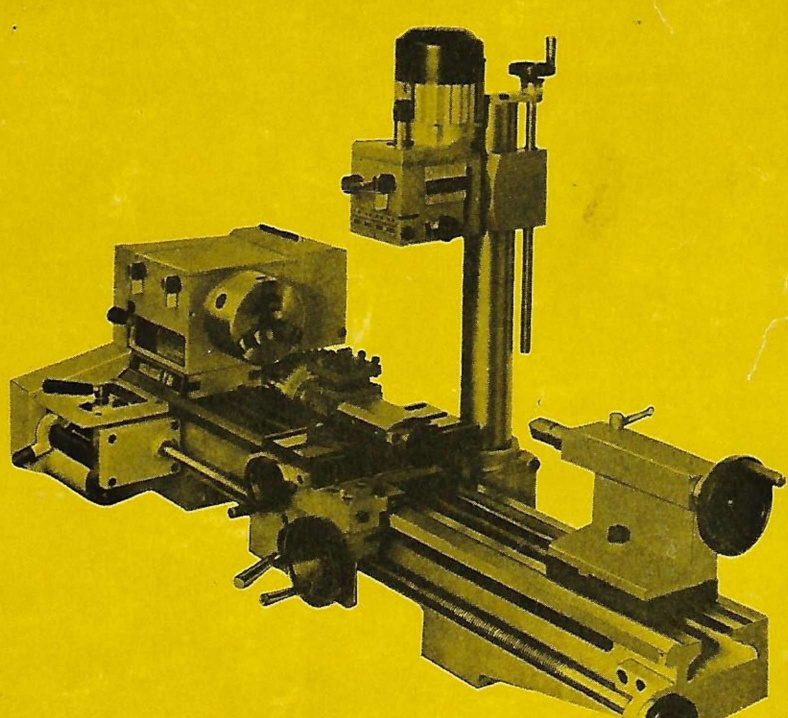
MANUAL 80/72

edelstaal™

PRECISION MACHINING TECHNIQUES



MAXIMAT V10 and MAXIMAT 7

TURNING / MILLING / DRILLING / GRINDING

A general handbook and operator's manual PUBLISHED BY **edelstaal technical institute**

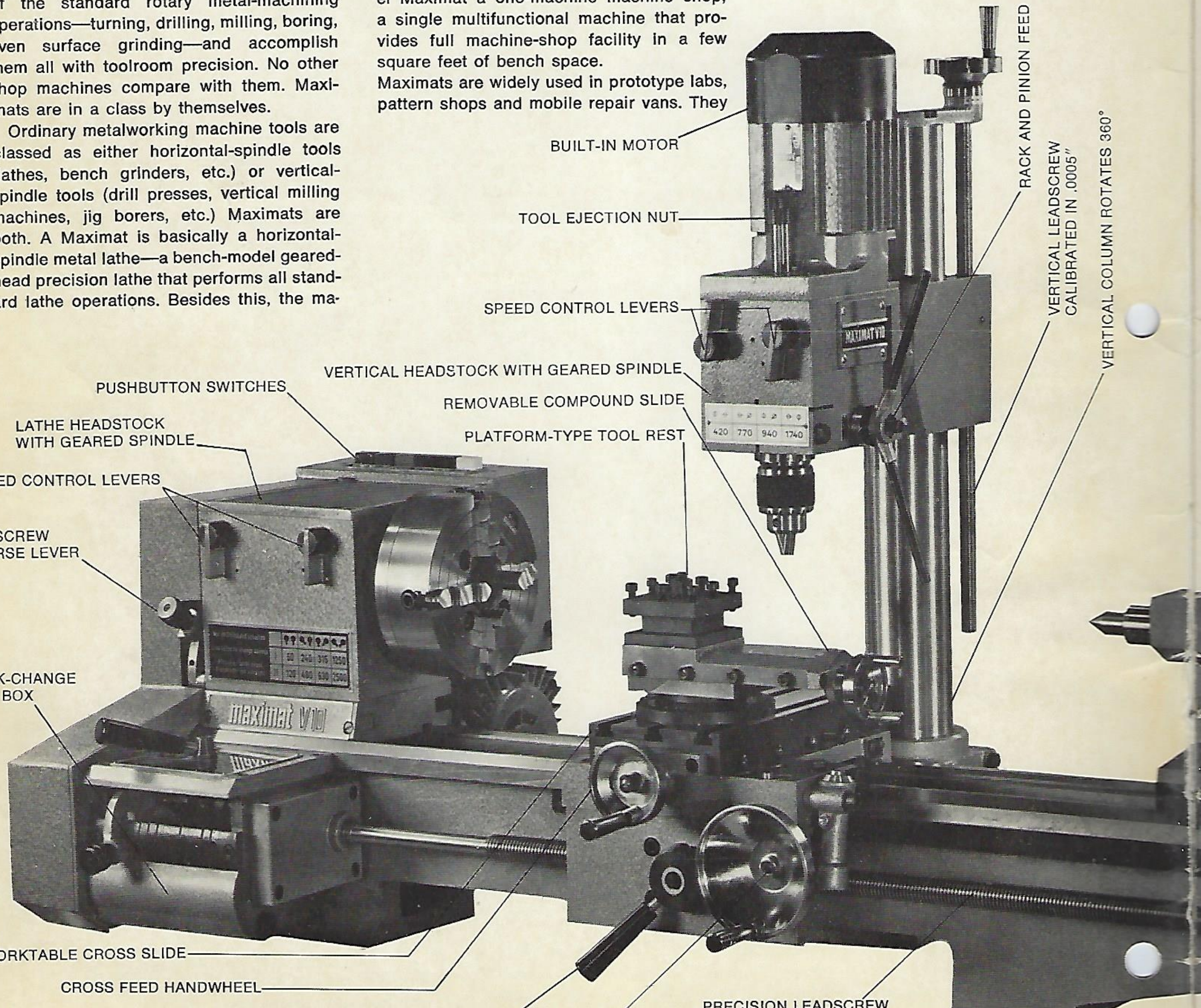
A Maximat is Four Precision Machines in One—
Metal Lathe, Sensitive Drill Press and Vertical and Hori…n…

INTRODUCTION

While differing in capacity, the Maximat V10 and Maximat 7 are very similar in design. Each model is a screw-cutting metal lathe, precision drill press, vertical and horizontal mill all in one, four machine tools incorporated in a single compact precision machine. Actually Maximats are not only combination machines but really **universal** machine tools, machines that perform **any** of the standard rotary metal-machining operations—turning, drilling, milling, boring, even surface grinding—and accomplish them all with toolroom precision. No other shop machines compare with them. Maximats are in a class by themselves.

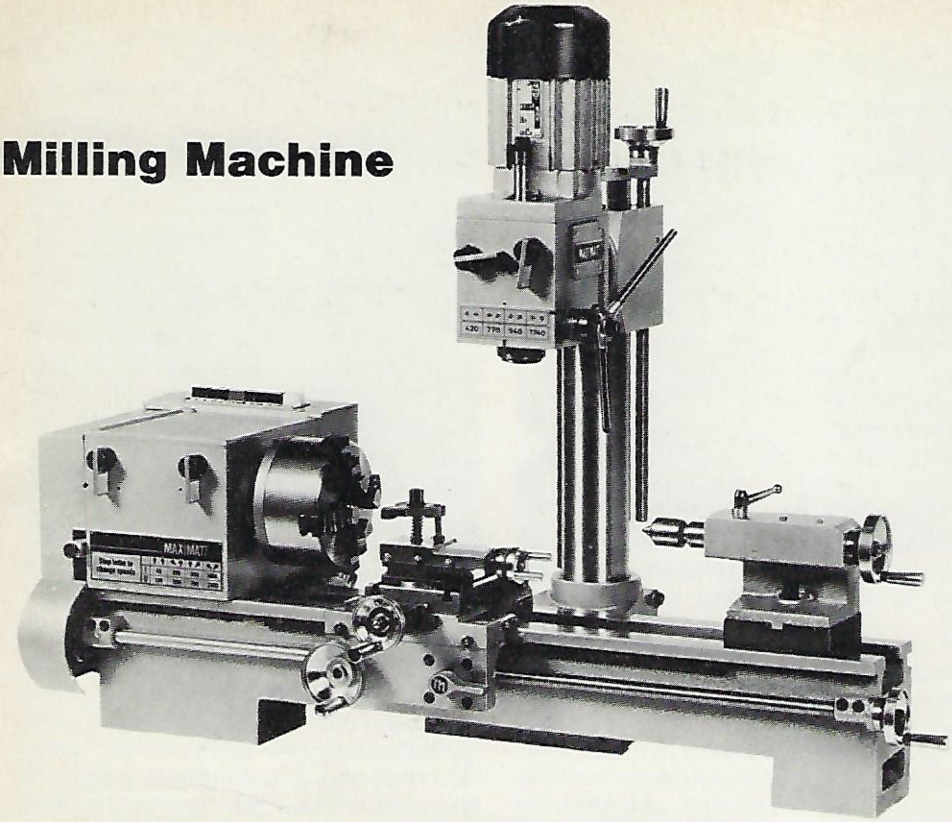
Ordinary metalworking machine tools are classed as either horizontal-spindle tools (lathes, bench grinders, etc.) or vertical-spindle tools (drill presses, vertical milling machines, jig borers, etc.) Maximats are both. A Maximat is basically a horizontal-spindle metal lathe—a bench-model geared-head precision lathe that performs all standard lathe operations. Besides this, the machine is built with a second geared-spindle headstock—complete with its own built-in independently-controlled motor—that mounts on a heavy vertical column bolted to the back of the lathe bed. The vertical-spindle headstock, which has both rack-and-pinion and calibrated-leadscrew feeds, serves not only for precision drill press work but also performs milling, boring and even grinding operations. This makes either model Maximat a one-machine machine shop, a single multifunctional machine that provides full machine-shop facility in a few square feet of bench space.

Maximats are widely used in prototype labs, pattern shops and mobile repair vans. They are ideal machines for instrument and general repairwork, gunsmithing or any other maintenance work requiring close-precision machining, particularly in shops in which space is at a premium. A Maximat is without doubt the ultimate metalworking machine for a physicist's, engineer's or inventor's



10"-SWING MAXIMAT is a bench-model universal machine tool that qives full machine-shop facility in a few sqare feet of bench space.

ta Milling Machine



7″-SWING MAXIMAT, smaller in capacity but similar in design to the larger machine, performs the same wide range of machining operations. Two bed lengths are available, providing 18″ or 24″ between centers.

home workshop. The machines are matchless teaching tools for industrial arts training, and they excel in light production work.

Apart from size, the two models differ in two constructional features. The larger 10″-swing-by-26″ Maximat has a V-way bed and a quick-change feed box. The smaller 7″-swing-by-18″ or 24″ machine has flat ways, and instead of a quick-change box the lathe's power feed train includes a patented shiftable idler gear unit that provides two carriage feed rates, "coarse" and "fine".

BIG-MACHINE FEATURES

Both models are built with features ordinarily found only on large industrial lathes. Both have geared headstocks with push-button-controlled motors, ultra-high-precision SKF Class 7 spindle bearings, work-table cross slides, platform tool rests and calibrated leadscrew and tailstock handwheels.

Since Maximats are used exactly like larger machine tools, anyone with machine-shop experience who follows standard shop practice will have no difficulty accomplishing complex work on either model. A skilled machinist when he examines either machine will immediately recognize the function of every lever and slide. He'll be able to judge the machine capabilities, to select work set-ups and cutting tools appropriate for particular jobs, and to operate the machine by "feel".

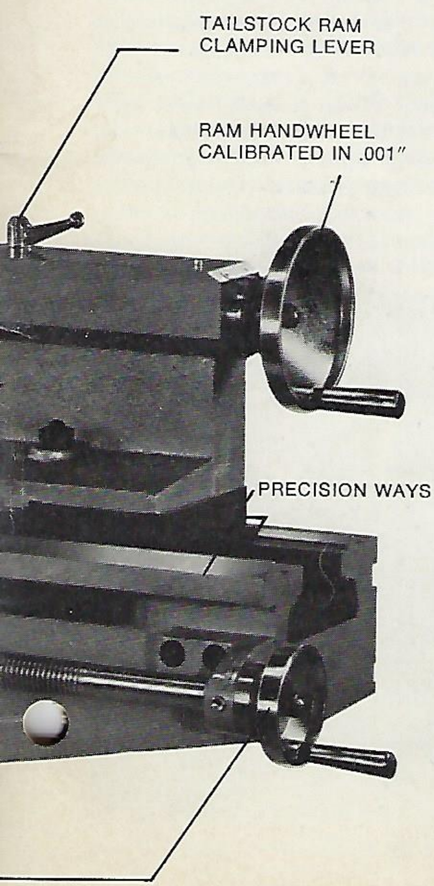
A craftsman lacking previous machining experience, on the other hand, may feel less confident, and may even be perplexed by the Maximat's many special features. But like all metalworking tools a Maximat is an essentially simple machine, and a novice can soon learn to use it like a journeyman machinist.

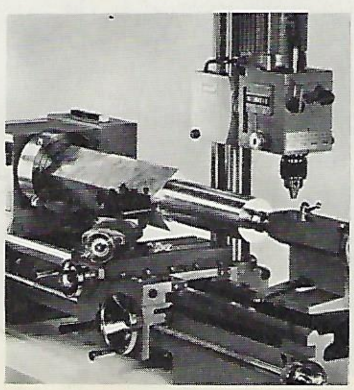
EASY OPERATION

This booklet will help a beginner get started. Although by no means a complete machinist's handbook, it briefs elementary procedures for using either model Maximat: it shows how the machines are set up and maintained, surveys the more common machining jobs, and indicates how the machines' many accessories are used. Skill as a machinist, which is really a practical knowledge of cutting tools and the metals cut with them, develops with practice. The more you use any machine tool, the more you're able to do with it.

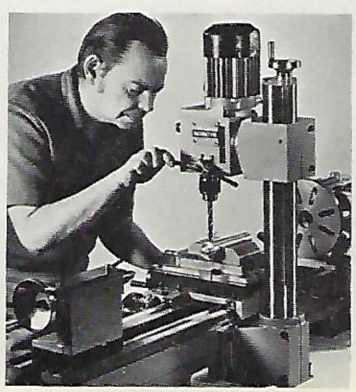
Keep it in mind as you read these pages that a Maximat though simply designed is not simply a conventional bench lathe. For one thing, since a Maximat has a second headstock, it's obviously more machine. For another, Maximat headstocks and carriages have features ordinary bench lathes lack. Maximats are in a class by themselves.

For example, instead of the awkward swinging-countershaft belt-drive used on most bench lathes, a Maximat's lathe headstock is built much like a 4-speed auto transmission, with the completely enclosed gear-driven spindle running in an oil splash-bath.

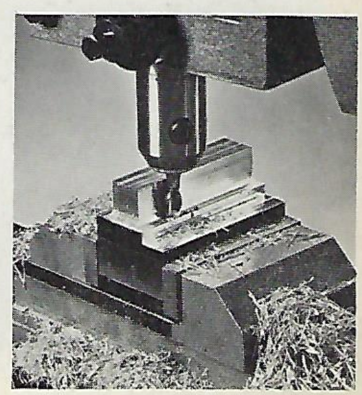




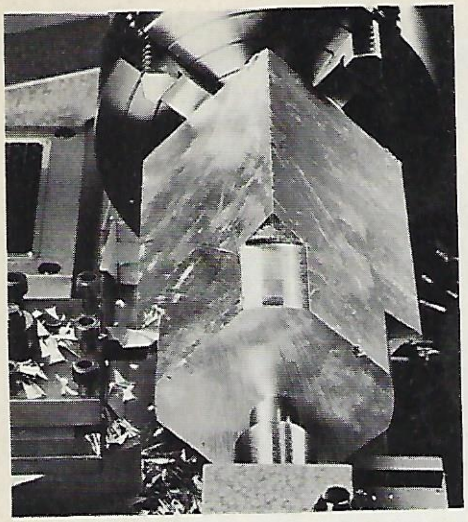
Turning



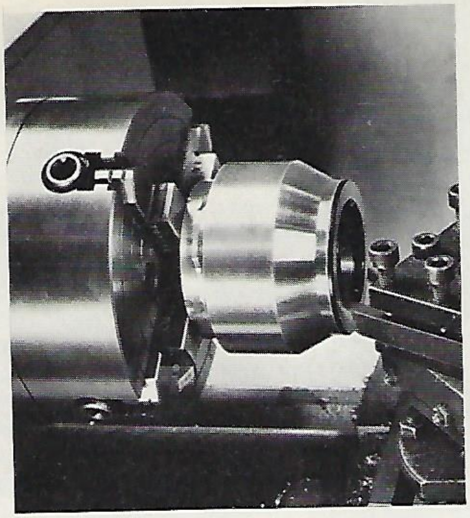
Drilling



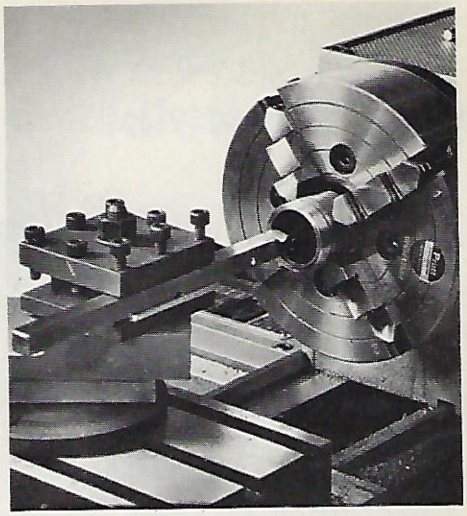
Milling



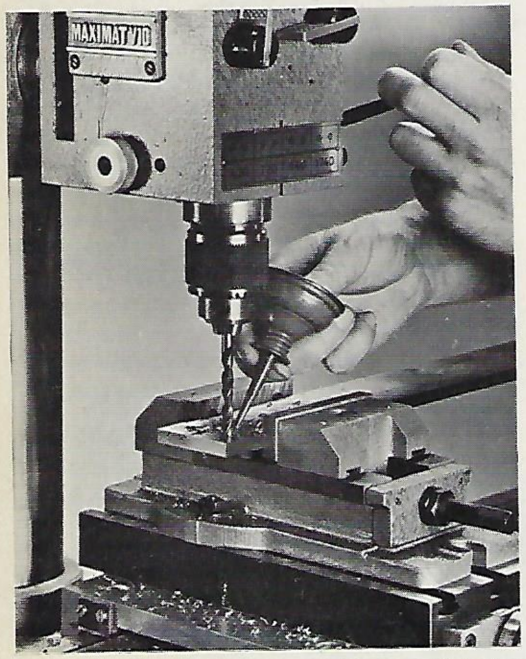
ROUGH-TURNING cuts square stock round and reduces work to near-finish size.



FINISH-TURNING finishes work to exact size. Use light cuts with fine feed.



BORING is simply internal turning to accurate size with an extended tool.



WORK DRILLED can be held in a machine vise or bolted on the carriage worktable.

Sliding gears on the backshaft and spindle, easily shifted with the headstock's two control levers, drive the spindle at any of four geared speeds. At any of the four lever-position combinations the lathe's reversible 2-speed motor can be operated at either low or high speed (1725 or 3450 rpms), which gives in all a choice of eight spindle speeds forward and eight reverse.

Pushbutton switches in the switchbox behind the lathe headstock control both of the machine's motors, which can be operated separately or simultaneously. Pushing either of the first two pushbuttons—one for forward operation, the other for reverse—starts the lathe motor at low speed. Pushing the double-width button as the motor runs switches it to high speed operation, doubling spindle rpms. The white button starts the vertical head's single-speed motor. The red button stops both motors.

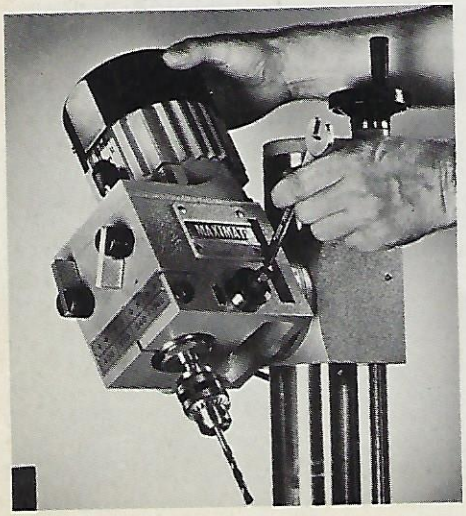
WORKTABLE CROSS SLIDE

The real key to the Maximat's versatility is its precision-ground worktable cross slide. Much like the worktables on bed-type milling and boring machines, this T-slotted table makes it easy to unbolt the lathe's compound slide tool rest and replace it with a machine vise or other workholding device to mount work to be drilled or milled with the vertical head. With the vertical head swung out over the ways, work to be drilled can be positioned under the spindle with the carriage traverse and cross feed.

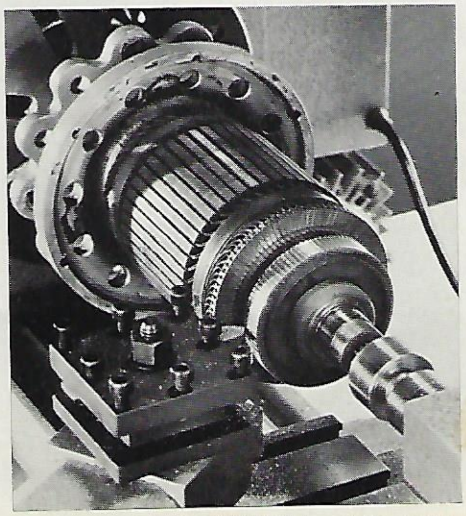
Work to be milled can either be hand-fed to milling cutters with the leadscrew handwheel or power-fed by engaging the lathe's power carriage feed.

The compound slide's platform tool rest, which differs from the slotted-post with overhanging holder used on most bench lathes, is similar to the tool rests on large production lathes. Large tool bits, shimmed to height as needed, simply clamp on the platform horizontally, a system that gives maximum rigidity and permits using a wide variety of cutting tools. Anyone preferring small bits in forged holders can use them, or small bits can be very conveniently mounted in the accessory turret tool block.

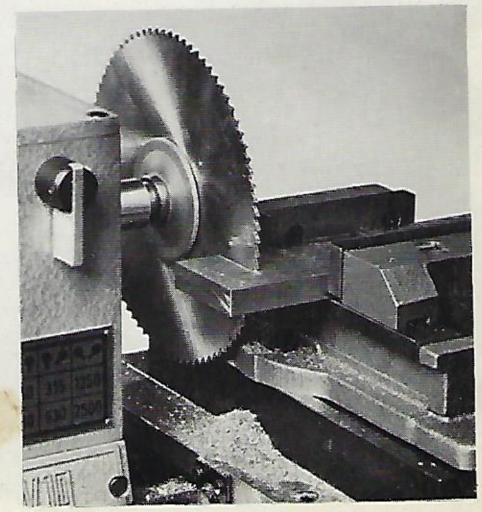
The vertical drilling/milling head's most



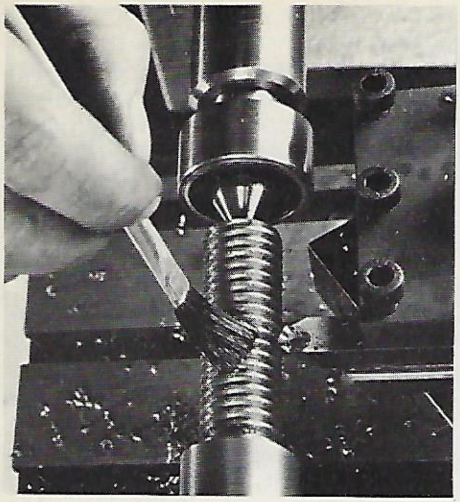
VERTICAL HEAD can be set at any angle required for angular drilling operations.



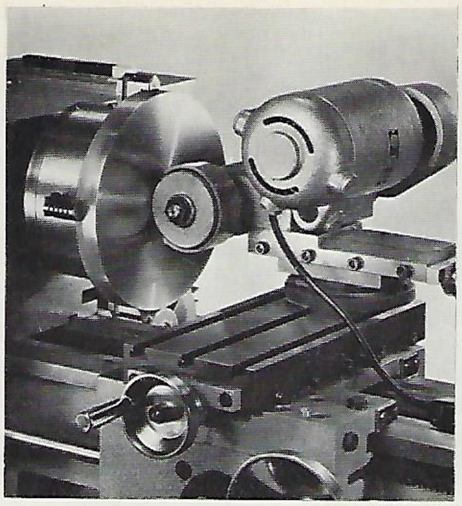
REFINISHING COMMUTATOR in a lathe reconditions AC-DC motor or DC generator armatures.



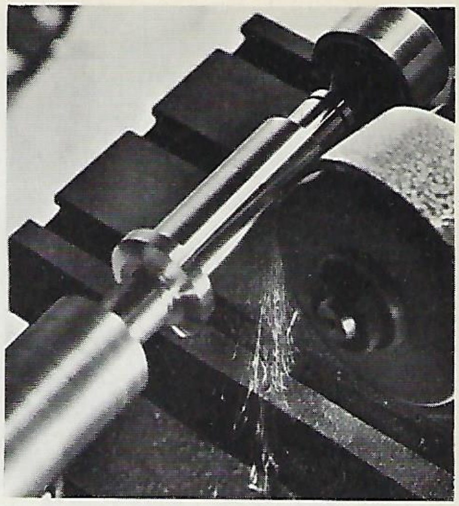
SAW BLADE on spindle neatly saws brass or aluminum bar stock to length.



SCREW THREADS are cut with a 60° threading bit using successive light cuts.



FACE GRINDING gives cast iron plates a beautifully smooth, accurately flat finish.



CYLINDRICAL GRINDING precision-finishes steel parts to very close tolerance.

