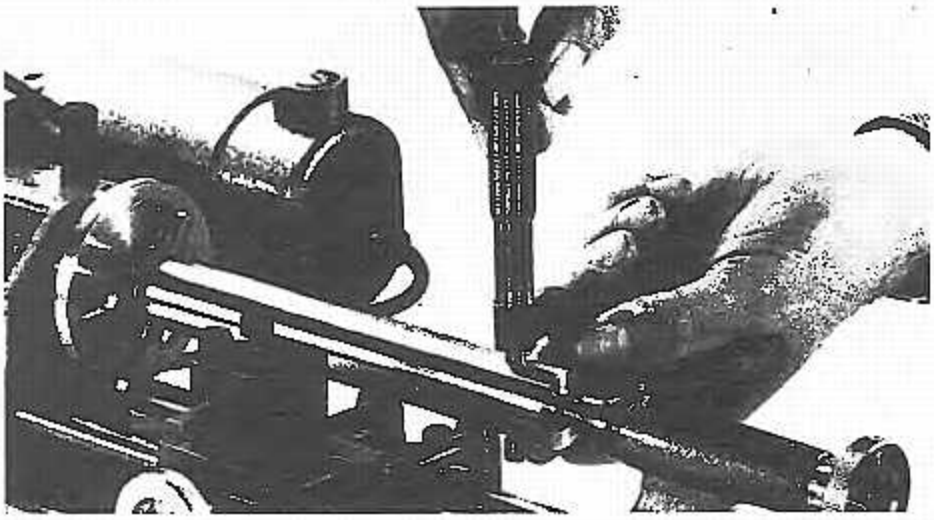
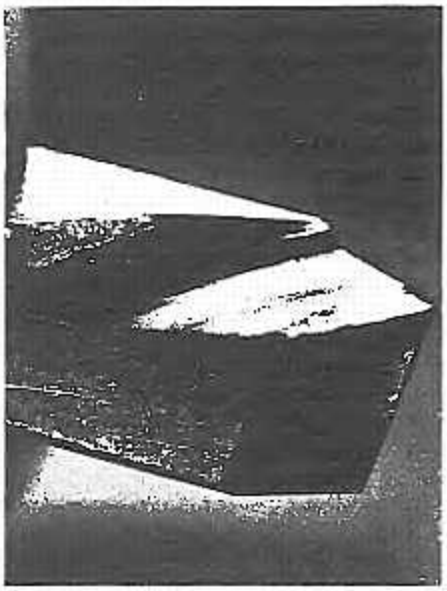


FOR PRECISION WORK the lathe spindle must be precisely aligned with the ways. Machine a test bar, measure both ends, then adjust headstock until lathe cuts true.



A "FALSE EDGE" gradually builds up on the bit's cutting edge. Whetting removes it.

notice in the course of your practice turning, a deposit of metal being machined gradually builds up along the top of the cutting edge, forming a pressure-welded "false edge." In rough turning this false edge does no harm, but for finish-turning the built-up metal should be removed by rubbing the bit's faces flat on a fine-grit oilstone. If you avoid rounding over the cutting edge, a lathe tool can be resharpened by whetting many times before it will require regrinding.

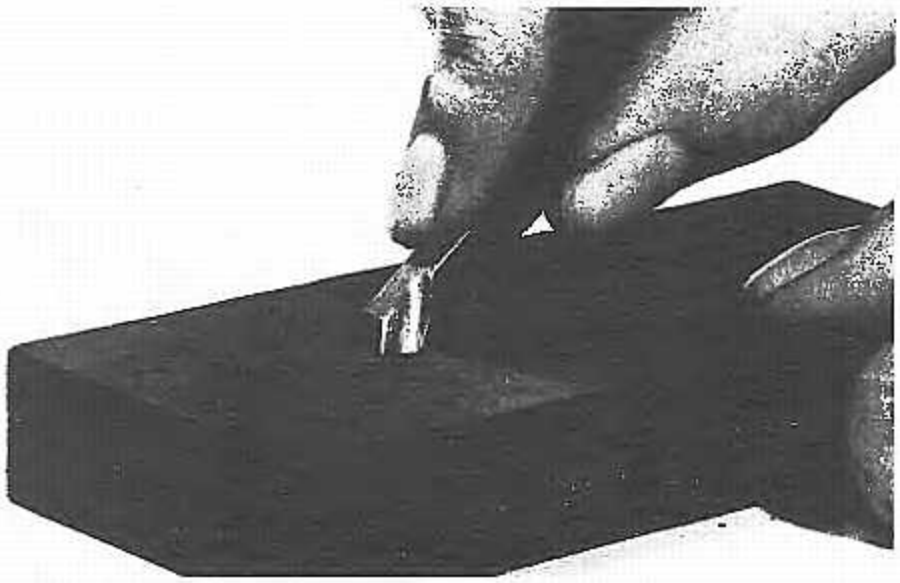
But when a tool's cutting edge finally becomes chipped and dulled, the bit needs regrinding. You can grind lathe tools on the Unimat itself with the headstock set up for grinding, or you can use any bench grinder. Regrind the bit's faces slowly on a medium-grit wheel enough to renew the edge, maintaining the tool's original shape. Avoid overheating the steel.

There are a number of fairly standard shapes of lathe tools that have proved efficient for the more common turning operations, and machinists soon learn to grind special bits for special jobs. A novice at machinework probably would be well advised to buy a set of ready-ground bits. Unimat tool bits are ground exactly like bits used in large industrial lathes—but smaller. If you can buy unground ¼"-square tool bits and grind them yourself, keep in mind the two important requirements for all metal-cutting cutting tools — clearance and rake.

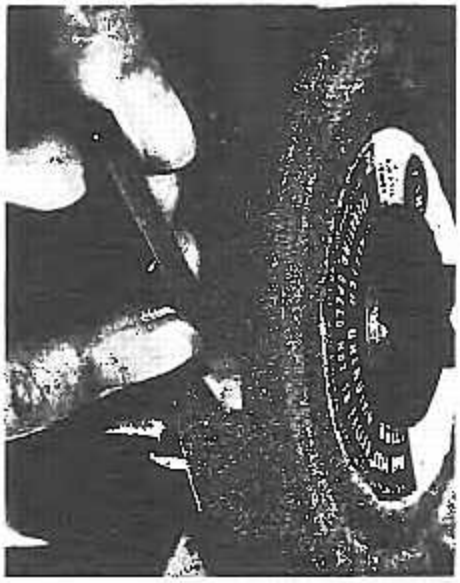
Both are angles expressed in degrees. Clearance is the angle at which the bit is ground for relief *under* its cutting edge. This relief, which usually should be about 10°, allows the sharp edge to advance into the work without rubbing. A lathe tool's cutting edge must have both side clearance and end clearance.

Rake is the angle of slope across the top of the tool. The rake may slope either sideways away from the edge or backwards from the edge. Side rake gives the cutting edge its shearing action. Back rake directs chips away from the work. In general tools with smaller rake angles (with squarer, beefier cutting edges) are used to machine hard-to-cut metals, and tools with larger rake angles (giving more acute cutting edges) are used to machine easier-to-cut metals. For turning hard cast iron, tool bits with about 10° rake usually give best results. For tools to turn soft steel, a 19° rake angle is most efficient. For turning soft aluminium, bits should be ground with 35° rake.

