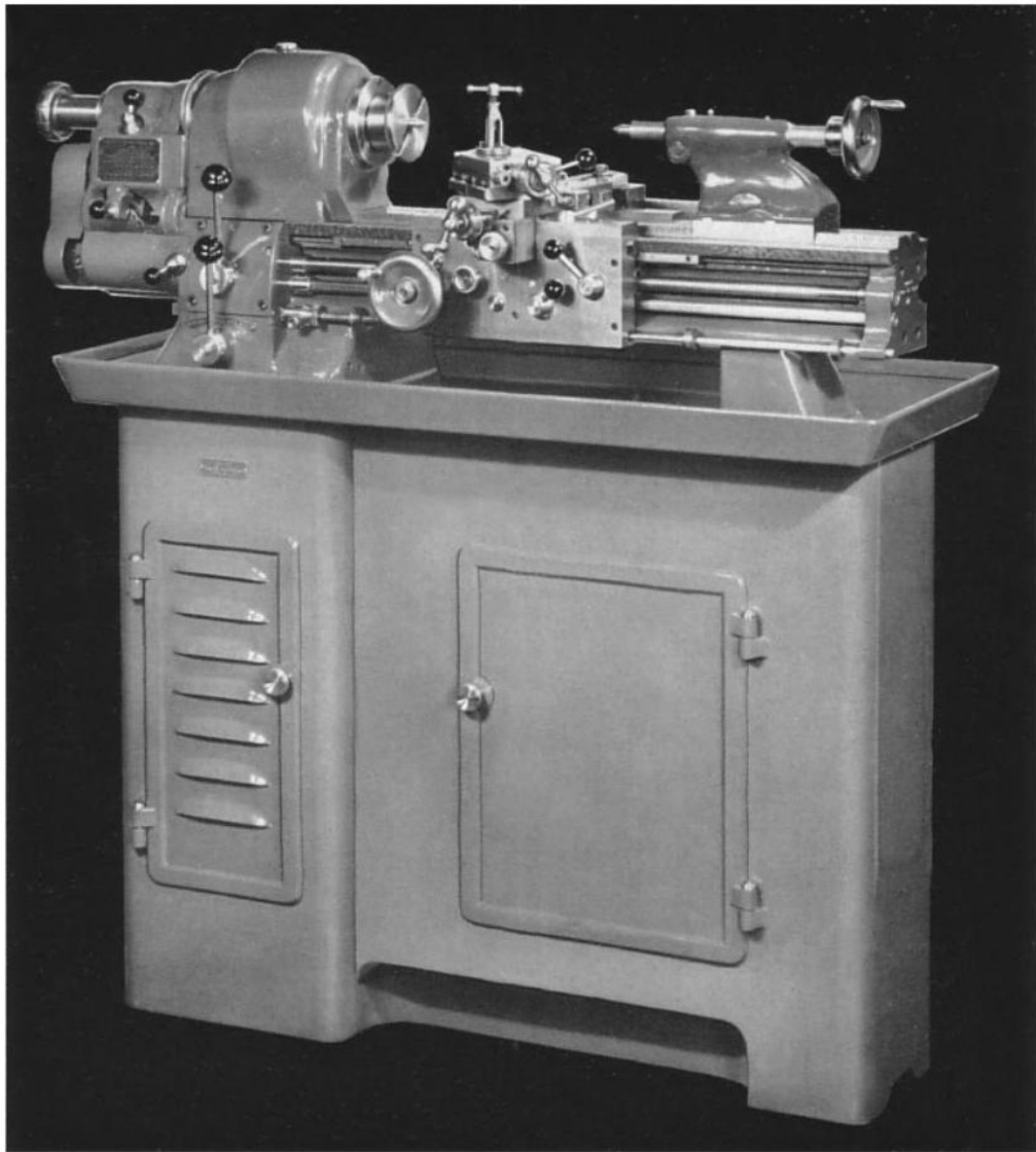


# HARDINGE

PRECISION BALL BEARING HIGH SPEED TOOL - ROOM LATHE



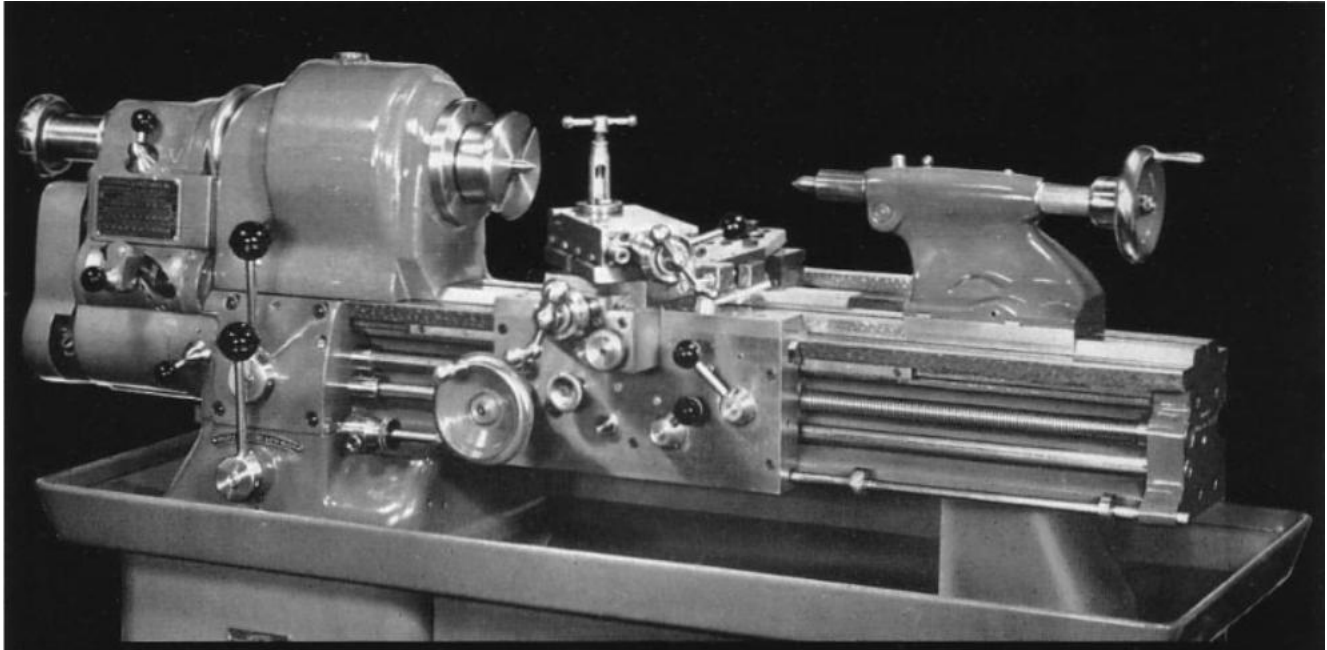
WITH

↖ ↗ DOVE-TAIL CARRIAGE AND BED CONSTRUCTION ↖ ↗

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

CHICAGO - NEW YORK - HARTFORD - DETROIT - PHILADELPHIA - CLEVELAND

## HARDINGE BROTHERS, Inc., ELMIRA, NEW YORK



FIFTY YEARS EXPERIENCE IN MANUFACTURING ACCURATE HIGH SPEED TOOL ROOM LATHES IS EMBODIED IN THIS MODERN MACHINE

### IS THIS HAPPENING IN YOUR TOOL ROOM?

**C**LOSE observation in a tool room will reveal the use of machines entirely out of proportion to the work. It is not uncommon to see engine lathes weighing two to four thousand pounds slowly laboring away on work one inch in diameter or less.

Tool rooms have small and large work and, for economy and proper results, there must be such a distinction among the lathes used. When using a large engine lathe for collet work, you are overlooking the greater investment, loss of floor space, added power consumption, improper speeds, poor results and, most important, the loss of valuable time.

The HARDINGE Precision Tool Room Lathe, presented in this bulletin, was primarily designed to fill a very old existant gap between the plain precision bench lathe and the engine lathe. Extreme accuracy, high spindle speeds, and thread cutting ability are coupled with power and handiness for ease of operation to *rapidly* obtain desired results.

The correct size of the HARDINGE Precision Tool Room Lathe will become apparent when turning and threading, changing collets and jaw chucks, positioning the tailstock and when making use of the many speeds and operation features.

