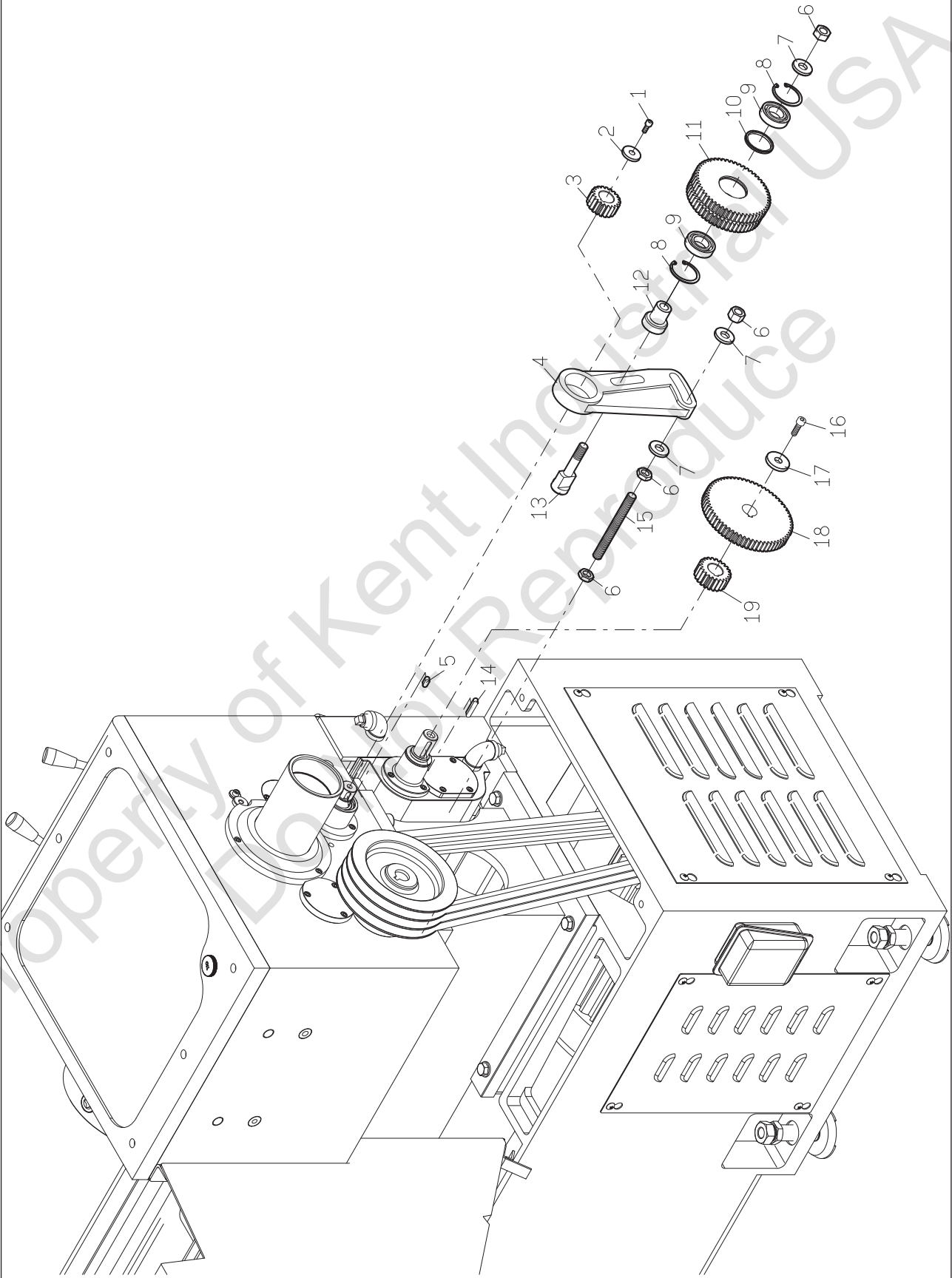
No.	Part No.	Part's name	QTY	REMARK	No.	Part No.	Part's name	QTY	REMARK
1	63001-40	Bed	1		50		Hex. socket head bolt	1	CAP 6x12
	63001-60				51		Hex. socket head bolt	4	CAP 6x16
					52		Hex. socket head bolt	9	CAP 6x20
3	63023	Nut	1		53		Hex. socket head bolt	2	CAP 10x35
4	63025	Plug	1		54		Set screw	2	SET 6x8
5	63041	Spring	1		55		Set screw	1	SET 6x10
6	63024	Bracket	1						
7	63021-M4	Rack	1	METRIC					
	63018-M6		2		58		Set screw	1	SET 8x10
	63021-I4		1	IMPERIAL	59		Set screw	1	SET 12x12
	63018-I6		2		60		Hexagon head bolt	8	M12x50
8	13-63024-GL	Rack	1	METRIC	61		Washer	8	M12
	14-63024-60G		1						
	63022-I		1	IMPERIAL	63		Snap ring	1	E6
9	63005-40M	Leadscrew	1		64		Pin	8	Ø6×25
	63005-60M				65		Pin	2	Ø6×50
	63005-40I								
	63005-60I				67		Steel ball	1	3/8"
10	60035	Collar	1		68		Thrust bearing	2	51105
11	63011-40A	Feed rod	1		69		Oil ball	2	1/4"
	63011-60A				70	61046	Block oil plate	1	
12	63020	Lever assy	1		71	60051	Block	1	
	63019	Pin	2		72		Hex. socket head bolt	2	CAP 8x25
	63014	Bracket	1						
	63017	Sleeve	1						
	63026	Spring	1						
	63015	Spring cover	1						
		Clip	1	S32					
14	63040	Knob	1						
	63020	Handle	1						
19	63016-40	Third rod shaft	1		a	63046-60	Shaft	1	
	63016-60				b		Hex. socket head bolt	2	CAP 8x70
					c	63043-60	Block	1	
21	60042	Connecting rod	1		d	63047-60	Pin	3	
22	60030	Pin	1		e		Set screw	1	SET 8x20
23	60036	Connecting rod	1		f	63049-60	Block	1	
24	61044	Switch base	1		g		Set screw	1	SET 8x16
25		Limit switch	2	TM1308	h	63044A60	Bracket	2	
26	60041	Collar	1		i	63052A60	Barrel	1	
					j		Set screw	1	SET 8x8
					k		Clip	1	S35

End Gear



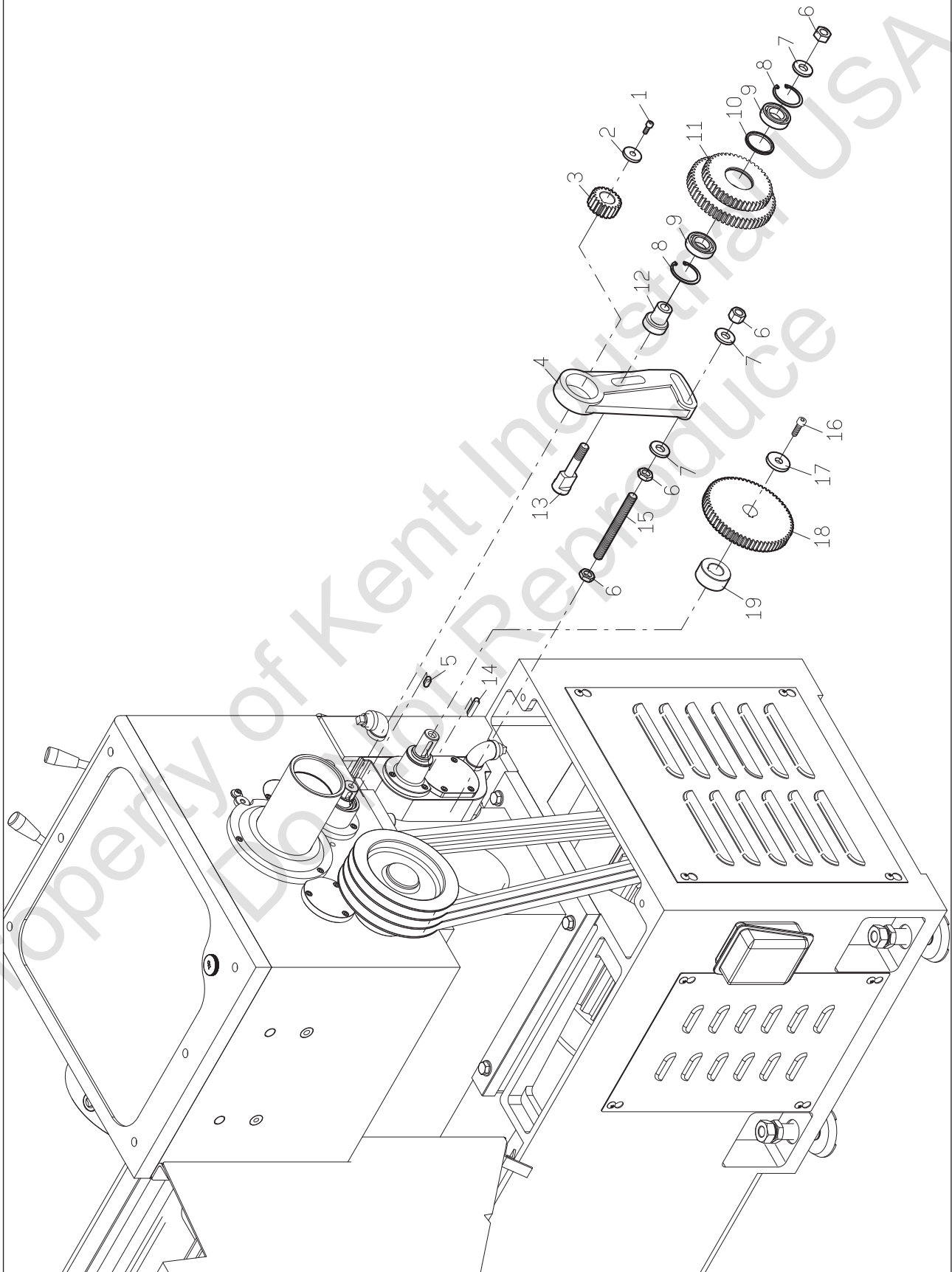
End Gear - 16"

METRIC



End Gear - 16"

IMPERIAL



End Gear - 16"

[illegible]

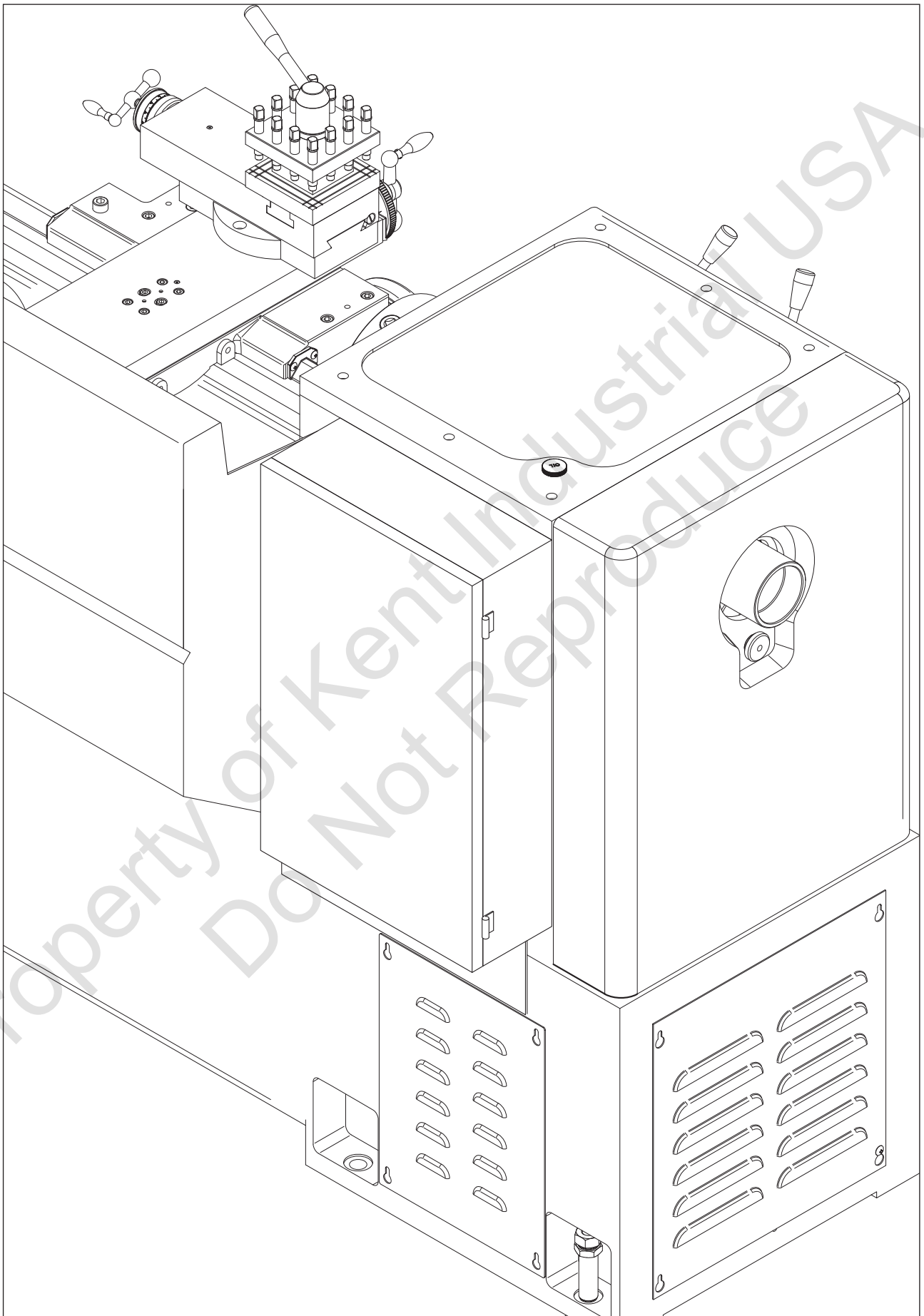
End Gear - 18"