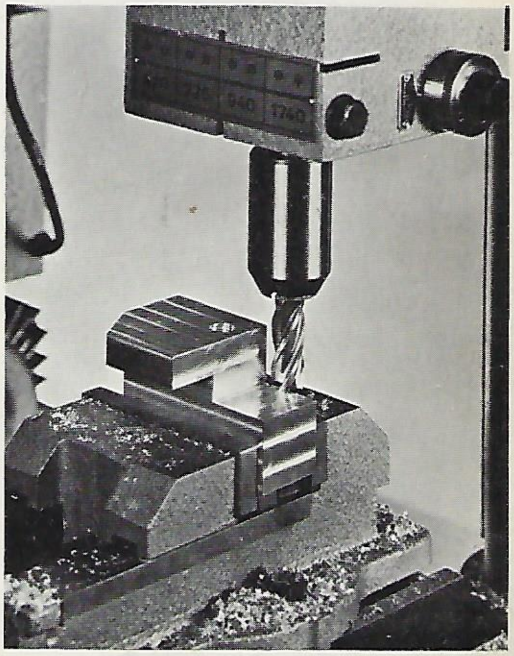
important feature, other than the rigidity of its heavy column, is its dual feed. For drilling the 4-speed geared spindle can be advanced drill-press-fashion with its spring-loaded rack-and-pinion feed. For milling the rack-and-pinion advance can be locked immovable with a lockscrew, and the entire head then can be advanced the full length of the column with the vertical leadscrew. The vertical head rotates 360° on its mount, and the column, head and all, rotates 360° in its base, which permits setting the head at any angle for angular drilling.

PRECISION CONSTRUCTION

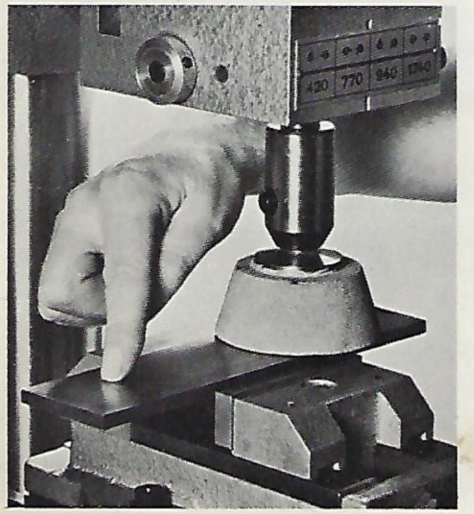
Finally, Maximats differ from ordinary lathes in the precision with which they are manufactured. They are built to tolerances surpassing ASA standards for toolroom lathes, and more, they are built to hold their precision through years of use. Both spindles have premium-quality bearings, and their internal Morse tapers are ground to extremely close tolerance. Bedways are finished to near-absolute parallelism. Leadscrews are milled on special equipment. Although for ordinary shop machining ultimate precision isn't always required, for many jobs it is, and a Maximat has the capability for the most critical close-tolerance work.

The Maximat's precision needn't deter a novice from experimenting with the machine, however. Provided you avoid power-feeding the carriage into a spindle chuck, the tool isn't easily damaged. Unless severely abused a Maximat depreciates very slowly, which makes it a lifetime investment.

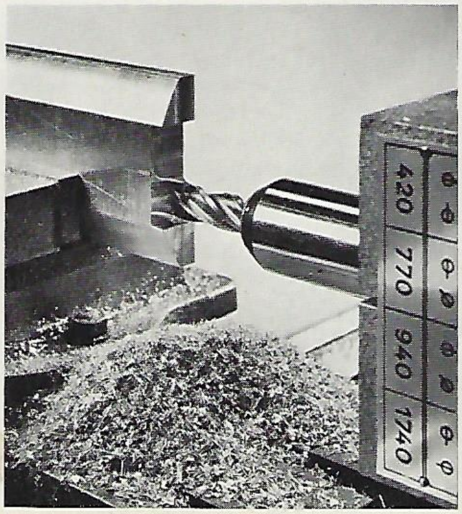
If you've never before tried your hand at machining, your first experimental work with a Maximat will be a revelation. Of all the fields of craftsmanship metal-machining is the most productive. Machine tools turn, drill, mill and grind, and directly or indirectly these operations make nearly all the consumer goods we use. A Maximat performs all four operations. It's a universal tool that gives you the facility to build anything you want to build. With this extraordinary machine you're equipped to machine metal just as well as anyone else can, even the largest corporations. For the craftsman a Maximat opens limitless possibilities.



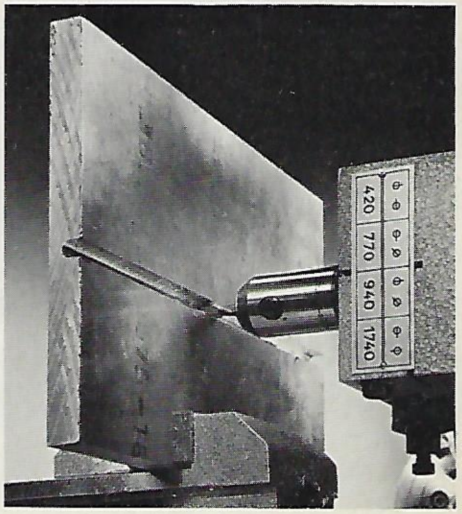
MILLING with end mills carves parts of complex shape from solid stock.



CUP GRINDING WHEEL accurately surface-grinds hardened or unhardened steel.



WITH HEAD HORIZONTAL, cross slide provides precision depth-of-cut control.



LARGE STOCK can be cut by grooving with an end mill, then hacksawing apart.

Setting Up Your Maximat

A Maximat is shipped in two crates, the larger containing the lathe and the smaller the vertical head unit.

Open the lathe crate carefully, prying up and removing the nailed top boards. The lathe's faceplate, wrenches, grease gun and other small parts are packed in the square paperboard box you'll find inside the crate. The lathe itself, fully assembled, adjusted and inspected, is secured to the crate's bottom with wooden cleats bolted across the ways. When these cleats are unbolted the machine can be lifted out.

The vertical head is also shipped fully assembled and inspected, with the motor's can-type starting capacitor ready-connected to the end of the stub motor cord. Locate the four mounting bolts and packet of small parts included with the vertical head as you unpack it.

Lathes are heavy machines. The Maximat V10 lathe's shipping weight is nearly 300 pounds, and the Maximat 7 lathe's nearly 200. It avoids risk to use a small cable hoist (a "come-along") to lift the machine onto its bench. Hook the cable to a large eyebolt bolted through a 2x6 wooden cleat turned crosswise under the lathe's ways at the point of balance.

MOUNTING THE LATHE

The heavy steel floor stand available as an accessory, which is designed especially for the Maximats, is recommended for mounting either model. Either machine can be mounted on a suitably substantial existing bench, however, or on a shop-built stand. If you build a stand yourself, make it rugged as Gibraltar, with a well-supported top at least 2″ thick. A cabinet-type stand should be especially heavily built, since a lightly built cabinet that resonates would make the machine seem noisy. Make the stand 31″ to 33″ high. Position the Maximat V10 with the front of the end gear cover flush with the front edge of the benchtop. Position the Maximat 7 with its leadscrew about 4″ in from the benchtop's front edge.

When a Maximat is used in a temporary location that makes leveling the bed impractical—in a mobile repair truck, for example, or on a ship—the machine can simply be set on sheet rubber pads and loosely bolted to the bench.

But when the machine is set up in a permanent location the bed should be accurately leveled and solidly bolted down. There are two reasons for leveling a Maximat. First, accurate leveling insures that the ways will not be twisted as the machine is bolted down, which is important because any twist in the bed would cause the lathe to cut a slight taper rather than a true cylinder. Second, when the bed is accurately leveled work can be set up on the carriage worktable by leveling the workpiece.

Level the machine with shims inserted under the bed as needed, or if the stand is bolted to the floor under the legs of the stand. Use a precision machinist's level in three positions—(1) across the ways at the headstock, (2) along the ways longitudinally, and (3) across the ways at the tailstock—to indicate which corners require shimming. The level should have a ground vial and be sufficiently accurate to show noticeable bubble movement when .002″-thick shim stock is placed under one end. Take the time to level the ways as accurately as you can, and always recheck the setup with the level before using the machine for critical close-tolerance work.

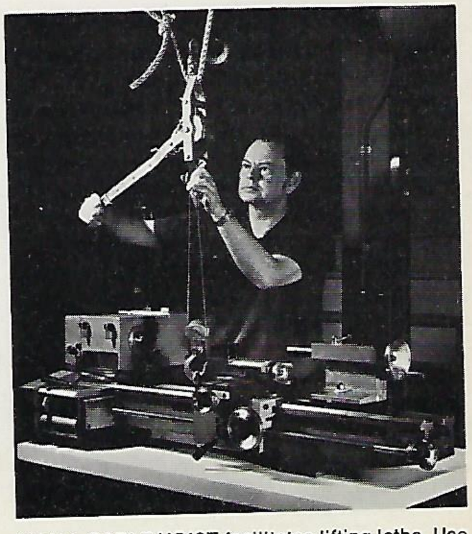
Before shipment from the factory the machine is sprayed with sticky preservative compound. Clean off this compound with a rag dampened in solvent, using an old toothbrush to scrub around levers and screws. Then immediately oil all bright-metal surfaces with light machine oil.

MOUNTING VERTICAL HEAD

Clean and oil both the mounting boss on the lathe bed casting and the machined surface of the vertical column's base casting before mounting the vertical head.

For precision drilling and milling the vertical head's spindle must be set accurately perpendicular with the carriage worktable. While this can be accomplished by squaring the column to the table with a machinist's square, the job can be done more easily and more accurately with a dial indicator. Mount the dial indicator on a No. 2 Morse-taper arbor inserted in the spindle's internal taper, and with both the base of the column and the head's graduated column mount set exactly on the zero marks, take readings with the dial indicator on all four corners of the carriage worktable. Use thin shims if necessary to adjust the column precisely vertical and tighten the base casting's four mounting bolts evenly Then turn the leveling screw in the base casting down against the benchtop to maintain the adjustment. It's good practice to recheck the squareness of the vertical head whenever the machine will be used for critical work

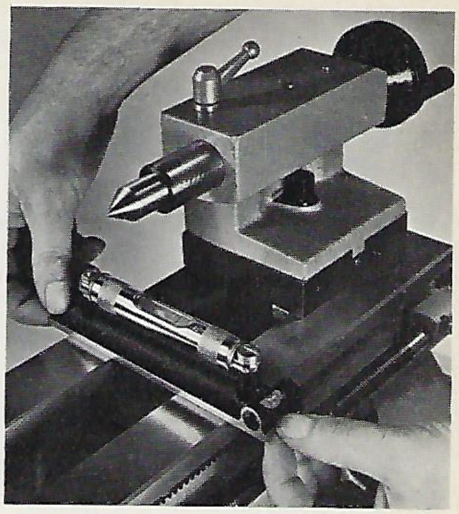
The heavy-duty can-type capacitors for both the lathe motor and the vertical head motor mount in the switchbox under the pushbutton switch unit. The lathe motor capacitor is factory-installed. The vertical head motor capacitor, which is taped to the vertical head for shipment, must be installed when the Maximat is set up. Remove



SMALL CABLE HOIST facilitates lifting lathe. Use eye bolt with cleat under bed.

SIX PRECAUTIONS

1. *Before operating the machine,* fill the headstock to gage-level with SAE 10 oil (and on the V10, also the quick-change box). Lube all grease fittings and oil the lathe's ways and cross slide.
2. *Always stop the machine* to change spindle speed or to reverse the lathe's leadscrew. Be sure the gears fully engage.
3. *Avoid stalling the motors.* Until you become familiar with the machine, take fairly light cuts at moderate feed rates.
4. *Never hammer the spindles.* Use a bar through the hole in the lathe spindle when removing chucks. Use the push-rod and ejection nut to remove taper-shank tools from the vertical head's spindle.
5. *Keep the machine clean.* Don't let metal chips fall into the pushbutton switches. Always clean and oil the ways before sliding the tailstock.
6. *Observe safety rules.* Don't wear clothing that can catch in the machine. Don't leave keys in chucks. Tighten the clamp ring on chucks and faceplate. Limit spindle speed to 700 rpms when using the faceplate. Wear protective glasses for any operation that produces flying chips.



LEVEL THE BED with an accurate machinist's level, shimming as needed.

the switchbox cover and insert this capacitor immediately under the lathe motor capacitor, tightening the nut on the capacitor's stud against the slotted bracket to secure the capacitor in place. Avoid denting either capacitor's can.

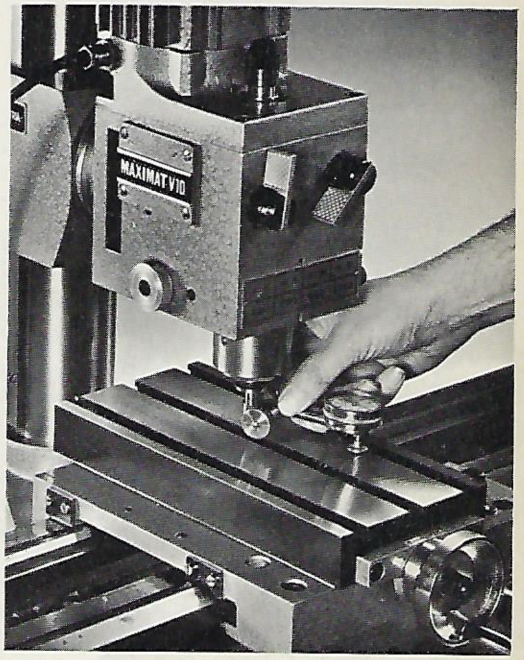
CONNECTING VERTICAL HEAD

Maximats are completely factory-wired except for three simple connections—the vertical head motor cord's three color-coded leads. Connecting these three wires to the switch unit is simply a matter of pushing the three slip-on connectors on terminal studs. Having fitted the cord's rubber grommet into the notch in the switchbox, connect the cord's yellow/green ground wire to the terminal on the switch unit's mounting screw. Connect the cord's brown wire (together with the blue wire from the capacitor) to the top slanted terminal on the vertical head's on-off switch (the switch with the white pushbutton). Connect the cord's blue wire to the lower slanted terminal on this same switch. Then tuck the wiring in neatly and replace the switchbox cover.

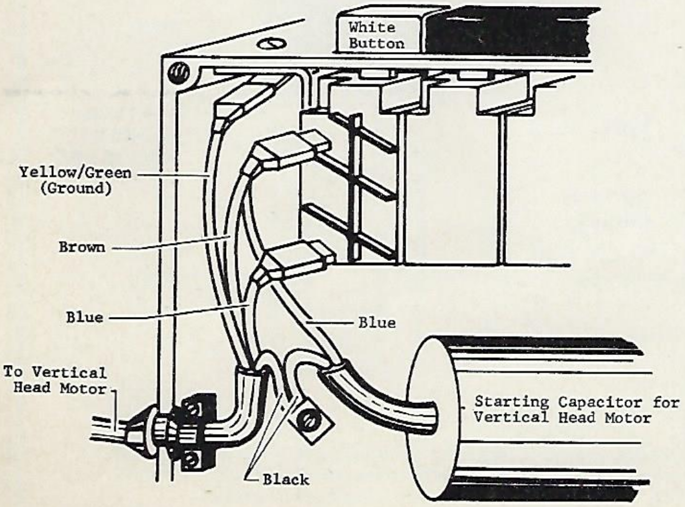
The machine's three-wire line cord is supplied with stripped leads—without a plug. Attach a 3-prong plug obtained locally, connecting the cord's yellow/green ground conductor to the plug's ground terminal. This ground wire grounds the machine's frame and both motors.

Both of the Maximat's premium-quality high-efficiency ball-bearing motors are built with completely sealed casings to keep out dirt and grit. Externally cooled, both motors have blowers that direct a flow of air past cooling fins on the casings to dissipate heat. The motors run quite warm to the touch, which is normal. Since both motors operating simultaneously under load draw less than 9 amps, the Maximat isn't likely to overload an ordinary 20-amp household circuit.

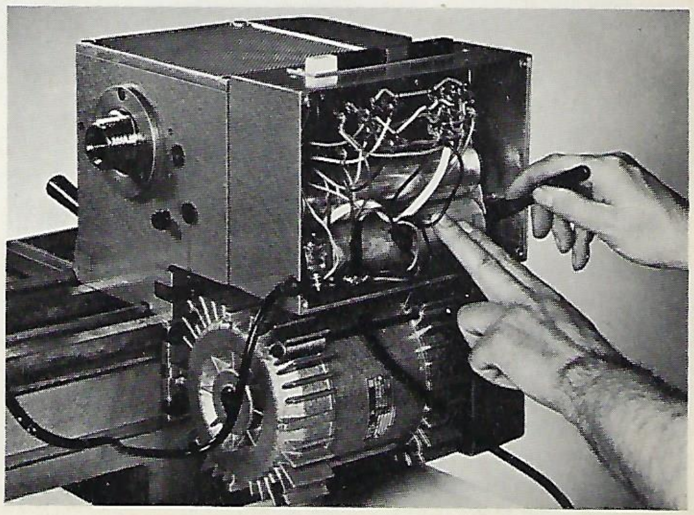
DO NOT OPERATE A NEW MACHINE until you have filled the headstock with oil to the center of the gage window (and on the V10 also filled the quick-change box) and lubed all of the grease fittings.



DIAL INDICATOR on arbor simplifies setting spindle perpendicular with table.



TO CONNECT the vertical head, push the cord's slip-on clips on the color-coded switch terminals as shown above.



MOUNT STARTING CAPACITOR for vertical head's motor in the switch box under the lathe motor capacitor.

SMALL PARTS supplied with the Maximat V10 lathe: a) two 60° centers, b) faceplate, c) clamp ring, d) faceplate stud, e) wrenches, f) grease gun, g) toolmaker's dog, h) Allen wrenches. Tool clamp is on machine. Set of 9 change gears is included with Maximat 7 lathe. Parts supplied with vertical head: i) spanner wrench, j) adapter fitting, k) removable drilling handle, l) four mounting bolts, m) drawbolt, n) tool-ejection pushrod. Spindle cap nut is on machine.

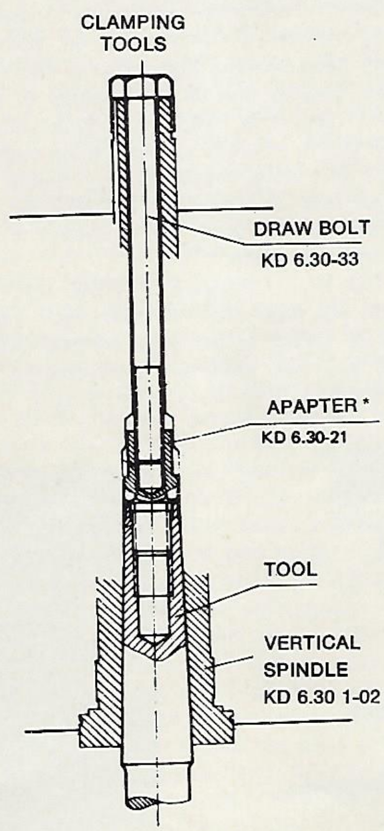
The Vertical Spindle

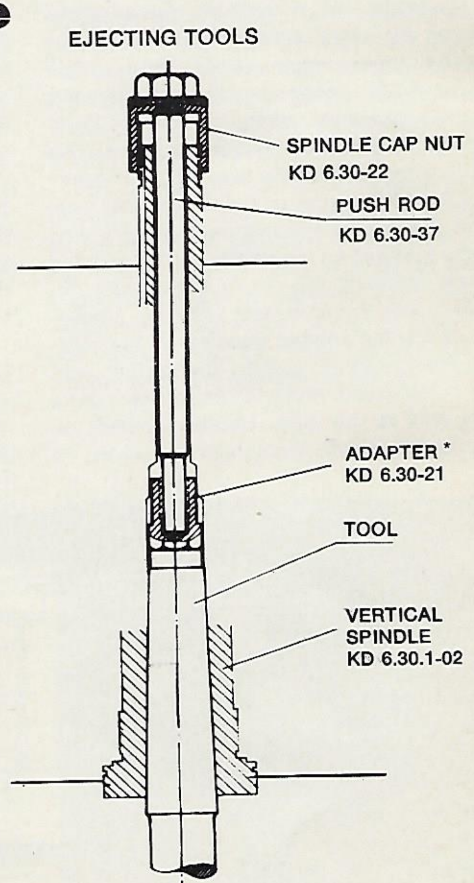
The vertical spindles on both Maximats are designed to permit seating taper-shanked tools in the spindle's internal No. 2 Morse taper securely with a drawbolt, and after use screw-ejecting the tools from the taper. *Never* drive out tools by inserting a rod through the spindle bore and hammering the rod, for repeated hammering would degrade the high precision of the spindle bearings.

The drawbolt, used to clamp mill-holders and other tools having threaded holes in the ends of their shanks, screws into an adapter fitting screwed into the tool shank (drawing left). Remember to screw this adapter into the tool, and also to clean and lightly oil both the internal taper and the tool's taper, before inserting the tool in the spindle. The drawbolt seats the tool very tightly. Avoid overtightening the bolt, which would make the tool difficult to remove.

The drawbolt isn't needed to hold drill chuck arbors in the spindle taper. Drill chuck arbors with tang ends can be seated in the spindle simply with a firm upthrust, which—if both tapers are clean—will hold them securely enough for drilling.

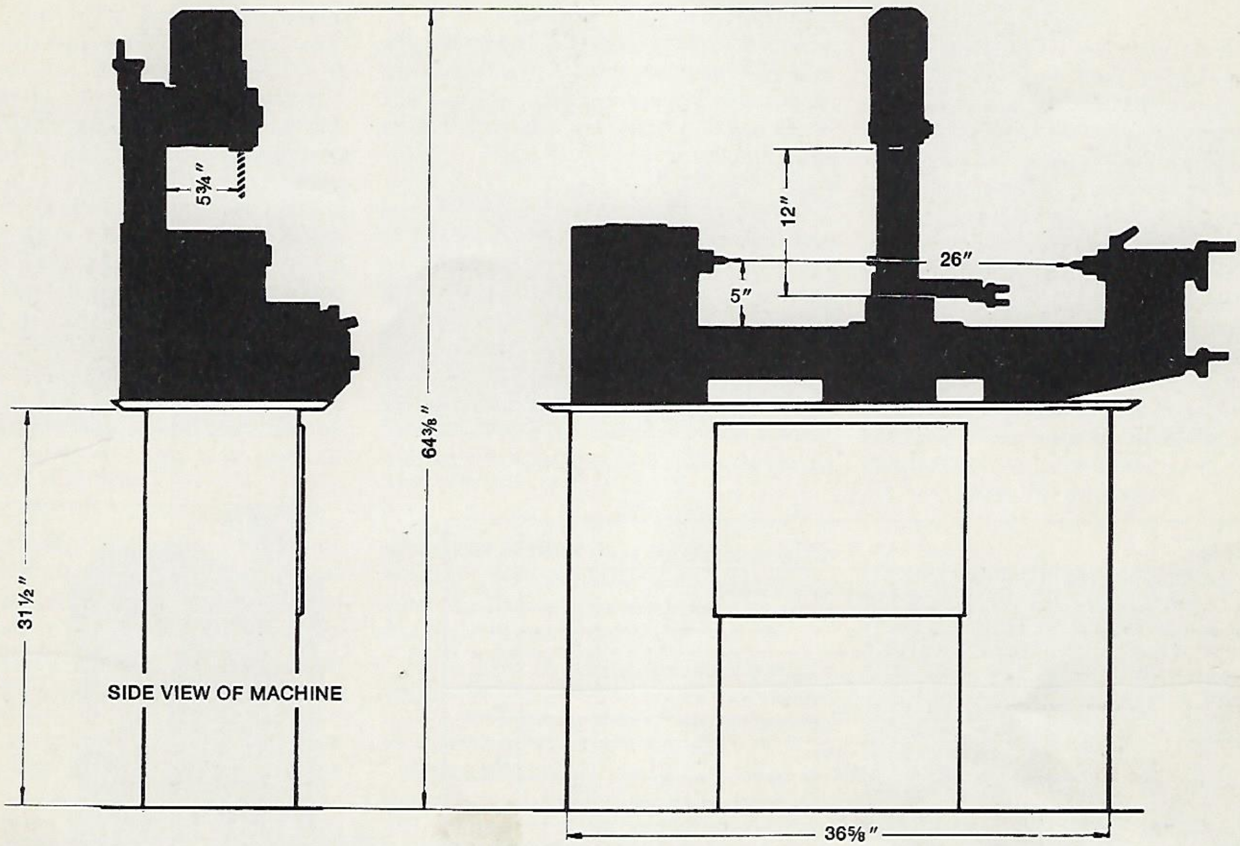
To eject tools from the spindle, unscrew the drawbolt and insert the pushrod supplied with the machine in the spindle tenoned-end-down (drawing right). Screwing the cap nut on the spindle and turning it down with the machine's wrench, with the spindle held with its spanner to keep it from turning, screw-ejects the tool. Take care not to drop ejected tools on the lathe's ways.



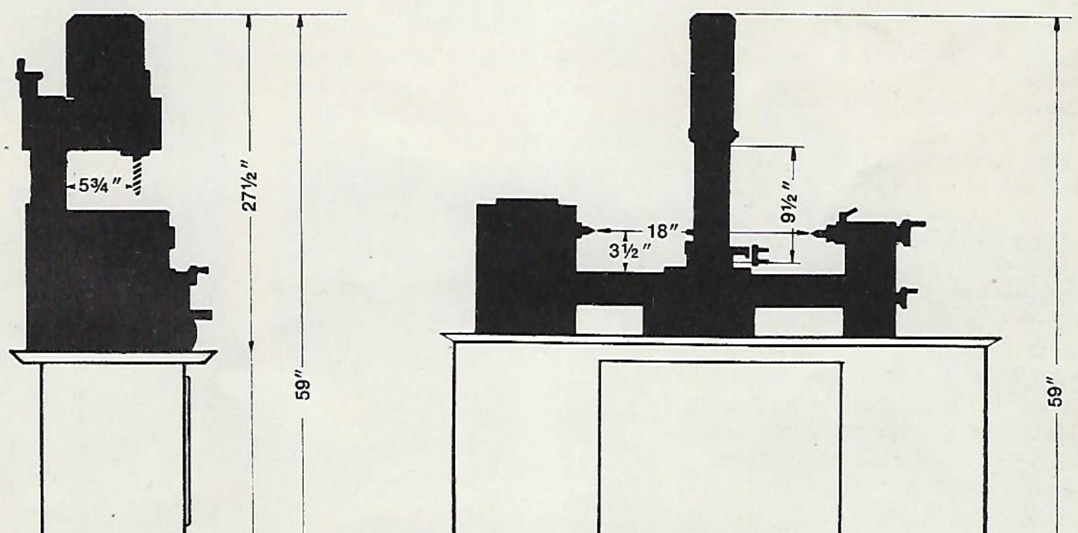


***NOTE:**
Adaptor KD 6.30-21 has *metric* threads for collet chuck #7210 and metric tooling. To use tooling, (such as end mill holders, etc.) with *inch* threads, use adaptor #7215. See Maximat accessory catalog for details.