### ACCURACY SPECIFICATIONS

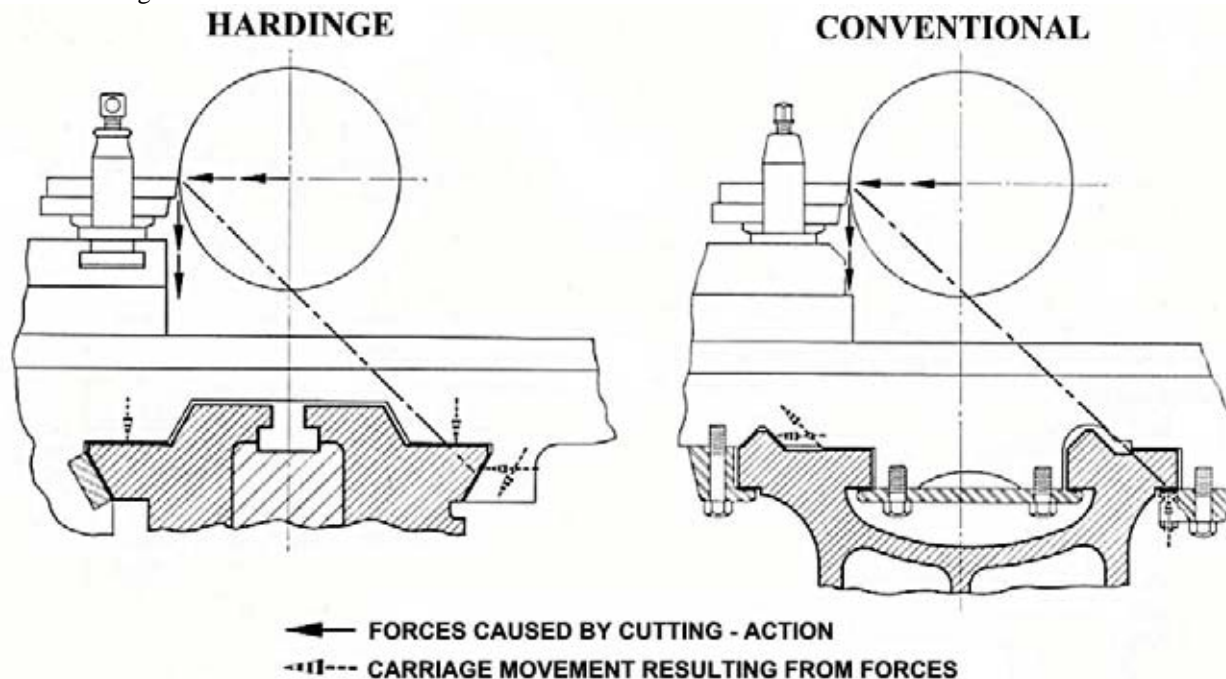
Turn ----	.0001 in 6"
Face ----	.0000 convex on 9" Diameter .0002 concave on 9" Diameter
Thread --	.0002 in 1" of lead .0003 in 3" of lead .0005 in 12" of lead

And, accuracy is sustained in a HARDINGE Precision Tool Room Lathe due to the latest design, modern materials and workmanship.

*HARDINGE "Cataract" Tool Room Screw Cutting Lathes have a long established recognition for extreme accuracy, high spindle speeds and operation features.*

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**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 accuracy and proper finish needs of the optical, camera, projector and range finder manufacturers. This was done with our Optical Turret Lathes having dove-tail carriage and bed construction. A convincing comparison is made in the accompanying illustrations to show why the dove-tail construction is used in the Hardinge Tool Room Lathe.



*Cutting action causes a pushing away and a pushing down force to the carriage.*

**Hardinge:** There can be no lifting action of the carriage as the back 30° way changes the pushing away force into a “pulling down” action to insure the three actual bearing sections shown by the shaded arrows.

**Conventional:** There is a lifting action of the carriage as the inverted vee way changes the pushing away action into a “lifting up” action to leave only two actual bearing sections shown by the shaded arrows.

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 can not collect on the surfaces.

## ADDITIONAL BED DETAILS

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

The center top section conforms with the ways of our bench lathe bed to afford the interchangeability of certain attachments. The back side has a scraped face and tee slot section for a taper turning attachment, illustrated and described on page TL-Six.

The bed has substantial individual base supports at each end. Two steel balls at the headstock end and one steel ball at the tailstock end provide a *three point bearing* between the bed and base supports. The steel balls are self-adjusting to compensate for floor irregularities. The base supports are attached by spring backed bolts, overcoming the possibility of bed distortion.