[illegible]

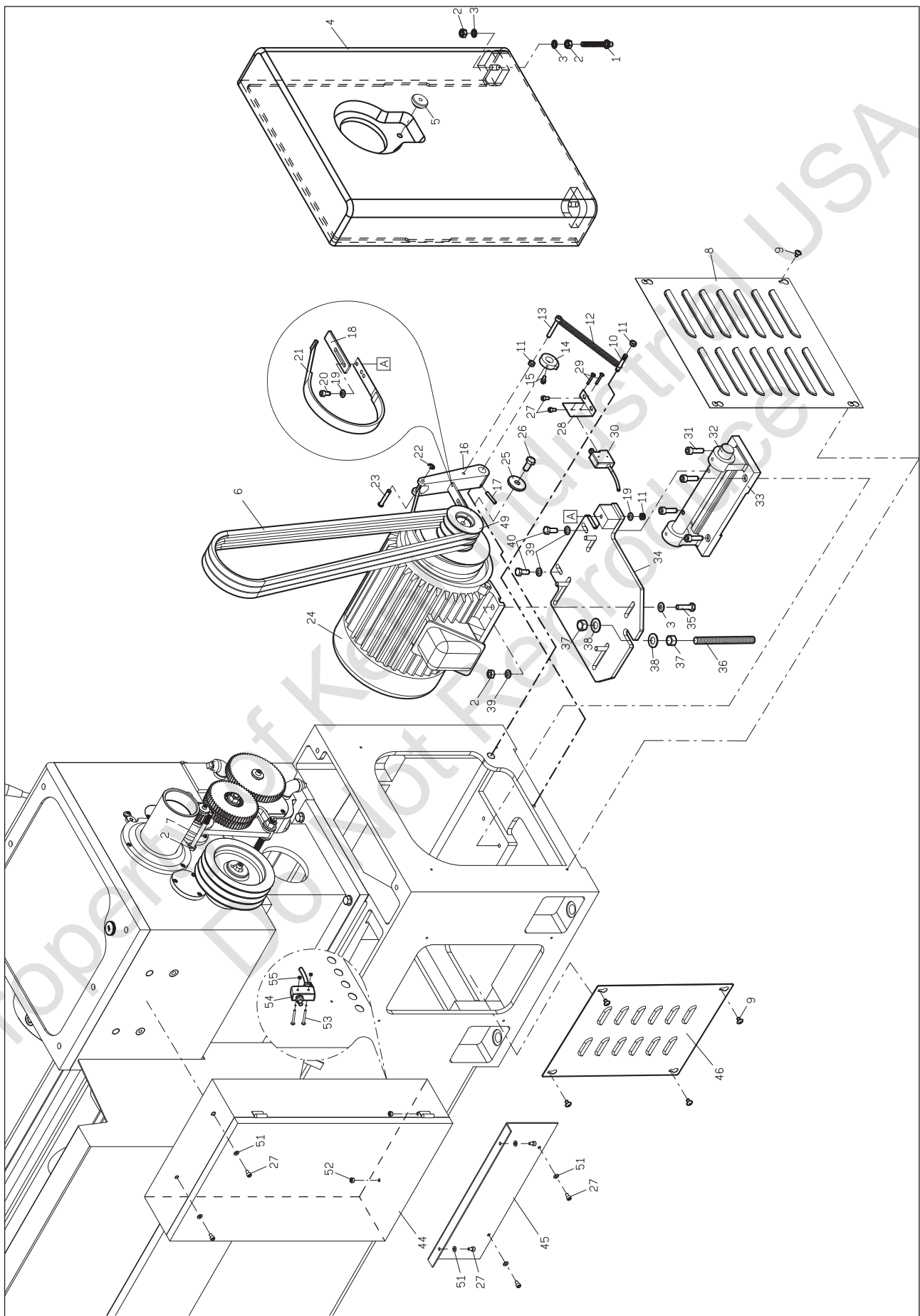
End Gear - 21"

[illegible]

Main Motor



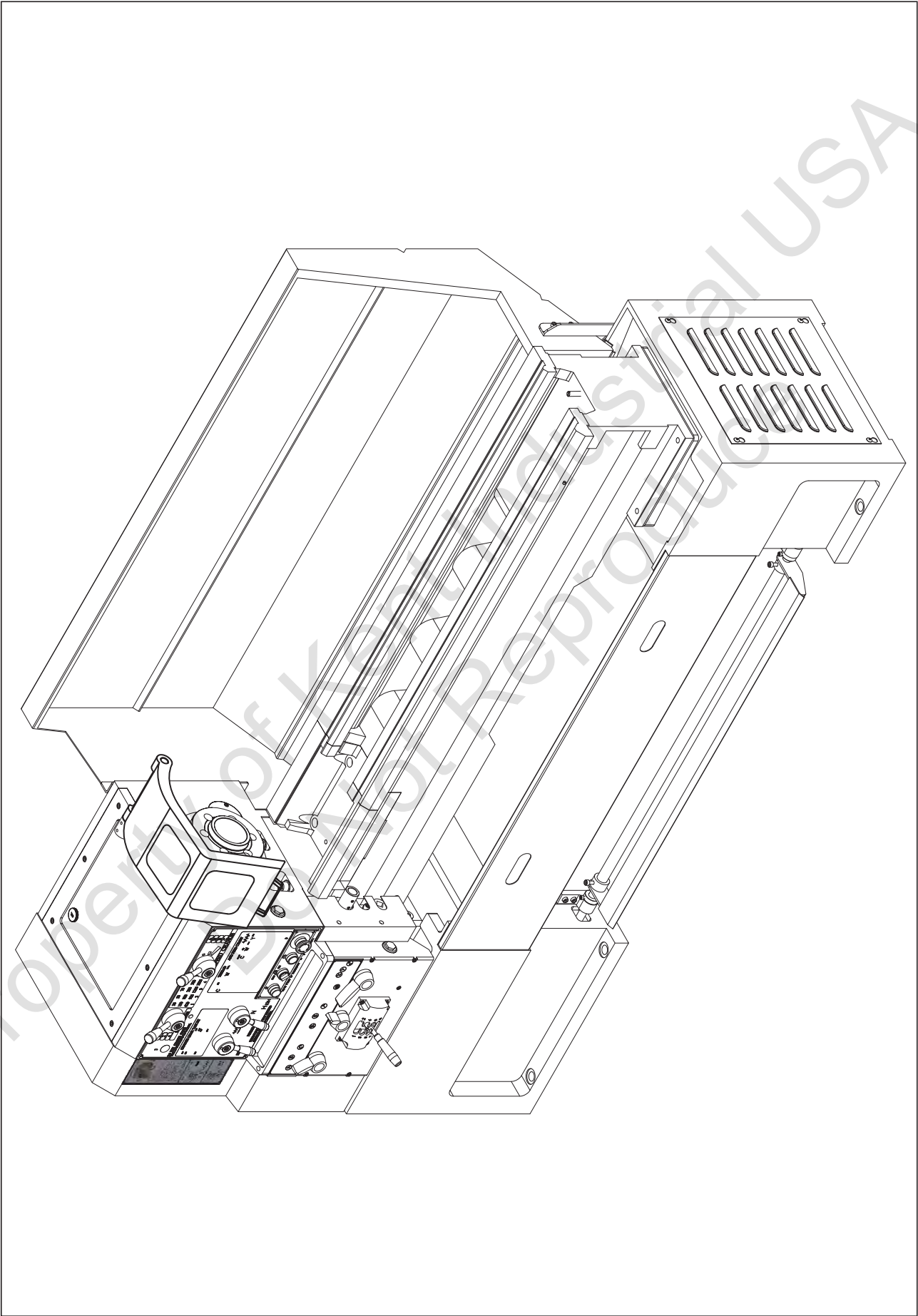
Main Motor



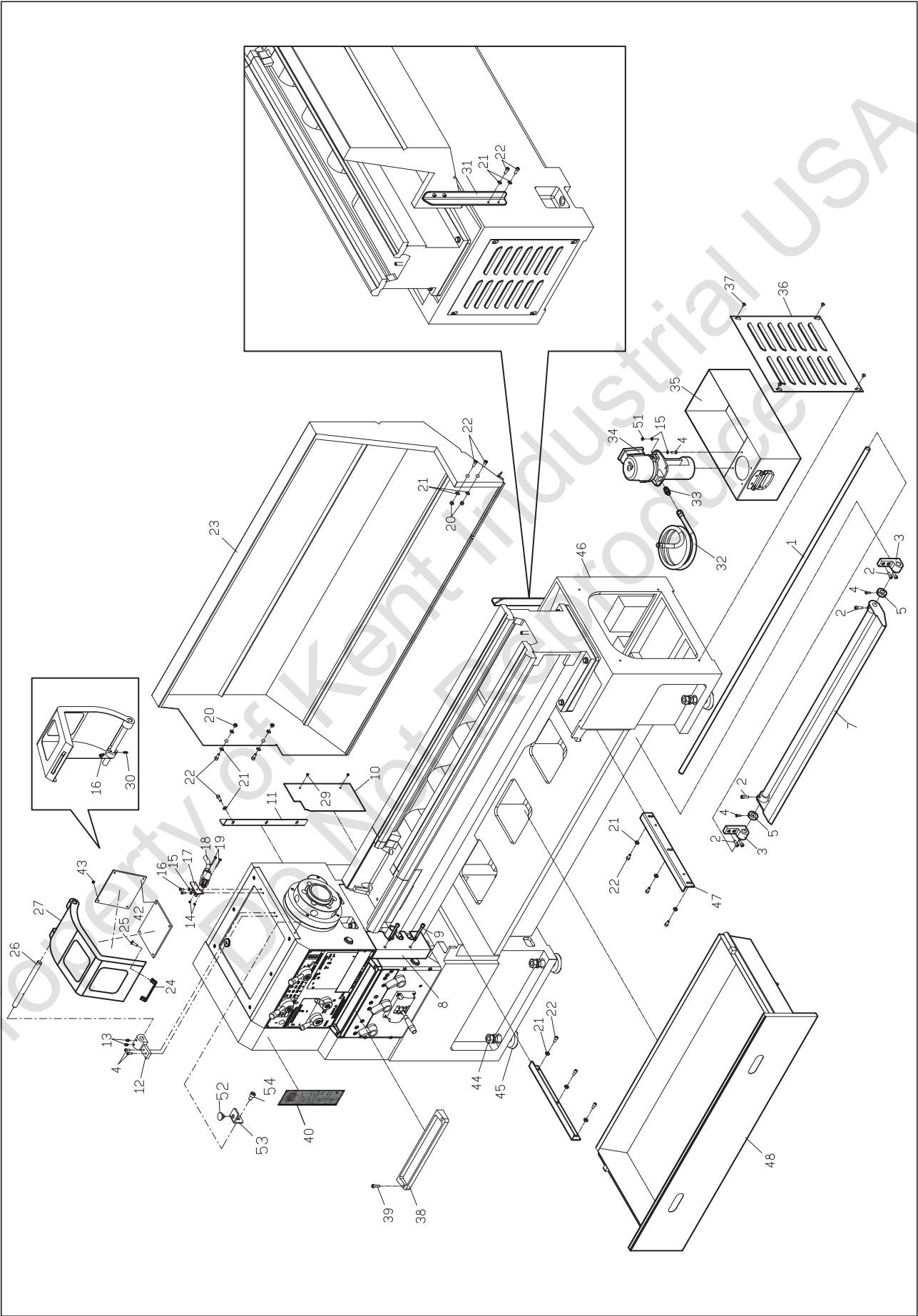
Main Motor

No.	Part No.	Part's name	QTY	REMARK	No.	Part No.	Part's name	QTY	REMARK
1	60058	Bolt	2		44	ML-67025-I	Electrical box	1	
2		Nut	9	M10	45	61075	Cover	1	
3		Washer	9	M10	46	64018	Cover	1	
4	16-61004	Cover	1						
	18-61004								
	21-61004				49	10043A76	Motor pully	1	
5	60056	Nut	1						
6		V belt	3	17 - B71	51		Washer	6	M6
				18 - B72	52		Nut	2	M6
				21 - B75	53		Dome cross screw	2	M4x40
7	60055	Bolt	1		54		Limit switch	1	Tm1307
8	61019	Cover	1		55		Nut	2	M4
9		Dome cross screw	8	M6x10					
10	60053	Bolt	1						
11		Nut	3	M8					
12	60046	Spring	1						
13		Hex. socket head bolt	1	CAP 8x55					
14	60033	Cam	1						
15		Hex. socket head bolt	1	CAP 6x16					
16	60047	Lever	1						
17		Spring pin	1	Ø6x35					
18	60061	Fixed plate	1						
19		Washer	2	M8					
20		Hex.socket head bolt	1	CAP 8x16					
21	60019	Brake belt	1						
22		Clip	1	E8					
23	60028	Pin	1						
24		Motor	1	7.5 HP					
			1	10 HP opt.					
25	60044	Washer	1						
26		Hexagon head bolt	1	M12x25					
27		Hex. socket head bolt	8	CAP 6x12					
28	61028A	Bracket	1						
29		Dome cross screw	2	M4x30					
30		Limit switch	1	Tm-1704					
31		Hex. socket head bolt	4	CAP 10x35					
32	60036	Shaft	1						
33	60061	Support	1						
34	61045M17	Plate	1						
35		Hexagon head bolt	1	M10x40					
36	60031	Screw	1						
37		Nut	2	M16					
38		Washer	2	M10					
39		Spring washer	6	M10					
40		Hexagon head bolt	2	M10x25					

