1977

HARDINGE

OPERATOR'S MANUAL

MODELS HC and HCT

HARDINGE CHUCKING MACHINES

HARDINGE MACHINE TOOLS LTD
ASSOCIATED WITH THE HARDINGE ENGINEERING GROUP
MARSH GREEN ROAD, EXETER, ENGLAND EX2 8PN
TELEPHONE: 0392 EXETER 51431/7
CABLES: HARDINGE, EXETER
TELEX: 42615

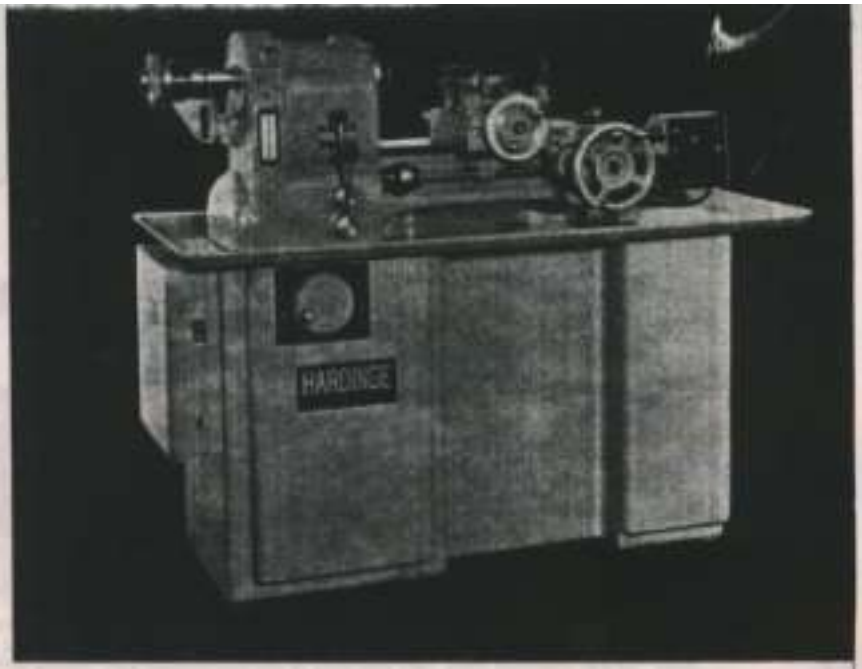
HARDINGE

OPERATOR'S MANUAL

MODELS HC and HCT

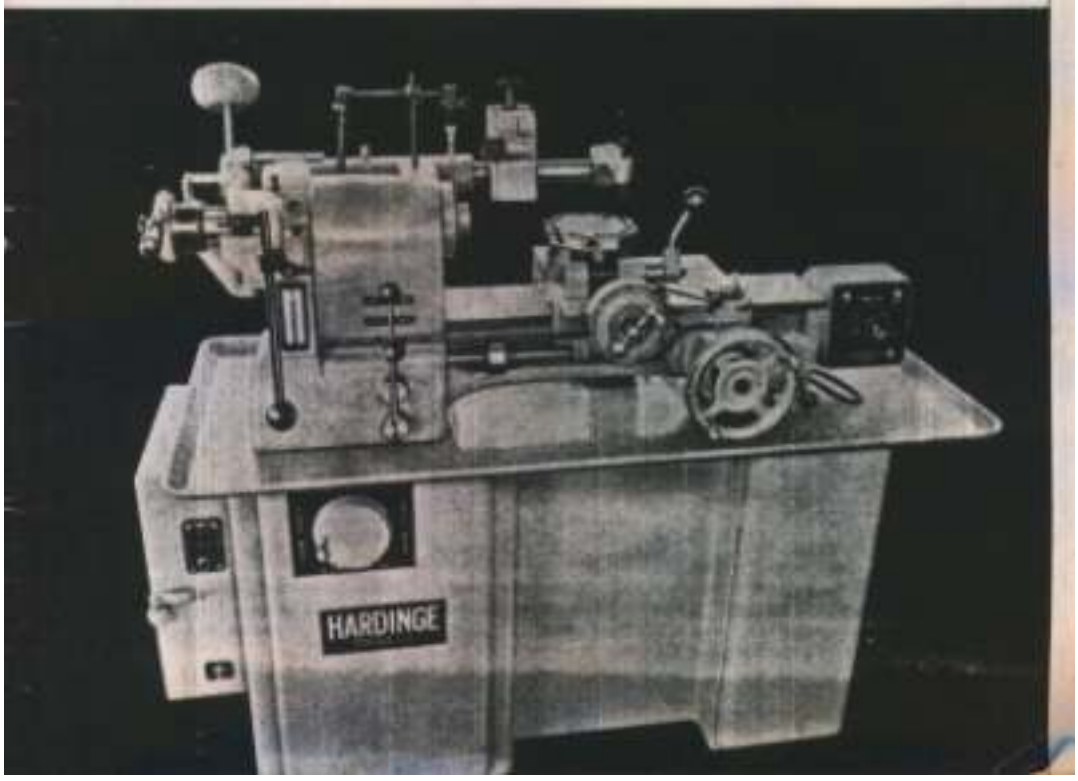
HARDINGE CHUCKING MACHINES

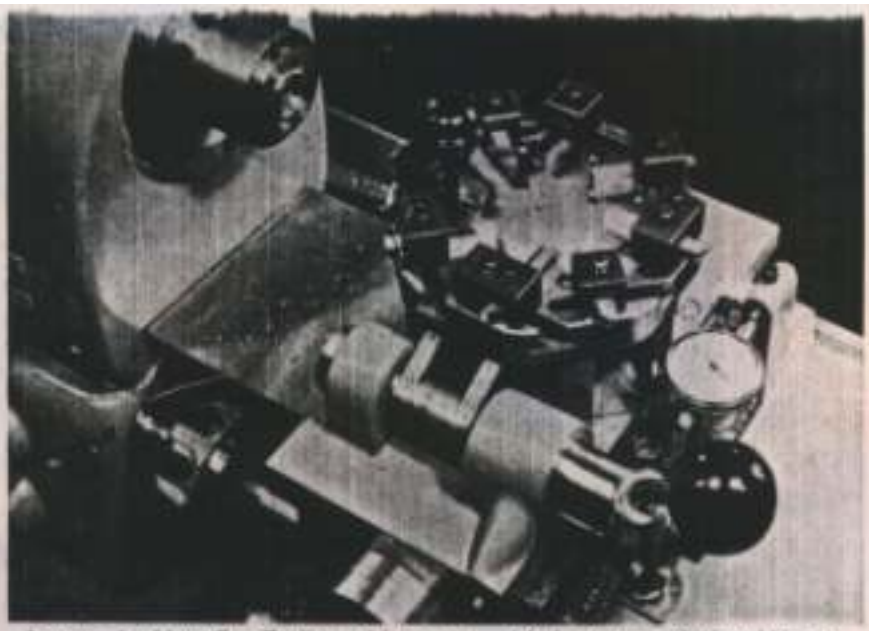
HARDINGE MACHINE TOOLS LTD.
ASSOCIATED WITH THE SHEEPBRIDGE ENGINEERING GROUP
MARSH GREEN ROAD, EXETER, ENGLAND EX2 8PN
TELEPHONE : 0392 EXETER 51431/7
CABLES : HARDINGE, EXETER
TELEX : 42645



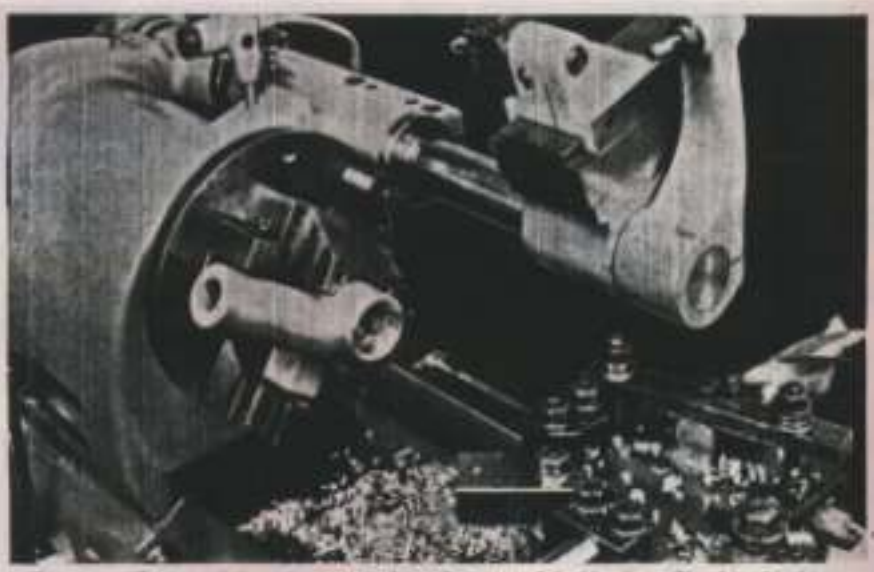
Above—Model HC Chucking Machine

Below—Model HCT Precision Chucking Machine with Production Threading Head





An example of Low-Cost Tooling and fast set-up—eight low cost standard tool bits are used to single-point machine this precision part. Tolerances are easily held to less than .0005" on a production basis. Fast chucking of the odd shaped part is done with a standard 2" step chuck.



The set-up illustrated above is given to show the range of the Hardinge Chucking Machine. Compare it to the 2" step chuck job shown in the illustration at the top of this page. This odd shaped casting was easily machined, including the threading operation, at high speeds, in the counterbalanced fixture.

INSTALLATION INSTRUCTIONS

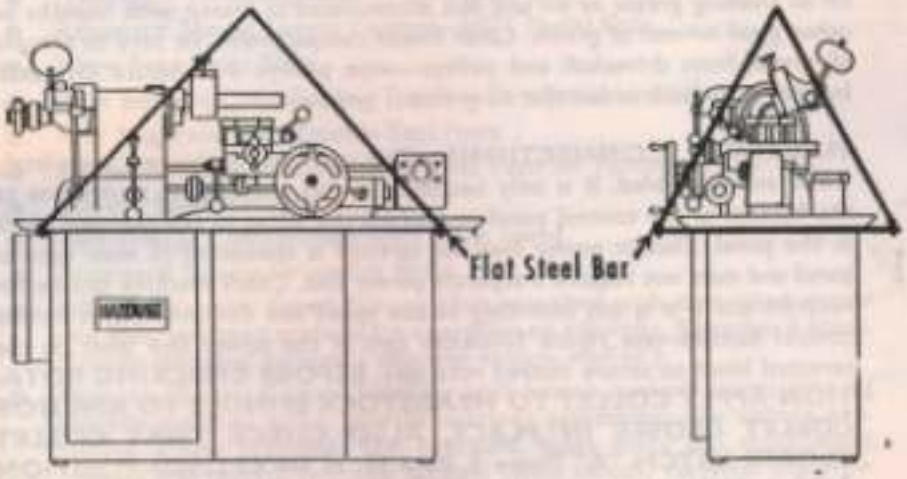
LIFTING MACHINE

Lifting with a crane, the rope or cable sling should be placed under the ends of the pan. NEVER LIFT MACHINE WITH ROPE OR CABLE AROUND SPINDLE, BED OR TAILSTOCK. The rope or cable must be capable of withstanding a weight of 18 cwt.

Lift machine slowly, checking to see that the correct balance is obtained. Use caution, as machine has somewhat more weight at the front and it is more easily tipped using the lift truck method than the crane and sling method.

