...a general handbook and operator's manual
for all machinex 5 lathes, drills and mills.

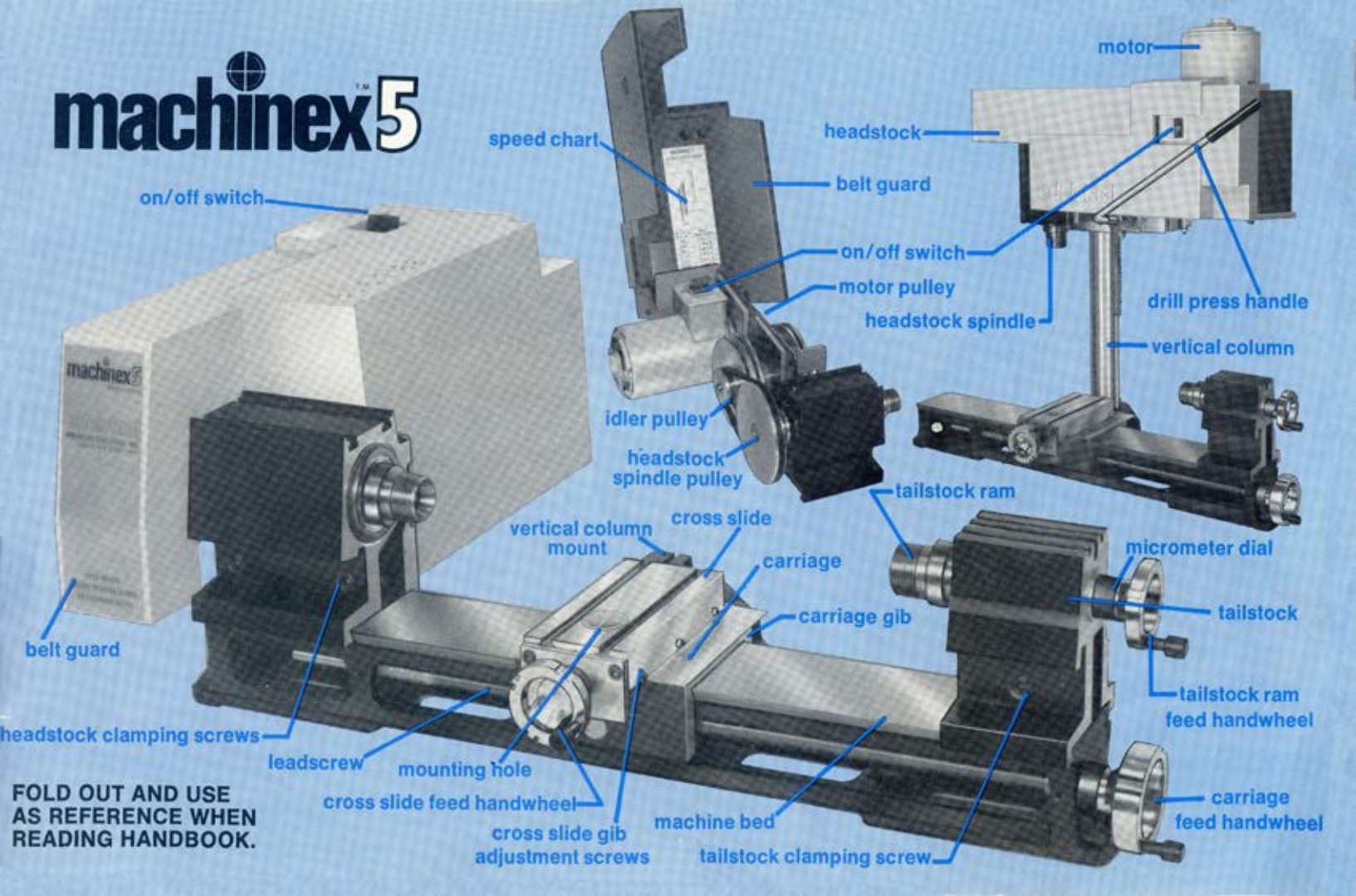
edelstaal®
miniature machining techniques

(machinex 5 set up as lathe)

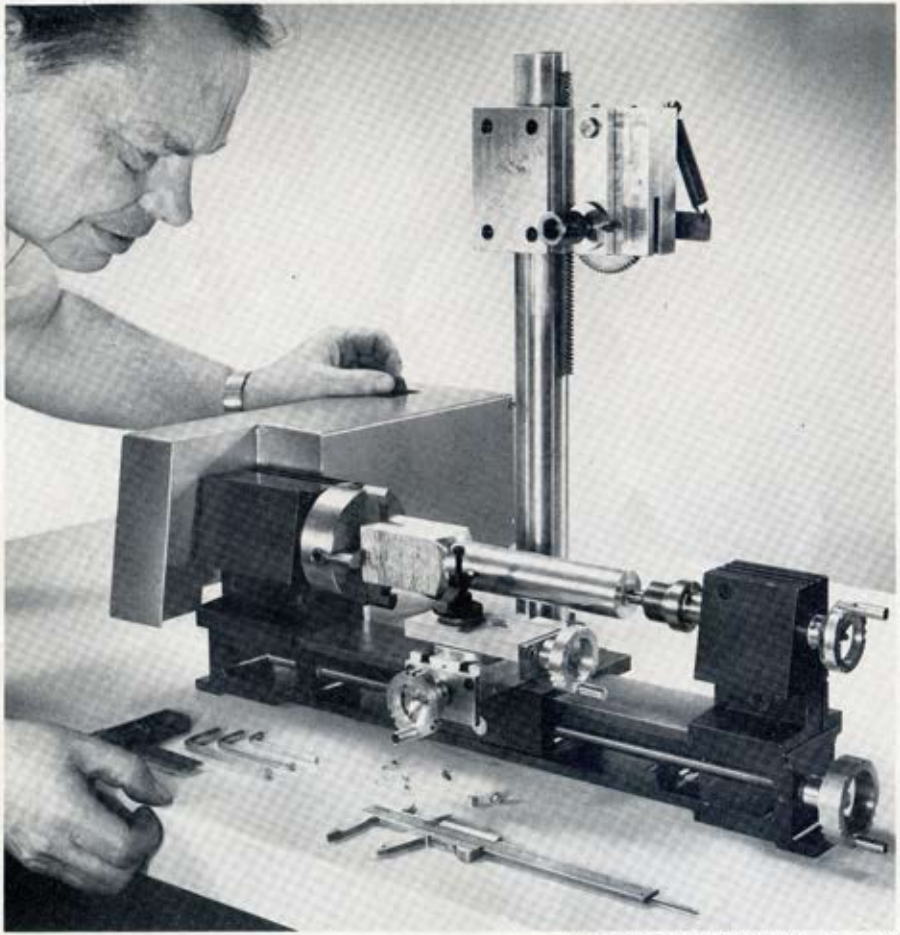
$2.00
No. 5-451

machinex 5 T.M.

machinex5™



FOLD OUT AND USE AS REFERENCE WHEN READING HANDBOOK.



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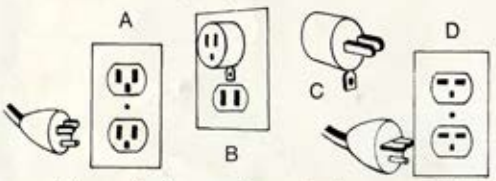
SAFETY PRECAUTIONS

1. Grounding and Electrical Connection Instructions:
   Machinex 5 should be grounded while in use to protect the operator from electric shock.
   This tool is equipped with a three-conductor cord and a 3-prong grounding type plug to fit the proper grounding type receptacle. The green (or green and yellow) conductor in the cord is the grounding wire. Never connect the green (or green and yellow) wire to a live terminal. If your unit is for use on less than 150 volts, it has a plug that looks like sketch A. If it is for use on 150-250 volts, it has a plug as shown in sketch D. An adaptor, sketches B and C is available for connecting plugs as shown in sketch A to 2-prong receptacles. The green colored rigid ear, lug, etc., extending from the adaptor must be connected to a permanent ground such as a properly grounded outlet box. No adaptor is available for the plug shown in sketch D.



   Use only three-wire extension cords that have 3-prong grounding type plugs and three-pole receptacles that accept the tool's plug. Replace or repair damaged or worn cord immediately.