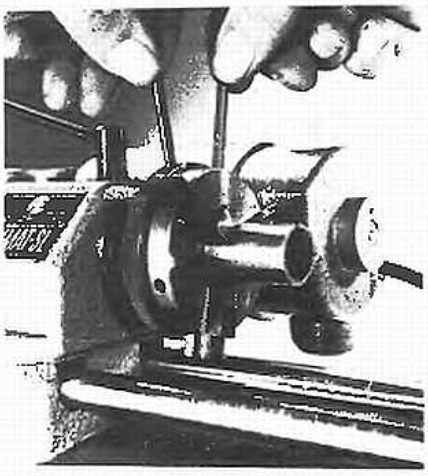
Tools for turning brass are an exception. Because a cutting edge with rake digs into brass and causes the tool to chatter, brass-cutting bits are always ground with standard clearance but with 0° rake—perfectly square across the top. Machinists usually keep a separate set of tools for brass-turning.



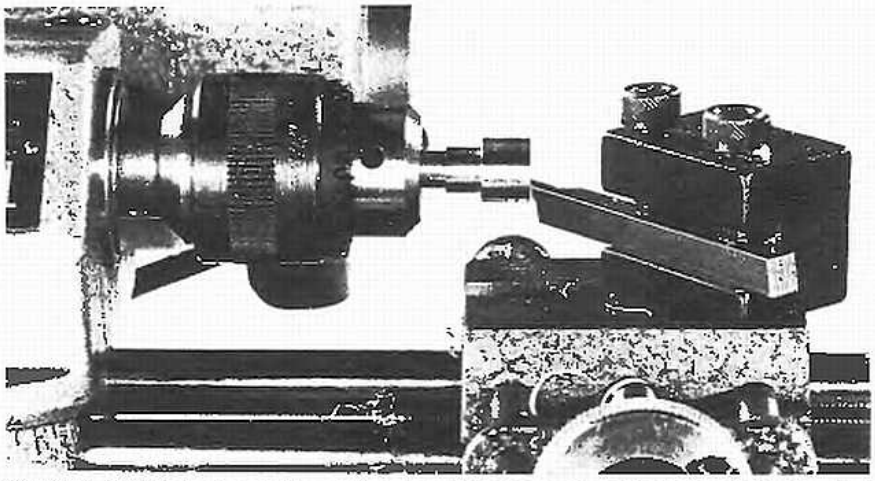
YOU CAN RESHARPEN lathe bits by whetting on an oilstone many times before they will require regrinding. Rub the bits' three ground faces flat on the stone.



REGRIND BITS on a medium-grit wheel, maintaining the tool's original shape.



THE 3-JAW UNIVERSAL CHUCK centers work up to 2" in diameter automatically.



THE DRILL CHUCK can be used to mount small workpieces as well as twist drills. Tighten the chuck evenly, using the key in all three pinion holes.

Other Ways To Mount Work

A metal-machining operation always involves two steps: first fixing the work in the machine rigidly enough to withstand the force required to shear off chips, and then, with a reasonably efficient cutting tool, applying that force. The machinist mounts the workpiece, making an appropriate "set up", and the machine then does the work.

Workpieces of any shape can be mounted in metal lathes for turning with various special workholding devices, most of which screw on the spindle's threaded nose. Two of the most commonly-used devices, a drill chuck (used to hold workpieces as well as twist drills) and a face plate, are supplied with the Unimat. A number of other workholding devices are available as accessories.

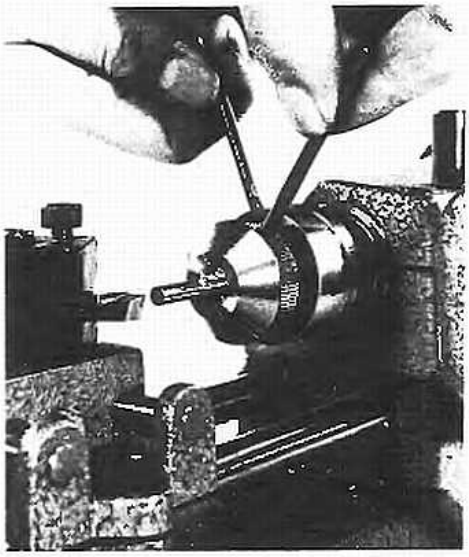
The Unimat's drill chuck centers small round work up to ¼" in diameter to within about .002". In order to grip very small-diameter drills the drill chuck's three hardened jaws have very narrow ground faces, and the jaws will bite deeply into a soft-metal workpiece if overtightened. Always tighten the chuck gradually and evenly on the work, using the key in each of the three pinion holes, and tighten it only enough to hold the work firmly. Work that hangs beyond the jaws enough to whip should be centerdrilled and supported with the tailstock center.

USING THE 3-JAW CHUCK

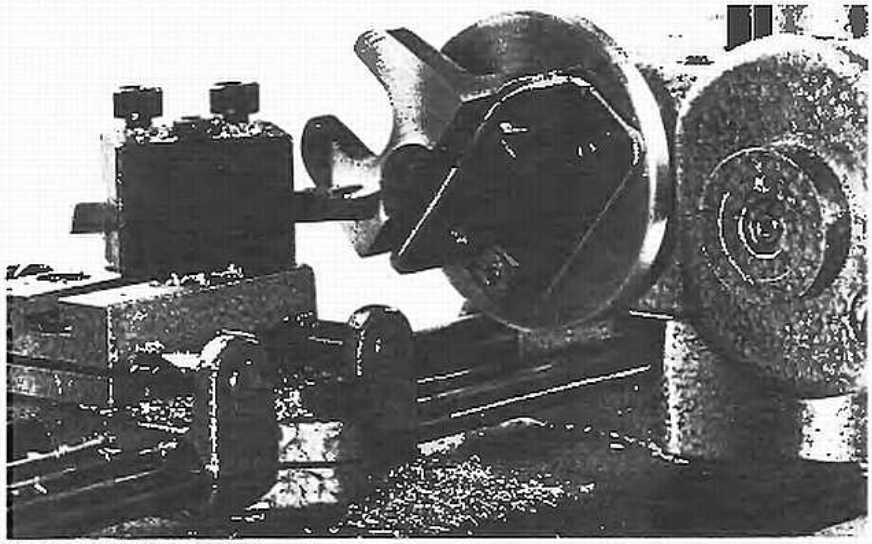
The simplest way to hold most large-diameter round workpieces for turning is to mount the work in the 3-jaw universal chuck, which is perhaps the most generally useful of all the Unimat's accessories (pg. 26). The 3-jaw chuck is supplied with its mounting plate finish-machined and attached, ready to screw on the spindle. The chuck holds work from .118" to more than 2" in diameter. Its three hardened jaws close simultaneously, centering the workpiece automatically as the chuck's knurled outer ring is rotated with pins inserted in the ring and chuck body. A scroll on the knurled ring screws the three jaws in or out. Jaws and jaw-slots are numbered. If you should screw the jaws out beyond the scroll, reengage them in 1-2-3 order.