Mounting Dimensions



Maximat V10



Maximat 7

Lubrication Requirements

A precision machine tool's numerous rotating and sliding parts need continual lubrication. Machinists ordinarily oil their machines from end to end once a day, squirting oil into every oilhole listed in a chart.

A Maximat, however, is to a degree self-lubricating. The lathe spindle's drive gears and bearings, and on the V10 also the gears in the quick-change feed box, run in an oil splashbath. The vertical spindle's gearcase is packed with light grease. Both motors have lifetime-lubed ball bearings.

Less-critical lube points on the machine have grease fittings rather than oilholes, and a push-action grease gun is supplied with each tool. Using this handy gun the operator can inject shots of grease into end gear bores, leadscrew bearings, carriage apron and tailstock in less time than it takes to fill an oilcan.

After a new Maximat has been run in at the factory the headstock is drained of oil for shipment. Be very sure when setting up the machine to refill the headstock with oil before the tool is operated. Unscrew the cover plate and pour in a little more than a half-pint of SAE 10 motor oil, filling the head to the center of the window gage behind the spindle nose.

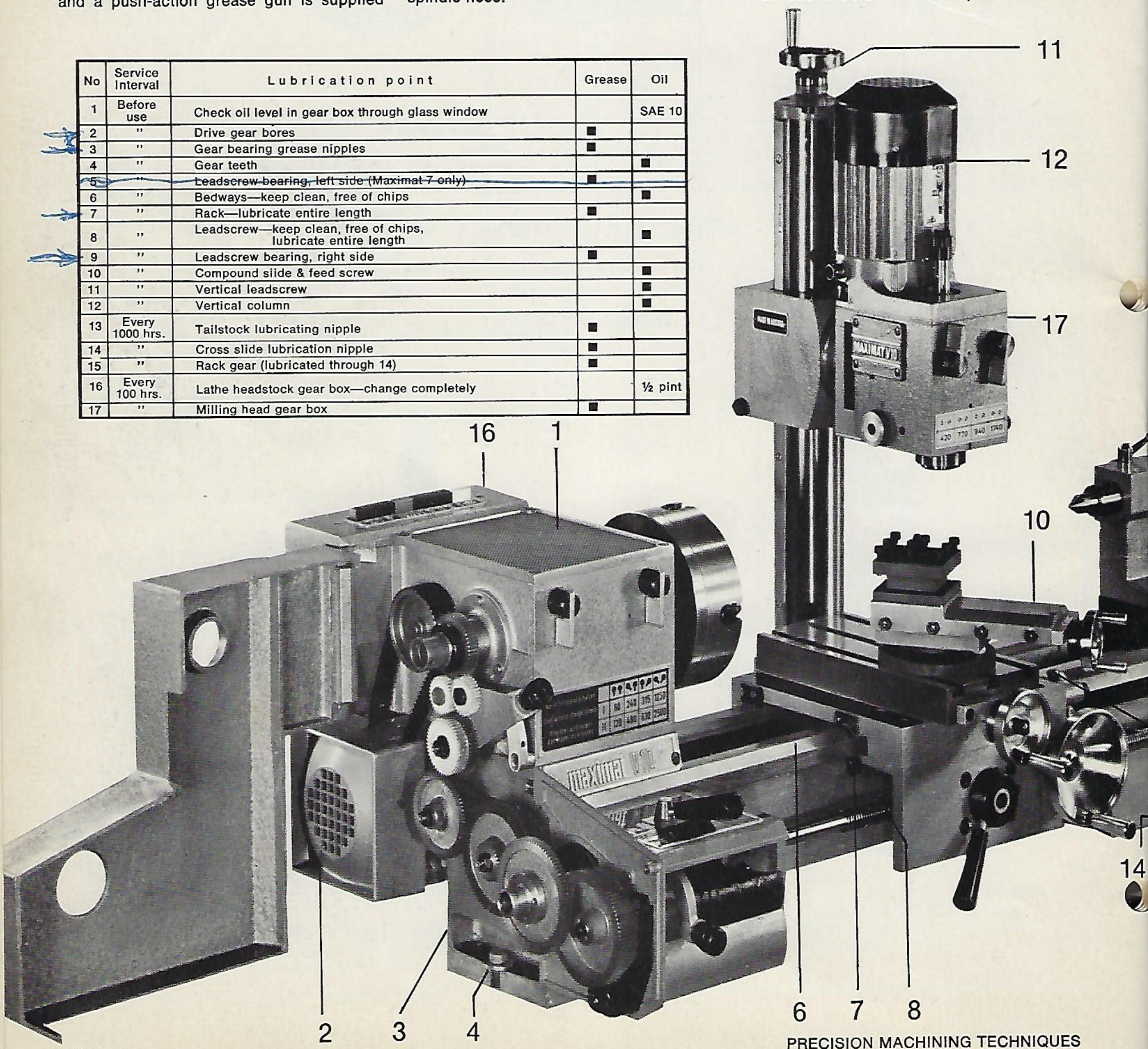
CHANGING OIL

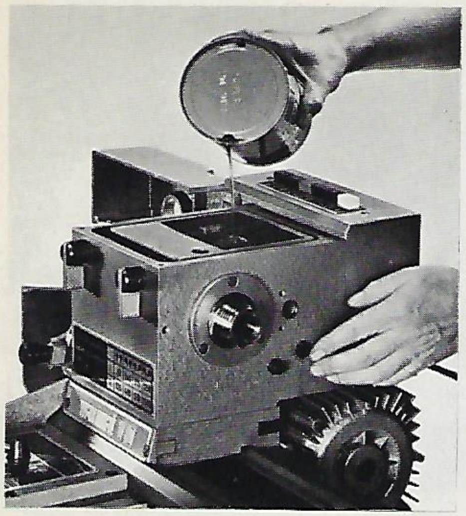
Every 100 hours of operation the oil in the headstock should be drained—by unscrewing the drain plug—and changed. Take care when changing oil that no chips or dirt falls into the open headstock.

The quick-change box on the V10 is also drained for shipment, and it too must be filled with a half-pint of oil before the machine is operated. Positioning the box's 3-position top lever in center position before unscrewing the cover simplifies reengaging the lever's lug with the sliding gear as the cover is replaced. Drain the quick-change box through its drain plug and change oil every 100 hours of operation.

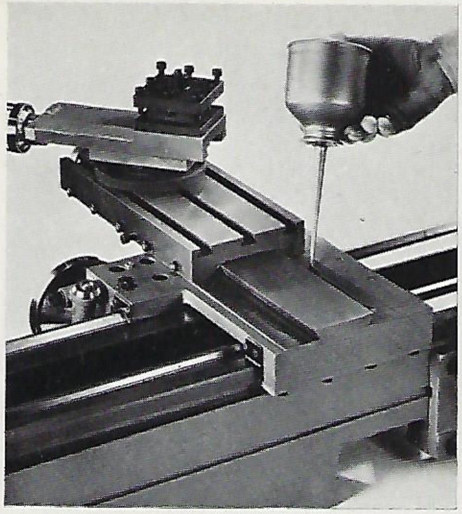
Also at 100-hour intervals the vertical head's gearcase should be regreased. To do this unscrew the nameplates from the

No	Service Interval	Lubrication point	Grease	Oil
1	Before use	Check oil level in gear box through glass window		SAE 10
2	"	Drive gear bores	■	
3	"	Gear bearing grease nipples	■	
4	"	Gear teeth		■
5	"	~~Leadscrew bearing, left side (Maximat 7 only)~~	■	
6	"	Bedways—keep clean, free of chips		■
7	"	Rack—lubricate entire length	■	
8	"	Leadscrew—keep clean, free of chips, lubricate entire length		■
9	"	Leadscrew bearing, right side	■	
10	"	Compound slide & feed screw		■
11	"	Vertical leadscrew		■
12	"	Vertical column		■
13	Every 1000 hrs.	Tailstock lubricating nipple	■	
14	"	Cross slide lubrication nipple	■	
15	"	Rack gear (lubricated through 14)	■	
16	Every 100 hrs.	Lathe headstock gear box—change completely		½ pint
17	"	Milling head gear box	■	

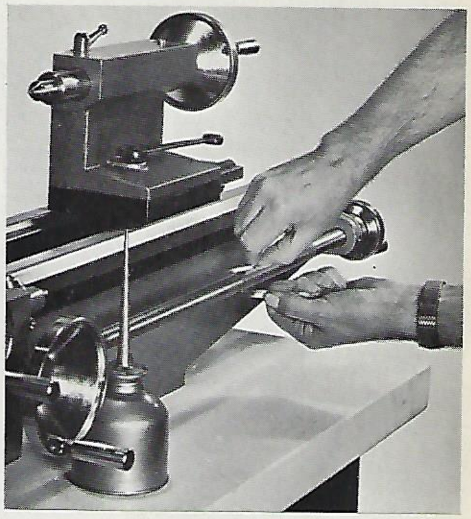




BEFORE OPERATING fill the headstock with SAE 10 oil to center of window.



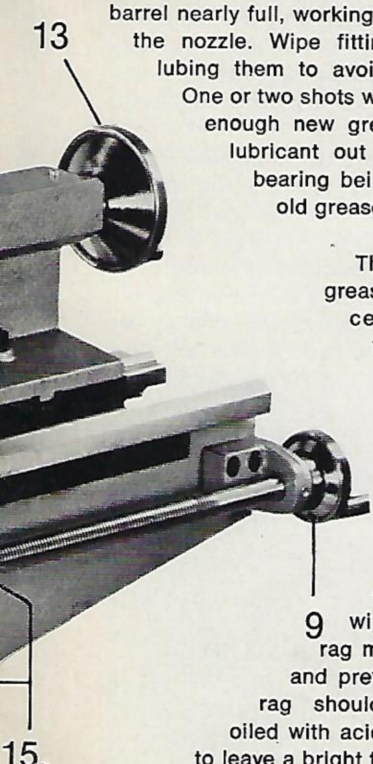
OIL THE CROSS SLIDE and the precision-ground ways with light machine oil.



CLEAN THE LEADSCREW with a strip of rag as the screw turns, then oil liberally.

sides of the head, and working from both sides, wipe out as much old grease as possible with your finger. Then wipe in gobs of fresh grease, rotating the spindle and distributing the grease on the gears and shafts. Use No. 1 NLGI grade heat-resistant lithium-base grease to relube the gearcase. Lime-base cup grease isn't suitable. Because grease expands as it heats, never fill the gearcase more than half full.

Use this same No. 1 grease in the grease gun to lube the grease fittings. To fill the gun, withdraw the follower and pack the barrel nearly full, working grease down into the nozzle. Wipe fittings clean before lubing them to avoid forcing in grit. One or two shots with the gun injects enough new grease to force old lubricant out the sides of the bearing being lubed, and the old grease can be wiped off with a rag.



This quick-and-easy greasing provides excellent lubrication for rotating parts, but a Maximat's slides must be kept cleaned and oiled with the machinist's best friend, an oily rag. Frequent wiping with an oily rag minimizes abrasion and prevents rusting. The rag should be sufficiently oiled with acid-free machine oil to leave a bright film on the surface wiped.

Wipe down the ways regularly whenever using the machine. An experienced lathe operator keeps his oily rag close at hand and cleans the bed on either side of the carriage every few minutes. He also always wipes and oils the ways before sliding the tailstock. Take particular care to keep the ways wiped when machining cast iron, since fine chips of cast iron are abrasive.

Small chips or grit the oily rag misses are caught by the carriage's felt way-wipers, which periodically should be unscrewed, washed in kerosene and reoiled.

Wiping with an oily rag will also keep the vertical column free from grit-scores and rust. Oil the foot of the column occasionally to keep it turning freely in its base. Lightly oil the Maximat's two leadscrews each time you use the machine.

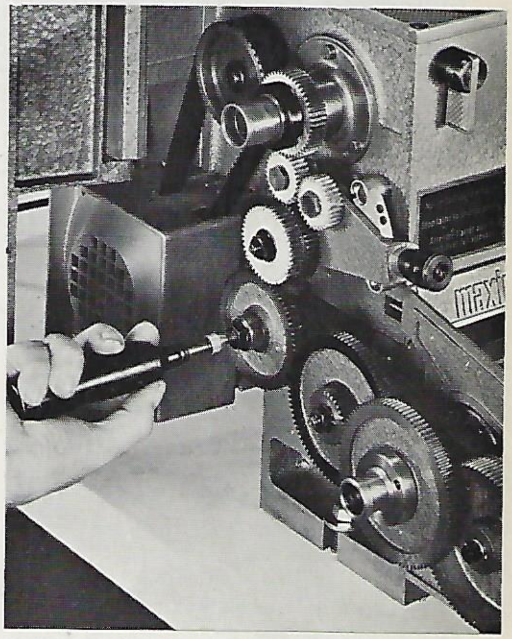
CLEANING INTERNAL TAPERS

Use a small oiled rag wrapped around a tapered stick to clean the machine's three internal Morse tapers. Inspect the tapers each time you use them to make sure that no grit is embedded in their surfaces. Inserting an oiled-rag plug in the lathe spindle's taper keeps it clean when the taper is not in use. Never attempt to clean an internal taper with the spindle running.

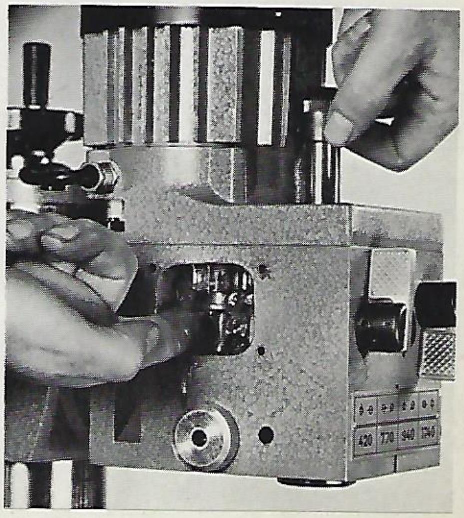
Always clean and oil the spindle's nose threads before screwing on a chuck or faceplate. It's good practice to keep a chuck or plate screwed on the spindle when the machine is not in use to avoid accidental damage to the threads.

By far the easiest way to clean a volume of chips from the machine is to use a shop vacuum, which will suck up dry or oily metal turnings like so much sawdust. If you grind lathe bits to cut short curled chips rather than long snakey coils, you can vacuum the machine, its bench and the surrounding area in minutes, and with that the machine is ready for a final wipe-down.

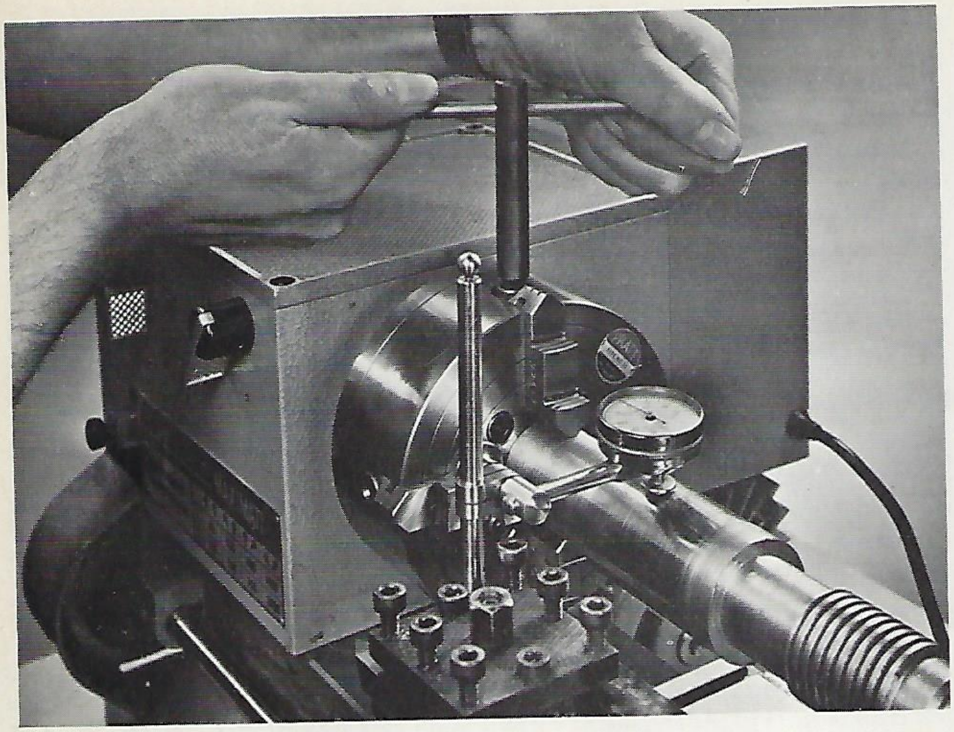
Keeping your Maximat lubed and wiped soon becomes second nature, and the effort required is well spent. When the machine is well maintained it not only does better work but its resale value is conserved, and this reduces the real per-year cost of owning a Maximat to a very moderate sum.



LUBE ALL GREASE FITTINGS with the push-type grease gun supplied with the tool.



REPACK vertical head's gearcase with bearing grease every 100 hours of operation.



Mounting Work To Be Turned

Considerable force is required to peel shavings from solid metal. Work to be turned in a metal lathe must be fixed in the machine securely, for otherwise the bit would lift the workpiece instead of cutting it. Ordinarily work is held in one of three ways: gripped in a spindle chuck, bolted on a faceplate, or mounted between centers.

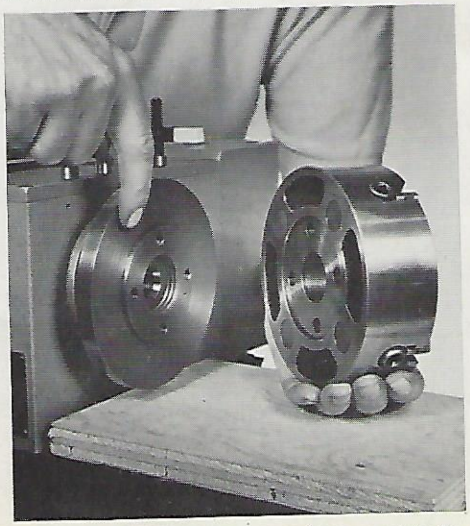
Most work is chucked. The two types of chuck used most often are the 3-jaw universal chuck, and the 4-jaw independent chuck.

SPINDLE CHUCKS

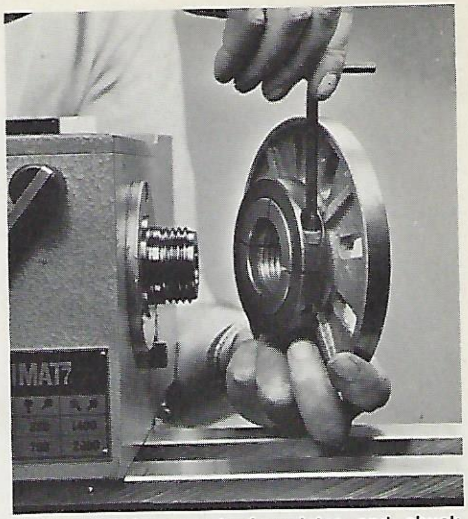
If you equip your Maximat with only one chuck, choose the more versatile 4-jaw. This chuck's four reversible step-jaws, which screw up separately, hold round, square or irrregular work either centered or off-center. The chuck's face has concentric grooves that facilitate centering work roughly by eye. The work then can be gradually readjusted—by loosening individual jaws and tightening the jaws opposite—until centered exactly. Setting a tool bit at the work's periphery and revolving the work by hand indicates which jaws require tightening, or a dial indicator can be used as pictured.

A 3-jaw universal chuck, the other commonly used type, holds round or hex work only. Turning its key rotates a geared scroll in the chuck body that closes the three step-jaws simultaneously, centering work to within a few thousandths automatically. The jaws of most scroll chucks can't be reversed; a separate set of outside jaws is used for gripping large-diameter work. Jaws and jaw-slots are numbered, and when interchanged jaws must be inserted in their own slots and engaged with the scroll in sequence.

Rather than screwing directly on the spindle, most quality 4-jaw and 3-jaw chucks are mounted on chuck plates. Chuck plates used on Maximats have split hubs that clamp on the spindle's nose threads with a clamp ring, which prevents chucks from accidentally spinning off. The same ring is used with faceplates. Before screwing either a chuck plate or faceplate on the spindle, set the headstock's control levers for slowest speed to lock the spindle. Then, with the ring slipped on the plate's hub and half-tightened, screw the plate on the nose threads until it seats against the spindle's shoulder. Then fully tighten the ring.



TO MOUNT CHUCK, finish-turn boss on plate to fit recess in body of chuck.



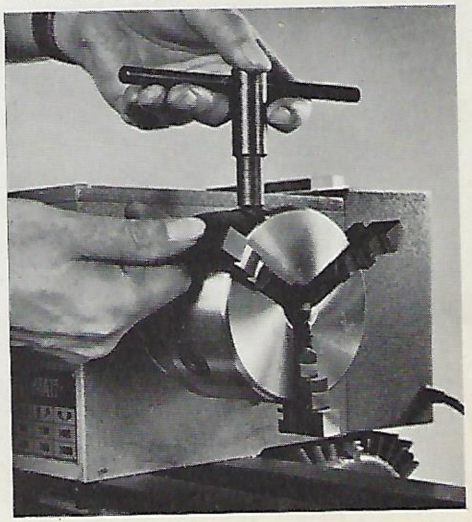
CLAMP RING prevents faceplates and chuck plates from spinning off when lathe stops.

Chuck plates come semi-finished to permit custom-fitting chucks to the particular machine. To finish-turn a plate, mount it on the spindle and face it with light truing cuts. Then turn the plate's central boss to the **exact** diameter of the recess in the back of the chuck. Take care not to turn this boss undersize, for it must fit into the chuck with a snug push fit. Then oil the plate and screw the chuck to it.

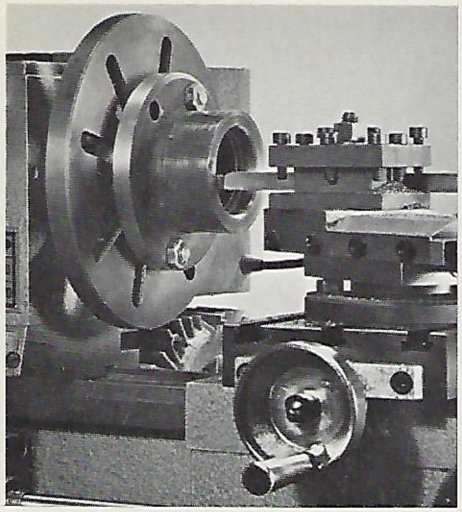
Keep chucks clean and lightly oiled. A quality chuck's tightly-fitted jaws work stiffly when new but soon wear in. Using brass shim stock under the hardened jaws prevents marring finished work. Work that overhangs the jaws more than a few inches should be centerdrilled and supported with the tailstock. Take care when inserting bar stock in a chuck not to nick the spindle's internal taper.

Never hammer a chuck to remove it from the spindle. Instead, insert a rod through the spindle's hole, hold the rod, and jerk the chuck with its key to unscrew it. Covering the ways with a square of plywood prevents damage in case a chuck is dropped.

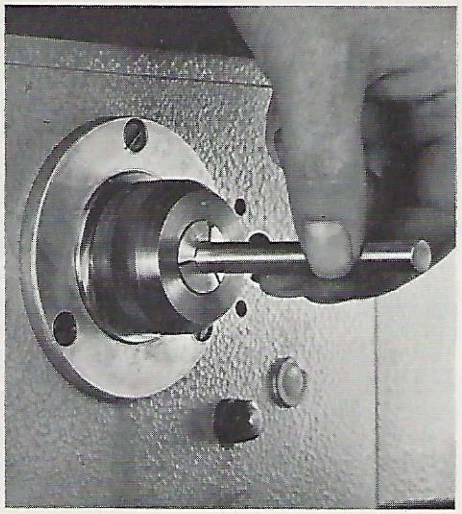
Other spindle workholding devices are available for special work. Chucks with jaws



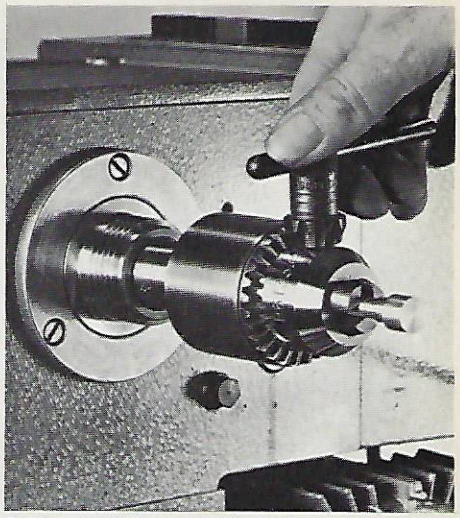
SCROLL CHUCKS have a separate set of jaws with reversed steps to grip large work.



WORK CAN BE SECURED on the faceplate with bolts or with special mounting fixtures.



DRAW-IN COLLETS, used for turning small precision parts, center work very exactly.



SMALL WORK can be held in arbor-mounted drill chucks.

that adjust either independently or simultaneously save time in production work. Jacob's-type chucks can be used to hold small parts. Draw-in collets that seat in the spindle's taper and close with a drawbar are used for work requiring extreme precision.

FACEPLATE WORK

Workpieces that for some reason can't be chucked often can be bolted or clamped on the faceplate. The work must be securely fixed on the plate, supported if necessary with parallels, an angle plate, or welded fixtures. A piece of bond paper under the work helps prevent slippage. Avoid springing the plate when tightening bolts or stud-clamps. Counterbalance heavy work mounted off-center. Never use spindle speeds higher than 700 rpms for faceplate work.