MACHINE FOUNDATION

The Hardinge chucking machines are designed to operate without the need of special foundations. A substantial wood or concrete floor is satisfactory. It must, however, be fairly flat and have sufficient strength to support the machine properly.



INSTALLATION INSTRUCTIONS—continued

Do not locate machine near other equipment that causes vibration which will transmit to this machine, as poor work finish will result.

LEVELLING MACHINE. The Hardinge chucking machines are designed with a three-point bearing arrangement between bed and pedestal base. The three-point bearing arrangement makes accurate levelling unnecessary. Levelling should be such as to be reasonable and so that coolant will properly drain back into sump from ends of pan.

There is an adjustable foot at back right-hand corner of the pedestal base to compensate for uneven floor conditions. To adjust, loosen the socket set screw and raise or lower the foot with a pin wrench so that all four feet rest firmly on the floor. Tighten socket set screw to retain setting. Should floor conditions be such that adjustable foot does not take care of the levelling, use shims under feet of pedestal.

CLEANING MACHINE. Use a cloth or brush to clean this precision machine. **DO NOT CLEAN MACHINE WITH COMPRESSED AIR.** The use of compressed air for cleaning a machine reduces the precision life of the machine. Small particles of dirt and foreign matter can be forced past seals and wipers into the precision slides and bearings. **USE ONLY CLOTH OR BRUSH TO CLEAN MACHINE.** This also applies to daily cleaning of unit after it is in operation.

After machine has been properly located, levelled and bolted to floor, wash off all slushing grease or oil and dirt accumulated in transit with naphtha or other good solvent of grease. Clean motor compartment. Be sure to remove all grease from driveshaft and pulleys—wipe pulleys dry. Rotate driveshaft by hand and check to see that all grease is removed.

ELECTRICAL CONNECTIONS. This machine is shipped completely wired and assembled. It is only necessary to run the electric power line to the bottom of the control panel and attach the wires to the terminal block in the panel. Electric power feed for carriage is connected to main control panel and does not require a separate power line. Check machine spindle for rotation and if it is not according to the speed and direction plates behind control handles—see Figure 1—switch two of the power line leads on the terminal block to secure desired rotations. **BEFORE CHECKING ROTATION APPLY COLLET TO HEADSTOCK SPINDLE TO ANCHOR COLLET CLOSER IN PLACE. ALSO CHECK THAT COLLET CLOSER LATCH "A"** Figure 9, Page 18, **IS IN CLOSED POSITION AND SPINDLE LOCK PIN "E"** Figure 9, **IS IN THE "OUT" OR RELEASED POSITION.**

MACHINE SPECIFICATIONS

Spindle Construction		Hardinge Preloaded Ball Bearing
SPINDLE CAPACITY	With Step Chucks	1" to 6"
	With Jaw Chucks	5"
	With Jaw Chucks (Through Spindle)	1-5/32"
	With Round 5C HARDINGE Collets	1"
	With Hexagon 5C HARDINGE Collets	⅞"
	With Square 5C HARDINGE Collets	¾"
Spindle Nose Diameter		2.189"
Spindle Nose Thread		2-3/16"—10 R.H.
Maximum Fixture Diameter		9"
Diameter for Threading—Internal and External		6"
Length for Threading		1-3/4"
Maximum Distance from Face of Turret to Spindle		13"
Travel of Cross-Slide with Screw Feed		4"
Power Feeds		1.4" to 10" per minute
Infinitely Variable Spindle Speeds		125 to 3,000 r.p.m.
Approximate weight of machine with regular equipment listed below		13¼ cwt.

REGULAR EQUIPMENT

The Hardinge Chucking Machine is furnished complete with:

- Fully Enclosed Preloaded Ball Bearing Headstock with splash guard for spindle
- HARDINGE Dovetail Bed with hardened and ground steel ways
- Ball Bearing Lever Collet Closer
- Production Threading Head—HCT Model Only
- Automatic Thread Length Control—HCT Model Only
- Screw Feed Cross Slide
- Eight position Cross-Feeding Turret with adjustable stations
- Four Single and Four Double Tool Posts
- Independent Electrical Variable Power Feed for Turning and Boring
- Welded Steel Pedestal
- Tool Storage Compartment with collet board
- Automatic Spindle Driveshaft Brake
- Infinitely Variable Speed Driving Unit complete with two-speed motor and lever operated controls for operation on 440 volts, 50 cycles, 3 phase. (Specify electrical current if different voltage wanted.)
- Magnetic Electric Control Panel for push button control circuit; time lag thermal overload relays provide overload protection; low voltage protection is also provided; cam operated, quick make and quick break forward and reverse switches; coolant pump switch; terminal block for direct application of power line—entire panel is one self-contained unit.

OPERATING INSTRUCTIONS
FOR
MODELS HC AND HCT MACHINES

SPINDLE CONTROL LEVERS—Figure 1

LOW-STOP-HIGH SPEED LEVER "A" is connected to a two-speed electric controller located in the electric control panel. As indicated by the plate directly behind the levers on the machine headstock, the motor and spindle will run at "LOW" speed when the lever is in the extreme left-hand position. When the lever is in the extreme right-hand position "HIGH" speed is obtained. Place the lever in the centre position and the motor spindle will stop.

REVERSE-BRAKE STOP-FORWARD LEVER "B" is connected to a reversing switch mounted in the same electric control panel as the two-speed controller. With the lever in extreme right-hand position the spindle and motor will run in the forward direction. With lever in the extreme left-hand position the motor and spindle will run in the reverse or backward direction. With the lever in the centre or "STOP" position the electric drive motor is Shut off and the driveshaft brake applied for rapidly stopping the spindle. To stop the machine move either lever "A" or lever "B" to the centre position.

Figure 1

TO START AND STOP SPINDLE—Figure 1

Press "**START**" button in front of electric control panel at left-hand end of pedestal base.

Both levers must be positioned to start spindle. The "**LOW-STOP-HIGH**" speed lever "**A**" is placed in either the "**HIGH**" or "**LOW**" speed position as the job requires. To start and stop the spindle, use the "**REVERSE-BRAKE STOP-FORWARD**" lever "**B**" only, as this control lever operates the driveshaft brake for rapidly stopping the spindle. If the job requires the use of both high and low spindle speeds, lever "**A**" can be moved directly from either position without stopping the spindle. For example, a part may be turned, faced and bored at the higher speed, then the speed reduced by moving lever "**A**" to the lower speed for the threading-operation. Lever "**B**" can be moved directly from forward to reverse without first stopping the spindle—this is used when tapping or loading and unloading threaded parts on a threaded arbor.

TO TURN SPINDLE BY HAND—Figure 1

When setting up or chucking work which requires the work to be indicated for concentricity, the spindle must be turned by hand. To obtain a free spindle for easy turning of the spindle by hand, place lever "**A**" in the centre or stop position, and place lever "**B**" in either "Forward" or "Reverse" position. Placing lever "**B**" in either the "Forward" or "Reverse" position releases the driveshaft spindle brake and gives a free rotating spindle.

LUBRICATION OF HEADSTOCK SPINDLE BEARINGS

The headstock spindle is mounted on precision preloaded ball bearings. The preloading and resulting load carrying capacity is engineered to take radial thrust or end thrust, or a combination of both.
The precision preloaded ball bearings are grease-packed for life and require no further lubrication. The entire bearing assembly is housed as a unit and is properly sealed to exclude dirt and foreign matter. The spindle bearing seals are designed to operate at speed without wear or friction.

SPINDLE DRIVING UNIT

The infinitely variable driving unit has a stepless range from 125 to 3000 r.p.m. The motor bearings and bearings in variable speed unit are grease packed and sealed and require no further attention. To change the spindle speed, turn the handwheel located on the front of the machine pedestal. Spindle speed can be changed while the tool is under cut.

- CAUTION: DO NOT TURN THIS HANDWHEEL UNLESS THE MACHINE IS RUNNING.

SPINDLE BRAKE

The spindle brake works on a brake drum mounted on the spindle drive motor shaft. Occasionally put a few drops of light oil on the brake drum to prevent the brake cork from drying out. The brake is operated electrically by a solenoid connected to the spindle starting lever. After considerable use it may be necessary to adjust the brake for wear. This is easily done by releasing the brake with the brake switch on the front of the electric control panel at the left-hand end of the machine. Remove the variable speed control handwheel from the front of the machine so the motor compartment door can be opened. Use a 5/32" hexagon socket set screw wrench to loosen the set screw in handwheel hub. The brake cork is mounted in a threaded plunger for adjustment. When adjusting, always turn 180 deg. so radius in cork will match radius on brake drum. The proper minimum clearance is .005" when brake is on "OFF" position.

TURRET—Figure 3

The eight-position turret is mounted on preloaded ball bearings for accurate and absolute rigidity. Turret bearings are grease-packed and sealed, requiring no further attention.

TO INDEX TURRET—Figure 3

Moving lever "**A**" toward the operator releases the hardened and ground indexing fork "**B**" from the locked position and the turret is then turned to the desired station and locked by lever "**A**" when positioned as shown in Figure 3. In the event lever "**A**" is not in a position convenient for rapid operation or it interferes with turret tooling, the position of this lever can be changed. Release hexagon nut "**C**" and then rap the hub of lever "**A**" with mallet to release hub from taper shaft. Move lever "**A**" to desired position and lock nut "**C**" to retain desired setting. The shaft for lever "**A**" and indexing fork "**B**" is mounted on ball bearings which are grease-packed and sealed for life. When indexing or revolving the turret a clicking noise will be heard. There is also a slight change in the feel of the turret as you pass each station. This is the action of a spring-backed plunger which is provided to signal the operator that the turret is in the proper position for locking after indexing. This spring-backed plunger has nothing to do with indexing position of the turret after lever "**A**" is in locked position.

ADJUSTABLE TURRET STATIONS—Figure 3

There are eight threaded studs "**D**", Figure 3, one for each of the eight turret stations. These threaded studs have rounded ends to give proper contact with indexing fork "**B**". The purpose of these threaded studs is to provide a fine individual adjustment for each turret station. In operation the turret tools are set in approximate position and locked in place. Then final fine cutting position can be obtained by loosening the lock screw "**E**" and adjusting studs "**D**" using a $\frac{1}{2}$" open-end wrench. Use studs "**D**" for fine

adjustment only—wide adjustments should be made by moving tool along T-slot of turret or by changing cross-slide stops "**F**". Final setting of stud "**D**" is retained by tightening lock screw "**E**".

IMPORTANT: Be sure lock screws "**E**" are tightened after adjusting studs "**D**" or an error will occur in indexing.