For chucking work larger than 15/16" in diameter the jaws can be reversed and work gripped in their steps. To reverse the 3-jaw chuck's jaws, turn the ring to screw out the jaws until they disengage, remove them from their slots, and replace them in this order: jaw #3 in slot #1, jaw #2 in slot #2, and jaw #1 in slot #3. Then reengage the reversed jaws with the scroll in reverse order—3-2-1.

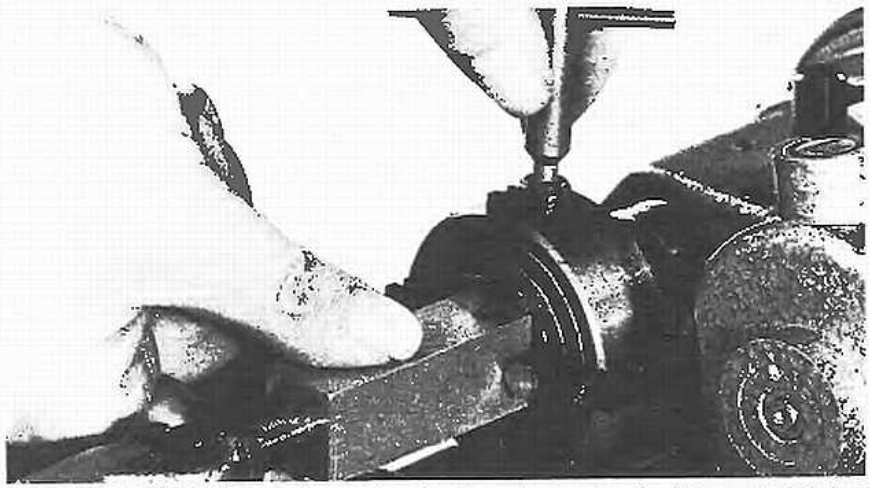
Besides round and hex stock, this chuck



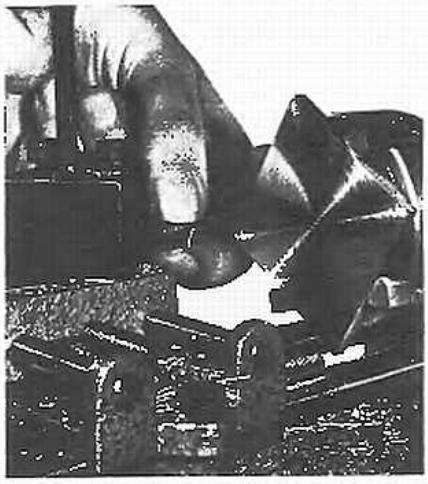
THE COLLET CHUCK centers drill rod or small parts with extremely high precision.



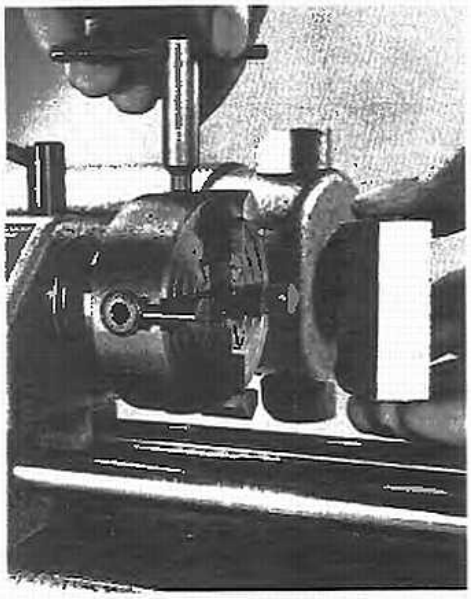
IRREGULARLY-SHAPED WORK can be mounted on the faceplate for turning. Angle plate or other special fixture may be needed to mount some workpieces.



WORK THAT OVERHANGS a chuck more than four times its diameter should be centerdrilled and supported with the tailstock. Avoid overtightening chucks.



SQUARE PLATES as large as lathe's full swing can be accurately faced in the 4-jaw chuck.



THE 4-JAW INDEPENDENT CHUCK holds round, square or irregular workpieces.

will also hold large work that has been bored or recessed. For this the jaws are opened to make the steps grip inside the bore.

The 3-jaw chuck centers workpieces to within less than .003". Since the jaws are tightly fitted, a new chuck at first may work quite stiffly, but the jaws soon wear in and thereafter if kept cleaned and oiled slide very smoothly. For consistently accurate centering make sure that the jaws grip with even purchase as they close on the workpiece. Use jaw pads cut from soft sheet metal to prevent the jaws from marring finish-turned work.

USING COLLET EQUIPMENT

Toolmakers and instrument repairmen when turning small parts that must be centered with extremely high precision usually hold the work in a split spring collet, which centers small-diameter round stock more accurately and grips more securely than any other workholding device. The accessory collet chuck available for the Unimat (pg. 27) uses precision-ground double-tapered spring steel collets that are alternately split to close full-length and grip with even pressure. The body of the chuck screws to a mounting plate that is supplied slightly oversize. The mounting plate is first screwed on the lathe spindle and accurately finish-turned to accept the chuck, and the chuck is then screwed to it. The chuck's threaded nose-piece has a precision-ground internal taper that when the nose-piece is tightened squeezes the collet back into the ground taper in the body of the chuck. Collets, purchased separately, are available in inch or metric sizes. Because they can spring closed only about 1/64th inch, the collet used must be no more than 1/64" larger than the work. A full set of collets is needed to handle work from 1/64" through 5/16" in diameter, the chuck's capacity. The collet chuck is especially useful when you're turning a quantity of small precision parts from drill rod or other smooth-finish rod stock. Avoid closing a collet on work that isn't perfectly round. Long stock up to ¼" in diameter can be fed through the lathe spindle's through-bore. Since both the collet chuck and its collets are extremely high-precision devices, handle them with care to avoid nicking them, keep them scrupulously clean, and lightly oil them regularly with an oily rag.

USING THE FACEPLATE

Odd-shaped work that can't readily be mounted in a chuck often can be screwed, bolted or clamped on the Unimat's faceplate for turning. Flat work as large as the lathe's full swing can be bolted directly to the plate. L-shaped work can be bolted to an angle fixture cut from angle iron and bolted on the faceplate.

When faceplate work must be turned with exacting precision, true the plate—taking a light cut across it with a sharp tool—before mounting the work, and when fixing the workpiece make sure that the mounting screws or bolts do not spring the plate. Ordinarily faceplate turning should be performed at moderate spindle speed. When irregularly-shaped work will be turned on a plate at high speed, counterbalance it to prevent vibration. Using the accessory T-slotted fixture plate on the Unimat's spindle as a faceplate simplifies mounting some workpieces.

USING THE 4-JAW CHUCK

The spindle workholding device that can hold the widest variety of work shapes is the 4-jaw independent chuck, which has four reversible step-jaws that screw-adjust individually with a square key. The 4-jaw chuck holds round, square, rectangular or irregular work, and the jaws grip very securely. Work can be centered in the chuck, or it can be offset for turning eccentrics. This chuck's only disadvantage is that it does not center the workpiece automatically. The work must be centered by hand. To accomplish this you first center the stock in the chuck roughly by eye, using the concentric rings on the face of the chuck for guidance, and you then make corrections by adjusting opposite jaws—loosening one jaw and tightening the jaw opposite—to shift the work as needed. The point of the tool bit will indicate which way the work requires shifting if the tool is set close to the workpiece and the lathe spindle is revolved by hand. For exacting work a dial indicator can be used to indicate runout. Although it takes patience, it's possible to center work in the 4-jaw chuck with extremely close precision.