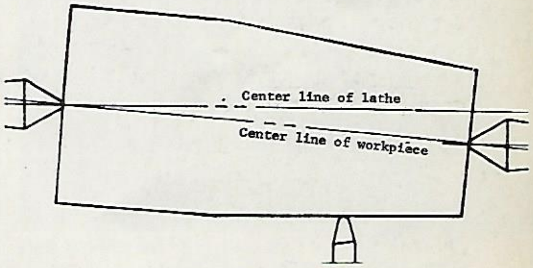
Shafting or other long workpieces, or any work that will be turned end-for-end and machined full-length, is generally mounted between centers. For this both ends of the workpiece are centerdrilled, and the work is then supported between hardened 60° centers inserted in the spindle and tailstock. A dog clamped on the work's spindle end driven by a stud on the faceplate revolves the workpiece. The "live" center in the spindle turns with the workpiece and keeps it aligned; the "dead" center in the tailstock serves as a fixed conic bearing surface on which the work revolves.

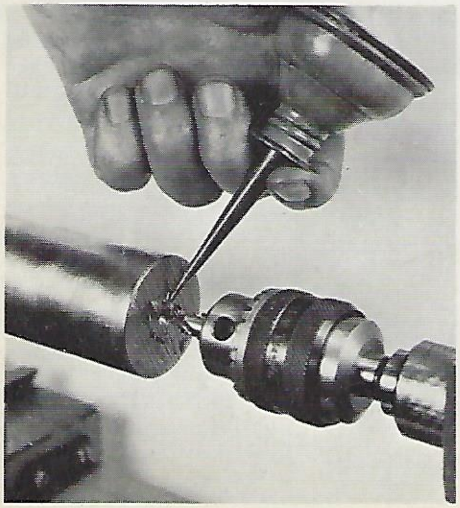
CENTERDRILLING

Most work can be centerdrilled in the lathe, using a 60°-countersink centerdrill held in a drill chuck inserted in either the spindle or tailstock. Centerpunch the work and drill at moderate speed to avoid breaking the centerdrill's tip, using cutting oil liberally when drilling steel.

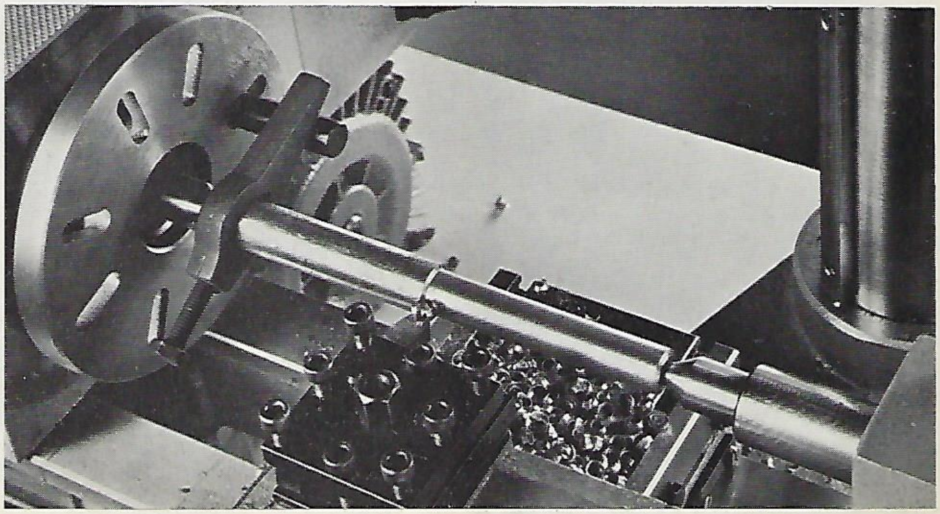
Then fill the centerholes with oil and advance the tailstock to support the work, adjusting the dead center with the tailstock handwheel just tightly enough to allow the work to turn freely but without play. As the work is machined the dead center will require frequent relubrication and readjustment. Metal turned in a lathe heats and expands, and if the workpiece expands enough to bind, the friction soon burns the center. A ball-bearing "live" tailstock center, available as an accessory, is recommended for any work turned at high spindle speed.

For close-precision work the lathe's dead center must be in precise alignment with the spindle center, since if the dead center is offset the lathe will turn a taper. To check center alignment, turn a test cylinder and measure both ends with a micrometer. If the two ends are not exactly the same diameter, adjust the tailstock's opposed set-over screws until the lathe cuts a true cylinder. Tapered pins, arbors or other tapered work can be turned by deliberately setting over the tailstock half the amount of taper desired.

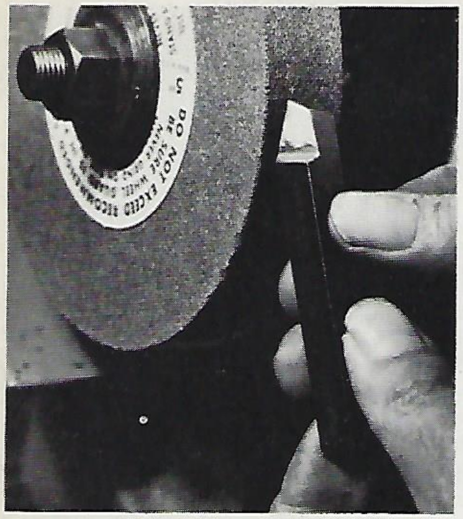




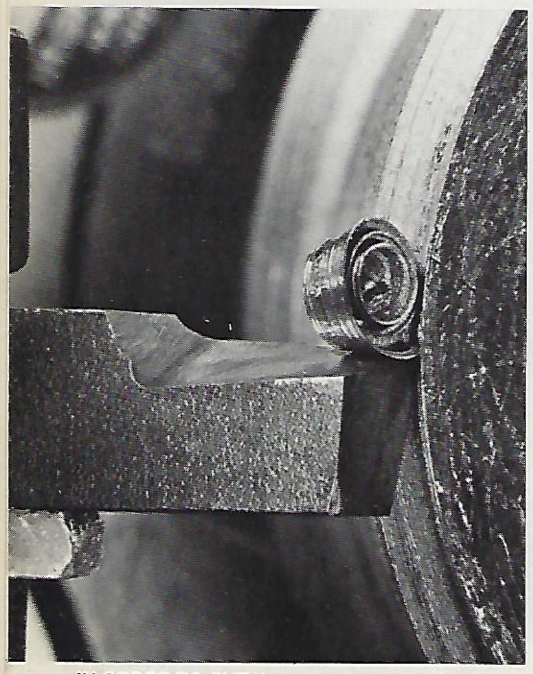
DRILL CENTERHOLES to the full depth of the centerdrill's 60° countersink.



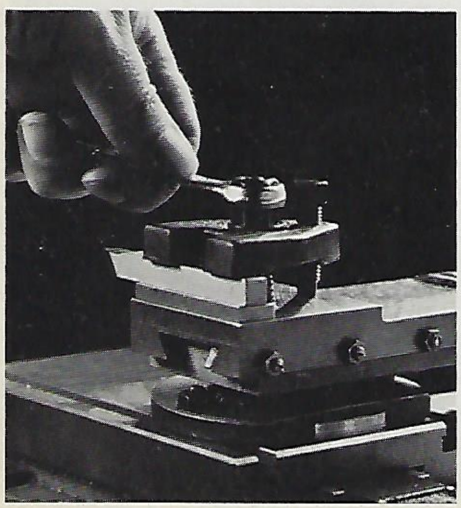
WORK MOUNTED BETWEEN CENTERS must becenterdrilled at both ends. Stud on face plate turns dog clamped on the spindle end of the work piece.



REGRIND LATHE BITS on a medium-grit aluminum oxide wheel. Avoid over heating bit.



IN ORDER TO CUT the tool must have side clearance, end clearance and rake.



TOOLS CAN BE CLAMPED on the tool platform with the triangular tool clamp.

Sharpening Lathe Tool Bits

A lathe bit's cutting action is really a deep scrape, the cutting edge bulldozing off a chip as the workpiece is forcibly revolved against it. If the metal being turned is ductile—mild steel, for example—the sheared-off chip curls across the top of the bit in a spiral. If the metal is brittle—cast iron, say—the chip crumbles into small pieces.

Whatever the metal being machined, there are three requirements for efficient cutting: (1) the tool must be harder than the material cut; (2) both work and tool bit must be rigidly mounted, and (3) the cutting edge must be suitably wedge-shaped.

LATHE BITS

It's primarily the heat generated at the cutting edge that dulls a lathe bit. For this reason tool bits are made from high-alloy steels that retain their hardness when hot. Plain "high speed steel" containing some 18% tungsten or molybdenum retains hardness to near-red heat. High speed steel bits are inexpensive, and their edges hold up well for ordinary work turned at moderate cutting speeds.

A special class of high speed steel having up to 10% cobalt added retains hardness to near-white heat. "High speed cobalt" bits hold their edges at higher cutting speeds than plain high speed steel bits, and the cobalt also increases abrasion resistance. This makes cobalt-alloy bits more efficient for turning cast iron and tough steels.

Bits with brazed-on or replaceable cemented tungsten carbide tips aren't materially affected by heat at all. They can be used at much higher cutting speeds than other bits and hold their edges many times longer. Carbide bits are widely used in production work, but they are expensive and without a diamond wheel difficult to resharpen.

Everything considered, high speed cobalt bits are usually best choice for general work in bench lathes. You can buy blank bits singly or ready-ground bits in sets.

Like heavy industrial lathes, Maximats have platform tool rests. Cutting tools can simply be clamped down on the tool platform horizontally, shimmed to height as needed, with the triangular tool clamp. If you prefer forged gooseneck toolholders to large bits, the shanks of the holders can be clamped on the platform similarly.

The open-side turret tool blocks available as accessories for both Maximats, however, are far more convenient tool-mounting devices than overhanging gooseneck holders. These tool blocks hold up to four bits of any size up to ½"-square. Small bits are raised to height on shims inserted in the block's grooves under the tool shanks.

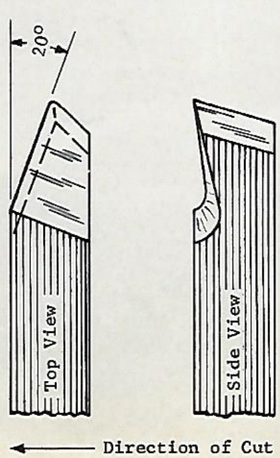
Because setting a bit above or below the work's centerline would change the tool's front clearance and rake angles, it's important—particularly when the workpiece is small in diameter—to mount the bit with the point of its cutting edge exactly at center height, level with the axis of the work. Simply align the bit's point with one of the lathe centers, using a brass or aluminum shim of the thickness required under the bit. Always mount bits with minimum overhang for maximum rigidity.

GRINDING CUTTING EDGES

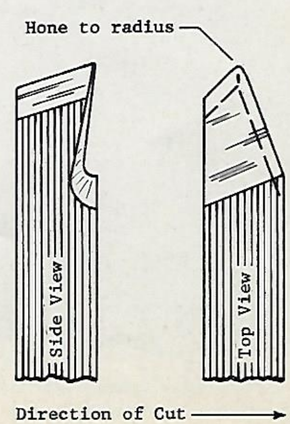
Shaping and resharpening single-point lathe bits isn't difficult if you first give thought to what you expect the tools to accomplish. Bits are ground for particular cuts in particular materials. You can find the dozen or more fairly standard lathe tool shapes—with often several equally-satisfactory versions of each—diagramed in machinist's handbooks.

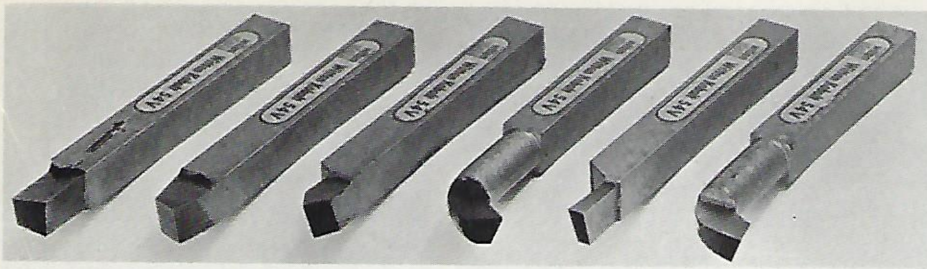
A lathe bit is simply a sharp wedge canted to cut when fed into the workpiece. Bits ground for cuts towards the headstock, which are sharpened on the left edge and fed in from the right, are termed right-hand tools. Bits ground for cuts towards the tailstock, sharpened on the right edge and fed in from the left, are termed left-hand tools.

RIGHT-HAND MULTI-PURPOSE BIT



LEFT-HAND MULTI-PURPOSE BIT





READY-GROUND TOOL BITS are available in sets. Shown above: roughing tool, finishing tool, 60° threading bit, internal threading tool, cut-off tool, boring tool.

TURRET TOOL BLOCK, convenient for general work, holds up to four tool bits.

In order to make the bit's cutting edge cut, the side immediately under the edge, and also the bit's end, must be relieved (ground off to a bevel) enough to allow the edge to bite into the work without rubbing. The angle of bevel is termed the clearance angle. Ordinarily about 12° side clearance and 8° end clearance are required (extra side clearance is needed because most bits feed sideways). Whenever a tool won't cut unless forced, check its clearance angles.

RAKE ANGLES

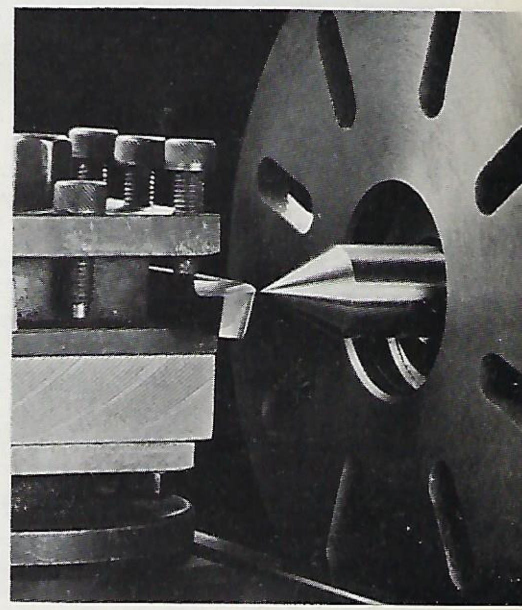
Grinding the bit's top face at a slope away from the cutting edge gives the tool its wedge-shaped cross-section. The angle of slope across the bit is termed side rake. The angle of slope backwards along the bit's axis is termed back rake. Usually a bit's top face is sloped at a compound angle, with some side and some back rake.

Varying these rake angles makes the included angle of the tool's cutting edge more acute (for cutting soft, ductile metal) or less acute (for cutting hard, brittle metal). Experience has show that a 61° cutting edge—a bit with 12° side clearance and 17° rake—cuts soft steel most efficiently. A more acute 53° edge—a bit with 25° rake— is preferable for cutting copper or aluminum. For machining cast iron a squarer 71° edge—a tool with 7°rake—holds up longest. Tools for machining brass should have zero rake, with the top face of the bits ground square-across to prevent the cutting edge from hogging-in.

A bit's side rake gives the cutting edge its shearing action. Back rake guides the chip away from the work and protects the point of the cutting edge. Tools used horizontally on platform tool rests often are ground with extra side rake and less back rake to avoid the necessity of grinding deeply into the bit.

Tools for roughing and finishing are similar in shape, but while the points of roughing tools are left needle-sharp, the points of finishing tools are rounded slightly—to about 1/64"-radius—and whetted smooth on an oilstone. Finishing bits can be resharpened a number of times by whetting before regrinding is necessary.

Multi-purpose bits ground as diagramed at left below are widely used for general work in bench lathes. Tools of this shape are satisfactory for light roughing cuts, finishing cuts and facing cuts in nearly any material, and they can be resharpened repeatedly with light grinding. Since most cuts are made towards a lathe's headstock, the right-hand tool is more frequently used.



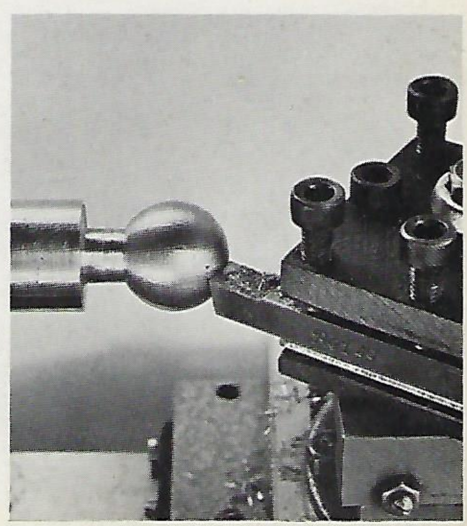
MOUNT BIT at center height, aligning point of cutting edge with lathe center.

RESHARPENING

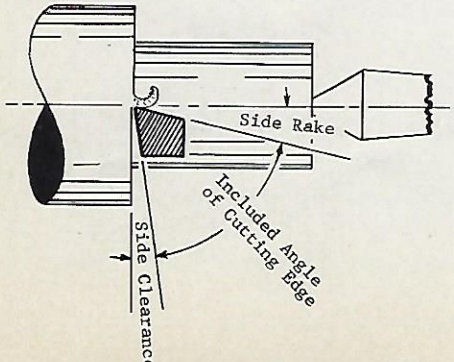
Choose a 60-grit medium-grade aluminum oxide wheel for grinding bits to shape. A 100-grit wheel can be used for resharpening. When sharpening a bit first grind its side clearance, then end clearance, then top rake. Grind slowly, cooling the bit in water repeatedly to avoid overheating the steel.

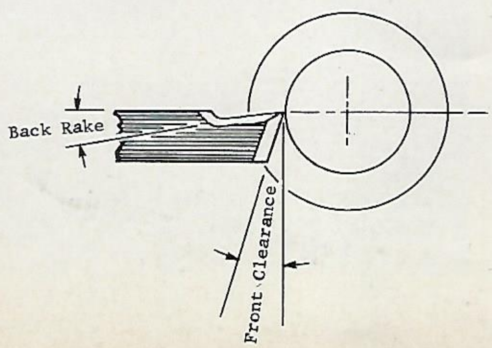
Forming bits ground to special profile can be useful for turning duplicate parts. Make sure such tools have adequate front clearance. Profiled cutting edges up to ⅜" wide can be used for turning non-ferrous metals. The cutting edges of forming tools for turning steel normally should be no more than ⅛" wide, although wider tools with zero rake can be used for light scraping cuts. Sharpen forming tools by lightly grinding the top face.

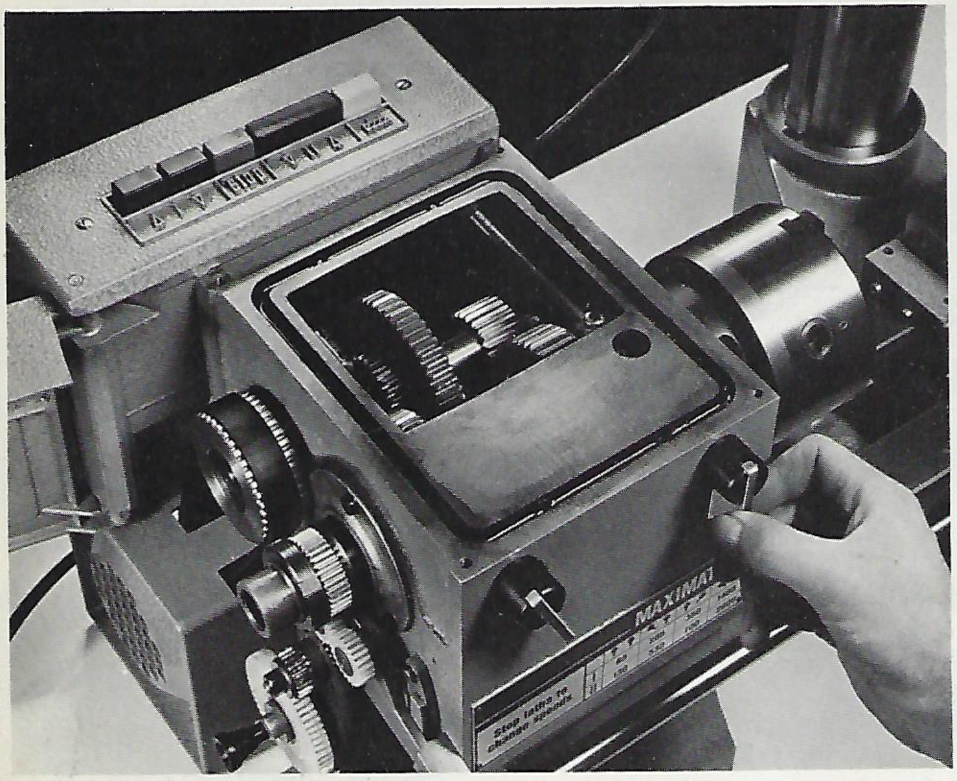
Grinding a shallow groove in a tool's top face immediately behind and parallel with the cutting edge breaks chips into short lengths. Long coiled chips that whip are a safety hazard.

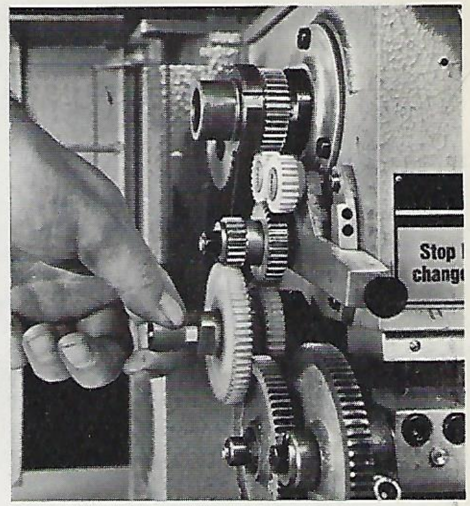


FORMING TOOL ground from blank bit simplifies turning ogees or spheres.









MAXIMAT 7's end gear train has shiftable idler giving "coarse" and "fine" power feed.

Lathe Speeds And Feeds

The various metals turned in lathes differ in their "machinability"—the comparative ease with which they can be cut. Harder-to-cut metals can be machined most efficiently with slower, deeper cuts. Easier-to-cut metals can be machined most efficiently with faster, lighter cuts.

Cutting speed—the rate at which a point on the work's periphery sweeps past the bit's cutting edge—is expressed in surface feet per minute, or sfm. Optimum rates of cut for particular metals under average conditions have been established by experience. The following cutting speeds for common metals are recommended:

Soft aluminum	300 sfm
Copper	200 sfm
Yellow brass	200 sfm
Mild steel	100 sfm
Stainless steel	100 sfm
Tool steel	80 sfm
Malleable iron	80 sfm
Grey cast iron	60 sfm
Cast steel	50 sfm

At these cutting speeds a properly-ground high speed steel tool bit used without coolant will hold its edge for about one-half hour of continuous cutting, which is considered the norm. A high speed cobalt bit will hold up somewhat longer.

SPINDLE SPEED

Because at the same spindle speed large-diameter work has much higher surface speed than small-diameter work, determining the spindle rpms needed to give the desired cutting speed takes a moment's figuring. You can make an approximate calculation quite easily by multiplying the desired cutting speed (sfm) by four, and then dividing the product by the diameter of the workpiece (inches), which will give the spindle speed required (rpms). Example: if you want to turn a piece of mild steel 1½" in diameter at a cutting speed of 100sfm, multiply 100 by 4, and divide by 1.5, which equals 266 rpms, the required spindle speed.

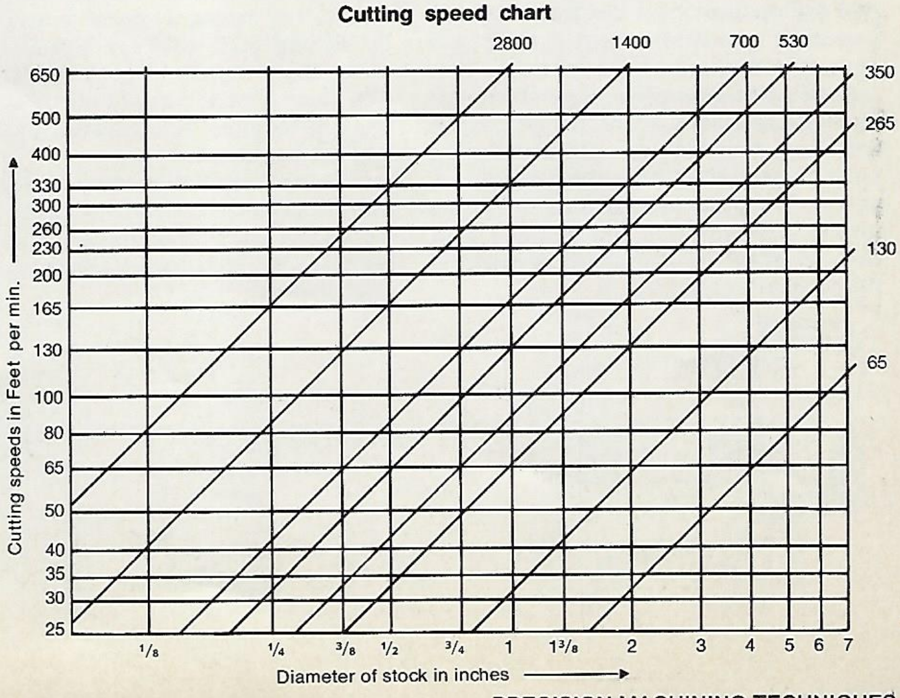
A still easier way to determine the proper spindle speed is to refer to the chart below. First find the cutting speed desired on the vertical axis. Then run your eye across the chart at that level to the work's diameter. The diagonal line nearest that point will give the spindle speed needed.

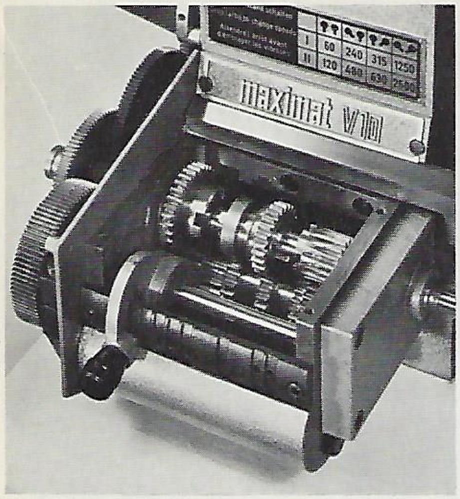
With spindle speed set, an appropriate depth of cut and carriage feed rate are selected. Remember always to make sure that the carriage lock screw is unlocked before engaging the lathe's power feed lever. Depth of cut and feed rate are related. Experienced machinists judge them by "feel".