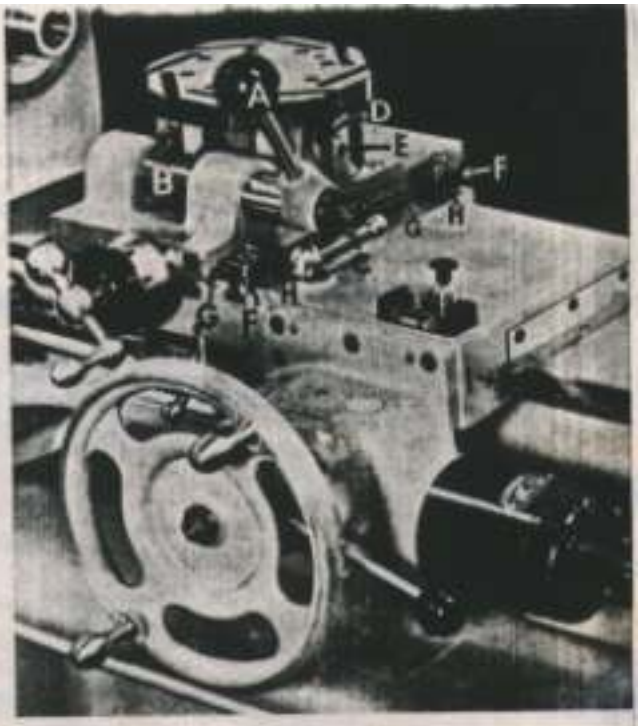


Figure 3

ADJUSTABLE CROSS-SLIDE STOPS—Figure 3

Two adjustable cross-slide stops "**F**" are standard equipment for the Hardinge Chucking Machines. Each stop block is equipped with an adjustable stop screw which sets against the hardened steel stop block of the cross-slide. After adjusting stop screw "**G**" to the desired setting securely tighten lock screw "**H**" to retain setting. A four-position barrel stop or a single-position stop with .0001" indicator are available as extra equipment, see page 31.

CARRIAGE GIB—Figure 3

After considerable use it may be necessary to adjust the carriage gib. To tighten gib loosen screw at small end of gib at left-hand end of carriage. Then advance screw "**I**" at right-hand end of carriage until gib is snug against bed and then tighten screw at left-hand end of carriage to anchor gib in place.

Excessive gib pressure or drag does not improve machine performance—check gib adjustment by moving carriage along bed. Generally, it is best practice to tighten gib a little on the tight side and back off adjustment until proper carriage feel is obtained.

CROSS-SLIDE—Figure 4

The cross-slide can be positioned by either screw feed or *lever feed. Screw feed is used when fine tolerances or heavy cuts are involved. Lever feed is ideal on fast short cuts, particularly in non-ferrous materials. The screw feed is always engaged when ball lever "**A**" is in the extreme right-hand position, as shown in Figure 3.

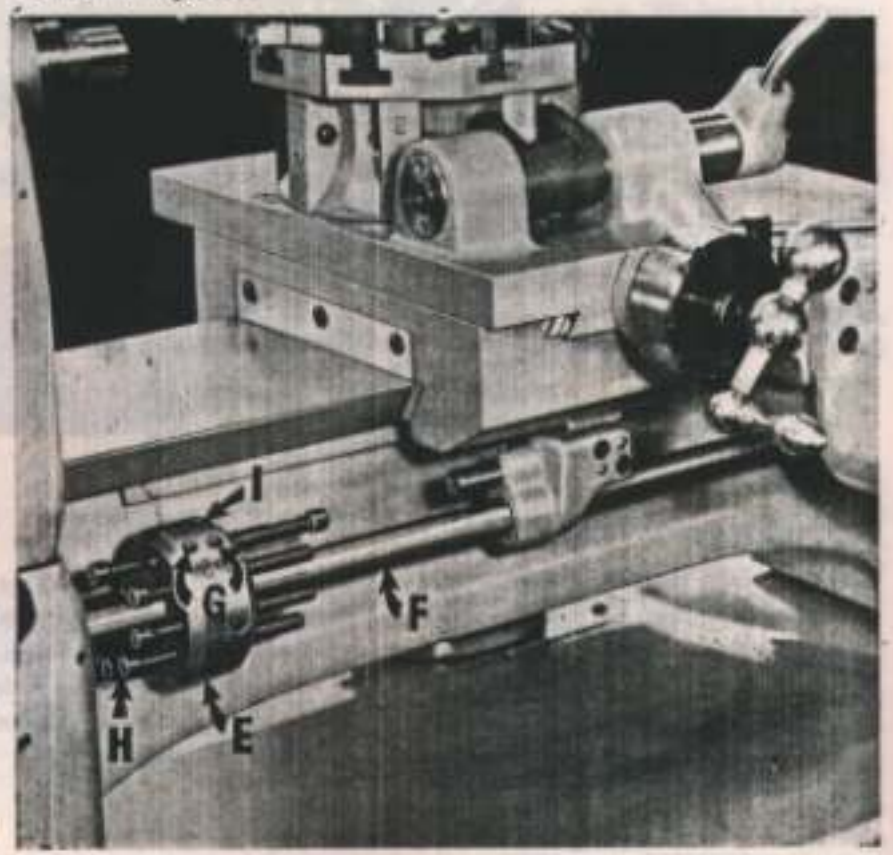


Figure 4

CARRIAGE STOP DRUM—Figure 4

The carriage stop drum "**E**" ,Figure 4, is used to position the carriage along the bed. The entire drum is adjustable along the stop drum shaft "**F**" by loosening lock screws "**G**". **CAUTION:** When set up is completed be sure lock screws "**G**" are tight so as to retain stop settings. There are eight adjustable stop screws "**H**", one for each of the eight turret stations. The setting of the carriage stop screws "**H**" is retained by lock screw "**I**". In operation, most setups can be made by using only one, two or three of the stop rod positions. Length differences of work steps can be made by moving

** Supplied on early models only*

turret tools. By using only one or two stops you will find that it is easier to set up and it also reduces job change-over time as well as speeding operations.

CARRIAGE HANDWHEEL—Figure 5

Carriage handwheel handle "**A**" may be positioned for operator's convenience by loosening nut "**B**" and rapping the back of the hand-wheel hub with a mallet; thus, releasing the taper of the hub bore from the tapered shaft. After placing handle "**A**" in desired location tighten nut "**B**" to retain setting of handle.

CARRIAGE CLUTCH ADJUSTMENT—Figure 5

To adjust carriage clutch, remove threaded plug "**C**". Then turn carriage handwheel until an adjusting screw is visible when looking straight down through opening where plug "**C**" was removed. Place a $\frac{1}{8}$" hexagon pin wrench through opening into set screw within clutch housing. Then loosen set screw only—**DO NOT REMOVE SET SCREW OR WRENCH FROM SET SCREW.**

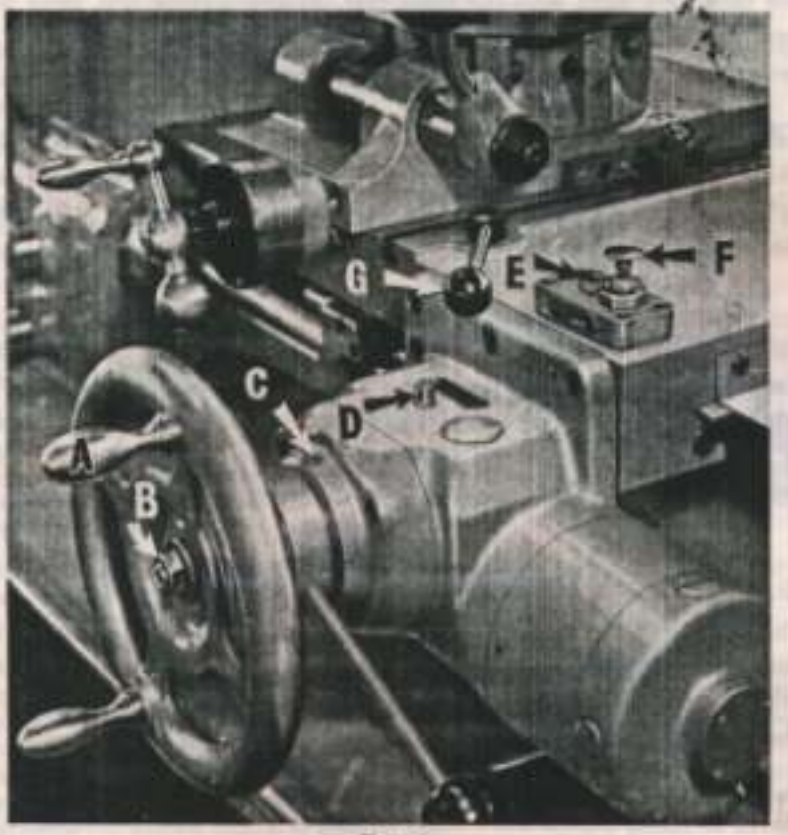


Figure 5

With wrench in loosened set screw, turn carriage handwheel to the left or toward the headstock. This will increase the clutch spring pressure. To release the spring pressure on the clutch turn the carriage handwheel to the right. It is best to adjust the clutch a little at a time in direction desired. Lock set screw and remove pin wrench and test clutch under power. Several test adjustments may be necessary before desired tension is obtained. When proper clutch adjustment is obtained tighten set screw and replace threaded plug "C".

The power feed clutch is of the friction type designed to slip when the carriage engages the carriage stop drum "E", in Figure 4.

The friction clutch has sufficient power to handle all work for which machine is intended, yet slip when in contact with the stop. This slip of the clutch does not affect the performance of the clutches. For example, when turning and facing are done with the same tool, do the turning first using power feed, engage carriage lock, disengage clutch and commence to face.

CARRIAGE CLUTCH AND GEAR BOX LUBRICATION—Figure 5

Lubricate carriage clutch and gear box once a week, using a good grade of light spindle oil. Fill oil cup "D" until oil runs out of overflow hole in under side of gear box. Do not apply grease to clutch assembly.

CARRIAGE AND BEDWAY LUBRICATION—Figure 5

Keep pressure lubricator reservoir "E" filled with a good grade of light machine oil. To lubricate carriage and bedways, pull plunger "F" up as far as it will go then release and allow it to return of its own accord. Operate pressure oiler as often as required to keep the bed ways wet with oil.

CARRIAGE LOCK—Figure 5

The carriage lock is used to hold carriage in fixed position on the bed when heavy facing operations are involved. The carriage lock handle "G" is shown in the released or unlocked position in Figure 5. Moving the ball lever toward the operator locks the carriage to the bed.

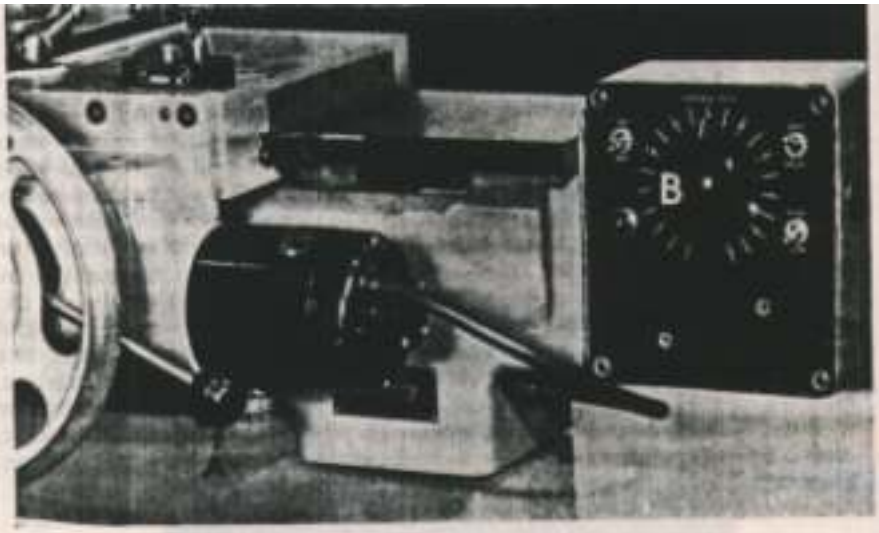


Figure 6

POWER FEED FOR CARRIAGE—Figure 6

The carriage feed is powered by a direct current, totally enclosed, ball bearing motor mounted on the carriage. The motor is connected to the clutch assembly by a worm gear.