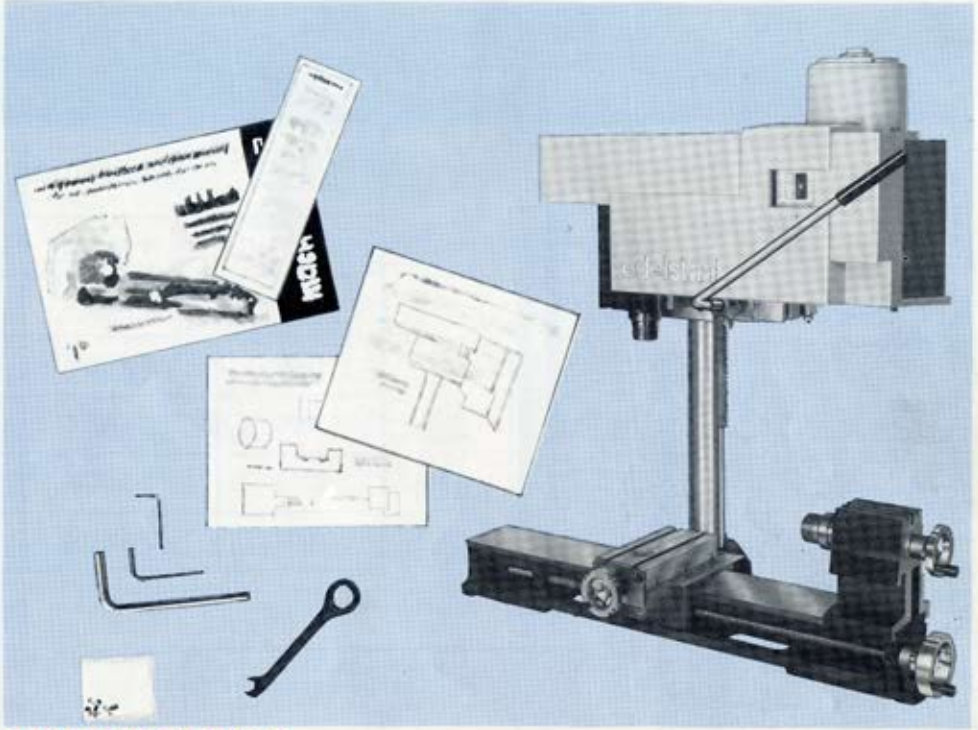
2. **KEEP BELT GUARD AND ACCESSORY EQUIPMENT GUARDS IN PLACE** and in working order.
3. **STOP MOTOR BEFORE LIFTING GUARD OR CHANGING BELTS.**
4. **REMOVE ADJUSTING KEYS AND WRENCHES.** Form habit of checking to see that chuck keys and adjusting wrenches are removed from tool before turning it on.
5. **KEEP WORK AREA CLEAN.** Cluttered areas and benches invite accidents.
6. **AVOID DANGEROUS ENVIRONMENT.** Don't use power tools in damp or wet locations, or expose them to rain. Keep work area well lighted.
7. **KEEP CHILDREN AWAY.** All visitors should be kept a safe distance from work area.
8. **MAKE WORKSHOP KID PROOF** with padlocks, master switches, or by removing starter keys.
9. **DON'T FORCE TOOL.** It will do the job better and safer at the rate for which it was designed.
10. **USE RIGHT TOOL.** Don't force tool or attachments to do a job it was not designed for.
11. **WEAR PROPER APPAREL.** No loose clothing, gloves, neckties, or jewelry to get caught in moving parts. Nonslip footwear is recommended. Wear protective hair cover to contain long hair.
12. **USE SAFETY GLASSES.** Also use face or dust mask if cutting operation is dusty.
13. **SECURE WORK.** Use clamps or a vise to hold work when practical. It's safer than using your hand and it frees both hands to operate tool.
14. **DON'T OVERREACH.** Keep proper footing and balance at all times.
15. **MAINTAIN TOOLS WITH CARE.** Keep tools sharp and clean for best and safest performance. Follow instructions for lubricating and changing accessories.
16. **DISCONNECT TOOLS** before servicing; when changing accessories such as chucks, cutters, bits, blades, etc.
17. **AVOID UNINTENTIONAL STARTING.** Make sure switch is in off position before plugging in.
18. **USE RECOMMENDED ACCESSORIES.** Consult the owner's manual for recommended accessories. The use of improper accessories may cause hazards.
19. **CHECK DAMAGED PARTS.** Before further use of the tool, a guard or other part that is damaged should be carefully checked to ensure that it will operate properly and perform its intended function — check for alignment of moving parts, binding of moving parts, breakage of parts, mounting, and any other conditions that may affect its operation. A guard or other part that is damaged should be properly repaired or replaced.
20. **DIRECTION OF FEED.** Feed work into a cutter or blade against the direction of rotation of the cutter or blade only.
21. **NEVER LEAVE TOOL RUNNING UNATTENDED. TURN POWER OFF.** Don't leave tool until it comes to a complete stop.
22. **WARNING.** For Your Safety—Don't wear gloves when operating the drill press.

23. **SECURE ALL WORKPIECES AND CUTTING TOOLS ADEQUATELY,** in lathe chucks and collets, on faceplates, etc., or mounted in toolholders, vise, or on worktables. Work or cutters that can come loose during operation are a safety hazard and can cause damage to machine and parts.

MACHINEX 5 BASIC PARTS CHECK LIST

The following is a list of parts for MACHINEX 5 models 1-510-01 and 1-514-01 basic unit. Be sure that all parts have been included in this shipment. In the event of a shortage, damage or other discrepancy, please notify our Customer Service Department at once.

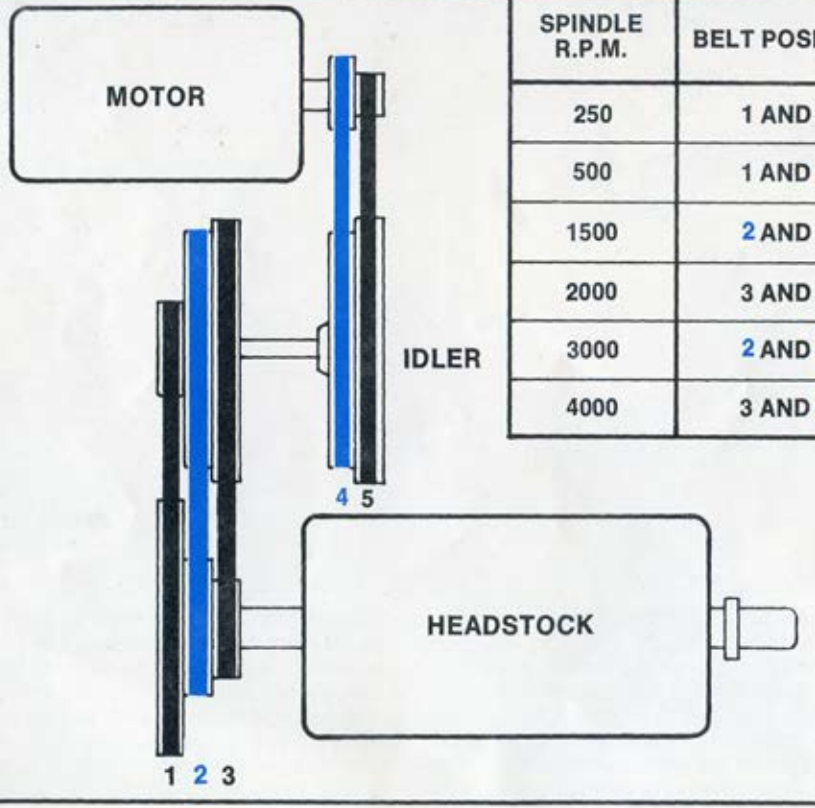
1. MACHINEX 5 Warranty Registration Card and Owner's Record
2. Owner's Instruction Handbook
3. Replacement Parts Handbook
4. Assembly instructions
5. Machine bed
6. Headstock with main spindle and spindle pully assembly
7. Carriage assembly
8. Cross slide assembly
9. Tool block
10. Tailstock assembly
11. Motor, pulley and switch assembly
12. Idler shaft and double-pulley assembly
13. Motor support casting
14. Belt guard
15. Vertical column with rack
16. Vertical column headstock mount
17. Drill press handle
18. 2 V belts
19. Plastic closure for cross slide
20. 5 service wrenches
21. Packet containing mounting hardware for motor, and motor support casting



CUSTOMER SERVICE

Before shipment from the factory each **Machinex 5** undergoes meticulous inspection. If when unpacking your machine you find that a part has been damaged in shipment — or in the event a part should prove defective within the warranty period—write to the Customer Service Department, American Edelstaal, Inc., 1 Atwood Avenue, Tenafly, New Jersey 07670, and describe exactly what is wrong, referring to the part by the name and number on the parts list. If it is necessary to return the part to us for replacement, we will mail you a special shipping ticket. Our repair department cannot accept parcels not previously authorized in this manner.

MACHINEX 5″ SPINDLE SPEED CHART



SPINDLE R.P.M.	BELT POSITION
250	1 AND 5
500	1 AND 4
1500	2 AND 5
2000	3 AND 5
3000	2 AND 4
4000	3 AND 4

MACHINEX 5 SPECIFICATIONS

Lathe Capacity

swing:	over bed: 5″ over cross slide: 3⅛″
Distance between centers	standard 20″ bed: 10″ long 24″ bed: 14″
Headstock spindle	bore: 9/16″ collet capacity: ½″ taper: special nose thread: 1″ x 16 threads
Speeds	number: 6 range: 250, 500, 1500, 2000, 3000, 4000 rpm
Carriage travel	standard 20″ bed: 9¼″ long 24″ bed: 13¼″
Cross slide travel	3″
Cross slide dimensions	4½″ x 2¼″
Cross feed screw	¼—20 nc rolled thread
Compound travel	2⅝″ (Accessory)
Compound feed screw	¼—20 nc rolled thread
Tailstock spindle	taper: No. 1 Morse Taper
Spindle travel	1-3/16″

Vertical Capacity

Spindle to cross slide	8″
Drill chuck to cross slide	5¾″
Drill to center of circle	6¾″
Drill press stroke	2″
Drive motor	electrics: 115v AC, 60hz, 1-P type: permanent magnet output: ¼ hp amps: 3
Overall machine dimensions	length: standard 20″ bed long 24″ bed—30″ height: lathe headstock—7″ with vertical column—22″ with second vertical headstock—27½″ width: 12″

weight: standard 20″ bed, net 42 shipping 47
long 24″ bed, net 45 shipping 50

WARRANTY INFORMATION

Each **Machinex 5** is covered by a limited 6 month warranty certificate that is mailed to the purchaser **as soon as we receive the owner's registration card** which is packed with the machine. Only registered machines are warranted. Be sure to fill out and mail the registration card promptly.

The registration card records the particular machine's serial number and establishes the purchaser as the owner of record (helpful if your machine should be stolen). It also puts you on our mailing list to receive new **Machinex 5** catalogs, new-accessory announcements, and any other pertinent literature that may be issued from time to time.

If you complete the information requested in the Purchaser's Survey section of the Warranty Registration Card, we will also send you, free of charge, a convenient slide-rule calculator that will quickly show the correct spindle speed to use for any turning, drilling or milling operation in any metal.

LIMITED WARRANTY

American Edelstaal, Inc. warrants this MACHINEX 5" to be free from defects in material or workmanship for a period of six months from date of original purchase.

American Edelstaal's sole obligation during this time period of limited warranty is to repair or replace, at its option, your MACHINEX 5" or any part or assembly, if proved defective in normal use and service WITHOUT CHARGE for either parts or labor by our Factory Service Department.

Should a defect arise during the limited warranty period, *first* contact the Customer Service Department of American Edelstaal Inc. (for purchase made in the United States) or Canadian Edelstaal Ltd. (for purchase made in Canada), giving the *Warranty Certificate Number* recorded on the Warranty Certificate covering your purchase. (The Warranty Certificate will be sent to you upon our receipt of your completed Warranty Registration Card that is supplied with each MACHINEX 5".) You will receive a special Authorized Return Shipping Label and necessary instructions for the return of the defective part(s). Shipping charges are not included in this limited warranty and must be prepaid.

This limited warranty covers defects encountered in normal use and service within the warranty period but does not apply to the following cases:

(a) Damage caused by misuse or abuse scratching or discoloration to the surfaces of the MACHINEX 5", incorrect wiring (not our own), neglect, improper installation, accident or failure to follow operating instructions correctly.

(b) Repair and/or modifications made or attempted by individuals other than authorized American Edelstaal, Inc. service personnel.

(c) Defects arising as a result of freight damage, water damage, dropping, etc.