The lead screw has an 9 pitch acme thread and is

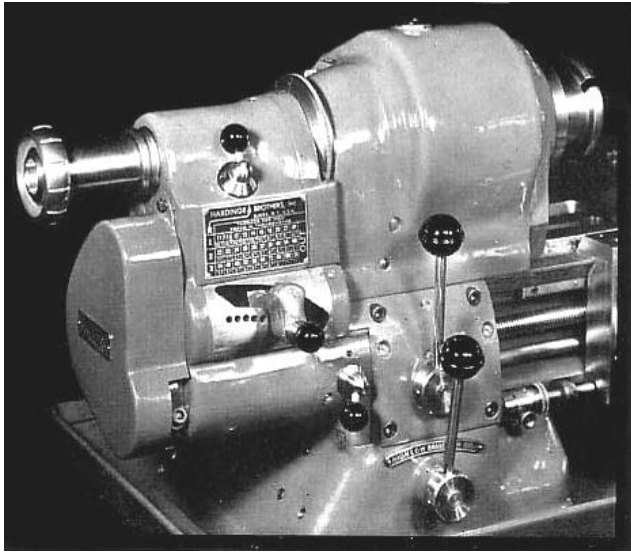
without a spline. It is held in completely enclosed preloaded ball bearings at the headstock end and roller bearings at the tailstock end. This design eliminates lead screw end play which is so detrimental to cutting of accurate threads. The lead screw has tapered ends and is arranged so that it may be turned end for end to double the usual service. There is no wear at the ends of the lead screw since they are tapered and mounted in rotating members. A lever at the headstock end disengages the lead screw so that it does not rotate when not in use.

The lead screw nut is of select bronze 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.

## HARDINGE BROTHERS, Inc., ELMIRA, NEW YORK

Headstock and Gear Box: The back geared headstock is fully enclosed for modern appearance and incorporates features proved by many years of service with our precision lathes. The spindle is hardened and ground, taking 1" capacity 5C HARDINGE Collets. The spindle has our standard taper or screw 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 bench lathes.

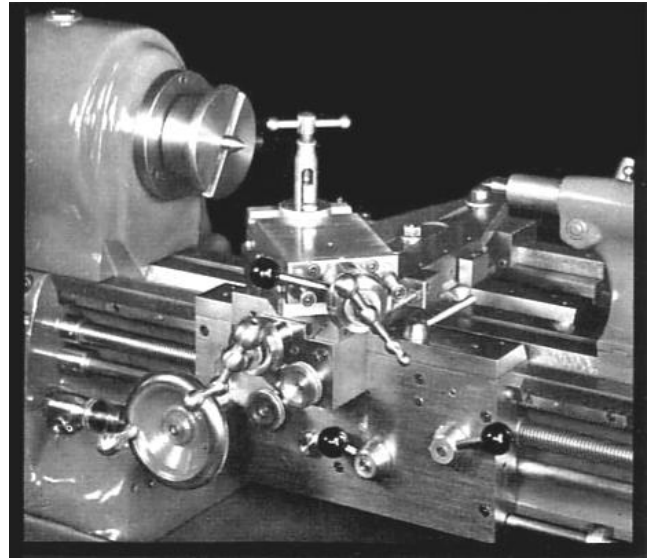


The spindle has duplex preloaded super-precision type ball bearings for extreme accuracy and carefree high spindle speeds. There is no radial or axial play and *the bearings require no adjustment* --- see separate bulletin BB for further details. There are sixteen, spindle speeds from 26 RPM to 1750 RPM with endless belt drive --- see page TL-Seven. The ten change gear box and the three change lever provide standard threads and feeds. Compounding outside of the gear box also permits a wide range of threads --- see next page. 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 spindle and the gear box.

The long 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 spindle 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.

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 bevel dials graduated to .001". The lever at the top slide operates a quick acting device for withdrawing the tool when cutting threads --- see next page.



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 a side 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 adjustable stops. 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 sixty-fourths of an inch. The one lever engages the power feed while the other engages the lead screw --- there is an interlock to prevent both being engaged at the same time. The two small wheels operate friction clutches for controlling power cross feed and power longitudinal feed. Each friction clutch is strong enough to carry any necessary load and is arranged to throw out 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 spring backed bronze wipers followed by oiled felt wipers.

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

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## 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.

AMERICAN (NATIONAL) STANDARD  
COARSE, FINE AND EXTRA FINE SERIES

Number or Size	Threads Per Inch			Number or Size	Threads Per Inch		
	Coarse	Fine	Extra Fine		Coarse	Fine	Extra Fine
0		80		7/16	14	20	28
1	54	72		1/2	13	20	28
2	56	64		9/16	12	18	24
3	48	55		5/8	11	18	24
4	40	48		3/4		16	20
5	40	44		7/8		14	20
6	32	40		1		14	20
8	32	36		1-1/8		12	18
10	24	32		1-1/4		12	18
12	24	28		1-1/2		12	18
1/4	20	28	32	1-3/4		12	16
5/16	18	24	32	2		12	16
3/8	16	24	32	2-1/4		12	16

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ELMIRA, N. Y., U. S. A.

