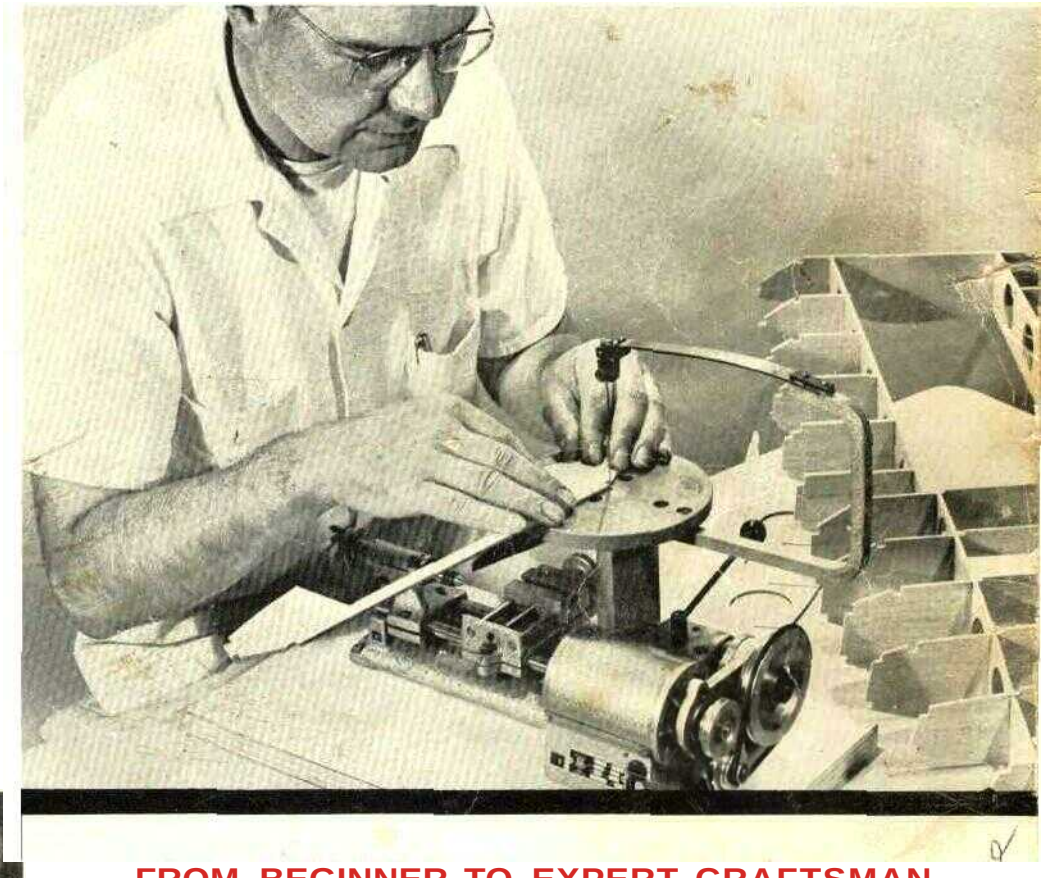
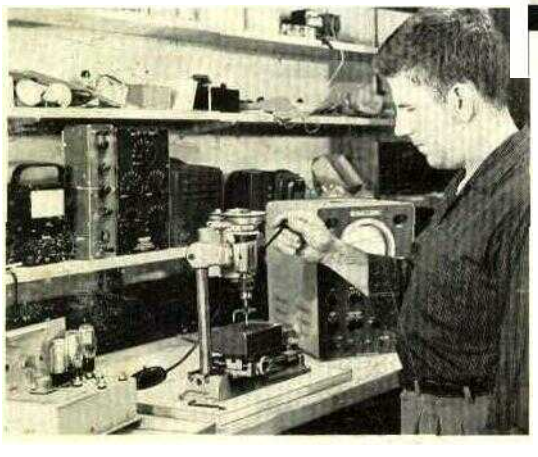
$1.00

MINIATURE MACHINING TECHNIQUES

ageneralhandbookandoperator'smanual



Torn Perzentka of Octura Models. Chicago. uses Jig Saw to cut bulkheads and curved stringers for the prototype of his famous gas powered model R/C hydro plane "White Heat V". The Jig Saw produces a smooth cut in small intricate sections of plywood and hardwood. Parts for motor and steering assembly were turned out on Unimat Lathe.



Well known author, Brice Ward, who designs electronic projects far national magazines, uses a Unimat to machine printed circuit boards, drill chassis holes, and wind special coils. This multifunctional machine takes up less space lhan the average oscilloscope, yet provides tool roam versatility.

FROM BEGINNER TO EXPERT CRAFTSMAN in METAL • PLASTICS • WOOD

metal turning • drilling • milling • grinding • polishing • sharpening • sawing • surface grinding • threading • boring • wood turning • special techniques • jigs and attachments

AMERICAN-EDELSTAAL, INC.
360 Broadway. New York 13, N. V.

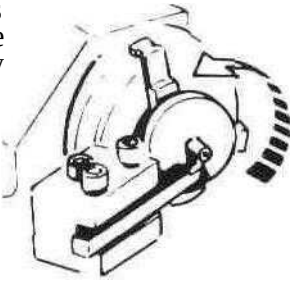
UNIMAT VERSATILITY

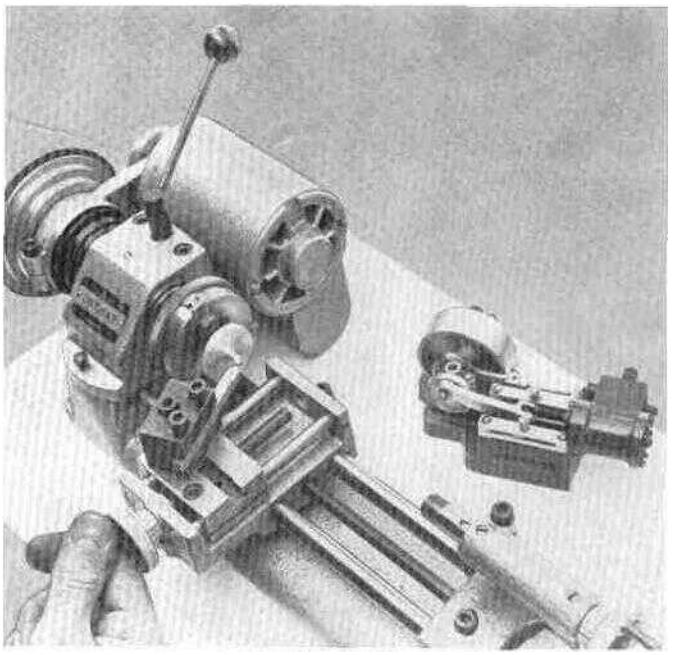
Typical projects show how Unimat performs any one of ten basic machine tool operations. Wherever creative designers, engineers, scientists and hobbyists work with small precise parts, Unimat is in constant use.

1 TURNING

an aluminum wheel casting for a model steam engine

Set up as a metal lathe Unimat turns discs, wheels, and cylindrical shapes up to 3-inch diameter. Headstock Raising Block (DB 1310) increases swing capacity to 4 1/2-inch diameter. Parts can be machined to accuracies of one-half thousandth of an inch with just a little practice. Lathe tools are available singly or in sets. The precision 3-jaw chuck is Accessory Part #1001.

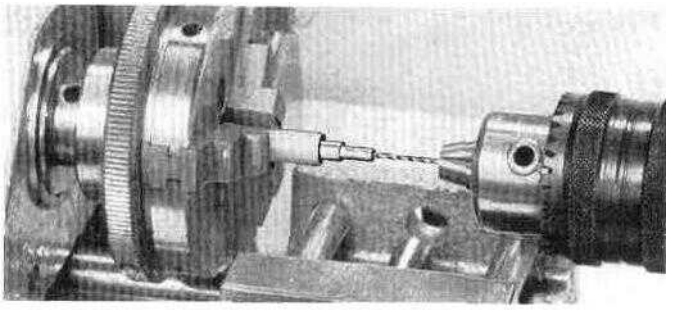


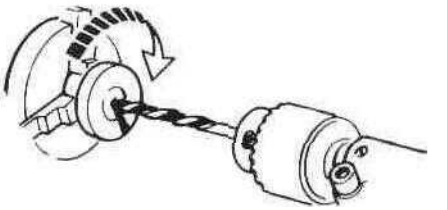


2 DRILLING

drilling a tiny hole in a brass spray nozzle fitting; drill size #70, diameter only .028 inch!

Try this job in an ordinary lathe or drill press and you'll probably break the drill. Precision ball bearing spindle gives you a true hole every time. The drill is shown chucked in the precise Jacobs-type 1/4-inch drill chuck that is part of every DB 200 Unimat. Vertical drilling is also a basic function of Unimat.

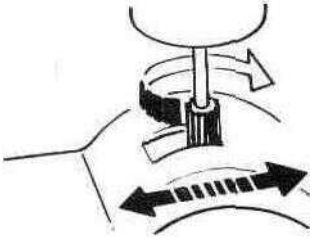


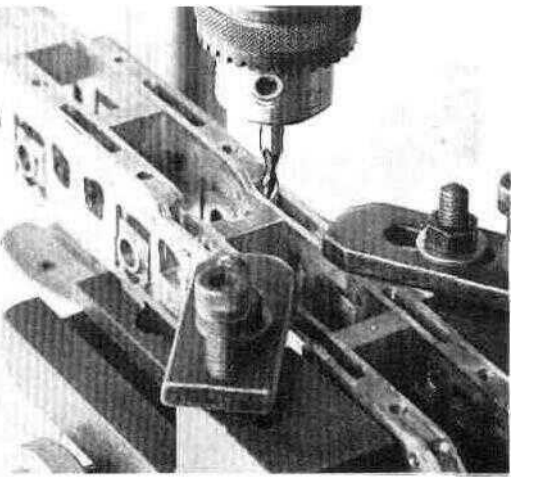


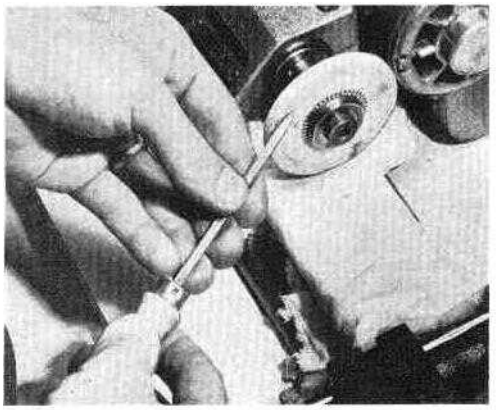
3 MILLING

milling slots in a live-steam model locomotive frame

This setup shows how you can clamp irregularly shaped parts on the Unimat accessory Milling Table (DB 1210). Because the detachable headstock can be set at any angle on the column, you can handle workpieces longer than the Unimat itself. Precise drilling and tapping operations are easy to run on the same setup.

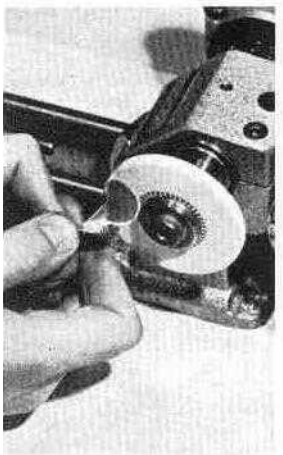


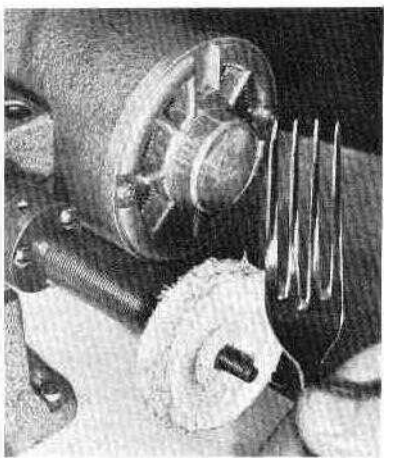


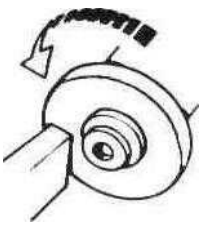


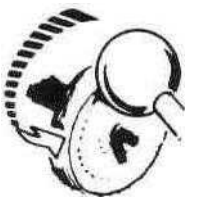
4 SHARPENING HAND GRINDING POLISHING

touching up the edge of a wood veining tool; grinding a model boat prop to shape; buffing silverware

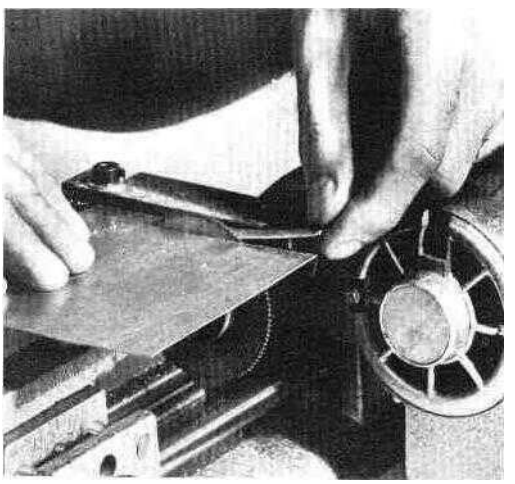






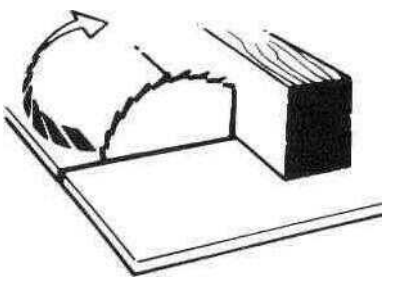


The eleven-step Unimat power drive gives you just the right cutting speed for proper abrasive and polishing action. Try some of these jobs on larger grinders and you may burn a small part. The Grinding Wheel Arbor can be used with the headstock in lathe position provided you protect the bed with cloth. Or, you can rotate the head 90° for handling large pieces easier.

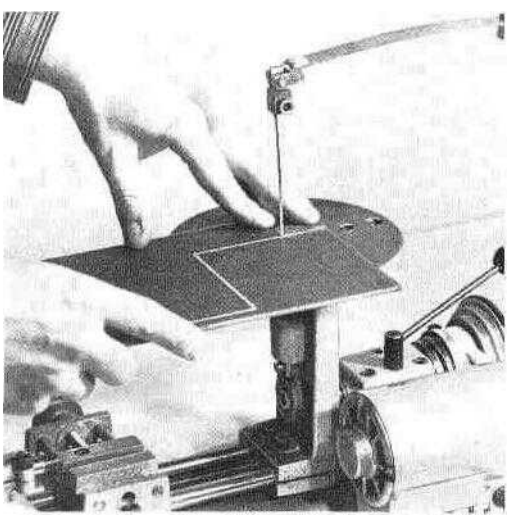


5 SAWING

a camera shop job ... sawing replacement slides for sheet film holders

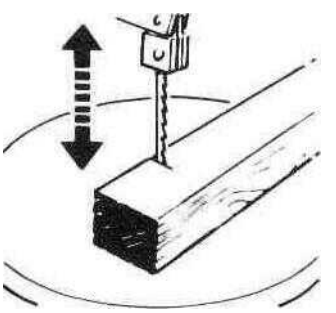


Try to cut thin brittle bakelite on an ordinary table saw, and blade wobble will give you a rough edge and spoiled work. Unimat spindle bearing precision guarantees true blade action. You can select cutting RPM for best results. The saw table attachment takes only seconds to set up.



6 JIG SAWING

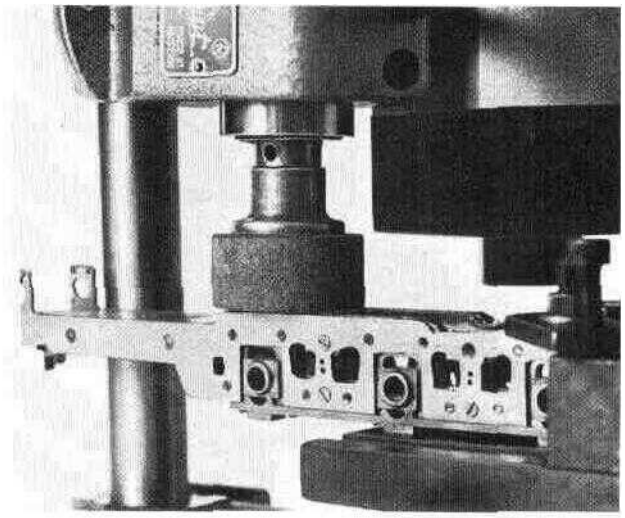
cutting quarter inch masonite for a tool shelf



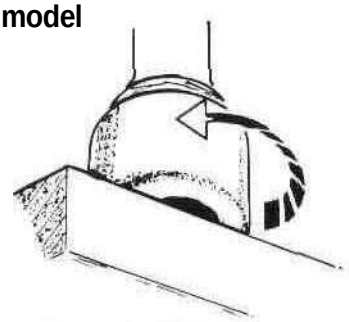
The Jig Saw Attachment has a throat that permits you to saw to the center of a 16-inch circle. For larger work you remove the overhead arm and use a saber blade. Files and abrasive strips also work well on this attachment. With the Unimat eleven speed power drive, you can select the best combination of blade and cutting speed for any material from soft balsa wood to hard materials.

UNIMAT VERSATILITY

7 SURFACE GRINDING

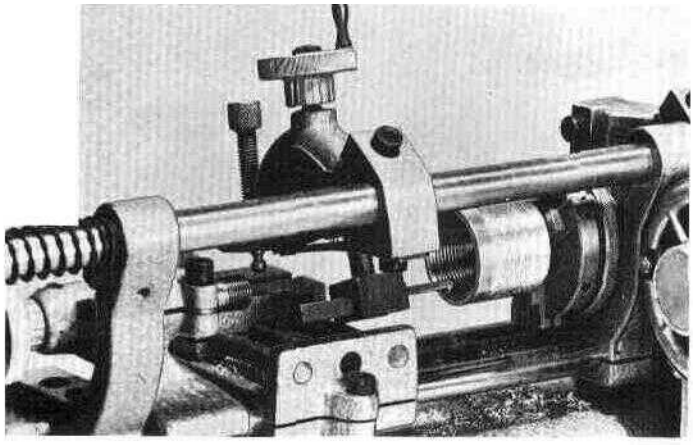


a precise flat on the surface of a model locomotive frame

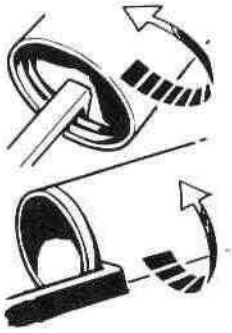


A familiar operation to machinists who make gages and instruments is surface grinding. With Unimat, you can get tool room precision right on the kitchen table with very little fuss. The locomotive part also shown under Milling nears completion with perfectly flat mating surfaces.

8 THREADING

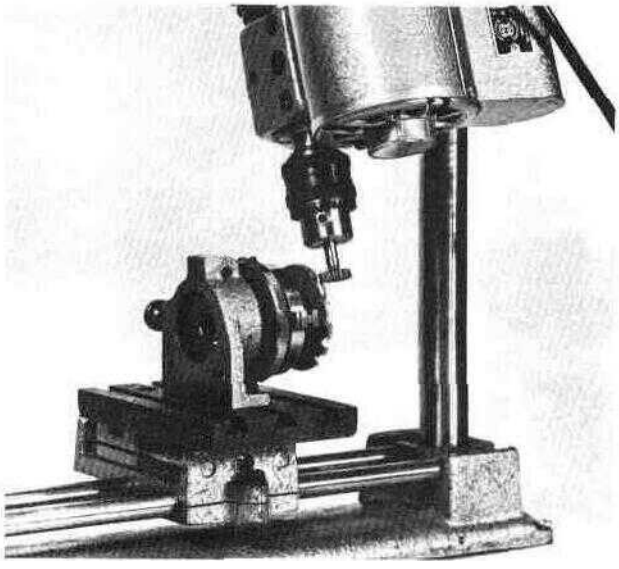


cutting internal and external threads on a 1 1/2 inch aluminum lens barrel

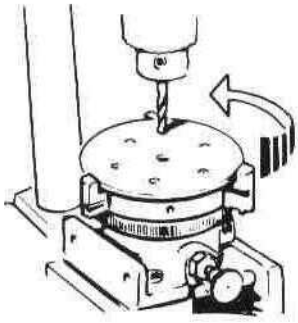


The Unimat with Threading Attachment (DB 1270) is far more accurate than ordinary lathes that use back gears and lead screws to move the thread cutting bit. A master pattern mounts solidly on the spindle behind the chuck and a chaser duplicates the exact thread pattern on the workpiece. Patterns are available from 16 to 56 threads-per-inch . and in a complete set of metric sizes.

9 INDEXING

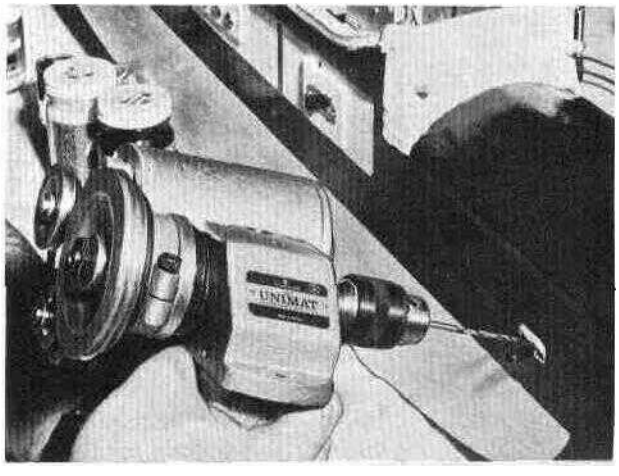


making a gear for a boat steering mechanism

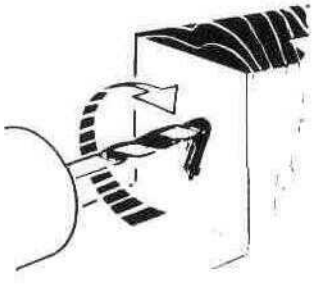


The Indexing and Dividing Attachment divides a circle into 18 integral numbers from 2 to 48 enabling you to cut gears, machine bolt heads, pyramid shapes, truncated cones and practically any polygonal shape. Because Unimat adjusts vertically, horizontally, laterally with a head that swivels in any direction, there is no limit to the shapes you can create in solid metal or any machineable material. Among the most interesting projects possible with this setup are mathematical models, and three dimensional models of molecules and crystalline structures.

10 HAND DRILL



a 3/16-inch hole through wood and metal on a model plane fuselage



Whenever it's necessary to take the tool to the job, just loosen one nut, slip the headstock off the drill press column and you've got an 11-speed tool with the sensitive feel of a dental drill right in your hand. And yet it will push a 1/4-inch drill through steel. You can also use the portable hand drill with buffs, grinding wheels, abrasive wheels, and sanding discs.

HERE IS YOUR BASIC UNIMAT

Before you start to use your Unimat be sure to read the following instructions carefully.

The basic Unimat Model DB 200 is shipped in a wood storage chest, which in turn is protected by a cardboard shipping box. As you open the storage chest check each item on the packing list.

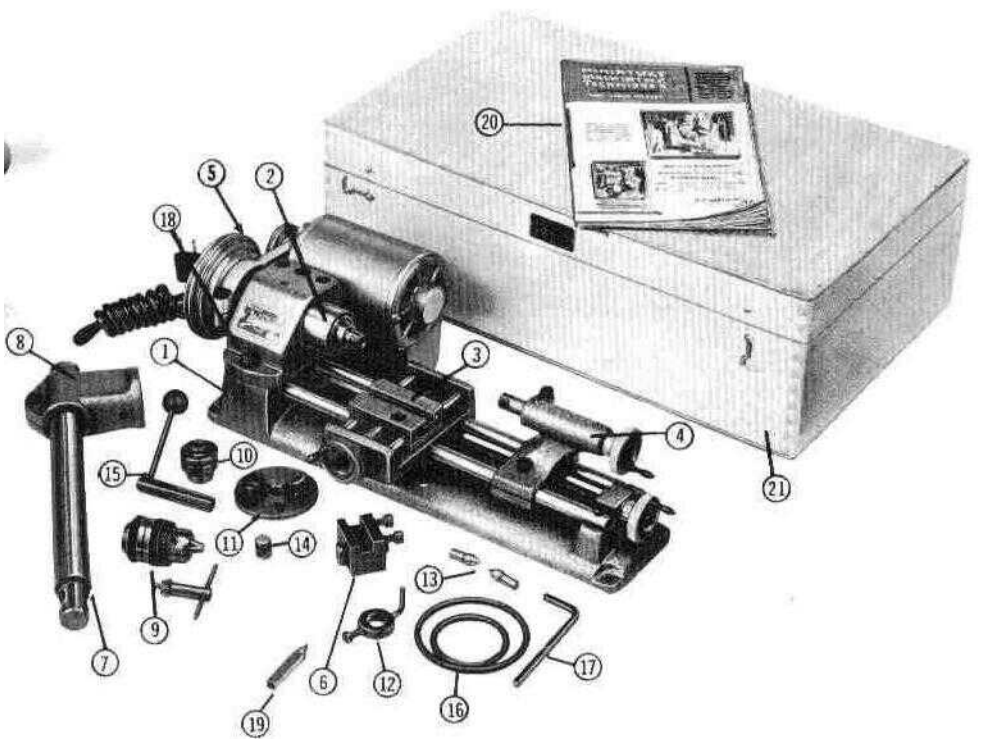
DB 200 parts are identified by means of the photos on this page. On pages 37 and 38 you will find a complete parts list for the basic Unimat and all accessories.

A guarantee registration card is included with each Unimat. Be sure to mail the card immediately. The card not only registers you as a Unimat owner, but automatically puts your name on a mailing list to receive a free one year subscription to the Unimat Owners Magazine as well as supplementary literature.

Your Unimat has been carefully inspected at the factory. If a part has been damaged in shipment or becomes defective during the warranty period, write to the Customer Service Department, American Edelstaal Inc. describing exactly what, is wrong. Be sure to refer to parts by name and number.

If it is necessary to return a part to us you will receive a special shipping ticket and instructions. The repair department will not accept shipments unless authorized as above. In most cases minor adjustments fully described in this manual are the answer, Unimat is a precise, carefully engineered machine. Take care of it, keep it clean and well oiled and it will give you many years of service.

Model DB 200 Unimat Basic Unit



Complete with powerful 1/10 hp motor and the following components:

1. Ribbed, Lathe Bed
2. Ball Bearing Headstock Spindle
3. Carriage Assembly
4. Tailstock
5. Ball Bearing Idler Pulley
6. Tool Post
7. Steel Vertical Column
8. Vertical Column Headstock Adapter
9. Jacobs-type Drill Chuck & Key
10. Grinding Wheel Arbor
11. Face Plate
12. Lathe Dog
13. Dead Centers (two)
14. Slotted Adapter
15. Spindle-feed Hand Lever
16. Set of Drive Belts
17. Allen Wrench
18. Headstock Alignment Pin
19. Roughing Tool Bit
20. 40 Page Instruction Manual
21. Wood Storage Chest

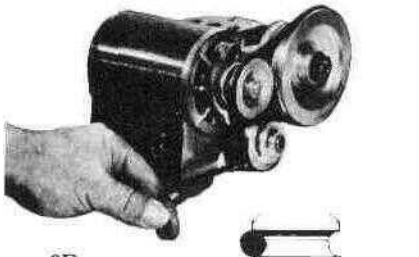
INTRODUCTION

INDEX

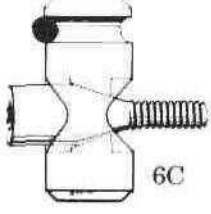
BASIC UNIMAT

SETTING UP YOUR LATHE

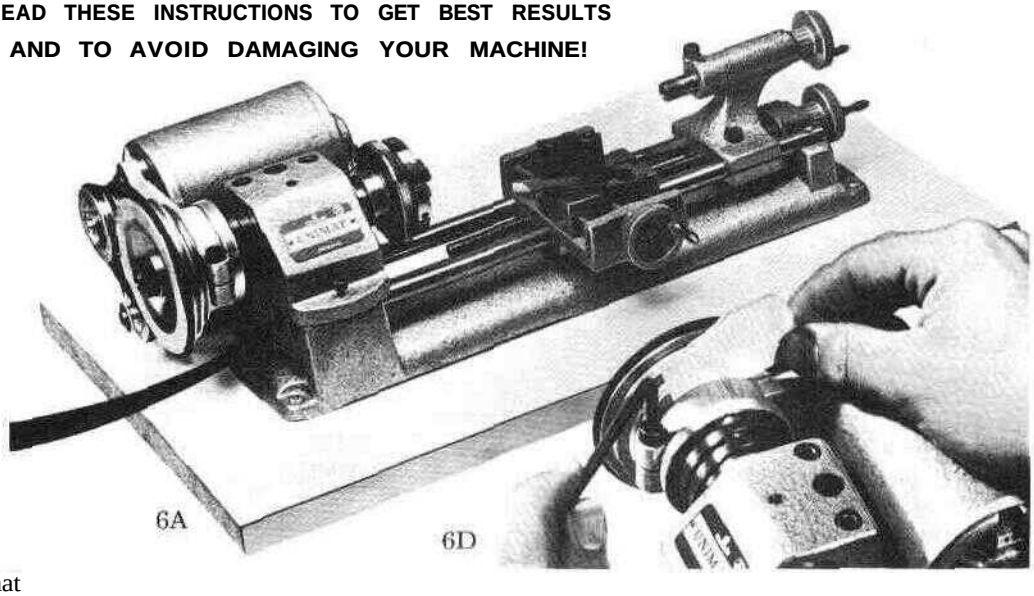
READ THESE INSTRUCTIONS TO GET BEST RESULTS AND TO AVOID DAMAGING YOUR MACHINE!



6B



6C



6A

6D

Working metal parts of the Unimat are protected in shipment with a coating of rust-resistant grease. Wipe off with a cloth dipped in kerosene or benzene. Then lightly oil the lathe bed, cross slide and all exposed metal surfaces to prevent rust. Number 10 motor oil or any light grade machine oil will do the job.

Though you can use the Unimat as is, you'll find it helpful to screw the bed down to a perfectly flat board. A piece of 11 x 18 inch plywood, 3/4 or 1 inch thick makes a good working base. The board shown in the photo was made of a piece of scrap Formica counter top, a material available at most lumber yards. The white color makes small parts easy to see and the grease resistant surface is easy to clean. A complete Unimat Workcenter (DB 1400) is available as listed on the back cover.

Before you plug in the motor, check the idler pulley. It should spin freely. Make sure the protective grease hasn't hardened around the ball bearings, and that the clamping screw is not too tight. This screw should be just snug enough to keep the assembly from slipping out. Put too much tension on this screw and it will distort the ball bearing race and prevent the pulley from turning properly.

The headstock pulley must clear the motor bracket. If the cap screw on the bracket loosens, the spindle spring will push the motor bracket up against the pulley causing the spindle to stall. Use a folded piece of cardpaper (about .015" thick) between the pulley and motor bracket to set the spacing and then lighten the cap screws.

Several types of motors are illustrated in this manual. The motor supplied with your Unimat is a high torque quiet operating 1/10th HP 110 volt 60 cycle motor. Motor designs are subject to improvement, and the motor delivered with your unit may have a slightly different appearance. If your motor heats after running continuously for 5 to 10 minutes, this does not mean it is defective. Your motor is fully enclosed to protect it from chips and dust and because a lot of power is packed in a small case, there is heat build-up, which has been provided for in the design.

Unimat spindle ball bearings are factory pre-lubricated and will need no additional attention for the first 300 hours of use. After this time, follow instructions on page 33 for disassembly of the spindle and lubrication.

LATHE

3 JAW CHUCK

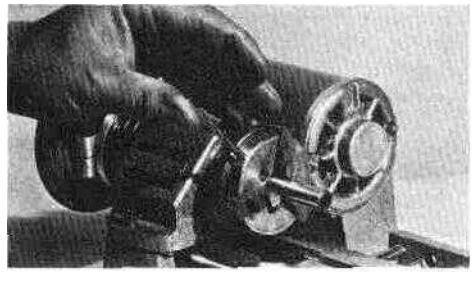
DB 1001 UNIVERSAL LATHE CHUCK CENTERS ROUND SHANK TOOLS AND WORKPIECES FROM .118" TO 2-1/64"

There are two lathe chucks available for your UNIMAT: #1001. 3-jaw Universal, and #1001a, 4-Jaw Independent chuck. *Both* accessory chucks must be 'trued' to the lathe spindle to make them run dead accurate. Before using, *machine chuck backplate* as described on page 18 under "Truing Instructions".

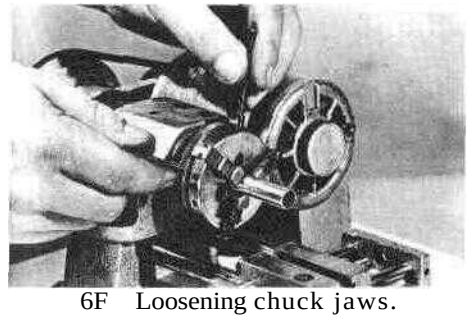
Carefully unwrap and clean the chuck. It is protected in shipment with a preservative which must be removed with solvent — kerosene, gasolene, or lighter fluid will do. Loosen the jaws by rotating the outside knurled ring counterclockwise looking at the face of the chuck.