IMPLIED WARRANTIES (IF ANY) FOR THE MACHINEX 5" AS TO MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE ARE LIMITED TO A PERIOD OF SIX MONTHS FROM THE DATE OF ORIGINAL PURCHASE AS SHOWN ON PURCHASER'S RECEIPT. NO RESPONSIBILITY IS ASSUMED FOR INSTALLMENT OR MAINTENANCE OF THE MACHINEX 5" OR FOR ANY PERSONAL INJURY, PROPERTY DAMAGE, OR ANY SPECIAL, INCIDENTAL, CONTINGENT OR CONSEQUENTIAL DAMAGES OF ANY KIND RESULTING FROM DEFECTS IN THE MACHINEX 5" EXCEPT WHERE PROHIBITED BY APPLICABLE LAW.

Some states do not allow the exclusion or limitation of incidental or consequential damages nor the limitation on how long an implied warranty lasts, so the above limitations or exclusions may not apply to you.

This warranty gives you specific rights, and you may already have other rights which vary state to state. In the event of a dispute with the warranty service or problems, you may be able to go to a Small Claims Court, a state court or a federal district court.

NOTE: THIS LIMITED WARRANTY IS GIVEN BY AMERICAN EDELSTAAL, INC., TENAFLY, N.J. 07670 WITH RESPECT TO THIS MACHINEX 5" PURCHASED IN THE UNITED STATES AND BY CANADIAN EDELSTAAL LTD., IN SCARBOROUGH, ONT., CANADA, WITH RESPECT TO THIS MACHINEX 5" PURCHASED IN CANADA AND NO OTHER WARRANTY, WRITTEN OR VERBAL IS AUTHORIZED BY AMERICAN EDELSTAAL, INC. IN THE UNITED STATES AND CANADIAN EDELSTAAL LTD. FOR CANADA. THIS WARRANTY SHALL NOT EXTEND TO ANYONE OTHER THAN THE ORIGINAL PURCHASER OF MACHINEX 5" OR THE PERSON FOR WHOM IT WAS PURCHASED AS A GIFT.

American Edelstaal, Inc. 1 Atwood Ave., Tenafly, N.J. 07670

Canadian Edelstaal, Ltd. – Suite 2100
372 Bay St., Toronto, Ont. Canada M5H2Y1

THE MACHINEX 5 LATHE/DRILL/ MILL

No other small shop machine can compare with it. The **Machinex 5** lathe/drill/mill is a truly universal machine tool that can perform **any** of the standard rotary metal-machining operations — turning, drilling, milling, boring or grinding. It has the capacity to machine good-sized work, yet it's compact enough to be used anywhere.

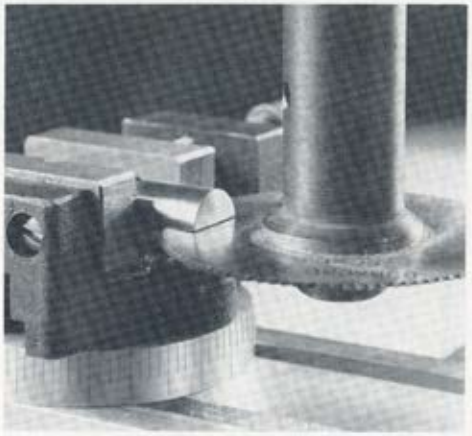
When you set up the machine as a metal lathe, you're equipped to turn your own steel, brass or aluminum parts to split-thousandth tolerances. When you set up the machine as a drill press, you're able to perform any of the common drill-press operations, including counterboring, countersinking, reaming, even "sensitive" drilling of extremely small holes with tiny drills. When you set up the machine as a vertical mill, you're able to mill intricately-shaped metal parts you couldn't make in any other way. Using the machine as a surface grinder, you can precision-grind hardened steel parts as accurately as any toolmaker can.

On this one machine it's possible to accomplish nearly any machining operation in nearly any common material, whether metal, plastic or wood.

For R&D, Prototype and Instrument Work

Virtually a one-machine machine shop, this remarkable machine has proved itself in a wide variety of applications.

In industrial labs **Machinex 5 s** are used in preference to far higher-priced speed lathes.



In university physics labs **Machinex 5 s** are used to build experimental hardware and mathematical models. In pattern shops **Machinex 5 s** are used for machining pattern fittings and parts for matchplates.

Many small service businesses have found the machine all but indispensible. In optical and electronic instrument repair shops the **Machinex 5** has become standard equipment, for quite often an instrument repairman can rebuild damaged or worn instrument parts on his **Machinex 5** in less time than it would take to order factory replacements.

A Professional's Tool

Gunsmiths, locksmiths, clockmakers, typewriter repairmen, electric motor repairmen, appliance repairmen, medical equipment repairmen, jewelers, lapidaries and craftsmen in many other fields use the **Machinex 5** to make or rebuild repair parts.

The **Machinex 5** gives inventors, designers, engineers, architects and other professionals who build scale models an economical way to produce precision parts that otherwise— if made on larger machines — would be quite expensive because of the setup time involved.

Perfect For Hobbyists

A great many hobbiests and home craftsmen also use the **Machinex 5.** Although the machine is built to industrial standards, it makes machining metal so simple that with only a few hours practice a home craftsman having no previous machine-tool experience whatever can turn out machined parts comparable in every way to parts made commercially on expensive heavy equipment. For amateur modelbuilders — particularly for beginners — the **Machinex 5** offers both adventure and education, opening a broad new field of interest.

Easy For Anyone To Use

Anyone experienced in the use of larger machines will have no difficulty using the **Machinex 5,** for the machine is used exactly as large machine tools are.

A complete novice using the **Machinex 5** for his first attempt at metal-machining will soon learn the fundamentals of machinework by trial and error. This booklet briefs elementary procedures. While not a comprehensive machinist's manual, it will give the new **Machinex 5** owner a survey of the many op-

erations the machine can perform, show some of the more commonly-used setups, and get him started in the right direction. Skill as a machinist (which is really a practical knowledge of cutting tools and the materials cut with them) comes with experience. The more you use a machine tool, the more you can do with it.

A WORD ABOUT ACCESSORIES

Like full-sized lathes and milling machines, the **Machinex 5** is sold as a basic machine—without cutting tools or accessories. This policy allows us to keep the machine's price as low as possible and to avoid charging the purchaser for accessories he might not need. A purchaser should be prepared to buy, at additional cost, the cutting tools and work-holding accessories needed to suit the machine to the particular kind of work he wants to do. Many purchasers order a set of lathe tools, a spindle chuck or set of collets, a live tailstock center, and a machine vise with their machine.

SETTING UP THE MACHINE

Having unpacked your **Machinex 5,** wipe the machine with a rag dampened in solvent to clean off the rust-inhibiting preservative compound protecting it. Then immediately oil all bright-metal surfaces with light machine oil to protect these surfaces.

TO REMOVE PRESERVATIVE *wipe the machine down with a solvent-dampened rag and oil all bright metal surfaces. Then oil the two lead-screw bearings and crossfeed screw bearing.*

Mounting

Although permanent mounting isn't really necessary — the machine can simply be set on a table and used — you may want to screw or bolt the machine down solidly on a bench top or other work surface. Using pads cut from sheet rubber under the bed casting's three feet will help silence the machine's slight noise of operation. Because the machine mounts at three points, the mounting screws will not twist the bed's precision-finished dovetail guideway as the bed is screwed down.

The Motor Drive

The machine's rugged ¼ hp permanent-magnet motor has permanently-lubricated bearings and needs no maintenance. Motor speed drops slightly as load is applied, which is normal. (Although the motor can withstand heavy overloads for short periods, if, when turning large-diameter work you should stall the motor, switch off power immediately.)

Tensioning The V Belts

The Gates narrow-width polyurethane 60° V-belts used for the **Machinex 5's** belt drive

THE MACHINE'S V-BELTS *should be tensioned quite tightly. Belt tension is correct when there is no appreciable "give" when you squeeze the belt between your thumb and forefinger.*

have ample capacity, transmit power efficiently and give long service life. But to avoid slippage the belts must be properly tensioned. A 60° V-belt should be tensioned more tightly than conventional V-belts. Tension is correct when there is no appreciable "give" to the belt when you grasp it midway between pulleys between your thumb and forefinger. A belt that is not tensioned tight enough will slip and not transmit power to the spindle. If the spindle stalls during operation, switch off the motor and recheck the belts.

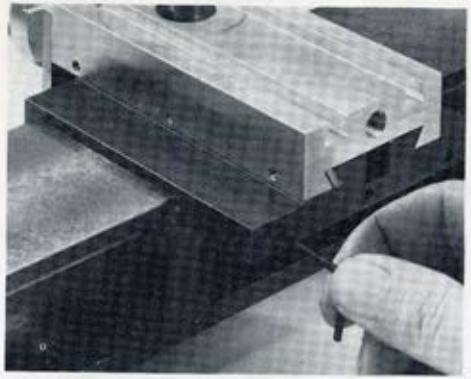
Changing Speeds

When changing spindle speeds, tension the spindle pulley belt first, loosening the pivoted plate on which the idler pulleys are mounted, pushing the plate to the rear, and then retightening the lock screw. Then tension the motor pulley belt similarly, unlocking the motor mounting plate, pushing it to the rear, then retightening the lock screw.

CARRIAGE MOVEMENT ADJUSTMENTS

The carriage movements move the lathe's cutting tool either longitudinally along the bed or crosswise at right angles to the lathe's axis. As on the finest large machine tools, dovetail slides are used for both of the **Machinex 5**'s carriage movements. Each slide has a non-galling brass gib that can be adjusted with four Allen-head screws for easier or tighter sliding action. On both the carriage and cross slide gib, one of the adjusting screws locks the slide immovable.

For ordinary machining of soft, easily-cut



THE CARRIAGE GIB ADJUSTING SCREW *on the right side is also used to lock carriage movement.*

metals (aluminum, for example) the carriage movements can be loosened somewhat, which permits faster operation. For close-tolerance machining of harder-to-cut metals (steel or cast iron) the movements should be set up tightly enough to make handwheel operation fairly stiff. Carriage movements that are too loose may cause tool chatter.

Tighten or loosen the three gib screws evenly when adjusting each movement. For proper cross slide operation, *first* tighten the rear-most gib screw as much as possible, permitting a snug movement of the slide. Next, tighten the screw second from the rear, with just a little less tension. Do the same with the two remaining screws, working from rear to front. A properly adjusted cross slide will not have any lateral play. Don't crank the cross slide out too far. Two of its gib screws should remain engaged with the carriage dovetail to prevent side play.