230-volt alternating current is fed from the main electric control panel at the left-hand end of the pedestal base to the power feed control panel at the right-hand end of the machine. It is then converted in the main panel by Westinghouse Rectifiers Direct Current for the Power Feed Motor. The electric cable from control panel to power feed motor is of oil-resistant P.V.C.

To start the power feed, position the **"ON-OFF"** toggle switch to the **"ON"** position. When this is done, the pilot light will light, showing that the panel is **"ON"**.

The **"LEFT-RIGHT"** toggle switch is used to reverse the power feed motor. Select the direction of feed required by positioning the **"LEFT-RIGHT"** toggle switch accordingly. When placed in **"LEFT"** position carriage will feed toward left or toward headstock. When in **"RIGHT"** position carriage will feed toward right.

The **"HIGH-LOW"** toggle switch changes the speed of the power feed motor. This switch may be changed from **"HIGH"** to **"LOW"** or **"LOW"** to **"HIGH"** without stopping power feed motor.

In operation, the carriage is advanced with the handwheel until the turning or boring tool is next to the work. Then, the carriage clutch is engaged by raising clutch lever **"A"**, Figure 6. The rate of carriage feed can then be increased or decreased by turning feed control knob **"B"** on electric control panel. The rate of feed is determined by material being cut and the finish required. The rate of feed may be changed while the tool is under cut. Experience has shown that it is best to make a few sample pieces to determine the spindle speed and rate of feed that is best suited to give desired surface

finish and production rate. When making the test run, record the number at which the power feed control knob "**B**" was set, when best results were obtained. Then, on the production run the operator can set control knob "**B**" to the reference numbers on the face of the control panel and obtain the same results as the test run. They do not represent either thousandths per revolution or inches per minute. For set up work or time study, the rate of feed in thousandths per revolution or inches per minute can be determined by the following method. When the carriage is moving at the desired rate of feed, draw a pencil line across the bed at the trailing edge of the carriage. Then, time the travel for one minute and draw another line across bed, then disengage the clutch handle "**A**" stopping the carriage. Measure the distance between the lines—this distance is in **inches per minute.** To convert inches per minute into thousandths per revolution, divide by the number of revolutions at which the spindle is set to run. Example:

$$\text{Feed per revolution} = \frac{\text{Inches per minute}}{\text{Revolutions per minute}}$$

When machine is operating at a spindle speed of 1,400 r.p.m., and the carriage feed rate is 7" per minute. $7 \div 1{,}400 = .005$" feed per revolution.

HOW TO REMOVE COLLET CLOSER—Figures 7 and 8

The collet closer should be removed from the machine when using jaw chucks, face plates, fixture plates or other nose type fixtures. Running the machine with the collet closer in place and **without a collet** will cause damage to the collet closer. It is also a good practice to remove the collet closer assembly occasionally and clean the inside of the headstock spindle. This is easily done by the use of a cloth and length of small diameter bar stock. To remove the collet closer remove link pin "**A**" Figure 7. This pin is easily removed by the use of a mallet and brass punch, striking pin at point "**B**". **CAUTION: DO NOT REMOVE COLLET CLOSER BY REMOVING SCREW "E"**, Figure 8. This screw is adjusted properly at the factory for proper operation of collet closer. Remove only link pin "**A**", Figure 7. After removing pin "**A**" remove collet closer as shown in Figure 8. It is then necessary to remove adjusting nut "**C**". This is done by pulling nut straight off end of spindle. **DO NOT TURN ADJUSTING NUT—IT IS NOT THREADED TO SPINDLE.**

APPLYING COLLET CLOSER—Figures 7 and 8

Clean the inside of the headstock spindle before applying collet closer. Also, clean outside diameter at rear of spindle where adjusting nut locates. Clean collet closer tube inside and out.

Apply a film of light oil on rear of headstock spindle and apply adjusting nut "**C**". Apply a film of light oil on bearing, section "**D**", Figure 8, of collet closer tube and slide closer on machine and insert link pin "**A**", Figure 7.

Figure 7

Figure 8

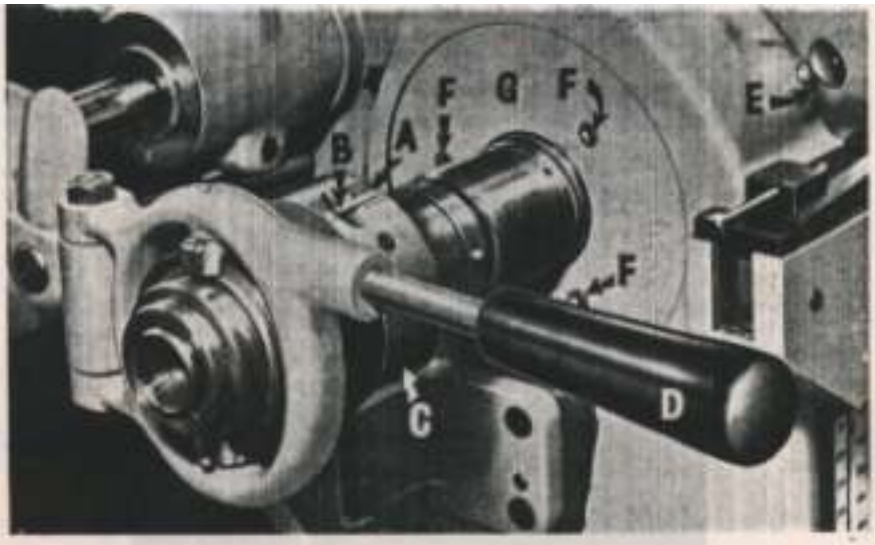


Figure 9

ADJUSTING COLLET CLOSER—Figure 9

1. Apply the desired size collet or step chuck to the machine spindle. Be sure the collet or step chuck and spindle are clean.

2. Open collet closer latch "**A**", Figure 9, by pressing down at point "**B**".

3. Start the collet closer tube on the collet or step chuck and thread about two turns only. To turn the collet closer tube, the operator, using his left hand, turns the black shell guard "**C**", Figure 9, forward while he holds the collet or step chuck in place with his right hand.

4. Place a work piece in the collet or step chuck.

5. Move lever "**D**", Figure 9, to the extreme left or closed position and then turn shell guard "**C**" toward the operator until it is drawn up as far as it will go by hand. If headstock spindle should turn, lock spindle by pressing in spindle lock pin "**E**", Figure 9. To engage lock pin "**E**" into notches provided, turn the spindle by hand until pin enters notches.

6. Move lever "**D**" forward to the released position and turn shell guard "**C**" toward operator so that latch "**A**" advances two notches on the adjusting nut "**C**", Figure 8.

7. Close latch "**A**" and test collet closer for tension on work. Should additional gripping pressure on the work be required, open latch "**A**" and turn shell guard "**C**" toward operator. For less gripping pressure turn shell guard "**C**" away from operator.

SPINDLE LOCK PIN—Figure 9

Spindle lock pin "**E**", Figure 9, is shown in the "**out**" or released position. The pin is held in this position by a spring-backed ball and detent groove in pin.

The spindle lock pin is used to hold the headstock spindle stationary when applying or removing spindle nose attachments, adjusting collet-closer, changing lead screws (HCT model) or when applying and removing work from box type fixtures or threaded arbors.

To engage lock pin, turn spindle by hand and hold lock pin "**in**" until it engages the notches in drive pulley or spindle. **BE SURE TO WITHDRAW LOCK PIN BEFORE STARTING MACHINE.**

COOLANT FACILITIES

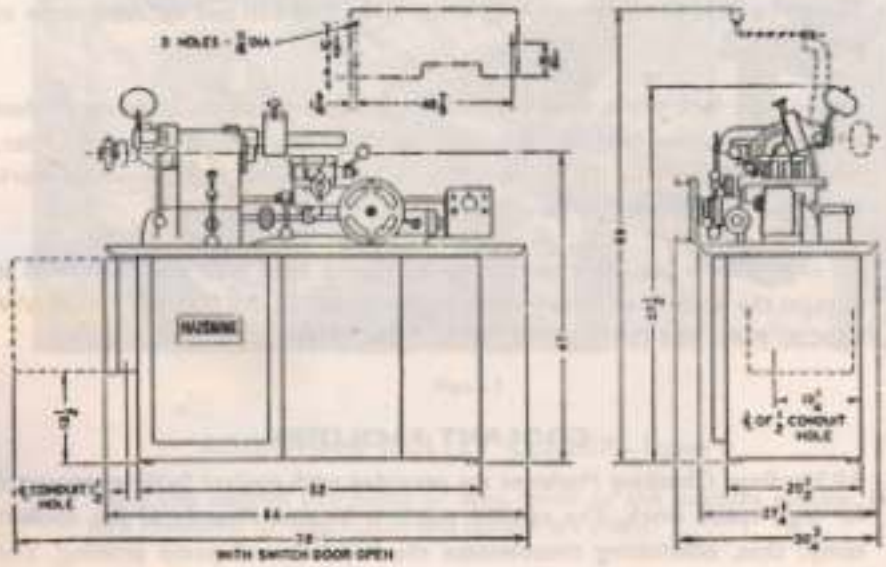
All Hardinge Chucking Machines are provided with coolant facilities required for high speed work. The coolant pump is located directly in the coolant sump; thus, eliminating troublesome check valves and pump priming. The pump is driven by an individual motor mounted directly above the sump. The pump motor is controlled by a conveniently located switch at the front of the electric control panel at left-hand end of pedestal base.

The pump will handle most common types of oil or water soluble coolants.

CAUTION: When using water soluble coolants, be sure mixture is correct to prevent rusting of machine and work.

Clean sump regularly, depending upon type of material being run. When machine cast iron or other powdery material dry, cover sump screen to prevent powdery material from mixing with coolant.

MACHINE FLOOR PLAN



MODEL HCT

The drawing above gives general floor plan dimensions of the model HCT Hardinge Chucking Machine with the production threading head.

MODEL HC

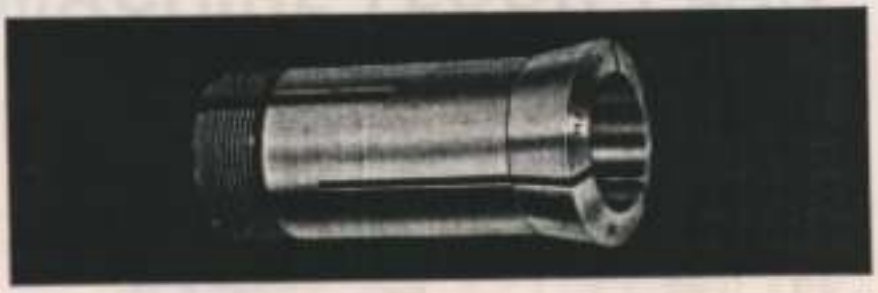
Model HC Hardinge Chucking Machine is of the same basic specifications as the model HCT unit. The only difference is the overall height as the HC model does not have the threading unit; therefore, disregard the 57¼" and 69" dimensions shown on the above drawing.

TOOLING

The next twelve pages cover standard tooling available for both the HC and HCT model Hardinge Chucking Machines.