Always tighten the four jaws firmly and evenly on the work, but avoid overtightening them. Since the key screws in the jaws with

overtightening them. Since the key screws in the jaws with enormous force, severe overtightening can strip the threads in the chuck's cast iron body. When chucking tubing or bushings that might be distorted by the jaw pressure, first turn a closely-fitted metal plug and insert it in the work. Stock that overhangs the chuck's jaws more than four times its diameter should be center-drilled and supported with the tailstock center.

Quite often the 4-jaw chuck is used to hold square or rectangular stock to be turned round, and this involves interrupted cuts—with the lathe bit cutting only the corners of the workpiece. Such cuts should be made at slow spindle speed to avoid excessive hammering, and the lathe's feed controls should be set up fairly tightly.

SPECIAL WORK HOLDERS

Some work because of its shape or the machining operation required can neither be held in a chuck nor mounted on a faceplate. A brass washer to be accurately finish-turned on all sides would be an example. Often such parts can be fixed on a piece of scrap metal and the scrap metal can be chucked. The washer could be soft-soldered on a piece of scrap brass, and with the brass chucked could be machined on three sides; it then could be melted off and resoldered on the brass other-face-out for turning on the fourth side.

A wheel-shaped workpiece is generally first gripped in a chuck, bored, and then remounted for additional machining on an arbor or mandrel. The work can be pressed on a specially-turned tapered mandrel and the mandrel mounted between centers. Easily turned from scrap steel, the special mandrel should have a taper of about .001" per inch of length (machined by offsetting the Unimat's headstock slightly). When pressed on the mandrel's taper firmly enough to prevent slippage, the wheel-shaped workpiece can be turned on both faces and its diameter with exact precision. For some work the mandrel can be threaded and the workpiece secured with a nut. A wheel-shaped part with a hub often can be fixed on a straight mandrel with a set-screw.

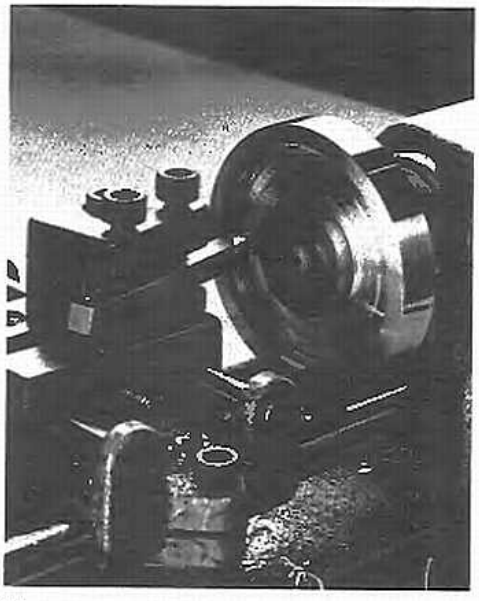
When you encounter work that can't be satisfactorily mounted with any of the standard workholding devices, it's nearly always possible to improvise a special fixture of some sort that will do the job. For example, you might turn a special split chuck—turned to accept the work, split with a hacksaw, and closed with screws or a tapered clamping ring. You might put an irregularly-shaped workpiece in a turned ring with Plaster of Paris. You might devise special lug-clamps to secure odd-shaped work on a fixture plate. You might drill and tap a large workpiece with counterbored 12x1 metric threads and screw the work directly on the Unimat's spindle nose.

Special tooling-up may also be required when you have occasion to machine a number of duplicate parts. To make special setups easier, unhardened steel jaws that can be machined as required are available for the Unimat's 3-jaw universal chuck, and soft steel collets that can be bored to any size needed are available for the collet chuck. After machining either soft chuck jaws or soft collets to suit the work, you can harden them with *Kasenit* or other surface hardening compound. Arbors or mandrels turned from mild steel can be similarly case-hardened.

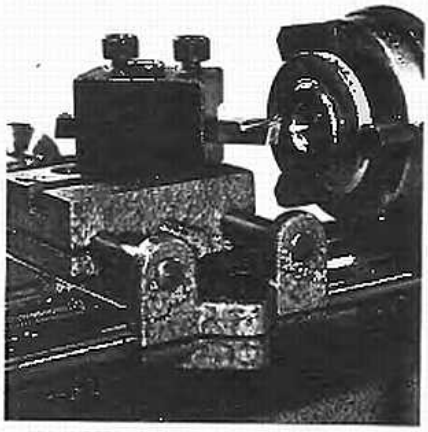
Since the various chucks and work plates all screw on the machine's threaded spindle nose, to maintain the Unimat's precision it's important to protect the spindle threads both from unnecessary wear and from accidental damage. Always clean and oil the threads and the spindle's shoulder before screwing on a chuck or plate. To avoid accidentally nicking the threads, it's good practice to keep either the faceplate or other device screwed on the spindle whenever using the machine.

When chucking lathework that must be turned with exacting precision, be sure to mount the work in such a way that you can finish-turn critical surfaces without rechucking. If a workpiece is bored and faced with one chucking, for example, the face will be machined precisely square with the bore. But if the piece were bored and then rechucked for facing, you could not expect perfect accuracy. It wouldn't be possible to remount the work in the chuck without losing some precision.

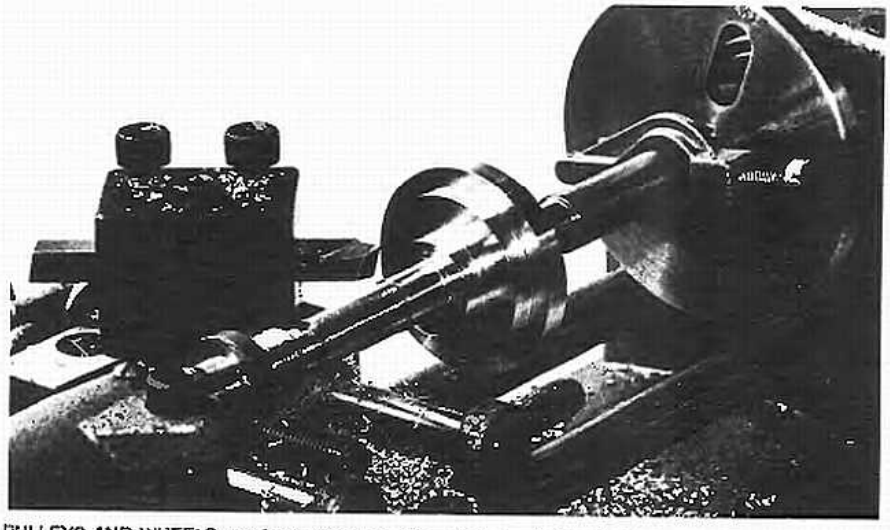
Spindle chucks should be cleaned and lightly oiled after each use. Avoid overoiling, however, for when overoiled a chuck throws black spray when run at high speed. Wipe the oil from the chuck's ground jaw faces before chucking a workpiece.



SOME WHEEL-SHAPED WORK can be mounted on the grinding wheel arbor for turning.



