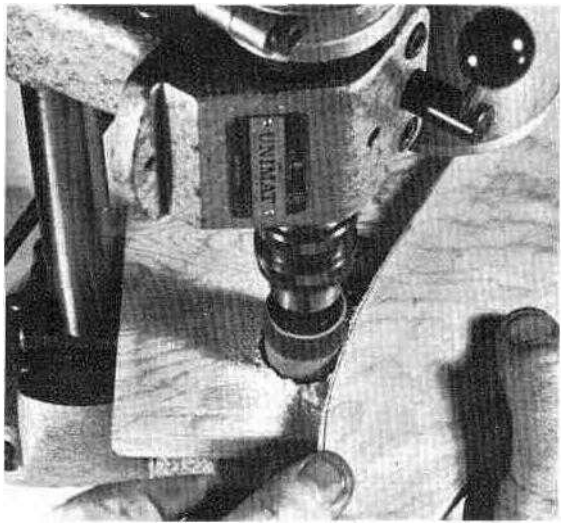
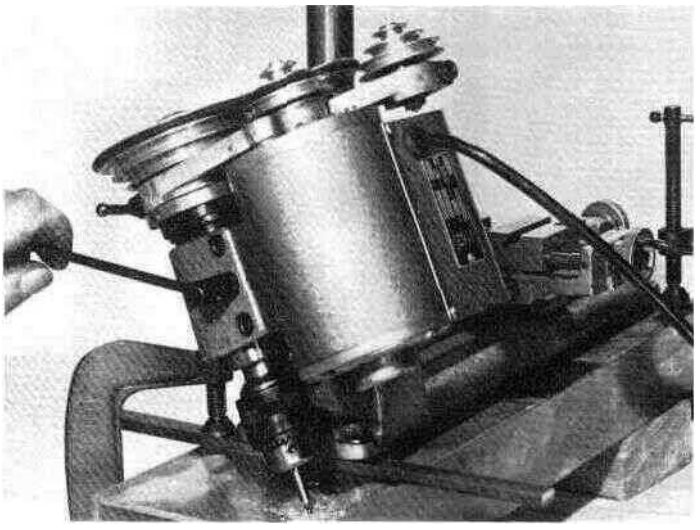
wrench. Photo 15C shows an alternate method in which a center point held in the chuck guides the tap center. The center is a $^{3}/_{16}$ x $7^{1}/_{2}$ inch steel dowel ground to a perfect point. If it is necessary to move the drill press upward on the column, this pointed rod makes centering easy.

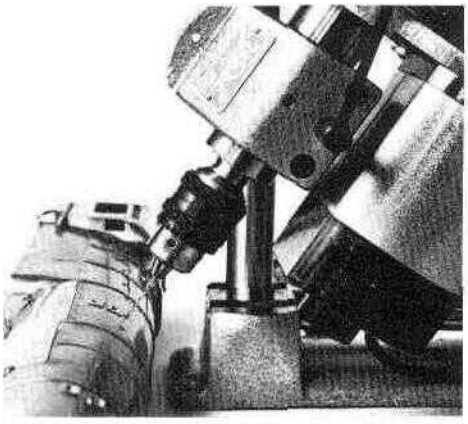
DRILL PRESS cont'd



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

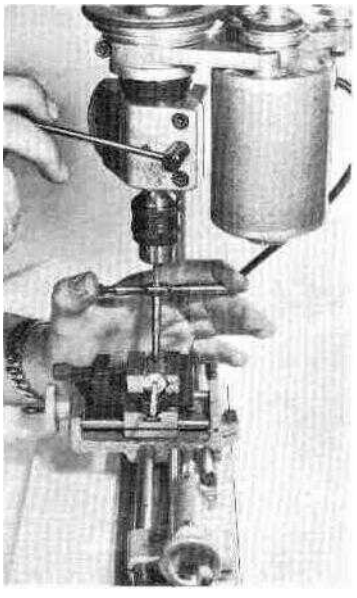


15D To handle a big job, take Unimat to the work! Clamps Insure accurate location.