THREADS PER INCH  
FEEDS IN THOUSANDTHS

1	11	11 <sup>1</sup> / <sub>2</sub>	12	13	14	16	18	20	27	34
	15.2	14.5	14.0	12.8	12.0	10.4	9.2	8.4	6.1	4.9
2	22	23	24	26	28	32	36	40	54	68
	7.6	7.3	7.0	6.4	6.0	5.2	4.6	4.2	3.1	2.4
3	44	46	48	52	56	64	72	80	108	136
	3.9	3.6	3.5	3.2	3.0	2.6	2.3	2.1	1.5	1.2

WHITWORTH  
STANDARD

Size	Threads Per Inch
3/32	48
1/8	40
5/32	32
3/16	24
7/32	24
1/4	20
5/16	18
3/8	16
7/16	14
1/2	12
9/16	12
5/8	11
11/16	11

AMERICAN  
(BRIGGS)  
STANDARD  
PIPE  
THREADS

Size	Threads Per Inch
1/8	27
1/4	18
3/8	18
1/2	14
3/4	14
1	11-1/2
1-1/4	11-1/2
1-1/2	11-1/2
2	11-1/2

BRITISH  
STANDARD

Size	Threads Per Inch
7/32	28
1/4	26
9/32	26
5/16	22
3/8	20
7/16	18
1/2	16
9/16	16
5/8	14
11/16	14
3/4	12
13/16	12
7/8	11

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.

- 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.
- 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.
- Lead screw can be turned end for end.** This example of good design doubles the ordinary service of the lead screw.
- 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.
- Dove-tail carriage and bed construction.** This feature eliminates chatter and vibration, which is so detrimental to good thread cutting --- see page TL-Three for full details.
- Wide range of speeds.** The sixteen spindle speeds from 27 to 1750 RPM provide a correct range for small and large diameter threading.
- No thread dial indicator.** The use of a thread dial indicator takes up time, requires attention which should be given to the work, and introduces the possibility of an error to spoil work. See next feature.
- Modern control of the carriage.** One lever at the headstock provides immediate Forward-Stop-Reverse control of the carriage. This control is instantaneous without reversing or stopping the headstock, without reversing gears and without disengaging the lead screw nut. The control is operated manually with the lever or by means of mechanical stops for the carriage. This positive control affords safety in the use of proper threading speeds even to thread to a shoulder without a relief. Provision is made for carriage return at high speed.
- Quick acting arrangement for tool post slide.** At the end of a threading cut, the tool is instantly cleared for return of the carriage to the next cut. This is accomplished by means of a lever actuating the tool post slide, independent of the feed screw. It also returns the tool to exactly the same position for the next threading cut. This saves time as attention to the feed screw micrometer dial is for depth of cut only, eliminating the usual backing and returning of the tool post slide by use of the feed screw.

**Compounding:** With necessary change gears the following threads can be cut when the ten change gear box handle is in the lock-out position: 1 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 5, 10, 25, 50 and 100 pitch threads.

**Metric Threads:** A bracket with translating gears converts the machine for cutting metric threads or a 3 M/M lead screw can be supplied at extra cost.

## TURNING IN A MODERN HIGH SPEED TOOL ROOM LATHE

The inherent stability of the Hardinge Precision Tool Room Lathe assures accurate turning with proper finish at high speeds. Accuracy and proper finish are secured through the use of correct cutting speeds, feeds and modern tooling. The accuracy and properly turned finish eliminate, in most cases, the necessity for grinding.

Further, the use of efficient cutting speed with modern tooling brings production to the tool room in machining high speed steel, carbon tool steel, stainless steel, alloy steel, carbon steel, screw stock, brass and aluminum alloys.