CLEANING AND OILING

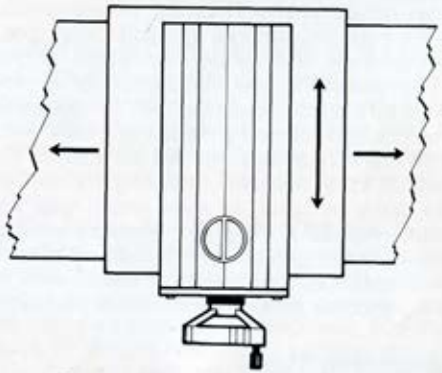
It's important to keep a metal lathe cleaned and oiled, for accumulated dirt and chips cause unnecessary wear. You can clean up metal chips from your machine very quickly with a shop vacuum, or you can brush the tool clean with a paintbrush. After each use oil the dovetail guideway and wipe down all bright working surfaces with an oily rag to prevent rust. Keep the feed screws clean, lubricating them with light machine oil. Apply a drop of oil to the leadscrew bearings each time the machine is used.

Make it a practice to keep the bed's dovetail guideway wiped clean with an oily rag as you use your machine, particularly when performing grinding operations that produce gritty swarf. Use enough oil on the rag to leave an oily film on the surface wiped.

WHEN REMOVING THE TAILSTOCK, *slide it off the bed along a groove in the handwheel.*

LATHE FUNDAMENTALS

A metal lathe is built with a tool carriage that slides lengthwise along the machine's bed parallel with the lathe's line of centers, or axis. This movement is termed the machine's longitudinal carriage feed. The sliding carriage incorporates a cross slide that travels crosswise at right angles to the lathe's axis, in or out. This movement is termed the machine's carriage cross feed.



ALL HANDWHEELS *have resettable micrometer dials graduated in .001"*

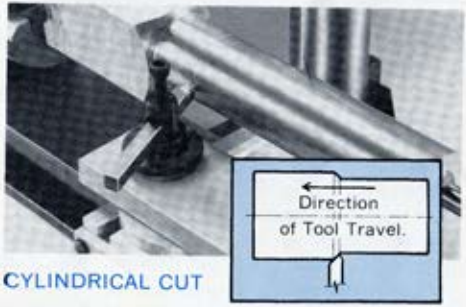
On the **Machinex 5** both longitudinal and cross carriage movements are controlled by feed screws with graduated handwheels. When a cutting tool is mounted on the carriage, turning the leadscrew handwheel slides the carriage along the bed and moves the tool to the operator's left or right. Turning the cross feed handwheel moves the cutting tool in or out.

Machinex 5 handwheels are equipped with calibrated resettable dials. Each calibration is .001". Since the dial is resettable, it can be positioned at 'zero' setting before a cut is taken, and the cutting tool advanced the desired number of graduations. The resettable dial feature eliminates remembering at which calibration a cut was started.

BASIC TURNING TECHNIQUES

Most work turned in lathes can be machined to the desired shape with three kinds of cuts:

Cylindrical cuts are fed with the leadscrew handwheel. Turning the handwheel moves the

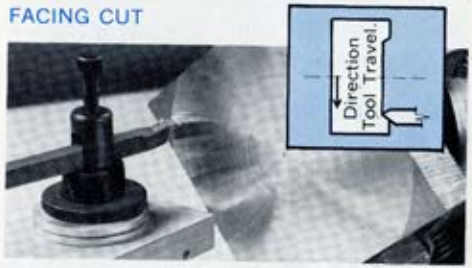


CYLINDRICAL CUT

cutting tool along a path parallel with the lathe's axis, and the tool turns the workpiece to straight cylindrical shape. Cylindrical cuts normally are made towards the lathe's headstock.

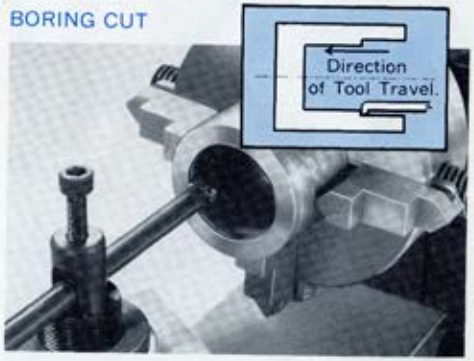
Facing cuts are fed with the cross feed handwheel. Turning the handwheel moves the tool in or out at a precise 90° angle to the lathe's axis, and the tool turns the end of the workpiece perfectly square. Facing cuts normally are made from the center of the workpiece out.

FACING CUT



Boring cuts are simply internal cylindrical cuts made with an overhanging tool bit or boring bar. With a boring bar it's possible to bore through-holes, blind holes or recesses.

BORING CUT

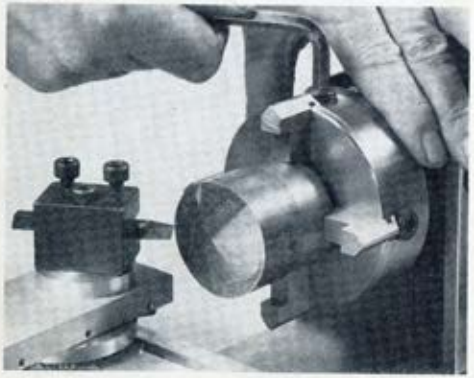


Although these three cuts in some combination will machine most lathework to shape, occasionally **angular cuts** are required. Angular cuts can be made on the **Machinex 5** using the accessory graduated compound or tool post slide, that bolts on the machine's T-slotted cross slide worktable. This compound can be set at any angle required. Angular cuts are fed with the top slide's handwheel.

MOUNTING WORK FOR TURNING

In most lathe operations the work is revolved against a fixed cutting tool that peels off shavings. It takes considerable force to pare chips from solid metal. The workpiece must be mounted in the machine very securely to make the tool's cutting edge cut the work instead of lifting it out of the machine.

WORK MUST BE CENTERED *in a 4-jaw independent chuck by hand. Chuck's step-jaws are reversible.*



While work can be mounted in several ways, the most common way is to grip the stock in a spindle chuck. Two types of lathe spindle chucks are commonly used, the 3-jaw universal chuck and the 4-jaw independent chuck. Both types are available as **Machinex 5** accessories.

USING THE 3-JAW UNIVERSAL LATHE CHUCK

The 3-jaw universal chuck has three jaws that close together and center the workpiece automatically. Turning the chuck's back scroll plate screws the jaws in or out. If you should screw the jaws out beyond the scroll, reengage them in 1-2-3 order.

A universal (self-centering) chuck centers work only to within two or three thousandths, and it can grip only round or hex stock. Because the jaws are tightly fitted, a new chuck at first may work quite stiffly, but the jaws soon wear in and thereafter if kept cleaned and oiled will slide smoothly. Make sure when using a 3-jaw chuck that the jaws grip with even purchase as they close on the work.

USING THE 4-JAW INDEPENDENT LATHE CHUCK

The other type of spindle chuck, **the 4-jaw independent chuck,** grips a wider variety of work shapes. This chuck has four reversible step-jaws that adjust independently with a key, which makes it possible for the chuck to grip round, square or irregularly-shaped workpieces either centered or off-center. The 4-jaw chuck's only disadvantage is that it does not automatically center the workpiece. Work must be centered by hand. When centering work, first center the piece in the chuck roughly by eye, and then make corrections by adjusting opposite jaws — loosening one jaw and tightening the jaw opposite — to shift the work as needed. Use the point of the tool bit as an indicator, revolving the work in the lathe by hand, to show which way the work requires shifting. For exacting work a dial indicator can be used to indicate runout. With patience, it's possible to center work in a 4-jaw chuck with extremely close precision.

Machining Tubes

Always tighten all four jaws evenly on the work. The jaws close with enormous force. When chucking tubing or bushings that might be distorted by jaw pressure, first turn a closely-fitted metal plug and insert the plug in the work.

Often the 4-jaw chuck is used to hold square or rectangular stock to be turned round, and this involves interrupted cuts — with the tool cutting only the corners of the work. Such cuts must be made at low spindle speed to avoid excessive hammering, and

the lathe's carriage movement should be set up quite tightly.

Any workpiece that overhangs the jaws of a chuck more than four times its diameter should be centerdrilled and supported with a tailstock center. While a dead center (non-rotating) can be used in the tailstock if the center is kept well lubricated, a live tailstock center (ball-bearing-mounted) is much more convenient for most work—and all but essential for work turned at high spindle speeds.

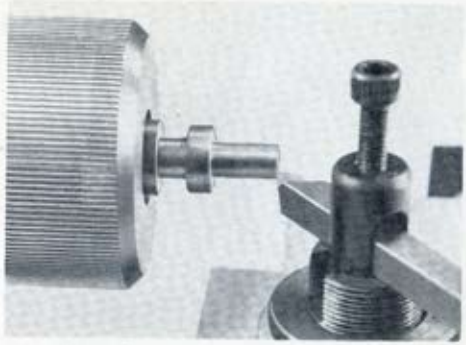
TURNING WORK HELD IN COLLETS

Toolmakers when turning small parts that must be centered with extreme precision usually hold the work in spring collets. A collet centers small-diameter round stock more accurately than any other workholding device.

The collets available as **Machinex 5** accessories are high-quality double-taper split collets closed by a closing collar that screws on the spindle's nose threads. Screwing on the collar squeezes the collet back into the taper in the spindle bore, compressing it enough to grip the work. The collets are available in either inch or metric sizes. A collet is precision ground to fit one size only. It should only be used on workpieces, drills or mills of that particular size. Clamping a smaller sized drill or milling cutter will distort the collet and ruin its accuracy.

Collets are especially useful when you're turning a quantity of small precision parts from drill rod or similar smooth-finished rod stock. Lengths of stock can be fed through the spindle bore from the rear.

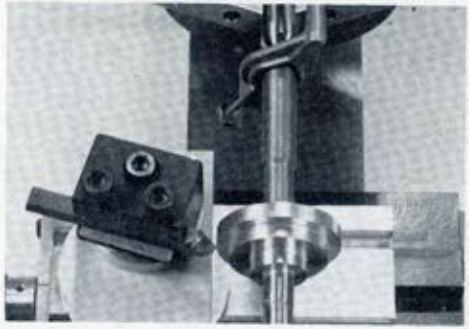
Collets are also used to hold drills and milling cutters accurately. (See page 20,24). Since collets are high-precision devices, keep them scrupulously clean, wiping them carefully with an oily rag after each use.



SPRING COLLETS *center work with extreme precision. They are closed with a knurled collar.*

TURNING WORK BETWEEN CENTERS

The most satisfactory way to machine a shaft or other part that must be turned its full length with precise concentricity is to centerdrill each end of the stock with a 60° centerdrill and then mount the work between centers. For this you'll need a headstock and tailstock center, faceplate and lathe dog, available as accessories. With the faceplate screwed on the spindle nose, the work is suspended between headstock and tailstock centers, and the dog — a bent-tailed fixture used to drive the work — is clamped on the spindle end of the stock in such a way that its tail engages a slot in the faceplate.