Cabinet & Panel



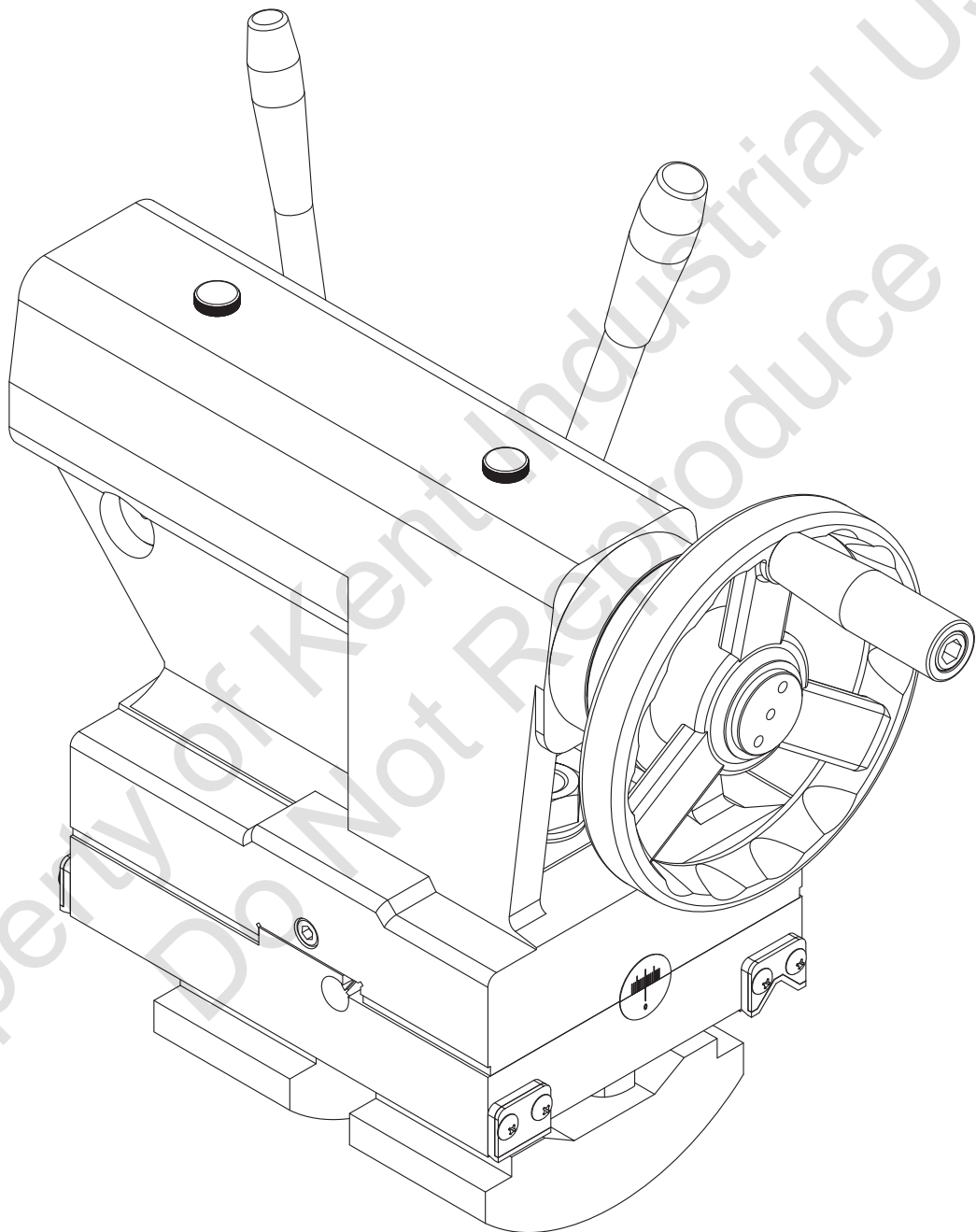
Cabinet & Panel



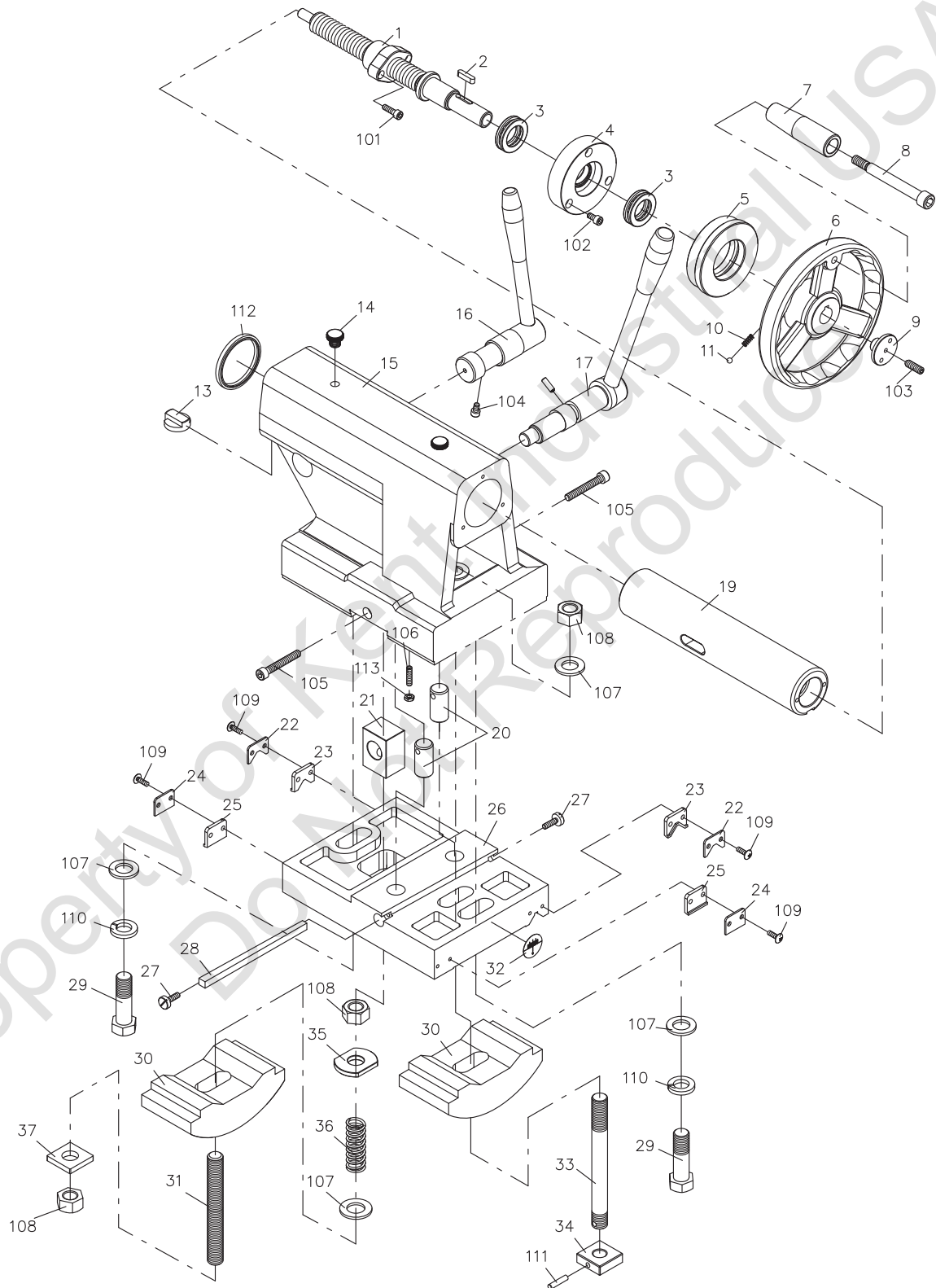
Cabinet & Panel

CABINET AND PANEL (FRONT MOVEABLE CHIP TRAY OPTIONAL)									
					Page 1/1				
KEY NO.	PARTS NO.	PARTS NAME	QTY	REMARK	KEY NO.	PARTS NO.	PARTS NAME	QTY	REMARK
1	60032-40	Shaft	1		42		Plate	2	PC
	60032-60				43		Nylon jam nut	8	M6
2		Hex. socket head bolt	6	CAP 8x25	44	63055-1	Screw	6	
3	60029	Pedal bracket	2			63055-2	Nut		
4		Hex. socket head bolt	8	CAP 6x16	45	63042	Block	6	
5	60027	Ring	2		46	63003-B40	Base	1	
						63003-B60			
7	61043-40	Saddle	1		47	61009PB6	Angle steel	2	
	61043-60				48	61009-B4	Chip tray	1	
8	61016	Plate	1			61009-B6			
9		Dome hexagon screw	4	M5x8					
10	61020	Plate	1		49		Rubber	1	
					50	18-61053-C	Fixed support	1	
12	10058	Small bracket	1		51		Hex. socket head bolt	1	CAP 6x10
13		Set screw	2	SET 8x12	52		Nut	4	M6
14		Nut	2	M4xP0.7					
15		Spring washer	10	M6					
16		Hex. socket head bolt	3	CAP 6x12					
17	61056	Bracket	1						
18		Limit	1	Tz9212					
19		Dome cross screw	2	M4x40					
20		Nut	4	M8					
21		Washer	14	M8					
22		Hex. socket head bolt	12	CAP 8x20					
23	61010M40	Splash guard	1						
	61010M60								
24		Knob	1						
25		Hex. head bolt	1	Screw 3/16"x3/8"					
26	10102	Pivot	1						
27	61053-D	Chuck safety guard	1						
29		Flat hexagon screw	2	M5x8					
30		Set screw	1	SET 5x16					
31	61079	Angle steel	1						
32		Coolant conduit 40	1	CT801x3/8"x72"					
		Coolant conduit 60		CT801x3/8"x78"					
33		Nipple	1	3/8"PTx3/8"PH					
34		Coolant pump	1	MC8150					
35	61010	Coolant tank	1						
36	61019	Cover	1						
37		Dome cross screw	4	M6x10					
40	NO.240	Nameplate	1	IMPERIAL					
	NO.241		1	METRIC					