As each jaw disengages from the scroll, it can be removed. The first jaw to release will be #3, next #2, and then #1.

Clean jaws and threads. Then oil with a light film of #10 motor oil or equivalent. To reassemble the chuck jaws in normal position, rotate the ring until the scroll 'ring' appears at a point just before slot # 1. Engage jaw # 1 by pressing inward gently. Continue turning the ring until it is next to slot #2. Install jaw #2, and then repeat for jaw #3



6E Tightening chuck jaws.



6F Loosening chuck jaws.

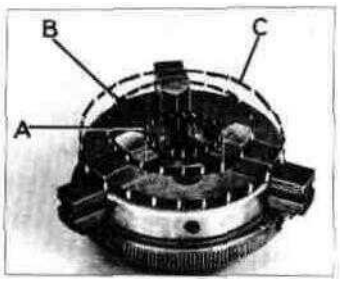
When chucks are new they require a light inward pressure to insure that they properly engage the scroll.

In normal position, the chuck jaws will take round work up to 15/16" on the inside. Or using the backs of the jaws on tubing, etc., you can handle up to a 2-5/32" diameter. By reversing the jaws, larger work can be machined up to 2-15/64" diameter. To reverse jaws, remove as explained before, but reverse each jaw and replace in the chuck in this order: jaw #3 in slot #1; jaw #2 in slot #2; and jaw #1 in slot #3.

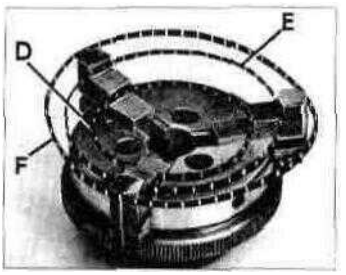
LATHE cont'd

The 3-jaw chuck fits both the headstock and the Unimat tailstock, after the lathe centers have been pulled out of the spindles. The chuck also fits the slotted screw for mounting on the cross slide. It can thus be used to hold round stock for drilling as shown in photo 13B and 13C.

Use a small piece of tubing to practice handling the chuck as in photos 6E and 6F. To tighten the jaws on the work, press bars together. To loosen the jaws grip the bars exerting gentle pressure until the workpiece is free.



JAWS **NORMAL**



JAWS REVERSED

DB 1001 3 JAW CHUCK CAPACITIES

	Setup	Decimal inches	Nearest Inch fraction	Millimeters
JAWS NORMAL	A.(Ext.)	.039-.945"	3/64-15/16"	1-24mm
	B.(Int.)	.709-1.535"	45/64-1-17/32"	18-39mm
	C.(Int.)	1.338-2.165"	1-21/64- 2-5/32"	34-55mm
JAWS REVERSED	D. (Ext.)	.945-1.653"	15/16-1-41/64"	24-42mm
	E, (Ext.)	1.575-2.244"	1-9/16-2-15/64"	40-57mm
	F,(Int.)'	2.20-3.0"'	2-13/64-3"'	56-76mm*

Note: Capacities are greater when Raising Block (DB 1310) is used, and when Chuck is mounted on cross slide or on vertical set-up.
' Indicates outside diameter of workpiece. Note that this is not intended for lathe machining, but may be useful in polishing O.D. of tubing, indexing, etc.
(Ext.) indicate* external gripping of O.D. (outside diameter) of workpiece.
(Int.) indicates internal gripping of I.D. (inside bore dia.) of workpiece

METAL TURNING TECHNIQUE

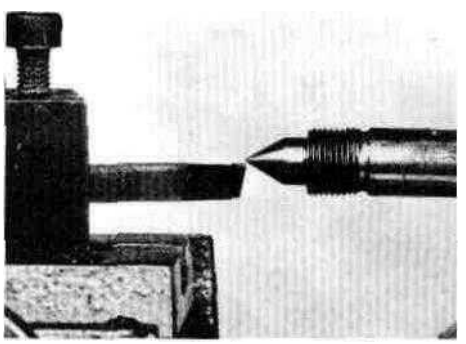
Before you start to do any serious precision work, it's best to get acquainted with the Unimat lathe by taking a few practice cuts on scrap aluminum. This metal is the best choice for practice because it's free-cutting, and won't dull your tools if you haven't. made just the right set-up. You can get a piece of $^{3}/_{4}$-inch round bar stock at most hobby or hardware stores, or if there is a screw machine shop in your neighborhood, you may be able to obtain scrap cutoffs for the asking.

Clamp the bar in a vise and use a hacksaw to cut off a piece about $1^{1}/_{2}$ inches long. Saw the end as straight as possible and then mount it (Photo 7A) in the 3-jaw chuck. If you have already tried converting your Unimat to other positions, insert the alignment pin in the headstock. This pin locates the headstock approximately on center. You may have to loosen the tapered clamping screw (Photo 7C) and move the headstock slightly until the pin seats in its hole.

Next mount the roughing tool bit in the tool post. One Allen wrench fits every locking screw on the Unimat. Put the center in the tailstock, and use it as a gauge to check the center height of the roughing tool cutting edge (Photo 7B).

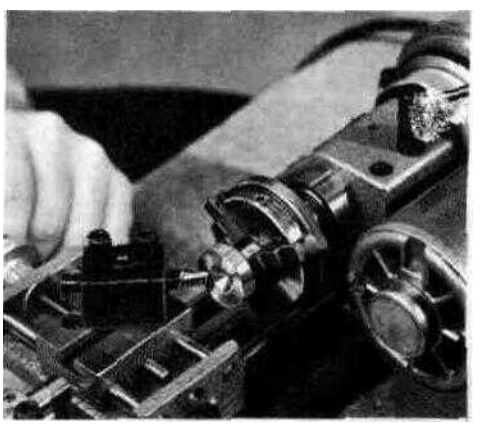
For perfect cutting, the sharp point of any lathe tool should be on dead center, or just a few thousandths beneath center. If a lathe tool is clamped above center, it will cut poorly or not at all because the edge will not contact the work properly. If the tool is too low, it will tend to dig in and cut unevenly. Use metal shims or cardboard to bring the tool up to the right working height

Now set the belts on position 11 (see speed chart on inside back cover. Feed the large belt from the outside (largest) pulley on the motor over to the large headstock pulley. This will give you a speed of about 1700 RP.M.



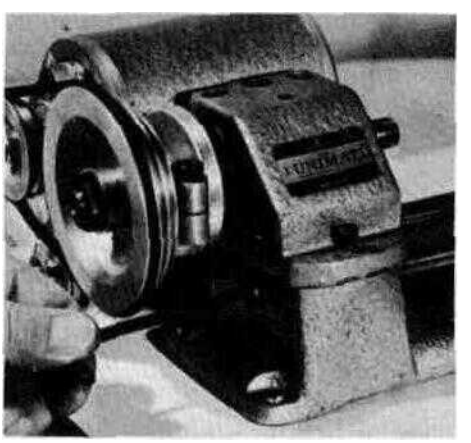
7B. Set tool bit height with tail center.

Tighten the headstock Allen screws on top, to lock the spindle in place. Revolve the spindle by hand to make sure it turns freely and that the belt is properly lined up. Then turn the feed screws to bring the tool over into position, and switch power on. ALWAYS FEED ANY METAL TOOL SLOWLY AS YOU APPROACH THE WORK. As the point of the tool bites in. it should cut a smooth even chip. If you feed too hard, you will notice that the. spindle may slow down while you are cutting. Practice making smooth even cuts. As you go in toward the center, you will be able to feed faster, since less metal is removed when the diameter decreases. Too much pressure may occasionally cause the spindle and the motor to stall. This will not damage the Unimat as long as you are working with soft metal and small work pieces, however the experienced machinist develops a feel for the material and the lathe and seldom jams the tool. If it happens, immediately switch off the power and back off the tool.



7A, Avoid overfeeding tool bit.

Now, you will want to try the other spindle speeds. The chart on the inside back cover shows you how the basic Unimat can be set up for any one of 11 different speeds. As long as you practise with soft metal, there will be little danger of damaging your roughing bit, but if you notice that the cuttings are smoking and that the tool is getting hot, your speed is too fast. The remedy is to use water, paraffin, or kerosene as a coolant.



7C. Allen wrench loosens headstock

BASIC UNIMAT LATHE cont'd

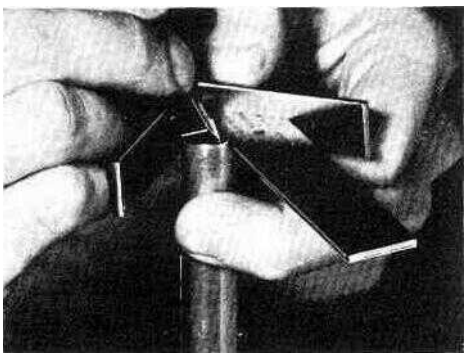
how to choose the right tool bit—center turning, roughing, facing, and machine adjustments...

If you are an experienced machinist, you will already know how to use the 6 kinds of lathe tool bits supplied in the DB 1100 set. However, we suggest that all Unimat owners, beginners and experts alike run through the following practice cuts. You'll find the skill gained will save time later on.

Start by cutting another piece of 3/4 or 1/2-inch scrap aluminum bar stock down to about 5 inches in length. The easiest way to locate centers in the bar is by means of a combination square. For Unimat miniature work, we recommend that you purchase a 4-inch junior sized combination square. Blades are 5/8-inch wide. The instrument is considerably smaller than the usual machinist's square and that makes it easier to hold on small work and thus somewhat more accurate.

8A Junior combination square (4 inch).

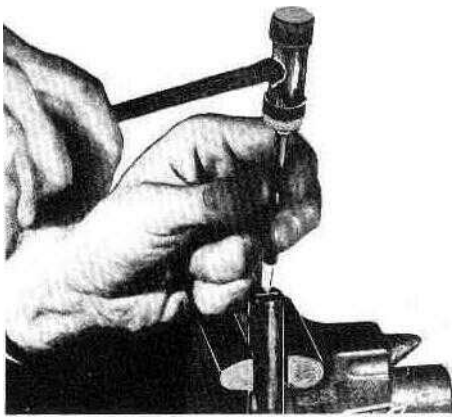
Clamp the bar in a vise and use the square to check the end of the bar. If the end has been sawed at a slight angle, you may need to true it with a hand file.



SB Scribing work center.

Now use the combination square center head to mark two intersecting lines on each end of the bar. The scriber shown in the photo is supplied with the combination set. Though you can mark the bare metal, you can save time and avoid errors by coating the metal with machinist's blueing lacquer. Quick drying model lacquers and enamels will also serve the purpose if you thin the liquid for better brushing. Before you mark, be sure that there are no burrs on the O.D. of the bar. Even a jeweler's hacksaw will leave high spots on the cut.

Next punch the center with *one* sharp blow of a small hammer. If the center punch is sharp, you will be able to find the center by "feeling" the point into the scribed marks. Mount the Jacobs-

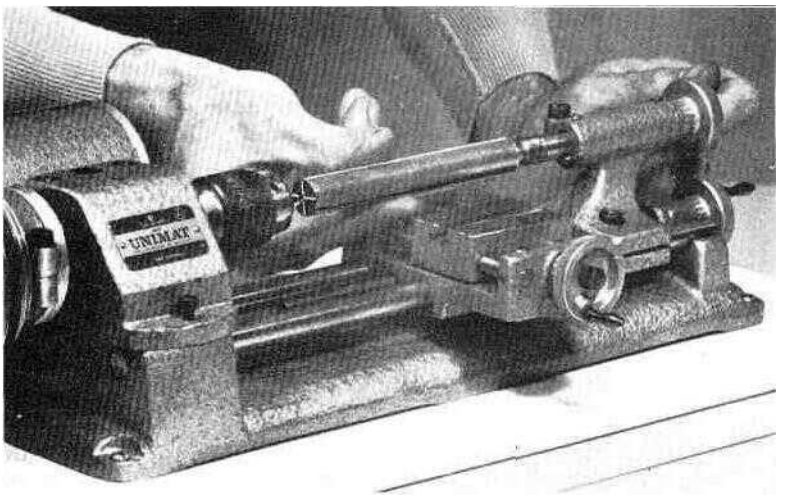


8C Center punching .

type drill chuck on the headstock, and put the lathe center in the tailstock. Support the work with one hand and line up the bar between the drill and center.

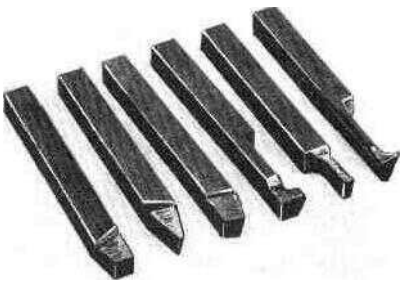
With the pulleys set at one of the lower speeds gently feed the tailstock until the edges of the drill almost *but not quite* reach the work piece. This point is very important. Too deep a center hole can cause inaccuracy. Repeat the operation on the other end of the bar.

For a practice cut, mount the bar on the lathe with the 3-jaw lathe chuck in the headstock and the lathe center in the tailstock. The triangular shaped roughing tool (included with the Basic Unit) is usually the most used tool bit of all six standard varieties. Oil the tailstock center with light machine oil. With belts set for the proper R.P.M., make the cut shown in photo 8F. As you feed the tool back and forth, you may notice a certain vibration. There are two tension



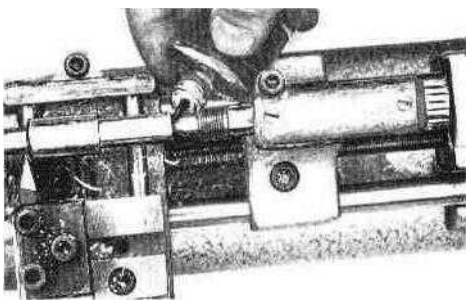
8D Drilling work center on lathe. Feed slowly and oil tailstock center frequently.

locks on the Unimat carriage (Photos 9B and 9C). These socket head screws can be tightened partially for increasing the tension on the feeds for greater accuracy, or can be used to lock the carriage at any desired position.



8E Left to right: left-hand finishing tool (DB 1103); roughing tool (DB 1101); right-hand finishing tool (DB 1102),- boring bar (DB 1105); parting off tool (DB 1104); and inside thread cutting bit (DB 1106).

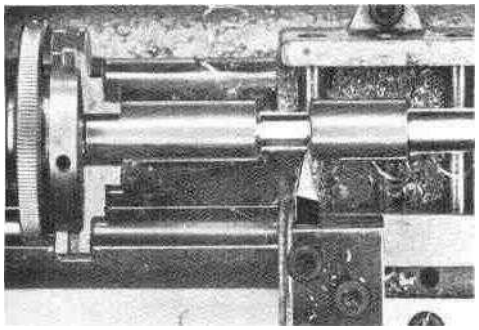
Next set up the left hand finishing tool in the tool holder as in Photo 9D. You will notice that the cutting edges are ground at less than a right angle to one another. This angle not only provides a chip clearance, but also makes it possible to face a perfectly square corner in the cut shown. One easy way to set



8F Use a small oil can or eye dropper to lubricate centers during turning.

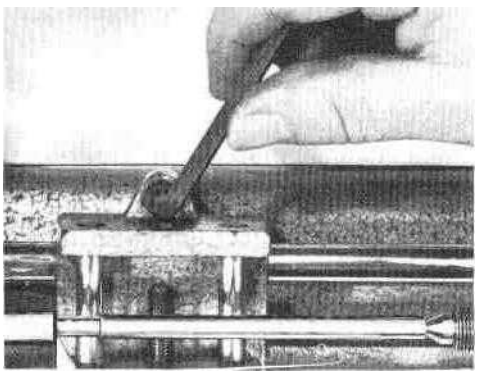
the tool at the proper angle to the work is to run it over the 3-jaw chuck and split the difference between the axes of the Unimat bed and cross feed.

LATHE cont'd



9A Use DB 1101 roughing tool bit for fast stock removal.

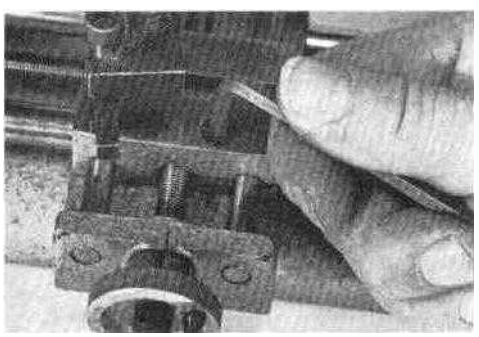
Finish the other side of the cut with the right-hand finishing bit (DB 1102). While both finishing tools will cut inward from the end of the tool as well as



9B Carriage lock tensions feed or freezes movement for facing cut-

laterally, this is not recommended. The proper tool for "digging" into a bar is the roughing tool, and the finishing tools should bo saved for final facing cuts.

If you have never worked before with a really precise lathe, running the Unimat can be an amazing experience. Small work of the type shown in Photo 9F



9C Use cross slide lock for turning long shaftsandbars,

takes shape in seconds. If you keep tools properly centered, sharp, and ground at the proper angles, you'll often find that the lathe tools produce work that looks as though it had been polished.

TURNING TO SIZE

All of the threads on Unimat, parts are metric. The long leadscrew which controls movement of the carriage from one end of the lathe bed to the other, and the cross slide screw are both 8 x 1 millimeter threads. This means that, if you turn the hand wheels one complete revolution, you get a feed of exactly 1 millimeter. The handwheel is further divided into 20 marks corresponding to a feed of .05 mm per mark.

Though most camera, optical and instrument parts are setup with metric system threads, you may prefer to work in inches. One millimeter equals .03937 inch. For all but the most exacting work, you can round off this decimal to .04". the amount of feed in one turn of the handwheel. In inches, each small mark is a feed of .002". It is important to remember that when you are cutting across the lathe bed, that you reduce both sides of the workpiece at once. Thus, turning one calibration actually removes double the feed, .004"; a complete turn of the handwheel, .08".

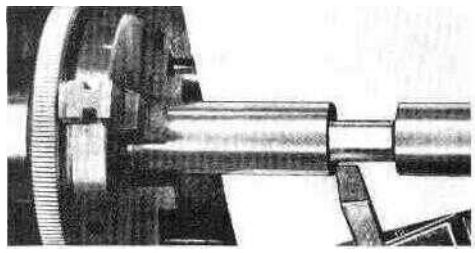
FEED ADJUSTMENTS

On most lathes, there is some backlash in the feed screws. In other words, the screw will turn slightly before the tool starts moving. To adjust this play, loosen the nut that holds the handwheel, adjust the wheel, and retighten the nut.

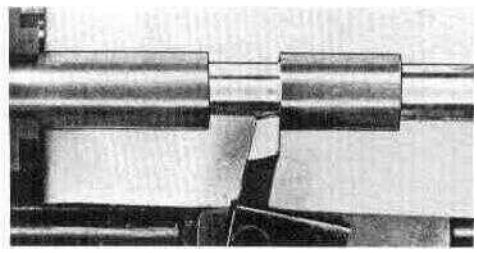
Too much tension on the feed wheels will give you a stiff slow working feed: too little tension can cause tool chatter. A loose feed is better for fast working in soft metals, wood and plastic, but you need a light feed whenever you cut cast iron, brass or steel. Practice will show you that the best, setup for any given material is a combination adjustment, of the handwheel and carriage or cross slide tension screws. The smaller the work diameter, the "tighter" the lathe should he.

It is very important to keep the feed screws clean and well lubricated with light machine oil. As chips accumulate, remove immediately with a small paint brush or use an ear syringe to blow them off. If you are working in brass or cast iron, metals that produce powdery small chips, you can protect the lathe bed and feed screws by covering with pieces of household aluminum wrapping foil. Whenever chips gather on the feed screws do not turn the handwheels since this can damage the threads. The easiest way to clean the threads is to place the Unimat in a shallow tray (a cookie baking tin will do nicely) and flush the chips loose with kerosene fed from an oil can.

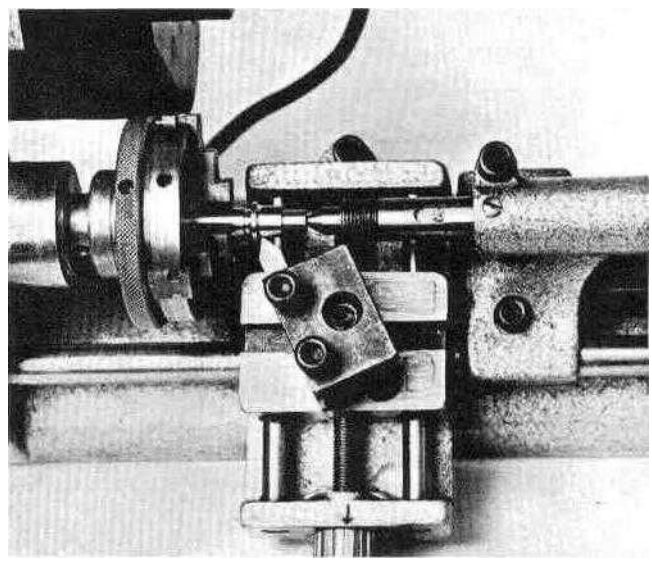
precision reaming, mandrel turning taper turning and lathe threading...



9D Right-hand finishing bit (DB 1102) turns diameter and shoulder of cut.



9E left-hand finishing tool (DB 1103) feeds toward tailstock .



9F
The smaller the diameter, the higher the RPM.
This aluminum model part was finish cut at 2,000 RPM.

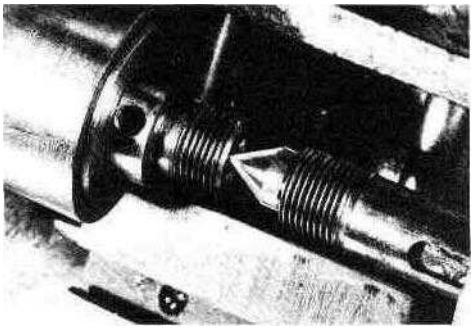
LATHE cont'd

headstock alignment, precision drilling and boring on the lathe...

HEADSTOCK SPINDLE ALIGNMENT

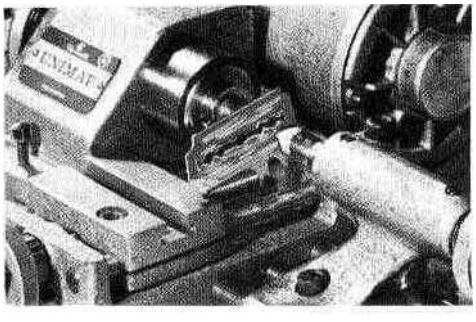
So far, the photos have shown Unimat cutting operations where only rough alignment, of the spindle was needed. At the factory, Unimat headstocks and tailstocks are mounted on the bed, and then bored in one operation. An alignment pin feeds through the lip on the front of the headstock casting down into the lathe bed. It gives you a quick way to center the headstock when setting up rough cuts, installing attachments, etc. However it is accurate to only about one degree of are.

Precise small work requires that the lathe run dead true. To make this setup, loosen the tapered bed clamping screw



10A Centering headstock spindle.

(see Photo 7B) and remove alignment pin. Never force any parts of the machine. Sometimes, if your Unimat is stored in a cold or dry place, and not used for months, tight fitting parts may stick in place. Use a penetrant such as "Liquid Wrench", a solvent available in small cans at hardware stores, and follow up with light oil.



10B Razor blade checks alignment.

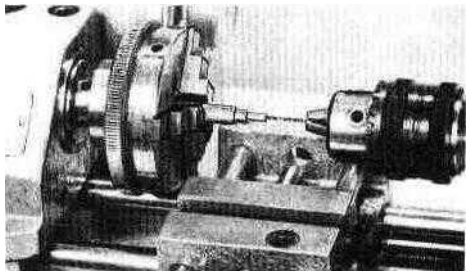
Now insert the feed pinion handlever in the headstock and move the headstock spindle as far as it will go to the right. Lock in place with the headstock cap screws. Move the cross slide, either all the way left until it almost touches the headstock, or far to the right out of the way. Then clean the tailstock bore with kerosene and cloth, and insert for centering.

Next move the tailstock over, lock it to the bed and gently feed it into the headstock spindle as in Photo 10A. As you do this, be sure that there are no chips or cuttings between head and tailstock castings and bed, or on any parts involved. As the dead center mates with the headstock spindle, it will line up the headstock to dead accuracy. Tighten the bed tapered clamping screw, but do not use the aligning pin.

One quick way to check alignment is to use a razor blade as in Photo 10B. If the blade will hang vertically to the bed axis between the two dead centers, your headstock is perfectly aligned. If you find that there is error, you may need to loosen the tapered bed screw slightly and tap on one corner of the headstock casting—(use a wood block or soft rubber mallet) to bring the center into alignment.

PRECISION DRILLING ON THE LATHE

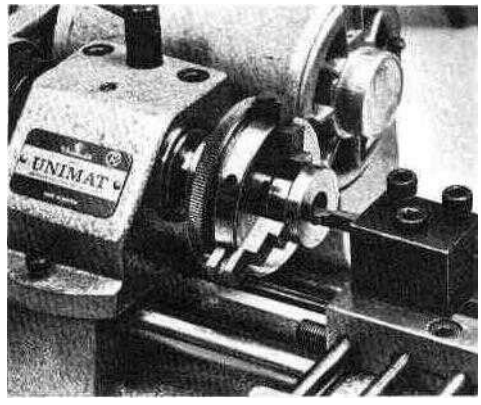
For ordinary rough work, you can drill holes in workpieces held in the 3-jaw lathe chuck even though the headstock spindle is not perfectly aligned. There will be no trouble with drills down to 1/32". However, if you want to drill perfectly true deep holes, you'll find if the spindle has not been aligned, that the



10C Drilling size 80 hole.

drill may produce a slightly conical hole, or the workpiece may even break drill.

With the headstock properly aligned, and chucks and bed cleaned and oiled, you should have no difficulty in drilling (Photo 10C) as small as an 80 size drill (.0135"). This type of work is impossible on most; lathes without, special tools. Whenever drilling below 1/32-inch, remember that it is easy to overfeed the drill. Small drills will tend to bend out of line slightly while they are making the hole, causing inaccurate bore. It is a good idea to watch the work with a large magnifying glass mounted over the lathe.



10D Boring tool mounts perpendicular toworkpiece.

PRECISION LATHE BORING

Purpose of the boring bar (DB 1105) is to turn internal holes. The end of the boring tool is ground at an angle similar to that on the side of the facing tools. Drill the workpiece out to 1/4 or 5/16-inch. Then set the boring bar in the tool holder, centering the edge as with the other lathe tools. Be sure to mount the tool in the holder parallel to the lathe ways. Do not try to cut all the way in one pass. Because chips tend to gather in the workpiece, it is necessary to run boring cuts slower and at lighter feeds than for external work.

As the bore approaches the desired diameter measure with vernier calipers, or by checking against a fitting part.

As an example, let's say that the bored ring in Photo 10D is a bearing that has to fit smoothly on a rotating shaft. As we make successive cuts, we can measure with various types of machinist's gauges. But these gauges are costly and you may not have one in the exact size desired.

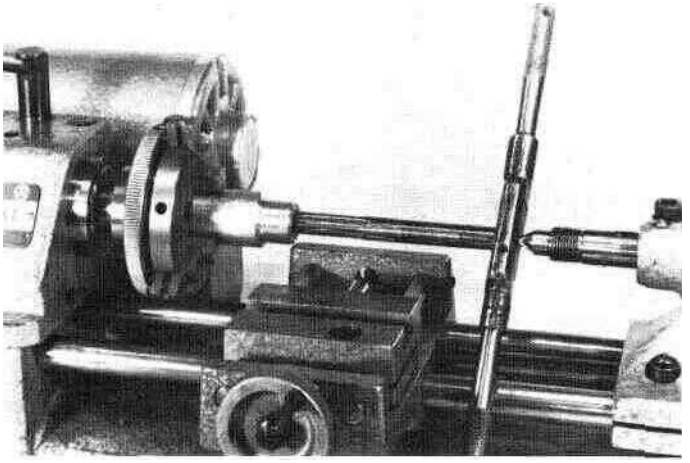
The easiest method is to machine the shaft first. Make it about one-half inch longer than finished size, and turn off the extra material for use as a diameter gauge.

Use a fine jewelers file or garnet paper and finishing cloth to polish down one end of your plug so it measures about 1/1000" less than the desired shaft diameter. Then as you bore the finish hole in the bearing, use this plug to check the inside diameter. Mark the plug gauge and save for future use. A set of such diameter gauges can be made up as you go along and will have many uses in the Unimat shop.

When boring large holes with the 3-jaw chuck, it is important to improvise a stop on the bed to prevent the tool from cutting into the chuck itself. You can clamp a wood block on the bed, or make bed stops by sawing a ring like the one shown in Photo 10D in half. It is also a good idea to chamfer the end of the workpiece facing the chuck, to avoid having to bore all the way through.

LATHE cont'd

precision reaming, mandrel turning.taper turning and lathe threading...



11A Tap handle holds reamer. Use tailstock center to guide look Same setup is used for precision tapping.

PRECISION REAMING

Though the Unimat runs more accurately than most common lathes, twist drills will generally not cut dead accurate. Boring tools below 1/4-inch are not satisfactory on deep holes because the tool may tend to bend against the workpiece. Reaming is a standard technique to use whenever you want small holes accurate to l/1000-inch.

Just like drills, reamers are available in fractional, number, letter and metric sizes. The reamer is a stiff fluted tool and should never be used to remove more than a few thousandths stock. To make the precise-fitting camera post (Photo 11A) the workpiece was first turned down to diameter and then drilled one size under that of the reamer.

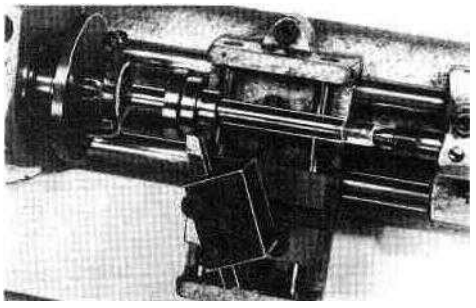
The reamer should not be driven by the drill chuck in the tailstock, since this can cause inaccuracy. Instead hold the reamer in a tap wrench. The back end of most reamers has a center hole. Engage this on the tailstock center, and either with the work rotating at very low speed, or turning the headstock spindle pulley by hand, slowly feed the reamer into the hole. Never force a reamer. Use plenty of lubricant and on deep holes, remove the reamer frequently and clean the chips. Never turn a reamer backward in the work since this can dull the cutting edges,

MANDREL TURNING

Many kinds of work are difficult to mount in the regular chucks. An example is a three step pulley. Photo 11B. The workpiece is mounted between centers on a special hardened dead straight bar called a mandrel. Mandrels are available through machinist's supply houses and are made by drill manufacturers. One end of the mandrel is slightly smaller than the rated diameter, while the other end is larger.

Thus to turn the pulley, your first step la to rough turn the stock to approximate diameter and length in the 3-jaw chuck. Then center drill one size beneath the required shaft diameter. Next the workpiece is reamed, in this example wiih a 1/4-inch reamer. The smaller end of the 1/4-inch mandrel is inserted in the hole and the work tightened by tapping the other end of the mandrel with a soft mallet until the work locks on the shaft.

Both ends of the mandrel have hardened centers. It mounts between lathe



11B Turning pulley on mandrel.

centers with the faceplate driving the lathe dog. As the work revolves you may find that you want to use scrap electrical wire to tie the lathe dog solidly to one faceplate slot, to prevent vibration in the cut. Be sure to oil the tailstock center every few moments as the machine runs. The tailstock should not be set so tightly that the center overheats. If much of this kind of work is done, you will need a DB 1220(a) ball bearing center.

TAPER TURNING

A taper is a cone-shaped cut on a workpiece. Taper-cut pins, shafts, and fittings are widely used in instruments and on machine tools because a tapered rod docs not wear into a hole to cause inaccuracy. Taper pins, for example, tend to seat in their sockets with a wedging action that self corrects for wear.

On most lathes, you cut a taper by offsetting the tailstock. On the Unimat. it is done by operating the headstock at an angle away from dead center. To machine a tapered bar or pin. *punch the ends of your work and mount between centers.* If the headstock is angled toward the rear of the lathe, the taper will cut smaller at the tailstock end. If the headstock is angled toward the lathe front, the taper will cut small at the left.

To establish the taper angle, you will need a *test bar.* This bar will have many other uses later on. Select a perfect piece of free-machining steel about 3/8-inch diameter. Cut it exactly 5 inches long, true the ends and mark the centers. Punch carefully. Align the lathe centers perfectly and use the roughing tool to cut the bar down to about .260". Then use the left hand finishing tool to turn the bar down to an exact 1/4-inch diameter. If your lathe was properly setup, the diameter should check exactly at .25" from one end to the other.

Now to set up a typical taper cut. Let's say that we want to machine some bars that have a taper of 1/4" per foot. This is equal to a taper of .1042 per the 5-inch length of our test bar. Place the test bar between centers and adjust the headstock angle until you can read a difference of .104 between the bar and the tip of a tool mounted exactly on center in the tool holder. Use shim stock (or a dial gauge mounted in the tool holder) and check at each end of the bar.

Some inaccuracy may be introduced when the centers drive the work at an angle. Therefore make a trial cut on another 5-inch bar. Exact diameter is not required since the taper per foot ratio will remain the same. Use a micrometer at each end to measure the diameters. Difference is the taper. A slight adjustment of the headstock may be required.