DEPTH AND FEED

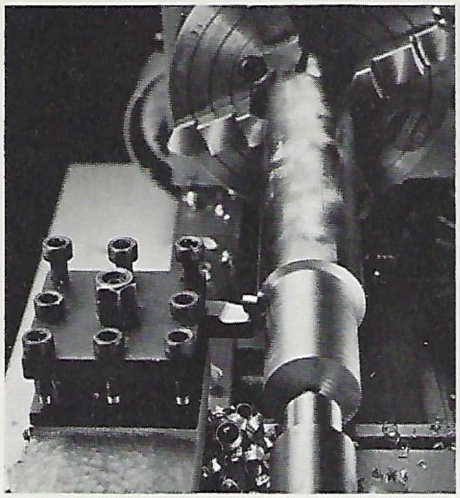
Deep roughing cuts aren't advantageous on small lathes. More metal per minute can be removed with cuts approximately 1/10" deep taken at recommended cutting speed.

Cutting speed chart

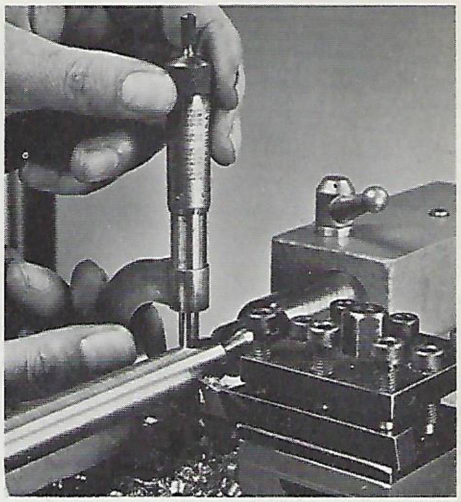




MAXIMAT V10's feed box (shown with cover removed) provides 24 carriage feed rates.



FOR ROUGHING CUTS use as coarse a feed as the lathe will pull without laboring.



FINISHING CUTS should be about .005" deep. Use fine feed rate for smooth finish.

Cuts .100" deep also simplify turning work to size without repeated calipering. On the Maximat 7 the "coarse" carriage feed rate (.005" per spindle revolution) is used for roughing cuts and the "fine" feed rate (.002" per spindle revolution) for finishing cuts. On the Maximat V10 the quick-change box provides a selection of 24 feed rates.

Ordinarily the optimum feed rate for a roughing cut is a feed just fast enough to produce a chip that heat-colors slightly—turning straw-yellow—as it leaves the bit's cutting edge. If the chip turns blue, either the feed rate or the depth of cut should be reduced.

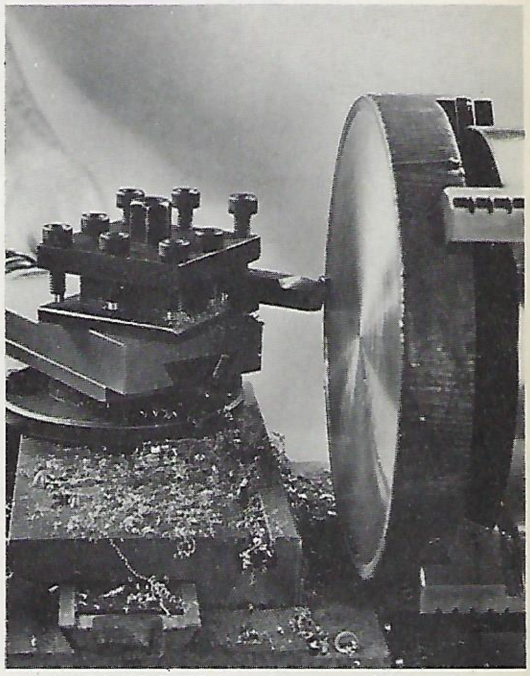
The allowance for finishing usually should be about .010", for a finishing cut half that depth. A light cut with a carefully-honed round-nose tool made at recommended cutting speed leaves the smoothest finish, but higher speed can be used to save time.

Feed facing cuts with the cross-feed handwheel from the center of the workpiece out. Avoid angling the bit's point in the direction of cut, for it would then tend to dig in. Make sure before starting facing cuts on large-diameter work that the cross slide will have sufficient travel to complete the cut. Lock the carriage on the ways with its lock screw and use the compound slide for depth-of-cut control. Take moderate cuts when facing large work to avoid overloading the lathe's motor as the bit nears the work's periphery.

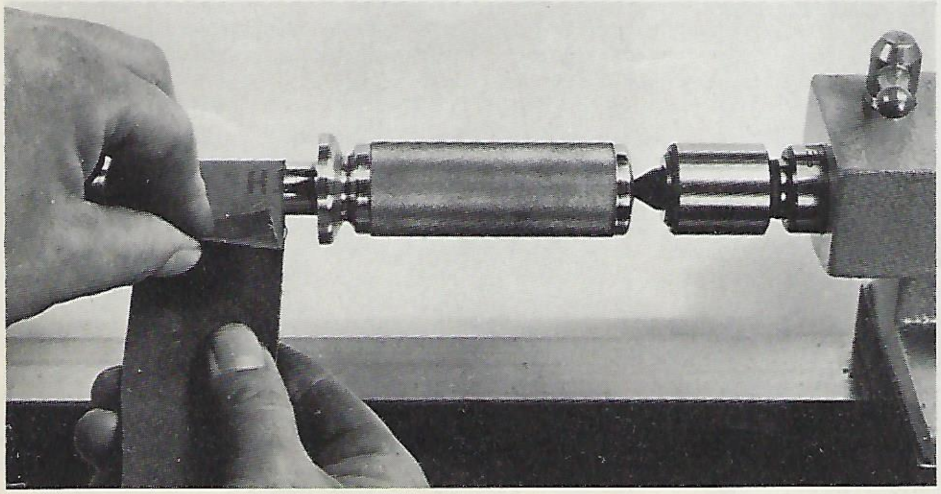
BORING

When boring holes always use the largest boring tool possible for maximum rigidity, and since even a heavy boring bar springs somewhat, bore with light cuts. Make sure the boring tool's cutting edge has enough front clearance to prevent its heel from rubbing in the hole. When boring work accurately to size finish the hole with two continuous cuts only a few thousandths deep, using the slowest feed rate.

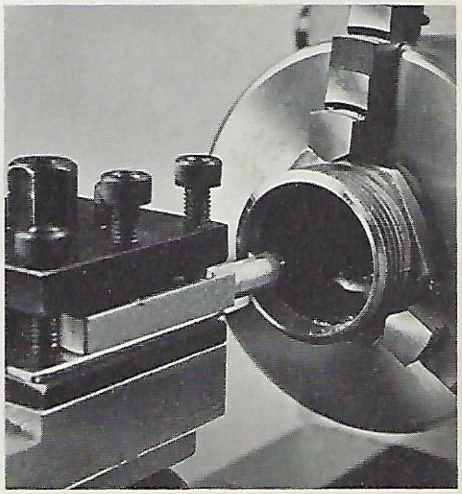
A Maximat's highest spindle speed is higher than the top speed available on most bench lathes and should be used only for turning and polishing very small-diameter work. Oil a piece of worn abrasive cloth to give work a final mirror polish.



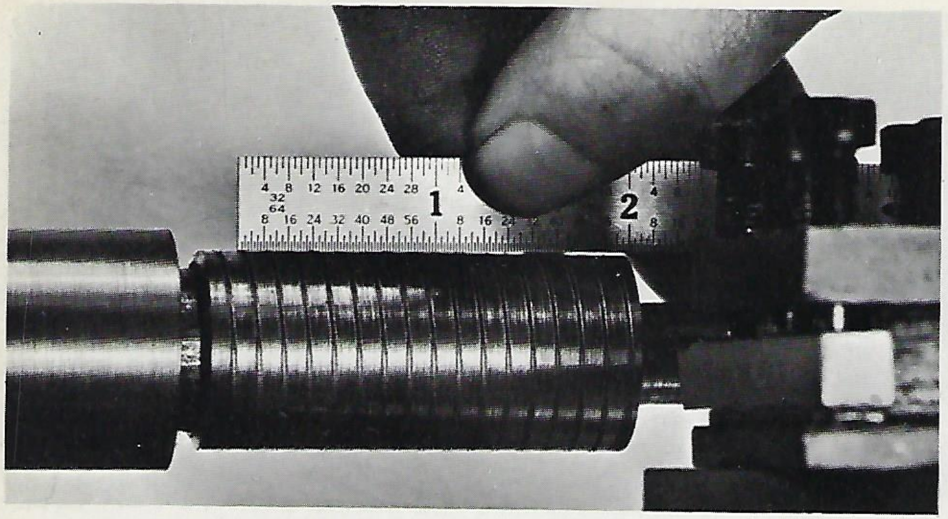
MAKE FACING CUTS from the center of the work out with a slow, steady feed.

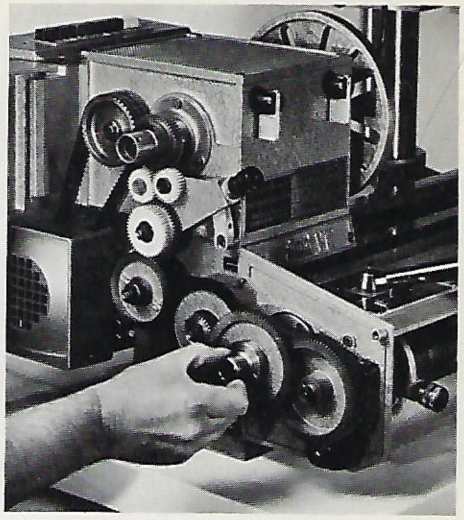


WHEN USING HIGH SPINDLE SPEEDS for polishing or turning small parts, disengage lathe's lead-screw. Use ball-bearing center for high-speed work.



BECAUSE BORING TOOLS spring slightly, finish bored holes with two very light cuts.





WITH SLIDING GEAR "OUT", Maximat V10's quick-change box cuts 24 inch thread pitches.

Cutting Screw Threads

Setting up a metal lathe to cut screw threads is simply a matter of increasing the carriage's power feed rate enough to make the tool cut a helix of the desired pitch. It's then possible by taking successive cuts with a bit ground to the profile of the thread groove to cut American National 60° V, International Metric, Whitworth, Acme, Square or any other form of thread. Threads cut towards the lathe's headstock will be right-hand threads. Threads cut towards the tailstock will be left-hand threads.

The relative speed of the lathe's leadscrew—the number of revolutions the screw makes for each revolution of the spindle—determines the pitch (threads per inch) of the thread cut, whatever its diameter. The Maximat 7 has a 16-pitch leadscrew. If the 16tpi leadscrew were to make one full turn for each revolution of the spindle, each spindle revolution would advance the carriage 1/16" along the ways and the tool would cut 16tpi. If the screw were to turn at half that speed, making one-half turn for each spindle revolution, each spindle revolution would advance the tool 1/32" and the tool would cut 32tpi. If the screw were to make two turns per spindle revolution, each spindle revolution would advance the tool ⅛" and the tool would cut 8tpi.

GEARING THE LEADSCREW

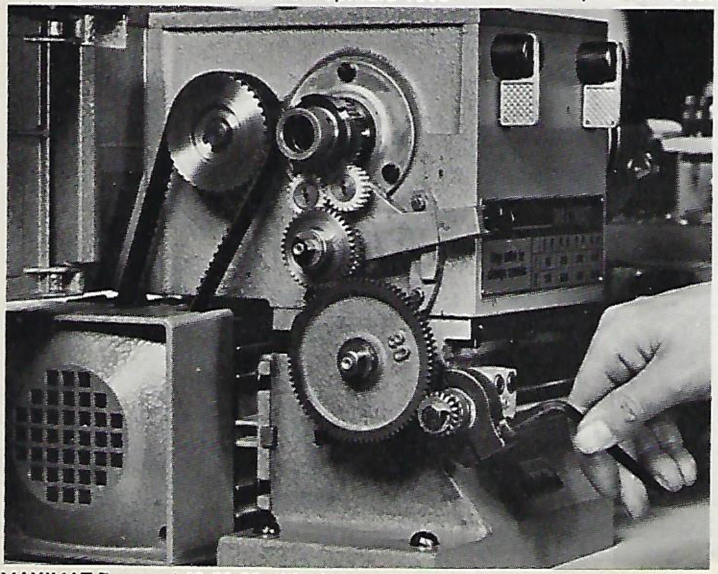
Driving the leadscrew at proper relative speed to obtain the desired thread pitch is accomplished by gearing the lathe's feed train to the proper ratio. On the Maximat V10 this can be done simply by shifting the quick-change box, which instantly gears the lathe to cut any of 24 pitches. On the Maximat 7 the end gear train must be re-geared with the change gears supplied with the machine. The chart inside the Maximat 7's gear cover (below opposite) shows the change-gear setups for both inch and metric pitches.

When you examine the Maximat 7's end gear train you'll see that it is driven by a 35-tooth gear on the end of the spindle, termed the spindle gear. The spindle gear turns a pair of reverse idlers that reverse the leadscrew's direction of rotation, and the reverse idlers drive a 35-tooth tumbler gear, the inner gear on the reverse lever stud. This spindle-to-tumbler section of the train remains unchanged, and since the tumbler gear has the same number of teeth as the spindle gear, this section can be disregarded when figuring the train's ratio.

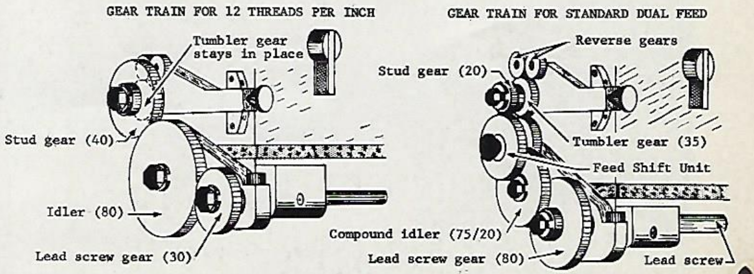
The outer gear on the reverse lever stud, the stud gear, is keyed to the tumbler gear and turns at the same speed as the spindle. This stud gear, through one or more idlers, drives the gear keyed on the end of the leadscrew, the screw gear. The ratio of stud gear teeth to screw gear teeth (a single idler merely transmits power) determines the leadscrew's speed relative to the spindle.

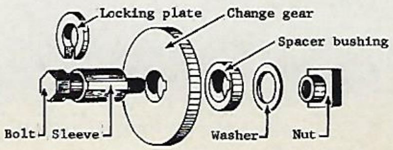
If for example you were to mount a 40-tooth gear on the stud driving via an 80-tooth idler a 20-tooth gear on the leadscrew, the train would have a 40-to-20, or 2-to-1, ratio. Each turn of the stud gear would turn the 16-pitch leadscrew two revolutions, twice the speed of the spindle, and the lathe would cut 8tpi.

You'll find this 40-80-20 setup (gears designated by number of teeth) given in the chart's 8-pitch column. Vertical lines represent power flow, showing which gears



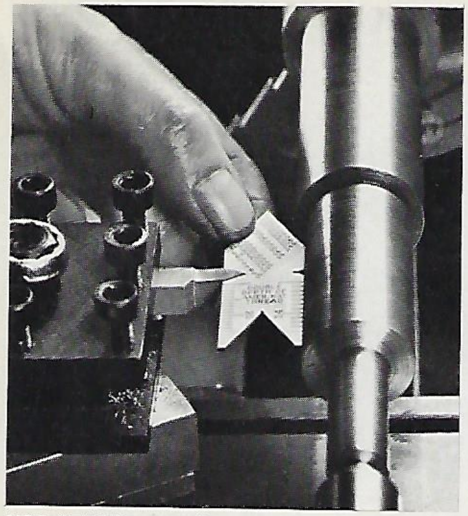
MAXIMAT 7 geared 40-80-20 with change gears (first column on chart) is set up to cut 8-pitch threads.



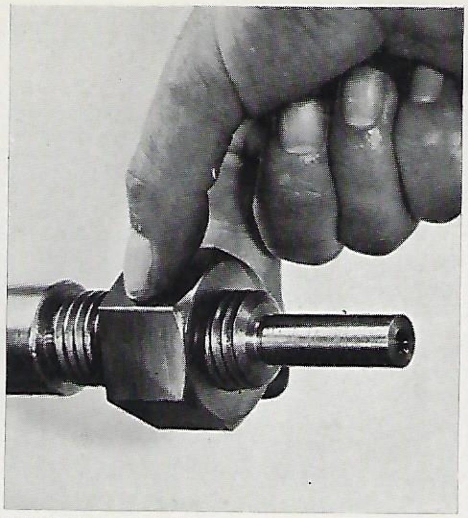


THREADING CHART LEGEND

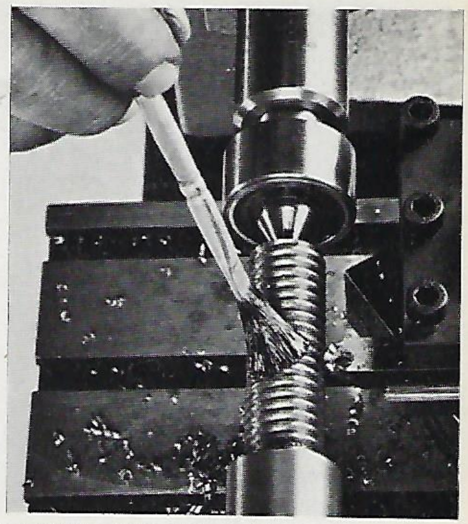
n/" = Inch system threads
mm = Metric system threads
W = Stud gear
Z_1 = First idler gear
Z_2 = Second idler gear
L = Lead screw gear
E = Feed shift unit
H = Spacer bushing



USE CENTER GAGE to set threading bit at 90° angle to the workpiece.



APPLY CUTTING OIL liberally with brush when threading steel. Finish with light cuts.



THREADS CAN BE MEASURED, or simply deepened until nut screws on smoothly.

mesh.. An H beside a gear number indicates that the gear mounts with a spacer bushing.

MOUNTING CHANGE GEARS

Idler gears mount on studs that can be positioned as needed along T-slots in the swinging mounting bracket, or quadrant. With the idler (s) mounted, the quadrant is swung up until the idler meshes with the stud gear. Avoid meshing the gears too tightly; a slip of bond paper inserted between the gear teeth gives proper clearance.

When the chart calls for two idler gears, mount the stud for the second idler in the quadrant's lower T-slot. Compound idlers (two gears keyed together on the same stud) are required in either first or second idler positions for cutting odd-pitch threads. Mesh compound idlers as the chart's vertical lines indicate.

The bit used to cut 60° threads should be ground to fit the notches in a center gage and whetted sharp. Be sure that both cutting edges have enough clearance to prevent the tool from rubbing in the thread groove. Grind threading bits with zero rake.

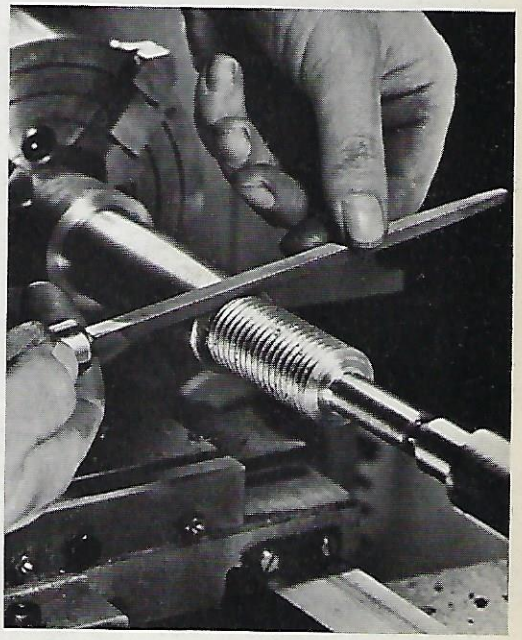
Set the bit square with the work at center height. When cutting 60° threads most machinists angle the compound slide at 29° and use the compound to advance the tool. The bit's leading edge then does most of the cutting with the trailing edge taking a light cleaning cut.

A threading dial is a convenient accessory but isn't essential. With a dial you can disengage and reengage the carriage with the leadscrew in register for succesive cuts. When cutting threads without a dial, engage the carriage and *leave it engaged* until the thread is completed. After each cut, stop the spindle, withdraw the tool from the thread with the cross slide, and then operate the motor in fast reverse to return the carriage to the starting point for the next cut. Set the cross slide handwheel's micrometer collar at zero before taking the first cut to permit repositioning the cross slide at its original setting for each succeeding cut. Before each cut advance the tool with the compound slide, making the first cuts about .005" deep and gradually decreasing depth to .001" for finishing.

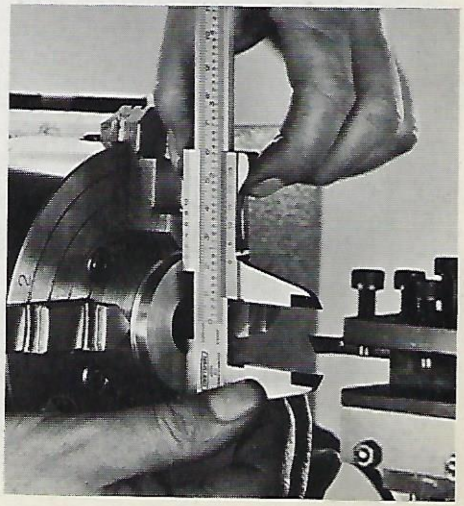
INTERNAL THREADING

Boring internal threads is exactly like external threading except that you work backwards, cranking the cross slide in to withdraw the tool from the thread. When threading blind holes undercut the bottom of the thread to simplify stopping the tool.

Double threads can be cut by first cutting one groove, then slipping an idler gear and revolving the work one-half turn without disengaging the carriage from the leadscrew, and then cutting the second groove.



SMOOTH UP cut thread with a triangular file, rounding crests slightly. Chamfer end.

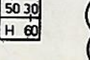


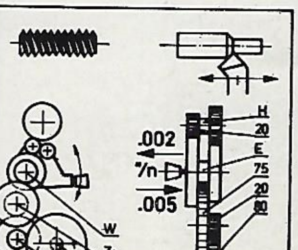
HOLES TO BE THREADED should be bored exactly to the thread's minor diameter.

n/"	8	9	10	11	11.5	12	13	14	16	18	19	20	22
W	40	40	40	40	50	40	40	40	30	40	70	40	40
Z_I	80 H	50 H	80 H	50 H	45 25	80 H	50 H	70 60	60 40	80 H	45 50	80 H	80 H
Z_{II}		45 60		55 60	H 60		65 60	H 50	H 50				
L	20 H	H 30	25 H	H 30	H 20	30 H	H 30	H 30	H 20	45 H	H 75	50 H	55 H

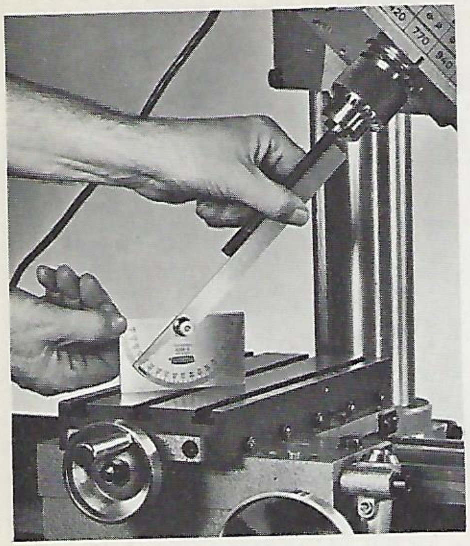
n/"	24	26	28	32	36	40	44	48	56	64	72	80
W	20	40	40	20	20	20	20	20	20	20	20	20
Z_I	50 H	70 H	65 H	80 H	80 H	80 H	80 H	80 H	65 H	60 H	55 H	55 H
Z_{II}	55 H										45 30	50 30
L	30 H	65 H	70 H	40 H	45 H	50 H	55 H	60 H	70 H	80 H	H 60	H 60

mm	0.4	0.5	0.6	0.7	0.8	1	1.25	1.5	1.75	2
W	50	55	35	55	50	40	50	60	70	65
Z_I	75 30	70 30	65 75	60 H	75 60	50 H	45 H	55 65	55 65	75 80
Z_{II}				50 30		55 65	55 65			
L	H 80	H 75	80 H	H 75	H 80	H 75	H 75	H 75	H 75	H 55

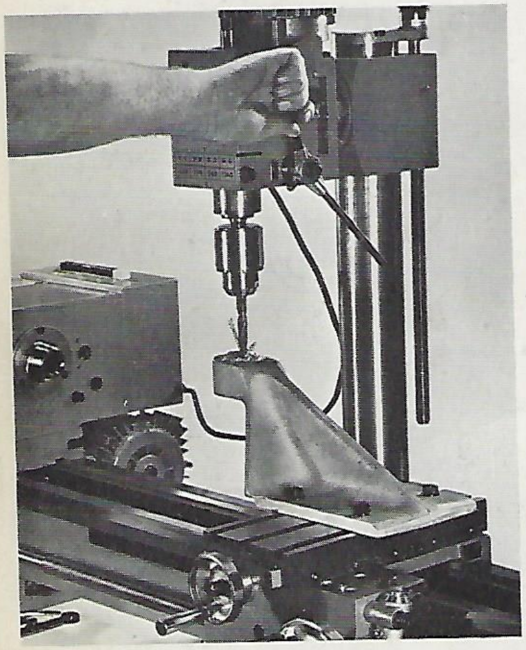
H=




Vertical Spindle Operations



INSERT ROD in chuck to check angular settings of head with a bevel protractor.



LARGE WORK can be bolted to table's T-slots or held on table with stud clamps.

Since so many metal parts are assembled with bolts, screws, rivets or pins that require holes, drilling is a fundamental machining operation. Most drilling jobs can be performed in a lathe, but often they can be accomplished faster and more conveniently on a machine that has a column-mounted vertical spindle—a drill press.

A Maximat can be converted from lathe to drill press simply by unbolting the compound slide from the T-slotted carriage worktable and replacing it with a machine vise. The machine's self-contained vertical head is then swung over the worktable.

The 4-speed geared-spindle vertical head rotates 360° horizontally, column and all, in its 5°-graduated base, and the motor-spindle assembly rotates 360° vertically on a 1°-graduated column mount. This permits using the spindle vertically, angled, at a compound angle, or horizontally. The head slides the full length of the column and can be locked wherever needed. Its precision spindle is housed in a non-rotating sleeve that has a spring-loaded rack-and-pinion feed. Turning the pinion with the removable handle or the machine's wrench lowers the spindle drill-press fashion.