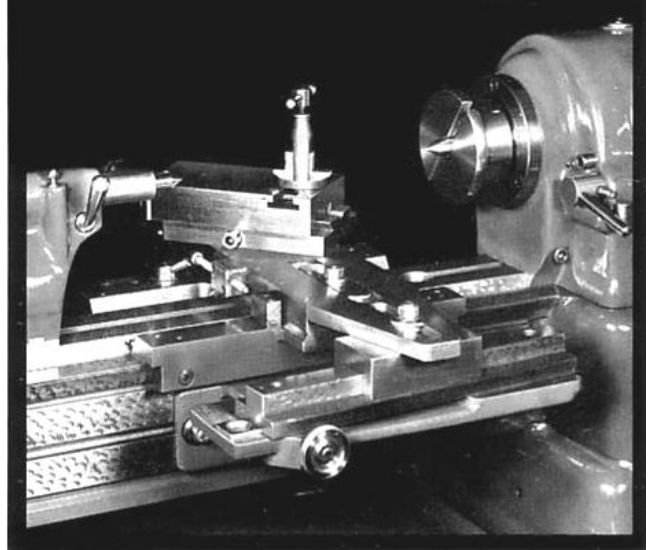
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**Tailstock:** The correct design and substantial construction of the tailstock are clearly apparent. Throughout, consideration was given to the fact that the tailstock should have features to easily take care of any load opposed on the headstock.

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 and the handwheel is graduated in thousandths of an inch. The spindle is made of hardened and ground steel, travels 3-1/2" and has Morse No. 1 taper. The male center is discharged at the end of the right hand travel of the spindle.

A lever operates two substantial half nuts to securely bold the spindle in any desired position. A reservoir and oil quill are provided for center lubricant.

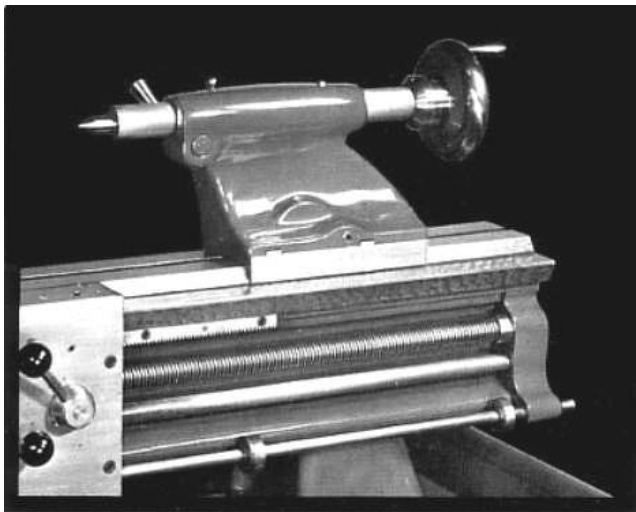
The tailstock has a cross adjustment base and a full fit of 6-1/4" on the central guideway of the bed. An eccentric binder and T-bolt hold the tailstock in any position along the bed.



**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 the 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 1/8" 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 nut at the top of the carriage. One wrench fits the various 9/16" hexagon nuts and bolts and the taper turning attachment may readily be applied or adjusted while the operator stands in front of the machine.



### STANDARD EQUIPMENT

The machine and all attachments illustrated and described in this bulletin, with the exception of the metric bracket, are furnished as standard equipment as follows:

HARDINGE "Cataract" Pedestal Cabinet Type, Back Geared, Quick Change Screw Cutting Lathe, 16" between centers, with 1" collet capacity, 9" swing fully enclosed headstock with precision preloaded 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 reversible motor (also available for other currents) ; controls for motor; wrenches unit completely wired and assembled ready for use. Weight 1020 lbs.