TURN PULLEYS OR WHEELS *on mandrels mounted between centers. Drive the mandrel with a dog.*

Work mounted between centers can be removed from the machine and later replaced for additional turning without loss of precision. If a special mandrel for a wheel-shaped workpiece is turned between centers, for example, you can remove the mandrel from the lathe, press on the workpiece, and then return the mandrel to the machine in order to turn the work. If desired the mandrel can be turned end-for-end in the machine and the dog clamped on the opposite end.

OTHER WAYS TO MOUNT WORK

When you encounter work that can't readily be gripped in a chuck, bolted to a faceplate or turned between centers, it's nearly always possible to improvise a special workholding device of some sort that will hold the work satisfactorily. For example, some odd-shaped work could be screwed or soft-soldered to scrap stock, and the stock

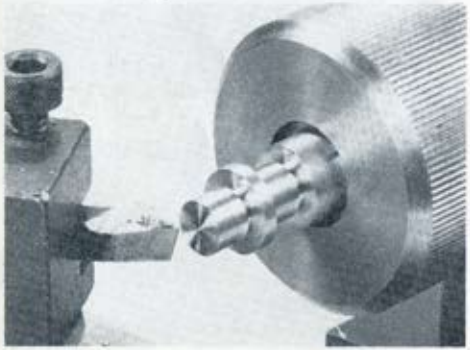
could be chucked. For some work you might want to make a special split chuck — turned to accept the work, split with a hacksaw, and closed with screws or a clamping ring. Or you might turn a ring and embed an irregularly-shaped part in the ring with Plaster of Paris. In one way or another it's possible to mount work of any conceivable shape in the lathe for turning.

MOUNTING THE CUTTING TOOL

The **Machinex 5**'s open-side tool block, the same type of toolholder used on large industrial lathes, mounts directly on the T-slotted cross slide worktable. By rotating the block the tool may be mounted on either side. Ordinarily for cuts towards the headstock the tool is mounted in the left side of the block.

The tool block's slot accepts either Edelstaal pre-formed lathe tools, which are easier to resharpen than conventional bits,

MOUNT THE CUTTING TOOL *with a minimum amount of hangover.*



or standard tool bits up to 5/16″ square. Standard bits are available in ready-ground sets or as blank bits that you grind yourself. The hole through the tool block simplifies mounting round boring bars 3/8″ in diameter.

Whatever the tool used, it must be mounted with the point of its cutting edge exactly at center height, level with the axis of the work. Use a sheetmetal shim of the thickness required to align the tool's point with the tailstock center, inserting the shim under the tool's shank. For maximum rigidity the tool should overhang the tool block no more than necessary.

PRACTICE TURNING

Before attempting critical work on your **Machinex 5** it's advisable to try some practice turning on scrap stock to get the "feel" of the machine. If you've never before used a metal lathe you'll find this a revealing experience. Aluminum is perhaps the most suitable metal for practice turning, since it machines freely and is not expensive.

Center Drilling

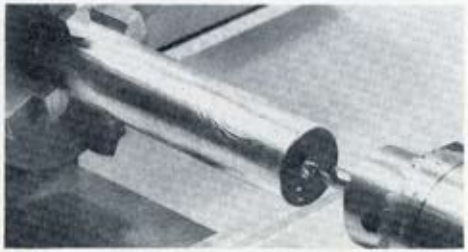
Having obtained a piece of aluminum bar stock perhaps 1″ in diameter and about 6″ long, grip it in a spindle chuck for centerdrilling. Seat a drill chuck in the tailstock's internal taper and insert a 60° centerdrill in the chuck. Then, with the machine running at lowest spindle speed, feed the center drill into the aluminum with the tailstock handwheel. Drill the centerhole to nearly the full diameter of the centerdrill, but not deep enough to leave a ridge around the counter-

LOCATE CENTER POINTS *on each end of stock with square or dividers and center punch.*

sink. Then remove the drill chuck, insert a center in the tailstock, and support the end of the aluminum workpiece with the center. Revolve the work in the lathe once by hand to make sure that it turns freely.

After positioning the tool beyond the work's right-hand end, feed the tool in with the cross feed handwheel enough to make a cut about 1/16″ deep. Then start the cut, turning the leadscrew handwheel steadily and evenly.

CENTERDRILL ANY LATHEWORK *longer than four times its diameter and support the end with the tailstock center. Drill the centerhole to nearly the full diameter of the centerdrill.*



The tool's cutting edge will pare off a continuous light chip. You can continue this truing cut until you reach the chuck.

Next try a deeper cut, setting the tool to pare off a chip about 3/16" deep, and turn the leadscrew handwheel fast enough to make the tool cut a thick, curled chip. As you'll see, this heavier cut will remove metal much faster but will leave a rougher finish on the work.

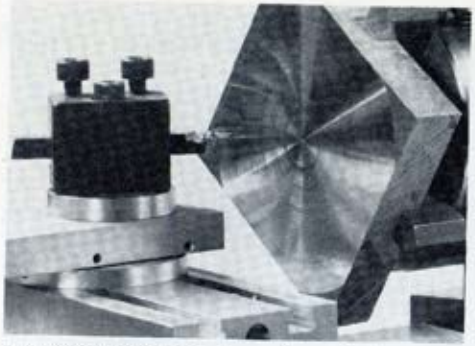
Now try a high-speed finishing cut. Using the handwheel's graduated dial, position the cutting tool for a very light cut only a few thousandths deep, shift the machine's belt-drive to give a moderately high spindle speed, and turn the leadscrew handwheel slowly and evenly to make the tool cut a very fine thread-like chip. This cut will leave a brilliant near-mirror finish on the work.

Facing Cuts

Try some practice facing cuts before discarding your scrap aluminum workpiece. To face the end of the stock, set the tool at a 45° angle and feed the cut with the cross feed handwheel, making the cut from the center of the work out.

When facing large-diameter workpieces it's necessary to take light cuts, for a heavy cut that the lathe could easily pull near the center of the work would labor the motor as the diameter of the cut increased. Make sure when facing large work that the cross slide will have sufficient travel to complete the cut.

Some turned parts will have stubs at one or both ends that must be cut off after the part is turned. While a parting tool (cut-off tool) can be used for cutting-off in the lathe,



FACING CUTS *are normally made from the center of the work out. Use slow spindle speed when facing large work. Be sure the cross slide will have enough travel to complete the cut.*

it's usually simpler to turn a V-shaped notch at the end of the part and to cut off the stub with a hacksaw after the part is removed from the machine. When turning down stock beyond the part, particularly when you're machining brass or aluminum, avoid turning it so small that the stub might break off before the part is completely finished.

SELECTING SPINDLE SPEED

Ordinarily all lathe operations are performed with first a series of deep roughing cuts and then a light finishing cut. Roughing cuts are taken at slow spindle speed to reduce the work to slightly more than finish diameter; then a light cut is taken at higher spindle speed to finish the work to exact size. The roughing cuts, usually made towards the headstock, can be as deep as the lathe can pull at slow spindle speed without excessive laboring. The allowance left for finishing generally should be about .010", for a finishing cut about .005" deep.

The depth of the roughing cuts the machine will pull, which you'll soon learn to judge by experience, depends on a number of factors: the machinability of the metal being turned, the work's diameter, the spindle speed, the rate of feed, the rigidity with which the work is mounted in the machine, and the shape and sharpness of the cutting tool. The **Machinex 5** can pull deeper cuts when machining soft, easily-cut metals than when machining tough, harder-to-cut metals. You can take deeper roughing cuts when turning soft aluminum than when turning brass. You can take deeper cuts when turning brass than when turning steel or cast iron.

ROUGHING CUTS *taken at slow spindle speed remove metal rapidly but leave a rough finish.*

FINISH CUTS *taken at high spindle speed with a round-nose tool leave a very smooth finish.*

The optimum spindle speed for a particular cut depends both on the work's machinability and its diameter. Small aluminum or brass parts can be turned at high spindle speeds. But when turning a large-diameter steel workpiece it's necessary to use slow speed and take comparatively light cuts, since deep cuts on large-diameter work could stall the lathe's motor. (If you should stall the motor, immediately switch off power, back out the tool and try a slower, lighter cut.) Also check belt tension. Loose belts will not transmit power and stall the spindle.

MATERIAL	0-5/16" dia.	5/16-3/4" dia.	3/4-1" dia.	1-2" dia.
Steel	1,400	950	590	310
(Alu., Brass, Copper)	1,700	1,400	950	500
Wood, Plastic	2,200	1,700	1,400	950
Steel	1,700	1,400	950	310
(Alu., Brass, Copper)	2,200	1,700	1,400	950
Wood, Plastic	2,200	1,700	1,400	950
Steel		370		
(Alu., Brass, Copper)		590		
Wood, Plastic		730		
(Alu., Brass, Copper)		590		
Wood, Plastic		730		
All materials	500	330	330	200
Metals (per stone dia.)	5,200	3,200	2,000	1,700

Slow spindle speed also minimizes tool chatter. When a tool vibrates in the cut, leaving a corrugated finish on the work, it's an indication that the setup isn't sufficiently rigid to resist the cutting forces involved. Chatter is often a problem when you're turning slender work that springs away from the tool's cutting edge. When a tool chatters, reset it at another angle and take a lighter cut at slower spindle speed.