Tapers can also be bored in short workpieces held in the 3-jaw chuck. If you plan to do considerable taper turning, it would be best to make a protractor bar which can be chucked in the tailstock for checking headstock offset against the faceplate.

LATHE THREADING

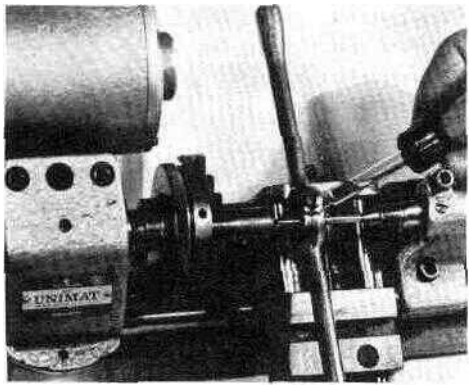
There are three ways of cutting threads on the basic Unimat: with taps, dies, or the Thread Chasing Attachment (DB 1270). To cut internal threads, you first must prepare the right size hole for the thread desired.

LATHE cont'd

die threading, making special chucks,

See a drill rnanulacturers chart of drill sizes. For example, the standard camera socket thread is 1/4-inch diameter by 20 threads-per-inch. For this thread, drill your workpiece with a #7 drill. Then with the lathe properly aligned, drive the tap like the reamer (Photo 11B), and slowly feed the tap into the work by hand. Often, it will be convenient to start the tappinginthelatheandthenfinishthe thread with the workpiece held in a vise.

External threads are cut with a threading die (Photo 12A). It is helpful



12A Use plenty of cutting oil when threading with a die.

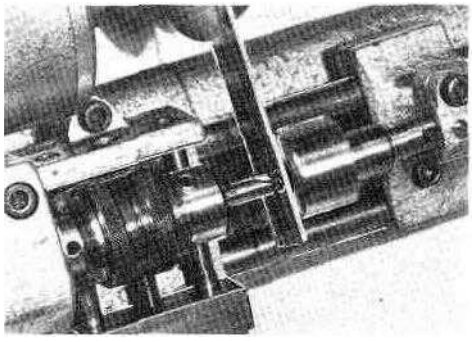
to start, the die against, the work by temporarily placing the faceplate on the tailstock. This guarantees a straight feed. Do not use power. Gently turn the work by hand feeding plenty of oil to the die. If the tension on the die increases, back off, brush chips away and repeat.

FACEPLATE TURNING

The Unimat faceplate has three slots which fit the standard cap screws used on the machine. Flat work up to the full swing of the lathe can be screwed directly to the faceplate. Extra holes can be drilled in the faceplate to clamp odd shaped workpieces that will not fit into the regular chucks. If you mount such work off center, be sure to balance the faceplate with additional bolts if cuts are to be made at high speed. For special setups, extra faceplates are available, (DB 64).

SPECIAL CHUCKS AND SPINDLE FITTINGS

Some kinds of work cannot be held satisfactorily in any ordinary way. The chuck shown in (Photo 12B) was made to hold 1/2-inch round balls for center drilling. To make the chuck, a piece of 1 1/4-inch round steel bar stock was cut to 1 1/2-inch length, and mounted in the 3-jaw chuck. Next it was center drilled



12B Ball chuck doubles as handy tailstock drill pad.

and bored to about 3/8-inch diameter and then drilled with a 13/32-inch drill. This produced a good fit when threaded with the Unimat TM 12 headstock tap (12mm dia. x 1mm pitch). The back end of the thread was cleared to fit the headstock spindle, and the front end bored on a slight taper to fit the balls. During the drilling the balls were held in place with a few drops of sealing wax.

This example illustrates how you can make chucks to fit any kind of special part. Such chucks can also be threaded to hold screws during machining operations. The chuck does double duty as a handy tailstock plate for drilling on the lathe. (Photo 12B)

DRILL PRESS

setting up your drill press

The changeover from lathe to vertical drill press can be accomplished in less than a minute. Remove the tapered screw which holds the headstock to the lathe bed. Pull out the headstock alignment pin and lift out the complete headstock unit. Substitute the drill press column, replacing and tightening the tapered screw. *Note that this is a one-way fit.*

Next remove the tapered screw in the adapter on the vertical column and use it to mount the headstock. Place the faceplate on the spindle and with the headstock tapered screw partially tightened, lower the assembly until it touches the top of the cross slide as in Photo 12D. Now tighten the headstock tapered screw and your drill press is vertically aligned ready to use. (Etch a mark in both castings for ready reference).

A slotted screw threaded to fit chucks and faceplate is supplied with the basic Unimat. Use the screw (Photo 13A) to

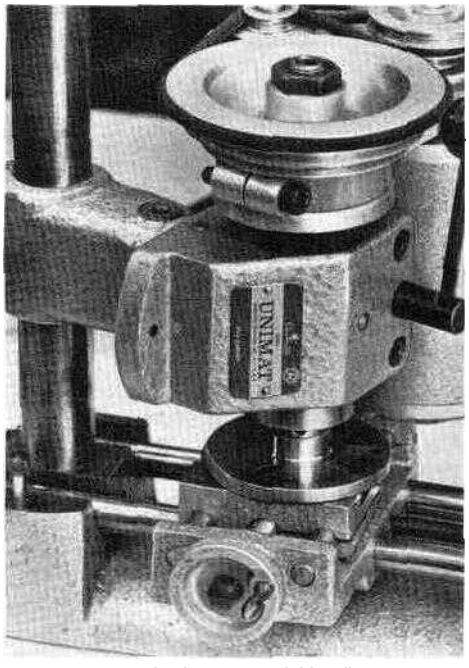
12C Ball chuck and TM 12 Unimat spindle thread lap.

mount the faceplate to the cross slide. Be sure the surface of the. cross slide is free of chips and you'll get a perfectly vertical hole every time. Adjust the cross slide so the hole in the center of the faceplate is beneath the drill.

When drilling in metal, use a starting drill or center drill such as DB 1135 (supplied as part of DB 1130 Tool Box) after you center punch the workpiece. This type of drill is more rigid than a plain drill point and guarantees more perfect centering of the hole. Center drills should be used at slow speed, with plenty of lubricant.

A footswitch makes drilling of unclamped work a lot easier. Heavy-duty sewing machine motor footswitches can be used, or you can improvise your own by using an automobile floor switch mounted on a suitable piece of wood.

The Unimat handlever pinion give you a vertical movement of about 5/8-inch,



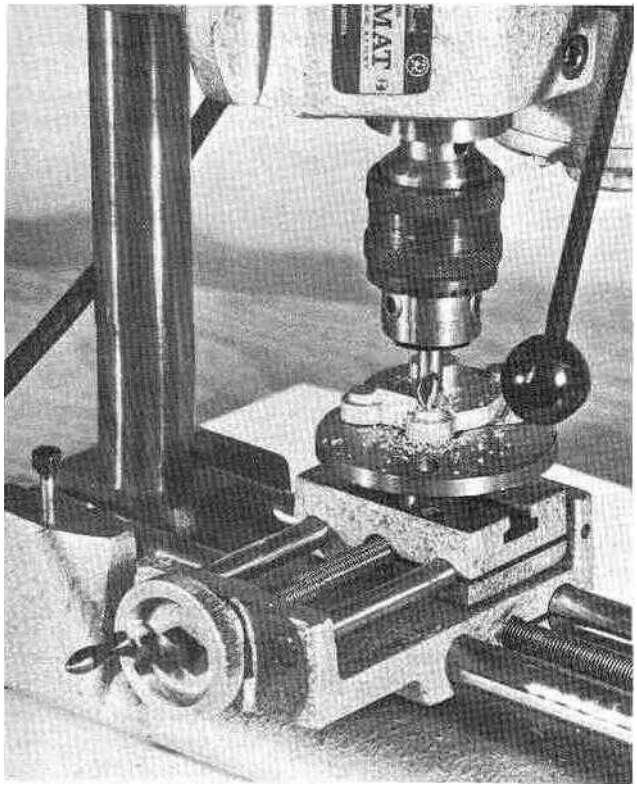
12D Simple setup quickly aligns vertical drill press.

enough for most kinds of precision model work. If you need more movement, you can remove the spindle return spring, increasing spindle movement to 1 inch.

Two basic kinds of drills are available: carbon and high speed steel. The less expensive carbon drills are intended for work in wood, plastics and soft metals, while the high speed drills are harder and will handle work in cast iron and

DRILL PRESS cont'd

drilling technique, types of drills, drilling speeds, miniature work..



13A Faceplate doubles as drill press table.

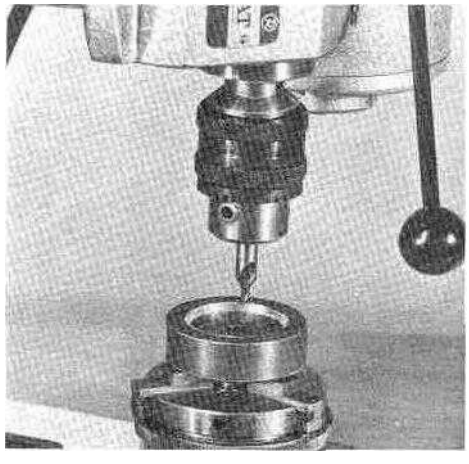
steel. Drills are sold in sets and singly. Sets are offered in fractional inch sizes, numbered wire sizes from 1 to 60. and 61 to 80, in letter and metric sizes. Usually sets of drills are supplied in drill cases with accurately sized holes that enable the user to keep the bits in order.

Drills commonly sold by hardware stores and tool supply houses are called jobbers length straight-shank twist drills. It is suggested that the Unimat owner order shorter length drill called "short set" or screw machine drills (DB 1140). Only about half as long as the regular jobbers length drills, this length gives you more tip rigidity and offers convenience in working. It's a good idea to contact the local office of the larger drill manufacturers. Request their latest catalog. Also, excellent manuals on drilling are usually given away free to drill users. Charts included give you complete information on all drill and tap sizes, cutting speeds, and decimal equivalents.

The correct speed for drilling is given by the formula: S.P.M. = .26 x R.P.M. x drill diameter in inches. S.F.M. refers to surface feet per minute, or the cutting rate of the drill tips against the work. Typical recommended S.F.M. rates for high speed steel drills are as follows:

alloy or stainless steel	20- 40
mild machinery steel	80-110
medium hard cast iron	70-100
brass and aluminum	200-300
bakelite	100-150
wood	300-400

If you use carbon steel drills, reduce cutting speeds by one-half.



13B 3-jaw chuck grips flywheel during drilling.

PROPER DRILLING TECHNIQUE

If a drill dulls rapidly at the edges or splits up the web, it usually means your speed was too high. Use a lubricant in all metals except cast iron. Chips should not be long and coiled since this tends to clog the point. A common mistake is to regard drilling as the easiest operation. The tendency is to rush through drilling jobs overfeeding the point and causing inaccurate holes and dulled cutting edges. Properly used, a quality high-speed drill should last for hundreds of holes in anything but the hardest metals.

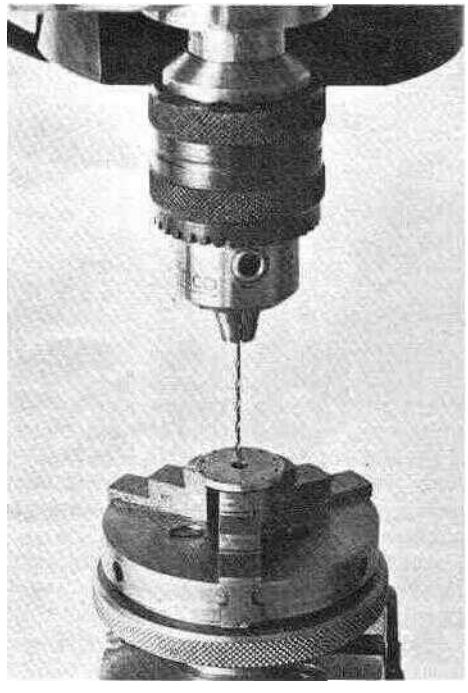
Sometimes the heat of a drill working in steel will "work harden" the hole. The drill will stop cutting and dull rapidly if allowed to run in the hole. The only way to avoid this trouble is to use turpentine, or water soluble oil when cutting hard steel.

Soft materials are drilled at higher speeds and so the tendency is to overheat the work often enlarging the hole. When you drill soft plastics, cut your speed and bring the tool in and out as quickly as possible in avoid melting the material with drill heat.

Drilling sheet metal is often a problem since the pressure of the point tends to distort the metal downward. Also, as the drill breaks through, it may grab on the work and break, or the workpiece can be pulled out of the hands with considerable danger. ALWAYS CLAMP SHEET METAL WORK SOLIDLY TO THE DRILL TABLE. Also, sheet, metal work should always be backed with a piece of hardwood or Masonite.

DEEP HOLE DRILLING

Model work often requires holes deeper than 5 times the drill diameter. This is called *deep-hole drilling* and requires special technique. Ordinarily the drill



13CDrillingwithtiny#75size drill bit.

flutes will pull the chips upward out of the hole, but when the hole is unusually deep, chips will tend to fall back in and clog the tip. The. remedy is to use ample lubricant which will help float the chips out. Abo back the drill out of the hole frequently during drilling. Especially in cast iron, a drill will tend to overheat in deep holes.

DRILL PRESS cont'd

miniature hole drilling, drill sharpening, angle drilling...

Space age miniaturization requires new shop technique that just a few years ago were practiced only by dentists, jewelers, and instrument makers. In the ordinary machine shop a size 60 drill is considered a limit in smallness. Until the introduction of the Unimat, smaller drilling could be handled only on very expensive special machines.

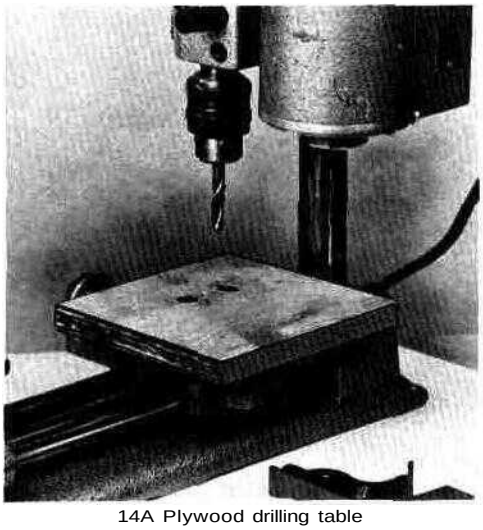
Practically all work with small drills below size 60 (.040-inch) should be handled like deep hole drilling. In proportion to its larger brothers, the miniature drill is very long. The ratio of length to diameter can be as much as 40 to 65 times, and yet the tiny drill must produce a hole in most jobs that is also proportionately many times deeper. Therefore a jeweler's touch is required or drill breakage is certain.

If a mechanic's stethoscope, or any kind of electronic amplifier is handy, use it, to listen to the sound of the tip cutting into the metal. Back the drill out frequently and use the cutting lubricant and an air hose or handy syringe to flush out chips.

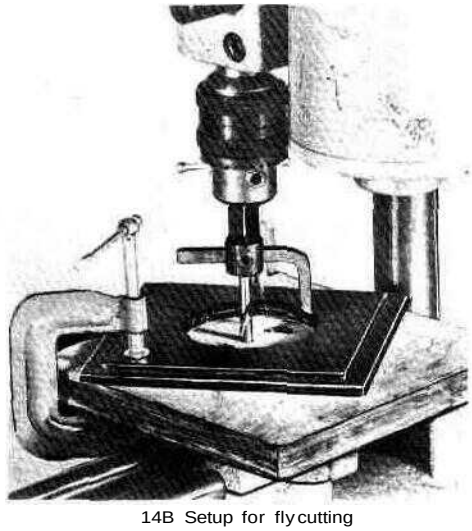
Always feed slowly, and if the drill tip dulls the least bit, immediately stop work and touch up the cutting edges using fine garnet paper under a magnifying glass. Using this technique, #75 size holes, only .021-inch diameter.were run through steel bars 3/8-inch thick. The standard DB 1005 Unimat drill chuck is capable of extreme precision, but it is important that you avoid keeping the chuck tightened on a drill overnight or for long periods of time. This can gradually distort the chuck jaws.

in place. Some workpieces can be held for drilling in the Unimat tool holder. Larger workpieces are best, supported on a work table (Photo 14A) that you can make of plywood or a piece of metal. Such a table supports a 4-inch lens board for drilling with a fly cutter (Photo 14B). Or you can use a pair of steel or plastic bars to support work such as the meter (Photo 14C) for drilling and countersinking. Bore a hole in the surface of the table and you can improvise a rotary sander (Photo 15A) for perfect edging of wood, plastic and metal. Clamp a fence to the table, and you can sand to any accurate width desired. In the same way, you can use your Unimat drill press to rout or carve.

Angle drilling (Photo 15B) is accomplished simply by loosening the headstock tapered clamping screw and setting the spindle axis against a protractor. Before drilling, chuck a test bar or drill blank and check against the work. Both the Unimat and the work should be securely clamped or screwed to the bench to prevent a spoiled hole. Photo 15D shows a method of clamping the Unimat drill press to a large workpiece. Steel bars, 1/4 x 1/2-inch were screwed to the lathe bed and in turn are clamped to the work. The hole is center punched



14A Plywood drilling table ѕ 5 x 5 x 1/2-Inch.



14B Setup for flycutting camera lens board.

14C Countersinking holes in electronic meter case.

On any precise drilling job it is important that the workpiece be securely clamped or chucked as in the photos, page 13. Double check the cross slide and carriage locks. For miniature drilling, center punch the work lightly to avoid creating a hard spot in the metal that, might cause a small drill to deflect from its path.

Clean the drill chuck with kerosene and make certain there are no chips on the jaws. Insert the drill in the chuck as deeply as possible, but. *never grip any drill point, an the flul.es.* If the drill shank is marred by burrs, remove with a fine file and polishing cloth. Use a thinner lubricant than recommended for ordinary drilling, such as very light machine oil, kerosene, etc.

As the drill penetrates the work, watch the tip with a magnifying glass.

Drill Sharpening

Many machinists claim to be able to sharpen drills accurately by hand. While this can be. done on larger drills if one practices the art constantly, it is very difficult to hand grind the proper cutting tip angles and hold an accurate center. Factory-new drills will be accurate to within 1/4-thousandth-inch or better. A drill sharpening fixture (see Photo 16A) will help you to grind drills l/8-inch and larger. However if your work demands maximum precision, It is recommended that you take your drills to a sharpening shop that has the proper grinding equipment.

Work Holding Methods

The 3-jaw chuck also mounts on the cross-slide (Photo 13B) and gives you a means of clamping circular work such as rings, pulleys and camera lens flanges and started with a center drill for dead true accuracy. Feed any angle drilling job slowly to avoid drift.

Drill Press Tapping

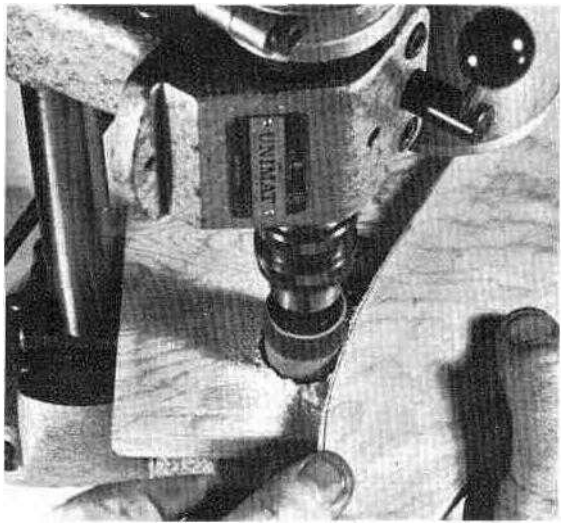
The skilled machinist always starts a threading tap with a drill press or lathe. If a tap enters a hole guided only by hand, it is *very easy* to start as many as 4 or 5 turns of the thread at a slight angle to the true axis of the hole. The result is a broken tap or spoiled work.

Start by drilling the hole the right size. Make sure the hole is clean and free of burrs and chips. Then, without changing the drill press setup, chuck the tap and using the handlever for light pressure, feed into the work, turning the chuck by hand. Do not use motor power.

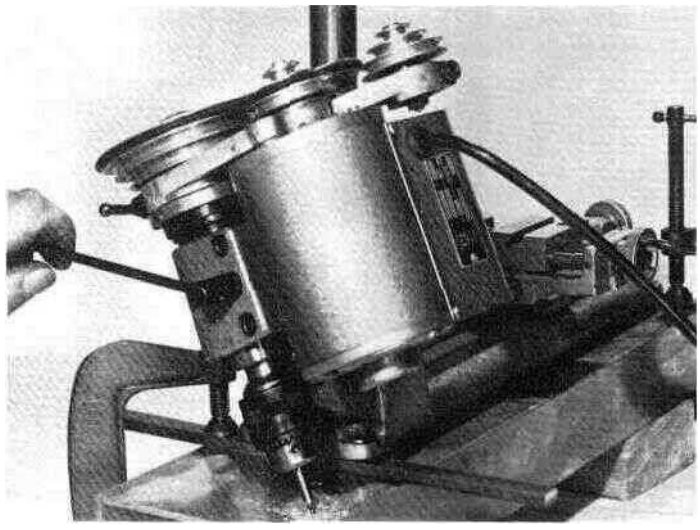
After two or three threads are cut, lock the spindle, unchuck the tap, back the spindle off and finish with a hand tap

wrench. Photo 15C shows an alternate method in which a center point held in the chuck guides the tap center. The center is a $^{3}/_{16}$ x $7^{1}/_{2}$ inch steel dowel ground to a perfect point. If it is necessary to move the drill press upward on the column, this pointed rod makes centering easy.

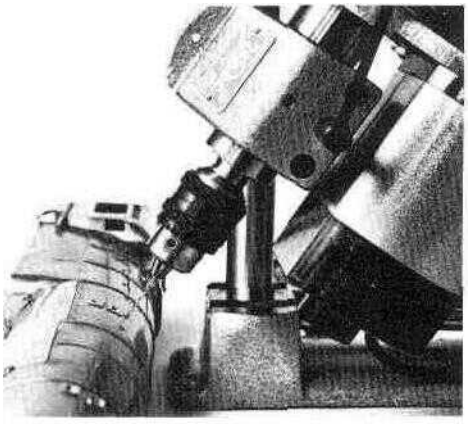
DRILL PRESS cont'd



15A For vertical or angle edging use 1-inch sanding drum on drill press.

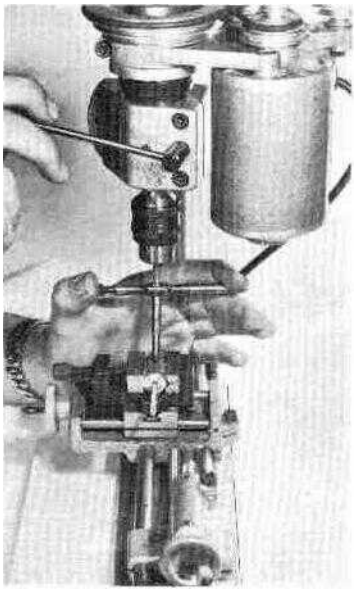


15D To handle a big job, take Unimat to the work! Clamps Insure accurate location.

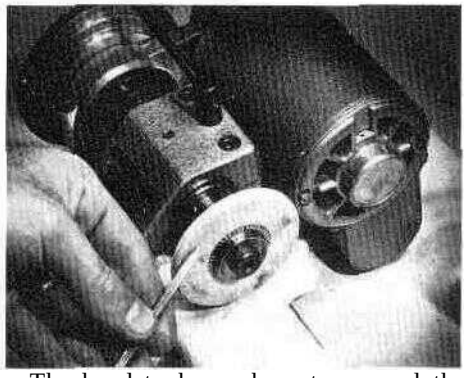


15B Drilling model locomotive.

15C (Below) Tapping with center bar guarantees perfect vertical thread



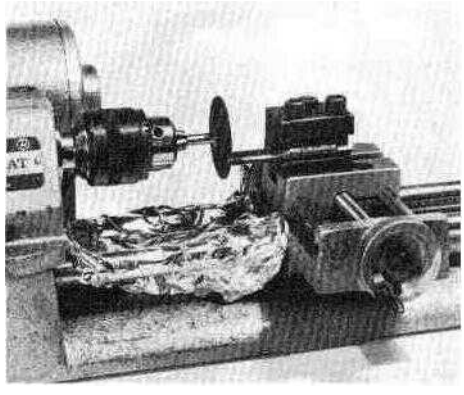
BENCH GRINDER

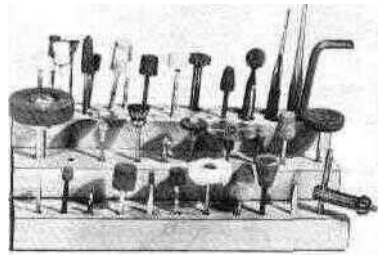


The headstock can be setup as a lathe or swiveled at a right angle to the bed for more working room. Whenever you work with abrasives be sure to protect the ways of the Unimat. It takes only a moment, to tie a piece of cloth or tissue paper to the bed bars with wire or rubber bands. Abrasive dust ground into the sliding parts can ruin the accuracy of your machine.

Another handy way to protect your Unimat is to use household aluminum foil which readily clamps itself on the machine. The abrasive wheel shown cutting the broken tap is one of dozens of types available.

Since abrasive wheels and mounted stones are quickly ruined if stored loosely in tool boxes, and because chipped stones can be dangerous, it is recommended that



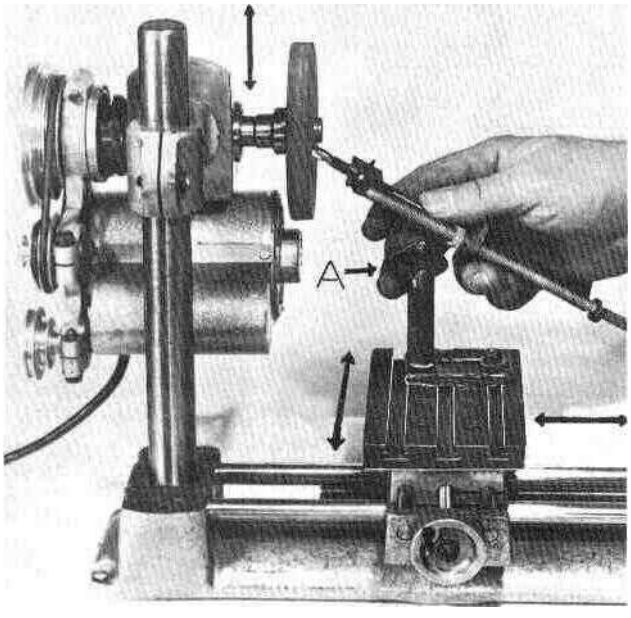


you make a tool rack of three pieces of scrap wood with holes to fit the tool shafts. Such a rack will save hours of time otherwise lost in hunting for tools.

Though it applies to all metal working

GRINDING cont'd

tool grinding, surface grinding, precision tool sharpening,..



16A With the Unimat grinding wheel arbor, abrasive wheel and attachment bolted to cross slide, you can grind any size drill or angle, by raising or lowering the headstock on the column, or moving the cross slide.

operations, this advice is most important in grinding. ALWAYS WEAR AN EYE SHIELD OR SAFETY GLASSES, (XR 53). GRINDING CHIPS CAN TRAVEL 20 FEET ACROSS A ROOM. It would also be good to have the Grinding Wheel Guard (DB 1115), or to make a shield of an 8 x 10-inch piece of clear plastic.

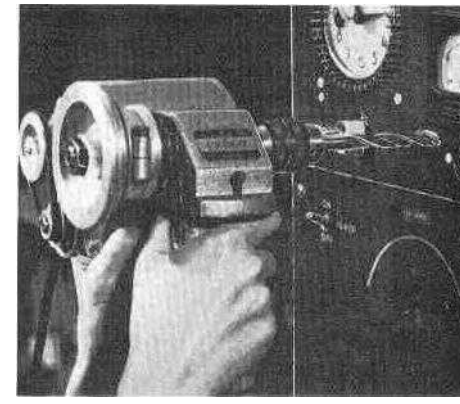
Grinding speeds depend on the material. Usually faster speeds remove the metal quicker, but you may overheat the part causing it to burn, chip or crack. Keep a pan of cool water close by and wet the workpiece frequently to reduce heat. Avoid excessive pressure on the grinding wheel. If a wheel or stone is accidentally dropped, it may start a crack which can cause the wheel to fly apart at high speed. For safety, discard any doubtful grinding wheel.

Most rough grinding, sharpening and polishing jobs can be handled quite well and with the workpiece simply held in the hands and brought to the cutting wheel. But if you want to sharpen lathe tools, drills, cutters, plane irons to exact angles and edges, the work must be rigidly clamped and fed to the rotating abrasive.

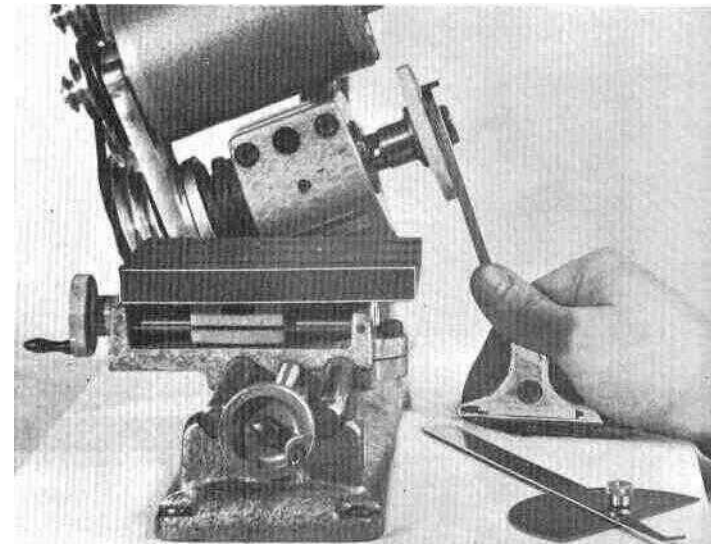
An unusual example of Unimat versatility is the setup for grinding drills, above. This drill grinding swivel attachment is typical of many such units on the market. The drill holder is adjustable at point "A" to 88, 69, 59 and 49 degree settings which correspond to the angles produced at the drill point.

Hand Drill

To use your Unimat as an **11** speed hand drill, remove the adaptor and headstock assembly from the drill press column. The adaptor becomes an easily gripped handle for your right hand while you support the motor with your left hand. The job shown in the photo is typical of the kind of work in which this Unimat application excels.

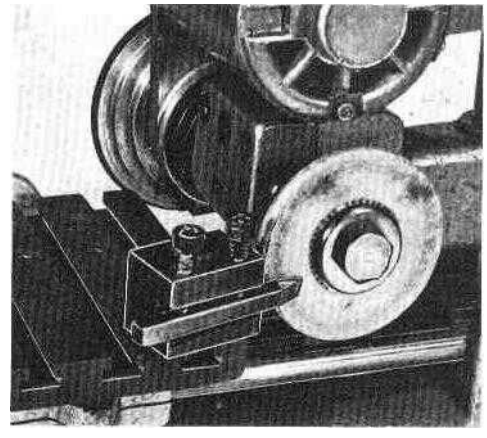


Useanordinaryheavydutyhanddrill on this kind of job, and you risk breaking through the aluminum and damaging partswithin.TheUnimatownerinthis case drilled a starting hole with a $^1/_4$-inch center drill, followed by a $^3/_8$-inch and $^1/_2$-inch drill, each on $^1/_4$-inch step down shanks. The drill cuts evenly hardly jarring the instruments, and the rubber drive belts act as torque release in the event the drill jams in the hole when breaking through.



16B Setting grinding angle with protractor.

16C Sharpening dull lathe fools.



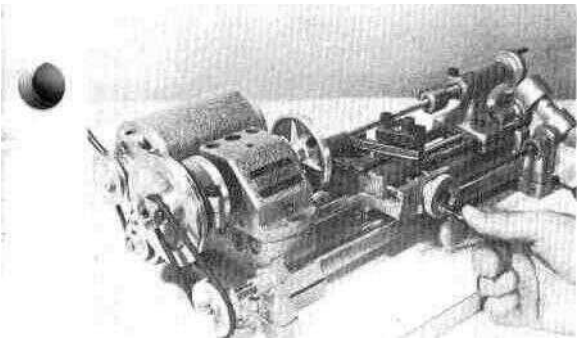
Grinding at Angles

Bolt the Unimat bed down to a flat surface as in Photo 16B. Use an adjustable depth gauge, or arm protractor to measure the angle and set headstock. The attachment shown fastened to the cross slide is DB 1210 Milling Table, (see page 19), which conveniently mounts a variety of attachments. The Unimat owner can also use steel bars of similar length to make grinding fixtures. In Photo 16C, the standard Tool Holder grips a lathe tool during sharpening operations.