Tailstock



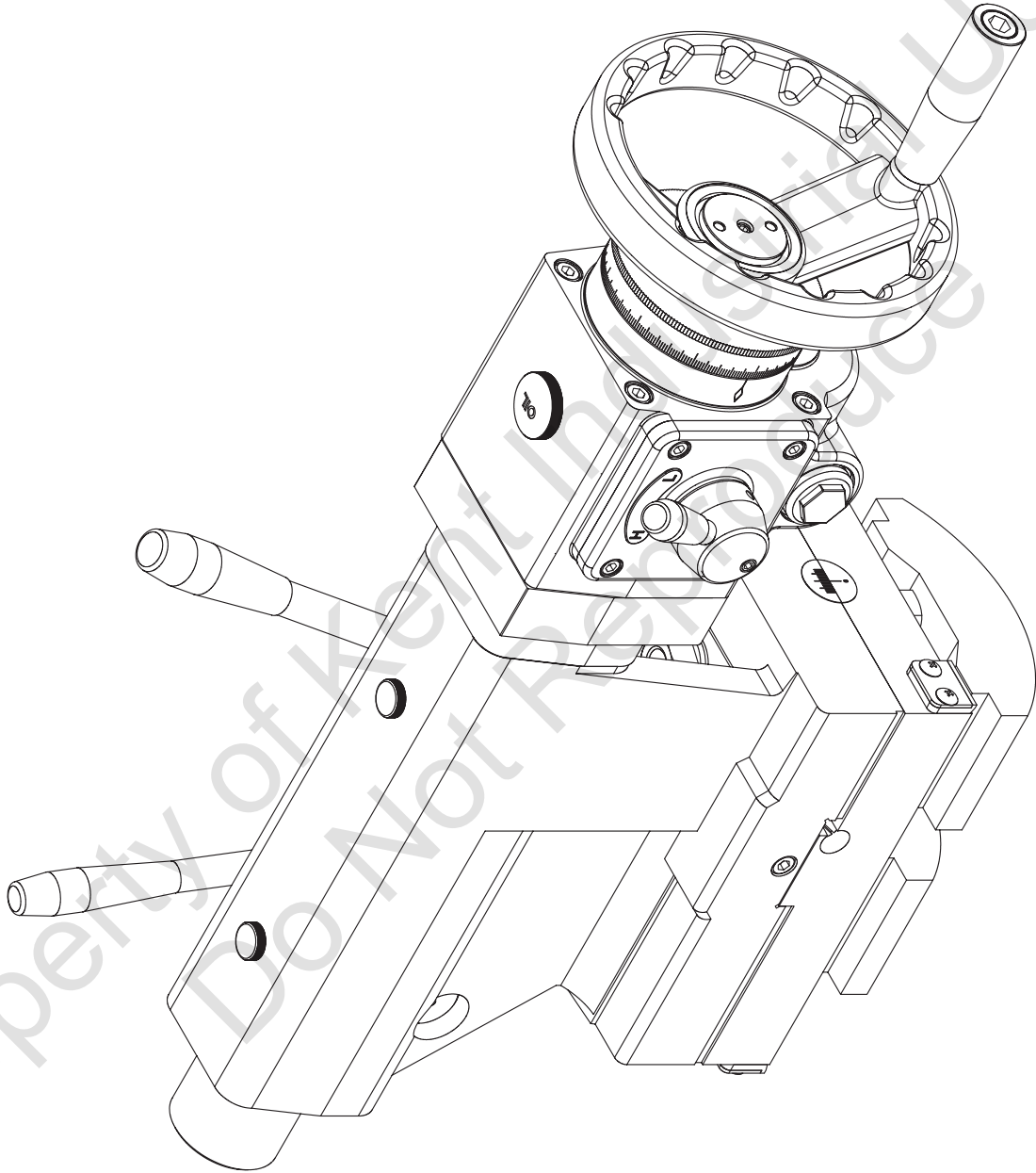
Tailstock



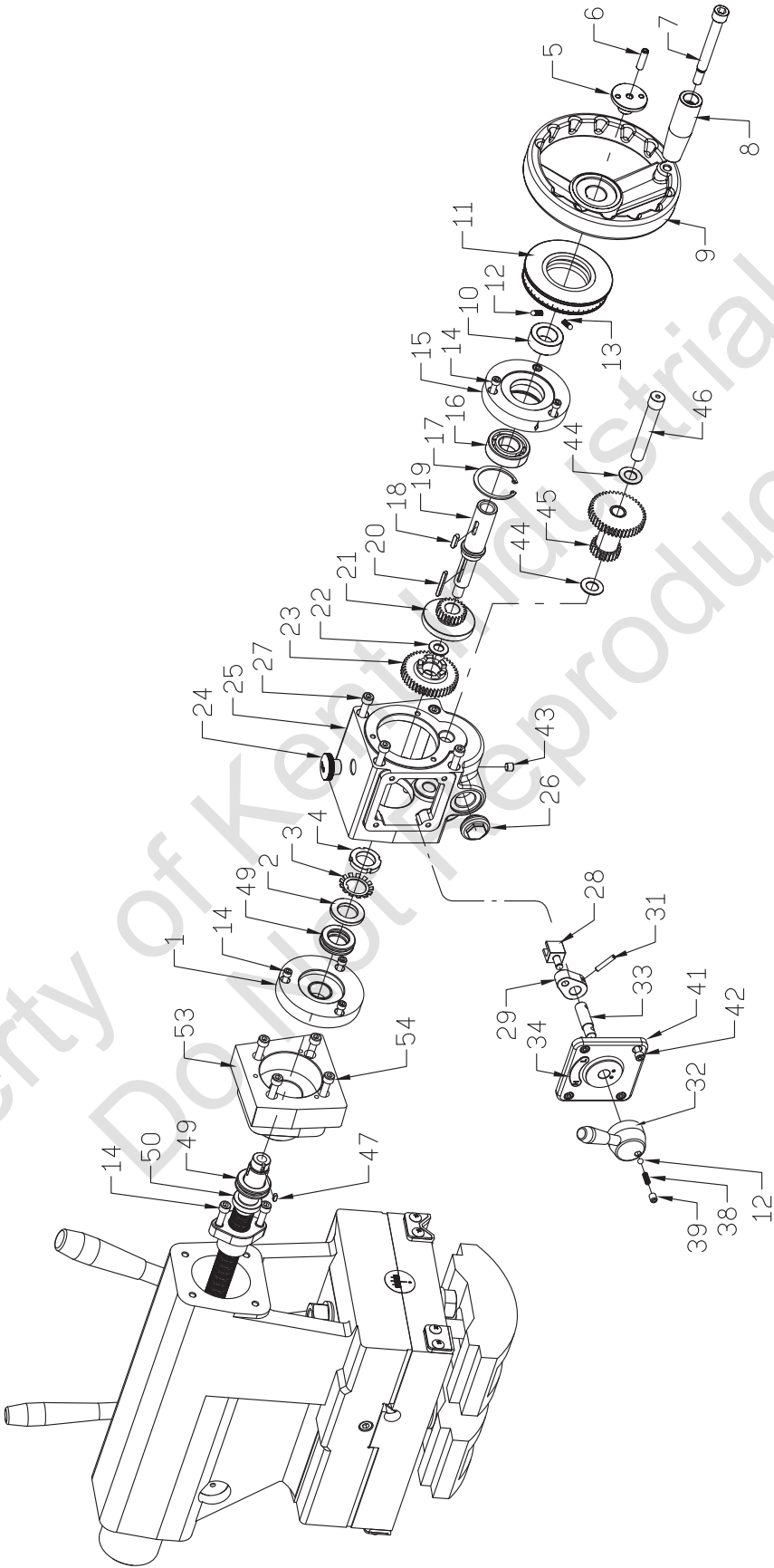
Tailstock

No.	Part No.	Part's name	QTY	REMARK	No.	Part No.	Part's name	QTY	REMARK
1	70004-M	Lead screw	1		101		Hex. socket head bolt		CAP 6x20
	70005-M	Nut	1		102		Hex. socket head bolt		CAP 6x25
	70004-I	Lead screw	1		103		Set screw		SET 8x28
	70005-I	Nut	1		104		Hex. socket head bolt		CAP 6x10
2		Key	1	6×6×25	105		Hex. socket head bolt	2	CAP 8×55
3		Thrust bearing	2	51105	106		Set screw	1	SET 6×25
4	70006-M	Flange	1		107		Washer	4	M18
	70006-I				108		Nut	3	M18
5	70007-M	Index ring	1		109		Dome cross screw	8	M5×12
	70007-I				110		Spring washer	2	M18
6	70010	Handle	1		111		Pin	1	Ø4×38
7	70012	Handle	1		112		Oil seal	1	DH-60
8	70011	Bolt	1		113		Nut	1	M6
9	70014	Fixed screw	1						
10	70008	Spring	3						
11		Steel ball	3	1/4"					
12	70030	Dead center	1						
13	70018	Guide key	1						
14	70091	Screw	2						
15	70001	Tail stock	1						
16	70017	Clamp lever L	1						
	70019	Cam shaft L	1						
17	70023	Cam shaft R	1						
	70024	Clamp lever R	1						
	70025	Pins	1						
20	70020	Pin nut	2						
21	70022	Pivot block	1						
22	70028	Plate V	2						
23	70026	Wiper V	2						
24	70029	Plate F	2						
25	70027	Wiper F	2						
26	17-70002	Base	1						
	20-70002								
27	70034	Gib screw	2						
28	70033	Gib	1						
29		Hexagon head screw	2	M18x65					
30	70016	Clamp block	2						
31		Stud bolt	1	M18×150L					
32	70032	Warked plate	1						
33		Stud bolt	1	M18×180L					
34	70015	Nut	1						
35	70095	Washer	1						
36	70102	Spring	1						
37	70081	Washer	1						

