HARDINGE

PRECISION BALL BEARING HIGH SPEED TOOL ROOM LATHE

WITH

DOVE-TAIL CARRIAGE AND BED CONSTRUCTION

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

"Performance has established leadership for Hardinge"

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SPECIFICATIONS OF HARDINGE PRECISION HIGH SPEED TOOL ROOM LATHE

Dove-tail Carriage and Bed Construction: Analytical consideration of bed construction for opposing cutting strains brought about the dove-tail carriage and bed design. Many years ago, Hardinge solved the accuracy and proper finish needs of the optical camera, projector and range finder manufacturers. This was done with our Optical Turret Lathe having dove tail carriage and bed construction. Because of the design of the Hardinge bed, there can be no lifting action of the carriage as the back 30° way changes the “pushing away” force into a “pulling down” action, thus insuring bearing surfaces on the 30° back way and the two flat top ways. On the other hand, the conventional bed design results in a lifting action as the conventional inverted vee way changes the “pushing away” action into a “lifting up” action, hence, reducing the number of bearing surfaces. The lifting action in the conventional bed design is admitted by the many “hold down” bolted sections for the carriage. This lifting action of the carriage causes chatter which means vibration and wear. Because there is no lifting action in the Hardinge construction, there is a steady support to bring about accuracy and fine finish. Further, the Hardinge construction covers the angular ways so that chips cannot collect on the surfaces.

The heavy box section bed is made of a seasoned alloy semi-steel casting. All important bearing surfaces are hand scraped to master gauges for alignment and to insure accuracy of movement of the carriage and bed attachments.

The center top section conforms with the ways of our precision lathe bed to afford interchangeability of certain attachments. The back side has a scraped face and tee slot section for a taper turning attachment. The bed has substantial base supports at each end. Two steel half at the headstock end and one steel ball at the tailstock end provide a three point bearing between the bed and pedestal.

The lead screw has an 3 pitch acme thread and is without a spline. It is held in completely enclosed preloaded ball bearings at the headstock end and a roller bearing at the tailstock end. This design eliminates lead screw end play which is so detrimental to cutting of accurate threads.

The lead screw nut is of selected material and has a full bearing around the lead screw.

There is a separate feed rod for power turning. The stop rod for the carriage is operated mechanically or manually for immediate Forward-Stop-Reverse control of the carriage. It is provided with safety stops, adjustable stops and a micrometer adjustment for fine settings. See the following pages for additional lead screw, power feed rod and stop rod features.

Headstock and Gear Box: The back geared headstock is fully enclosed and incorporates features proven by many years of service with our precision lathes. The spindle is hardened and ground, taking 1” round capacity 5C Hardinge Collets. The spindle has our standard taper nose construction as described in our lathe attachment bulletin. This permits desirable interchangeability of collets, jaw chucks, face plates and other headstock attachments with our 1” collet capacity precision lathes.

The spindle has duplex preloaded super-precision type ball bearings for extreme accuracy and carefree high spindle speeds. There is no radial or axial play and the bearings require no adjustment. There are sixteen spindle speeds from 27 RPM to 1750 RPM with vee belt drive — see page TL-Three. The ten change handle and the three change lever provide thirty standard threads and thirty feeds. Compounding outside of the gear box also permits a wide range of threads — see page TL-Four. All gears and shafts are made of heat treated special alloy steel. There is a hand wheel for easy turning of the spindle for set-up work, etc. This hand wheel is graduated for accurate turning of the spindle 1/2, 1/3 or 1/4 turn when cutting double, triple or quadruple threads. A sliding gear provides immediate disengagement between the spindle and the gear box.

The upper lever gives instant Forward-Stop-Reverse control of the power feed rod or lead screw with the headstock continually operating in one direction. The lower lever is electrically connected to the motor to control two speeds forward and two speeds reverse and, when in the central position, applies a mechanical brake.

There is an interesting feature in the fact that the movement of a single lever, at the back of the headstock, leaves the spindle “free” on ball bearings for balancing of face plate work and rotating of the spindle by hand. The collet draw spindle is notched for a spanner wrench and a lock pin is provided to hold the main spindle when changing attachments. Special attention is called to the fact that the back gears are fully enclosed and operated by two levers at the back of the headstock.

Carriage and Apron: Proper proportion and size make the carriage and apron capable of withstanding heavy cuts and still give an operator the “feel” necessary for precision work.

The top slide and cross feed screws have precision square threads and 1-13/16” diameter adjustable dials graduated to .001”. The lever on the top slide operates a quick acting device for withdrawing the tool when cutting threads — see page TL-Four.