DB 1290

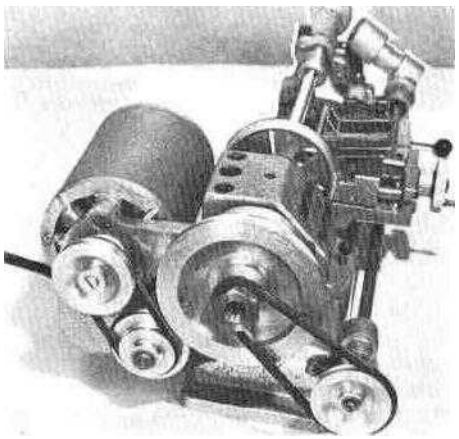
POWER FEED

new attachment eliminates tedious hand feeding and produces high-precision finish...

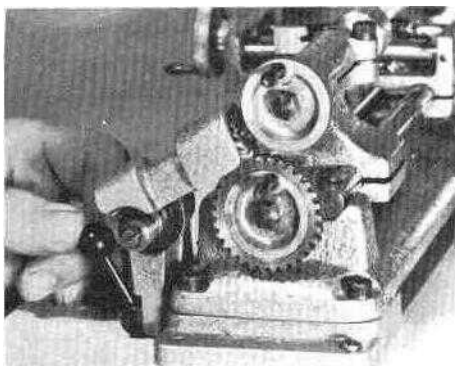


17A Power Feed Attachment gives ultra-smooth finish to motor shaft.

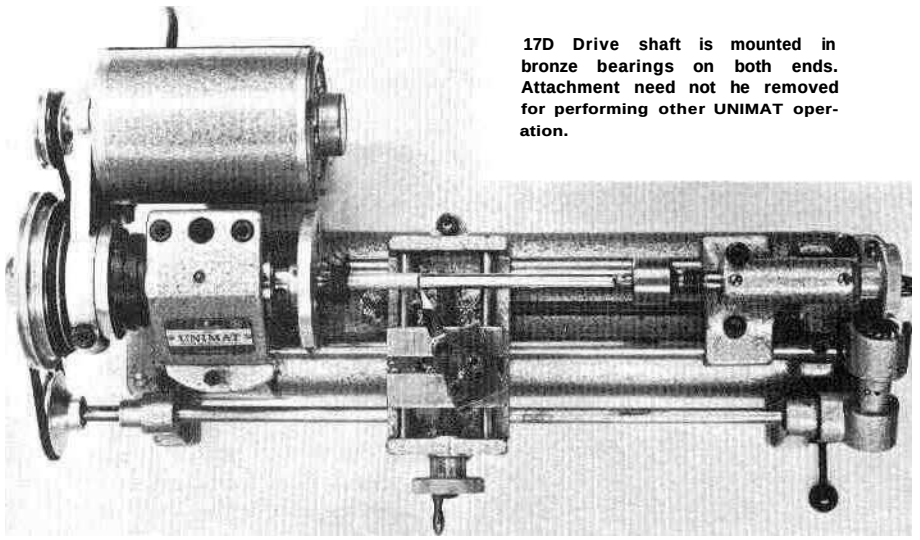
Designed to fit all Unimat models, the Power Feed Attachment is belt driven from the spindle and drives the carriage toward the headstock for super-fine lathe work. Lathe turning, boring, and many operations in machining hard materials, and very small work can be handled with minimum effort and extreme precision.



17B Power feed drive shaft is belt driven and provides a feed rate of .0008-inch per spindle revolution.



17C Flip the gear engagement lever, and the carriage starts to move, smoothly and efficiently, or stops.



17D Drive shaft is mounted in bronze bearings on both ends. Attachment need not he removed for performing other UNIMAT operation.

The drive attachment is controlled by a lever that engages a worm gear at the tailstock end of the lathe enabling you to start and stop the feed with motor running. Bolted beneath the lathe bed. the attachment in no way interferes with any regular Unimat operation.

Installation Steps.

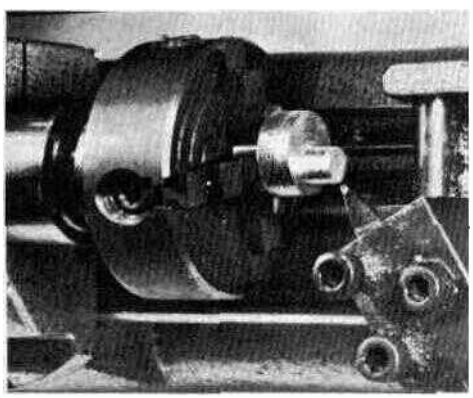
1. Remove complete spindle from headstock by loosening clamping screws and set screw. Remove motor bracket and clamp headstock pulley in a vise between pieces of scrap wood.
2. Remove the spindle nut with an adjustable wrench and replace with Pulley Nut DB 270-13. Replace the spindle assembly as it was before.
3. Remove the leadscrew handwheel by loosening the hexagon nut. Replace with the geared handwheel.
4. Clean bottom surface of lathe bed and oil lightly. Also clean top surface of feed attachment and oil.
5. Under each of the attachment mounting plates are Allen head cap screws which hold the drive shaft bearings. Loosen but do not remove.
6. Place lathe on the mounting plates. Line up mounting holes and secure with four Allen head cap screws supplied.
7. Using headstock feedlever, back spindle out (toward left) and line up spindle pulley nut with drive shaft pulley.
8. Attach belts and arrange drive for moderate speed. With attachment in operation tighten the bearing supports. This will be easier if you place the Unimat on scrap wood blocks.
9. As you tighten, if the drive shaft, stalls, loosen bearing screws, adjust and retighten,
10. During operation, use light machine oil in the holes of each hearing support to prevent stalling. Also oil the tailstock feed gear frequently.

The step-down pulley and gear drive of the attachment provides a 1:50 reduction ratio. Each turn of the spindle advances the carriage 0.02mm (.0008-inch). A uniform chip, very smooth turning, and much longer wear-life of the lathe tool edges than with manual turning results. Though most turning operations should be run toward the headstock, you can reverse power feed direction by crossing the power feed pulley belt.

ACCESSORIES 4-JAW INDEPENDENT LATHE CHUCK

The 4-jaw chuck is similar to the 3-jaw chuck, but where the 3-jaw chuck automatically self-centers round workpieces, the jaws of the 4-jaw chuck adjust separately. This enables you to grip square stock, oval slock, and irregular shaped pieces for turning, drilling, boring, milling or grinding. The 4-jaw chuck also handles such jobs as cranks and cams which may have to be turned or drilled off center.

Because this chuck is supplied as optional equipment, it must he made to balance and center with the threaded spindle of your particular Unimat. This is done by filling the over-sized back plate adapter on your own Unimat lathe. See TRUING INSTRUCTIONS (right)

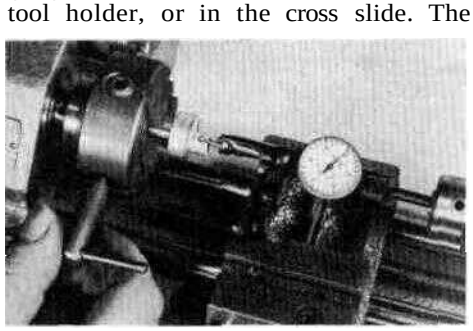


18A Turning off-center crank .

Using 4-jaw Chuck

Each jaw adjusts separately by means of a square chuck key provided. You can reverse any one or all four of the chuck jaws to grip irregular work, but unlike the 3-jaw chuck, each jaw should be used in its own slot.

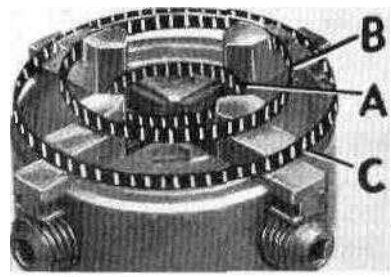
By far, the most convenient way of centering offset work is by using a dial gauge mounted in the tailstock. on the tool holder, or in the cross slide. The



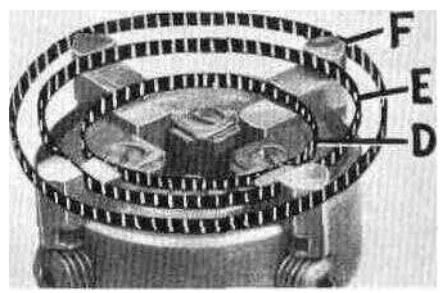
13B Indicator dial movement shows work is not centered.

workpiece is first centered roughly by hand. Then remove the spindle drive belt and revolve the chuck to determine in which direction the work must be moved. Adjustment may require loosening and tightening two if not all four jaws.

JAWS NORMAL

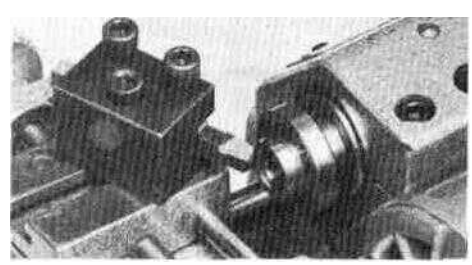


JAWS REVERSED



With practice, work can be centered in less than a minute. The final centering shows on the dial gauge which indicates movement of the surface under the tip in thousandths of an inch. Other less expensive instruments for center finding are available, and you can also improvise your own center locator.

One way is to use a piece of thin feeler slack or paper as a center finder. Mount a blunt ended bar in the tool holder. Place the paper strip between the bar and the workpiece and advance cross slide until the tension barely holds the paper in place. Then rotate the chuck. If the tension decreases or increases it indicates work is not centered. Another useful and very precice indicating method is to use a coating of very thin black or blue lacquer. Revolve the chuck by hand and a



18C Backplates are supplied oversized. Only a fine trulng cut is required.

lathe tool tip will mark the high spot on the workpiece.

Center punched for the desired bore or cut. you can suspend some workpieces between the tailstock and headstock centers, and then screw the jaws inward until they contact the work. This practice is not recommended unless you "torque in" each jaw very carefully since the center can be deflected by the chuck leverage.

DB 1001a 4-JAW CHUCK CAPACITIES

	Setup	Decimal inches	Nearest Inch fraction	Millimeters
JAWS NORMAL	A. (Ext.)	.157 -.945"	11/64-15\16"	4-24mm
	B. (Int)	.709-1.535"	45/64 -1-17/32"	18-39mm
	C.(Int.)	1.338 - 2.165"	1-21/64 - 2-5/32"	34-55mm
JAWS REVERSED	D.(Ext.)	.945-1.653"	15/16 -1-41/64"	24-42mm
	E.(Ext.)	1.575-2.244"	1-9/16 - 2-15/64"	40-57mm
	F. (Int.)'	2.20 3.0"*	2 13/64 - 3"*	66-76mm*

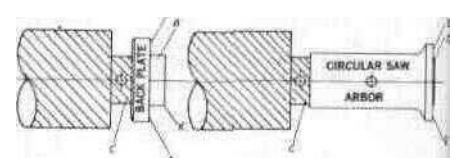
Note: Capacities are greater with Raising Block (DB 1310) is used and when chuck is mounted on cross slide or on vertical setup.

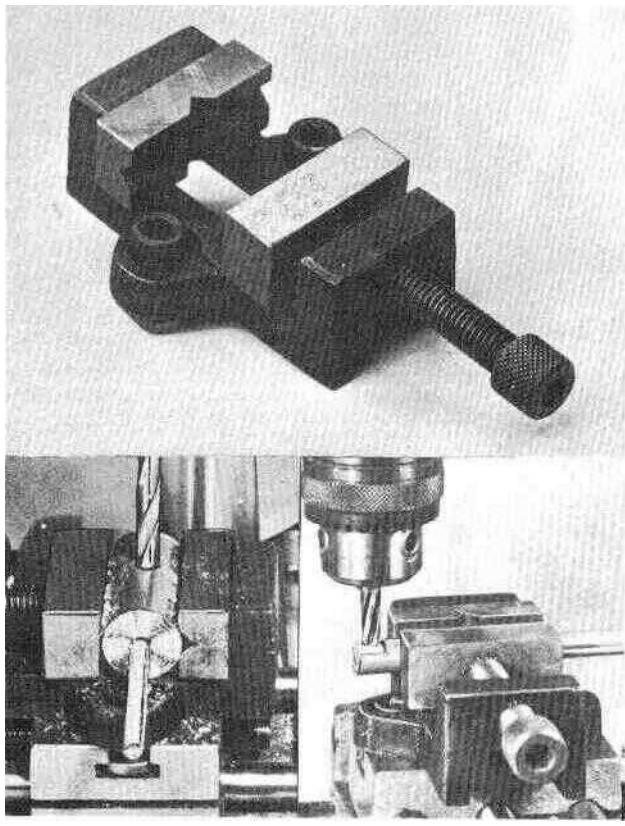
***Indicates outside diameter of workpiece. Note that this is not intended for lathe machining, but may be useful in polishing O.D. of tubing indexing, etc (Ext.) indicates external gripping of O.D. (outside diameter) of workpiece. (Int.) indicates gripping of I.D. (inside bore dl of workpiece.**

TRUING INSTRUCTIONS

The following steps apply to lathe chucks DB 1001 & DB 1001 A, and also to the DB 1020 Collet attachment, DB 1030 Polishing Arbor and also DB 1230, 1230A Circular Saw Arbor.

1. Align the lathe centers (see page 10) and check. Then tighten headstock clamping screw.
2. Clean threads of headstock spindle and backplate adaptor.
3. Thread backplate on headstock spindle until rear face seats firmly against spindle shoulder, C.
4. Use right hand facing tool to take light cut on vertical bearing surface A. Be sure to lock carriage on bed and feed tool from center outward.
6. Then set tool to take lightest cut possible on surface B. The diameter at B must fit exactly into the rear recess bore of the accessory. Undercut where A and B join, to ensure proper seat. Use a fine file at point C to round the leading edge slightly.
6. Clean chips and try the accessory for fit. You may have to repeat the cut and try several times until the fit is perfect. The result will be a perfectly balanced accessory.
7. If you make an error, additional adapters, DB 1001a/1 for the 4-Jaw Chuck, DB 1020/3 for the Collet Attachmert, and DB 1030/1 for the Polishing Arbor can be ordered separately.
8. Mount the accessory with the screws provided.
9. DB 1230 and 1230a Circular Saw Arbor is supplied threaded to fit the spindle, but to center the saw surfaces D and E must be fitted and faced in the same way as for chucks.





DB 1010

MACHINE VISE

Next in line to the 4-Jaw Chuck, the Machine Vise is the most useful accessory you can own. The jaws hold work up to $1^1/_2$-inch for drilling, milling, grinding and sawing. Also, the vise can be fastened to your bench, or screwed to a piece of flat steel to make a very useful hand vise.

Jaws are dead parallel. The fixed jaw has a milled vertical and horizontal V-slot which will center round work. The vise mounts either on the cross slide or the DB 1210 Milling Table, with two T-nuts which fit the Allen head screws used to mount Unimat accessories.

Photo at left shows how vise centers round work. A flat for a pulley set screw (center) is milled by feeding the work back and forth under the milling cutter. (Right) Step milling a jig part.

DB 1210

MILLING TABLE

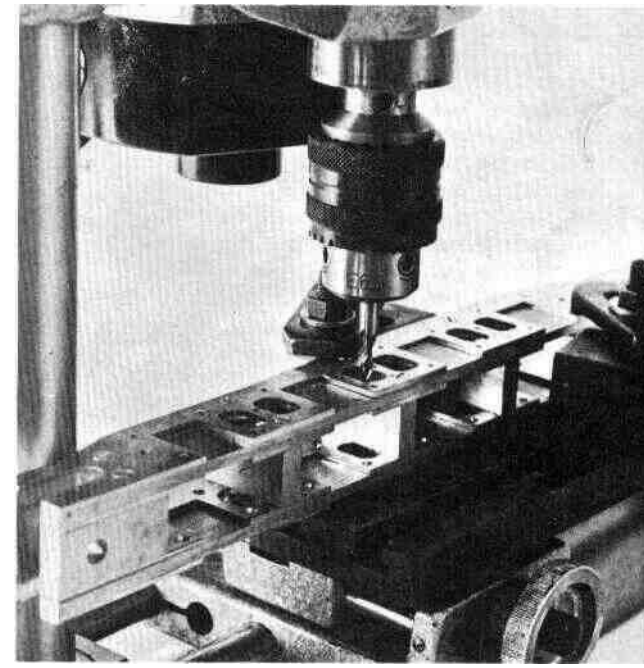
The 3 x 5-inch Milling Table is a true flat surface on which round stock, machine parts, model castings and practically any irregularly shaped part can be clamped. The T-slots in the table are the same size as the one in the Unimat cross slide. This makes it possible to use the slotted screw chuck mounting method (see Photo 13A) to mount chucks or faceplates at any point on the table effectively increasing the operating range and versatility of the basic Unimat.

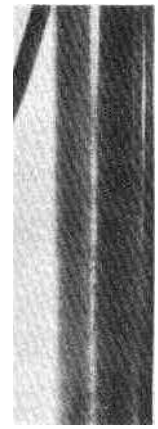
A very unusual Unimat technique is possible with the milling table. A part can be chucked in any Unimat, chuck, collet attachment, or mounted on the faceplate. Then, without upsetting the centering, you can remove the chuck from the lathe, mount it on the milling table for a cut, and again return to lathe operations.

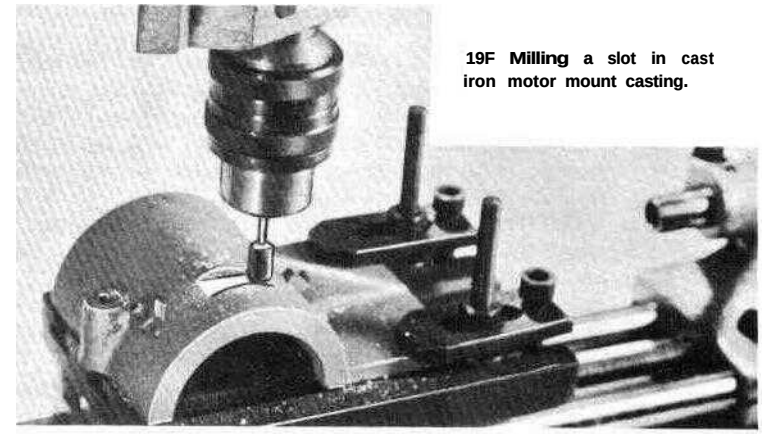
Two T-nuts hold the milling table to the cross slide in 8 *different, ways,* lengthwise, vertical or at a 45-degree angle to the lathe axis. When mounting your work, arrange the T-slot, clamps so that the longest possible straight surface is in contact with the top of the table.

You can mill with the vertical drill press position, or set the headstock at an angle. Milling is easy after a little practice. Start with test cuts in light alum-

19E There's no limit on milling length. If your work is over a foot long, support the outboard weight with casters or rollers. Project shown is a 20-inch locomotive frame.





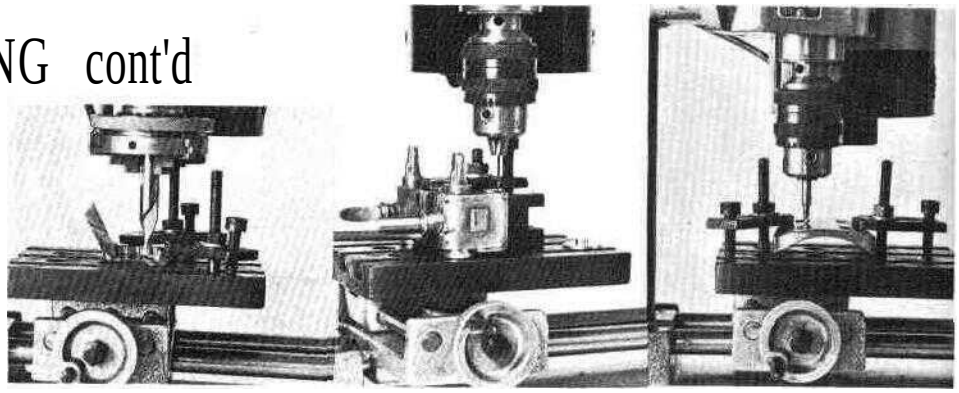


19F Milling a slot in cast iron motor mount casting.

inum or wood to get the feel of the machine. The most frequent mistakes are using too high a spindle R.P.M., or feeding too fast. General purpose mills will do a good job in most materials, but for the fastest cutting and best finish, it is best to buy milling cutters designed for the material. For example, aluminum cutting mills have broader edges and less flutes, while milling in cast iron is best done with the kind of mill that has more flutes and low clearance to prevent digging into the work.

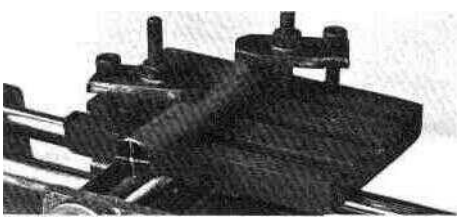
One way to roughly estimate the proper R.P.M. is to divide the recommended drilling speed for the same diameter tool by 2. Milling requires the same cutter lubrication recommended for lathe work and drilling. Always be sure that machine and work are solidly locked down, and make your starting cuts lightly. Feed the work under the mill slowly and evenly. (The DB 1290 Power Feed Attachment gives you an exceptionally even cut on long pieces).

If a milling cutter chatters on the work, it means your feed is too fast or you are trying to take too deep a cut. The final down-to-size finishing cut should be very fine, removing as little as a thousandth of an inch of metal, while roughing cuts can be as deep as .04-inch in steel and more in wood, plastic or aluminum.



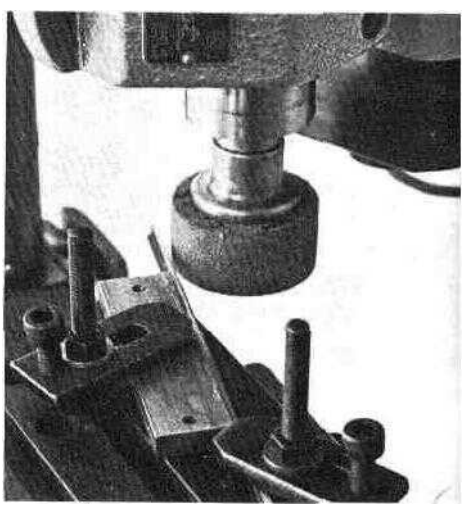
10A, B, C Complex shapes milled In parts for a working model steam locomotive. Use the drill chuck, or Collet Attachment, for mills under 1/4-inch, and the 3-jaw lathe chuck for larger sizes. The bigger the mill the slower the R.P.M.

If only a little milling work of a certain size is needed, the resourceful Unimat owner can improvise milling cutters by grinding the ends of discarded drill points flat, and by cutting back the trailing edges of the drill flutes. Many hand carving tools can also be used for milling plastic and aluminum, but not iron, steel or brass.



20D Typical mounting for milling flats on shafts. If you need additional milling clamps and bolts, order 1210/3.

Always protect your eyes during milling with a plastic shield clamped between you and the machine, or with Safety Goggles (see XR 53, page 33).



20E Surface grinding is usually possible only on very expensive machine tools. This Unimat setup is capable of split-thousandth accuracy and can be used to produce parts for guns, cameras, gauges and scientific Instruments.

DB 1260

INDEXING AND DIVIDING ATTACHMENT

Gears, cams, flanges, lens mounting rings and other circular parts often require a series of evenly spaced holes arranged on a circle. The DB 1260 attachment has a precise spring loaded pin which locates angles on the circle by fitting into a toothed index plate. This index plate is protected from dirt and chips by the casting as shown in photo at right. The attachment is supplied with one 48-division index plate. Index plates giving other divisions are separately available.

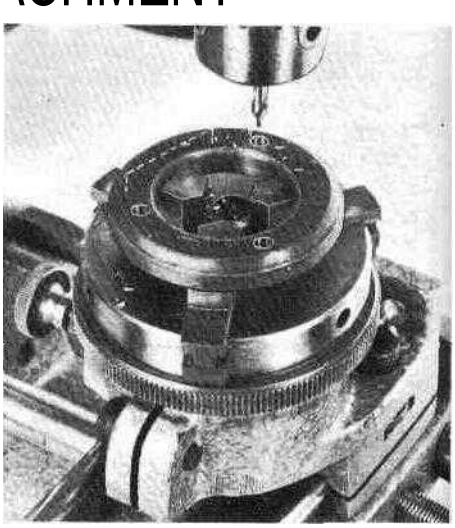
You can use your Basic Unimat 3-Jaw Lathe Chuck on the attachment. It has a built-in backplate. Just remove the lathe chuck backplate, place the chuck on the attachment, line up the holes and mount with the three screws. Be sure to tighten them a few turns each at a time, instead of running them all the way in. On any such assembly, you can damage the fit by tightening one side before the other two screws are in place.

Odd shaped or bulky workpieces can be easily clamped to an accessory unit, DB 1261 Round Table. This table has 3 T-slots and 3 clamps. The table slots are the same size as those in the DB 1210 Milling Table and the cross slide of the lathe, so that clamping bolts and nuts used on other attachments will fit.

Let's demonstrate a typical job. The flange in Photo 20F requires three precise equally spaced holes. Also we need to cut a "flat" on one side of the flange dead parallel to the holes. We can use the 48, 36 or 30 division index plate, since three divides equally into any of these numbers.

Since the center of this flange must press fit on a machined shaft, we previously turned the inside diameter of the flange with the chuck jaws reversed. The outside of the flange requires no turning, so we replace the 3-jaw chuck jaws in normal position and grip the flange on its inside diameter.

Now our holes in the flange must be located on an exact $1^3/_8$-inch circle. With the workpieee still chucked in the lathe, we mark the circle by coating the flange face with machinist's marking dye. a lacquer-like fluid that dries in a few seconds. With a scriber point in the lathe tool holder it is easy to engrave a precise circle, simply by rotating the spindle by hand. Then, at any point on the circle, we carefully punch a center mark.

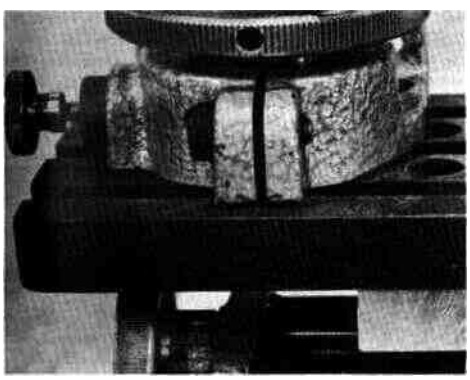


20F The attachment may be mounted in 8 different ways on the cross slide.

Next, we mount the chuck on the Index Attachment and using the drill press handlever, we bring the center drill (mounted in drill chuck) down to the center punch mark. Lathe feeds are used in both directions to bring work to exactly the right place. Lathe cross slide and carriage locking screws are now locked down solid. We also tighten the drill press column clamping screw.

As a safety measure, we now use a crayon to mark the location of the first hole. Then we pull the pin and rotate the chuck about a third of a full circle. When we release the pin, it goes down into the index plate tooth at that point, guaranteeing that we have moved an exact 120 degrees. We repeat this step again and then turn the chuck to its starting place.

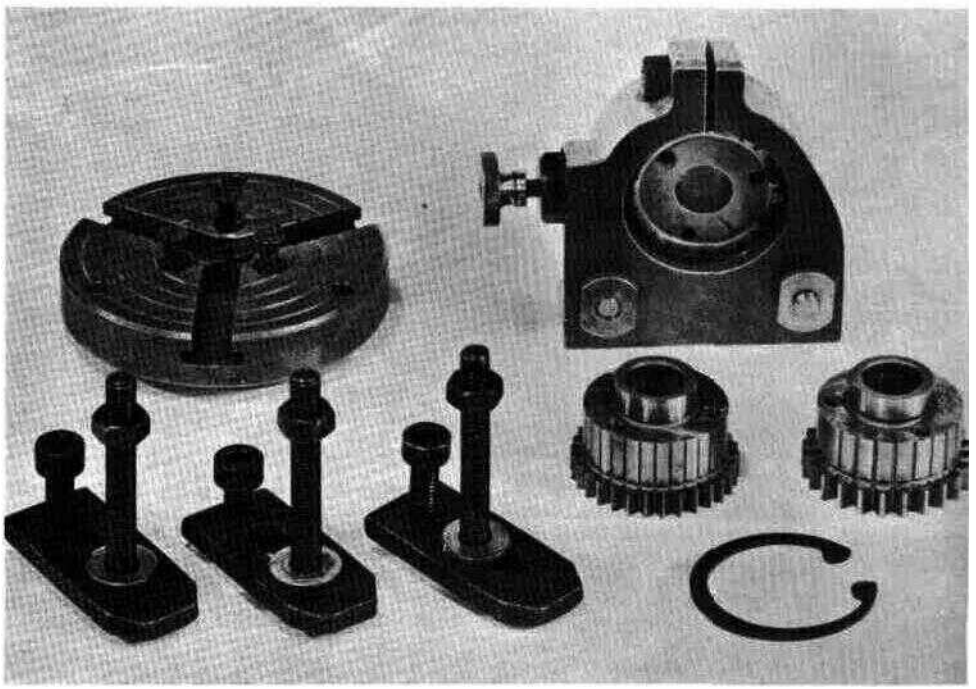
Now we tighten the Allen head locking screw on the attachment. This locks the assembly tightly in place and prevents the slightest rotation. The first hole is drilled, followed by the second and third holes. In each instance, a starting hole is made with the center drill, followed by the regular drill. For this kind of job, we reserve a set of sharp new drills that are perfectly true on their cutting edges. The crayon marks previously applied prevent errors in using the wrong cog on the index plate.



21B You can increase capacity of your Indexing Attachment (mounted here on DB 1210 Milling Table) by making a raising block that allows the table to pass over the cross feed knob. The 1/2-inch thick aluminum or steel block measures 2 x 3 1/2 inches. Holes drilled through the block match the Milling Table for bolting.

Dividing Procedure

To mill the flat on the side of the flange, we turn the chuck to a point midway between two of the previously used points. The Dividing Attachment is firmly locked. We replace the drill with a small milling cutter, loosen the cross slide feed locking screw, and back the assembly away from the drill toward the front of the lathe bed. The cross slide is again locked, and now we use the lathe carriage feed screw to run the work back and forth under the milling cutter, advancing the cross feed each pass. Thus we cut a flat edge on one side of the flange.



21A DB 1261 Round Table (top left), accessory to Indexing Attachment mounts with three flat head screws. Indexing Attachment DB 1260 (top right) is shown with Index plate installed. The Round Table has three tapped holes which fit all Unimat 6mm round head Allan screws.

Index Head Applications

The basic method of indexing and dividing described above can be used to mill (and grind) a wide variety of materials into triangular, square, or multi-sided shapes of any number of sides as shown in the table. To save time in your setups, use wood and rotary carving or wood routing bits to practice cutting angular shapes.

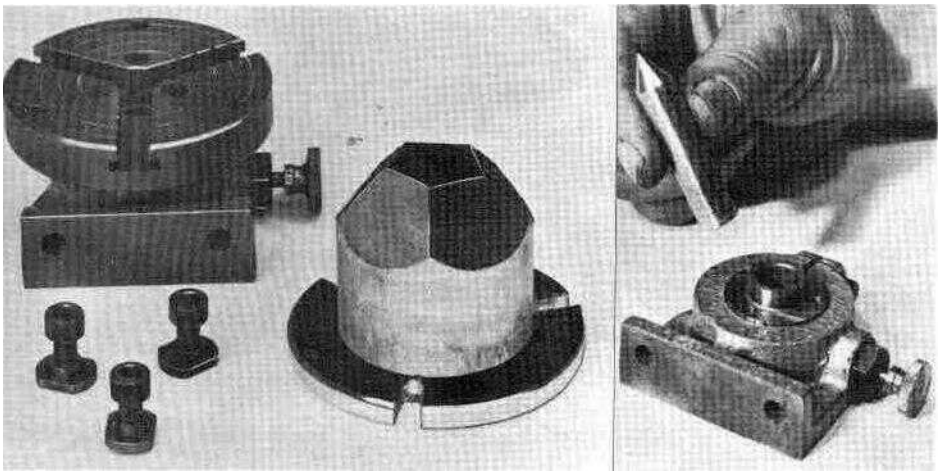
Square bolt heads can be made by this method, as well as hexagonal bolts of any size. A pyramid shape can be milled by setting the headstock at an angle. Gears require a milling cutter shaped to the exact profile of the desired gear tooth. If the gear teeth are to be milled at an angle, you'll need to improvise an angle base for the Indexing Attachment which can be bolted between the attachment base and the Milling Table. If possible, obtain a finished gear of the same pitch angle desired, and use it to make trial test cuts. Because of the wide variety of gear designs, detailed instructions are not given in this manual. To produce evenly milled teeth, you will need to add carriage and cross slide stops to your Unimat.

To produce common service gears, it is suggested that you can save time by first milling a test blank of the proper diameter in soft material such as Masonite Benelux, or any good plastic. To machine instrument gears of high precision, the only approach is to mathematically compute all required distances, feeds and traverses, and to improvise test fixtures to check each cut.

Interchangeable Index Plates	For Circular Divisions In These Combinations
48 (included with attachment)	2,3,4,6,8,12.16,24,48
40 (DB 1263/40)	2, 4, 5, 8. 10, 20, 40
36 (DB 1263/36)	2, 3. 4, 6, 9, 12, 18, 36
30 (DB 1263/30)	2, 3, 5, 6. 10, 15, 30

To interchange index plates, remove the retaining ring from the slot in the rear of the casting. Use a needle nose plier or retaining ring plier to compress the snap ring. Four index plates provide 18 different divisions.