### ADDITIONAL ATTACHMENTS

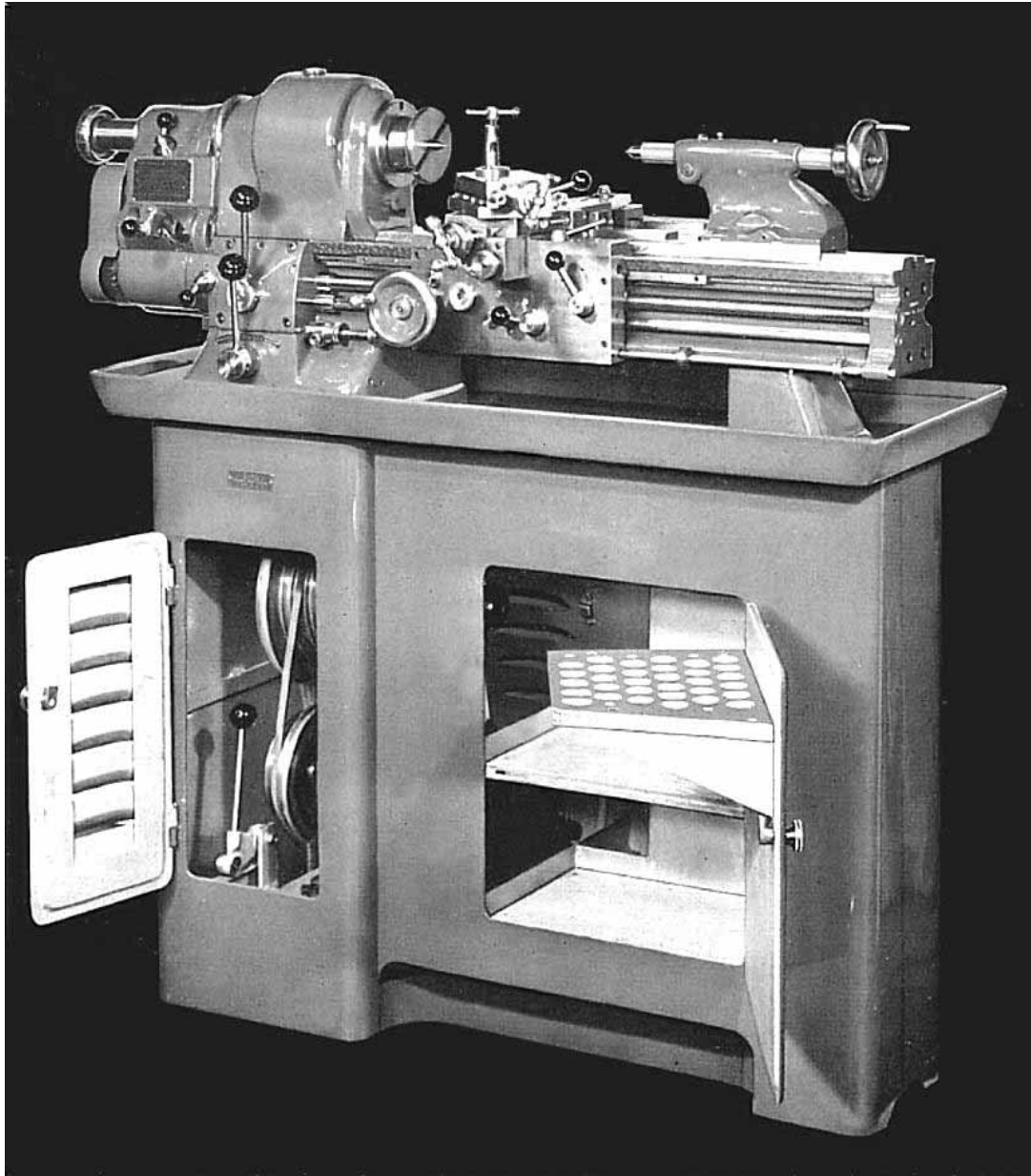
(See Separate Bulletins for Details)

- 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
- 9" Diameter Slotted and Tapped Face Plate
- Angle Plate for Slotted and Tapped Face Plate
- Carriage Stop for use with hand feed
- Center Rest
- Follow Rest
- Metric Bracket complete with translating gears and guard
- T-Rest
- Grinding Attachments
- Automatic Collet Closer
- Tilted Turret
- Built-in Oil Pump, Piping and Sump
- Emery or tin faced laps
- Half, female, and V-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

## HARDINGE BROTHERS, Inc., ELMIRA, NEW YORK

**Pedestal Cabinet Driving Unit:** The welded steel pedestal is a modern support for the modern Hardinge Tool Room Lathe. Illustrations on page TL-One, this page and the following page completely show the unit.

The pedestal fully encloses the motor, controls, driving unit and provides cabinet space for storage of chucks, tools, collets and other attachments. Floor space required for the complete lathe unit is 26"x 52". 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. Louvres are provided for ventilation.