SMALL WASHERS can be soft-soldered on scrap brass, turned, then melted off.



PULLEYS AND WHEELS can be pressed on a tapered mandrel for finish-turning. Turn the mandrel to suit work from scrap steel and mount it between centers.

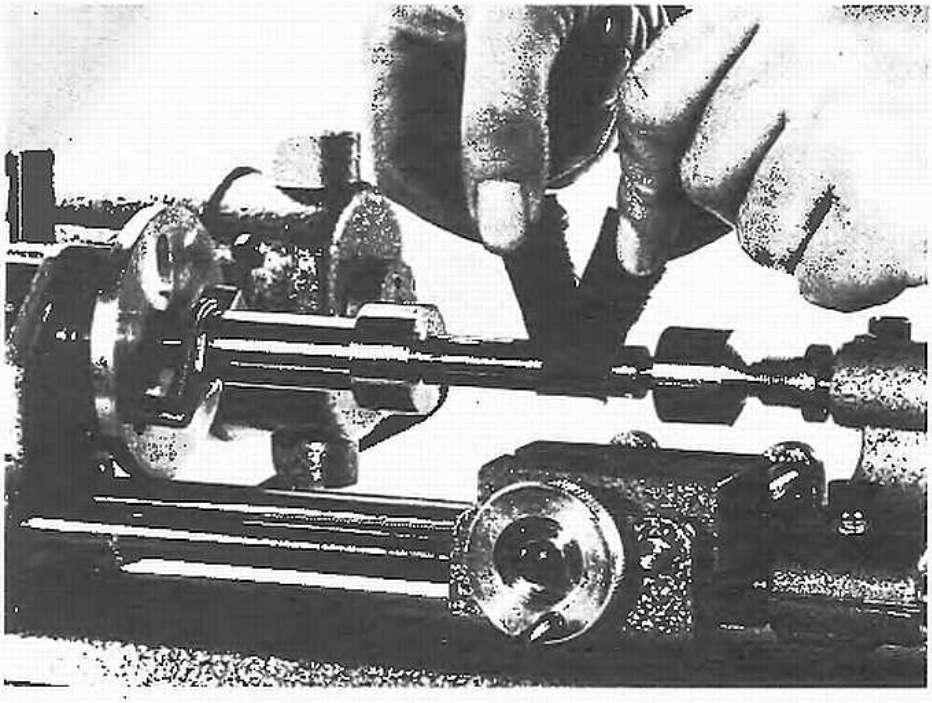
Special Lathe Operations

Of all machine tools the metal lathe is the most versatile. Many operations other than plain turning can be performed on lathes, and all of these special jobs can be accomplished on small scale with the Unimat. This section surveys some of them.

FINISHING

Lathework often requires one or more finishing operations. To remove burrs or round sharp edges, turned work can be filed as it revolves in the machine. For filing use the slowest spindle speed, angle the file for best cutting action, and file with slow strokes.

Any turned work can be polished with strips of abrasive paper or cloth to as high a finish as desired. Use extra-fine wet-or-dry silicon carbide paper for an attractive soft polish on small parts. To polish larger workpieces use strips of aluminum oxide cloth, oiling a worn strip for final mirror-finishing. Since for polishing the lathe is run at high spindle speed, the dead center must be adjusted somewhat loosely and relubricated frequently to prevent it from binding and burning. Using a ball-bearing center in the tailstock that rotates with the work eliminates the risk of burning center points.



YOU CAN POLISH turned work to high finish with strips of abrasive cloth. Using a ball-bearing live center in the tailstock makes frequent readjustment unnecessary.

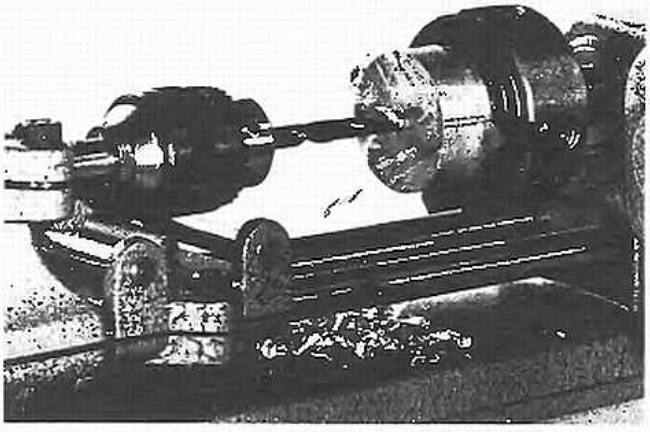
HORIZONTAL DRILLING & REAMING

A metal lathe is an excellent horizontal drill press, and drilling is one of the more commonly performed operations. Ordinarily the drill is mounted on the tailstock ram and revolved in a spindle chuck. Either the drill fed with the tailstock handwheel into work chuck or the collet chuck (for precision small-hole drilling) can be screwed on the Unimat's tailstock to hold small straight-shank twist drills. Large drills with straight shanks can be held in the 3-jaw universal chuck screwed on the tailstock.

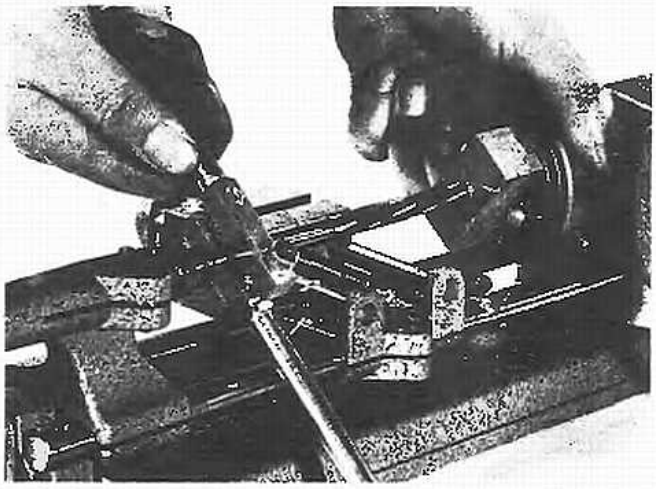
In order to start a twist drill cutting without wobble, turn a small starting dimple in the work with a sharp-pointed lathe bit. The feel of the drill in the work will indicate proper feed rate. Advance the drill with the tailstock handwheel just fast enough to make it cut smoothly, using cutting oil liberally when drilling steel. Withdraw it from the hole as often as necessary to prevent chips from packing in the flutes.

Except when drilling with very small drills, use the slowest spindle speed for drilling in the lathe. Each lip of a twist drill cuts exactly like a lathe bit, and forcing the lips to bite into hard metal takes considerable power. The larger the hole, the more the power required. To avoid overloading the motor when drilling a large-diameter hole with the Unimat, enlarge the hole in steps—first drilling a small pilot hole, then enlarging the pilot hole with a larger drill, then enlarging the hole again with a still larger drill, and so on. Drilling an extra deep hole is also likely to overload the motor, since friction increases as the hole deepens. Don't try to drill a deep hole with a drill that has worn margins. For deep holes use new drills.