Two-Step Tailstock



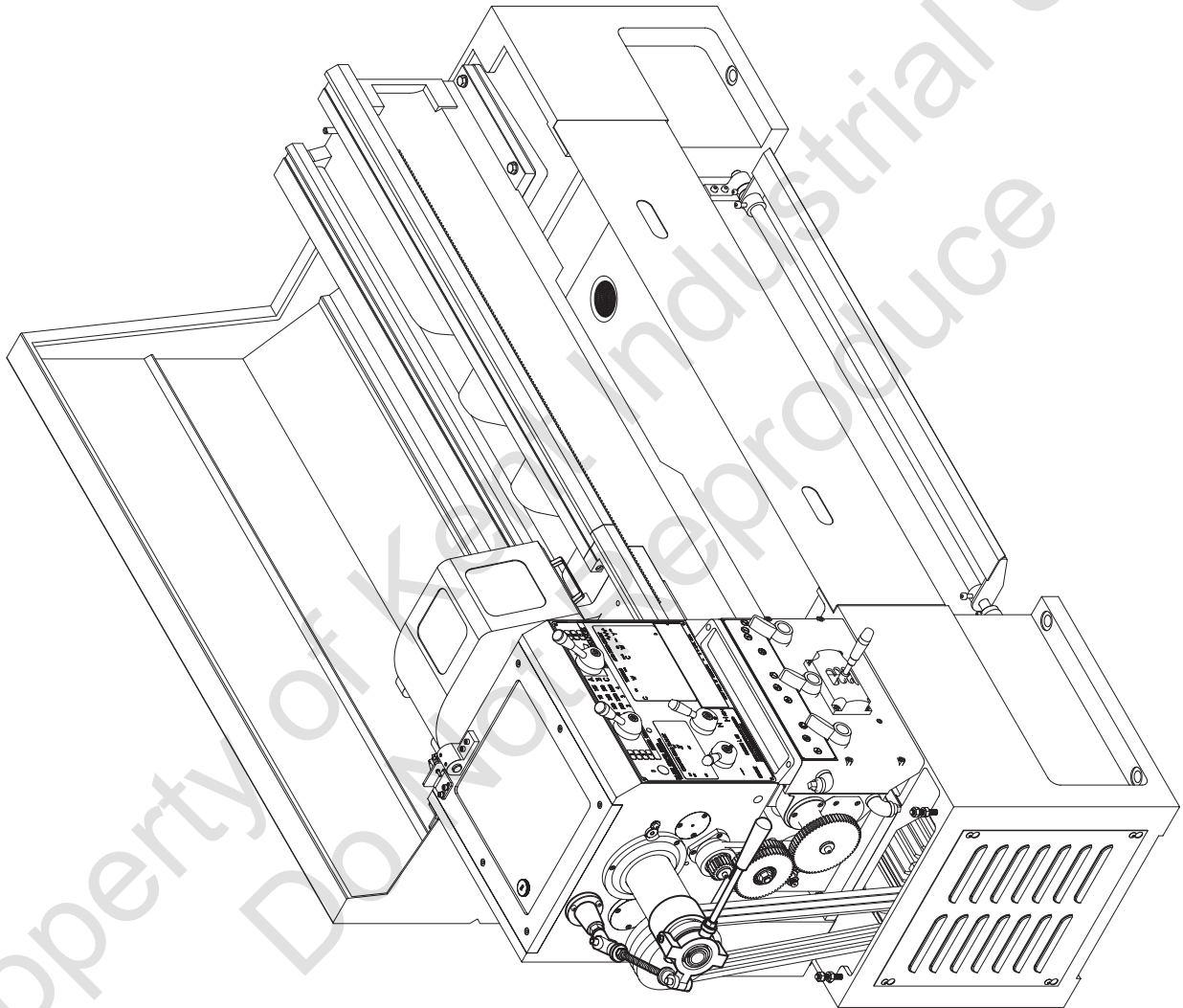
Two-Step Tailstock



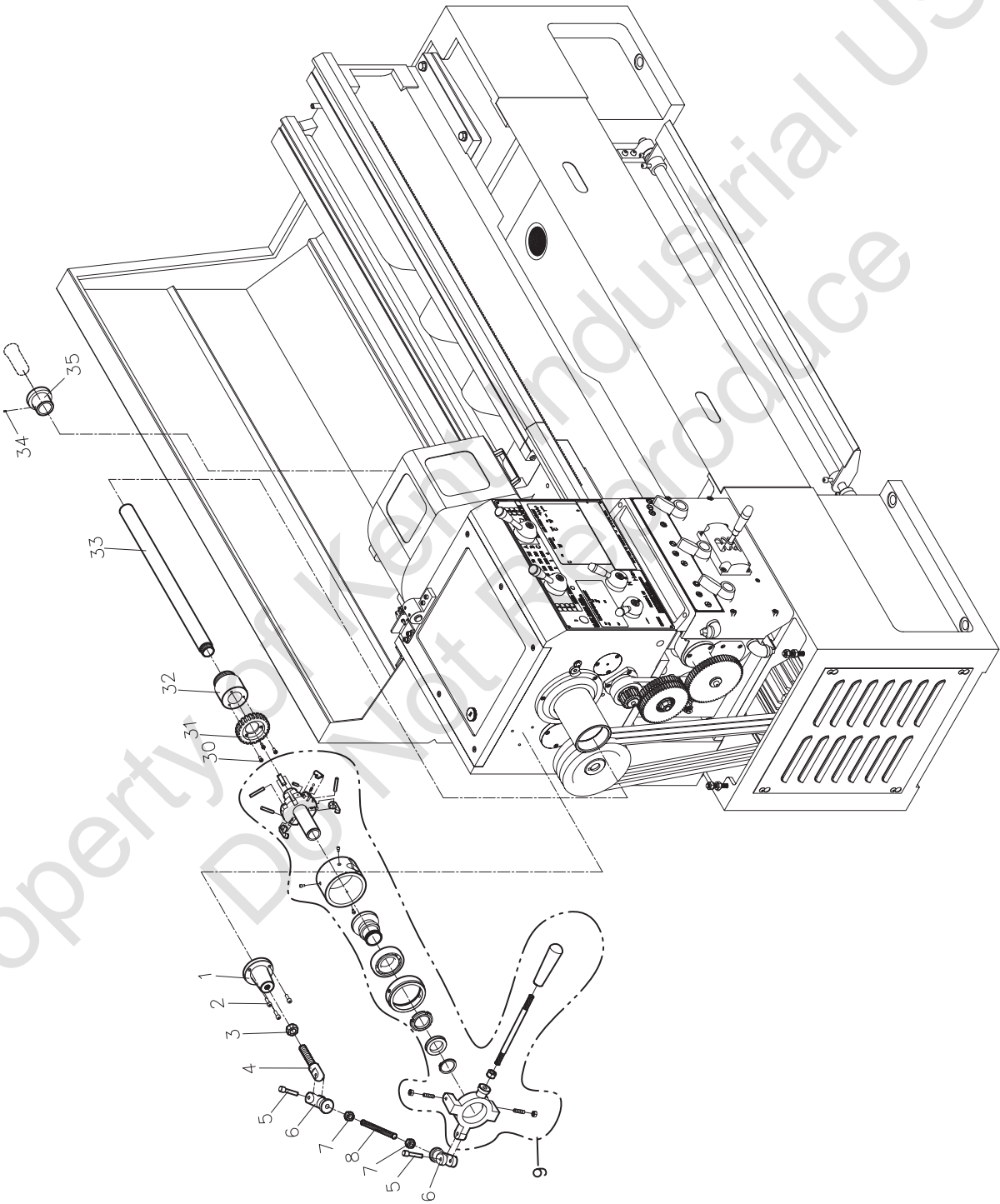
Two-Step Tailstock

NO.	Part NO.	Part's name	QTY	REMARK	No.	Part No.	Part's name	QTY	REMARK
1	70006-D	Flange TD	1		44	70073-D	Washer TC	1	
2	70065-D	Washer TD	1		45	70072-D	Gear	1	22T/44T
3		Locking washer	1	AW05	46	70071-D	Fixed shaft	1	
4		Locking nut	1	AN05	47		Key	1	4x4x10
5	70009	Fixed screw	1						
6		Set screw	1	SET 8×30	49		Thrust bearing	2	51105
7	70011	Bolt	1		50	70005-SI	Nut	1	
8	70012	Handle HW	1			70063-DI	Lead screw	1	
9	70010	Handweel	1			70005-SM	Nut	1	
10	70074-D	Collar TA	1			70063-DM	Lead screw	1	
11	70007-I 70007-M	Index ring	1						
12		Steel ball	4	1/4"	53	70085-DF	Join seats	1	
13	70008	Spring	3		54		Hex. socket head bolt	4	CAP 6x60
14		Hex. socket head bolt	8	CAP 6×20					
15	70075-DI 70075-DM	Flange	1						
16		Ball bearing	1	6205Z					
17		Snap ring	1	R52					
18		Key	1	5x5x18					
19	70067-D	Handweel shaft	1						
20		Key	1	4x4x40					
21	70069-D	Gear	1	22T					
22	70070-D	Washer TB	1						
23	70068-D	Gear	1	44T					
24		Oil cover	1	NF 3/4"					
25	70064-D	Small gear box	1						
26		Oil Sight	1	PS 3/4"					
27		Hex. socket head bolt	4	CAP 8×120					
28	70079-D	Fork TD	1						
29	70076-D	Lever TD	1						
31		Spring pin	1	Ø4x24					
32		Spring pin	1	Ø4x24					
		Set screw	1	SET 6×6					
	70081-D	Handle TD	1						
	70082-D	Hub TD	1						
33	70077-D	Short shaft	1						
34	70080-D	Curve plate	1						
38	20022	Spring	1						
39		Set screw	1	SET 8×8					
41	70078-D	Box cover	1						
42		Hex. socket head bolt	4	CAP 6×12					
43		Hex. socket head plug	1	PT 1/8					

5C Collet Closer Attachment



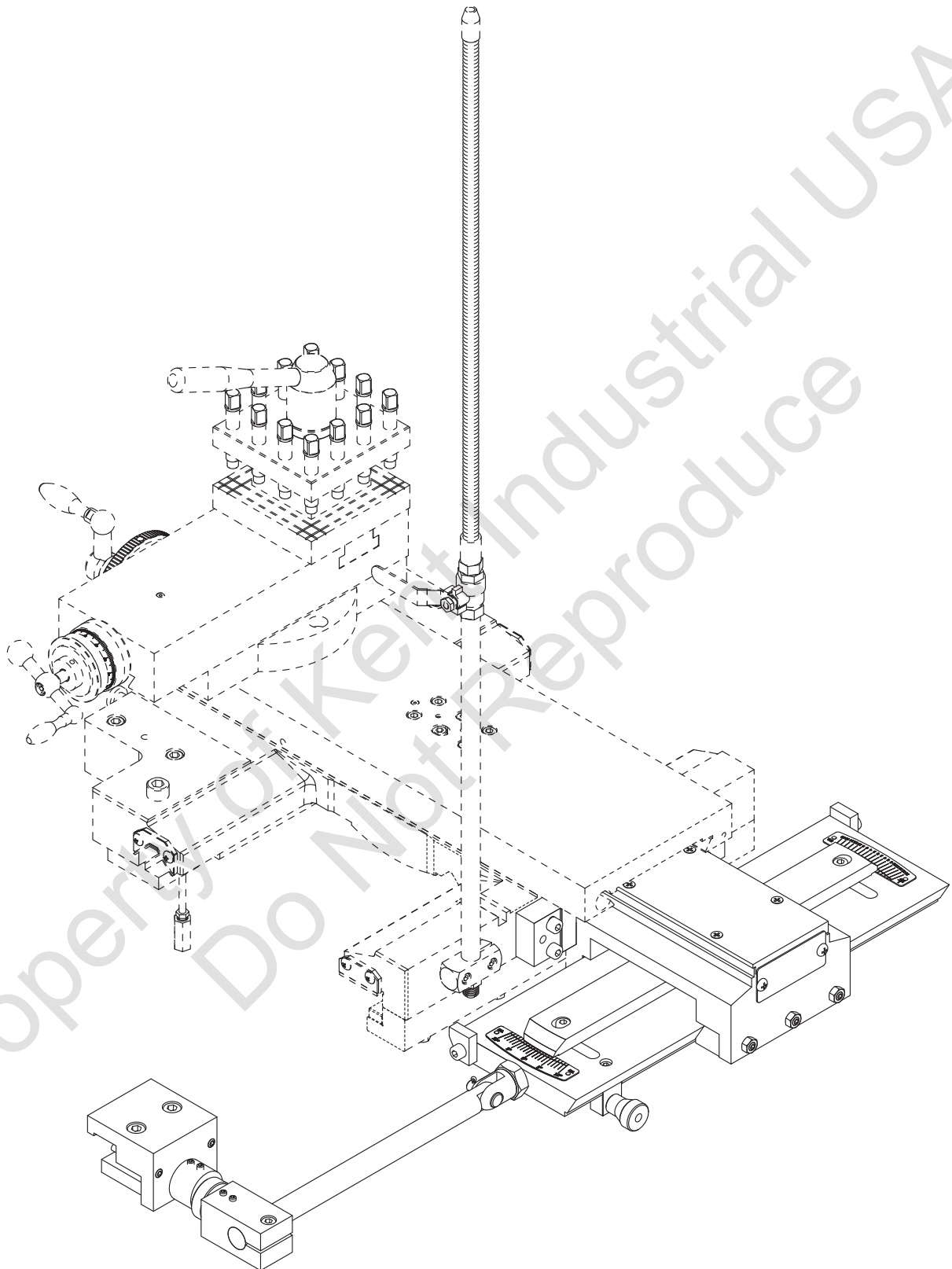
5C Collet Closer Attachment



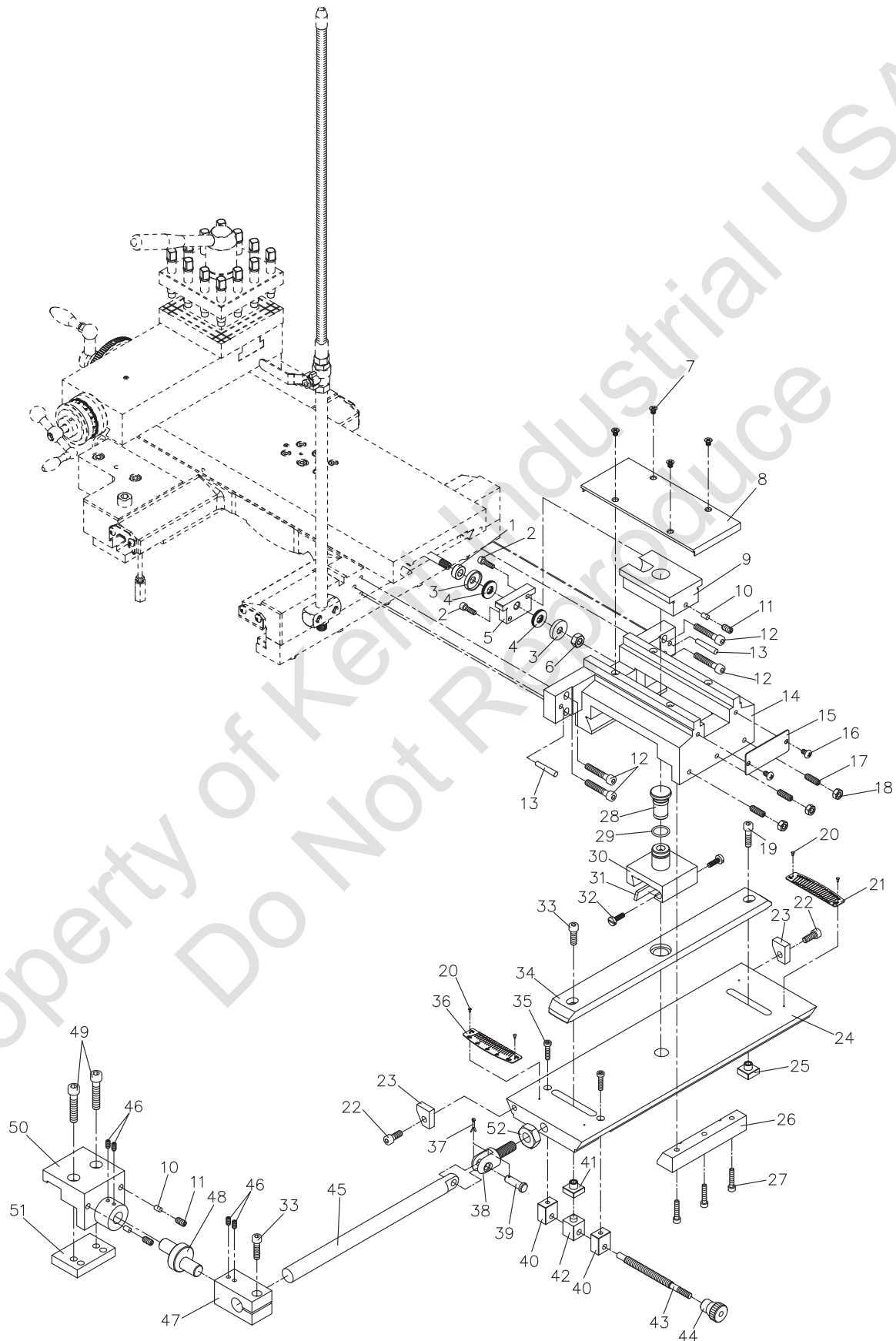
5C Collet Closer Attachment

No.	Part No.	Part's name	QTY	REMARK	No.	Part No.	Part's name	QTY	REMARK
1		Hex. socket head bolt	3	CAP 6x25					
2	90048	Bracket	1						
3		Nut	1	M16					
4	90049	Bolt	1						
5	90055	Bolt	1						
6	90047	Connector Casting	1						
7		Nut	2	W½"					
8	90050	Screw	1	W½ x 155mm					
9	90044	Handle Casting	1						
		Set screw	2	SET M8x10					
		Nut	2	M8					
		Nut	1	½" - 12UNC					
	90045	Handle Rod	1						
	90046	Handle	1						
		Clip	1	S34					
		Washer	1	Ø52.4xØ34.4x9					
	90042	Nut	1						
	90038	Bearing and Retainer	1						
		Ball bearing	1	6208					
	90037	Cam	1						
		Hex. socket head bolt	3	CAP 4x8					
	90043	Collar	1						
	90029	Tube	1						
	90031	Finger	3						
	90032	Pivot Pin	3	Ø6x40					
	90035	Knob	1						
		Steel ball	1	Ø5					
	90033	Spring	1						
		Pin	1	Ø5x18					
30		Hex. socket head bolt	3	CAP 5x12					
31	90025	Index Ring	1						
32	90023	Hub	1						
33	90028	Tube	1						
34	90027	Pin	1						
35	90026	Bush	1						