The tool post slide is mounted directly on the solid swivel base which, in turn, is solidly mounted on the cross slide. The 360° graduations are on the top of the cross slide and are read through an opening in the swivel base. The top slide has a travel of 4” and a flat machined surface for placing an indicator stand or a square. The tool post takes standard 3/8” square tool bits or standard tool holders.

The cross slide has a travel of 4-3/4” and is provided with an adjustable stop. The apron is of the double wall type with gears enclosed in chambers filled with grease. The hand feed wheel has a friction dial graduated in .010 of an inch. Two levers are provided to engage the power feed and lead screw — there is an
interlock to prevent both being engaged at the same time. Friction clutches operated by ball handles are provided to control the power cross feed and the power longitudinal feed. Each friction clutch is strong enough to carry any necessary load and is arranged to slip if a solid obstruction is in the way of the carriage.

The carriage may be locked in any position on the bed by means of an eccentric lever operating directly against the gib. Because of the dove-tail construction described previously, this action assures positive locking for the carriage on both vees and the top of the bed. The carriage and apron have hardenened, ground, and lapped wipers.

Lead screw, power feed rod and stop rod details are given on pages TL-Two and TL-Four.

**Tailstock:** The tailstock supplied on the HARDINGE High Speed Precision Tool Room Lathe is of the correct design and substantial construction. Throughout, consideration was given to the fact that the tailstock should have features to easily take care of any load opposed on the headstock.

The spindle, regardless of position, never loses any of its full bearing and has a precision ball bearing to absorb thrust. Graduations on the spindle are in eighths of an inch. The hand wheel is provided with an adjustable dial, graduated in thousandths of an inch for accurate depth control when reaming, boring or facing. The dial can be set at zero at the start of the operation. The spindle is made of hardened and ground steel, travels 3-1/2” and has a No. 2 Morse taper. The male center is automatically discharged at the end of the right hand travel of the spindle. A lever operates two substantial half nuts to securely hold the spindle in any desired position. A reservoir and oil quill are provided for center lubricant.

The tailstock has a cross adjustment base and a full fit of 6-1/4” on the central guideway of the bed. An eccentric binder and T-bolt hold the tailstock in any position along the bed.

**Taper Turning Attachment:** In the design of the taper turning attachment we have again incorporated modern principles to insure good finish when turning. The bed of the machine has a full length scraped face and tee slot so that the taper turning attachment may be applied in any position or set to one side when not in use. It has two T-bolts at the extreme ends for securely locking the attachment in place.

The guide bar embodies the sine-bar design, swivelling from one end and having a taper bearing to allow take-up of play at any time. The guide bar is 11” in length. Graduations are in degrees and 1/32” taper per foot. There is a fine screw adjustment for positioning the guide bar and a bolt for locking. The slide is 4” long and gibbed for adjustment. The cross feed screw is released by turning the hexagon bolt at the top of the carriage. One wrench fits the various 9/10”, hexagon nuts and bolts and the taper turning attachment may readily be applied or adjusted while the operator stands in front of the machine.

**Pedestal Cabinet Driving Unit:** The welded steel pedestal as shown on page TL-One is a modern support for the HARDINGE Precision Tool Room Lathe. The pedestal fully encloses the motor, controls and driving unit and provides cabinet space for storage of chucks, tools, collets and other attachments. The floor space actually required for the complete lathe unit is 26 1/2” x 54 3/4”. The total space required to allow the removal of the draw spindle from the headstock and the tailstock from the bed is 26-1/2” x 74-3/4”. The pedestal is arranged to provide foot space for the operator and has openings at each end at the floor to facilitate moving. Provision for bolting the machine to the floor is made inside the pedestal base, eliminating brackets on the outside of the machine. Angle ventilation is provided at top and bottom of the pedestal and also around the doors and rear cover.

The driving arrangement comes as a proven unit through years of use with our precision lathes, second operation machines and milling machines. There are no gears, clutches or loose pulleys to cause noise, chatter or vibration. Our application of vee belts and sound electrical principles brought about a silent, powerful driving unit with anti-friction-bearing motor, driveshaft and headstock spindle.