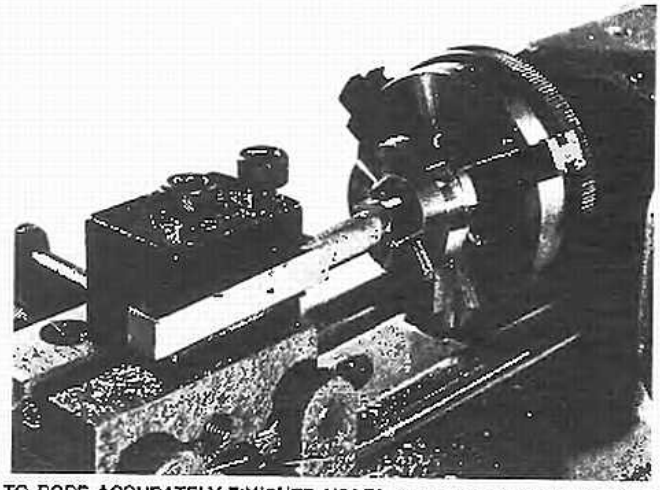
A twist drill drills a hole a few thousandths larger than the drill's nominal size. When the diameter of a hole must be exact, the hole is drilled slightly undersize and reamed to finish size with a reamer. When reaming in the Unimat, support the reamer in alignment with the hole with the tailstock



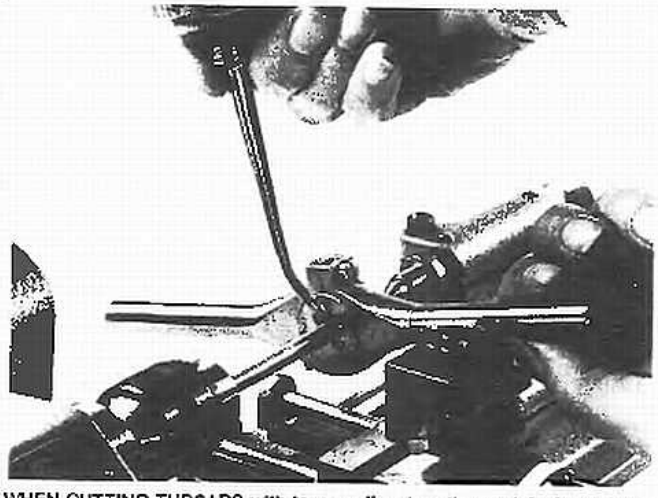
FOR DRILLING work held in a spindle chuck, screw the drill chuck on the tailstock ram. Ram's handwheel feeds the drill.



WHEN REAMING HOLES in the lathe support the reamer with the dead center. Hold the reamer and turn the spindle by hand.



TO BORE ACCURATELY-FINISHED HOLES, set a boring tool in the tool block parallel with the ways. Bore with light, continuous cuts.



WHEN CUTTING THREADS with taps or dies, turn the work by hand, holding tap or die in a tap wrench or die holder.

center, and feed it into the work slowly with the tailstock handwheel while revolving the lathe spindle by hand. When reaming holes for tapered pins with a tapered reamer, avoid feeding the reamer at too fast a rate. Never back a reamer in the hole, which would nick its teeth. Flood the hole with cutting oil when reaming steel.

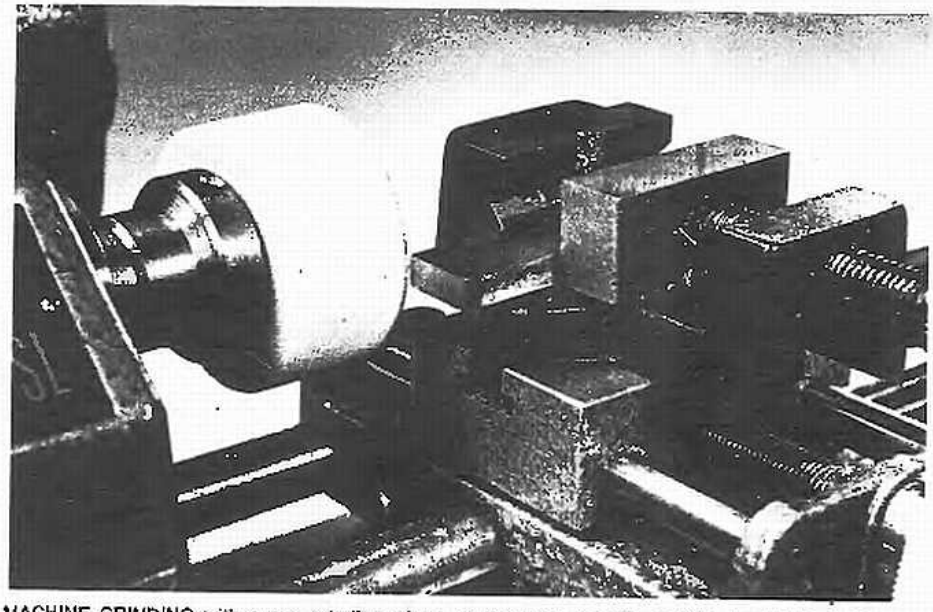
BORING

Boring in the lathe—simply internal turning with an extended cutting tool— is the easiest way to finish large-diameter holes accurately to size. The boring tool is advanced by screwing the cross-feed out; then run through the hole with the longitudinal feed. When making a boring set-up be sure that the tool's cutting edge has sufficient clearance to prevent the bit's heel from rubbing in the hole. The lathe's feed controls should be set up snugly, and the boring tool positioned in the tool block with no more overhang than necessary. Since all boring tools spring somewhat, use lighter cuts for boring than you would for turning. When boring a hole to close tolerance, be sure that the Unimat's headstock is accurately aligned, and having honed the boring tool very sharp, finish the hole with very light cuts, making the final finish cut continuous.

Work requiring precision through-boring can be fixed on the Unimat's carriage and bored with a small fly-cutter boring bar (which you can make yourself) mounted between centers.

THREADING

Many parts turned in lathes require threading. Usually the easiest way to cut small-diameter threads in turned work is to use a tap or die, revolving the workpiece in the lathe by hand as the tap or die is kept from turning with a tap wrench or die holder. A tap with a centerdrilled shank can be supported to start it squarely with the tailstock center. When taps or dies are used to cut threads larger than ¼" in diameter, the threads are started in the lathe, and the work is then removed from the machine and gripped in a bench vise for the rest of the operation. Use cutting oil when threading steel.

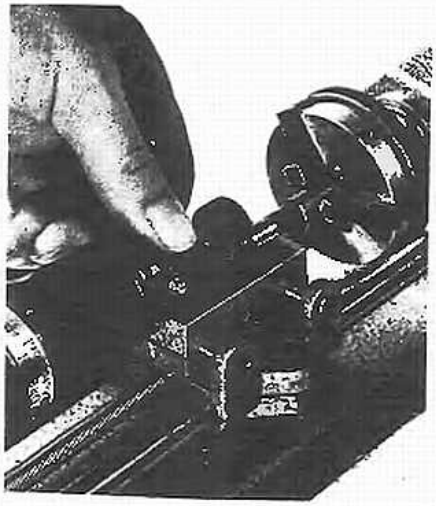


MACHINE GRINDING with a cup grinding wheel on the lathe spindle and the work held in the machine vise is an easy way to finish-grind the edges of small parts.