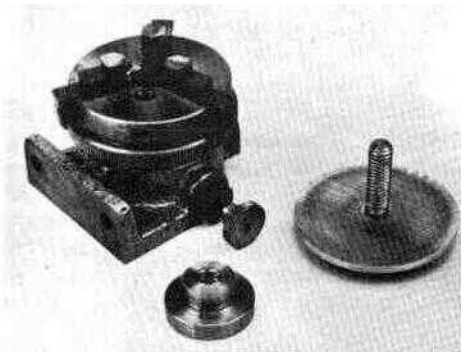
ACCESSORIES INDEXING DIVIDING cont'd and GEAR CUTTING

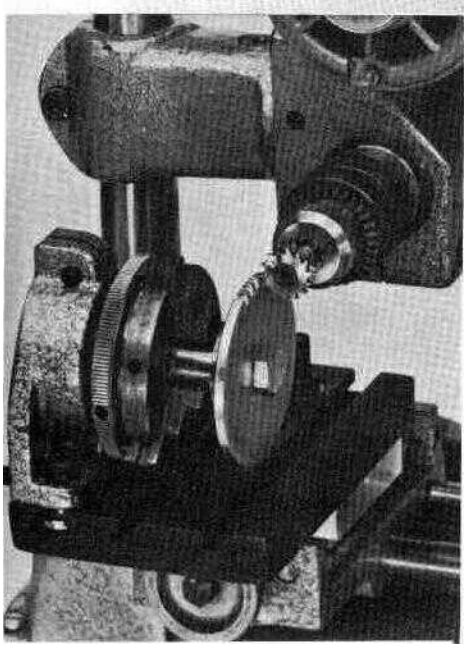


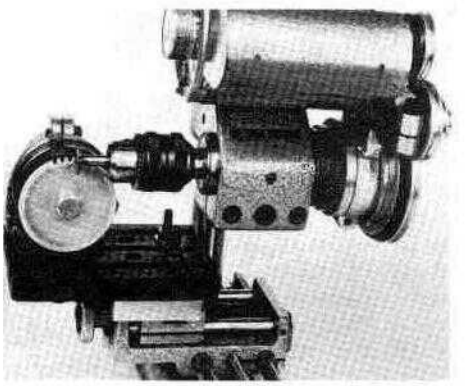
The intermediate mounting plate shown at top left was turned on the Unimat lathe to fit over the Indexing Attachment plate. Made of 1/4-inch aluminum, it has a 1/2-inch center hole. The wooden workpiece, in this case, a 1 3/4-inch maple dowel would have been marred if mounted in the regular 3-jaw chuck. To mount even larger work pieces, make your own mounting plate as shown, but instead of bolting to the Round Table with the T-slot bolts, run screws up through the bottom of the table.

Center photo shows method of locating large workpieces over Indexing Attachment. A piece of 1/2-inch cold-rolled steel about 3 inches long was mounted between Unimat lathe centers and turned to a diameter to just fit the Round Table center hole. One end of the bar was turned to a point. Finished length should be about 2 1/2 inches.

Machine designer Ervlng Edell (above righl) checks angle of sawing cut on five sided block. Blocks of this type with any desired number of sides can be machined on the Dividing Attachment to make mathematical and chemical models, or bases for trophies, models, and chessmen. The same setup can be used for sawing botanical sections, or for making cutaway models of motors, and mechanisms.

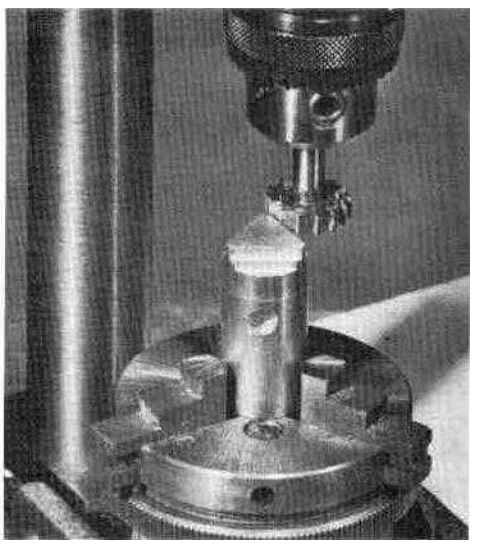






Three views of gear cutting selup show a general procedure. The first step Is to make your own gear blank holder. This one (above left) was turned on the Unirnat lathe from a piece of 1-inch round cold-rolled steel. The flat rear face rests solidly against the top of the 3-law chuck providing o precise centered grip. Since the gear was designed to fit a 5/16-inch shaft, a bolt of exactly this diameter partially threaded Is used as a center. A DB 1133 Woodruff-key cutter was ground down to the gear tooth shape to make the special gear milling cutter shown in photos.

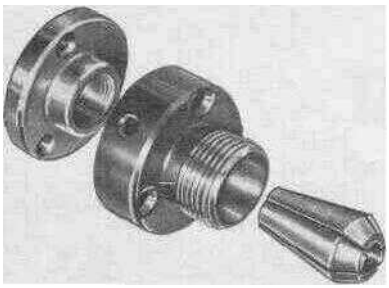
Instrument gears requiring mare accuracy than is obtainable on this setup would be mounted on your own thread-center, or taper center backplates turned to fit the Indexing Attachment. The cutting tool for greatest accuracy, should be mounted in a special holder or in DB 1020 Collet Attachment. The 1/4-inch collet available for this attachment will fit many special milling cutters and grinders available in that sizeshank.

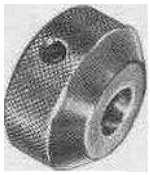


[Above) 3-Jaw Chuck screws directly to attachment collar to automatically center work. Two step triangular insignia plate is milled with Woodruff cutter. Object is setting for ring,
(Below)Unimatversatilitysolvesmachineshop problem. In seconds, Indexing Attachment bolts to DB 1 2 1 0 Milling Table which in turn clamps to large drill press table. Ordinarily, job could be handled only with expensive Milling Table.

DB 1020

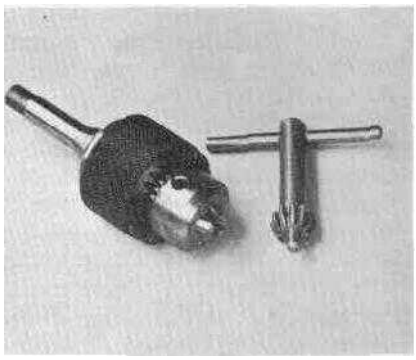
COLLET ATTACHMENT AND COLLETS





The Collet Attachment is used on the Unimat lathe, drill press and mill, whenever round stock, or tools must be gripped with utmost precision. There are four main parts, (from left to right) the back plate, collet holder body, collet and nose piece. The back plate fits the headstock spindle. Since it must revolve with perfect concentricity on your machine, you will need to take a small truing cut, as shown in Truing Instructions, on Page 18. Flat head screws are provided to fasten the collet body to back plate.

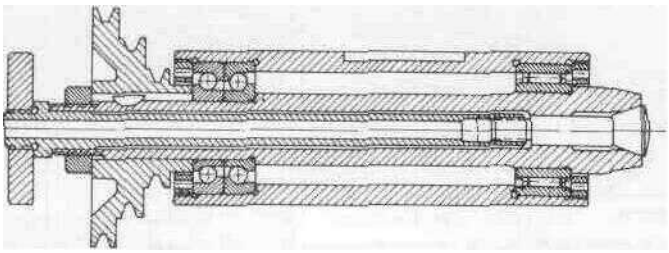
Quarter-inch and 1/8-inch collets will grip the most popular size tool shanks. Never chuck anything but the rated size in any collet. An attempt to grip work more than a few thousandths over or under can cause damage to the collet. Collets are available in all 64th-inch sizes up to 5/16-inch and in all half millimeter sizes from 1 through 8mm.



DB 2600

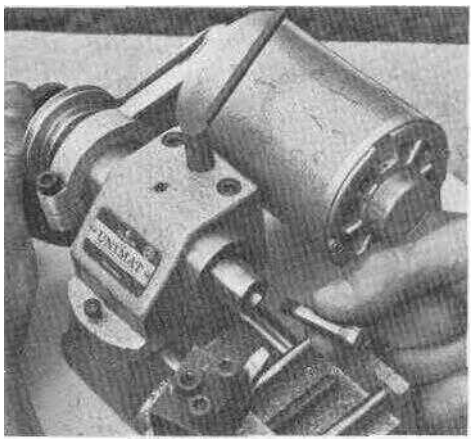
DRAW BAR SPINDLE

for ultra-fine precision work

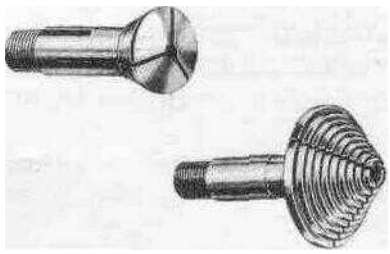


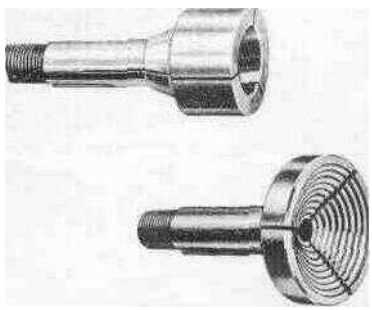
This accessory replaces the standard Unimat headstock spindle. It takes less than a minute to install the assembly which converts your Unimat into a machine capable of watchmaker's precision. The spindle accommodates all standard WW (watchmakers) size lathe collets, chucks and accessories, shown. Like the standard spindle, the Draw Bar Spindle engages the headstock hand-Feed lever so that it can be used to feed either in the drill press or lathe positions.

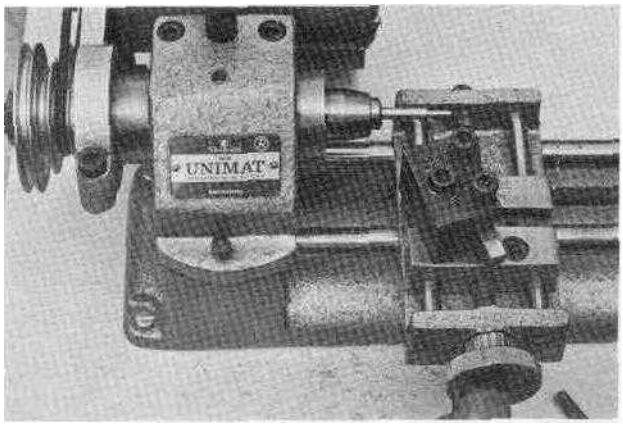
Like the Collet Attachment, collet chucks for the Draw Bar Spindle must not be forced or distorted by use on any size other than the exact diameter stamped on the nose. Bar stock up to 4mm diameter (.157-inch) can be fed through the hollow center of the draw bar. Spindle runout is rated at .0004 or less.



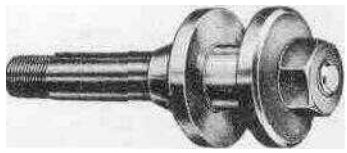
Before installing collet make sure spindle recess is perfectly clean. Collet keyway must line up with spindle bore key.







Draw Bar Spindle is suitable for production work on small instrument parts.



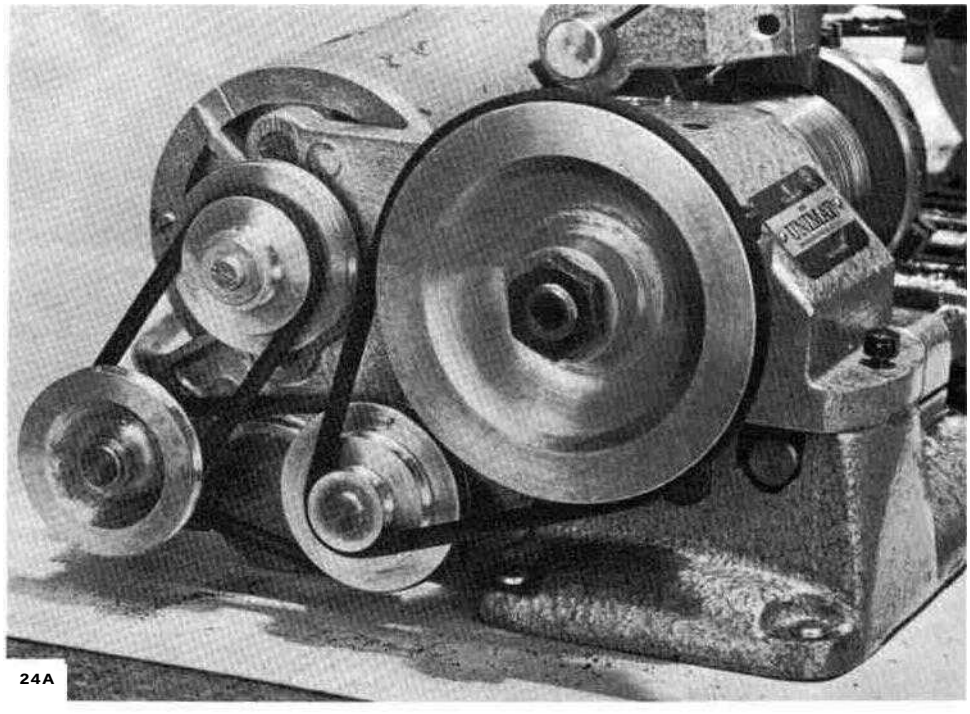
DB 1280
SLOW SPEED ATTACHMENT

This attachment consists of a casting which adds an extra idler pulley to your Unimat power drive system to give you two additional low speeds, 100 and 330 R.P.M. These speeds must be used when turning large diameter work, in threading, and machining hard metals.

To install the attachment, unscrew the motor pulley screw, remove the pulley and unscrew the motor from the original motor bracket casting. Then remove the headstock spindle from the headstock housing. The motor bracket casting can now be removed from the spindle assembly by loosening the Allen head screw. Replace with the Slow Speed Attachment and re-assemble as in the photo.

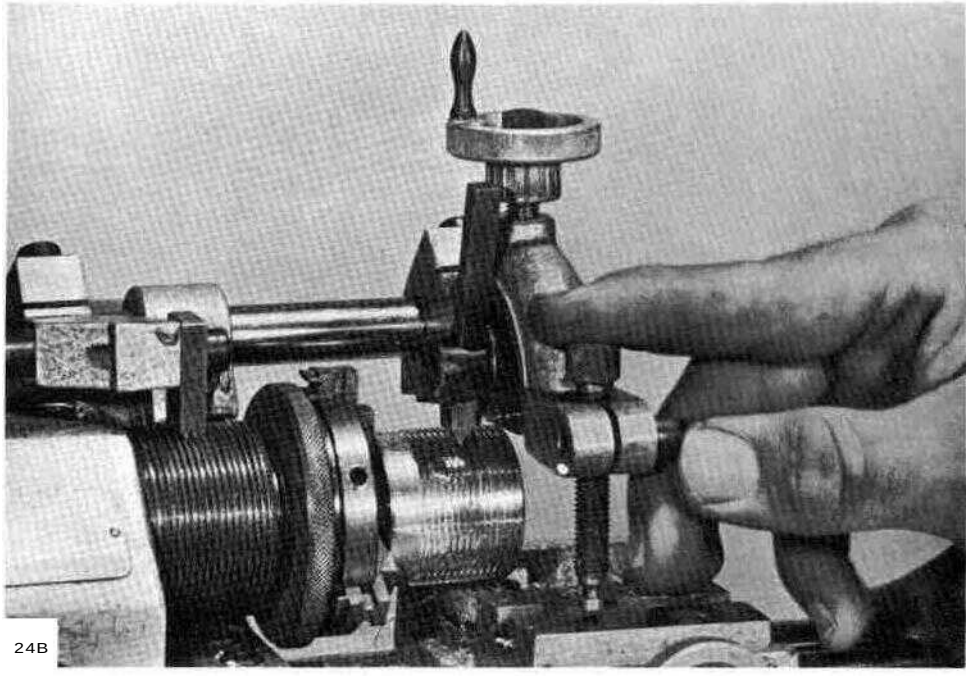
Use a straight edge to make sure the pulleys are in exact plane to one another. Avoid over tightening the Allen head screw which holds the idler pulley ball bearings. The bearings must spin freely without binding.

With this as well as many other attachments, you will find it convenient to mount the Unimat bed on a block of wood about an inch thick. This permits easier changing of the belts.


24A

DB 1270
THREADING ATTACHMENT

Unimat produces precision threads in all common sizes from 16 through 56-per-inch!


24B

'Using your Unimat Threading Attachment is actually easier than working with the carriage lead screws and gears on most lathes, and it is far more accurate. Precision threads for cameras, microscopes, telescopes, measuring instruments and laboratory apparatus are all easy to make.

Instead of a lathe lead screw, the attachment uses a mode of operation usually found only on very expensive special lathes. A master pattern controls the thread pitch (distance between thread crests). The cutting tool, as shown in the photos, is pulled along the surface of the workpiece by a follower that rides in the master pattern. These thread patterns (DB 1271) are available from 16 to 56 threads-per-inch, and from .50 to 1.50 mm.

There is very little wear on the thread pattern because it is made of hard steel, and the follower is brass. The brass surface takes the wear, and the more costly part, the master is unaffected. When the brass follower wears down so much that accuracy suffers (only after hundreds of threading operations) replacement followers are available at nominal cost.

To install the attachment, fasten the two mounting brackets at each end of the lathe bed. You can use either the 3-jaw or 4-jaw chucks for threading. Remove the backplate from the chuck and reassemble on the spindle with the desired pattern placed between the chuck backplate and the spindle end, as shown in drawing.

Packed with attachment are a set of flat head screws slightly longer than those ordinarily used to mount the chuck to its backplate. To cut American Standard, and Metric threads, use the 60-degree thread cutting tool supplied with the attachment. (Whitworth and BSF threads require a 55º point). Other thread forms, square, rounded etc. require that you grind a tool bit to the desired shape and angle.

Let's suppose that you want to cut a 1/4-inch x 20-thread screw. This is a

THREADING cont'd

very common size used on camera screws and laboratory apparatus. The first step is to assemble the attachment with either 3-jaw or 4-jaw chuck.

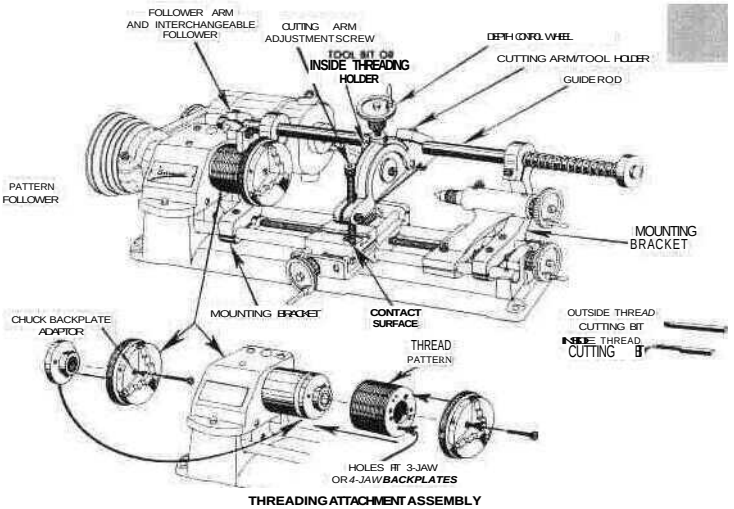
We start by checking the major diameter with a micrometer. In this case, a 1/4-inch screw has a nominal diameter of about .250-inch. Turn down the section of metal to be threaded to this diameter. If the work piece is a stub thread (Photo 24B), it is a good idea to file a rounded edge on the end of the work for a better start.

Then mount the thread cutting lathe tool as in Photo 24B so it just touches the workpiece. The cutting arm adjustment screw rests against the top of the lathe cross slide, and this surface serves to guide the cut.

The thread pattern must be set so it can be engaged at the first thread on the right side of the thread master as we begin the cut. Threading must be done at the lowest lathe speeds, and for large diameter work, the Slow Speed Attachment (DB 1280) will be needed.

The threading cut is a rapid process. You simply press down on the cutting arm adjustment screw. The thread follower engages the master thread pattern, and the lathe tool traverses the work cutting a fine line in the surface of the metal. We repeat the operation several times. At the end of each cut, the assembly is automatically lifted upward. After every few cuts, we can increase the depth of thread by turning the depth control wheel. As the thread is formed, we can measure it by any one of several methods.

The easiest way is to compare with a screw that is known to be accurate. The depth of thread can be measured by wrapping wire around the diameter and measuring with a micrometer. Special thread micrometers with pointed anvils are available, or you can simply fit the thread into the nut or tapped hole within which it is to work.



THREADING ATTACHMENT ASSEMBLY

With a little practice the threads you make on your lathe should easily equal the quality of threading found on ordinary commercial hardware. To produce instrument threads, there are two distinct approaches. The easiest way to make high quality fits is to individually mate pairs of threaded parts, and this method will serve for most model and experimental work.

A more time consuming and painstaking approach is to follow factory procedures in setting your own tolerances for the fits of threads you cut. To do this, you will need to consult good manuals on thread standards.

Internal threads are cut in the same way as external threads, except that you mount the DB1106 inside threading bit (part of DB1100 lathe tool set) on the internal cutting arm (Photo 25B), with the point of the tool facing downward. As you back the assembly out of the bore after a cut take care not to nick the finished threads.

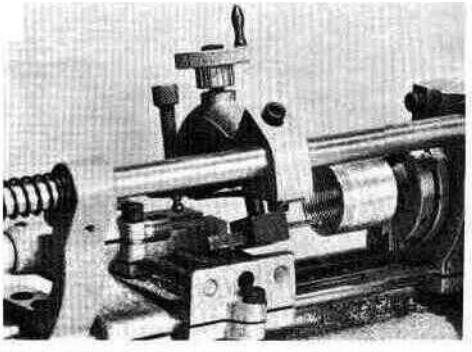
In all threading work, it is important to keep your threading bit tips sharp by touching up with a fine stone. Use light cutting oils for threading steel, and kerosene for aluminum. The workpiece and all parts of the Threading Attachment must always be solidly fastened in place. Whenever you set up for threading a workpiece, scribe a witness mark opposite your #1 chuck jaw. If the work should slip in the chuck you will be able to return the work to its original starting point. Multiple threads and compound threads can be cut by first producing one thread, and then rotating the work the desired number of degrees to a new mounting position in the chuck.

AVAILABLE INCH THREAD PATTERNS AND CORRESPONDING THREAD SIZES

PATTERN (THREADS PER INCH)	NC DIAMETER	NFDIAMETER	WHITWORTH (BSW) DIAMETER
16	3/8"	3/4"	3/8"
18	5/16"	9/16"& 5/8"	5/16"
20	1/4"	7/16" & 1/2"	1/4"
22	not a standard size		
24	#12 (.2160") & #10 (.1900")	5/16" & 3/8"	7/32" & 3/16"
26	not a standard size		(For 1/4" Br. St. Fine)
28	not standard	1/4" & #12 (,2160")	notstandard
30	not a standard size		
32	#8 (.1640") & #6 (.1380")	#10 (.1900")	5/32"
36	not standard	#8 (.1640")	not standard
40	#5 (.1250") & #4 (.1120")	#6(.1380")	1/8"
48	#3 (.0990")	#4(.1120")	3/32"
50	not a standard size		
56	#2 (.0860")	#3 (.0990")	not standard

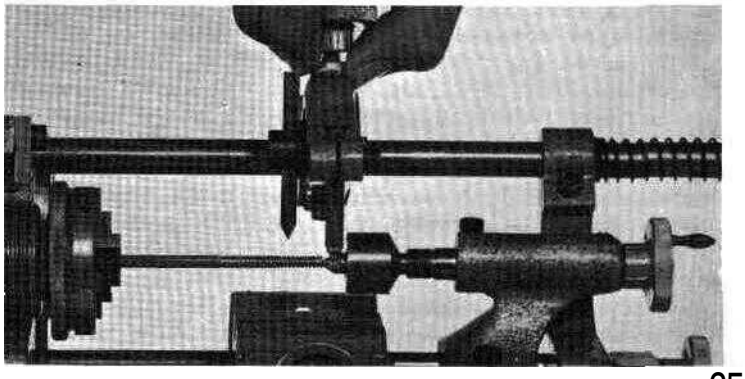
AVAILABLE METRIC THREAD PATTERNS AND CORRESPONDING THREAD SIZES

PITCH	INTERNATIONAL STD. DIAMETER	FRENCH STANDARD DIAMETER
.50 mm.	3 mm.	not standard
.70 mm.	4 mm.	not standard
,75mm.	4.5 mm.	4 mm. & 4 5 mm.
.80 mm,	5 mm.	not standard
1.00 mm.	6 mm. & 7mm.	6, 7, 8 & 9 mm.
1.25 mm.	3 mm. & 9mm.	not standard
1.50 mm.	10mm. & 11 mm.	10mm. 8 12 mm



24A
Inlernal Ihreading (right) requires drop bar tool holder.

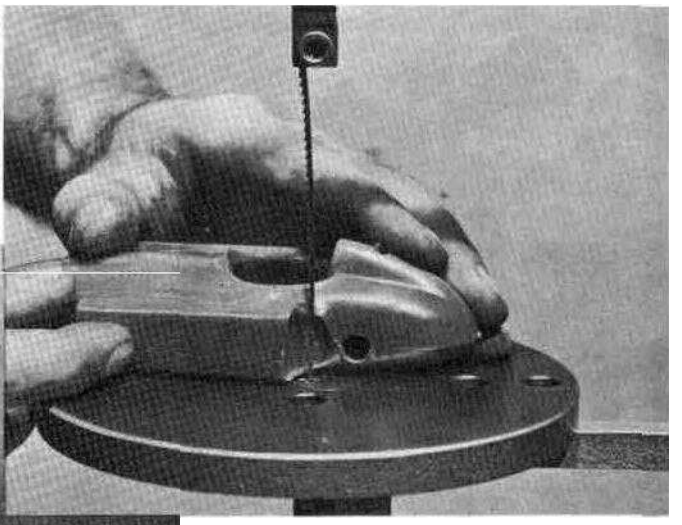
24B
Support long, thin workpieces (below) with ball bearing live Center (DB1220 or1220a) intailstock.

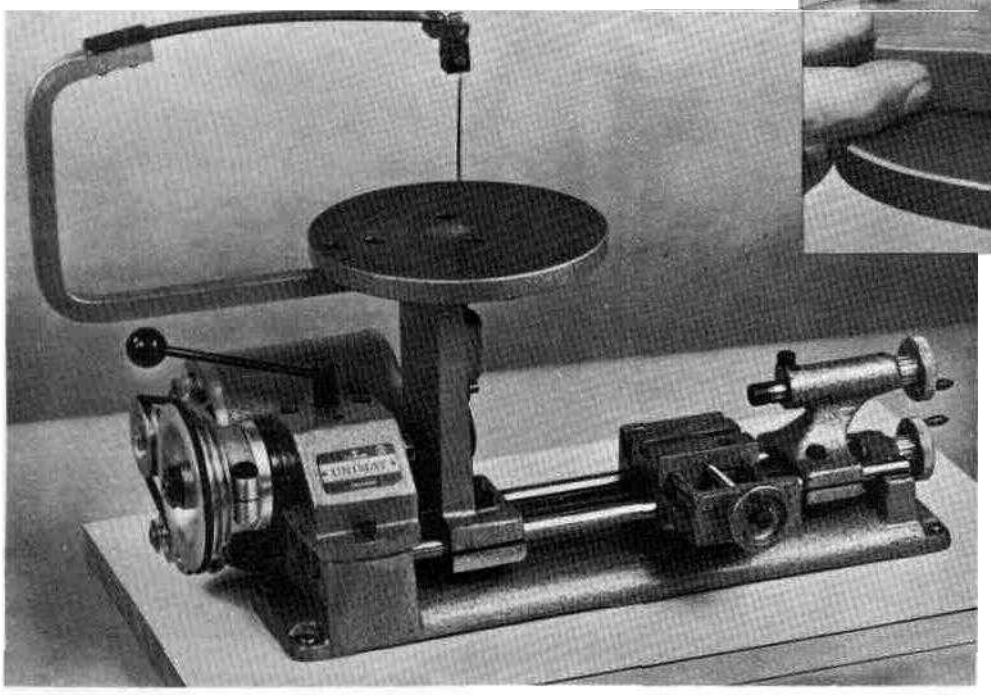


DB 1070

JIG SAW

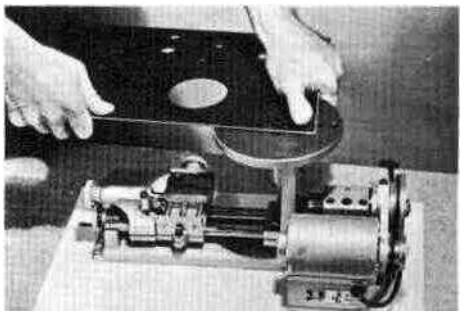
cuts intricate shapes in metal wood and plastics...

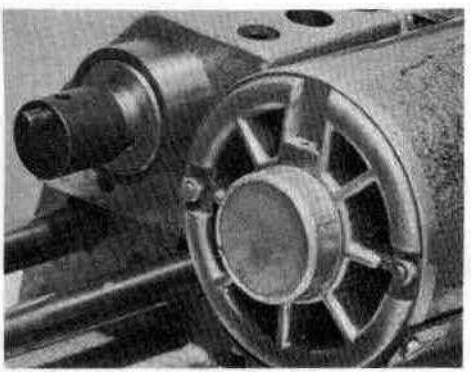


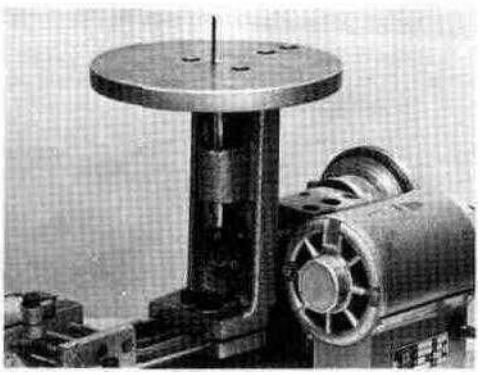


26A (Above) For delicate jobs use minimum spindle speed. A foot switch provides a convenient control factor.

26B (left) Jig saw will cut to center of 16-inch circle. Ball bearing mechanism gives smooth reciprocating action.







26C Eccentric drive threads on headstock spindle (left).

26D With frame removed, saber saw handles large workpieces such as electronic meter panel, above.

Perhaps the modeler's most useful attachment is the Unimat Jig Saw. It follows any line you can draw on metal, wood, plastic, and hardboard. The eleven speed headstock drive gives you a means of using just the right speed for the job, prolonging blade life and getting a smooth controlled cut. every time.

Your first step in installing the attachment is to feed the headstock spindle full right and lock it in place. Then put the jig saw eccentric drive on the spindle (Photo 26C). Next slip the base assembly over the bed and add the clamping plate as in Photo 26D. Before locking the Allen head screws, gently slide the assembly toward the headstock so that the eccentric drive pin engages the mechanism. Check the action by revolving the headstock pulley by hand.

The table fastens to the base with two Allen head screws. Install a saber blade and you are ready for saber cutting. Two more screws mount the jig saw arm, as in Photo 26B.

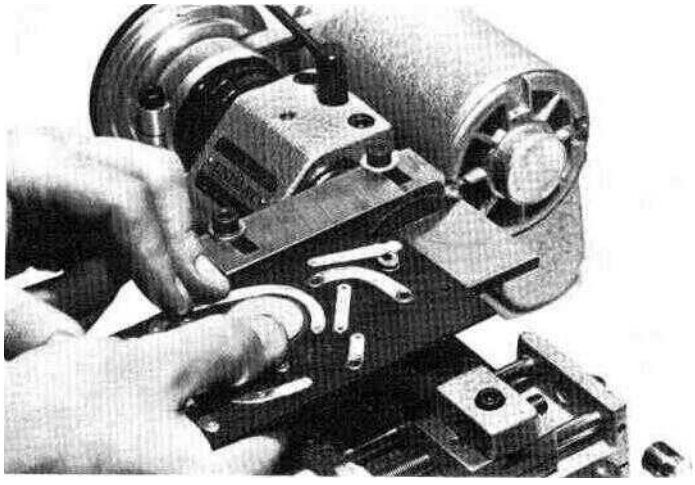
Before turning the power on. arrange your belt drive for lowest speed. It is always a good idea to make a trial cut at minimum R.P.M. to get the "feel" of the machine and the material. Then, you can increase speed for faster cutting. The blade must be centered in the slot, Jigsaw blades will break if they are clamped out of line.

A coarse-toothed blade cuts faster, but also tends to break or tear thin material. Fine-toothed blades tend to choke up on thick material. Usually the coarse blade is intended for fast wood cutting, the medium-toothed blade for plastics, and the fine-toothed blade for metals. Spiral-toothed blades have the advantage of cutting in any direction.

Unimat saber saw blades are color coded: blue for metal cutting, red for plastics, and yellow for wood.