HOLDING DRILLS

The spindle's internal No. 2 Morse taper accepts a variety of toolholding devices. Jacob's-type or Albrecht (keyless) drill chucks with up to ½″ capacity mounted on tapered arbors are used to hold straight-shank twist drills. Straight-shank drills also can be held in the accessory collet chuck. Drills or reamers with taper shanks can be inserted in the spindle directly.

Take care when mounting tools in the spindle not to jim the internal taper. Always clean and inspect both taper and tool shank to make sure they are free from nicks. Morse tapers are self-holding. A tool inserted in the spindle with a firm upthrust seats so tightly it can't readily be withdrawn.

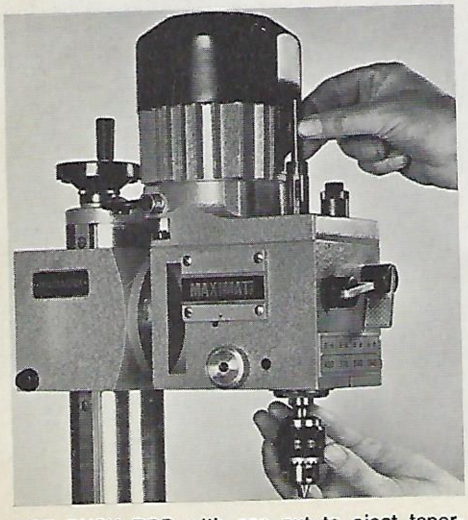
When removing tools from the taper never drive out the shanks with hammer-blows, for repeated hammering would degrade the spindle's precision bearings. Instead, screw-eject tools with a push-rod and the spindle's cap nut. Insert the rod in the spindle from the top, and while holding the spindle to keep it from turning, screw down the cap nut until the rod pushes the tool out of the taper. Swinging the head to one side avoids the risk of nicking the lathe's ways if you should accidentally drop a tool.

MOUNTING WORK

The accessory machine vises available as Maximat accessories are precision-built and grip with enormous holding power. It's never necessary to hammer a vise's wrench to tighten the movable jaw. Using copper or aluminum jaw pads prevents marring highly-finished work. When through-drilling work held in a vise be careful not to drill into the vise itself.

Large work can be mounted directly on the Maximat's T-slotted worktable with T-head bolts or stud-clamps. If the work will be through-drilled, support it on parallels or scrap aluminum plate to avoid drilling into the precision-ground table.

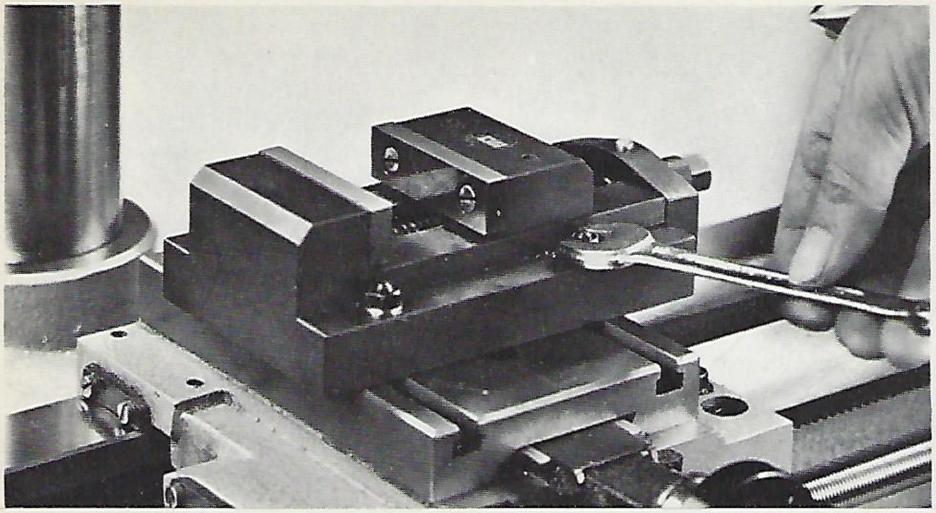
When drilling holes that must be accurately located a machinist ordinarily lays out each hole with punch and dividers. After punching a hole's center point, he scribes a circle the diameter of the hole around the punchmark and starts the drill in the mark. When the point has cut a shallow cone, he lifts the drill and examines the work. If the cone is not exactly concentric with the circle, he grooves one side of the cone with a small chisel, which draws the cut towards the side chiseled. This correction can be repeated as often as necessary to make the drill cut precisely to the scribed circle as it



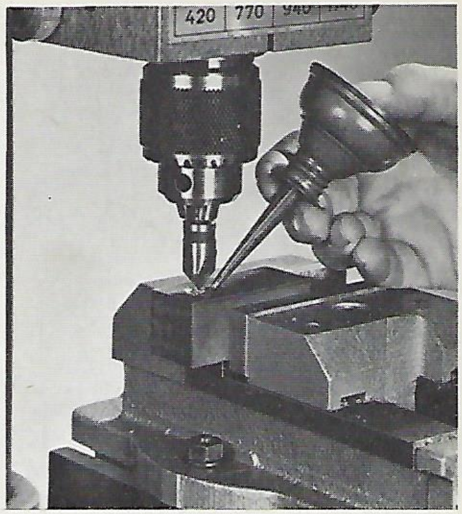
USE PUSH ROD with cap nut to eject taper-shanked tools from spindle taper.

CAREFULLY CLEAN taper-shanked tools and spindle's internal taper before inserting.

DEPTH GAGE can be set for drilling to exact depth. Turnstile handle is removable.



MACHINE VISES for either model Maximat can be mounted either along or across the T-slotted carriage worktable. Clean table and vise before mounting.



WHEN COUNTERSINKING holes use slowest spindle speed and cutting oil to avoid chatter.

begins cutting full-diameter.

The drum-type depth gage on the vertical head's pinion simplifies drilling holes to exact depth. To set the gage, lower the drill until it touches the work, loosen the hex-head lock screw in the center of the pinion, and turn the gage to zero.

SHARPENING DRILLS

For precision drilling the drills used must be sharp. Whlie drill-grinding jigs are available, most machinists resharpen drills off-hand, a skill soon learned with practice. Use a 100-grit wheel.

Like lathe bits, the lips of twist drills must have sufficient clearance behind the cutting edges—about 12°—to allow the edges to bite into the work without rubbing. When regrinding a drill hold one of its lips parallel with the wheel's face and lightly grind the cutting edge; and then with the same pass, turning and lowering the shank, grind off an even layer of metal from the edge back to the lip's heel in order to maintain original clearance. Then grind the other lip identically. Grind with light pressure to avoid overheating the steel.

When properly ground the drill's point will be exactly centered, with the cutting edges forming 59° angles with the axis of the shank to give a 118° point. You can judge these angles by comparing the drill you're grinding with a new drill, or you can use a drill point gage. A correctly ground drill cuts identical helical chips. If the lips are ground unequally, the drill will wobble and drill an oversize hole.

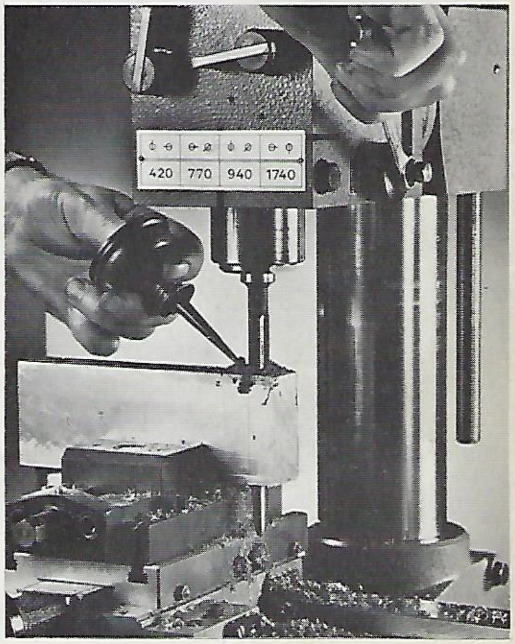
Resharpened drills are satisfactory for drilling shallow holes but not deep holes. A twist drill's flute margins are slightly taper-ground to give the flutes clearance in the hole, and the margins soon wear near the tip. If you attempt to drill a deep hole using a drill with worn margins, it may wedge in the hole and break. Always use new drills to drill deep holes.

Drills stay sharp longer when used at moderate spindle speed. As a rule of thumb, use the vertical head's high speed for drills up to ⅛″ in diameter, second speed for 3/16″ drills, third for ¼″ drills and slow speed for drills that are larger. Avoid overloading the head's motor. To drill a large hole, first drill a small pilot hole and enlarge it in steps with successively larger drills. Large holes can be finished to exact size with a boring tool fed with the vertical head's leadscrew.

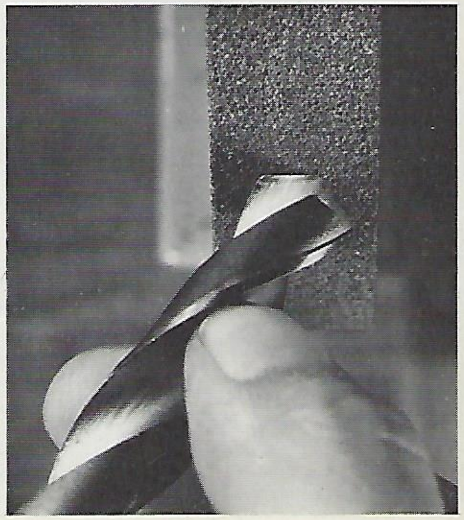
REAMING

Twist drills drill holes slightly larger than their nominal sizes. When a hole must be finished to exact size it is generally drilled 1/32″ undersize and then reamed. Straight-flute chucking or jobber's reamers can be used for machine-reaming at slowest spindle speed. Flood the reamer with cutting oil. Never turn a reamer backwards in the hole, which would nick its edges.

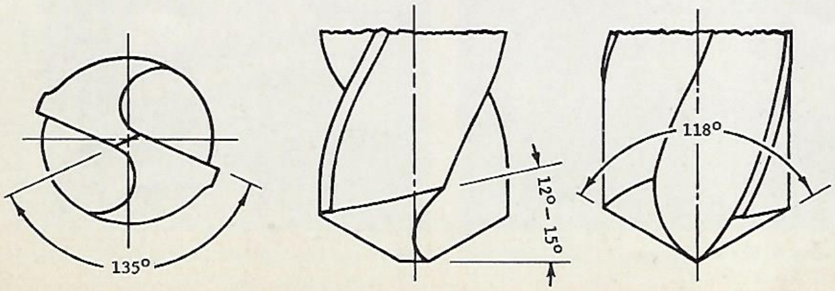
When a hole is to be tapped, a lathe center can be inserted in the vertical spindle to hold the tap perpendicular as it is turned in by hand with a tap wrench.



REAMING with taper-shanked reamer finishes drilled holes accurately to size.



TO SHARPEN DRILL, grind from the cutting edge to the heel of each of the two lips.



Milling And Surface Grinding

With a milling cutter mounted in the vertical spindle, a Maximat becomes a versatile vertical mill capable of a wide variety of precision milling operations, simple or complex. The machine can perform work ordinarily accomplished on heavier, far more expensive milling equipment.

For milling the vertical head's rack-and-pinion spindle advance is clamped immovable with its lock screw, and the .0005"-calibrated vertical leadscrew, which advances the entire head the full length of the keyed column, is used for precision depth-of-cut control. A workpiece mounted on the carriage worktable can be fed to the milling cutter by hand with the leadscrew and cross feed handwheels, or if the lathe headstock is operated and the carriage's power feed engaged, work can be power-fed to the cutter at any of 192 power feed rates (16 power feed rates on the Maximat 7).

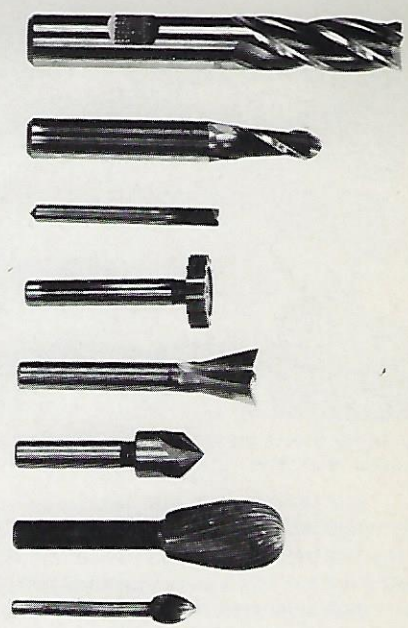
SCREW ADAPTER into collet chuck or millholders before inserting in spindle taper.

While nearly any type of milling cutter can be used in the spindle, most small milling jobs can be accomplished readily with end mills. Comparatively inexpensive cutters, end mills come in a variety of shapes in sizes up to 2" in diameter. They can be used to face-mill, slot, recess, bevel, spot-face, counterbore, V-groove or profile-mill. End mills with two flutes, often termed slotting cutters and then fed laterally to mill a groove. Staggered-tooth end mills, which have serrated cutting teeth, are also designed for heavy lateral cuts. Spiral end mills with multiple flutes and radial end teeth give work the smoothest finish.

Many special-purpose cutters are available for special jobs. Ball-end mills are used to sink cavities. T-slot mills are shank-type cutters used to mill the wide groove at the bottom of a T-slot after the narrow upper groove has been cut with a slotting cutter. Woodruff keyway cutters mill standard semicircular keyways in shafts. Angular cutters cut dovetails. Straight mills, gear-tooth cutters or slitting saws can be used on the spindle if mounted on a taper-shank stub arbor. Since the vertical head's spindle revolves clockwise (viewed from above), always use right-hand cutters.

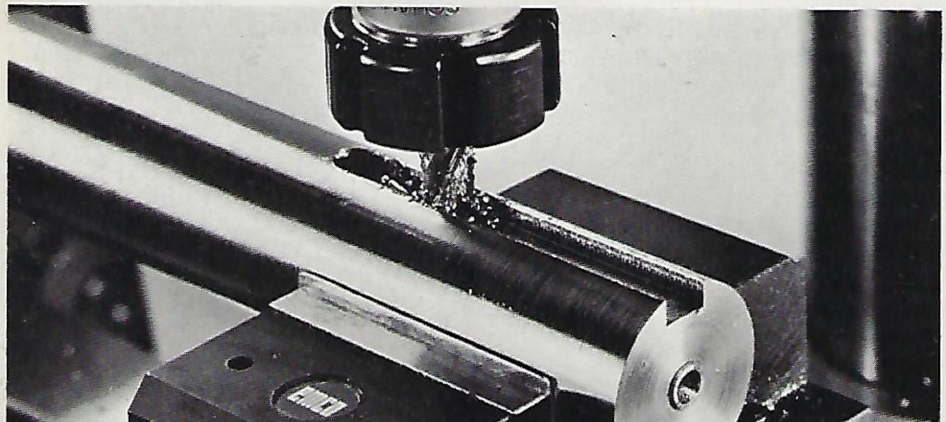
MOUNTING CUTTERS

Milling cutters should be mounted close to the spindle nose, and for best performance and long life they must run perfectly true. Straight-shank end mills can be held either in an end mill holder or in the head's accessory collet chuck, both of which secure in the spindle's internal taper with a drawbolt screwed into a reducer fitting threaded into the holder's taper shank. Remember to screw in this fitting before inserting either holder in the spindle.

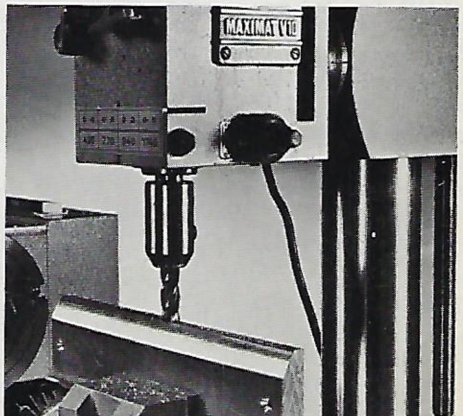


Work to be milled must be fixed on the worktable as rigidly as posible. Small work can be held in the machine vise. Large work can be mounted directly on the table with T-bolts or stud-clamps, supported if necessary with parallels, V-blocks or special holding fixtures. For radial or circular milling or cutting gear teeth or splines, the accessory indexing head can be bolted on the worktable and the work mounted on the index head. Whatever the setup used, for maximum rigidity always lock the carriage movement not used to feed the work.

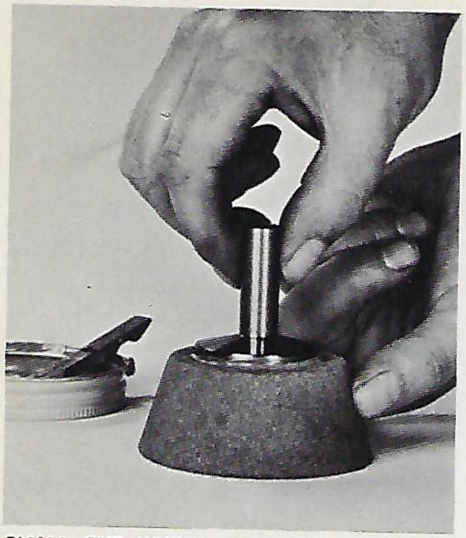
It's important to feed work to the cutter in such a way that the upwards sweep of the mill's cutting edges oppose the direction of feed. Use this work-to-cutter relationship, which is termed "up" milling, whether the machine's head is used vertically or horizontally. If feed is in the opposite direction, the



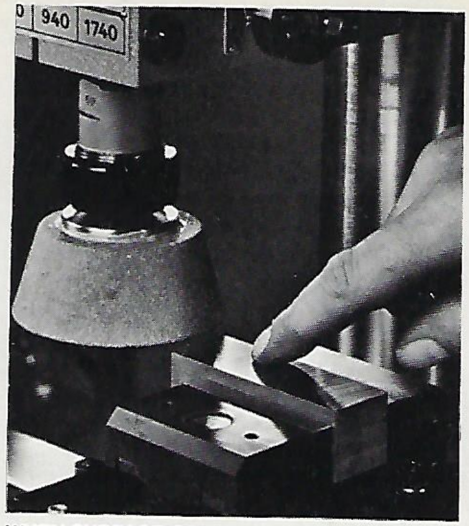
TO MILL SQUARE KEYWAYS use spiral end mills of suitable size. Scribe depth of keyway on end of shaft, then mill the groove with successive light cuts.



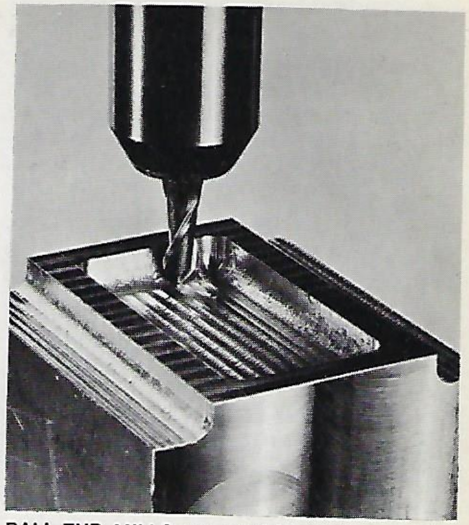
LIGHT EDGING CUTS with a multiple-flute end mill trues edges square and parallel.



SMALL CUP WHEEL can be cemented on a turned flanged shank with filled epoxy.



WHEN SURFACE-GRINDING take cuts only a few thousandths deep. Use highest speed.



BALL-END MILLS are used for sinking cavities and milling filleted corners.

cutter will tend to climb the work and may break.

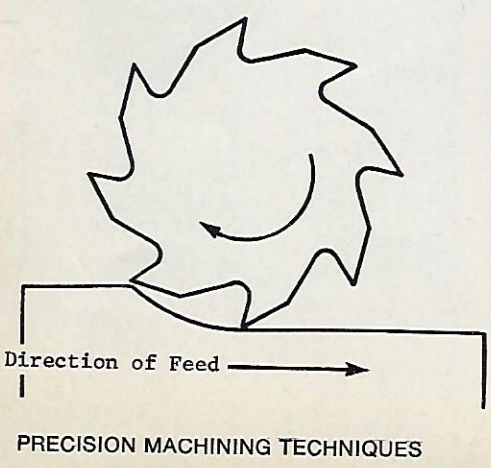
SPEEDS AND FEEDS

Milling operations are normally performed with first roughing and then finishing cuts, the rough cuts removing the bulk of the stock and the finish cuts giving dimensional accuracy and smooth finish. While optimum speeds and feeds for milling can be found in tables in machinist's handbooks, usually the operator relies on judgment. As a rule of thumb, the harder the metal milled, the slower the spindle speed used. The cutter's diameter is also a factor—the larger the cutter, the slower the speed.

The feed rate for milling should be fast enough to give the cutter's cutting edges bite but not heavy enough to overload the motor or dull the cutter. Until you learn to judge feed rates by experience, take light cuts at moderate feed rates. If a cutter chatters, stop the machine and take a lighter cut. For safety's sake never feed work to a milling cutter with the carriage traverse handwheel. Instead, engage the carriage to the leadscrew and use the leadscrew handwheel to feed the work.

Apply cutting oil liberally when milling steel. The oil serves as coolant, dissipating heat that would otherwise dull the cutter, and improves the cut's finish. Cast iron should be milled dry, and also brass. Use kerosene when milling alloy aluminum.

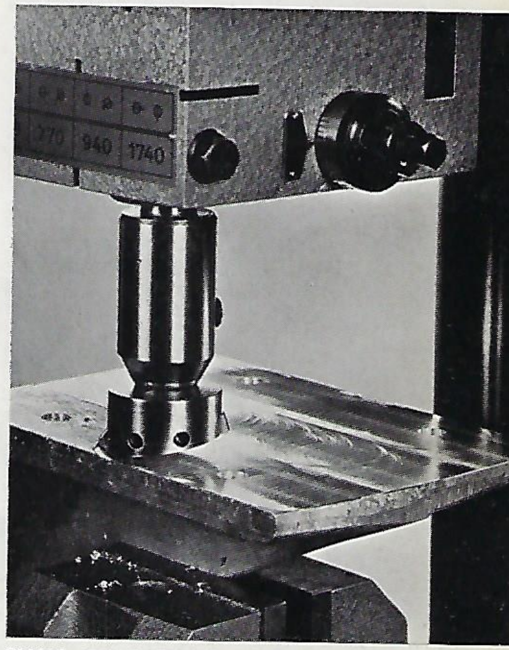
Use milling cutters with care to keep them sharp. Avoid backing a mill in the cut, which would nick its cutting edges.



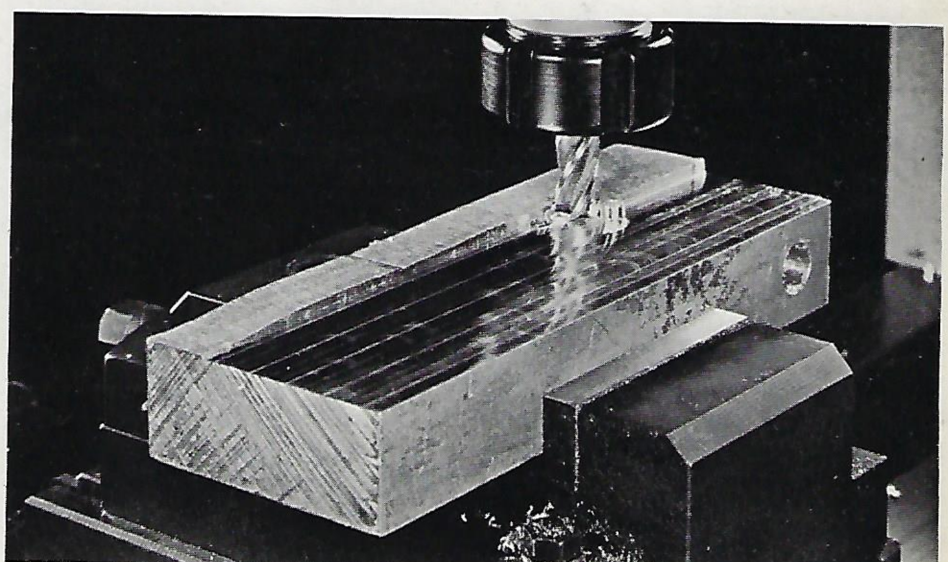
SURFACE GRINDING

If a small grinding wheel is mounted on the vertical head's spindle a Maximat can perform surface grinding and cutter-grinding operations that would otherwise require special grinding equipment. A medium-grit 3″-diameter cup wheel will give tool or machine parts a handsome Dutch finish. To mount the cup wheel, lathe-turn a flanged arbor that has a ½″-diameter shank and cement the cup permanently to the arbor's flange with filled epoxy cement.

Since the spindle's top speed is quite slow for grinding, an epoxy-mounted cup isn't likely to shatter and can be used without a guard. When surface grinding take very light cuts at a slow feed rate.

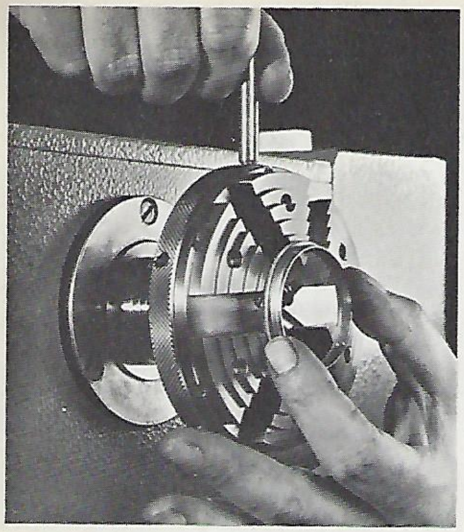


SMALL FLY-CUTTERS, which you can make yourself, are useful for milling and boring.

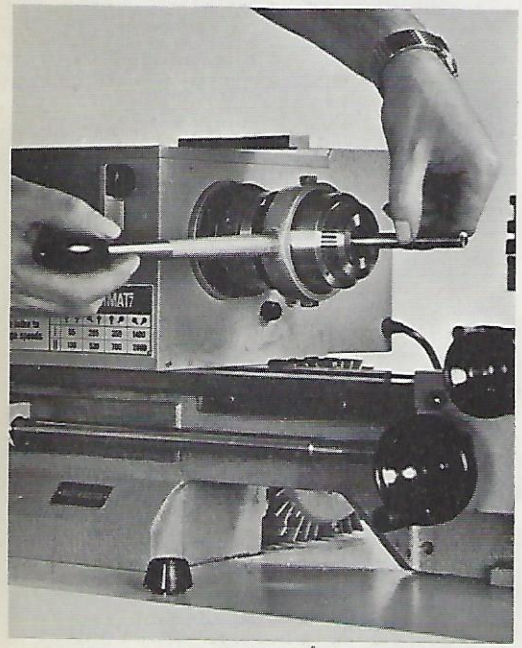


REPEATED CUTS at same depth mill surfaces accurately flat. Be sure the vertical spindle is set square with the worktable to avoid scalloping.