Taper Attachment



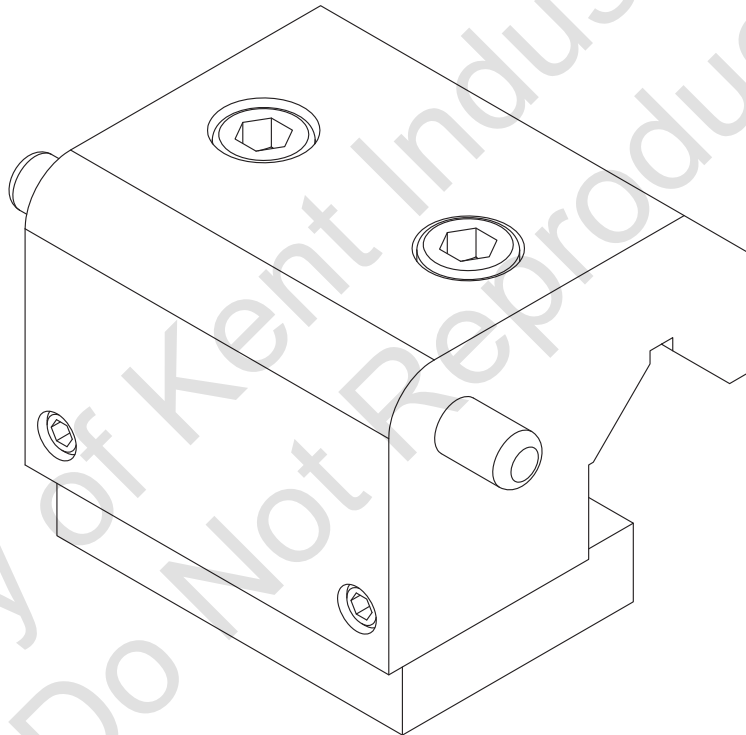
Taper Attachment



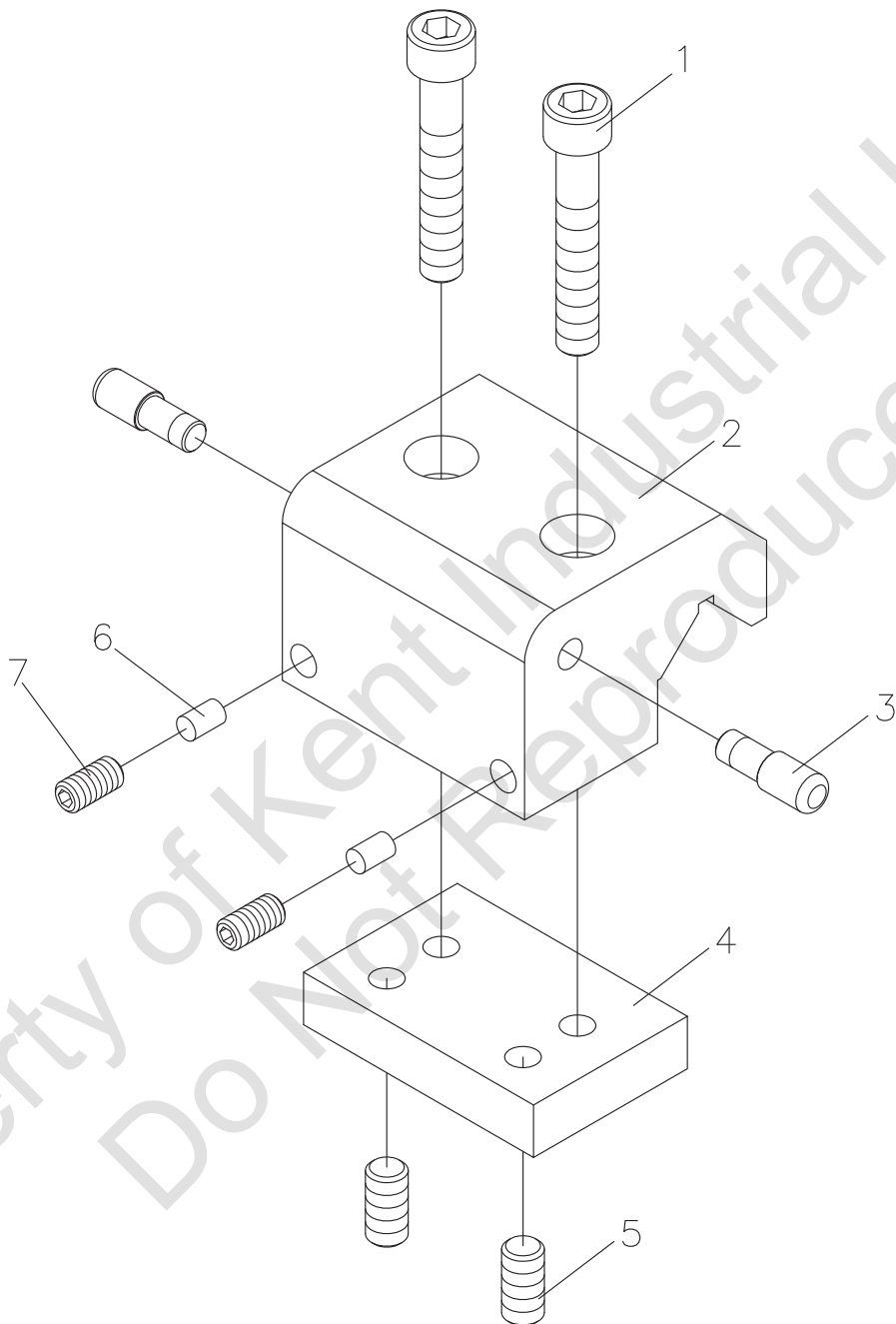
Taper Attachment

No.	Part No.	Part's name	QTY	REMARK	No.	Part No.	Part's name	QTY	REMARK
1	50017	Collar	1		49		Hex. socket head bolt	2	CAP 10x50
2		Hex. socket head bolt	2	CAP 6x20	50	80027	Bracket	1	
3	50026	Cap collar	2		51	18-80023	Hub	1	
4		Thrust bearing	2	NTB / AS2-1226	52		Nut	1	
5	80005	Yoke Plate	1						
6		Nut	1	M10					
7		Flat hexagon screw	4	M6x8					
8	80002	Cover plate	1						
9	80004	Yoke	1						
10	18-70083	Copper pin	3						
11		Set screw	3	M8x6					
12		Hex. socket head bolt	4	CAP 8x45					
13		Taper pin	2	#6x1½"					
14	15-80001	Main bracket	1						
15	18-80003	Plate	1						
16		Done cross screw	2	M6x10					
17		Set screw	3	M8x25					
18		Hexagon nut	3	M8					
19		Hex. socket head bolt	2	CAP 8x30					
20		Rivet	4	Ø2					
21	15-80025	Name plate	1						
22		Hex. socket head bolt	2	CAP 8x20					
23	18-80033	Stop	2						
24	15-80010	Plate	1						
25	18-80017	Nut	1						
26	15-80012	Gib	1						
27		Hex. socket head bolt	3	CAP 6x30					
28	18-80011	Slide pivot pin	1						
29		O ring	1	P21					
30	18-80006	Side block	1						
31	80008	Gib	1						
32	80007	Screw	1						
33		Hex. socket head bolt	2	CAP 8x25					
34	15-80009	Swive slide	1						
35		Hex. socket head bolt	2	CAP 6x25					
36	15-80024	Name plate	1						
37		Split pin	1	Ø2.5x16					
38	18-80031	Bolt	1						
39	18-80030	Pin	1						
40	18-80019	Block	2						
41	18-80016	Nut	1						
42	18-80018	Block	1						
43	18-80015	Screw	1						
44	18-80014	Knob	1						
45	18-80028	Bolt	1						
46		Set screw	4	M6x12					
47	18-80021	Bracket	1						
48	18-80020	Eccentric pin	1						