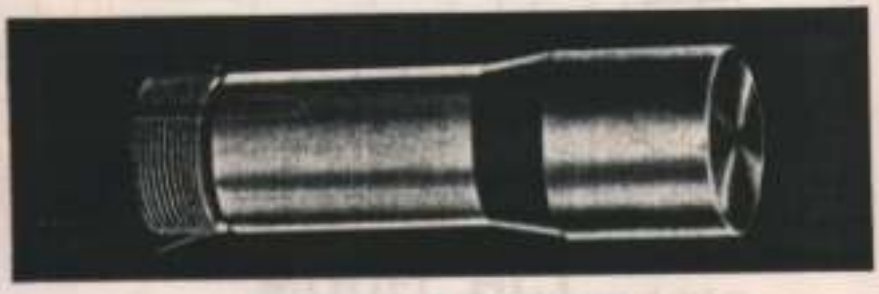
In tooling certain jobs it may be necessary to make a special fixture to be applied to the threaded headstock spindle nose or the fixture to have a collet type shank. Dimensional information relative to the threaded nose spindle, fixture mount is given at the top of page 25. Collet fixture shank dimensions are given at the bottom of page 22. Other dimensional information is given where required to help in preparing tooling for these machines.

HEADSTOCK SPINDLE TOOLING



5C HARDINGE COLLETS

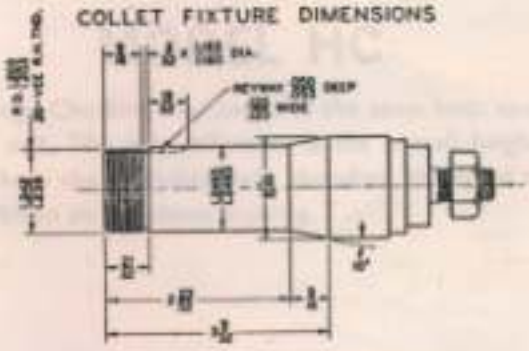
The Hardinge Chucking Machines take 5C Hardinge collets with capacity of 1" round $\frac{7}{8}$" hexagon and $\frac{3}{4}$" square. Hardinge precision collets are manufactured to exact precision standards and are available in all types and sizes for all makes of lathes and milling machines, as well as our own precision machines.



5C HARDINGE PLUG CHUCK

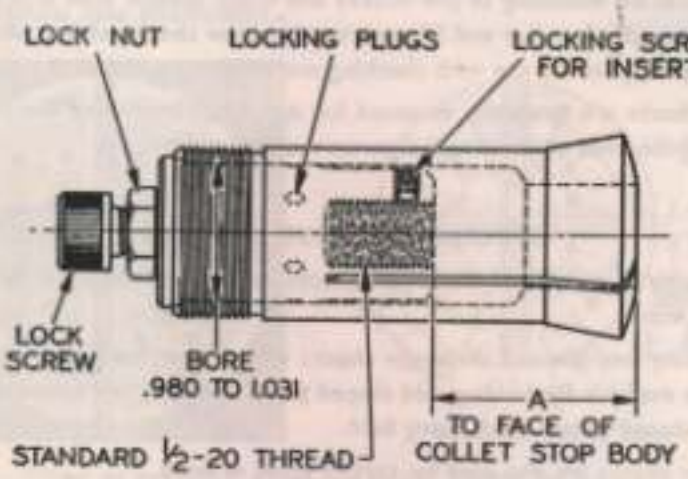
The collet shank section is finished for direct application to your machine spindle. The nose section is 1-15/32" in diameter and 1-3/4" long. It can be machined in place for the greatest degree of accuracy to suit your particular requirements for special arbors.

COLLET FIXTURE DIMENSIONS



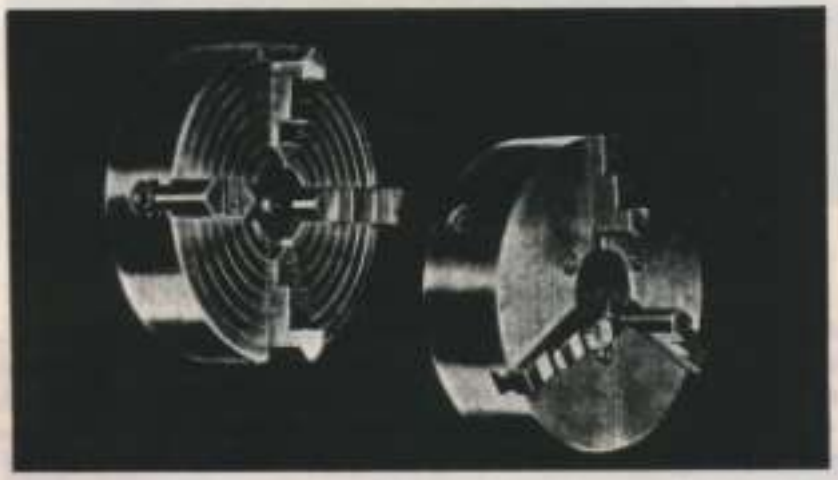
UNIVERSAL COLLET STOP

This stop converts 1" capacity 5C HARDINGE collets into solid stop or spring ejector stop collets, without alteration of the standard collets. The application of this stop to the collet requires no machining. In other words, all collets used with this machine can be used in the regular manner or as solid stop collets or as spring ejector stop collets.



Dimension "**A**" is equal to 1-3/8" and is the maximum depth a part may be chucked using a solid stop. The maximum depth for spring ejector stop is 13/16". This is due to space required for spring ejector construction.

HEADSTOCK SPINDLE TOOLING



JAW CHUCKS*

Chucking machines are supplied with a threaded nose headstock spindle for rapid accurate mounting of jaw chucks and other spindle nose attachments. The 5" capacity four-jaw and 5" capacity three-jaw chucks, shown above, are regularly supplied for use with chucking machines.

These chucks are integrally mounted for direct application to the threaded nose spindle, thus eliminating a separate mounting plate.

SPECIAL PURPOSE CHUCKS

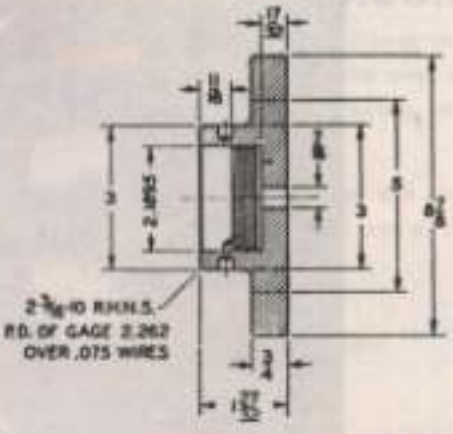
6" capacity four-jaw and three-jaw chucks can also be supplied for larger, heavier work.

6" capacity four-jaw and three-jaw chucks with master jaws to take soft top jaws are available for holding odd shaped parts. Soft jaws are inexpensive and can be shaped to suit work being held.

Two-jaw chucks are also used for certain types of work.

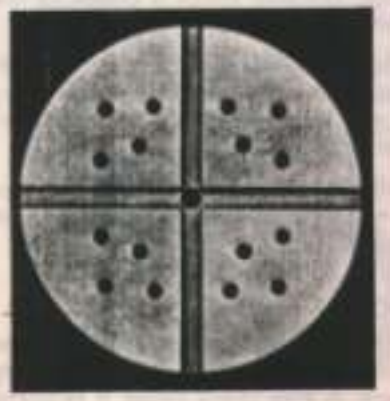
Hardinge can supply the chucks mounted on a regular fixture plate for direct application to the machine spindle.

*When ordering specify for threaded Nose Spindle and give machine Serial No.



FIXTURE PLATES*

The fixture plate is machined all over for direct application to the headstock spindle. The three sizes are: 3", 5" and 8-7/8".
This plate can be machined to become a fixture or for mounting fixture to hold work. See illustration at bottom of page 4 for example of using the standard fixture plate as a base for a built-up work holding fixture.
Fixture plate can also be used for mounting special purpose jaw chucks or other spindle nose attachments.

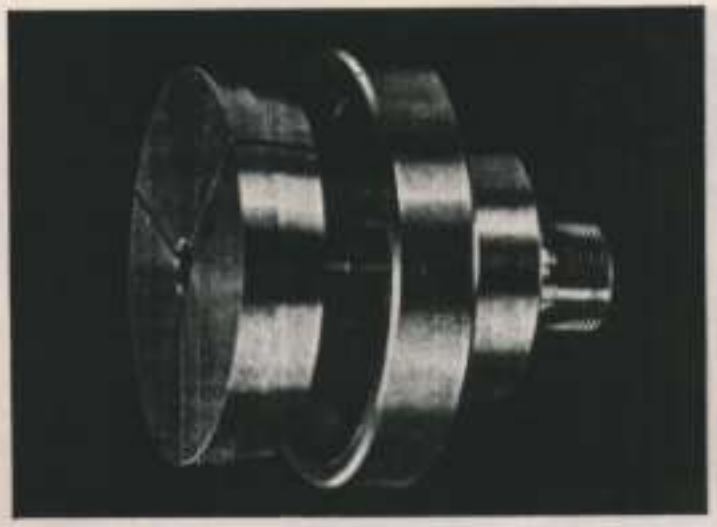


9" SLOTTED AND TAPPED FACE PLATE*

The slotted and tapped face plate is used for holding irregular shaped pieces. Holes are*drilled and tapped to permit the use of standard bolts when clamping work.

*When ordering specify for threaded Nose Spindle and give machine Serial No.

HEADSTOCK SPINDLE TOOLING



STEP CHUCK CLOSER STEP CHUCK

5C HARDINGE STEP CHUCKS

A step chuck is exceptionally useful for accurately holding work larger than 1" diameter up to 6" diameter. Tubing can be held without crushing or distorting. The step chuck will also hold castings, mouldings, stampings and machined parts rigidly and accurately. The standard ball bearing lever operated collet closer is used to close the step chuck. The step chuck is closed by the taper on the periphery seating in the taper of the closer.

We carry 2", 3", 4", 5" and 6" step chucks and closers for all Hardinge headstocks. They are ⅛" larger in diameter than the rated size, so the full capacity step may be readily applied. Step chucks may be purchased in finished form, split only, or split and stepped to specifications.

Many users purchase step chucks, split only, and then apply the desired steps while the step chuck is in place on the machine, assuring dead accuracy of the steps in relation to the headstock spindle.

STEP CHUCK CLOSERS*

A closer is required for each size step chuck. The closer fits directly to the machine spindle and has a taper corresponding to the taper on the periphery of the step chuck for closing the step chuck. A step chuck closer is required for each nominal size step chuck to place the closing pressure over the stepped area of the chuck, resulting in greater gripping power and accuracy.

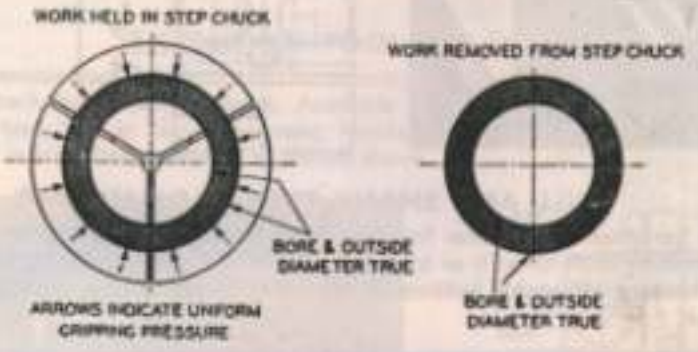
With locating pins applied in the step chuck closer and with clearance holes for the pins drilled in the step chuck, work may be held to predetermined length.