A standard two-speed ball bearing motor is vee belt connected to a four step pulley to give eight forward and eight reverse spindle speeds from 165 to 1750 RPM and with the 6-1/4 to 1 ratio back gears engaged, from 27 to 280 RPM or sixteen spindle speeds forward and reverse. The motor has cushions and is mounted on a hinged bracket. A lever arrangement is provided for raising the motor to permit quick positioning of the vee belt on the fourth step pulley. Three vee belts connect the driveshaft with the headstock spindle. The driveshaft is supported by self-aligning ball bearings. Adjustment is provided to maintain proper tension for the vee belts at all times. The lower lever at the front of the headstock end operates an electrical motor control for LOW—BRAKE STOP—HIGH speeds. These immediate speed changes materially assist in reducing time required for various machining operations. A ball lever operated reversing switch is provided in the control panel at the headstock end of the pedestal. The mechanical brake is mounted inside the pedestal above the driveshaft. It is controlled to and operated by the “Low-Brake Stop-High” lever. The brake is of simple and foolproof design. It consists mainly of a plunger with a cork insert working on a drum on the driveshaft. A spring provides constant pressure when the brake is applied. Adjustment for wear may be made quickly and easily and replacement of the cork takes only a few minutes.

**STANDARD EQUIPMENT**

HARDINGE Pedestal Cabinet Type, Back Geared, Quick Change Screw Cutting Lathe, 16 tripod between centers, with 1” collet capacity, 9” swing fully enclosed headstock with precision pre-loaded ball bearings; draw spindle; drive plate and center; quick acting tool post slide; 30 change gear box; carriage; apron; tailstock with male center; taper turning attachment; set of eight change gears; complete with 220, 440 or 550 volt, 60 cycle, 3 phase, 2 speed reversing motor (also available for other currents); controls for motor; wrenches—unit completely wired and assembled ready for use. Weight 1020 lbs.
ADDITIONAL ATTACHMENTS

5" 3 Jaw Universal Chuck, Integral Mount, with set of inside and outside jaws
5" 4 Jaw Independent Chuck, Integral Mount, with reversible jaws
1/2" Drill Chuck mounted for tailstock
7" Diameter Slotted and Tapped Face Plate
Angle Plate for Slotted and Tapped Face Plate
Carriage Stop for use with hand feed

4-1/2" Center Rest
Follow Rest
Metric Bracket complete with translating gears and guard
T-Rest
Built-in Oil Pump, Piping and Sump
Half, Female, and Y-Centers
2", 3", 4", 5", and 6" Step Chucks and Closers
5C HARDINGE Collets in any fractional or odd decimal size to the capacity of 1" Round, 7/8" Hexagon, and 23/32" Square

THREAD CUTTING IS NO LONGER AN "ART"

Practically every tool room has its own expert for cutting good threads—this fact should prompt attention since there is no such distinction among toolmakers in other machining operations. An expert at cutting threads became an "artist" because the success was dependent upon the operator and not upon the machine.

The HARDINGE Precision Tool Room Lathe changes the situation as it has the thread cutting ability to enable an operator to rapidly produce good threads.

![Thread Cutting Table]

The center illustration is a duplication of the gear box plate for threads and feeds. The various systems for standard threads are reproduced to show that the HARDINGE Precision Tool Room Lathe Gear Box provides quick change for all standard threads above and including eleven per inch.

The following features are incorporated in the HARDINGE Precision Tool Room Lathe, and together they constitute all requirements for accurate, high speed thread cutting without chatter and vibration.

1. No radial or axial spindle play. The spindle is mounted in super precision preloaded duplex ball bearings. This provides positive "metal to metal" contact of the balls to the ball races and does away with end play and camming action of the spindle.

2. No radial or axial lead screw play. The lead screw also has preloaded duplex ball bearing mounting to eliminate play. The elimination of spindle and lead screw play means that the accuracy of the lead screw is duplicated on the part being threaded.

3. Proper mounting for the tool post slide. In contrast to the circular mounting, the tool post slide is placed directly on top of the carriage for full rectangular bearing. This assures rigidity and a full dove-tail fit for the tool post slide.

4. Dove-tail carriage and bed construction. This feature eliminates chatter and vibration, which is so detrimental to good thread cutting—see page TL-Two for full details.

5. Wide range of speeds. The sixteen spindle speeds from 27 to 1750 RPM provide a correct range for small and large diameter threading.

Compounding: With necessary change gears the following threads can be cut when the ten change gear box handle is in the lock-out position: 10 to 100 pitch—every thread, 100 to 150 pitch—every other thread and all threads divisible by five, 150 to 250 pitch—every thread divisible by ten. Eight change gears are supplied as standard equipment with a chart for cutting 10, 25, 50 and 100 pitch threads.

Metric Threads: A bracket with translating gears is available to convert the machine for cutting metric threads.

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