Bed Stop

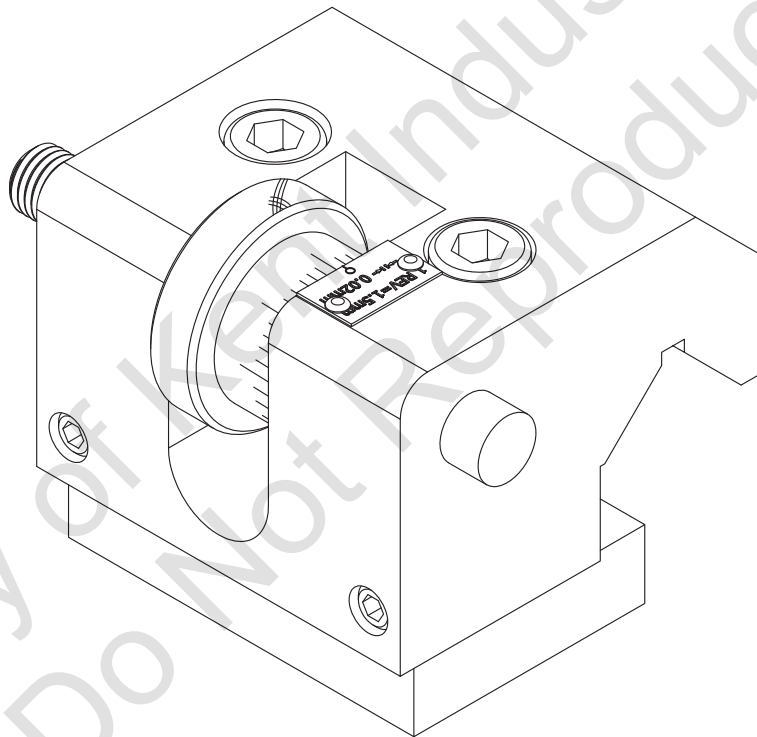


Bed Stop

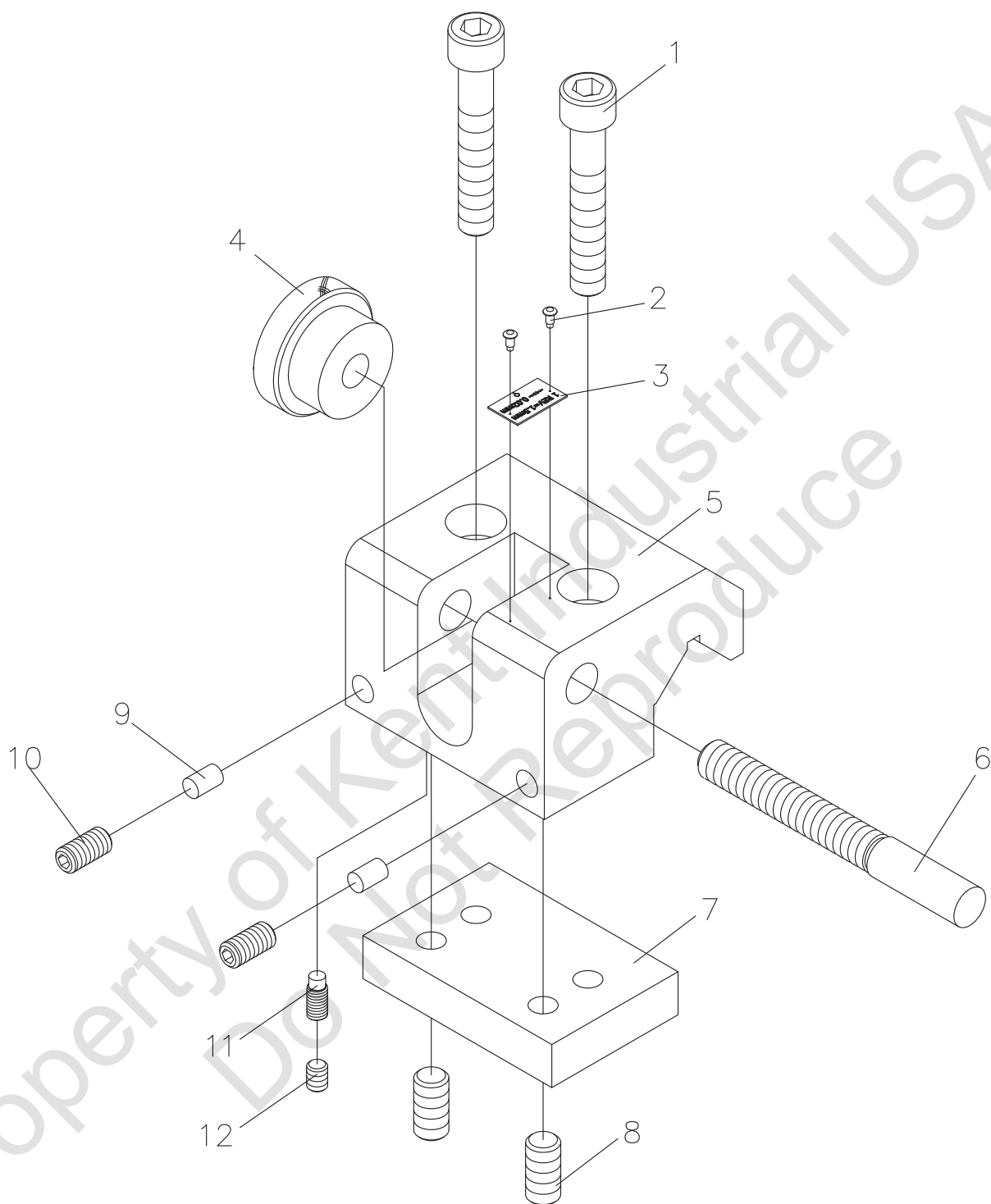


No.	Part No.	Part's name	QTY	REMARK	No.	Part No.	Part's name	QTY	REMARK
1		Hex. socket head bolt	2	CAP 10x60	5		Set screw	2	M10x20
2	18-70085	Body	1		6	18-70083	Copper pin	2	
3	18-70084	Pad	2		7		Set Screw	2	M8x16
4	18-70059	Clamp plate	1						

Bed Stop - Micrometer

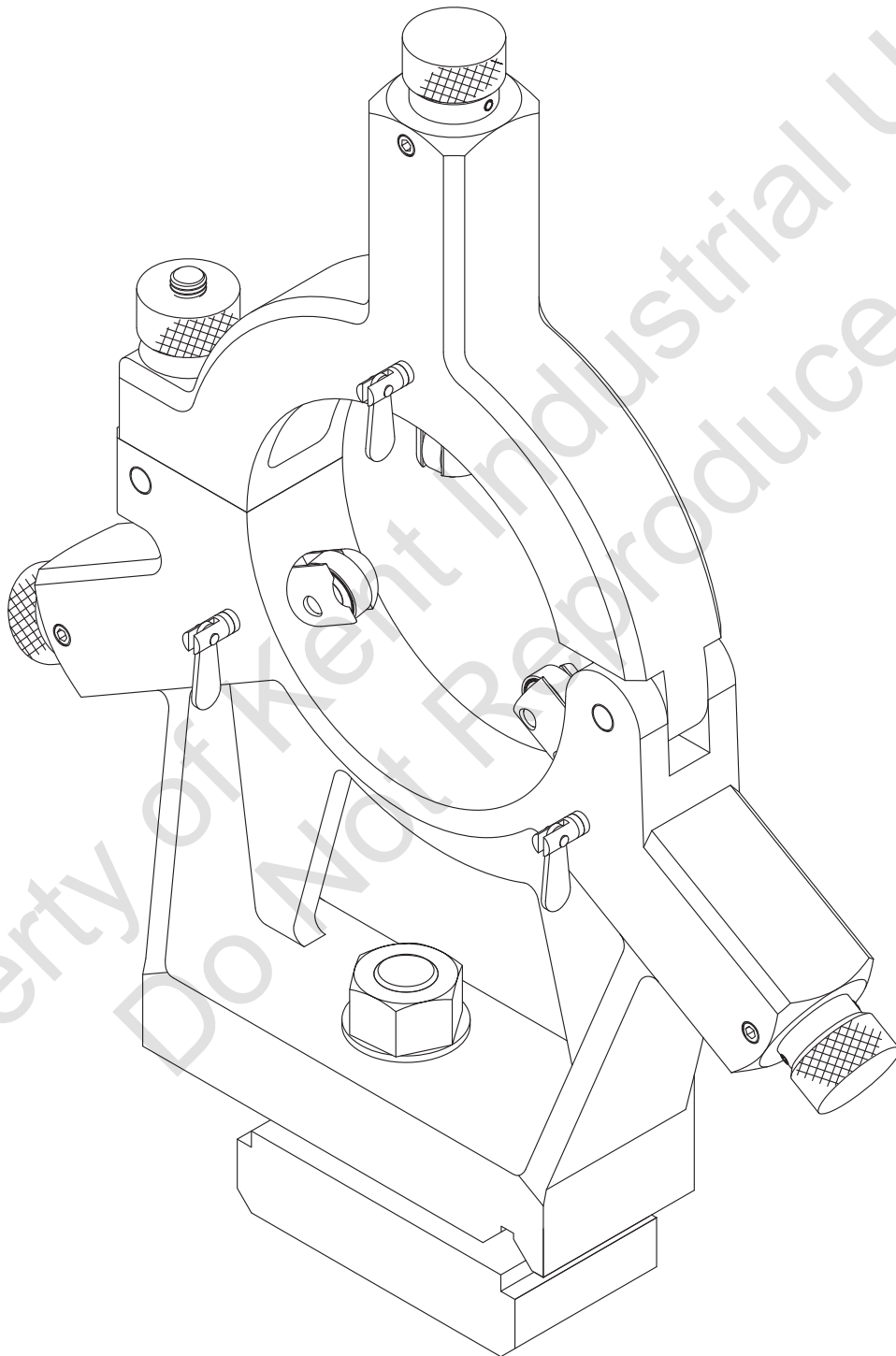


Bed Stop - Micrometer

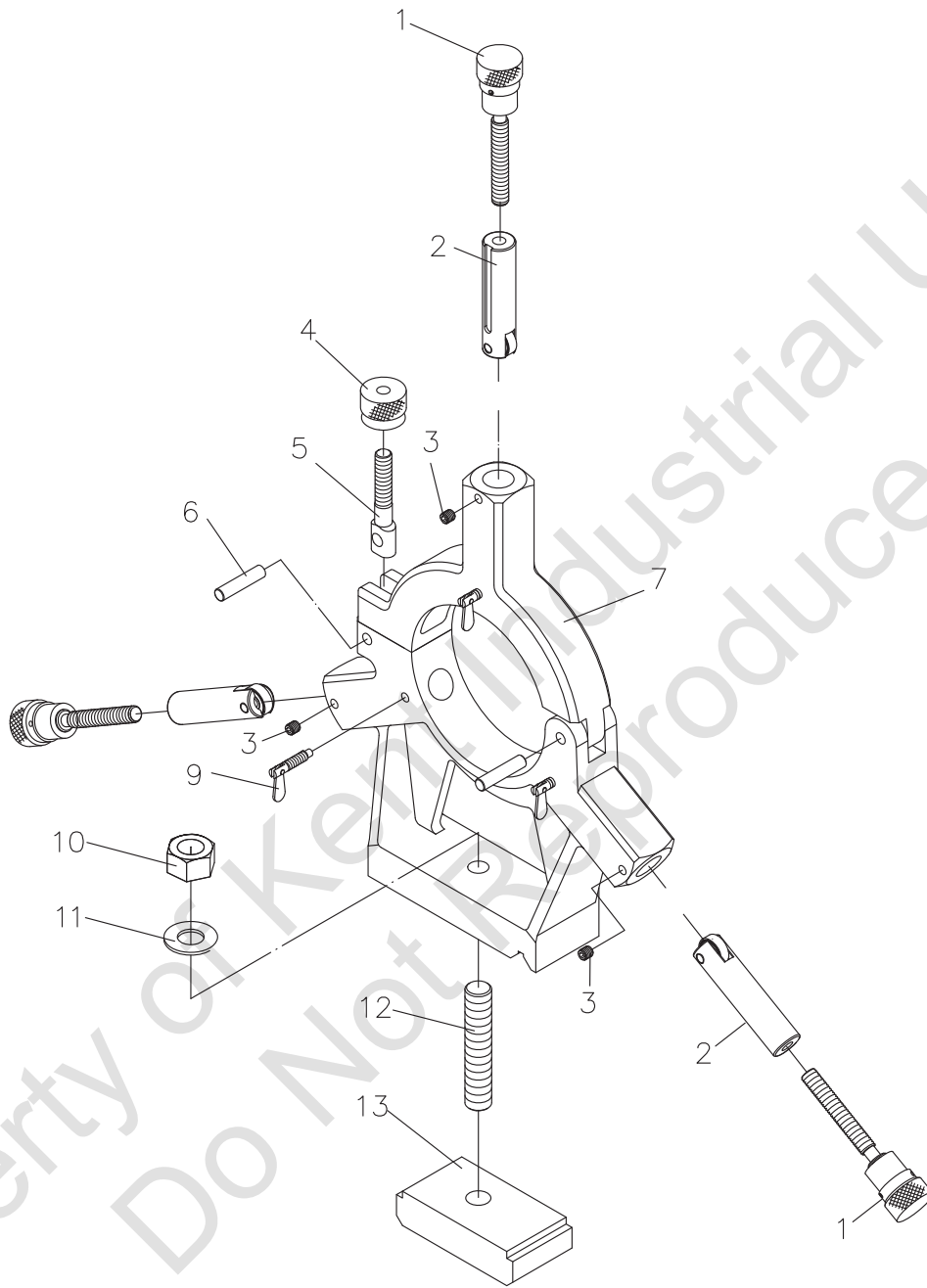


No.	Part No.	Part's name	QTY	REMARK	No.	Part No.	Part's name	QTY	REMARK
1		Hex. socket head bolt	2	CAP 10x60	6	18-70056-I	Rod	1	
2		Rivet	2	Ø2		18-70056-M			
3	18-70060-I	Name plate	1		7	18-70059	Clamp plate	1	
	18-70060-M				8		Set screw	2	M10x20
4	18-70057-I	Micro dial	1		9	18-70083	Cooper pin	2	
	18-70057-M				10		Set screw	2	M8x16
5	18-70048	Body	1		11		Set screw	1	M8x12
					12		Set screw	1	M8x12