*When ordering specify for threaded Nose Spindle and give machine Serial No.

ADVANTAGES OF USING STEP CHUCKS

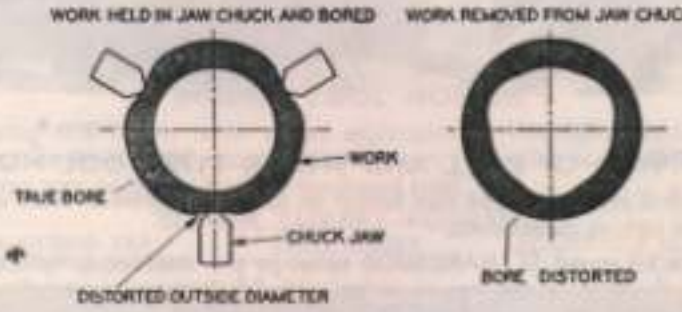
Step chucks, developed by precision instrument makers are a time-proven method of holding work, rigidly and accurately. Step chucks take over on sizes above the regular collet capacity, providing collet-like accuracy, convenience, and precision results as with collets.

WHEN USING STEP CHUCKS: Analytical consideration of the gripping pressure applied on the work by a step chuck clearly shows one of the advantages of using step chucks.



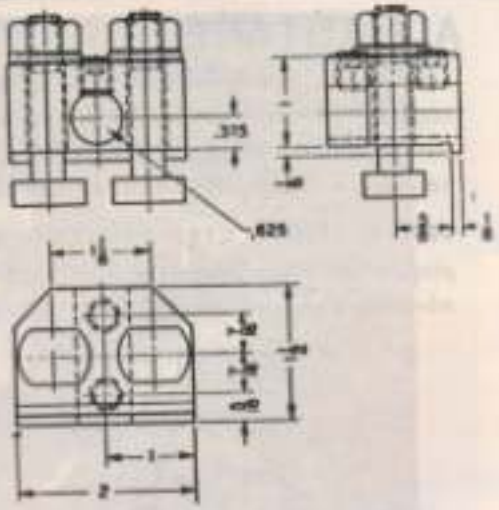
Note how the gripping pressure is uniformly distributed over the entire circumference of the work. The large gripping area prevents distortion and eliminates marking of the work.

WHEN USING JAW CHUCKS: Studied consideration of the gripping pressure applied on the work by a jaw chuck clearly shows the disadvantage of using jaw chucks for precision work.



Note how the localised gripping pressure of the jaws distorts the work. The small area of the gripping surface of the chuck jaws will also mark the surface of the work.

TURRET TOOLING



DRILL AND SHANK TYPE TOOL HOLDER

This hardened steel holder fits directly to the eight-station turret. It is used for holding drills directly or by brushings, or for holding drill chucks, releasing tap holders, adjustable holders or any other turret tooling with $\frac{3}{4}$" diameter shank.

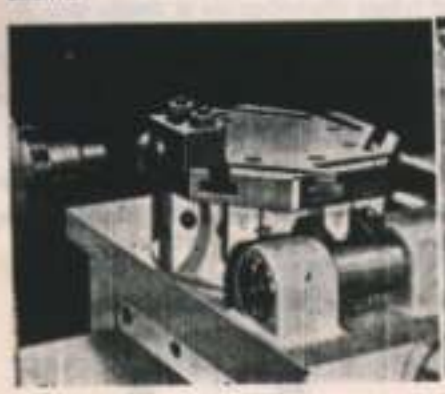


Illustration A

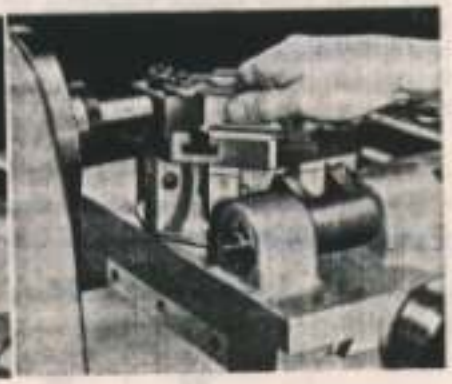
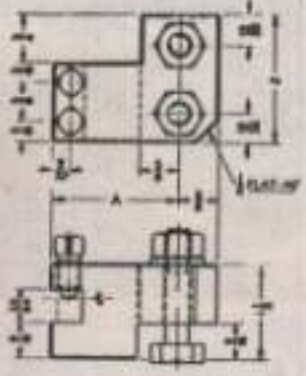


Illustration B

SETTING OF DRILL AND SHANK TYPE TOOL HOLDER

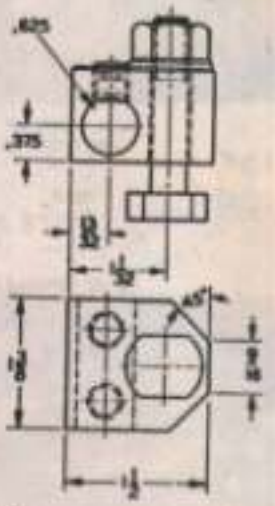
Place drill and shank type tool holder on turret as shown in illustration "**A**". Do not tighten clamp bolts.

Place a 1" round 5C HARDINGE collet in the machine spindle and chuck standard set-up gauge bar in collet with $\frac{3}{4}$" diameter protruding. The $\frac{3}{4}$" diameter fits the bore of the drill and shank type tool holder. The set-up gauge bar is standard equipment supplied with each chucking machine. Advance carriage by hand. Enter $\frac{3}{4}$" end of set-up gauge bar into bore of drill and shank type tool holder as shown by illustration "**B**". Then tighten two clamp bolts to retain this alignment of holder.



EXTENSION TOOL HOLDERS

The extension tool holder is used for turning and boring large diameter parts or for back facing flanged work. Available in four sizes: 2", 3", 4" and 5" lengths (see "A" in above diagram). Holder takes $\frac{3}{8}$" square standard tool bits and is furnished complete as shown above.



BORING TOOL HOLDER

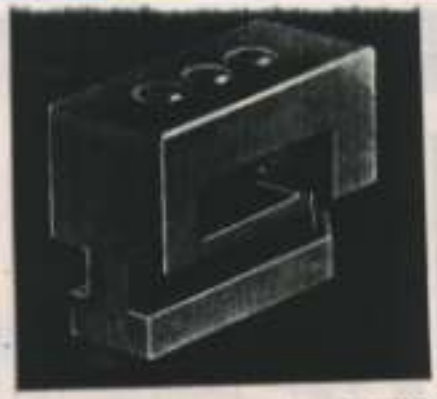
The boring tool holder is for direct application to the eight-station turret. It is used for holding $\frac{3}{8}$" diameter boring bars or boring tools. The body of the boring tool holder is made of hardened steel.

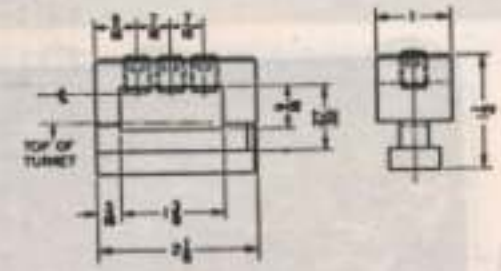
OTHER TURRET TOOLING

RELEASING TAP HOLDER $\frac{1}{4}$" CAPACITY

DRILL CHUCK $\frac{1}{4}$", $\frac{3}{8}$" or $\frac{1}{2}$" CAPACITY

ADJUSTABLE HOLDER $\frac{1}{4}$" CAPACITY

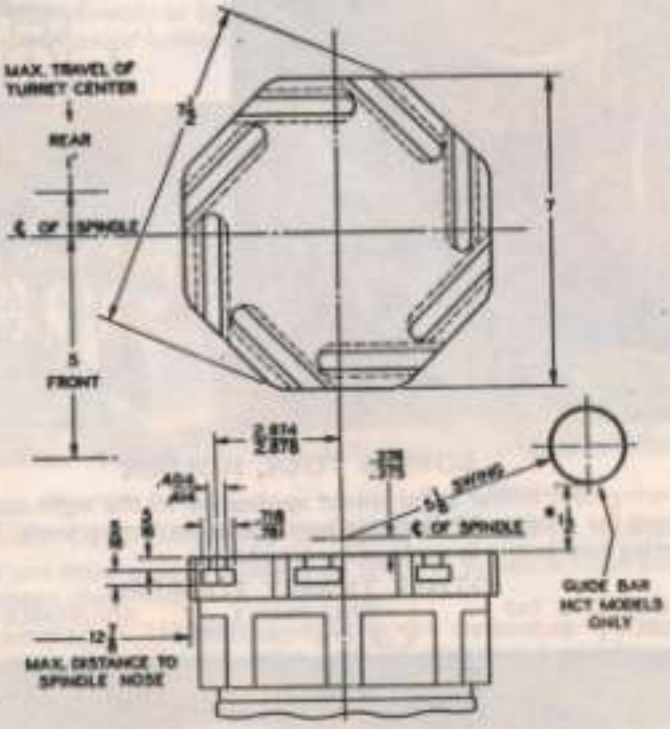




TRIPLE TOOL HOLDER

The triple tool holder fits directly to the turret and is used to hold three standard $\frac{3}{8}$" square tool bits.
The tool holder body is made of hardened steel and has three clamp screws—one for each tool bit to facilitate rapid set-up.
Four double tool holders and four single tool holders are supplied with the machine as standard equipment.

TURRET DIMENSIONS



* 1" CLEARANCE WITH OVERARM SUPPORT BRACKET IN PLACE

TURRET CROSS SLIDE TOOLING

FOUR POSITION INDICATOR STOP

Four position indicator stop is available for direct application to the cross slide and carriage. Used when several close tolerance diameters are involved. Barrel stop screws have a 2" range and provide fine adjustment. The entire barrel stop assembly is adjustable along the T-slot of carriage.

The indicator reads to .0001" and is of the jewelled bearing type. An over-travel arrangement is provided to protect the precision indicator.

SINGLE POSITION INDICATOR STOP

The single position indicator stop is available for direct application to cross slide and carriage. Stop block is adjustable along T-slot to suit particular jobs. Fine adjustment is made with adjusting screw in stop block.

The indicator reads to .0001" and is of the jewelled bearing type.

INSTRUCTION FOR OPERATION of PRODUCTION THREADING HEAD for MODEL HCT CHUCKING MACHINES

The production threading head permits production of accurate threading of an almost limitless range of pitches without the use of detrimental change gears. A lead screw of the desired pitch is applied on the ground diameter at the rear of the headstock spindle. A lead screw is used for each different pitch to be cut. There are no intervening gears; therefore, an accurate duplication of the lead screw is assured.

The threading head and follower arm are connected by a hardened and ground guide bar which moves through long adjustable bearings at the rear of the headstock. In other words, the whole unit is in reality one piece moved only by the lead screw. In operation, the follower arm is lowered and the follower contacts the lead screw, causing the guide bar and threading head to move in unison toward the headstock according to the lead of the lead screw.

Figure 10

THREADING UNIT CONTROL HANDLE

This handle is used to swing the production threading unit in and out of operating position, as well as returning threading tool to starting position. Engaging of lead screw follower with lead screw is also done with the control handle "**A**", Figure 10. Control handle "**A**" is adjustable to suit the operator by loosening clamp bolt "**B**". The position of handle shown in Figure 10 is most universally used.