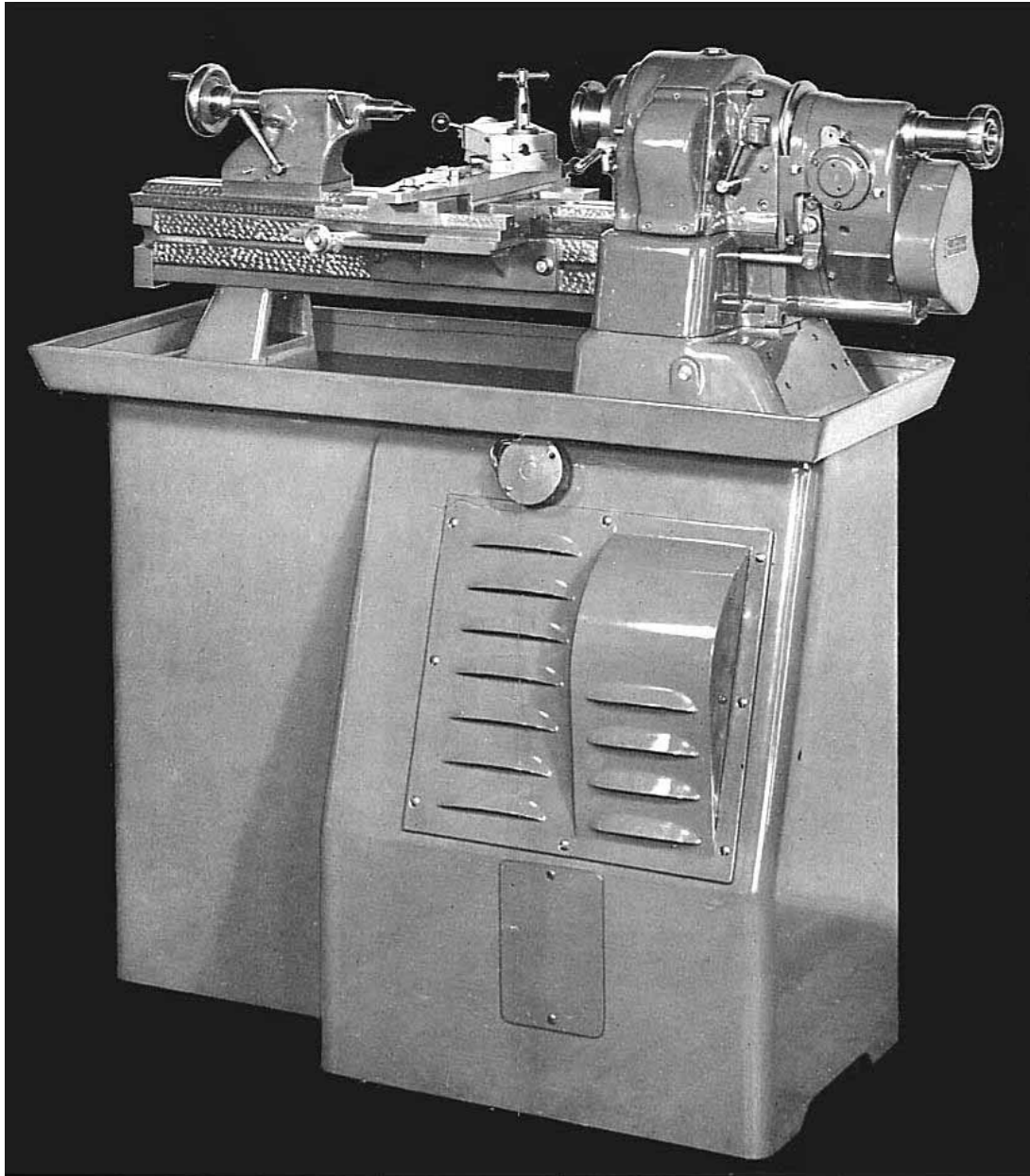
The driving arrangement comes as a proven unit through of use with our precision lathes, hand screw machines and milling machines. There are no gears, clutches or loose pulleys to cause noise, chatter and vibration. Our application of endless vee belts and sound electrical principles brought about a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

A standard two-speed ball bearing motor is endless vee belt connected to a four step aluminum 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 rubber cushions and

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is mounted upon a hinged bracket which also rests upon a rubber cushion. A lever arrangement is provided for raising the motor to permit quick positioning of the vee belt on the four step pulley. Three endless vee belts connect the drive shaft with the headstock spindle. The drive shaft is supported by self-aligning ball bearings. Individual adjustment is provided to maintain proper tension for the endless vee belts at all times.

The lower lever at the front of the headstock end operates an electrical motor control for LOW REVERSE---HIGH REVERSE---BRAKE STOP---LOW FORWARD---HIGH FORWARD speeds. These immediate speed changes materially assist in reducing time required for various machining operations.



**Brake:** A mechanical brake is mounted inside the enclosed headstock and is controlled as described above. The brake and brake band are arranged around the spindle pulley. The brake lining is not riveted to the brake band, to allow it to float or rotate when the brake is applied, thereby presenting ever changing surfaces to distribute the wear and assure long life. The action of the brake is positive and rapid, but gradual.

**Note:** The above rear view illustration shows a number of features referred to in the preceding pages of this bulletin. Special attention is called to the fact that the back gears are fully enclosed and operated by the two levers at the back of the headstock.

The lever at right disengages the spindle to provide the "free" spindle as described on page TL-Four.