Steady Rest

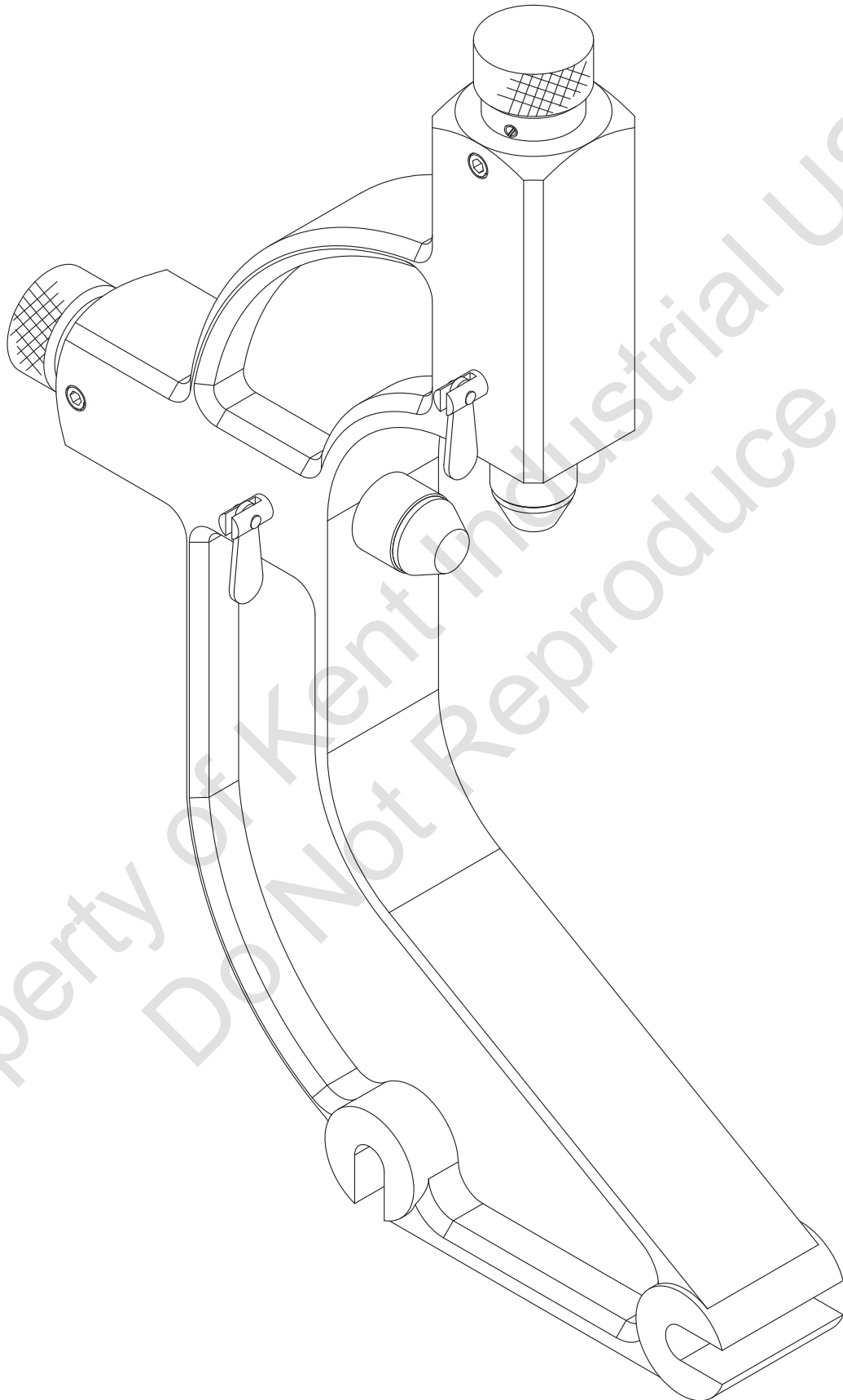


Steady Rest

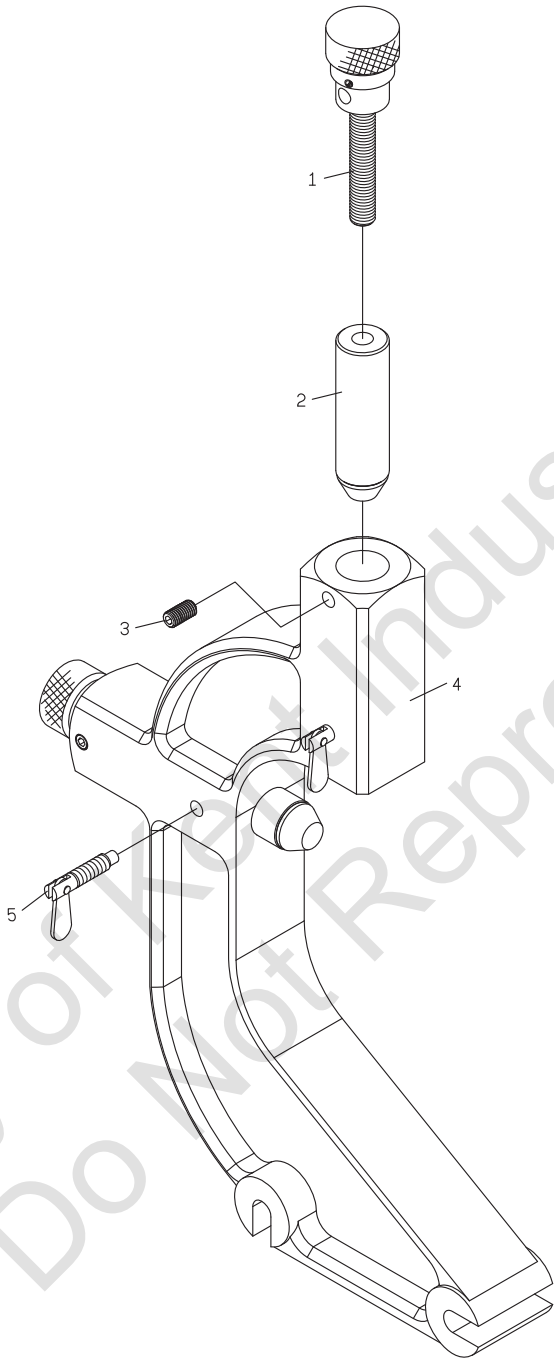


No.	Part No.	Part's name	QTY	REMARK	No.	Part No.	Part's name	QTY	REMARK
1	70038	Adjusting knob	3		6	70032	Hinge pin	2	
		Spring pin	3	Ø4x40L	7	70029	Top casting	1	
	70062	Collar	3			17-70030	Base casting	1	
	70035	Screw	3			70029	Top casting	1	
2	70037	Finger	3			20-70030	Base casting	1	
		Pin	3	Ø8x23L	9	70063	Single wing bolt	3	
		Ball bearing	3	627	10		Nut	1	M12
3		Set screw	3	M8x8L	11		Spring washer	1	M12
4	70064	Knob nut	1		12		Hexagon head bolt	1	M12x75
5	70033	Clamp screw	1		13	70039	Clamp plate	1	

Follow Rest

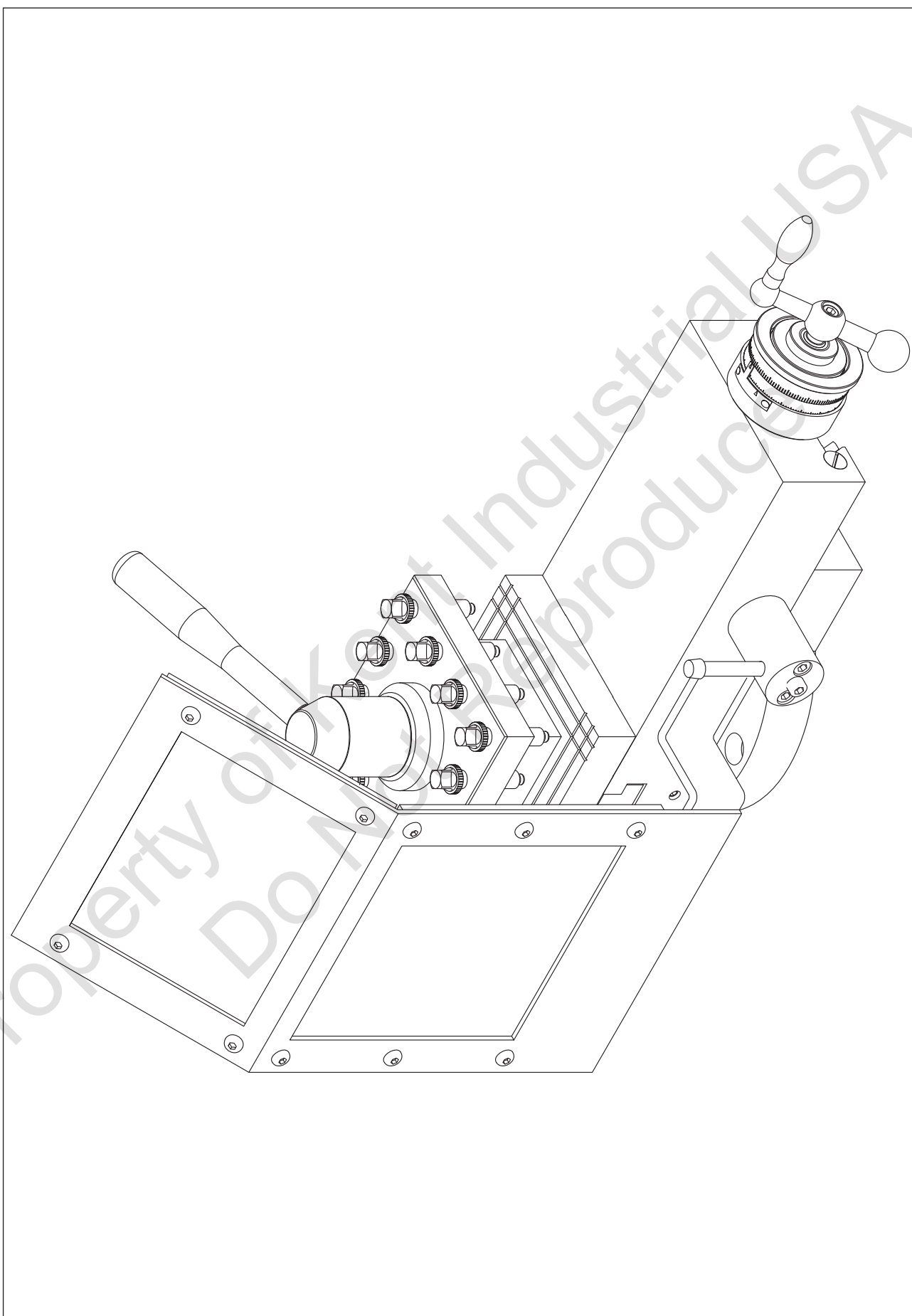


Follow Rest

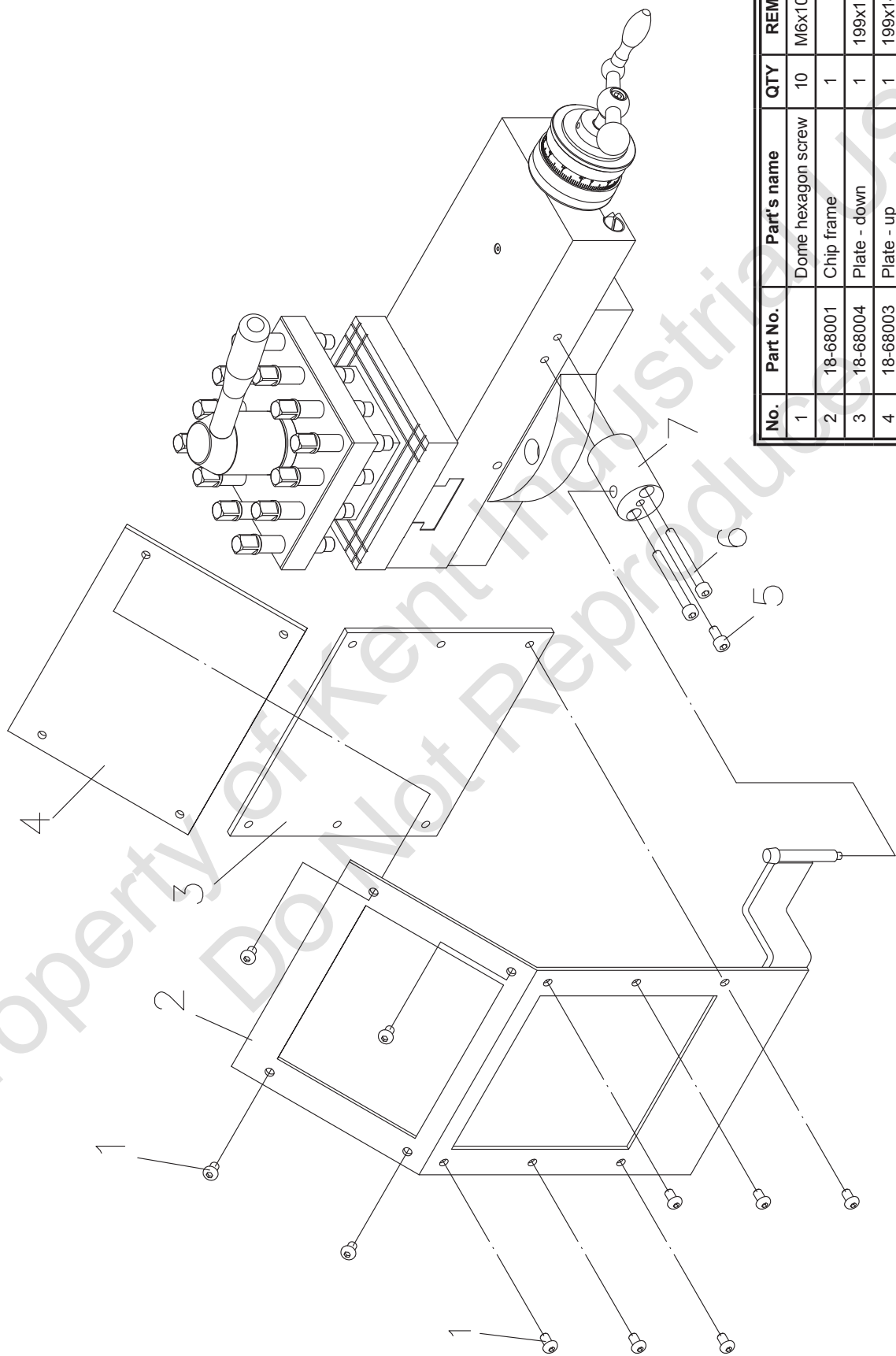


No.	Part No.	Part's name	QTY	REMARK	No.	Part No.	Part's name	QTY	REMARK
1	70038	Adjusting screw	2		3		Set screw	2	M8x8
		Spring pin	3	Ø4x40L	4	17-70041	Casting	1	
	70062	Collar	3			20-70041			
	70045	Screw	2		5	70063	Single wing bolt	2	
2	70044	Finger	2						
		Bracket	2						

Tool Post Safety Guard



Tool Post Safety Guard



No.	Part No.	Part's name	QTY	REMARK
1		Dome hexagon screw	10	M6x10L
2	18-68001	Chip frame	1	
3	18-68004	Plate - down	1	199x175x4.5
4	18-68003	Plate - up	1	199x144x4.5
5		Hex. socket head bolt	1	CAP 6x12
6		Hex. socket head bolt	2	CAP 6x25
7	18-68002	Cover seat	1	