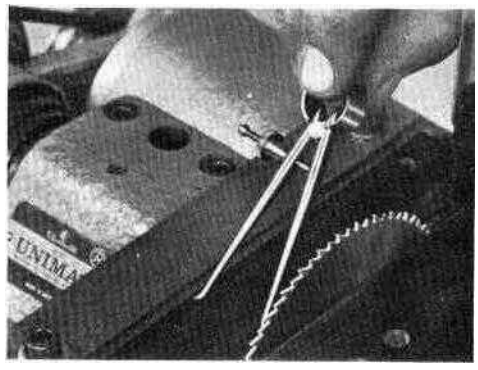
Photo shows boat bulkheads sawed from hardwood. To cut sharp inside corner, use spiral blade. With plain blade, make first cut slightly short of comer, then come in at right angle for finish cut.

DB 1230 21/2-INCH CIRCULAR SAW

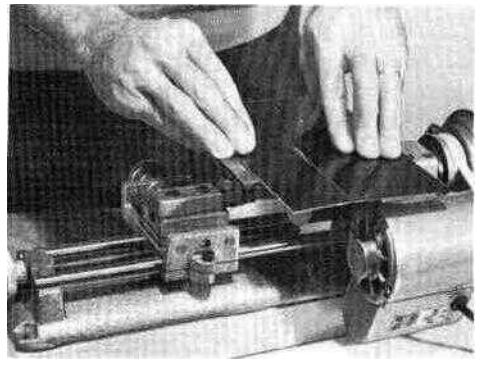


27A Electronic designers find small table saw ideal for cutting phenolics, printed circuit boards and insulating material.

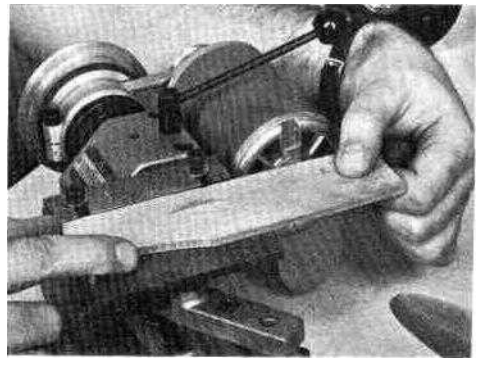
27B Fit blade properly and you've got the most accurate inexpensive table **saw** in the world!



27C Using XR 41 inside spring caliper to set fence for desired cut.



27D When cutting thin sheet metal, feed slowly. Lift and twist thin slices away from the rearmost saw edge to avoid jamming. Use kerosene on soft aluminum.



27E When wood grain converges near your saw line, the wood may compress back of the cut and jam the saw. Stop the saw and put a small wedge in the cut.

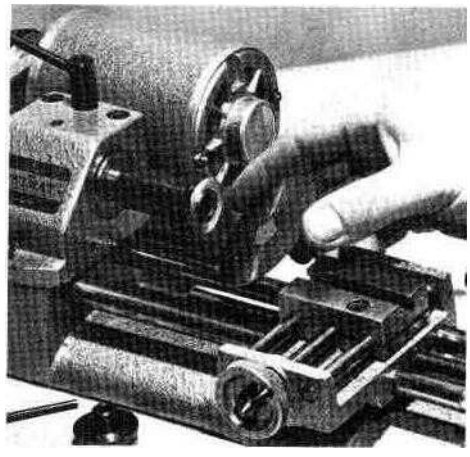
Unimat Circular Saw Attachments are designed to give you a tool at very low cost that will do extremely fine, straight accurate cutting of metals, wood and plastics.

Installing the attachment takes only a few seconds. If your Unimat is set up as a lathe, you can change over to the circular saw and back to the lathe in less time than it takes to change blades on some table saws! Be sure your headstock spindle threads are clean, and that the surface of the cross feed is free of chips. The attachment fastens to the cross slide with two Allen screws and T-slot nuts.

You will find that the saw blade will not fit the arbor until you take a fine truing cut with a lathe tool (see instruction, page 18). Proceed *very* cautiously. It takes a very small cut, less than 1/32-inch to fit the saw to the arbor. Unimat saw blades will then all fit the arbor, however the meticulous machinist; will want to permanently equip each special saw blade he acquires with its own arbor, because saws will wear into a more perfect circle with use. Also, you can devise saw sharpening fixtures which will dress the saw teeth while the saw is mounted on the headstock spindle. By such means, you can develop perfectly balanced saws for ultra-thin high speed cutting.

For ordinary work you'll find that the perfectly trued Unimat saw blade offers an advantage. Unlike the usual home workshop saw, you will be able to follow a marked line on wood very easily though guiding freehand. There is no tendency with a truly smooth running machine for the blade to pull away from the line.

A rip fence is included for repeat cutting. You can set it by rough trial and re-setting, or you can use an Inside Caliper (XR-41) to measure from the blade to the fence. A faster way requires that you have a sample piece of material of exactly the desired width. Layers of thin metal can be used to make up the thickness. Place the sample between the saw blade and the fence along with a layer of thin paper for clearance spacing. Gently press the fence toward the saw blade.



With the paper layer against the saw, the blade should just barely turn with a little resistance. Then lock the fence in place. On some materials you will need a very slight extra clearance at the rear end of the fence.

Every time you set up for precise slitting, cut an extra piece of stock about 4 inches long, mark it and save for future use as a width setting gauge. Sets of such "thickness blocks" will not only enable you to quickly run duplicate work in the future, but will have many other uses in your shop.

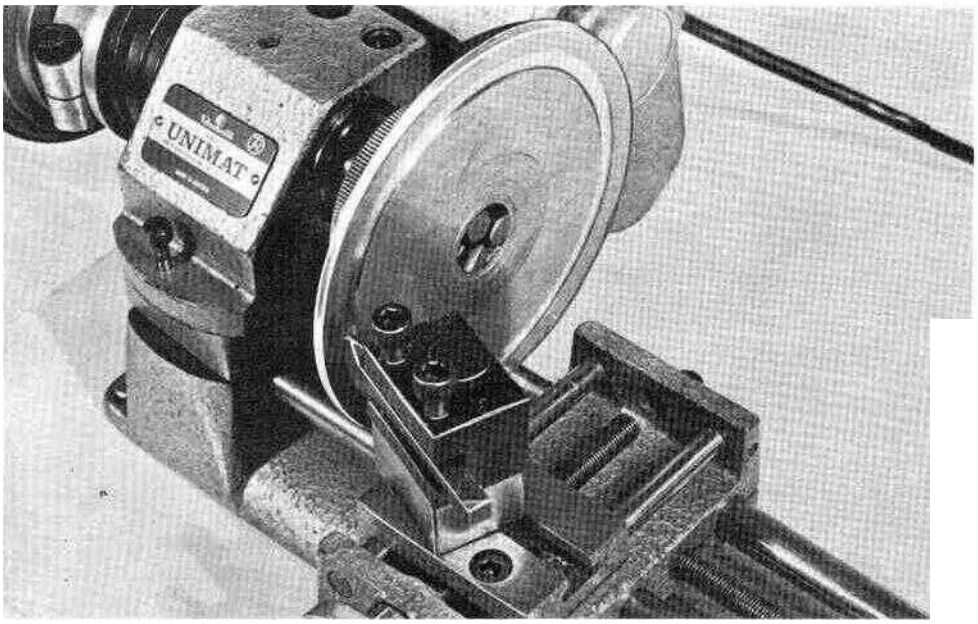
For a start, try ripping scrap material first. With a little practice you'll soon find that you can hold wood thicknesses to micrometer tolerances. The right speed for sawing in any material is the speed that gives you the fastest, smoothest cut without overheating the blade. Always feed gently. Feeding hard will overload the teeth—chips will backup, and overheating that can draw the saw blade temper, is the result. Excessive speeds can also burn the work.

Two standard blades, 2 3/8-inch diameter are stock for the small DB 1230 saw table. The coarse-toothed blade is intended for wood (DB 1231); the fine toothed blade for aluminum, light metals and plastics (DB 1232). Any fine-toothed blade can also be used on thin pieces of wood and will produce very accurate smooth cuts. But such use can overheat and ruin the blade. With care, cutting slowly, keeping the blade cool, it can be done in an emergency.

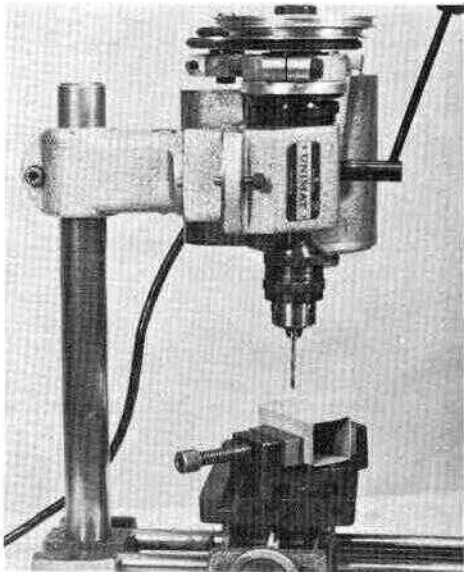
To cut very long thin pieces. or to cut large unwieldly sheets of material, you will find you'll need to improvise outboard sawing guides. Turn some 2-step rollers on your lathe. These can be mounted on heavy wood blocks nailed or clamped to the rear or sides of your work bench to guide the saw cut in an absolutely straight line.

DB 1310

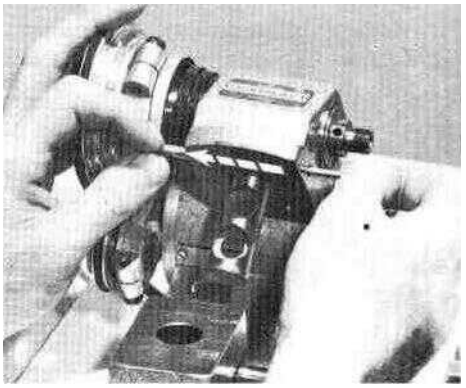
HEADSTOCK RAISING BLOCK & CLAMPING BOLT



Unimat lathe equipped with headstock and tool holder raising blocks machines aluminum disc of 43/16-inchdiameter.



Headstock raising block used on drill press set-up increases reach. Drill press will now drill lo center of7 5/8 -inch0 circle.



Clamping pin should pull out easily.

Fitting between the headstock casting and the lathe bed casting, this newly introduced accessory increases your lathe toafull 4 7/16-inch swing.

The block is steel, machined on both sides 3/4-inch thick and is supplied with a longer clamping bolt. Because the new bolt has two holes, you can use it on the lathe set-up, either with or without the raising block.

To install the bolt, remove the locking pin as the photo shows. After a long period of use. this pin may freeze in place. Do not force by punching or hammering. Use a drop of "Liquid Wrench" or penetrating oil to free the pin. Install the new bolt and replace pin.

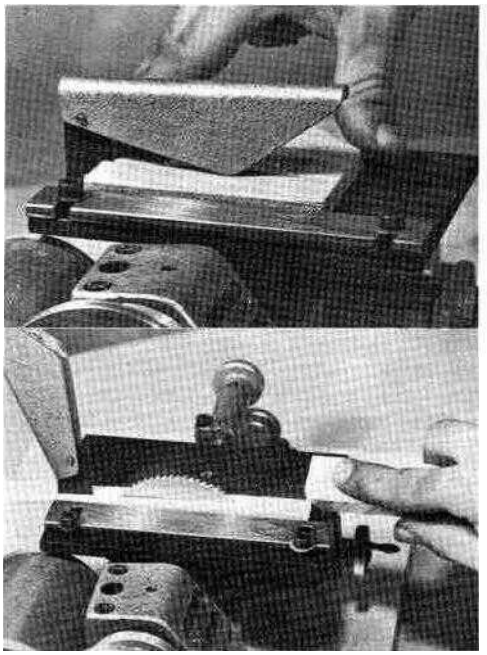
The quickest way to align the lathe headstock is to mount the face plate on the tailstock, and the 3-jaw chuck (with jaws removed) on the headstock. Partially tighten the tapered headstock clamping screw and butt the face of the 3-jaw chuck against the face plate, allowing the headstock to swivel into line. Tighten clamping screw solidly.

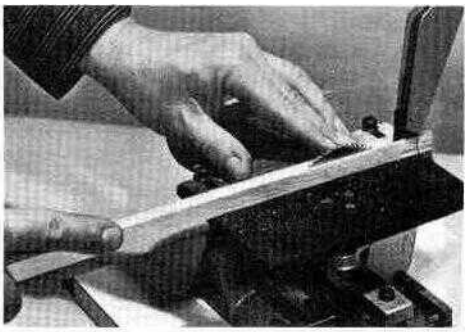
With raising block in place, light lathe cuts can be taken with the tool holder in normal position. However this upsets the geometry of the tool, and is not recommended for extensive work. Make a tool-holder raising block of a piece of 3/4-inch thick scrap aluminum, steel or.hard wood. One of the long bolts from the Milling or Indexing Table will hold the improvised tool post block in place.

DB 1230a

3 9/16 INCH CIRCULAR SAW

This is a larger version of the table saw shown on page 27. It requires that you use the headstock raising block shown above, and swings a full 3 9/16 -inch saw blade. This larger saw unit comes equipped with one coarse-toothed saw-blade £or cutting wood and some plastics,





The 4 3/4 *x* 6 5/16-inch table Include; a pivot guard that protects the fingers and a slitter that helps to open the saw cut (above) and prevent jamming the blade.

When you push wood close to the end of a cut, if the wood suddenly splits, the saw can slice your hand. Make a beveled push-slick, notched to grip various sizes, Paint the stick a bright color—hang it on your tool rack and use it every time you saw small pieces of wood on any power table saw.

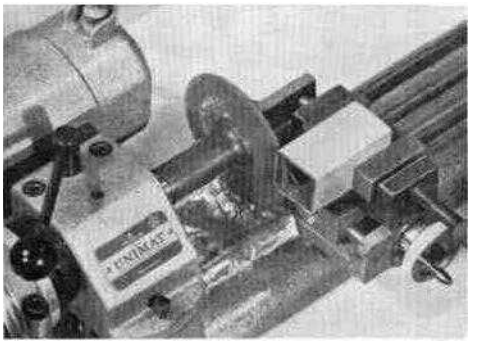
MACHINE SAWING

Dead straight cuts on tubing, round or square stock and odd-shaped sections can be made by clamping the work either in your Machine Vise (DB 1010) or Milling Table (DB 1210) mounted on the cross slide. The work must be lined up dead parallel to the lathe bed, and the headstock perfectly centered in lathe position. As shown in the photo, you slowly feed the work to the cutting blade, with the cross feed screw.

The common fine-toothed saw blades will handle a limited amount of cutting in soft aluminum, but should never be applied to hard aluminum, iron or steel. Special metal slitting blades are available that have hardened teeth, and you can obtain or make thin milling blades that also will cut hard metals. On special order, you can get miniature carbide toothed blades.

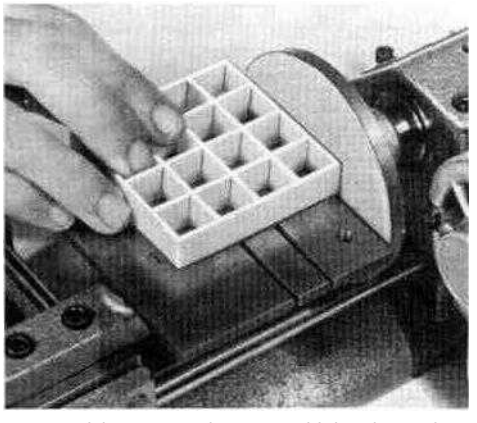
Even hardened tool steel can be cut with this set-up by using the right grade of abrasive cut-off wheel. Modern flexible abrasive wheels should be used at maximum R. P. M. Unlike the rigid wheels, there is little danger of the disc breaking up, but you may need to machine oversized collars to support the wheel properly.

Abrasive cutting can also be done on short lengths of material with the Unimat set up in the drill press position, and the work supported vertically on the cross slide with vise or chuck. With a perfectly clamped set-up, and caution in feeding, you can use larger abrasive wheels, than would fit on the lathe set-up.



Abrasive wheel saws thin stainless tubing. Use damp cloth to keep metal cool.

DB 1330 3 1/2-INCH SANDING DISC



Use minimum speeds to avoid burning soft materials such as the plastic lamp louver.

This cast iron Sanding Disc requires DB 1310 Headstock Raising Block, and has reinforcing ribs on the back side. It is built like a heavy-duty face plate. You can use it as a power sanding disc as shown in the photo, or as a metal-turning face plate. To turn large pieces of metal, you will need to drill radially balanced holes in square or triangular pattern, through which you can bolt your work.

This disc is an ideal companion to cither the large or small circular saw tables. Precision duplicate sanding can be done by clamping a guide to the table parallel to the disc.

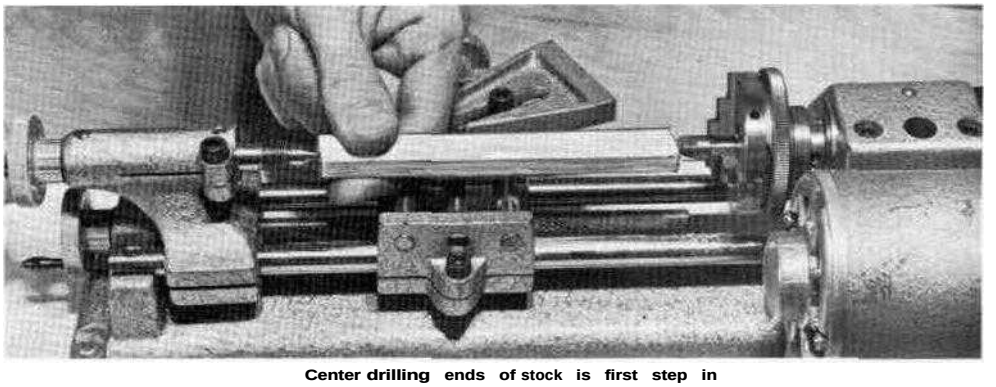
Perfectly round wheels can be produced by installing a pin in the saw table top. Saw a disc shape of any size on the: jig saw. Drill a center hole In the workpiece. then use your sander, and saw table with pin set-up, to sand the edge to a true circle.

If you plan to do considerable work in wood, you will probably want sets of sanding discs (DB 1331, 2, 3) ready to use with fine, medium and coarse paper. To save the cost of buying extra cast-iron discs, turn discs of 1/4-inch hardboard. Mount the disc with three flat-head screws (counter-sunk level with the hardboard surface) to match slot holes in the Unimat face plate. Secure with nuts on the back side of the face plate. Ordinary flat sandpaper can be used in an emergency, to make abrasive discs. But factory made die-cut discs (DB 1131, 2, 3) are preferable, since they have true edges and will lay perfectly flat. Using common rubber cement is hazardous since discs can fly off at high speed. For safety, use Sanding Disc Cement. such as DB 1335 (See Page 32).

WOOD TURNING

Wood turning is a hobby in itself, and in fact is one of the earliest mechanical crafts known to man. You can turn an infinite variety of cylindrical shapes; among them, such practical objects as handles for tools, bases for lamps, trophies, etc. Beautiful models of antique furniture can be seen in many museums and are easily produced on the Unimat. The same is true of architectural models. Many mode! items in metal, for example cannon barrels, start out as wood-turned patterns for foundry castings.

At your local foundry, you can have the shape duplicated in iron, brass or aluminum.



Center drilling ends of stock is first step in wood turning.

As an example in wood turning, let's say we need a dowel of a certain size. Working from a large block or board of wood, the first step is to cut a square section on the table saw. If we want to finish with a 3/4-inch round dowel, 1-inch square would be a good start. Mark the center of each end and set up the lathe as shown above. Put a center drill in the chuck and use the tailstock to push the wood into the rotating drill. Repeat for the other end.

Now mount the wood between the DB 1205 Spur Drive Center (which screws on the lathe spindle) and the tailstock center. The Spur Drive Center has two

WOOD TURNING cont'd

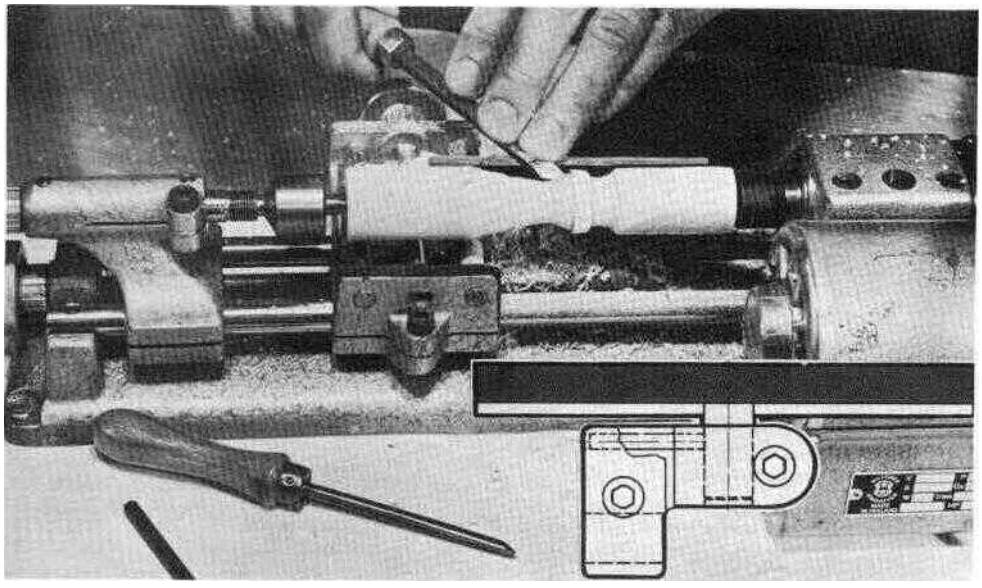
with the

DB 1201 STEADY FOR WOOD TURNING

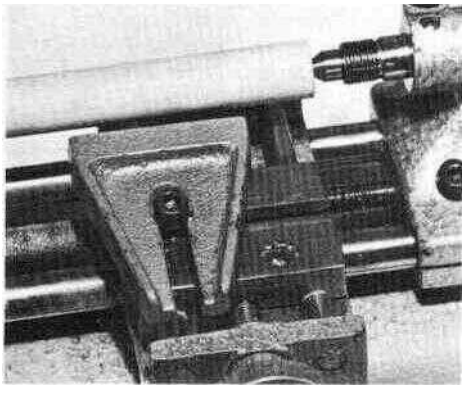
DB 1201a ADJUSTABLE HAND TOOL REST

DB 1205 SPUR DRIVE CENTER

DB 1220 & 1220a BALL BEARING LIVE CENTERS



DB 1201a Adjustable Hand Too! Rest gives you a 4 3/4 inch straight surface for resting your wood turning chisels, in foreground is DB 1136 Round Tipped Gouging Tool. In use is DB 1137 Veining Tool, a straight bladed tip that is useful for cutting in long straight lines, You can grind your own special shape tools from discarded shanks of broken taps, drills, etc. For safety, always use long, well-made handles on wood turning chisels, and always make sure your lathe is solidly locked up before turning power on.



DB1201 Steady Rest is a good support for wood turning in close corners. Also, it makes a useful rest for hand grinding when sharpening chisels, plane blades, etc. Photo shows wood turning job supported in 3-jaw chuck which can be used for very light cutting, or slow sanding work, But set-up is *not sate* at high speed since wood can give, causing 3-jaw chuck jaws to open and possibly cause damage to themselves or bed ways, Also, chuck jaws mar work. On any high speed work, it is always a good Idea to double lock your chucks, lathe dogs, and fixtures, with heavy rubber bands or twine.

prongs which bite into the wood, driving the workpiece. You can use either the regular lathe center, or one of the ball bearing live centers, (DB 1220 or I220a) shown at right. The Live Center is preferred because it will take high speeds without overheating and scorching the wood.

To turn a square into a round, start with a DB 1136 Gouging Wood Chisel. Use a medium speed and with the wood chisel supported on either rest, slowly approach the wood. The handle of the chisel must be firmly gripped in the hands. Avoid digging into the wood too fast. Fingers on the chisel blade will tell you when the tool is overheating.

Make a complete pass to produce a rough cylinder. Then increase the speed and make fine cuts to reduce size until your cylinder is just slightly larger than desired. Finish by taking a final cut with a long strip of sandpaper held in both hands and "stroked" diagonally from one end of the work to the other. Three or four light passes with the paper will give you a perfectly true round piece.

Your Unimat lathe can be used to turn tapered table legs and other long workpieces if you improvise a lathe extension. Make a holder for the tailstock and clamp it to your bench in line with the headstock. Then use a long piece of angle iron or straight bar stock as a steady rest.

With the DB 1310 Raising Block and the DB I201a Adjustable Hand Tool Rest, you can turn small plates and wooden bowls. Secure the workpiece to the face plate with wood screws running from the back.

Live Center DB 1220 (left) with single bail bearing race is suitable for all wood turning jobs. DB 1220a is a heavy duty model. Shown in cutaway view, double ball bearings take more lateral thrust, for tough cuts in metal.

These center bearings are life-time lubricated, and cannot be dismantled. At no time should you oil them since this could break up the grease inside. After long periods of use at high speed, you may notice grease leakage. This will not affect operation, until you see it every time you use the Live Center. Then, it would be wise to force a small amount of new bearing grease through the hole which runs down the stem. Insert the grease with a swab and push inward with a drill blank of diameter to fit.

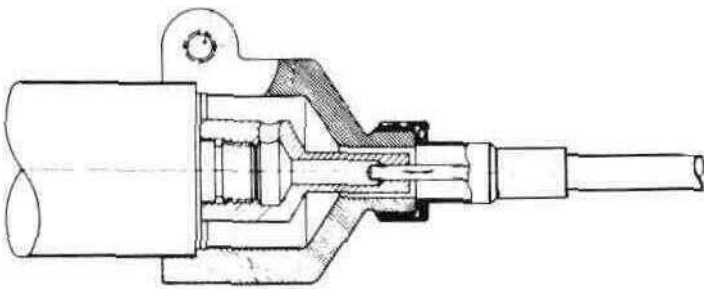
A wide variety of special tailstock centers can be made to fit the ball bearing centers. For turning pipe, you can make your own cone or cup centers. For machining long shafts, you might want to make a ball bearing chuck center. For very small wood turning jobs, you might need a hollow tube center.

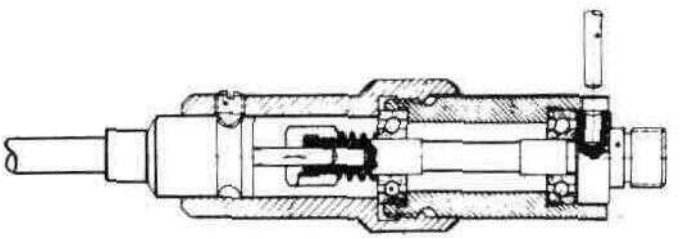
Procedure is easy. First remove the original tailstock center. Use a good quality machinists' punch that just fits the bored hole that runs through the live center. Put the live center face down on a soft wood 2 x 4 that has a half-inch hole drilled through, and gently knock out the live center piece. Copy the shank dimensions and install your own center piece.

twin ball bearings in hand-piece for precise carving, routing, engraving, polishing...

DB 1250

FLEXIBLE SHAFT



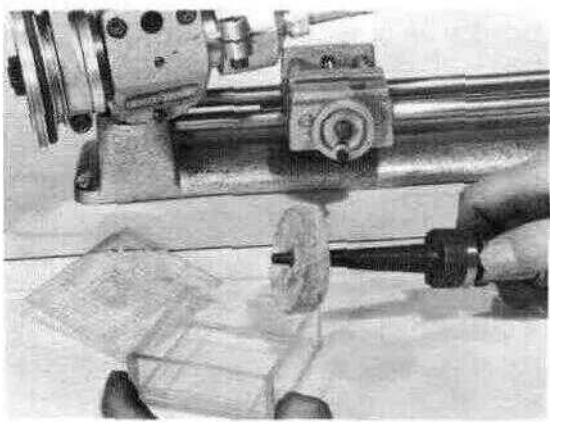


Because it is almost as flexible and easy to direct as a dental drill, the Flexible Shaft is very popular. You have the advantage of using it with all Unimat work-load speeds up to 3750 R.P.M.

The hand-piece has two ball bearings of excellent precision and the nose is equipped with the standard Unimat spindle thread, so that all chucks and accessories can be mounted on the shaft,

To install, thread the driver on the headstock and tighten with the bar supplied. Then put the shaft driving end on the headstock spindle. Revolve by hand to make sure the mating drive parts engage. Then lock the adapter housing to the headstock spindle housing.

Power is transmitted through the Flexible Shaft by means of a twisted cable. It is designed to run in the forward clockwise direction only. Overloading the shaft will ruin it. For example: if you use a large sanding disc and press too hard, the shaft will buck and shake, and the strain may damage the cable. The Unimat power drive belts will help to take up sudden overloads.



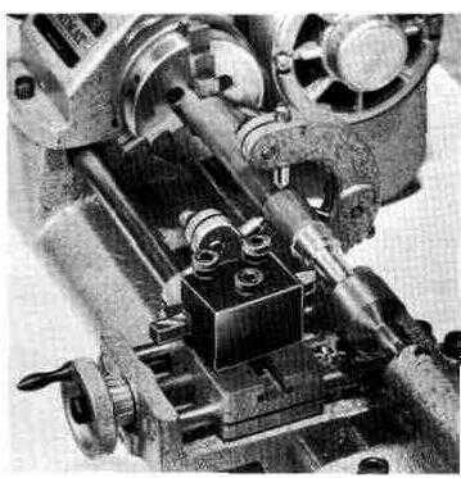
Flexible shaft does fine job buffing plastic box with DB 1030 Polishing Arbor and Felt Disc. Polishing preparations such as lemon oil, buffing wax and fine pumice are available from craft suppliers. Tooth powder works well on many jobs.

Generally, the largest size drill you can use is about 5/32-inch. Larger drills will overload the shaft, and you can do this even with small drills by feeding too fast. Never use the shaft when it is bent into a tight curve or around a sharp corner. It's best to operate with the headstock turned away from the lathe axis. Store your shaft, hanging it straight up and down on a wall rack, or laying it flat in a drawer. If the flexible shaft has been curled into a small circle in shipping or storage, it is best to lay it out flat for a few hours to allow the cable to straighten itself.

The shaft is pre-lubricated, but in use, some of the grease will work out. After every 10 hours of use, examine the ends and add grease if necessary. The symptom of a lack of grease will be sudden heating of shaft spindle, or unusual scraping noise. Stop power immediately and check. Your warranty does not cover equipment that has been damaged thru careless use.

DB 1040

STEADY REST

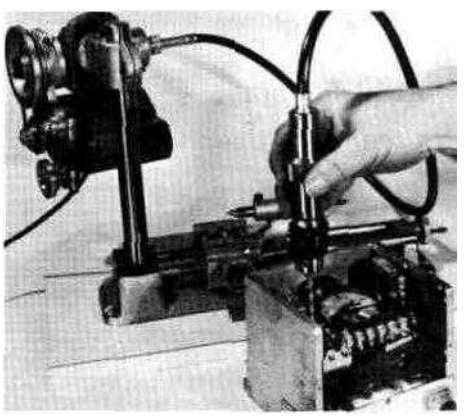


Clamped on the bed, the DB 1040 Steady Rest will take roundstock up la 1 1/2-inch diameter.

A steady rest is needed whenever you want to turn slender fragile bars, or drill into the end of long cylindrical pieces.

The quickest way to set up the rest is to support the work on lathe centers or between chuck and tailstock. Then loosen the three Allen head screws and push the brass jaws inward, until they contact the work lightly. Lock in position, and during machining use a heavy amount of oil or grease to lubricate the tips. Brass jaws are used because they cause minimum marring of the work. *Never run them dry.* At their point of contact, the workpiece must be smooth.

For super-accurate work, the Unimat owner may wish to install small contact rollers on the work. Also, a tight fitting ring can be temporarily placed in the work to provide a riding surface. Often, you may have a ball bearing of the right shaft size that can be supported between the Steady Rest jaws.



Here's how NOT to use tool. Shaft is bent sharply near neck of hand-piece and it operating in a circle which puts extra load on cable. Use of headstock on column for power drive is handy. For this job, place Unimat on shelf or box so that shaft operates in straight line.

POLISHING, BUFFING and SANDING

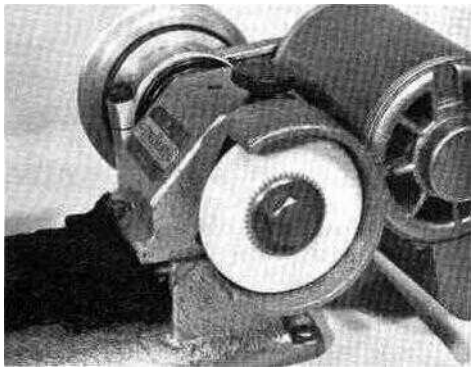
with DB 1030 POLISHING ARBOR
DB 1035 RUBBER BACKING PAD
DB 1150, 1, WIRE BRUSH WHEELS

DB 1115

GRINDING WHEEL GUARD

Even if you do grinding only rarely, this guard is a necessity. Grinding wheels are the only cutting tools that suffer invisible damage that can be really hazardous. Always store your wheels in fitted cases or cardboard boxes. Never keep them on high shelves from which they can drop. If the wheels are hung in the open on a wall rack, they can be accidentally nicked by other tools. In drawers, they can be jarred and cracked by heavy objects.

The guard is intended for use in hand



grinding or on the headstock when you use it horizontally on the drill press column as a surface grinder. It not only protects you against flying particles that can put an eye out if the wheel is defective, but also against snagging on the work. Remember it only takes a minute to put. your safety goggles on, but an eye operation can take months.