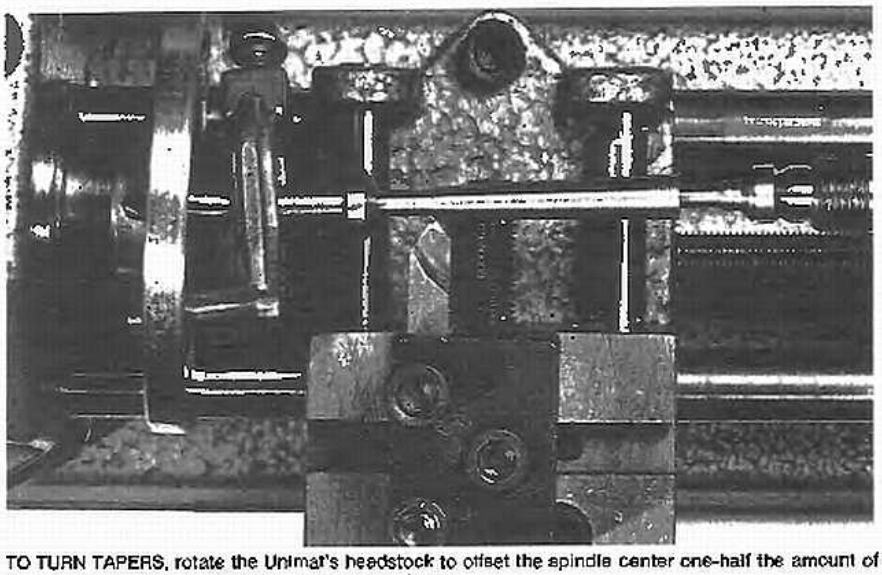
Screw threads can also be cut with the Unimat's accessory threading attachment (pg. 30), which is used whenever it's not practical to cut the thread required with a tap or die. With this attachment threads can be cut to a shoulder, for example, or fine threads can be cut on instrument bezel rings. Unimat's threading attachment employs a precision-threaded pattern bushing to lead a 60° threading bit. Threads are cut to finish depth with successive light cuts.

SPECIAL TECHNIQUES

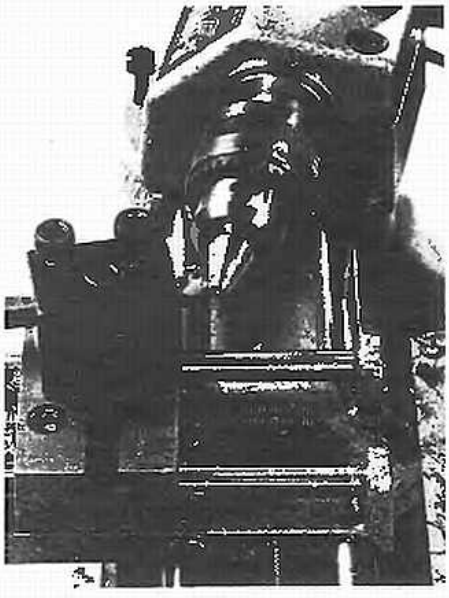
A number of useful machining operations can be performed on the Unimat with a rotary cutting tool mounted on the lathe



HAND GRINDER can be used on cross slide to machine-grind hardened parts.



TO TURN TAPERS, rotate the Unimat's headstock to offset the spindle center one-half the amount of taper required. Be sure the lathe dog revolves freely.



FOR STEEP TAPER, simply mount work in a chuck and rotate the headstock.

spindle and the workpiece held on the carriage in the accessory machine vise. Grinding wheels, end mills or rotary files can be used in this way. A cup grinding wheel on the spindle will beautifully finish-grind the edges of small parts. If the workpiece is blocked to height in the vise, an end mill held in a spindle chuck can be used for slotting, spot-facing, or squaring the ends of rough-cut stock. Rotary files are useful for grooving or recessing. Although end mills and rotary files can be chucked in the drill chuck, the collet chuck centers them more accurately and grips them more securely.

If you mount a small hand grinder on the Unimat's cross slide with an improvised clamp—or simply hold the neck of the grinder down firmly in the cross slide's T-slot with your fingers—you'll be able to accurately finish-grind hardened steel parts chucked in a spindle chuck. When grinding in this way belt the lathe's spindle for slowest speed and take very light cuts, advancing the cross slide only a thousandth or two at each pass.

TAPER TURNING

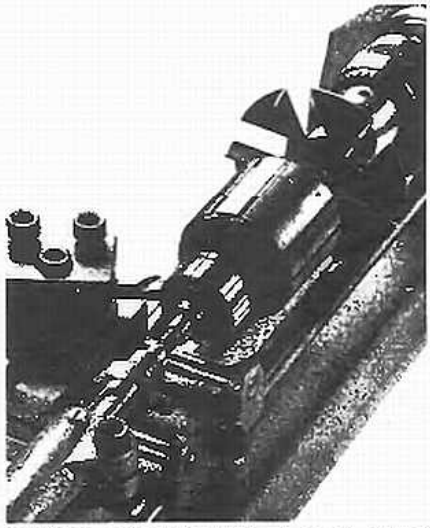
If a lathe's line of centers is not precisely parallel with the ways, the machine turns a taper rather than a true cylinder. When you want to turn tapered pins, shaft ends, fittings and seats or other tapered work on the Unimat, set up the machine to cut the required taper by rotating the headstock. To turn a gradual taper on long work, mount the workpiece between centers, and then rotate the headstock to offset the spindle center half the amount of taper. Shifting the spindle center towards the rear of the lathe makes the taper larger at the spindle end. Shifting the spindle center towards the front of the lathe makes the taper larger at the tailstock end. The amount of spindle center set-over can be measured from the tailstock center, but usually tapers are turned by trial and error—by making trial cuts and correcting set-over as needed. An easy way to find the set-over required to turn a tapered pin that must fit a hole reamed with a tapered reamer is to mount the reamer in the lathe and then adjust the headstock until a tool bit travels parallel with the reamer's cutting edges.

By rotating the headstock you can also cut short, steep tapers on work held in spindle chucks. Tapered holes can be bored similarly. Cones and sockets or conic fittings and seats that are turned and bored with the same set-up will match exactly. Be sure when cutting tapers to set the point of the tool bit exactly at center height.