WHEN TURNING LARGE-DIAMETER WORK *use the machine's slowest spindle speed. Take light cuts.*

SHARPENING LATHE TOOLS

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

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

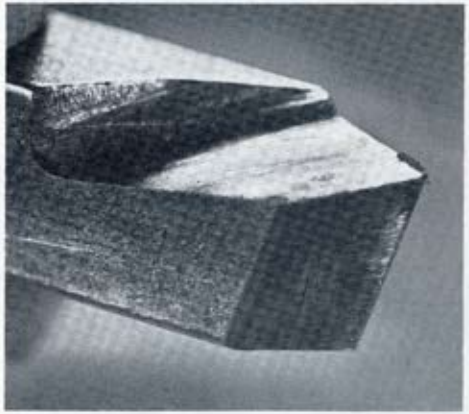
But when a tool's cutting edge finally becomes chipped and dulled, the bit must be reground. Edelstaal pre-formed lathe tool inserts can be reground very easily, simply by grinding a little metal off the end of the insert. When regrinding conventional square tool bits, grind each of the tool's faces slowly on a medium-grit grinding wheel, grinding

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

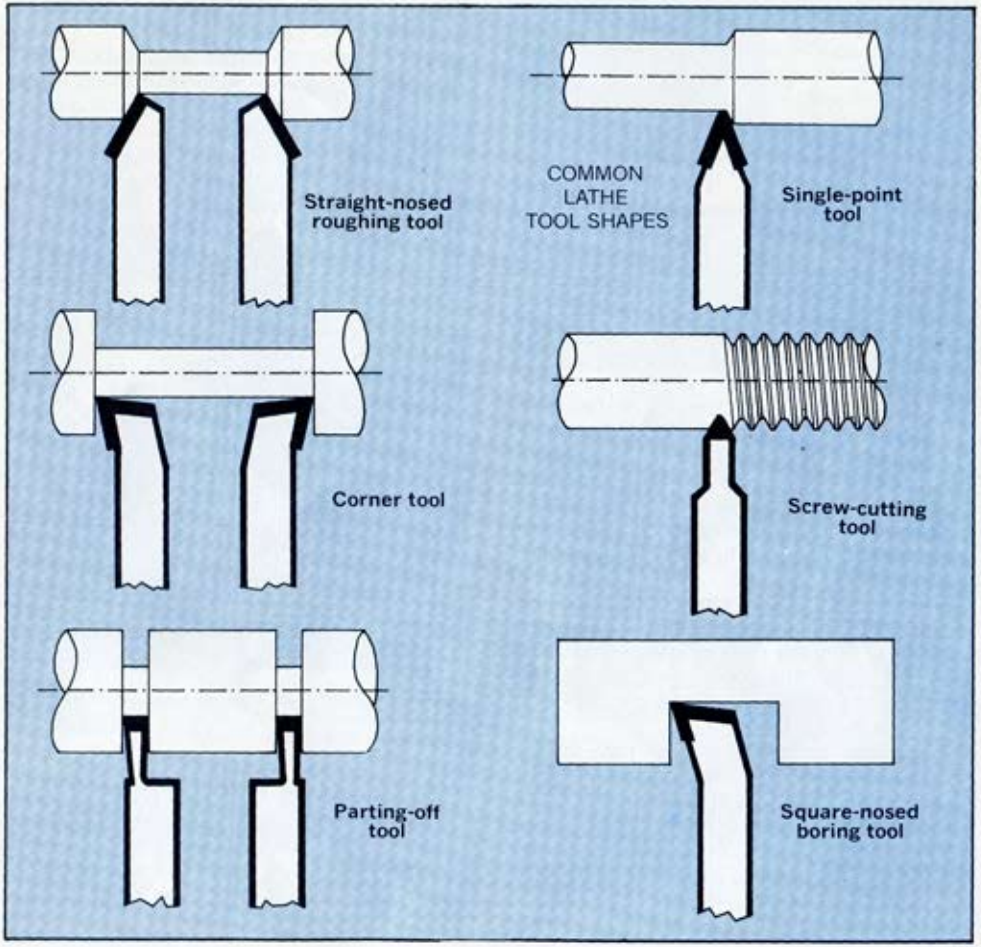
away enough metal to renew the edge but taking care to maintain the tool's original shape.

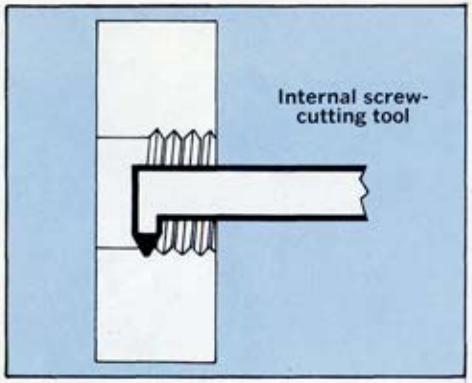
There are a number of fairly standard shapes of lathe tools that have proved efficient for particular turning operations, which you'll find diagrammed in machinist's handbooks, and machinists soon learn to grind special tools for special jobs. A novice machinist probably would be well advised to buy a set of ready-ground bits and keep them for

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



reference. Though smaller, cutting tools for the **Machinex 5** are ground exactly like the bits used in large industrial machines. If you buy unground 5/16″-square bits and grind them yourself, keep in mind the two important requirements for any metal-cutting cutting edge—clearance and rake.



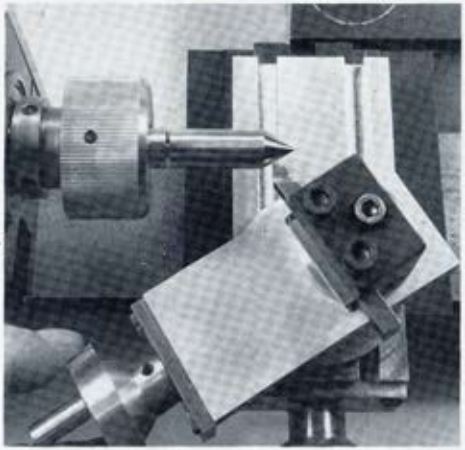


Both are angles expressed in degrees. Clearance is the angle at which the bit is ground for relief **under** its cutting edge. This relief, which generally should be about 8°, allows the sharp edge to advance into the workpiece without rubbing. A lathe bit's cutting edge must have both side clearance and end clearance.

Rake is the angle of slope across the top of the tool. The rake may slope either sideways away from the edge or backwards away from the edge. Side rake gives the cutting tool shearing action. Back rake directs chips away from the work.

In general, tools with smaller rake angles (with squarer, beefier cutting edges) are used to machine harder-to-cut metals, and tools with larger rake angles (giving more acute cutting edges) are used to machine easier-to-cut metals. For turning cast iron, tools with 10° rake give best results. For tools to turn mild steel, a 19° rake angle is most efficient. Tools for turning soft aluminum should be ground with 35° rake.

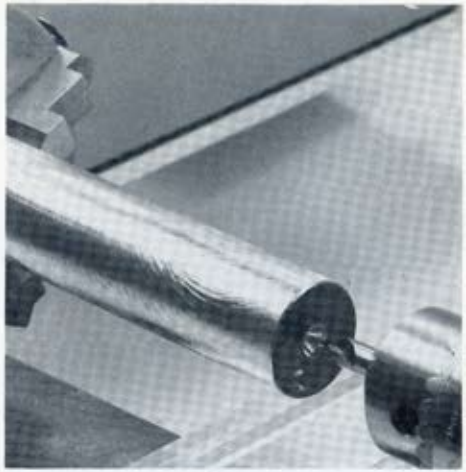
Brass-turning tools are an exception. Because a cutting edge with rake tends to dig into brass and chatter, tools for cutting brass are always ground with standard clearance but with zero rake—perfectly square across the top. Machinists usually keep a separate set of tools for brass-turning.



ACCESSORY GRADUATED COMPOUND *makes angular cuts. Above: making a 60° center for use in a ½" collet.*

OTHER LATHE OPERATIONS

Use the accessory graduated compound, which mounts on the machine's carriage worktable and can be set at any angle, to turn tapers, chamfer, or make other angular cuts. Graduations are in 15°.



FEED THE DRILL BIT INTO THE WORKPIECE *using the tailstock handwheel.*

Horizontal Drilling In The Lathe

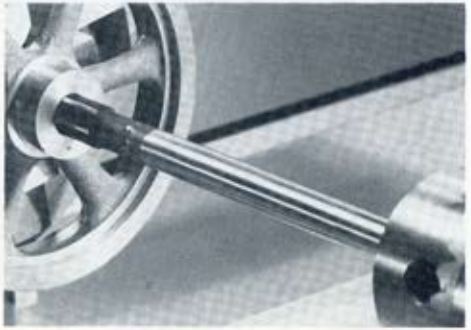
A metal lathe is an excellent horizontal drill press, and drilling is one of the more commonly performed lathe operations. Twist drills are usually held in an arbor chuck inserted in the tailstock's internal taper. To start a drill cutting without wobble, either first centerdrill the work (see page 14) or turn a small starting dimple with a sharp-pointed lathe tool. The feel of the drill as it cuts will indicate the proper rate of feed. Use cutting oil liberally when drilling steel, withdrawing the drill from the hole as often as necessary to prevent chips from packing in the flutes.

Except when drilling with very small-diameter drills, use slow spindle speeds for drilling in the lathe. Each lip of a twist drill cuts exactly like a lathe bit, and forcing the lips to bite into hard metal takes considerable power. First drilling a pilot hole simplifies drilling large holes.

Reaming Drilled Holes

A twist drill drills a hole a few thousandths larger than the drill's nominal diameter. When the hole's size must be exact, the hole should be drilled slightly undersize and then reamed to finish size with a reamer. The reamer can either be chucked in the tailstock, or it can be supported by the tailstock center and fed into the hole as you revolve the work by hand. Never back a reamer in the hole, for this would nick its teeth. Flood the hole with cutting oil when reaming steel.

CHUCKING REAMERS *can be used either in the lathe or in the drill press to finish small holes to size. First drill the hole slightly undersize, then ream it with slow, even feed.*



BORING IN THE LATHE *is the easiest way to finish large holes accurately to size. Mount the boring tool at center height with no more overhang than necessary to complete the hole.*

Boring In The Lathe

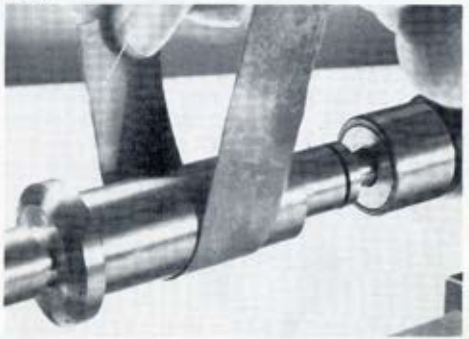
Boring in the lathe—simply internal turning with a boring bar—is the easiest way to finish large-diameter holes accurately to size. The boring tool is run through the hole with the leadscrew handwheel. When making a boring setup make sure that the boring tool's cutting edge has sufficient clearance to prevent the heel under the edge from rubbing in the hole. Since all boring tools spring somewhat, use lighter cuts for boring than you would for turning. Always make final finishing cuts continuous.

Filing And Polishing

Turned work often requires one or more finishing operations. To remove burrs or sharp edges, you can file the work as it revolves in the machine. When filing use the slowest spindle speed, and file with slow, firm strokes.

Turned parts can be polished with strips of abrasive paper or cloth to as high a finish as desired. Use extra-fine wet-or-dry silicon carbide paper for an attractive soft polish on brass or aluminum. To polish steel, use strips of fine-grit aluminum oxide cloth, oiling a worn strip for final mirror-polishing.