Special Machining Jobs



SPECIAL CHUCKS facilitate special work. Above: step chuck for instrument bezels.



LEVER-OPERATED Rubber flex collet chuck speeds small-parts production work.

Of all metalworking machines the screw-cutting lathe is most versatile, and the drill press and vertical mill are respectively next and third. Since a Maximat combines the functions of all three, on this one machine it's possible to accomplish virtually any machining job—provided you're able to mount the work in the machine.

Solving special-work tooling problems isn't always easy. But setups that seem impossible when attempted with ordinary workholding devices often become quite simple when you use special accessories—special-purpose chucks, fixtures, centers, arbors, mandrels, jigs, rests, clamps, etc. Special holding devices also can save time in production work, and since in production machining labor is the largest cost factor accessories that speed up repetitive operations lower cost dramatically.

SPECIAL HOLDING DEVICES

Devices to hold work on or in the spindle comprise the largest group of lathe accessories. Several types of chuck designed expressly to hold particular kinds of work are available—precision step chucks, for one example, used primarily for turning and threading rings and instrument bezels.

Small cylindrical work can be held in any of several types of collet equipment. Toolmaker's draw-in collets, which center work very precisely, are available either hardened or unhardened. Hardened collets come in standard sizes, inch or metric. Soft collets nave pilot holes that are easily bored out to the exact size required for special work.

Because tightening draw-in collets with a drawbar is a slow operation, quick-closing Rubberflex collets are usually preferable for production work. A Rubberflex collet, which has multiple hardened jaws bonded in a rubber ring, closes as the ring is forced back into an internal taper in a special handwheel- or lever-operated chuck. A lever-operated chuck permits closing collets on work without stopping the lathe spindle. Individual Rubberflex collets grip through a wider range of diameters than individual draw-in collets, and work as large as the spindle bore can be fed through the spindle.

Cutting tools can be mounted more ways on Maximats than on conventional bench lathes. Boring large holes, for example, can be accomplished by mounting the work on the carriage worktable and chucking a fly-cutter in the spindle, or for through-boring, mounting a boring bar between centers. For small-parts production tools can be mounted in a tailstock turret. For production machining on work mounted between centers, a second toolpost can be mounted behind the work.

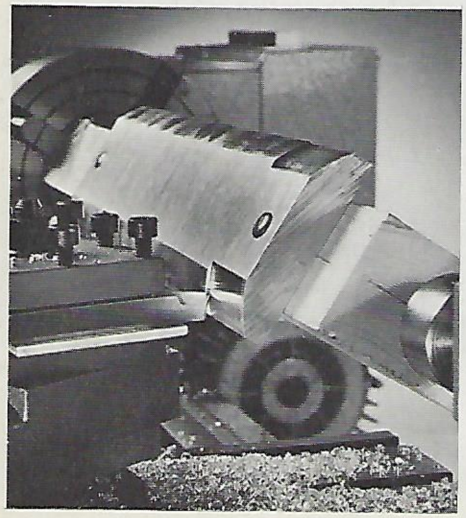
WORK RESTS

When long, limber work is turned in a lathe the pressure of the bit's cutting edge may deflect it, causing chatter. When this occurs the workpiece should be supported with a follower rest. This rest mounts on the carriage and travels with the bit. Set its two brass jaws to bear against the work without springing it, and keep them well oiled. Readjust the jaws for each cut.

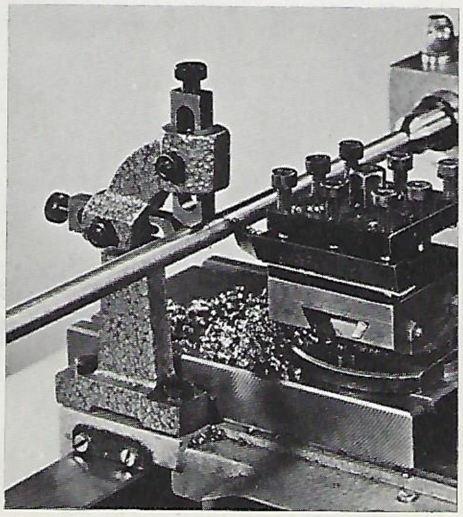
Use a steady rest, similar but with three jaws, to provide intermediate support for long work to be machined at one end. This rest mounts anywhere along the ways. If the steady rest is clamped at the end of the bed in place of the tailstock, it's possible to turn work longer than the lathe.

TOOL POST GRINDER

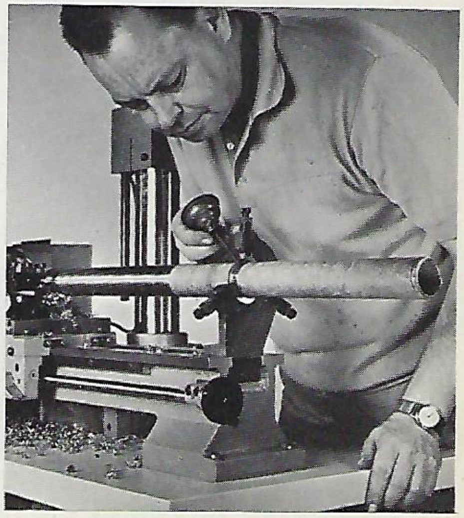
A tool post grinder equips either Maximat for external and internal cylindrical grinding. The grinders available as accesories have precision spindles with three speeds. 4500, 8000 and 12000 rpms. Low speed is for external grinding; the higher speeds for internal grinding. Grinding wheels mount on the



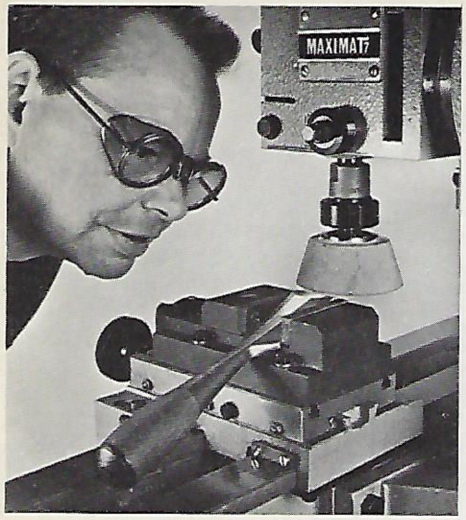
TO TURN ROUNDED CHAMFERS, screw the workpiece to a block of scrap wood or metal.



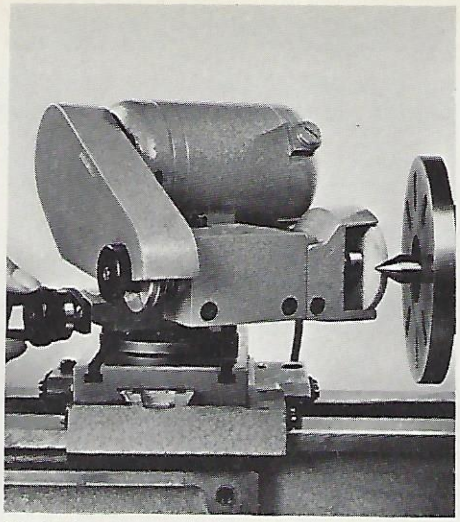
FOLLOWER REST prevents limber work from springing away from the cutting tool.



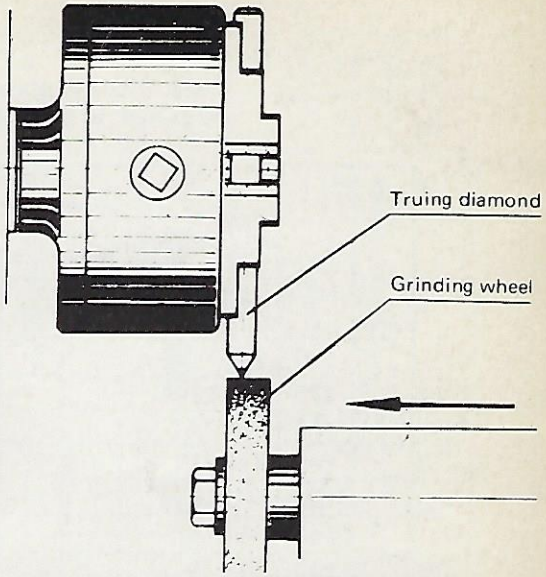
USING A STEADY REST you can turn workpieces longer than the lathe's bed.



WHEN GRINDING any edged tool, grind "on" rather than "off" the cutting edge.



TO REGRIND 60° CENTERS, set compound at 30° angle. Check point with center gage.



spindle's drawbar arbor. Shank-type grinding points for internal grinding are held in collets. Grade M 80-grit wheels are recommended for general use.

GRINDING PRACTICE

To obtain perfect finish true the wheel with a diamond dresser before each job, mounting the dresser in a spindle chuck and passing the wheel across its point. Take light cuts, advancing the wheel .001" per pass, to remove glaze and metal particles.

Work to be ground should revolve at slow spindle speed in a direction opposing that of the grinding wheel. External rough-grinding cuts should be .002" or .003" deep. Internal rough-grinding cuts usually should be .001" deep. A finish cut made without advancing the wheel finishes the work. Wear protective glasses when grinding, and remember to protect the machine fom swarf, covering the carriage and ways with aluminum foil or plastic sheeting.

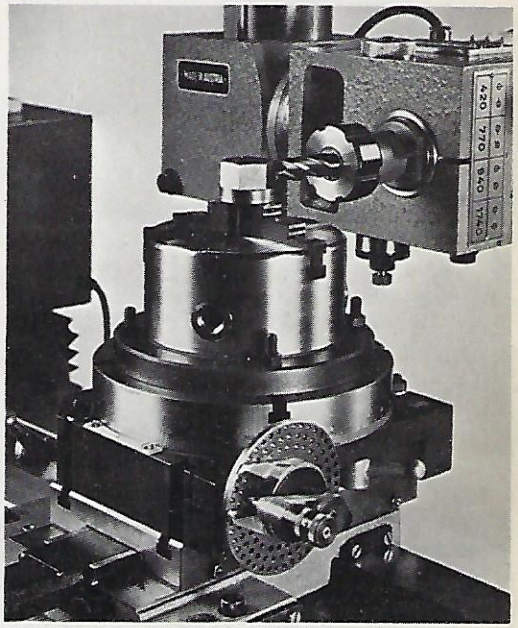
INDEXING AND DIVIDING

Mounting the accessory indexing head on the Maximat's worktable equips the machine for milling radially or in semi-circles, milling cams, gears or splines, milling and grinding rotary cutters, or milling accurate squares, hexes or octagons. Work to be milled can be bolted or clamped directly on the head's T-slotted table, or it can be held in a chuck mounted on the head with an adapter plate. Small work can be held in an arbor-mounted drill chuck inserted in the head's central No. 2 Morse taper bore. A lathe center inserted in this bore simplifies centering the indexing head under the vertical spindle.

The head's table can be indexed in three ways: (1) With the worm-drive disengaged, the table can be freely rotated, positioned with its 360° graduations, and locked. (2) By pulling out and turning the large lever the table can be direct-indexed every 15°, in 1/24th-circle increments. (3) Work can be precision-divided using the 1:40 worm drive. Each turn of the worm's crank rotates the head's table 1.40th-turn, or 9°; 5 crank-turns rotate the table 45°; 10 turns 90°; and so on.

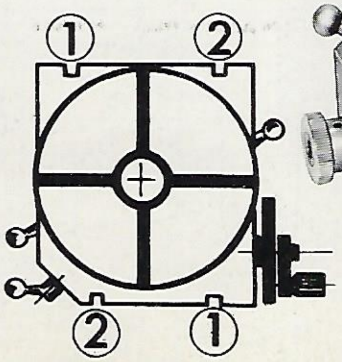
Engaging the crank's pin in holes in master indexing plates facilitates turning the crank exact fractions of a full turn. Each circle of holes in the index plates subdivides full crank-turns into the number of parts stamped on the plate. When stepping off divisions count spaces between holes, using the sector arms to help you keep count. If the plate with the 27-division circle of holes is used, for example, and three spaces in the 27-division circle are stepped off with the pin, the crank will have turned 3.27ths, or 1.9th, of a full turn, and the table will have rotated 1.9th of 9°, or exactly 1°. With the head's three plates, circles can be divided either angularly or in equal parts into any of 88 different radial spacings (see table) with accuracy within 3 minutes of arc.

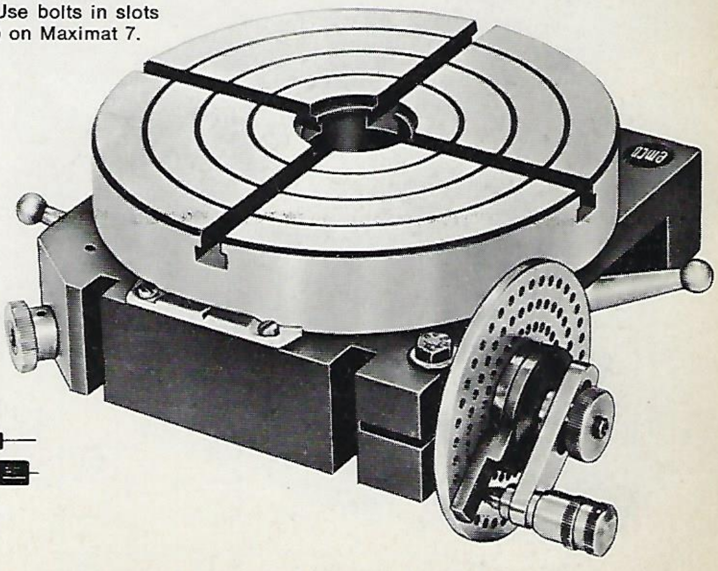
For circular milling use the indexing head's crank to feed the work to the milling cutter. It's possible to circular-mill work larger than the lathe's swing.



SPINDLE CHUCK can be mounted on the indexing head's table with adapter plate.

Mount head with two T-bolts. Use bolts in slots (1) on Maximat V10; in slots (2) on Maximat 7.





INDEXING AND DIVIDING HEAD has table rotated by a 1-to-40 worm drive. By counting turns of crank work can be angularly divided with exact precision.

INDEXING TABLE

THIS TABLE gives the number of full crank turns and fractions of turns required to divide circles into equal divisions or angularly by degrees.

Division Desired	Degrees	No. of crank turns req'd.	Number of holes to be added for each index plate							
			27	33	34	36	38	39	40	42
2	180°	20								
	175°	19	12							
	170°	18	24							
	160°	17	21							
	150°	16	18							
	140°	15	15							
	130°	14	12							
	125°	13	24							
3	120°	13	9	11		12		13		14
	110°	12	6							
	100°	11	3							
4	90°	10								
	80°	8	24							
	75°	8	9	11		12		13		14
5	72°	8								
	70°	7	21							
	65°	7	6							
6	60°	6	18	22		24		26		28
	55°	6	3							
7		5								30
	50°	5	15							
8	45°	5								
9	40°	4	12			16				
10	36°	4								
11		3		21						
12	30°	3	9	11		12		13		14
13		3						3		
14		2								36
	25°	2	21							
15	24°	2	18	22		24		26		28
16		2			17	18	19		20	21
17		2			12					
18	20°	2	6			8				
19		2					4			
20	18°	2								
	16°	1	21							
21		1								38
22		1		27						
24	15°	1	18	22		24		26		28
25		1							24	
26		1						21		
27		1	13							
28		1								18
30	12°	1	9	11		12		13		14

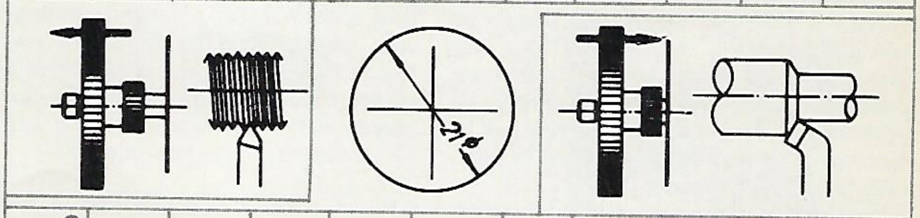
Division Desired	Degrees	No. of crank turns req'd.	Number of holes to be added for each index plate							
			27	33	34	36	38	39	40	42
32		1				9			10	
33		1		7						
34		1			6					
35		1								6
36	10°	1	3			4				
38		1					2			
39		1						1		
40	9°	1								
42										40
44				30						
45	8°		24			32				
48						30				35
50									32	
	7°		21			28				
52								30		
54			20							
55				24						
56										30
60	6°		18							
64									25	
65								24		
66				20						
68					20					
70										24
72	5°		15			20				
76							20			
78								20		
80					17	18	19		20	21
84										20
85					16					
88				15						
90	4°		12			16				
95							16			
96						15				
100									16	
120	3°		9	11		12		13		14
180	2°		6			8				
200									8	
240						6				7
270			4							
360	1°		3							
	40′		2							
	30′					2				
	20′		1							

SPECIAL THREADING SETUPS

Cutting metric threads on the Maximat V10 is another operation requiring a special setup. Gearing the lathe to cut metric threads is accomplished by replacing the standard end gear train with an accessory universal quadrant and change gears. The more common metric threads can be cut with the change-gear setup diagramed at left in the table below, with the desired pitch obtained by using the designated stud gear. Some metric pitches can be cut away with any of several setups. Two pitches, however, (1,25 and 1,5mm), can be obtained only with the change-gear setup shown at the head of the table's right-hand column. Cap and lower-case letters in the table indicate the quick-change box's top lever and tumbler lever positions (see data plate, right).

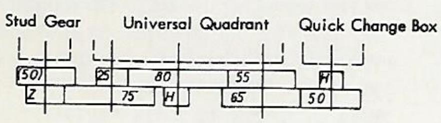
To cut inch threads either coarser or finer than the V10's standard pitches, re-gear the end gear train to give a ratio either one-half or twice the standard train's ratio, which will halve or double the pitches given on the quick-change box data plate.

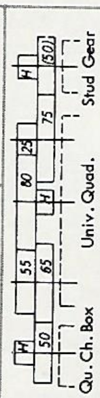
A	8	9	9½	10	11		12		13	14
B	16	18	19	20	22		24		26	28
C	32	36	38	40	44		48		52	56



A	.0139	.0125	.0117	.0111	.0101		.0093		.0085	.0079
B	.0069	.0062	.0058	.0055	.0050		.0046		.0043	.0040
C	.0035	.0031	.0029	.0028	.0025		.0023		.0021	.0020
	a	b	c	d	e		f		g	h

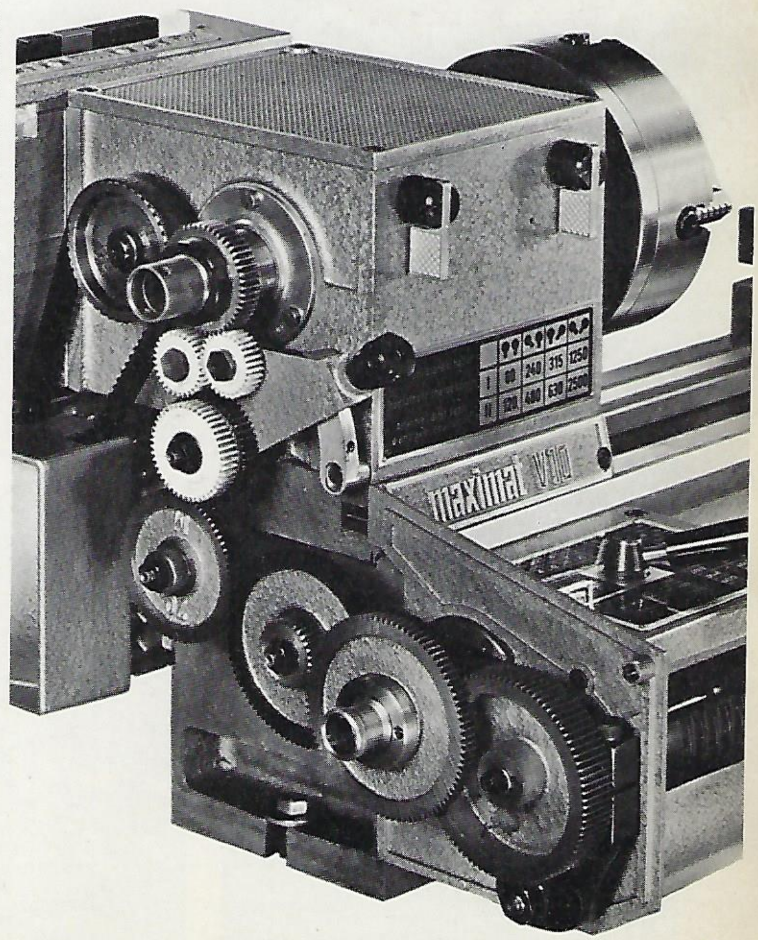
H = Spacer sleeve
A — C = Top lever position
a — h = Tumpler lever position
Z = Stud gear on reverse gear holder





Pitch in mm	Z-30	Z-35	Z-40	Z-45	Z-60	
0,25	C f	C h				
0,30	C d					
0,35		C d				
0,40			C d			
0,45				C d		
0,50	B f	B h	C a	C b	C f	C d
0,60	B d				C d	
0,70		B d				
0,75	B a			B f	C a	
0,80			B d			
0,90				B d		
1,00	A f	A h	B a	B b	B f	B d
1,25						B a
1,50	A a			A f	B a	
1,75		A a				
2,00			A a	A b	A f	A d
2,25				A a		
2,50						A a
3,00					A a	

TABLE (left) shows change-gear setup and lever positions (above) for cutting metric threads on V10.

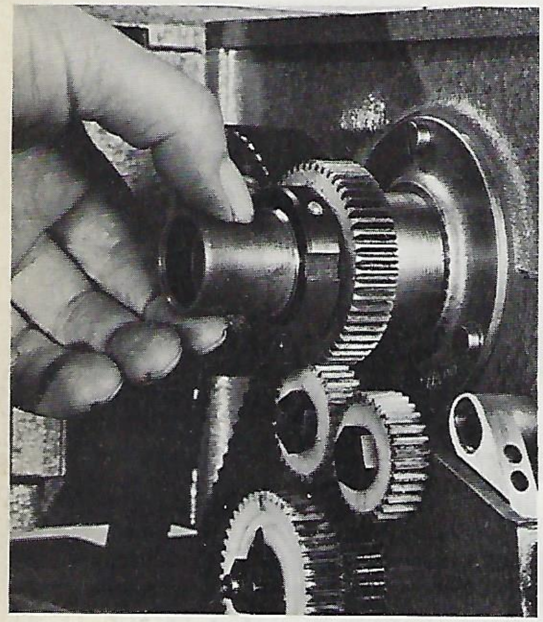


MAXIMAT V10's standard end gear train (above) can be replaced with universal quadrant and change gears.

Adjustments And Service

A machine tool's adjustments compensate wear and permit tightening or loosening the fit of sliding parts. For high-precision work a lathe's slides and feed screws should be set up fairly tightly. For ordinary work they can be eased to the point of smoothest operation. All but one of the adjustments on a Maximat are quite simple, and they can be considered correct when the machine operates to your satisfaction.

The one critical adjustment is the alignment of the lathe spindle with the ways. Because the accuracy of this "master" adjustment in large measure determines the lathe's precision, each machine's spindle is aligned at the factory with special equipment to extremely close tolerance. To avoid degrading the spindle alignment, *never loosen the bolts securing the headstock on the machine's bed casting.*



LATHE'S SPINDLE BEARINGS can be adjusted by turning thrust nut with spanner wrench.

Some of the other adjustments when once made will require further attention only very infrequently. The leadscrew reverse lever's latch plate is an example. This plate should be positioned to make the reverse gears engage smoothly in forward and reverse and disengage fully in neutral.

SPINDLE BEARINGS

The lathe spindle's high-precision Class 7 SKF tapered roller bearings, which are adjusted before the Maximat leaves the factory, will need readjustment only after many years of service. If in time the spindle develops end play, play can be eliminated by turning up the slotted thrust nut on the end of the spindle with a hook spanner wrench. Loosening the lock screw releases the nut. Take care not to overtighten the spindle bearings, which would distort them. After running the lathe for an hour to warm the spindle, adjust the thrust nut until the spindle turns with neither play nor drag.

The carriage's cross and compound slides both have adjustable gibs. To adjust either gib, loosen the adjusting screw's lock nuts and turn the screws equally to make the gib bear evenly its full length. Having set the slide as tightly as desired, retighten the lock nuts.

The vertical head's gib bears against the column's key. This gib's two adjusting screws should be set up fairly tightly.

FEED SCREWS

The machine's feed screws each have two adjustments. Axial play (endwise) can be taken up with the threaded collars that hold the handwheels on the screws. Loosen the lock screw in the center of the collar and adjust the collar with the machine's wrench to eliminate play.

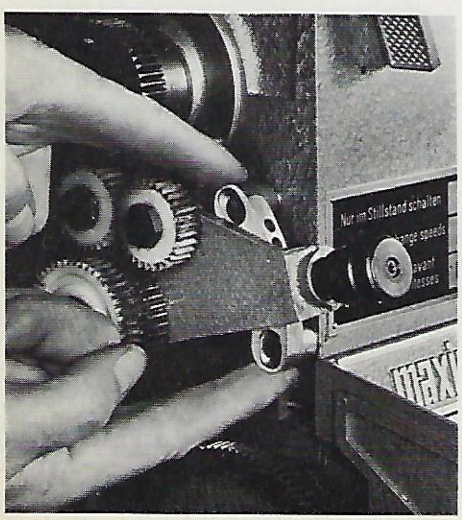
HONE NICKS on surface of carriage worktable flush with a Hard Arkansas stone.

Each screw also has a backlash adjustment. To adjust lash, unscrew the feed screw's end support bracket, turn out the screw, and then turn the slide's slotted threaded bushing slightly to reduce play. All feed screws require some backlash, normally about ⅛ th-turn, for smooth operation. If set up too tightly a screw gives jerky feed.