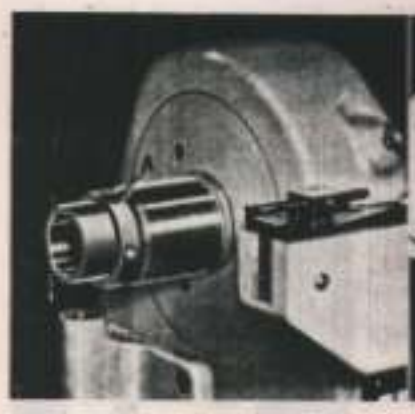


Figure 11

Figure 12

HOW TO CHANGE LEAD SCREWS

Figure 11 and Figure 12

1. Remove collet closer and adjusting nut, per instructions on page 16.
2. Remove lead screw retaining-nut "A", Figure 11. **DO NOT USE PUNCH AND HAMMER METHOD OF LOOSENING OR TIGHTENING AS THIS POOR PRACTICE WILL DAMAGE THE PRECISION SPINDLE.**
3. Remove lead screw.
4. Clean spindle surfaces "B" and "C", Figure 12. Apply a few drops of spindle oil on surfaces "B" and "C" as this will prevent rust and facilitate easy removal of lead screw.
5. Clean desired lead screw and apply to spindle so that slot in shoulder section of lead screw is around key in spindle.
   CAUTION: Do not force lead screw on spindle. If lead screw binds on spindle remove lead screw and look for dirt, chips or burrs.
6. Apply lead screw retaining nut "A", Figure 11, and tighten nut with spanner wrench.
7. Replace adjusting nut and collet closer per instructions on page 16.
8. Lubricate lead screw thread surface with good grade of spindle oil before starting threading operation. Also lubricate lead screw occasionally during a production run. Lubricating lead screw will materially increase life of lead screw and follower.

HOW TO CHANGE AND ADJUST LEAD SCREW FOLLOWERS

A separate lead screw follower is required for each lead to be cut. The follower must be of the same pitch as the master lead screw.

1. Apply the bronze lead screw follower "**A**" to the follower arm "**B**", Figure 13. The side of the follower stamped with the number corresponding to the pitch of the follower should be away from follower arm "**B**" as side not stamped is the surface held square and true for reference. Tighten nut "**C**" with fingers only—**DO NOT LOCK LEAD SCREW FOLLOWER** tight to follower arm until aligned with lead screw on spindle, per following instructions.

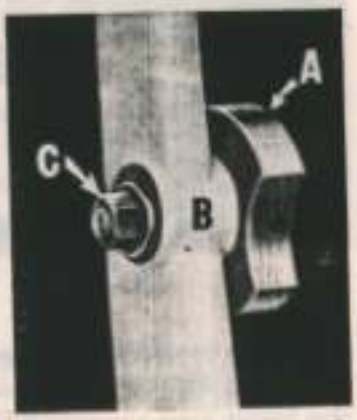


Figure 13

2. Bring lead screw follower arm "**B**", Figure 14, into operating position as shown.

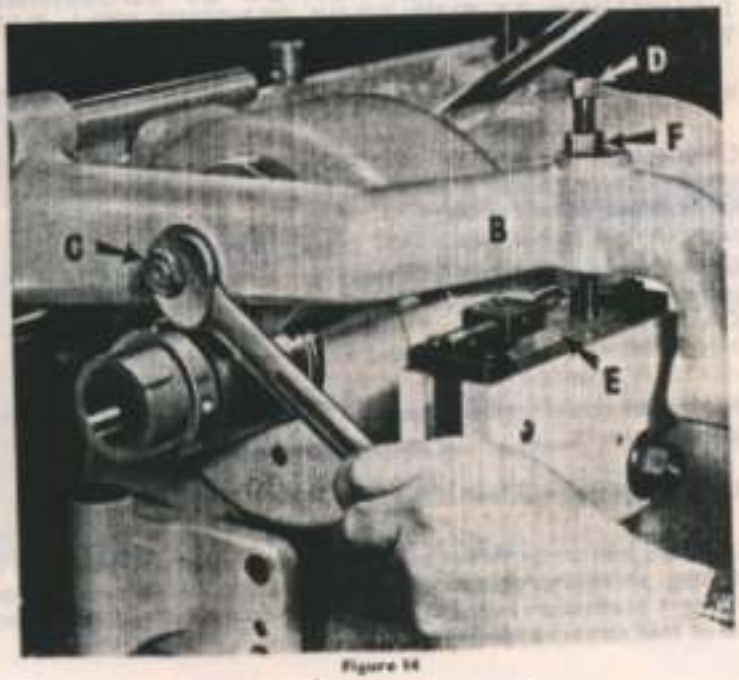


Figure 14

3. With lead screw follower **"A"**, Figure 13, loose, engage it, with lead screw and back of guide screw **"D"**, as shown in Figure 14, until end of guide screw **"D"** does not bear on guideway **"E"** of automatic thread length control. This will allow lead screw follower to seat full depth into thread of lead screw. It may be necessary to rotate spindle slightly to engage follower properly. This may be done by hand or by jogging motor using Reverse-Forward control lever. Guideway **"E"** must be in position shown in Figure 14 when setting follower—**Not** in raised position as shown in Figure 16.

4. Tighten lead screw follower retaining nut **"C"**, locking lead screw follower securely in place.

5. With lead screw and follower properly engaged, turn guide screw **"D"** down until it contacts guideway **"E"**. Then turn the guide screw a fraction of a turn more to raise the lead screw follower a few thousandths of an inch from the lead screw; thus, assuring positive contact of guide screw with guideway.
IMPORTANT: Lead screw follower must always clear lead screw, and guide screw must bear on guideway.

6. Lock guide screw **"D"** by tightening lock nut **"F"**, Figure 15, against follower arm **"B"**. **DO NOT PERMIT GUIDE SCREW "D" TO TURN WHEN LOCKING NUT "F".**

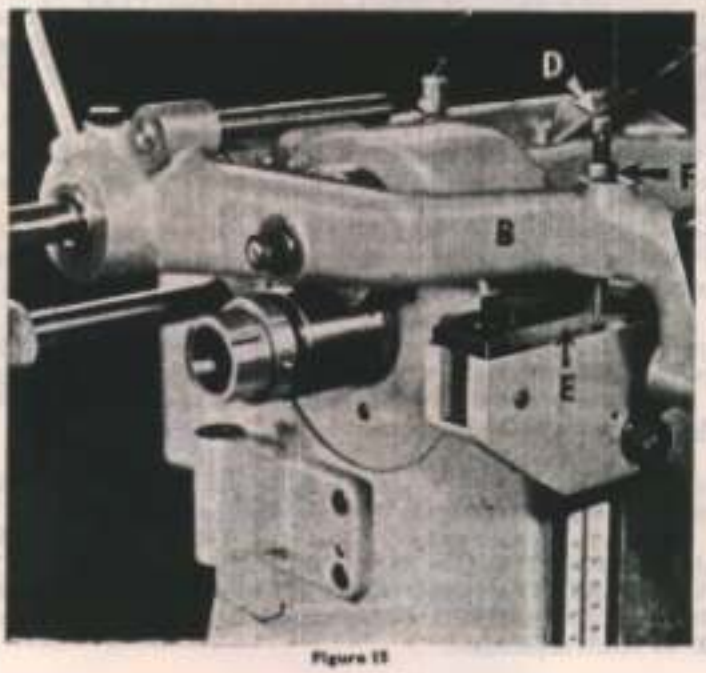


Figure 15

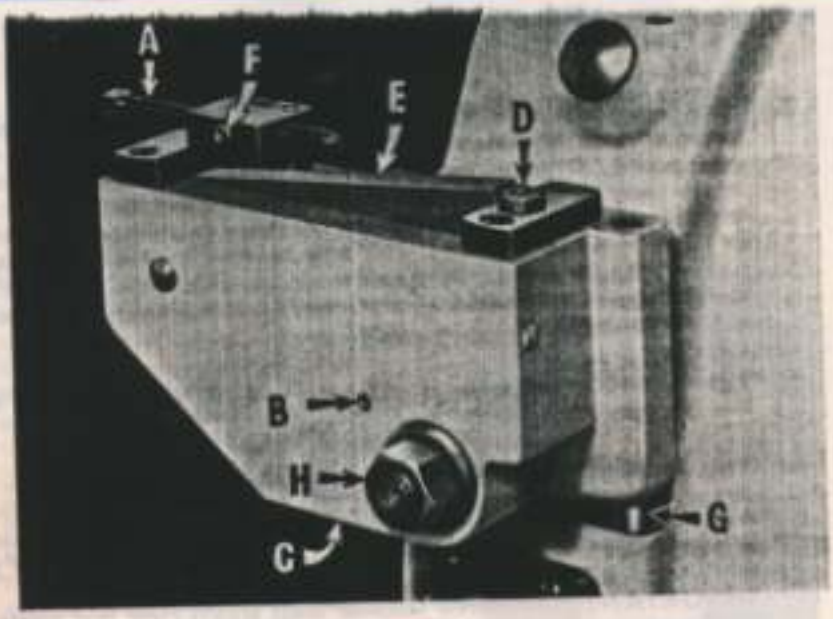


Figure 16

AUTOMATIC THREAD LENGTH CONTROL—Figure 16

The production threading unit is automatically controlled by the automatic thread length control shown by Figure 16. This control unit automatically stops the threading tool at any predetermined position. By the use of this control, threads may be cut at high speed to shoulders or into bottomed holes.

In operation, the automatic thread control accurately guides the threading tool and, at a predetermined point, releases the follower from the lead screw which disengages the threading tool and stops the movement of the follower arm and threading tool. When the release is tripped, the guideway raises for disengagement and to serve as a return guideway for positioning the cutting tool at the starting point.

Figure 16 shows the guideway "**E**" in the raised or released position. To operate automatic thread length control by hand, press guideway "**E**" down to locked position as shown in Figures 14 and 15. To release pull stop screw "**A**", Figure 16, to the left.

Should guideway "**E**" have up and down play when in the locked position loosen set screw "**B**", Figure 16. Then advance adjusting screw "**C**", located at under side of control box. **DO NOT TIGHTEN EXCESSIVELY — JUST ENOUGH TO REMOVE "PLAY". TEST ACTION OF GUIDEWAY BY HAND AND MAKE TEST RELEASES AS PREVIOUSLY DESCRIBED.** When adjustment is proper, tighten lock screw "**B**" to retain adjustment.

The vertical travel of guideway "**E**" may be adjusted by screw "**D**". Figure 16. For the regular run of work, the adjustment as it is made at the factory is proper. However, when cutting a small diameter internal thread, adjust screw "**D**" to prevent guideway from raising too high so that threading tool will clear in bore of work.

LEVELLING OF AUTOMATIC THREAD LENGTH CONTROL

Figure 16

The parallelism of a thread is determined by the accuracy of the setting of the thread length control unit. There are two levelling screws "**G**", Figure 16. (Only one is shown in illustration—the other is the same distance to the left of the swivel post.)

To level control unit, loosen clamp nut "**H**" just enough to permit the unit to be rolled by adjusting screws "**G**". To check guideway for parallelism see Figure 17, Page 38. After securing desired setting tighten clamp nut "**H**". Lubricate thread length control by flushing light spindle oil over guideway.