DB 1160

TRUING DIAMOND

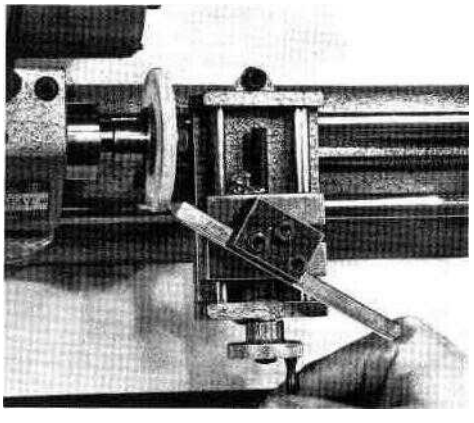
Abrasive wheels often clog up with chips particularly when you are grinding soft metals, or when the work is oily. Sometimes you can clean a wheel with solvent and a wire brush. A better way is to cut away the abrasive with this diamond-tipped dressing tool. You can use it free hand, resting the tool on your wood steady, or feed it with the lathe tool holder. ALWAYS WEAR SAFETY GLASSES and feed the diamond tool cautiously, slowly, stopping the feed frequently to avoid overheating.

These operations are the last to be described in this manual, and are the last when you finish a project. Whenever surface appearance is important your finishing technique can make the difference between an average job and a true craftsman's prize winner.

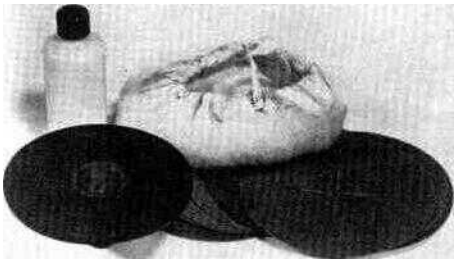
Grinding is one way of finishing flat surfaces. On iron or steel, with the right grinding wheel and feed, you can produce a finish as fine as a piece of glass. If the work is round, you can finish-turn it in the lathe with a well-honed tool, and then follow up with strips of garnet, paper and crocus cloth, cut into strips about 2 x 10 inches. Running the machine at medium speeds, and being careful to constantly move new abrasive into contact with the work, a mirror finish is possible.

On wood, start with good accurate saw cuts at the right. R.P.M. Follow up with coarse sandpaper to get down close to size. Use the sanding disc described on page 29 for all flat square edge work. Rubber Backing Pad (DB 1035) shown right fits the headstock and the Flexible Shaft. This disc, made of soft rubber, flexes with the work, making it ideal for polishing or sanding curved surfaces, edges, and for rounding corners. If you use it with the flexible shaft, work very lightly. REMEMBER THIS RULE: ALWAYS LET THE SPEED DO THE WORK. HOLD YOUR TOOL SO IT BARELY CONTACTS THE SURFACE . . . moving it in, constantly changing patterns to avoid cutting in. Never rush a sanding job. When you get near the end, use lower speeds. They are safer.

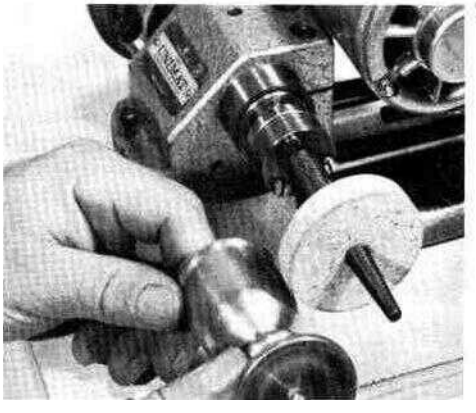
On wood that has been lacquered, it sometimes is necessary to use "wet cloth", a special abrasive that must be liberally watered. Fasten your abrasive papers to the rubber pad with DB 1335 Sanding Disc Cement, a special adhesive that dries in a few moments. Use benzene to remove it.



Cloth buffs can be used plain, wet, or charged with abrasives. Expert cutlery polishers often work with marked sets of buffing wheels, each one previously loaded with abrasive liquids of varying bite.



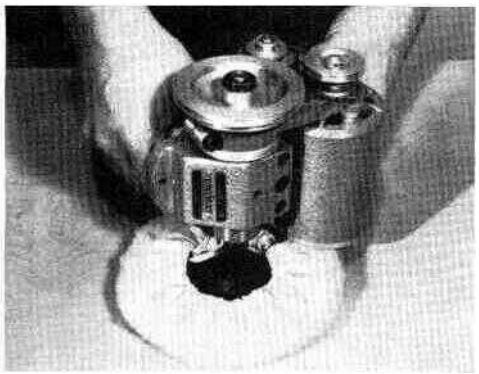
Bottle (above) is 3 ½ oz quantity of special Unimat sanding disc cement. Spread thinly, it dries almost immediately. Coat both surfaces. When replacing abrasive disc, both Sanding Disc and Rubber Pad (above) must be perfectly clean of all remaining cement. Dissolve with hot water.



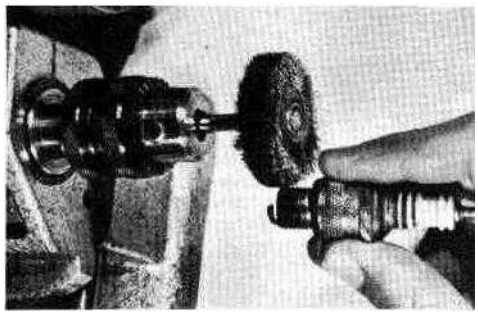
Buffing silver plate with DB 1033, 2¼ inch cloth wheel. Use minimum R.P.M. Press lightly, moving work constantly to avoid burning. Practise on scrap or hidden spots and use buffing compound if surface is highly tarnished.

DB 1030 Polishing Arbor has back plate which must be trued to spindle. Truing instructions are on page 18. Felt wheels are offered in 1½, 2 and 2¼ inch sizes. Tapered stem of arbor takes all diameter centers from 7/32 to 9/16-inch.

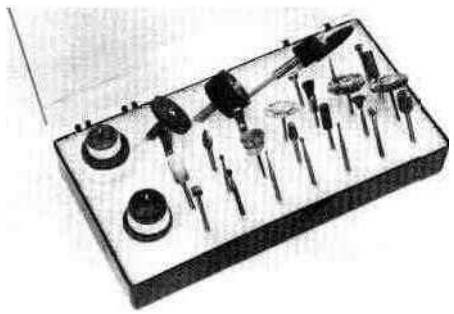
Plastic polishing is a real art. As with all materials, never risk a finished piece of work on a buffing wheel until you practise the polish on scrap. A harmless looking cloth wheel running at high speed. or pushed too hard, can burn even the hardest, plastics, or ripple the surface. Every grade and make of plastic is different... so to be safe, write to the



Five-inch lamb's Wool Bonnet (DB 1036) can be used on Urimat set up as hand drill to polish furniture, plastics and even your car. Buffer mounts over Backing Pad (DB 1035). Move lhe buff constantly, using minimum R.P.M. Waxes help to prevent scorching. Press as lightly as possible.



DB 1150 Brass Wire Brush removes spark plug corrosion.



DB 1500 sets include burrs, mounted abrasives, wire and bristle brushes, for various materials. See Accessary Catalog for details on each set.

manufacturers for specifications sheets on buffing and finishing.

DB 1150 (brass) and 1151 (steel) Wire Brush Wheels can be used by hand in the grinding position, or on the Flexible Shaft. They are most useful for reaching into tight corners and rounded areas. Either tool is good for polishing out rust spots on tools and instruments. On wood, the steel brush will give you a weathered effect that enhances the realism of historic models. The brass brush is best for working on soft metals, since the harder steel wire tends to dig in. Wire brush wheels are particularly dangerous to the eyes since bits of wire constantly break off and fly into space. Wear your goggles and keep well out of the plane of rotation.

Kits of miniature wire wheels, buffs and mounted abrasive stones are available. The six sets, DB 1500, 1, 2, 3, 4, 5 give you a good selection of these tools.

Unimat Thread Sizes

Threaded Part	Thread Size	Drill Size	Tap & Drill SetOrder#	Die order#
Headstock, tailstock spindles	M 12x1	10.8mm	TM 12	DM12
Leadscrew, cross-feed screw	M 8 x 1 (left)	6.7mm	TM 8	DM 8
Allen head screws	M 6x1	5.0mm	TM6	DM 6
Spindle locating screws	M 4x1	3.3mm	TM4	DM 4
Watchmaker spindle draw-bar	6.9	15/64"	TM69	DM69
Handwheels	M 5x1	4.2mm	TM 5	DM 5

ACCESSORIES

Unimat Screws

NOTE: All screws are available from stock, A useful assortment is the SC 6-6 Set of 18 Unimat Allan Head screws. All Unimat Allen head screws have a 6mm diameter Set consists of three each of following lengths: 12, 15, 20, 25, 30 and 35 mm.

Time Saving Tips For The Unimat Owner

CLEANING SMALL PARTS. Never use water Rust will accumulate and ruin precise surfaces. The simplest way to clean small parts is to obtain an empty coffee can, but an empty gallon paint can is better yet. Then pour kerosene into the can to a depth of about 1½-inch. Make a small basket of aluminum window screen bent to shape. Chucks, tools and machine parts covered with oil and chips can then be lowered into the liquid and allowed to soak.

CLEANING UNIMAT LATHE. Jobs in brass, wood and aluminum will throw chips that will completely cover your machine. Use a 16-inch cookie baking pan, covering the bottom with newspaper Place Unimat In pan and brush with kerosene. The chips will collect on the paper which can then be discarded.

RUST PREVENTION- Plastic suit-covers used by dry cleaners make a fine dust-tight cover for your Unimat and tools. Be sure bed, drill press column and other exposed metal parts are clean and well oiled before you cover the machine. Otherwise entrapped moisture in the air will cause rust almost overnight.

GRINDING SAFETY. Whenever you turn on any grinding wheel, or large rotating tool, stand well away from the machine. The faster a wheel turns, the more the centrifugal force. Bits of a cracked grinding wheel can fly across the room and cause injury. Always wear safely glasses- A plastic work shield fitted to your Unimat baseboard is also a very good safety idea.

SMALL DRILLS. Always chuck small drills as close to the beginning of the spiral flutes as possible To get maximum accuracy and prevent drill breakage. To get greatest centering accuracy with regular drills, cut them down to minimum length and carefully re-sharpen, checking with a drill gauge.

PROTECT CUTTING EDGES. Lathe tools, drills, milling cutters and chisels should never be stored loosely in a drawer or chest. Edges will soon be nicked and dulled by contact. Protect sharp edges by wrapping tools with wax paper and frequent oiling.

SPINDLE THREADS. Every time you change chucks or mount an accessory on the Unimat, be sure the headstock spindle threads are clean. A fast wipe is not enough because tiny particles of steel, brass, etc., can cling to the bottom *of* the threads. When the accessory is installed over dirt. there is danger of jamming and ruining the accuracy of the part, Use an old toothbrush and kerosene to clean. Soft cotton string also is useful far cleaning threads.

USING BROKEN TOOLS. Save all broken files, saw blades, drill points and taps. The tool steel can be ground down to make special wood turning tools, chisels, scribers, and center punches.

ELECTRICAL SAFETY. IF you work on damp floors or near water pipes, ground the frame of your Unimat to prevent electrical shock in case of a short. This recommendation is a must for all portable electrical saws and drills.

KEEP RECORDS. Every time you try a new tooling technique an your Unimat, jot down the kind of metal, cutting diameter, R.P.M., and a rough sketch of the tool shape. Such notes will become very valuable in the future when you want to quickly duplicate past jobs.

OIL DISPENSERS. Medicine bottle eye droppers make handy containers for various grades of cutting oil, lubricants and solvents.

DAILY REMINDER. Get in the habit of always removing chucks, belts and loosening all locking screws when your Unimat is not in use. This simple procedure will prolong the life of the machine and the accuracy of its parts,

UNIMAT GUARANTEE- To protect your investment, be sure to complete and return Guarantee Card to officially register your warranty. If you haven't already done so, mail the Guarantee Card today.

Headstock Maintenance

The motor, intermediate pulleys, and the headstock spindle should spin freely. Avoid over-tightening the Allen head screws which hold the intermediate pulley bearings. This can cause the bearing to bind.

If your Unimat has been stored for a long time, set up a low speed and run the spindle a few minutes to recirculate the grease in the bearings-

Headstock bearings are well protected from chips and dirt, but fine abrasive dust can penetrate. If you hear unusual rough noise, or the headstock shows more friction, stop the machine immediately and check the bearings. Greasing is required after every few hundred hours of average running time. However, if you operate your Unimat continuously at high speed, more frequent greasing will be needed.

To remove bearings, place a tightening bar through the spindle locking hole, and turn the spindle nut counterclockwise. Then remove the pulley. If the nut is frozen, use a drop of penetrating oil or 'Liquid Wrench' to free it. The headstock spindle can then be removed by pulling through the headstock casting toward the tailstock. Lay the parts out on the bench so you can replace in exactly the same order, with bearing races facing in the same direction as they were.

Wash the bearings in kerosene, dry on lintless cloth or paper, and then relubricate with high quality bearing grease (EP1). Reassembly is done in much the same way as a bicycle hub. Tighten the headstock all the way until you feel tension on the bearings. Then turn the nut backwards, so the bearings just spin freely without binding and without play.

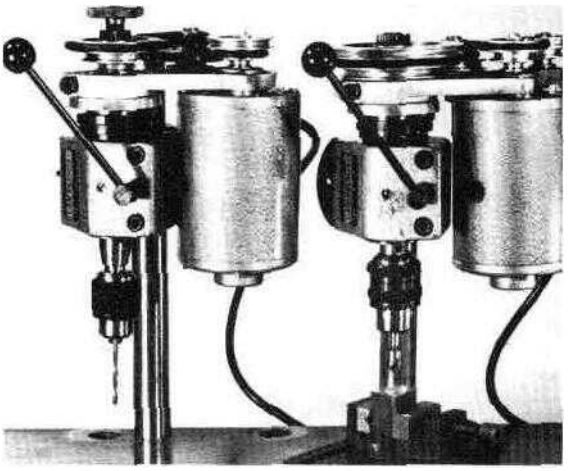
ADVANCED TECHNIQUES

Unimat at home in tool room, machine shop electronics lab, and instrument repair shop...

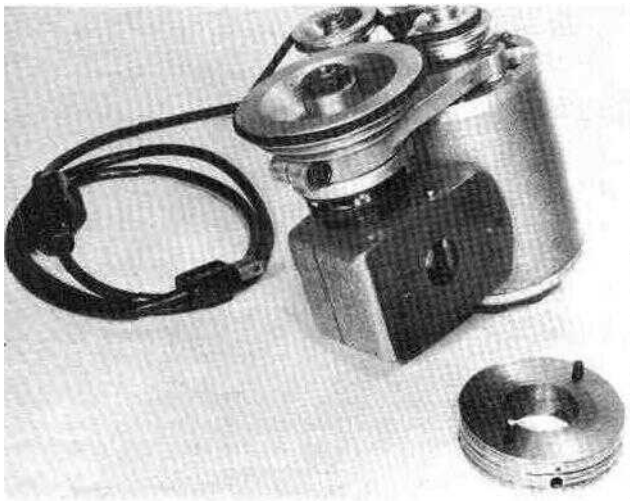
Machinists, tool makers and instrument builders all over the world own Unimats. Often you'll see a chest containing a complete Unimat and accessories right up on the shop bench along with the traditional machinist's tool case. Here are a few examples showing how shop men apply Unimat versatility to solve tough tooling and production problems.

Many times Unimat saves the cost of expensive special fixtures. The high speed spindle can do a job in precise grinding, or micro-drilling that would be impossible without investing in special machinery. By taking advantage of the unusual angular adjustments of the Unimat headstock and drill press column, you can temporarily combine your Unimat with other machines to handle jobs of unusual complexity...with surprising ease.

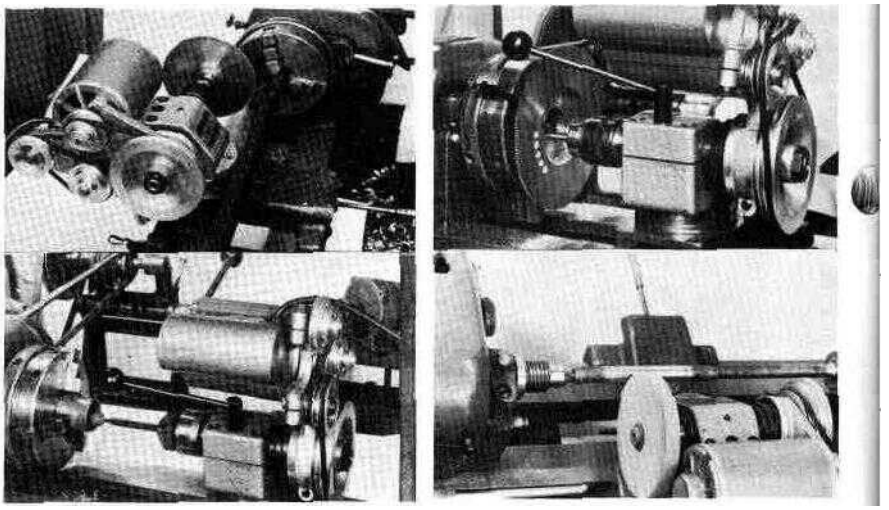
Twin Unimats for production!



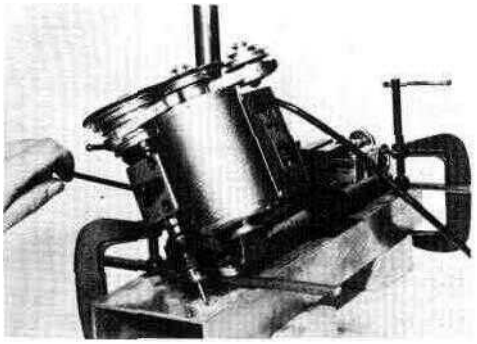
An economical idea for short run precision jobs. Steel or aluminum tooling plate (the base) is bored to mount two or more Unimat columns precisely vertical. Drill press assembly (above left) consists of DB 2600 Draw Bar tapered spindle with DB 2601 precision drill chuck; the combination very suitable for high-speed operation with minimum runout. On table is DB 1010 Machine Vise mounted to DB 1210 Milling Table, . . a setup just heavy enough to keep a small job in place under the drill, but not too bulky *to* move from one machine to the next. Drill press above at right Is standard Unimat headstock spindle and drill chuck.



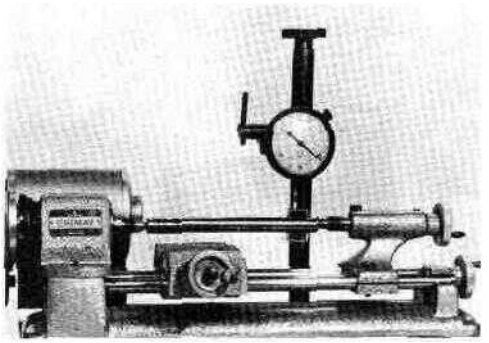
LATHE SWIVEL ADAPTER. It takes only an hour's work to make this ring to fit any lathe. This one was made for a 6-inch lathe. Diameter is 2¾ inches and thickness is critical. To fit your Unimat to larger lathe, measure from lathe center down to top of cross slide (or to tool post top on 10, 12-inch lathes). Subtract center height of Unimat headstock. Difference is thickness of adapter required to center Unimat spindle with lathe axis. Mount with two Allen head screws.

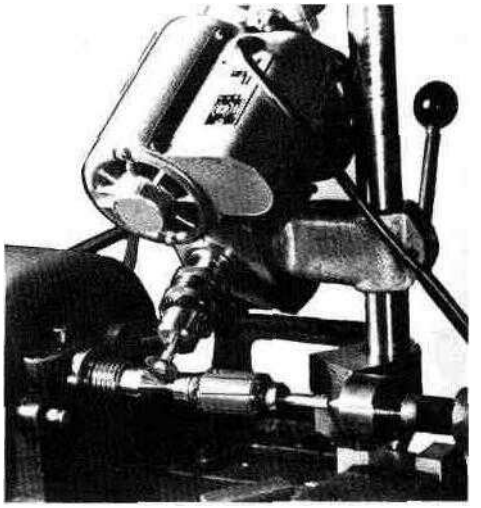


ADAPTER APPLICATIONS: Sawing plastic tubing (top left) in production. Fine toothed blade produces burr-free edge that needs no sanding or polishing. Index drilling (top right) is good setup for producing program clock discs. Internal grinding (lower left) demands high speeds of usual tool post grinder, however this setup with collet chuck is capable of precise work in emergency and can also be used with milling cutter. Polishing mandrel with rubber wheel (lower right) produces very fine accurate finish, particularly when lathe bed feed is used.

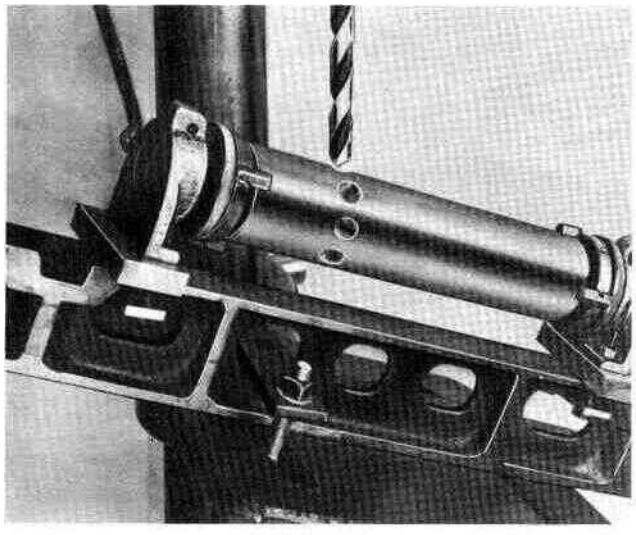


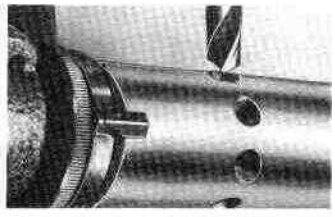
When the work is too big, take your Unimat to the job instead of bringing the work to the machine. This precise drilling job on architectural channel is done by bolting bars to base of Unimat and clamping to work at desired position. GAGING AND INSPECTION, (center) Support Unimat on pairs *of* parallel blocks above inspection plate, so dial gage stand Is free to slide beneath. Boring tool is mounted between centers. Dial Indicates accuracy of cutting edges. UNDERCUTTING MOTOR ARMATURE. Unimat drill press column (right) is fitted to lathe carriage; supports headstock at any angle. Metal cutting saw slots rotor of small motor to preset depth.



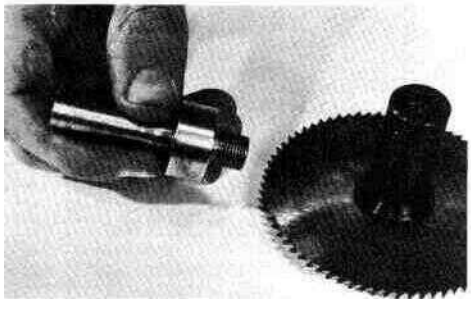


versatile Unimat accessories in the machine shop solve tough grinding, drilling and sawing problems; do the "impossible" in minutes instead of hours,..



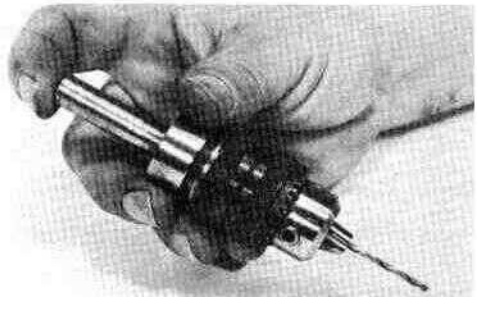


At left, two DB 1260 Indexing Attachments both equipped with DB 1001 3-Jaw Chucks, grip workpiece (2¼ x 10-inch steel round stock) for angle index drilling under drill press of milling machine, Close-up above show; angular location of holes.

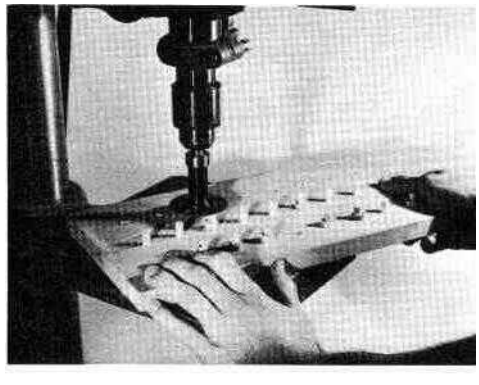


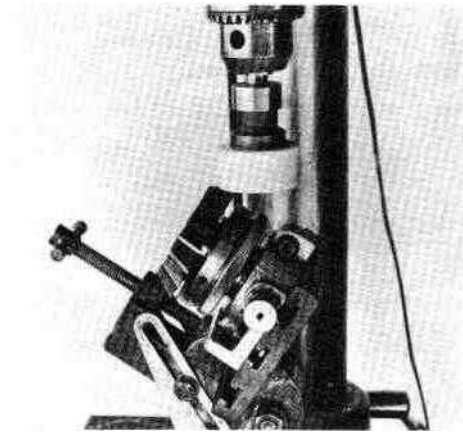
Make this stub holder and you'll find it has hundreds of uses. You'll need a piece of steel about 3½ inches long by an inch in diameter. The threaded portion is a duplicate of your Unimat spindle nose thread, and will fit all your chucks and power attachments. Start with the metal supported between the 3-jaw chuck and tailstock center, in the lathe set-up. Reduce the thread size to ,465", and the other end to about .425". Then mount between lathe centers and take a fine finishing and polishing cut driving with the lathe dog and faceplate, To make the thread, you will need threading die DM 12 (12x1mm) or the 1 millimeter thread pattern for DB 1270 Threading Attachment. Make sure your threads are dead square with the bar,

Here the stub holder solves a tough fixture building problem. The wooden coil form dowels on this electronic factory fixture had to be exactly 1/2-Inch high. Holes were drilled in the hardwood base, and the dowels fastened in place with glue. Using DB 1230/1 circular saw arbor, and the DB1232 metal cutting blade, a perfectly level smooth cut was obtained on the shop drill press.



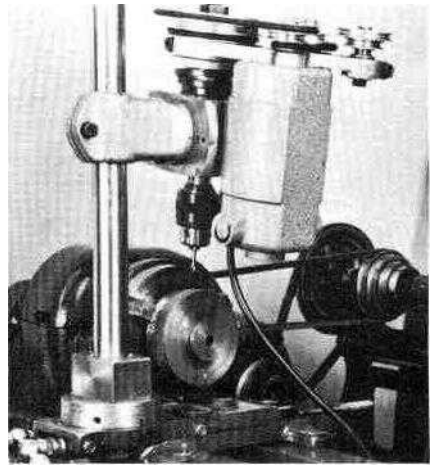
The stub holder converts your chucks into handy holders For small drills, points and carving tools. Model makers working on ships find this precision "pin vise" specially useful. In the same way the holder will grip your 3-jaw, 4-jaw, and collet chucks for accurate hand work.



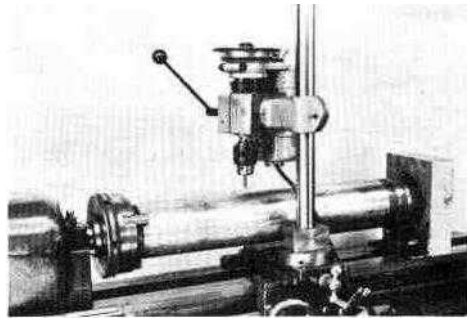


Here's another accessory you can make to adapt your Unimat to other machines. The post was turned to match the diameter of the Unimat drill press column, and a base was turned to fit the cross feed swivel plate of this 6 Inch lathe.

Now the Unimat drill can be positioned anywhere over work chucked in the lathe. The job shown required a series of indexed holes to be drilled radially at an angle with very close accuracy. Inexpensive Unimat parts solved an otherwise tough problem that would have required a special drilling fixture



Using the same column for milling. the machinist produced a cut normally impossible on a lathe; the lathe feed screw is used to drive the carriage, by hand or by separate feed screw motor The setup permits milling at angles (Page 34) as well as a variety of complex lateral and transverse cuts, and can be used equally well for grinding.



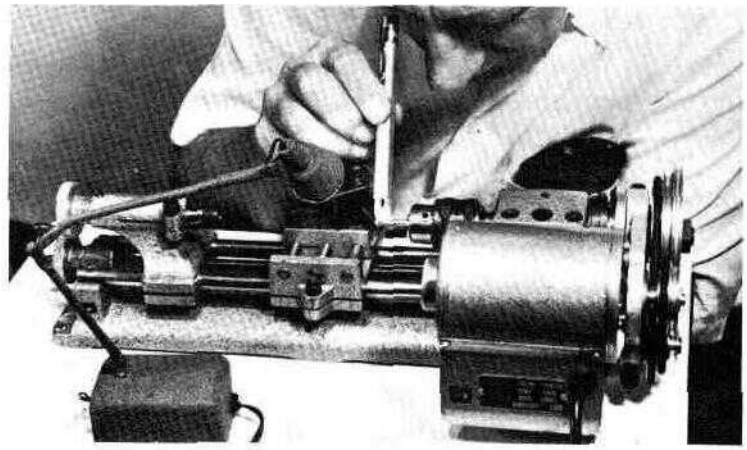
Here's how Ihe stub holder (left photo) and DB 62 grinding arbor and DB 1121 cup grindstones solve a tough sharpening problem. The tool mounted on the 3-jaw chuck and DB 1210 Milling Table is a flycutter used for machining large holes in sheet metal. The tip dulls rapidly in production and should be sharpened to a perfect point, with a smoothly rounded back edge. By sliding the Milling Table over the drill press table a perfectly shaped ground edge was obtained.

Here's a sharpening problem that a machinist solved with Unimat parts (center photo). The milling cutter gripped in the 3-jaw chuck is a 2½-inch diameter face mill with teeth beveled at 60 degrees. Usually the sharpening job requires a special machine. The mill was firmly chucked on its inside diameter in the 3-jaw chuck mounted on the Indexing Attachment (DB 1260). This in turn was fastened to the Milling Table gripped in a swivel vise at the proper angle.

The drill press was used to set the depth of grind, and the cut made by slowly gliding the entire setup toward DB 1121 Cup Wheel and arbor, mounted in the stub holder.

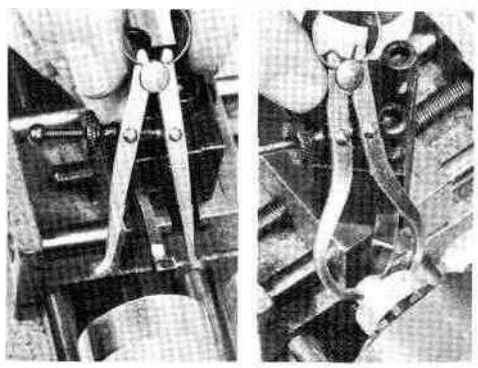
MEASURING ACCESSORIES

precision miniature machining requires quality measuring instruments and aids...

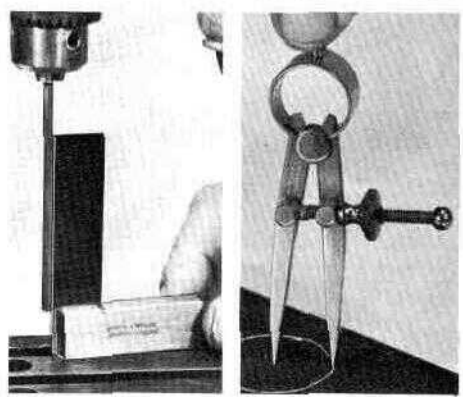


Miniature Lamp (XR 20) has transformer in base. Throws high intensity light, bnghter than 150 watt bulb at some distance. Lamp arm folds for storage, measures 15 inches extended. Micro-Mike (XR 22) combines clear optical 20 power magnification with 1% accurate rulings on giass within instrument. Examine drills, laps, lathe tools and work, and immediately see measurement. Touch tip of Mike to work, and image it automatically in focus.

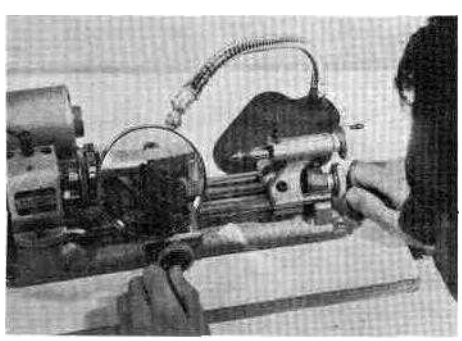
Magna-Viewer (XP 51} permits you to see magnified image of small work, cutting tools, etc, from comfortable working distance. View it wide angle, clear and causes little eye strain. Extra high power auxiliary lens swings down over standard lens for up to 5.25 power.