YOU CAN POLISH *turned work to a high finish with strips of fine-grit aluminum oxide cloth.*



Milling And Grinding In The Lathe

A number of useful milling and grinding operations can be performed by mounting a milling cutter or small grinding wheel on the lathe spindle and fixing the workpiece on the T-slotted carriage worktable or in the accessory machine vise. A cup grinding wheel will put a beautifully ground finish on the edges of steel parts, for example.

Mounting a small hand grinder on the worktable in an improvised holding fixture will make it possible to perform cylindrical grinding operations on small parts.

VERTICAL OPERATIONS WITH MACHINEX 5″

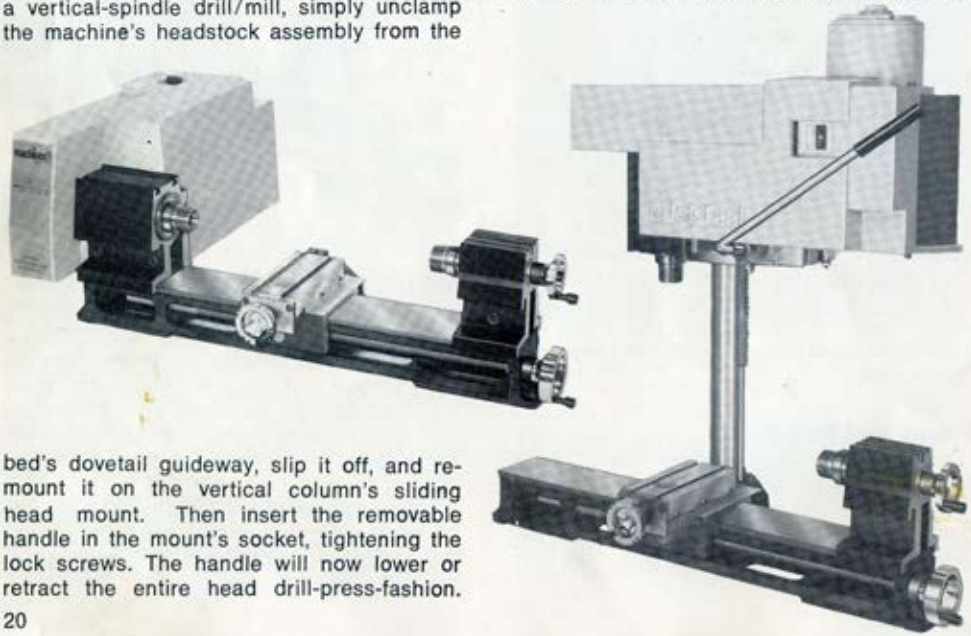
CONVERTING THE MACHINE TO A DRILL/MILL

Although in one way or another it's possible to accomplish nearly any metal-machining job on a lathe, some operations — particularly drilling, milling and surface grinding — usually can be performed more conveniently on a machine that has a vertical spindle, such as **Machinex 5**.

To convert the **Machinex 5** from a lathe to a vertical-spindle drill/mill, simply unclamp the machine's headstock assembly from the bed's dovetail guideway, slip it off, and remount it on the vertical column's sliding head mount. Then insert the removable handle in the mount's socket, tightening the lock screws. The handle will now lower or retract the entire head drill-press-fashion. Lifting the handle all the way up disengages the feed mechanism from the column's rack, which allows the head to be lifted or lowered by hand to any height along the column.

The handle is designed to reposition in the column mount every 30°—a feature especially useful when drilling deep holes.

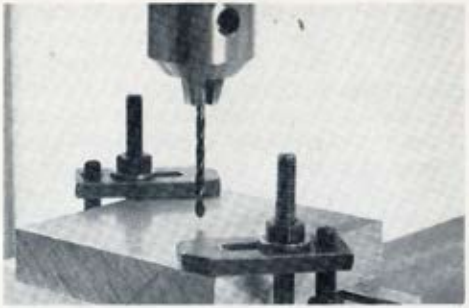
When mounting the headstock on the vertical mount, or back onto the machine bed, tighten both clamping screws to approximately 100 to 125 inch-pounds so that the head is repositioned completely square to the bed or mount. (An inexpensive torque wrench is recommended for this procedure.)



WORK TO BE DRILLED *in the drill press can be mounted on the worktable in the machine vise.*

DRILLING OPERATIONS

Straight-shank twist drills can be held either in a drill chuck, or for more precise concentricity, in collets. Although inexpensive plain carbon steel drills are adequate for drilling wood, plastic or soft metal, high-speed steel drills, which hold their hardness even at near-red heat, are needed for drilling steel or cast iron. You can buy drills singly or in sets, in fractional-inch sizes, numbered wire-gauge sizes, letter sizes, or metric sizes. Sets usually are packaged in cases with sized holes that simplify keeping the drills in order. Drills commonly sold in hardware stores are termed "jobber's length". "Short sets", which are screw machine drills with shorter shanks and flutes, are available from industrial supply firms. Their shorter length gives the machine greater capacity, and because they're more rigid at the tip these shorter drills are preferable for use in the **Machinex 5.**



LARGER WORKPIECES CAN BE SECURED *on the T-slotted worktable with T-bolts and strap clamps.*

MOUNTING WORK FOR DRILLING

Any work to be drilled should always be securely fixed on the machine's cross slide worktable, both for safety's sake and to avoid drill breakage. Work that is not adequately secured may rotate and be a safety hazard. Small work can be held conveniently in the accessory machine vise. Position the work in the vise in such a way that when the drill breaks through the work it will clear the vise body. A piece of hardwood plywood fixed on the worktable with screws and T-nuts makes a handy auxiliary table for drilling woodwork.

BORING HOLE IN PLATE WITH FLY CUTTER.

SELECTING DRILLING SPEEDS

Twist drills can cut soft materials faster than hard materials. The most efficient drilling speed for each material drilled has been established by long experience, and this speed, termed "surface speed", is expressed in surface feet per minute, or sfm.

Average surface speeds for drilling common metals with high-speed drills are:

Alloy steel or cast iron	60-80sfm
Mild steel	100sfm
Brass or bronze	200sfm
Aluminum	300sfm

For anyone who likes math, the formula that relates surface speed to spindle rpms is:

$$\text{Rpms} = \frac{3.8 \times \text{desired sfm}}{\text{drill diameter in inches}}$$

Rounding off the 3.8 to 4 simplifies calculating the approximate spindle speed needed to give the required surface speed. To find the rpms needed to drill mild steel at 100sfm with an ⅛" drill, for example, you'd figure:

$$\text{Rpms} = \frac{4 \times 100\text{sfm}}{⅛"} \text{ or } \frac{400}{.125}$$

or 3200 rpms. A machinist soon learns to solve this equation in his head without bothersome calculation. He'd simply reason (in the example given) that if 400 is ⅛th of the speed needed, then total rpms would be 8 times that, or 3200.

Locating Holes Accurately For Drilling

When a hole must be located with exacting precision, lay out and accurately centerpunch its center point before mounting the work in the machine. Then fix the workpiece on the cross-slide and accurately align the punchmark with the axis of the spindle. Enlarging the punchmark with a centerdrill before drilling the hole insures that the drill will start without wobble.

Aids To Effective Drilling

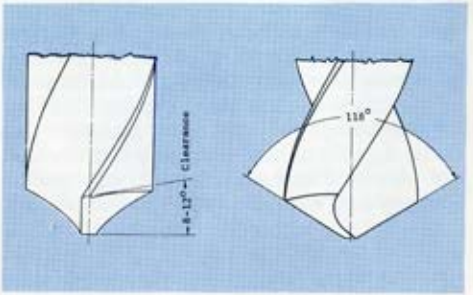
Use cutting oil liberally when drilling steel. The cutting oil functions both as coolant and as lubricant. Light machine oil is the most satisfactory lubricant for drilling mild steel. Use turpentine or kerosene to drill tough alloy steel. Brass and aluminum ordinarily are drilled dry. Cast iron always should be drilled dry, since fine chips of cast iron are abrasive and when mixed with oil form a compound that laps the drill dull.

Feed the drill with enough pressure to keep it cutting, but avoid excessive feed, for "forcing" the drill will chip its cutting edges. A sharp, correctly-ground drill drilling mild steel at correct spindle speed and proper feed rate will produce two identically curled spiral chips.

USE CUTTING OIL *and work at slow spindle speed when countersinking or counterboring steel.*

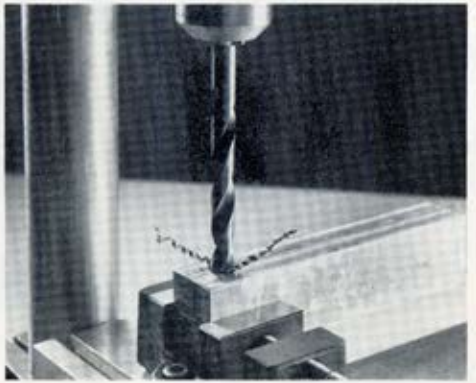
DRILLING DEEP HOLES

Drilling holes deeper than five times their diameter presents special problems. When a drill cuts a shallow hole, its spiral flutes lift chips clear. But when the hole is deep the chips pack in the drill's flutes, and this makes it necessary to withdraw the drill from the hole periodically to clear the cutting edges. Most other deep-drilling problems are caused by lack of clearance. A twist drill's flute margins are ground to a very slight taper (the flutes are about a thousandth larger in diameter near the tip than near the shank) to give the drill clearance in the hole. As the drill



wears, its flute margins wear more at the tip than at the shank, and clearance is soon reduced to zero. A drill with worn margins still performs perfectly well for drilling shallow holes, but when a worn drill is used for deep-hole drilling it will wedge in the hole, overheat and break. Always use a new drill to drill a deep hole.

DRILLING ALUMINUM.



DRILLING SMALL HOLES

Drilling very tiny holes, termed "sensitive drilling", involves the same problems encountered in deep-hole drilling. In machine shops #60 drills (.040" in diameter) are the smallest commonly used. But in these days of miniaturization instrument repairmen often have occasion to drill holes much smaller. Extremely small drills are long in relation to their diameter, and the small holes drilled with them are proportionately very deep. Unless tiny drills are used with very sensitive touch, breakage is certain.

When drilling a tiny hole centerpunch the work very lightly to avoid work-hardening the metal, and be sure the work is rigidly mounted. As you start the drill in the work, watch its tip with a jeweler's loupe to make sure it begins cutting concentrically. Drill with very light feed, letting the drill cut its own way. Withdraw it frequently to clear chips and flush the hole with a syringe filled with light-viscosity lubricant, either kerosene or mineral oil. High spindle speeds can be used when drilling tiny holes in soft metals, but use moderate speeds when drilling steel, since excessive speed may dull the corners of the drill's cutting edges and tiny drills are very hard to resharpen.