SETTING THREAD LENGTH—Figure 16

After the production threading head has been set properly (with follower arm to extreme right so that tool will be in starting position), the length of travel can be set by loosening lock screw "**F**" and moving stop screw "**A**" accordingly. Testing for length must be done by running machine as in actual operation. When adjusting to cut to a shoulder or bottomed hole, always start by making setting short and gradually move adjusting screw "**A**" until desired setting is obtained. When proper length of travel is established tighten lock screw "**F**".

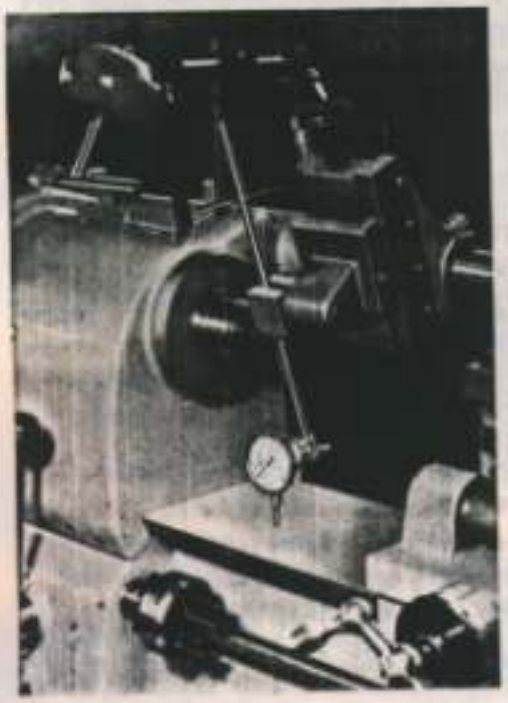


Figure 17

CHECKING SET UP FOR PARALLELISM

Figure 17

When setting up for threading operation the first and most important step is to check the automatic thread length control unit for parallelism as per instructions for levelling given on page 37.

Wipe top of bed clean, mount indicator in tool block and travel threading head by running machine at low speed of **130 r.p.m.** Adjust levelling screws "**G**", Figure 16, until indicator reads zero when moved along bed by power operated motion of the threading head as when cutting a thread.

PRODUCTION THREADING HEAD—Figure 18

The production threading head carries the threading tool for either internal or external threads. In operation, the threading tool is fed into the work by hand knob "**A**", Figure 18. The travel of the slide "**B**" is governed by stop screw "**C**". The position of stop screw "**C**" is retained by lock screw "**D**". The setting of stop screw "**C**" is obtained by actually cutting a thread and checking with gauge until a proper fit is obtained. Then, with stop screw tight against stop block, lock with screw "**D**".

The threading head is adjustable around and along guide bar "**E**", Figure 18. To move threading head on guide bar, loosen the two clamp bolts "**F**" at rear of unit. **BE SURE THESE BOLTS ARE TIGHT BEFORE STARTING THREADING OPERATION.**

The gib for slide "**B**" must always be adjusted to a snug fit. The adjustment is made by gib screw "**G**". After adjusting gib screw, lock screws with gib screw lock nuts to retain setting.

Figure 19

Figure 18

SETTING THREADING HEAD AT PROPER ANGLE—Figure 18

With work piece in place and threading tool in threading head, set threading head at 20 degrees from vertical as illustrated in Figure 18. It is necessary to have work piece in place to obtain correct lengthwise position of head along guide bar "**E**".

Threading tool can be set in tool holder "**H**" in an approximate position. Adjust threading head until threading tool is about $\frac{1}{4}$" from end of work. (When setting threading head be sure follower arm "**B**", Figure 14, is to the extreme right against headstock.)

SETTING THREADING TOOL HOLDER—Figure 19

Use same protractor setting of 20 degrees as in positioning threading head, Figure 18. To roll tool block "**H**", loosen clamp bolt "**I**", Figure 19, and turn tool block until it is parallel with straight edge of protractor. Then, lock clamp bolt "**I**".

It may be necessary to adjust tool holder block body "**J**" on slide "**B**" to bring cutting edge of tool to diameter of work to be threaded. To move tool holder block body "**J**", loosen clamp screws "**K**". **BE SURE THESE SCREWS ARE TIGHT BEFORE STARTING THREADING OPERATION.** Tool block "**H**" is also adjustable "**in**" and "**out**" from tool holder body "**J**" by loosening clamp bolt "**I**" and then turning screw "**L**". This adjustment is used to pick up threads when part is practically completed and tool must be sharpened, or it is desired to reach in the work to give additional clearance past threading head for work and fixture.

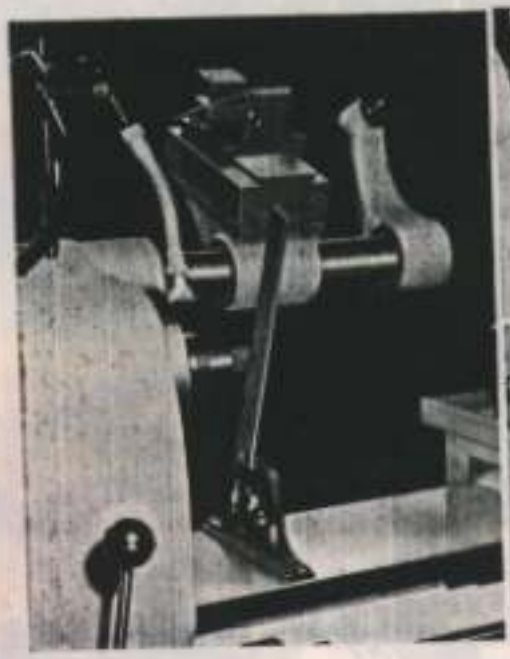


Figure 20 Figure 21A (top) Figure 21B (bottom)

SETTING EXTERNAL THREADING TOOL—Figures 20 and 21A

1. Remove work and work holding device.
2. Apply a 1" round 5C HARDINGE collet to headstock spindle.
3. Apply tool setting gauge bar to collet and close collet.
4. Use protractor set at 20 degrees from vertical (same for setting threading head and tool block) and turn headstock spindle by hand until gauge surface is parallel with straight edge of protractor as in Figure 20. Be sure bed of machine is clean.
5. Remove protractor from machine bed. **DO NOT ROTATE SPINDLE.**
6. Swing production threading head into cutting position. Be sure guideway "E" is in position as shown in Figure 15. Then feed threading head slide down until cutting tool almost touches gauge bar. Top surface of cutting tool should be even with gauge surface as shown in Figure 21A. If it is not, adjust tool accordingly. If below centre, shim tool in tool holder to bring top of tool in line with gauge. Should top of tool be above centre, surface grind off bottom of tool.

SETTING INTERNAL THREADING TOOL—Figures 20 and 21B

Setting up for cutting internal threads the operator follows the same procedure as when cutting external threads. However, it is first necessary to rotate the tool carrying block 180 degrees from the position shown in Figure 21A to position shown in 21B with tool clamp bolts toward operator.

Note that tool setting gauge bar in Figure 21B is rotated 180 degrees from that used for external threads, Figure 20.

THREADING UNIT GUIDE BAR SUPPORT BRACKET

Figure 22

Removable bracket "**A**" and guide block "**B**", Figure 22, are supplied as standard equipment with the HCT model chucking machine. The support bracket is used to give added support to threading unit guide bar when cutting of coarse pitch thread and/or when long work makes it necessary to mount the threading head toward the outer end of guide bar. Position guide block "**B**" on turret, as shown, and clamp in place with T-bolt. Then swing production threading unit into cutting position. Lead screw must be engaged with follower and guideway of thread length control in the "**down**" position, as shown in Figure 14. To level or align guide block "**B**" with spindle apply dial indicator to tool block; the same set-up can be used as shown in Figure 17.

Figure 22

Then slide bracket "**A**" on guide bar with screw "**D**" in contact with guide blocks "**B**" and tighten the two cap screws "**C**" at rear of bracket. Turn screws "**F**", Figure 22, to align block to zero indicator reading.

When properly set up, guide bar support bracket "**A**" will govern the parallelism of the thread. Screw "**D**" should be advanced so that it touches the guide block "**B**" and leaves .001" to .002" clearance between guide screw "**D**", Figure 14, and guideway "**E**", Figure 14. After proper adjustment has been made, tighten lock nut "**E**", Figure 22, to retain adjustment.

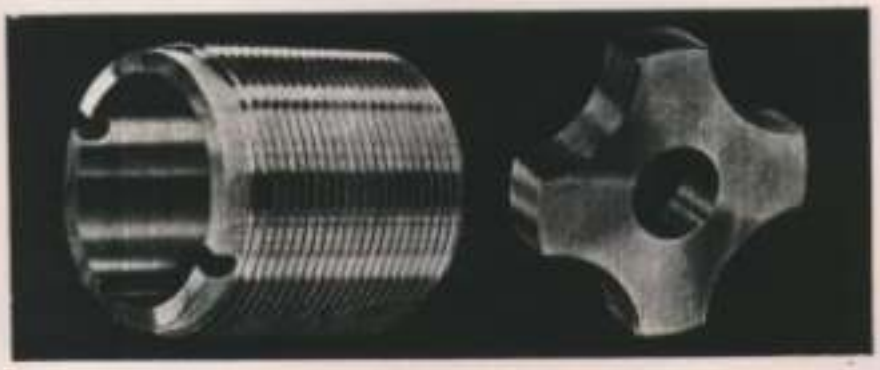
LEFT-HAND THREADS

Left-hand threads can be cut on the model HCT Hardinge chucking machine with the same ease and speed as right-hand threads. A left-hand lead screw and lead screw follower is required. The headstock spindle is run in the reverse or backward direction—this permits the cutting tool to cut from the outside in toward headstock and the automatic thread length control can be used. The tool holder block "**H**", Figure 18, must be rotated 180 degrees from the position used for ordinary right-hand threads. The cutting edge of the tool is also reversed as the spindle is running in the opposite direction from right-hand threading.

LUBRICATION AND ADJUSTMENT OF GUIDE BAR BEARINGS

Mounted on the rear of the headstock is a large bracket forming the housing and bearing for the long circular guide bar for threading unit. Fill large transparent oiler with a good grade of light spindle oil. This single oiler lubricates the entire bracket bearing sections.

The long bearings are of the split type employing the push and pull screw method of adjustment. To tighten bearings, loosen set screws and tighten large cap screws. **DO NOT OVER-TIGHTEN**: guide bar should move freely in bearings.



LEAD SCREWS

Hardened and precision ground lead screws are available for direct application to the headstock spindle. Carried in stock in the following pitches: 12, 13, 14, 16, 18, 20, 24, 28, 32, 36, 40, 50 or 64 pitch with right-hand lead.

Left-hand lead screws and other pitches are special and made to order.

BLANK LEAD SCREWS

Hardened and ground lead screw blanks are also available, finished ground to fit directly to the chucking machine headstock spindle. The user can mount the finished blank on an arbor and grind a special lead thread or leads to suit his particular requirement.

LEAD SCREW FOLLOWERS

A bronze follower having a pitch corresponding to the pitch of the lead screw is required for each lead screw. Finished lead screw followers, as shown above, are available in the following pitches: 12, 13, 14, 16, 18, 20, 24, 28, 32, 36, 40, 50 or 64 pitch for direct application to the follower arm. Each of the four sectors have the same pitch. Left-handed lead screw followers and other pitches are made to order.

BLANK LEAD SCREW FOLLOWERS

Blank lead screw followers are also available. They are machined all over except the threaded section which is blank. To thread the follower blanks, mount two followers opposite each other on a tool room lathe faceplate. Then bore and thread using the lead screw as a thread gauge.