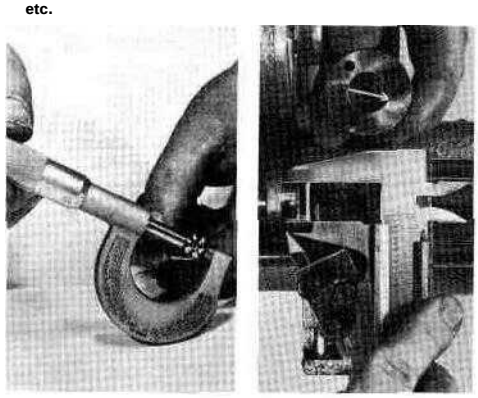
Precision work requires these two miniature 2-inch calipers. Inside Caliper (DB 41) is on. left. Outside Caliper (DB 42) on right. Measurements can be transferred from one to the other, or from calipers to rules, micrometers, etc.



Toolmaker's Precision Square (XR 45), above left, is best tool for layout of vertical lines, checking drill press and grinder set-ups. Hardened end tempered 2-inch blade guarantees high accuracy. Two-inch Spring Divider (XR 43), above right, is used to measure distances lengthwise on lathe work, and to scribe layout lines and centers on flat metal work.



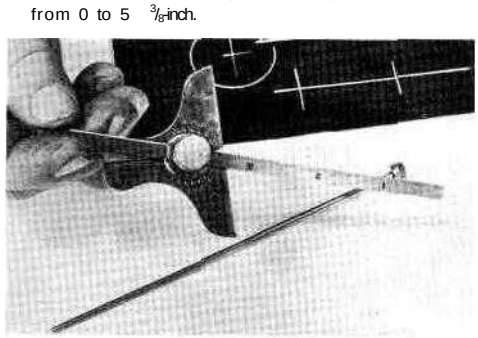
Five-inch magnifying glass (XR 21) gives you full visibility and protects eyes too. Flexible stand adjusts to any angle.



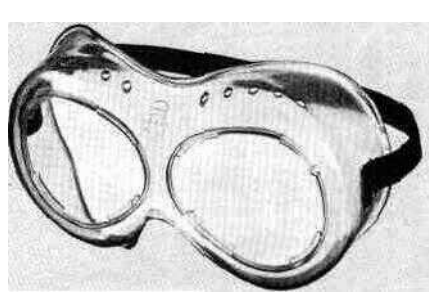
0-1-inch Micrometer (XR 70), above left, is every machinist's most often used tool. You'll need it to check drills, taps, screws. The thickness of sheet metal, and to measure work turned in the lathe. Above right, Vernier Caliper (XR 60) is usefuf for measuring inside and outside diameters, thicknesses, etc. Reads from 0 to 5 $^{3}/_{8}$-inch.

The most Importanl measuring tool is XR 44 Machinist's Combination Square. Blade is 4 inches long. Comes with carrier head for marking round stock, scriber and square, head.

Foot Switch Rheostat (XR 100) frees your hands for better control and safety in sawing, drilling and lathe work. Cannot be used with induction-type Unimat motors. Use only with brush-type motors. Built-in 100 watt rheostat controls speed from zero to full R.P.M.



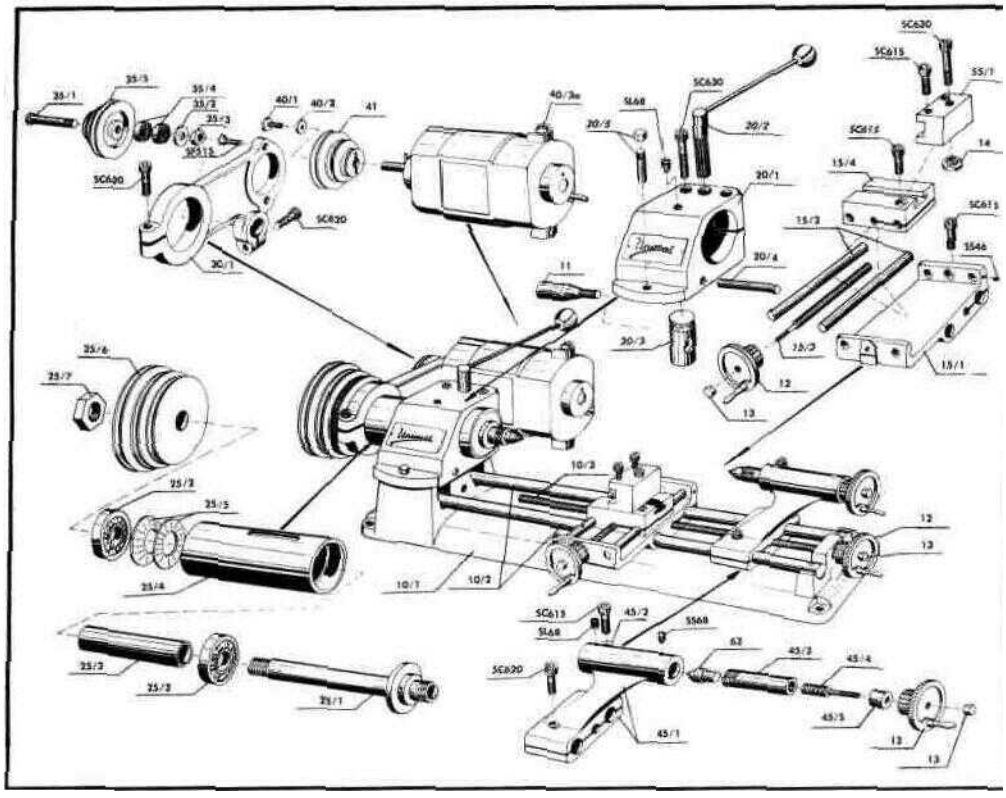
Adjustable Angle Depth Gauge (XR 47) is supplied with 6-inch rod for measuring hole too small for rule. Tool sets to every 15 degree angle on the circle. Excellent for layout work too, and for checking grinding and sawing angles.



Use these inexpensive Safety Goggles (XR 53) whenever you cut steel or brass on lathe, and for all grinding, polishing, buffing operations.

Protractor (XR 40), not shown here, has a 6-inch blade and can be used to read drilling, milling, sawing, mitering and layout angles. One-degree markings, from 0-180 are numbered in both directions. Markings are sharp and fractions of a degree can be estimated,

Model DB 200, UNIMAT BASIC UNIT



DB 10 Lathe bed, complete with ways & cross slide (DB 15)
DB 10/1 lathe bed only
DB 10/2 Bed way
SC 635 Allen head screw (16x35mm) for ways
DB 10/3 Leadscrews
DB 11 Headstock tapered clamping screw
DB 12 Hand wheel
DB 13 Nut for hand wheel
DB 14 "T" nut

DB 15 Cross slide assembly, complete
DB 15/1 Lower cross slide
DB 15/2 Cross slide way
SS 46 Set screw (4x6mm) for ways
SC 615 Allen head screw (6xl5mm) for lower cross slide
DB 15/3 Cross feed screw
DB 12 Hand wheel
DB 13 Nut for hand wheel
DB 15/4 Upper slide rest
SC 615 Allen head screw (6x15mm) for upper slide rest

DB 20 Headstock assembly, complete with spindle (DB 25), motor (DB 40 motor bracket (DB 30) & idler (DB 35)
DB 20/1 Headstock casting only
SC 630 Allen head screw (6x30mm) for headstock casting
DB 20/2 Hand feed lever & pinion
DB 20/3 Clamping bolt
DB 20/4 Locking pin for clamping bolt
DB 20/5 Aligning pin for headstock (type illus.)
DB 20/5a Aligning washer (for earlier models)
DB 20/6 Spindle return spring
SL 68 Locking screw (6x8mm) for spindle

DB 25 Headstock spindle assembly, complete with bearings, pulley & nut
DB 25/1 Spindle shaft
DB 25/2 Ball bearing race
DB 25/3 Spacer sleeve
DB 25/4 Spindle housing
DB 25/6 Pair of Belleville washers
DB 25/6 Pulley
DB 26/7 Nut for pulley

DB 30 Motor bracket complete with Idler (DB 35)
DB 30/1 Motor bracket casting
SC 620 Allen head screw (6x20mm) for bracket
DB 35 Idler bearings & pulley assembly, complete
DB 35/1 Idler shaft
DB 35/2 Washer for idler shaft
DB 35/3 Nut for idler shaft
DB 35/4 Ball bearing race
DB 35/5 Pulley

DB 40 Motor complete with cord, switch, pulley mounting screw & washer
DB 40/1 Pulley mounting screw
DB 40/2 Washer for pulley mounting screw
DB 40/3 Brushes (give motor specifications)
DB 40/3a Caps for brushes (* * *)
DB 40/4 Condensor for Induction-type motor
DB 40/5 Cord switch

DB 41 Pulley for motor
SF 515 Motor mounting screw (5xl5mm)
DB 43 Motor, 220 volt

DB 45 Tailstock assembly, complete
DB 45/1 Tailstock casting & clamping plate
SC 620 Allen head screw (6x20mm) for clamping plate
SC 615 Allen head screw (6x15mm) for spindle clamp
DB 45/2 Spacer washer for spindle clamp
DB 45/3 Tailstock spindle
SL 68 Locating screw (6x8min) for spindle
DB 45/4 Tailstock spindle feed screw,
DB 45/5 Bearing sleeve for feed screw
SS 6B Set screw (6x8mm) for bearing sleeve
DB 12 Hand wheel
DB 13 Nut for hand wheel

DB 50 Set of drive belts
DB 50a Small drive belt
DB 50b Large drive belt

DB 55 Tool post complete with screws & "T" nuts
DB 55/1 Tool post without screws
SC 630 Allen head screw (6x30mm) tor mountlng tool post (type illustrated)
SC 620 Allen head screw (6x20mm) for mounting tool post (recessed bore type)
SC 615 Allen head screw (6x15mm) for clamping tool bit
DB 14 "T" nut
DB 60 Vertical column complete with adapter & screws
DB 60/1 Column
DB 60/2 Adapter
DB 11 Headstock tapered clamping screw
SC 620 Allen head screw (6x30mm)

DB 61 Lathe dog
DB 62 Grinding wheel arbor, washer & screw
DB 63 Dead center
DB 64 Face plate
DB 65 Slotted adapter screw
DB 66 Allen wrench
DB 67 Wood storage case for Unimat
DB 68 Operating & Instruction manual

3-Jaw Universal Lathe Chuck, DB 1001

DB 1001/1 Back plate (adapter)
DB 1001/2 Jaws, unground. set of 3
DB 1001/3 Horseshoe clip
DB 1001/1 Tightening bars
SF 425 Flat head screw (4x25mm)

Drill Chuck, DB 1005

DB 1005/1 Drill chuck body
DB 1005/2 Key

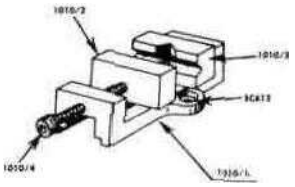
ACCESSORIES

4-Jaw Independent Lathe Chuck, DB 1001a

DB 1001a/1 Back place (adapter]
DB 1001a/2 Jaws, set of 4
DB 1001a/3 Key
SF 430 Flat head screw (4x30mm)

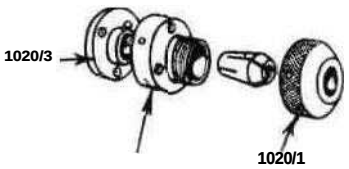
Machine Vise, DB 1010

DB 1010/1 Vise frame
DB 1010/1 Movable jaws & guide plate
SF 58 Flat head screw (5x8mm) for plate
DB 1010/3 Stationary jaw
DB 1010/4 Clamping screw & pin
SC 612 Allen head screw (6xl2mm)
DB 14 "T" nut
SM 410 Fillister head screw (4x10mm)



Collet Attachment, DB 1020

DB 1020/1 Nosepiece
DB 1030/3 Collet holder body
DB 1020/3 Back plate (adapter)
DB 1001/4 Tightening bars
ST 418 Flat head screw (4x18mm)



1020/2

Polishing Arbor, DB 1030

DB 1030/1 Back plate (adapter)
DB 1030/1 Arbor
SM 418 Fillister head screw (4xl8mm)

Steady Rest, DB 1040

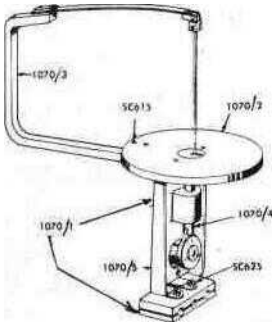
DB 1040/1 Casting with clamping plate
DB 1040/1 jaws, set of 3
SC 612 Allen head screw (6xl2mm) for clamping jaws
SC 620 Allen head screw (6x20mm) for clamplng plate

REPLACEMENT PARTS LIST

ACCESSORIES cont'd

Jig Saw Attachment, DB 1070

DB 1070/1 Base casting & clamp plate
SC 625 Allen head screw (6x25mm)
DB 1070/2 Saw table
SC 615 Allen head screw (6x15mm]
DB 1070/3 Top frame with leaf spring & clamp
DB 1070/4 Bottom blade clamp, bar & bearing
DB 1070/5 Eccentric driver
DB 1001/4 Tightening bar



Adjustable Hand Tool Rest, DB 1201a

DB 1201a/1 Casting with clamping plate & pin
SC 620 Allen head screw (6x20mm)
DB 1201a/2 "T" bar tool post

Milling Table, DB 1210

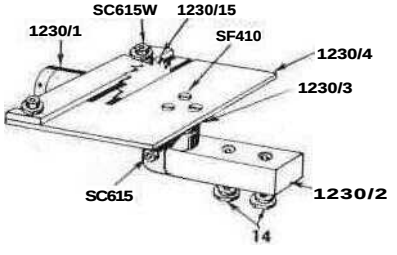
DB 1210/1 Table
SC 612 Allen head screw [6x12mm)
DB 14 "T" nut
DB 1210/2 Clamp with 2 screws, nut & washer

2 1/2-inch Circular Saw Attachment, DB 1230

DB 1230/1 Arbor with washer & screw
DB 1230/2 Base casting
SC 615 Allen head screw (6x15mm) for base casting
DB 14 "T" nut
DB 1230/3 Pivot arm
SF 410 Flat head screw (4x10mm) for mounting table to pivot arm
DB 1230/4 Saw table
DB 1230/5 Work guide
SC 615W Allen head screw (6x15mm) & washer to clamp guide
DB 1001/4 Tlghteningb a r

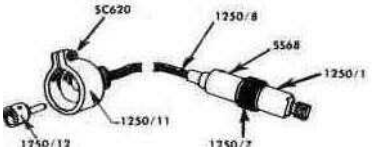
3 9/16-inch Circular Saw Attachment, DB 1230a

DB 1230a/1 Arbor with washer & screw
DB 1230a/2 Base casting
SC 615 Allen head screw (6x15mm) for base casting
DB 14 "T" nut
DB 1230a/3 Pivot arm
SF 410 Flat head screw (4x10mm) for mounting table to pivot arm
DB 1230a/4 Saw table
DB 1230a/5 Work guide
SC 615W Allen head screw (6x15mm) & washer to clamp guide
DB 1001/4 Tightening bar
DB 1230s/6 Bladeguardwithbracket
SM 48 Fillister screw (4x8mm) for mounting guard



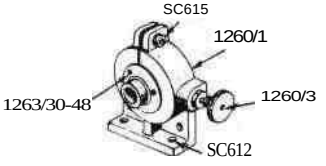
Flexible Shaft, DB 1250

DB 1250/1 Spindle complete with bearings, threaded housing, spring & nut
DB 1250/2 Spindle shaft
DB 1250/3 Ball bearing race
DB 1250/4 Spindle housing
DB 1250/5 Spindle shaft nut
DB 1250/6 Bearing loading spring
DB 1250/7 Knurled ring
DB 1250/8 Shaft complete with core, housing, and knurled ring
DB 1250/9 Shaft housing with knurled ring
SS 68 Set screw (6x8mm) for sleeve
DB 1250/10 Shaft core
DB 1250/11 Adapter clamp for headstock
SC 620 Allen head screw (6x20mm)
DB 1250/12 Threaded driver
DB 1001/4 Tightening bar



Indexing & Dividing Head, DB 1260

DB 1260/1 Indexing head casting
SC 615 Allen head screw (6x15rnm) for clamping index plate
SC 612 Allen head screw (6x12mm) for mounting unit on cross slide
DB 14 "T" nut
DB 1260/2 Horseshoe clip for Index plate
DB 1260/3 Spring loaded locking pin with threaded holder, spring & pin with knurled head
DB 1260/4 Pin with knurled head only
DB 1263/30 Indexplatefor30divisions
DB 1263/36 Index plate for 36 divisions
DB 1263/40 Index plate for 40 divisions
DB 1263/48 Index plate for 48 divisions
DB 66a Allen wrench, short head



Round Table, DB 1261

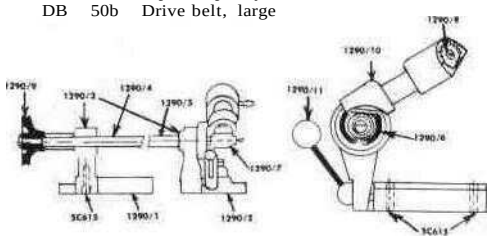
DB 1261/1 Table
DB 1261/2 Clamp with 2 screws, nut & washer

Slow Speed Attachment, DB 1280

DB 1280/1 Motor bracket casting
SC 620 Allen head screw (6x20mm)
DB 35 Idler bearing & pulley assembly (also see DB 35/1 to 35/5)

Power Feed Attachment, DB 1290

DB 1290/1 Base casting
DB 1290/2 Base casting
DB 1290/3 Bearing casting & bearing
SC 615 Allen head screw
DB 1290/4 Drive shaft, washer & nut
DB 1290/5 Horseshoe clip
DB 1290/6 Horseshoe clip & washer
DB 1290/7 Worm
DB 1290/8 Worm & bevel gears
DB 1290/9 Pulley, nut & washer
DB 1290/10 Gear guard casting
DB 1290/ll Hand lever & spring
DB 1290/12 Handwheel with gear
DB 1290/13 Pulley-nut for headstock spindle pulley
DB 50b Drive belt, large

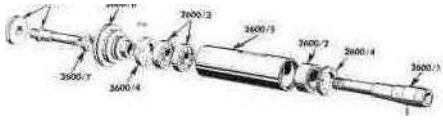


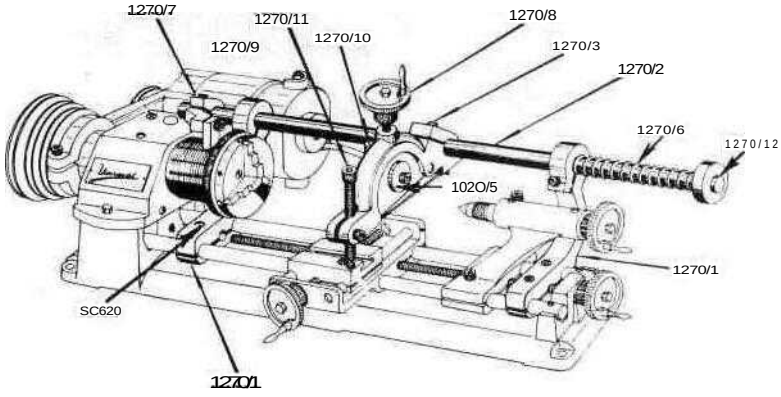
Headstock Raising Block, DB 1310

DB 1310/1 Raising block
DB 1310/2 Double hole clamping bolt

Drawbar Spindle, Watchmaker's Style WW, DB 2600

DB 2600/1 Spindle shaft
DB 2500/2 Front roller bearing race
DB 2600/3 Pair of angular-contact rear bearings
DB 2600/4 Threaded bearing holder rings
DB 2600/5 Spindle housing
DB 2600/6 Spindle pulley
DB 2600/7 Nut for pulley
DB 2600/8 Draw bar with hand wheel



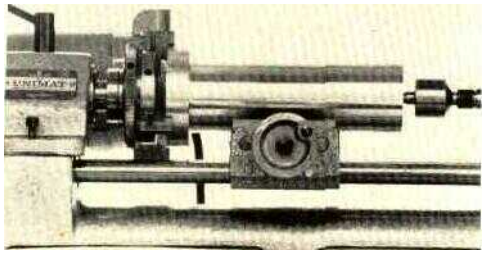


Thread Chasing Attachment, DB 1270

DB 1270/1 Mounting bracket casting
SC 620 Allen head screw (6x20mm) for mounting bracket
DB 1270/2 Guide rod
DB 1270/3 Cutting arm casting with pivoting tool holder base
SC 620 Allen head screw (6x20mm) for cutting arm
DB 1270/4 Leaf spring for cutting arm
SC 612 Allen head screw (6x12mm) for leaf spring
DB 1270/5 External threading tool holder with spacer washer
SC 620 Allen head screw (6x20mm) for external tool holder
DB l270/6 Guide rod return spring
DB 1270/7 Follower arm casting
SC 625 Allen head screw (6x25mm) for follower arm
DB 1270/8 Depth adjustment wheel
DB 1270/9 follower only, (give t.p.i. size)
DB 1270/10 Internal threading tool holder
SC 615 Allen head screw (6x15mm) for internal tool holder
DB 1270/11 Adjustment screw for cutting arm
DB 1270/12 Spring stop collar & set screw
DB 1107 Outside (external) threading tool bit
SF 430 Flat head screw (4x30mm) for mounting thread pattern on 3-jaw lathe chuck
SF 435 Flat head screw (4x35mm) for mounting thread pattern on 4-jaw independent lathe chuck
DB 66a Allen wrench, short head

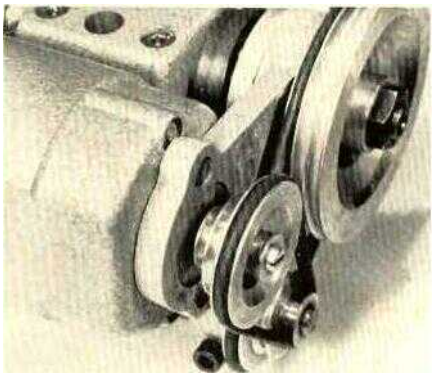
SPEED CHART

The speed of your Unimat headstock spindle depends upon four factors; the motor, the belt arrangement, the load and the kind of cutting operation. The heavier the workplece, the more load and consequent reduction in speed. Your spindle will always tend to accelerate up to maximum speed, however as you start to feed a lathe tool, or drill, it will slow down slightly. If you feed too fast, the spindle may even stall causing the belts to slip. In this way, you have a built-in safety factor.



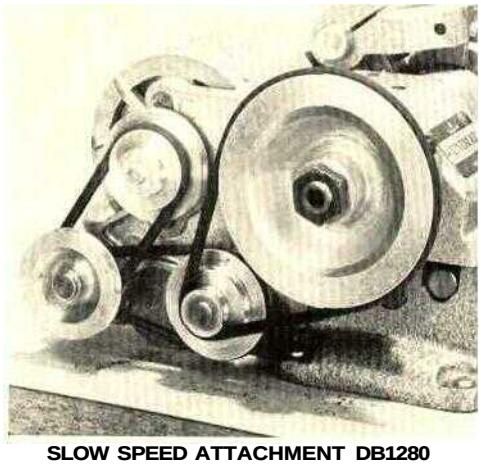
MOTOR LOAD TEST BAR

The R.P.M. figures listed in the chart were based on this test procedure: an aluminum bar weighing 1 8 ½ - ounces, the maximum size that fits the lathe (without using the Headstock Raising Block) was mounted between the 3-jaw chuck and the tailstock Ball Bearing Center. This bar (see photo) measures $5^{5}/_{32}$-inch long, by $1^{5}/_{8}$-inch dia., with 2½-inch dia. by 1/2-inch neck. Motors were run for a 15 minute warmup, and speeds were measured with line voltage held at 120.



BELT AND PULLEYS ON MAXIMUM R.P.M.

The basic Unimat provides eleven speeds. Two additional speeds used for threading and turning large diameter work are provided by DB 1280 Slow Speed Attachment. You can obtain other speeds by machining your own extra motor pulleys of diameter to suit.

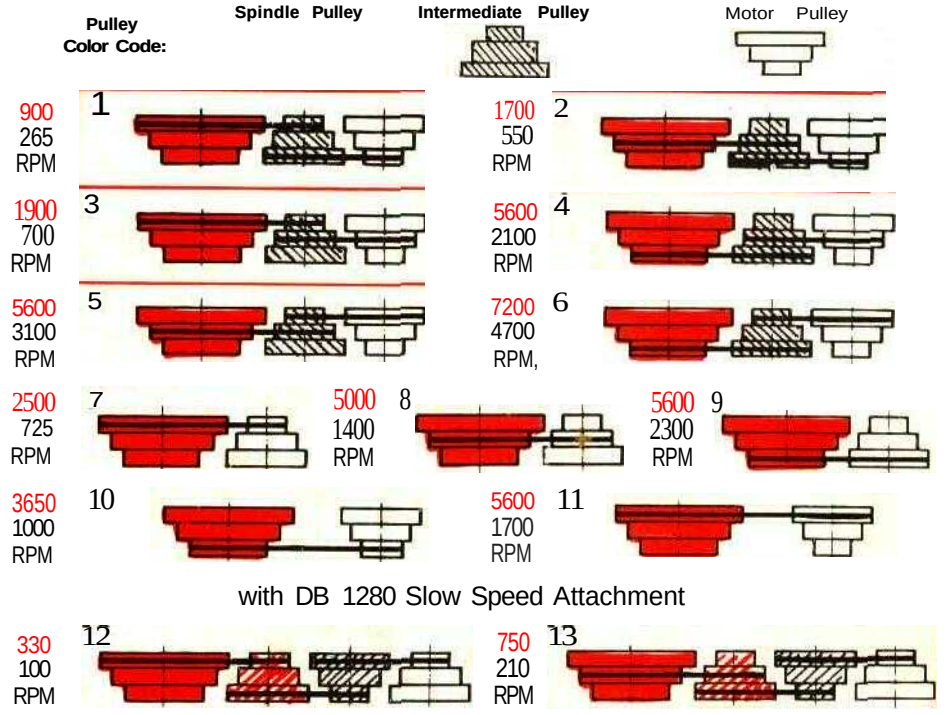


SLOW SPEED ATTACHMENT DB1280

In maximum speed belt position with Drill Chuck and no other load, speeds can exceed 10,000 R.P.M. This is not recommended for continuous use. Before using set-up #6 or 9, be sure bearings are free turning and well lubricated. Note that cutting and drilling speeds under load will drop to 1 2 or less of the R.P.M. figures shown at all speeds above 1,000 R.P.M.

SPINDLE SPEEDS
(with test bar mounted in 3-jaw chuck)

Motor Speed Running Free
BRUSH-type: 16,000 (Spindle R.P.M. indicated in RED)
INDUCTION-type: 3,600 (Spindle R.P.M. indicated in BLACK)



with DB 1280 Slow Speed Attachment

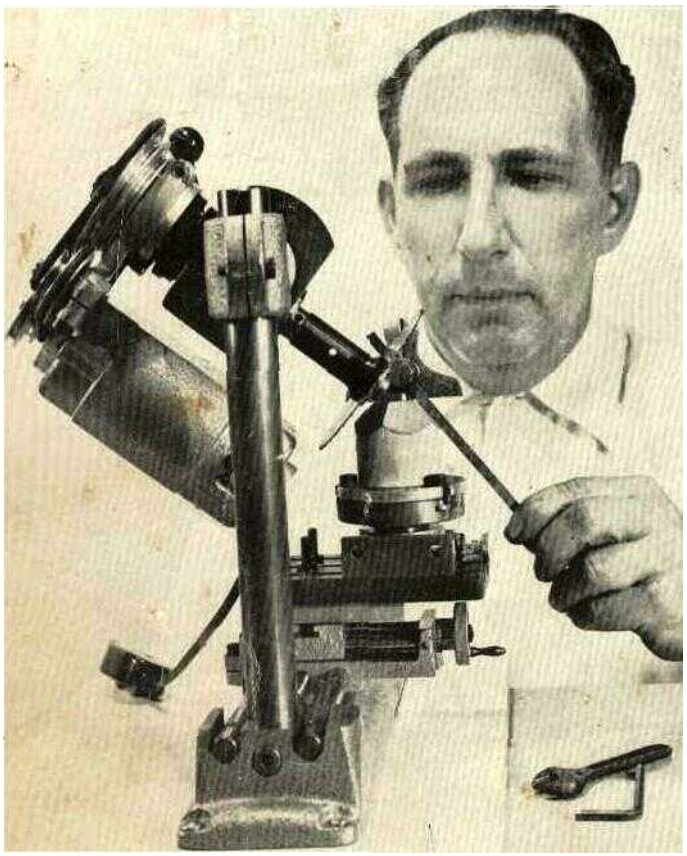
AVERAGE CUTTING SPEEDS

NOTE: These speeds are listed only as a help in getting started. Optimum speeds depend on hardness of materials, cutting angles, etc. It Is suggested that you make trial cuts at recommended R.P.M., and then increase or decrease if better results are obtained. Keep a chart or notes of your own results.

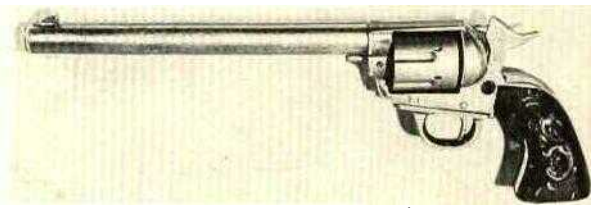
MATERIAL	0-5/16" diameter	5/16-3/4" diameter	3/4-1" diameter	1-2" diameter
TURNING AND MILLING				
Steel	1,400	950	590	310
(Aluminum, Brass, Copper)	1,700	1,400	950	500
Wood, Plastic	2,200	1,700	1,400	950
DRILLING (high speed drills only)				
Steel	1,700	1,400	950	310
(Aluminum. Brass, Copper)	2,200	1,700	1,400	950
Wood, Plastic	2.200	1,700	1,400	950
JIG SAWING				
Steel		370		
(Aluminum, Brass, Copper)		590		
Wood. Plastic		730		
CIRCULAR SAWING				
(Aluminum. Brass, Copper)		**590**		
Wood, Plastic		730		
THREADING				
All materials	500	330	330	200
GRINDING				
Metals (per stone diameter)	5,200	3,200	2,000	1.700

THE WONDERFUL WORLD OF UNIMAT

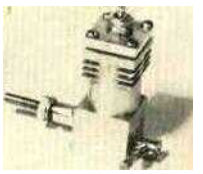
Initially sold only to industrial users, UNIMAT has also become the leading, metal-working machine tool for serious-minded hobbyists. There are years of fun and satisfaction ahead for you with UNIMAT and the fascinating new hobby of miniature machining. You'll have pride In accomplishment with the accurate results that the versatile UNIMAT will give you. Pictured here ore but a few of the thousands of different projects handsomely created with the UNIMAT equipment.



Designer Erv Edell, Chicago, Ill. machining mathematlcal model.

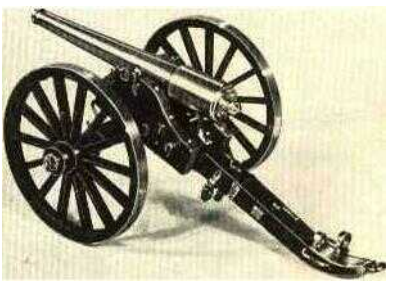


"Colt Peacemaker", 1/2 size replica $7\frac{1}{2}$ made of brass & wood by R, Stankiewicz, Bohemia, N.Y.

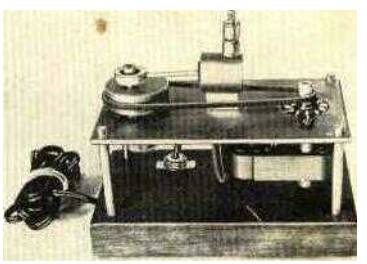


Above left Film Strip Carrier & Lens Adapter made of aluminum by Dr. A. Tumolo, Brooklyn, N.Y.

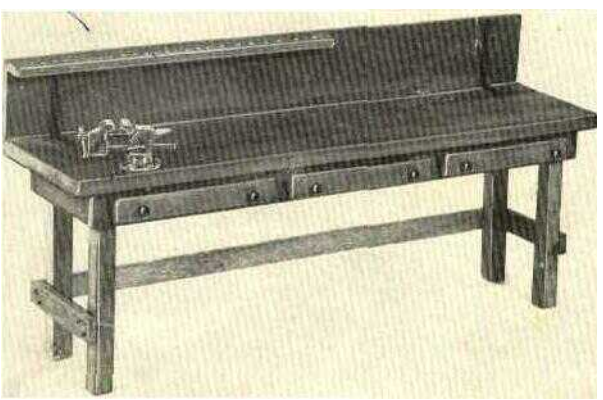
Above right, "Little Dragon" airplane engine made of aluminum bar stock by James Wilson, Hazelwood, Mo.



"Parrot Rifle" replica made of brass & walnut by Robert J. Slattery, Denver, Colo.



Aquarium Air Pump, made of brass & **wood** by Louis Herbinger, Bronx, N.Y.



Steam Engine (left) made of steel, brass & bronze by Henry Limbach, Belrose, N.Y. Wood Model Workbench (above) with operating steel vise. Size 10" x 5" x 3" made by Richard Neff, Houston, Tex. Below, 32" Underwater Spear Gun, made from scrap tubing & aluminum bar stock by Gunsmith H.M. Nierling, Dania, Flo.

Photograph courtesy o f Mechanix Illustrated Magazine, copyright 1963,