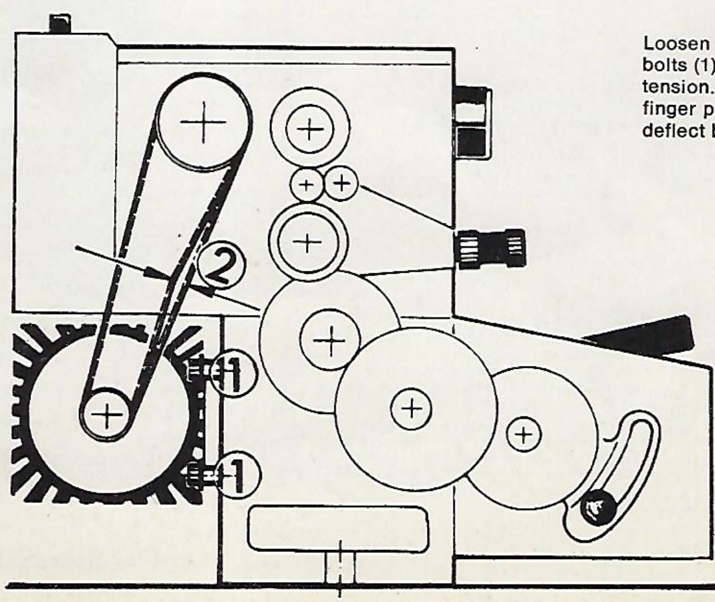
Adjust the Maximat 7's cross feed screw backlash with the small grub screw in the center of the worktable.

The screw in the top of the tailstock casting takes up the tailstock screw's backlash. With the ram all the way out, adjust the screw in half-turn increments.

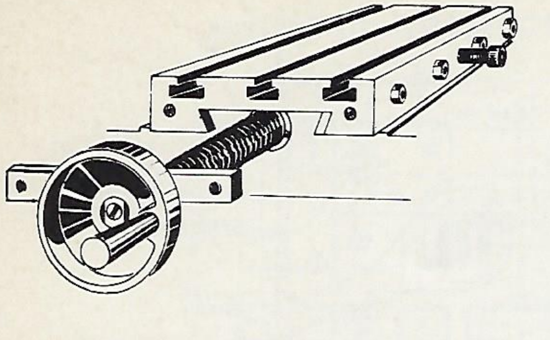
In time the carriage apron's half-nuts, which are made of soft metal to minimize wear on the leadscrew, will wear loose in their guides. The right-hand guide is adjustable. To adjust it, loosen the two right-hand Allen-head screws in the apron's face and turn in the small adjusting screws (between them) until the half-nuts slide crisply.

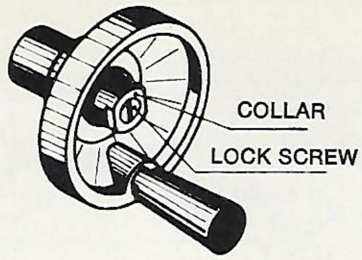


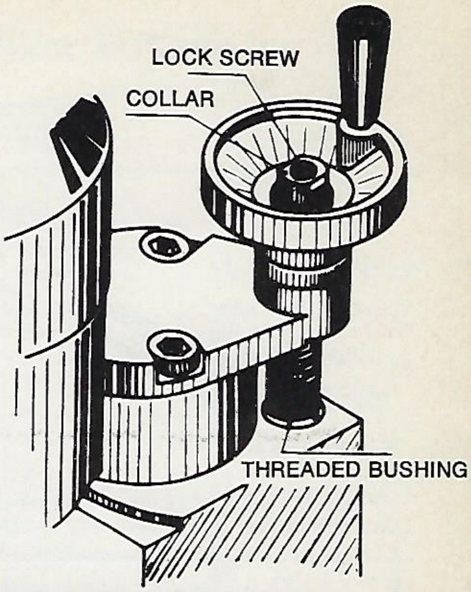
LEADSCREW REVERSE LEVER'S latch plate adjusts for smooth forwards-reverse shift.



Loosen motor mounting bolts (1) to adjust drive belt tension. At correct tension finger pressure will deflect belt ¼"-5⁄16" (2).







To adjust leadscrew backlash (the screw's play in the half-nuts when they are closed), unscrew the half-nut lever's stop screw slightly to remove play. On the Maximat V10 this screw is in the bottom of the lever's hub. On the Maximat 7 the stop screw is in the bottom edge of the carriage apron.

REPLACING BELT

After years of service the cogged rubber belt driving the lathe's backgear shaft will wear. To replace the belt, first unscrew the square motor fan shroud. Then with ring pliers remove the snap-ring retaining the cogged pulley on the backgear shaft, and slip the keyed pulley, belt and all, off the shaft. Then fit the new belt and slide the pulley back on the shaft. The belt should fit quite tightly, deflectingf no more than ¼" under firm finger pressure. If necessary loosen the motor mounting bolts to adjust belt tension. Avoid smearing grease on the rubber belt.

Maximat motors have sealed, lifetime-lubed ball bearings that require no attention. An induction-type motor's windings very seldom burn out unless the motor is severely mistreated. When any capacitor-start induction motor fails to start, the trouble usually can be traced to either the motor's starting capacitor or the starting switch. Replacing either is a comparatively simple job.

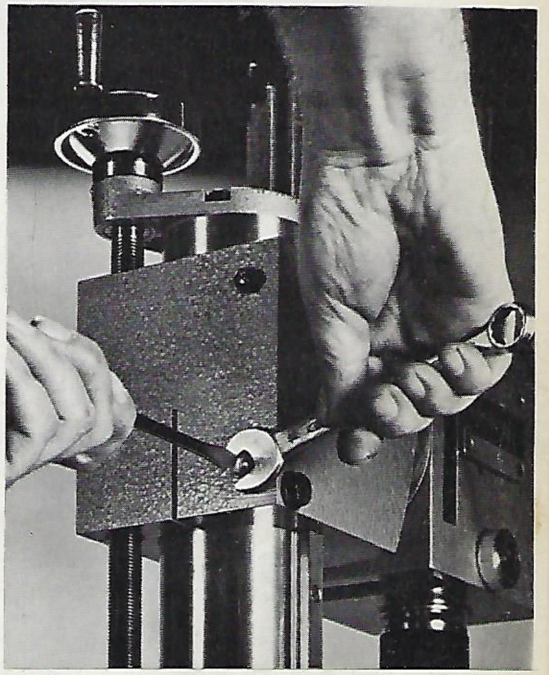
The wiring diagram (pg. 31) shows how the Maximat's pushbutton switch unit is wired to control the machine's two motors. The switches themselves are heavy-duty snap switches with large contacts for long service life. If a pushbutton should fail to function, the probable cause will be a chip or bit or dirt that has worked into the linkage. Disconnecting power and rapidly operating the pushbutton a number of times may dislodge the dirt and restore normal operation. If not, remove the two motor capacitors, unbolt the switch unit, and gently lower and lift out the entire unit for cleaning, being careful not to disturb the wiring. The switch unit's snap switches can be replaced individually.

QUALIFIED SERVICE

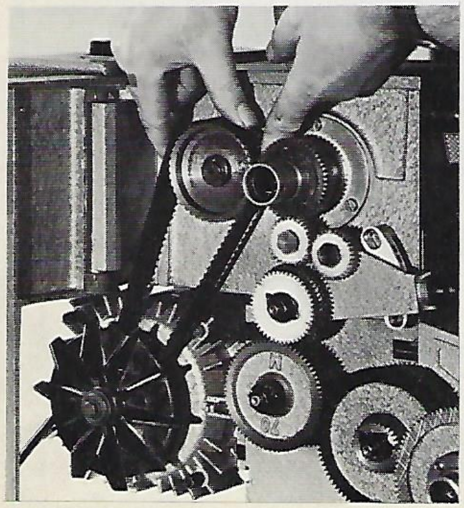
American Edelstaal, Inc., maintains factory-service facilities and stocks replacement parts for prompt delivery. Write for shipping instructions before sending equipment for repair. To order replacement parts, address correspondence to the Service Department, giving a full description of the parts needed together with the model and serial number of the machine.

Maximat lathes and vertical heads have separate serial numbers. Lathe serial numbers are stamped on the end of one way. Vertical head numbers are stamped on the column's key near the top.

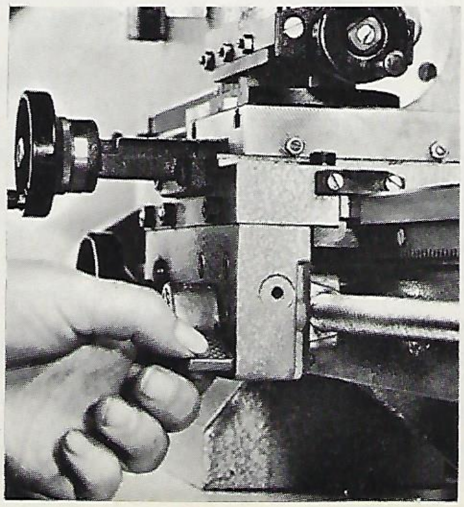
A Maximat owner of course is himself equipped to make any part required to repair or rebuild virtually any machine—even the Maximat itself.



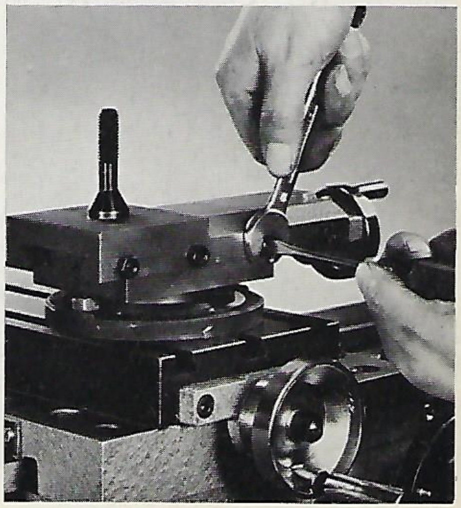
VERTICAL HEAD'S GIB, which bears on column's Key, adjusts with two screws.



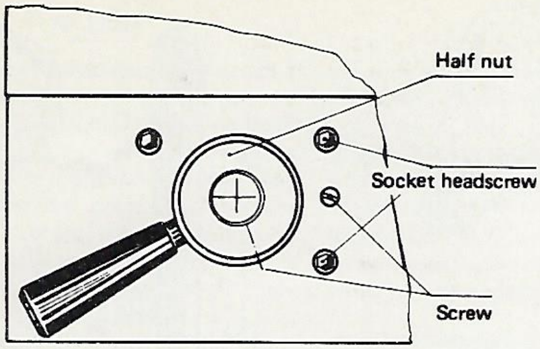
TO REPLACE DRIVE BELT, loosen motor and slip new belt over backshaft pulley.

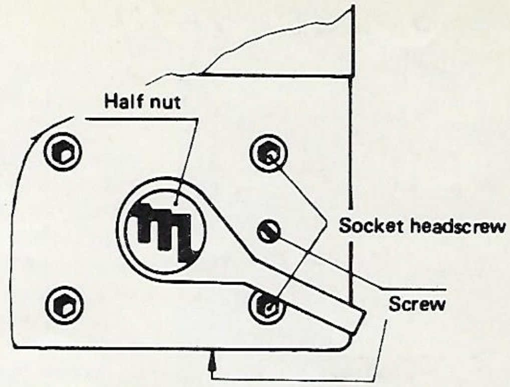


HALF-NUTS should close on lead screw crisply, sliding freely but without play.



ADJUSTMENT SCREWS give the gibbed carriage slides tighter or freer action.

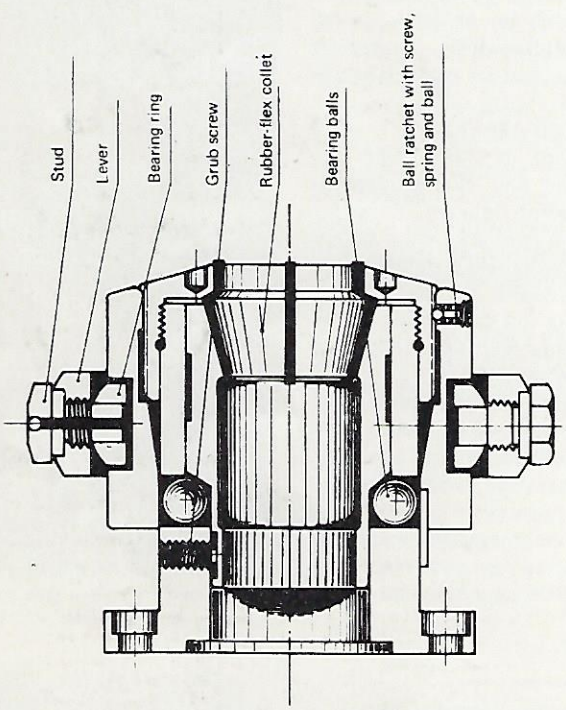




TO ADJUST HALF-NUTS on the Maximat V10, loosen right-hand Allen head screws and turn center screw to tighten guide.

MAXIMAT 7 has similar half-nut guide adjustment. To take up backlash, unscrew stop screw in bottom edge of apron slightly.

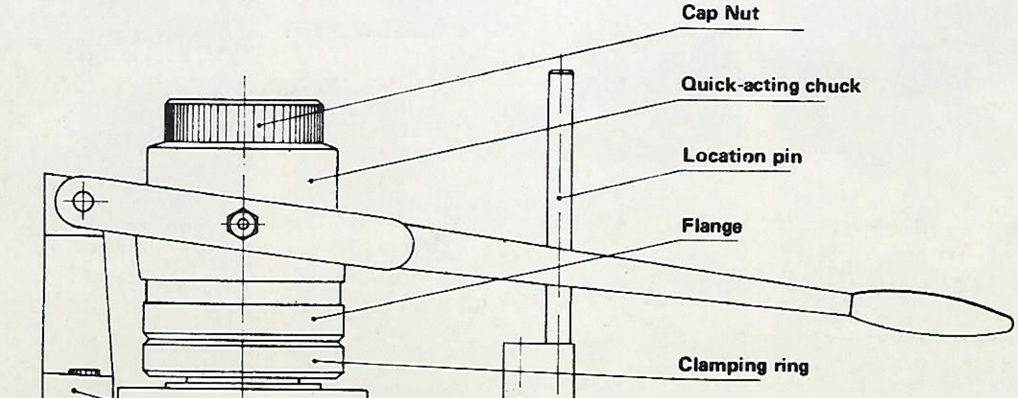
Lever-Operated Rubber-Flex Collet Chuck



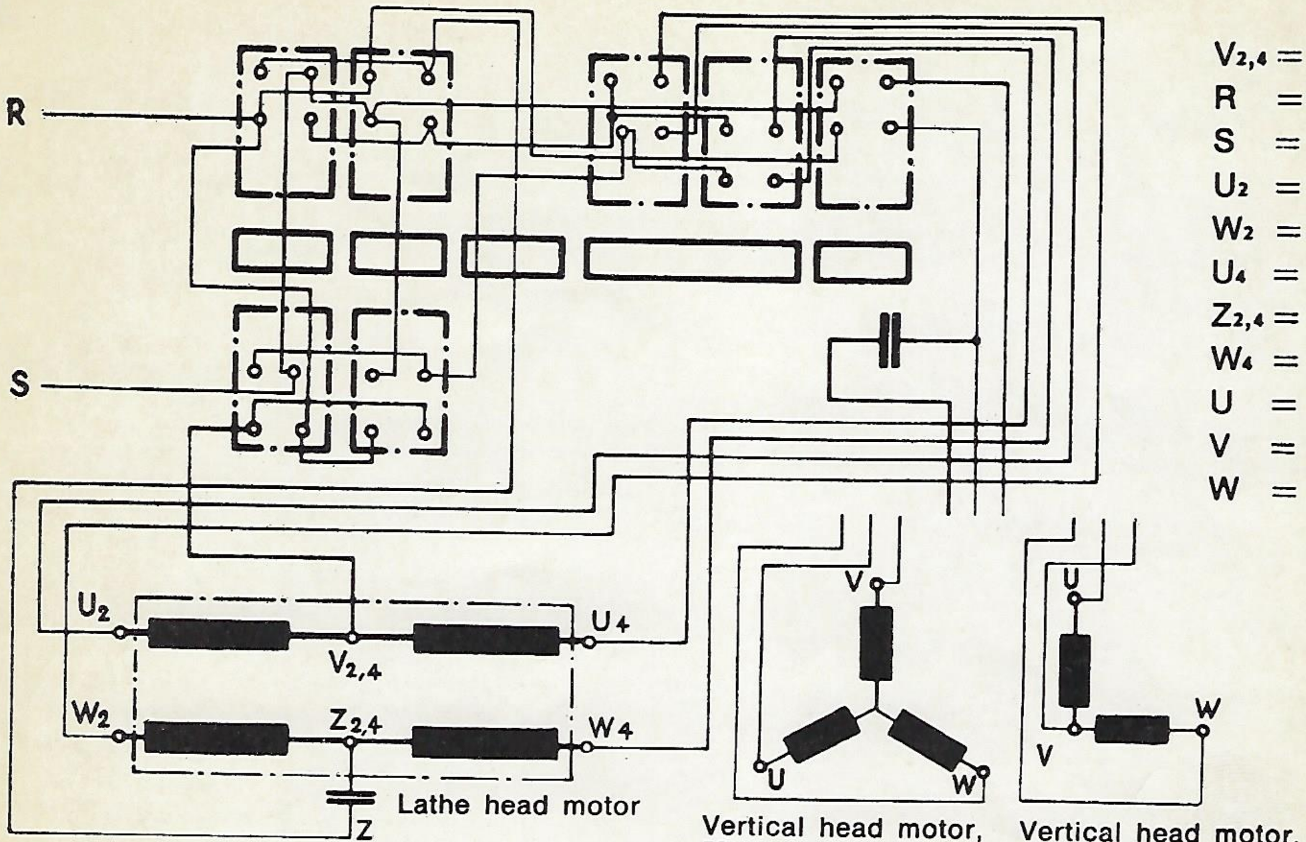
A fast, ultra-high-precision holding device, the lever-action Rubber-Flex collet chuck available as a Maximat accessory is widely used for small-parts production work. Work to 25/32"-diameter, the chuck's capacity, can be gripped or released *without stopping the lathe spindle,* and work to this size can be fed through the spindle bore.

The Rubber-Flex collets used in this chuck grip twice as firmly as draw-in collets, and individually they close through a wider size range, with 8 Rubber-Flex collets giving full 5/32"-to-25/32" range. Each collet's multiple hardened jaws, which are bonded in a synthetic rubber ring and ground within .0002", close with true parallelism, gripping evenly and releasing smoothly. The rubber is uneffected by oil or coolant.

The chuck itself, hardened and ground throughout, is precision built with large ball bearings for continuous high-speed operation without heating. It mounts on a ring-clamped flange supplied semi-finished to permit truing on the particular lathe. Headstocks of both Maximats have ready-tapped holes for mounting the lever bracket. Turning the chuck's ratchet-action nut adjusts the "open" diameter of the collet used.

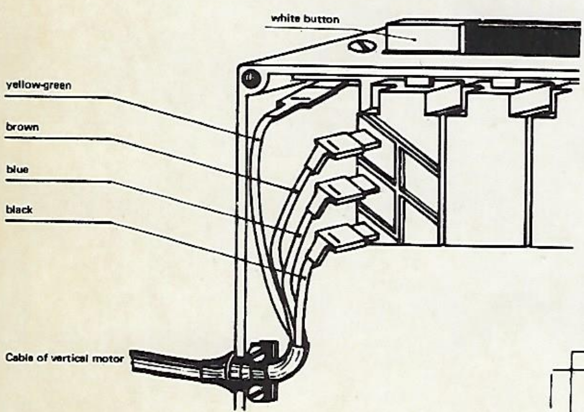


WIRING DIAGRAM FOR MAXIMATS WITH SINGLE PHASE MOTORS



$V_{2,4}$ = White
R = Brown
S = Blue
U_2 = Yellow
W_2 = Green
U_4 = Red
$Z_{2,4}$ = Blue
W_4 = Grey
U = Brown
V = Blue
W = Black

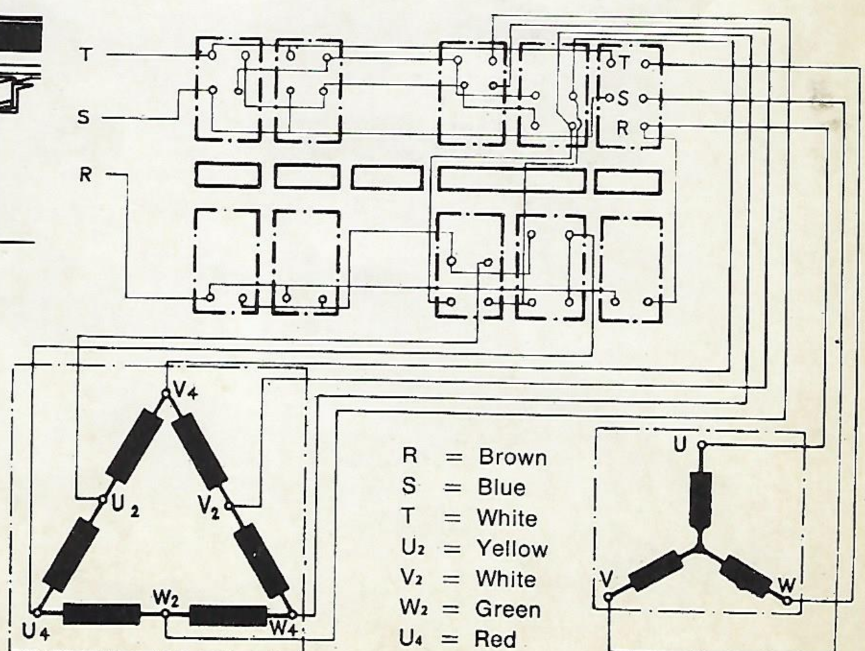
WIRING DIAGRAM FOR MAXIMATS WITH THREE PHASE MOTORS



SWITCHBOX CONNECTIONS
(3-phase machines)

If motor turns in wrong direction, interchange blue and brown leads.

NOTE: Wiring diagrams shown are for lathe and mill head motors, brand FFD. Wiring diagram for motors, brand WSW, will be sent upon request.



Lathe head motor

Vertical head motor

R = Brown
S = Blue
T = White
U_2 = Yellow
V_2 = White
W_2 = Green
U_4 = Red
V_4 = Blue
W_4 = Grey
U = Brown
V = Blue
W = Black

CAPACITIES

HORIZONTAL	MAXIMAT V-10	MAXIMAT 7
Swing over bed	10''	7''
Swing over cross-slide	5 23/32''	4 1/8''
Distance between centers	26''	18" or 24"

VERTICAL	MAXIMAT V-10	MAXIMAT 7
Vertical spindle nose to cross slide	12''	9 7/8''
Drill to center of circle	11 13/32''	11 13/32''
Max. table travel, longitudinal	25 3/4''	18 15/16" or 24 15/16"
Table travel, cross	5 29/32''	3 1/4''

COMPONENTS

LATHE HEADSTOCK	MAXIMAT V-10	MAXIMAT 7
Collet capacity	25/32''	25/32''
Hole thru spindle	.836''	.836''
Spindle nose thread	1 1/2 x 8-threads	1 1/2 x 8-threads
Taper	MT No. 3	MT No. 3
Spindle bearings, front & rear	2, SKF Class 7, pre-loaded tapered roller bearings	

VERTICAL MILLING/DRILLING HEADSTOCK	MAXIMAT V-10	MAXIMAT 7
Collet capacity	5/8''	5/8''
Spindle taper	MT No. 2	MT No. 2
Spindle bearings, front	1, SKF needle bearing	
Spindle bearings, rear	2, Ball bearings	
Spindle quill feed	1 9/16''	1 9/16''

MOTORS	MAXIMAT V-10	MAXIMAT 7
Lathe, Motor, HP (2-speed)	1/2 / 3/4	1/3 / 1/2
Milling Head Motor, HP	1/3	1/4

CROSS-SLIDE—MILLING TABLE/COMPOUND	MAXIMAT V-10	MAXIMAT 7
Max. table travel, longitudinal	25 3/4''	18 15/16" or 24 15/16"
Table travel, cross	5 29/32''	3 11/32''
Table size	4 3/4'' x 10''	4 x 6 5/16''
Compound rest travel on cross-slide	5 3/4''	1 13/16''
Compound rest feed	4 1/16''	1 29/32''
Compound rest graduations	0-60-0°	0-90-0°
Tool clamp capacity	3/4'' center height	9/16'' center height

TAILSTOCK	MAXIMAT V-10	MAXIMAT 7
Spindle diameter	1 3/16''	1''
Spindle taper	MT No. 2	MT No. 2
Spindle travel	3 1/8''	1 7/8''
Spindle graduations	1/8''	1/16''
Spindle set-over	1/2''-0-1/2''	1/2''-0-5/16''

SPEEDS

	MAXIMAT V-10	MAXIMAT 7
Lathe spindle speeds (8)	60, 120, 240, 315, 480, 630, 1250, 2500 rpm	65, 130, 265, 350, 530, 700, 1400, 2800 rpm
Milling head spindle speeds (4)	420, 770, 940, 1740 rpm	

FEEDS

	MAXIMAT V-10	MAXIMAT 7
No. of turning feeds	24	2
Range of feeds	.002'' to .014/rev.	.002'' and .005''/rev.
No. of power milling feeds	192	16
Range of power milling feeds	.13''+MIN—39''/MIN.	.13''/min.- 14''/min.

THREADS

	MAXIMAT V-10	MAXIMAT 7
—inch	8, 9, 9 1/2, 10, 11, 12, 13, 14, 16, 18, 19, 20, 22, 24, 26, 28, 32, 36, 38, 40, 44, 48, 52, 56	8, 9, 10, 11, 11 1/2, 12, 13, 14, 16, 18, 19, 20, 22, 24, 26, 28, 32, 36, 40, 44, 48, 56, 64, 72, 80

THREADS

	MAXIMAT V-10	MAXIMAT 7
—metric	Metric Threads can be cut with use of Accessory #3120 — Universal Quadrant and Set of Change Gears. See page 6.	0.40, 0.50, 0.60, 0.70, 0.80, 1.00, 1.25, 1.50, 1.75, 2.00

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