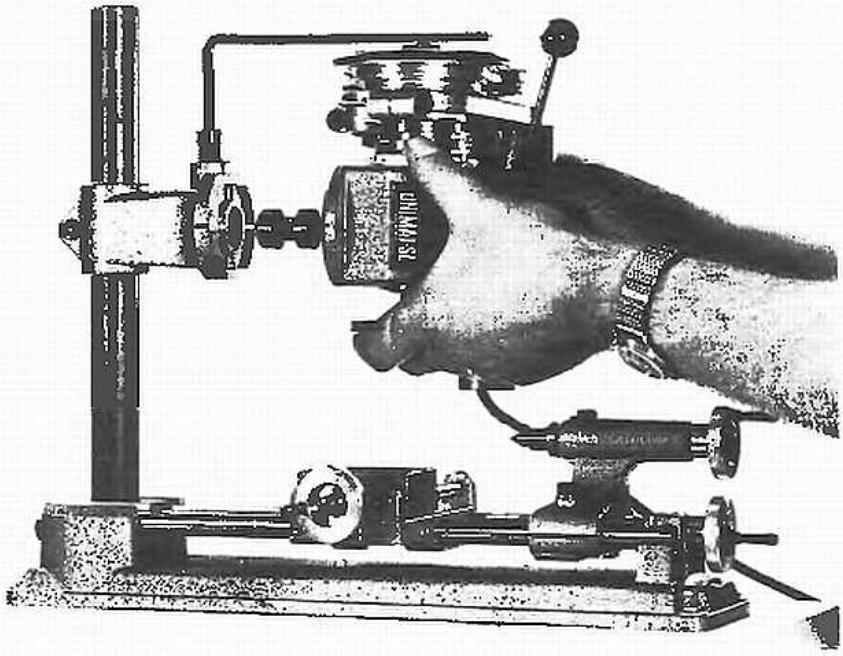
Truing worn commutators on small brush-type AC-DC motor armatures is a common repair job that can easily be accomplished on the Unimat with nice precision. If the armature's shaft is centerdrilled, the armature can be mounted in the lathe between centers. If not, chuck one end of the shaft in the drill chuck and support the commutator end in a brass cup center turned to fit the tailstock ram. Operating the lathe at slow spindle speed, take a light finish cut across the commutator using a very sharp round-nose tool bit having a 1/32" radius, and then polish the copper segments with fine flint sandpaper. After turning, undercut the mica between the commutator's segments using a piece of hacksaw blade with the teeth ground down to proper thickness. Make sure that no metal chips remain in the commutator's slots.

A few special lathe jobs that would otherwise present difficulties are no problem at all when you have the appropriate lathe accessory. A steady rest (pg. 29), for example, makes it possible to turn work longer than the lathe bed. Other special jobs can be performed if you make or adapt suitable accessories yourself. You can knurl turned work with knurling rolls, for example, if you machine a holder to mount standard rolls on the Unimat's cross slide. Or you can use the lathe to wind coils for electronics work if you make a coil from mandrel and wire guide.

Broaching is still another special lathe operation you occasionally may want to perform on the Unimat. A broach is simply a hooked scraping tool drawn repeatedly lengthwise through a hole to scrape a groove. With suitably-ground broaches you can cut square keyways in pulley holes, broach round holes square, or broach internal splines. Mount work to be broached in a spindle chuck and wedge the spindle's step-pulley to prevent the work from turning. Pull the broach with the lathe's longitudinal feed.



REFINISH COMMUTATORS of small AC-DC motors, with a sharp round-nose tool.



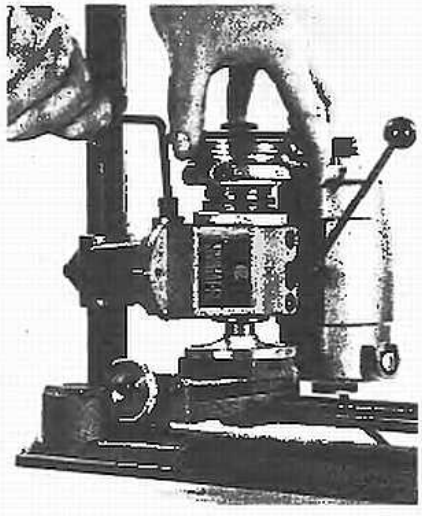
Vertical-Spindle Machining

Although in one way or another it's possible to accomplish any metal-machining job in a lathe, a number of machine operations, particularly drilling, milling and surface grinding, usually can be performed more conveniently on a machine that has a vertical spindle. The Unimat can be set up for *either* horizontal-spindle or vertical-spindle jobs—either horizontally for lathe-work, or vertically, with the headstock on the auxiliary column, for drilling, vertical milling or surface grinding. The changeover takes only half a minute.

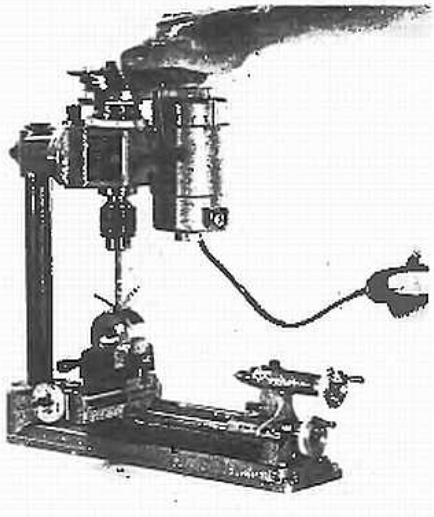
To make the conversion, pull out the headstock's alignment pin and unscrew the headstock clamping screw enough to permit lifting the entire headstock from the bed. In its place insert the auxiliary column and retighten the clamp screw, making sure the screw seats in the column's tapered hole.

The column's adapter casting slides along the column and can be positioned wherever needed. Inserting the headstock's tenon in the adapter and tightening the adapter's clamp screw mounts the head. The easiest way to align the spindle accurately perpendicular with the machine's bed is to screw the faceplate on the spindle nose, lower the headstock on the column until the plate rests on the carriage cross slide, and then adjust the head until the plate touches squarely. Having aligned the head, raise it and loosen its two spindle lockscrews just enough to permit advancing the spindle cartridge with the ball-handled pinion lever. When these screws are nicely adjusted, the spindle's coil spring will retract the spindle smoothly as the pinion lever is released. The lever advances the spindle about 5/8". When more vertical movement is needed, the return spring can be removed to increase travel to 1".

With the drill chuck screwed on the spindle, the Unimat is now set up for 90° drilling. When you want to drill at some other angle, insert a length of drill rod in the chuck and set the head as required with a protractor.



TO ALIGN SPINDLE perpendicular with bed, screw on faceplate and lower head.



COIL SPRING retracts the spindle when you release the pinion feed lever.

While inexpensive plain carbon steel twist drills are satisfactory for drilling wood, plastic or soft metal, high-speed steel drills, which hold their hardness even at near-red heat, are needed for drilling steel or cast iron. You can buy them singly or in sets, in fractional-inch sizes, numbered wire-gauge sizes, letter sizes or metric sizes. Sets usually are packaged in cases with sized holes that simplify keeping the drills in order. Drills commonly sold in hardware stores are termed "jobber length." "Short sets," which are screw machine drills with shorter shanks and flutes, are available from industrial supply firms, and because they're more rigid at the tip these shorter drills are preferable for use in the Unimat.

MOUNTING THE WORK

Any work drilled should always be securely fixed on the cross slide, both for safety's sake and to avoid drill breakage. Rectangular work can be held conveniently in the accessory machine vise (pg. 32), which bolts on the cross slide with T-nuts. Position the work in the vise in such a way that when the drill breaks through it will clear the vise body. Work awkward to grip in the vise can be mounted in a spindle chuck or on a work plate, and the chuck or plate then can be mounted on the cross slide with the Unimat's T-head adapter stud. Since this stud has the same thread as the spindle nose, any of the Unimat's spindle chucks can be used on the cross slide as circular drilling vises. This makes it possible to unscrew chucked work turned in the lathe, mount it chuck and all on the cross slide for a drill press operation, and then remount it on the lathe spindle for additional turning, all without removing the work from the chuck.

The Unimat's faceplate serves as a drill press table for small work, but mounting either the accessory sanding plate (pg. 38) or the T-slotted fixture plate on the cross