COUNTERSINKING AND TAPPING

Countersinking or counterboring holes for screwheads involves no problems provided you work with light cuts to avoid chatter.

When a hole you've drilled and countersunk requires tapping, start the tap in the hole before removing the work from the machine. With the tap chucked, turn it in by hand while applying moderate pressure on the feed handle. **Don't attempt to run taps in under power.**

WHEN DRILLED WORK MUST BE TAPPED, *start the tap before removing the work from the machine.*

MILLING SETUPS

With the **Machinex 5** set up as a vertical milling machine, you can readily mill slotted or recessed parts that would be difficult to machine in any other way.

COMMON TYPES OF MILLING CUTTERS

Many kinds of cutters can be used for vertical milling, but three types are most common: slotting cutters, spiral end mills, and rotary files. SLOTTING CUTTERS have two flutes. They can be sunk into work like drills and then fed laterally to mill slots or recesses. SPIRAL END MILLS, which have

MANY TYPES OF CUTTERS *can be used for vertical-spindle machining. Some are shown above. Use milling cutters with care to keep them sharp.*

multiple spiral flutes with multiple cutting edges, are designed to make shallow cuts sideways, with the cutter's radial end teeth scraping the work to a very smooth finish. ROTARY FILES, which have cut rather than ground teeth, are less expensive than ground cutters and are available in a wider variety of shapes. WOODRUFF KEY-SEAT CUTTERS and other special cutters are available for special jobs. Since the **Machinex 5**'s spindle rotates clockwise (viewed from above), always use right-hand cutters for milling.

Milling cutters must be used with care to keep them sharp. Their cutting edges are hard and brittle, and to avoid chipping their teeth it's necessary to feed the cutter into the work slowly and evenly.

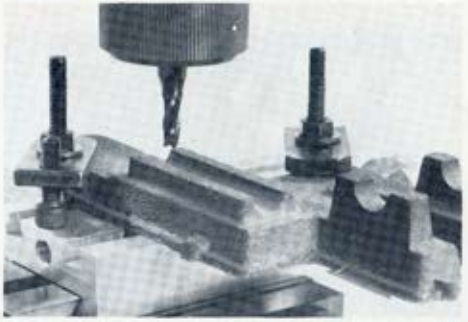
USE TWO-FLUTE CUTTERS *like woodworking router bits but at slower speed.*

MOUNTING WORK FOR MILLING

Mount the work to be milled on the carriage worktable as rigidly as possible. The workpiece may rotate if not adequately secured and present a safety hazard. Also, any "give" in the work might break the cutter.

The machine's carriage movements should be set up quite tightly for milling, with the longitudinal feed used whenever possible to feed the work to the cutter. It's important

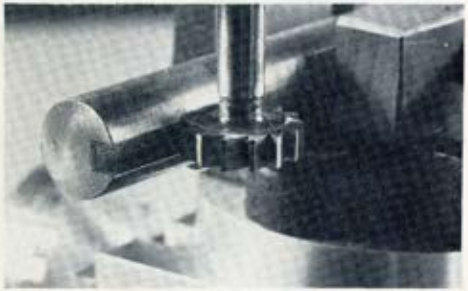
ALWAYS MOUNT THE WORKPIECE TO BE MILLED *on the machine's worktable as rigidly as possible.*

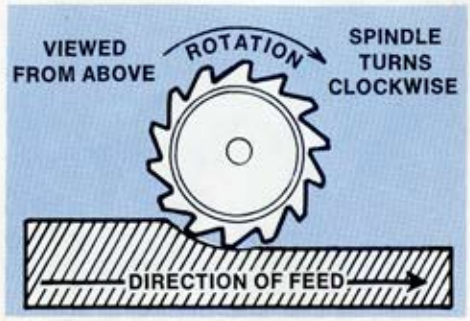


WITH BALL END MILLS *you can mill filleted recesses, rounded grooves or small die cavities*

when making milling setups to orient the work for "up" milling. The cutter's teeth should always sweep forwards along the line of cut, opposing the direction of feed, and then upwards and out of the work. Never mill with the cutter's teeth sweeping downwards and back, for the teeth would then tend to pull the work under the cutter, and this would cause the cutter to climb and break.

WHEN MILLING A KEYWAY, *orient the cutter for "up" milling and make the cut with even feed.*





Milling at moderate spindle speeds greatly prolongs the useful lives of cutters. Flood the mill with cutting oil when milling steel. Large-diameter end mills used to mill flat surfaces should be run at the machine's slowest spindle speed.

USING COLLETS

Very tiny end mills give best service when held in collets, since a collet grips the cutter accurately concentric with the spindle axis. Use very gradual feed when milling with small mills. If you use a jeweler's loupe to mill to scribed lines, it's possible with practice and patience to make unbelievably intricate cuts with small end mills.

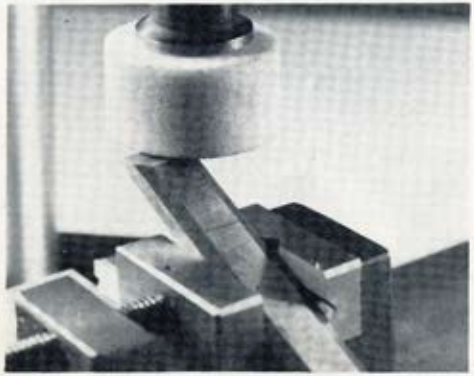
USE COLLETS *to chuck end mills more accurately.*

SURFACE GRINDING SETUPS

With a grinding wheel mounted on the spindle the **Machinex 5** will do a beautiful job of grinding small steel parts, either hardened or unhardened.

Most surface-grinding jobs can be performed most satisfactorily with a cup wheel. The wheel should turn at fairly high speed, around 5000sfm. Since any grinding wheel throws swarf, remember to wear protective glasses when grinding.

YOU CAN MACHINE-GRIND CHISELS *with a small cup grinding wheel mounted on a turned arbor.*



Always grind with successive light passes, removing no more than a few thousandths of metal at each pass. When surface-grinding large areas, take **extremely** light cuts to avoid overloading the machine's motor. Take care not to overheat the workpiece when grinding a small heat-treated part. If the grinding wheel leaves a mottled finish on the work, it's an indication that the wheel needs dressing, which is accomplished by feeding the wheel across the point of a diamond dressing tool. Dress the wheel very lightly — just enough to remove embedded particles of metal and to expose fresh abrasive grains.

ACCESSORIES

The **Machinex 5** is sold as a basic machine without accessories. This allows the purchaser to consider thoughtfully which accessories he will need, to acquire the accessories one by one over a period of time, and to collect exactly the equipment he needs for the particular work he wants to do. Many accessories for the **Machinex 5** can be made on the machine itself if the purchaser wants to.

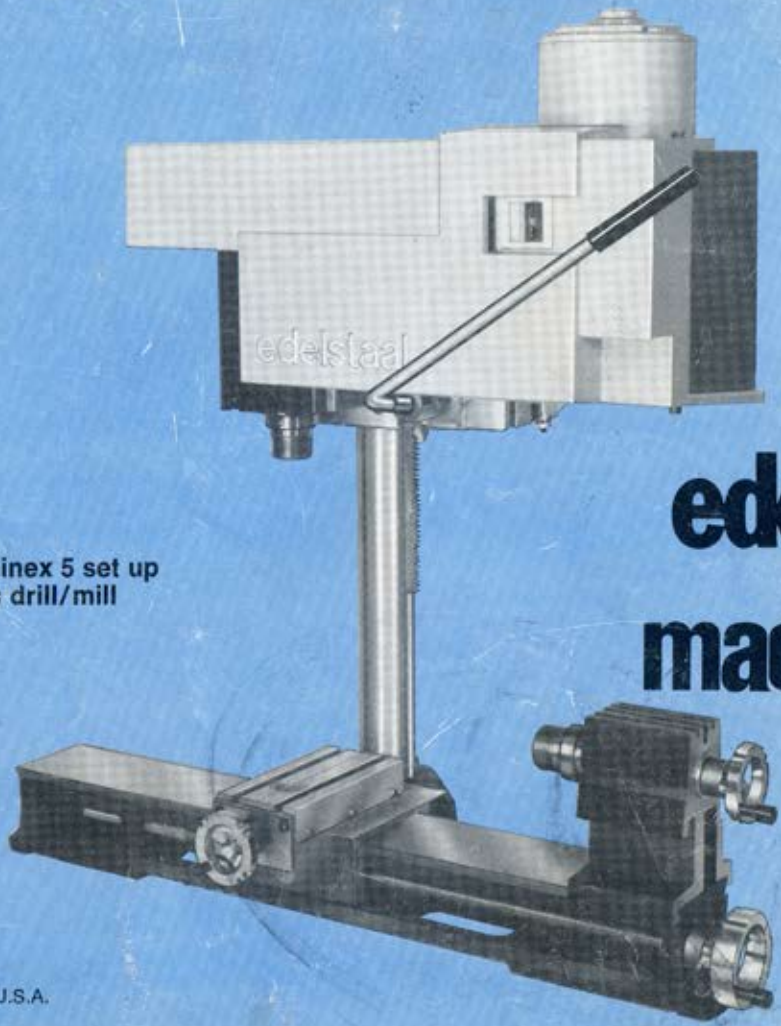
Basic accessories — lathe tools, spindle chucks, collets, live tailstock center, machine vise, carriage top slide, faceplate and lathe dog — are available at this time. A complete drilling/milling headstock assembly (a second identical headstock that makes it unnecessary to remove and remount the lathe headstock for vertical-spindle operations) is also available. Other accessories are in preparation and will be offered shortly.

For a catalog showing the **Machinex 5** accessories currently available, write American Edelstaal, Inc., 1 Atwood Avenue, Tenafly, New Jersey 07670.

A MACHINEX 5 OWNER *can make many accessories for the machine himself. Example: a tool rest for woodturning chisels cut from angle steel and mounted on the worktable with T-bolts.*

In accordance with our policy of continuing product improvement, minor changes have been made in the design of the **Machinex 5** since the machine was first introduced, and other changes may be made in the future. The aim of this improvement program is to give the purchaser the finest machine possible at the lowest possible price. Because **Machinex 5** specifications are subject to change without notice, your new machine may not be identical in every respect with the machines pictured in this booklet.

DISTRIBUTOR



machinex 5 set up
as drill/mill

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Printed in U.S.A.

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