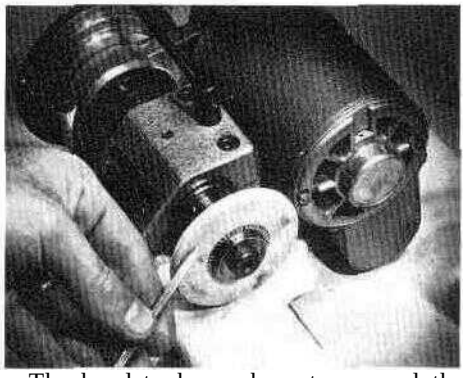


15B Drilling model locomotive.

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



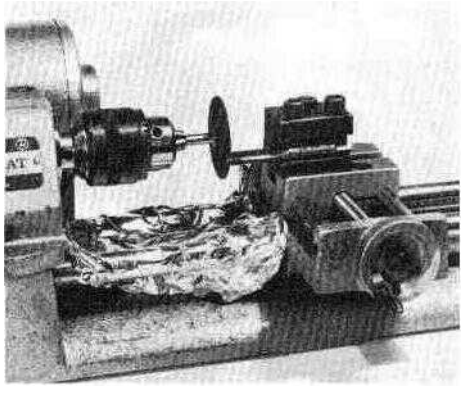
BENCH GRINDER

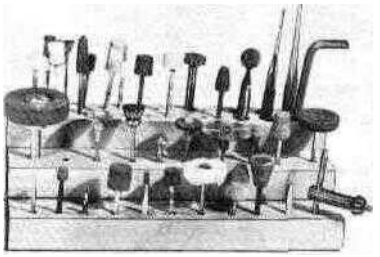


The headstock can be setup as a lathe or swiveled at a right angle to the bed for more working room. Whenever you work with abrasives be sure to protect the ways of the Unimat. It takes only a moment, to tie a piece of cloth or tissue paper to the bed bars with wire or rubber bands. Abrasive dust ground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



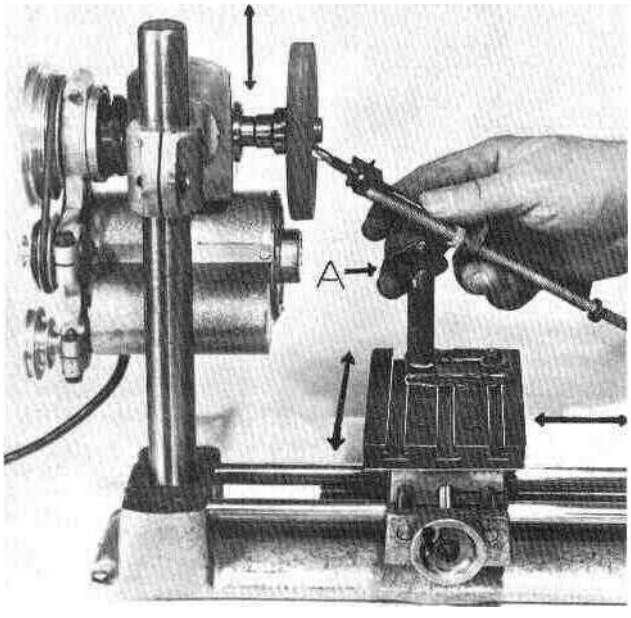


you make a tool rack of three pieces of scrap wood with holes to fit the tool shafts. Such a rack will save hours of time otherwise lost in hunting for tools.

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.

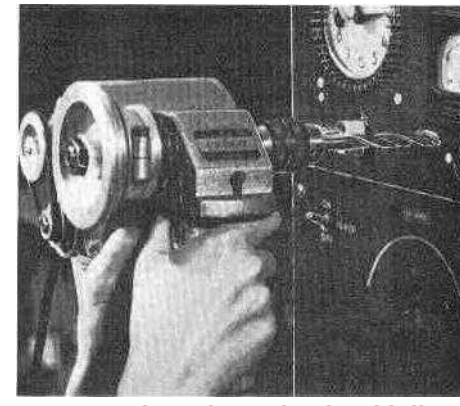
Grinding speeds depend on the material. Usually faster speeds remove the metal quicker, but you may overheat the part causing it to burn, chip or crack. Keep a pan of cool water close by and wet the workpiece frequently to reduce heat. Avoid excessive pressure on the grinding wheel. If a wheel or stone 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.

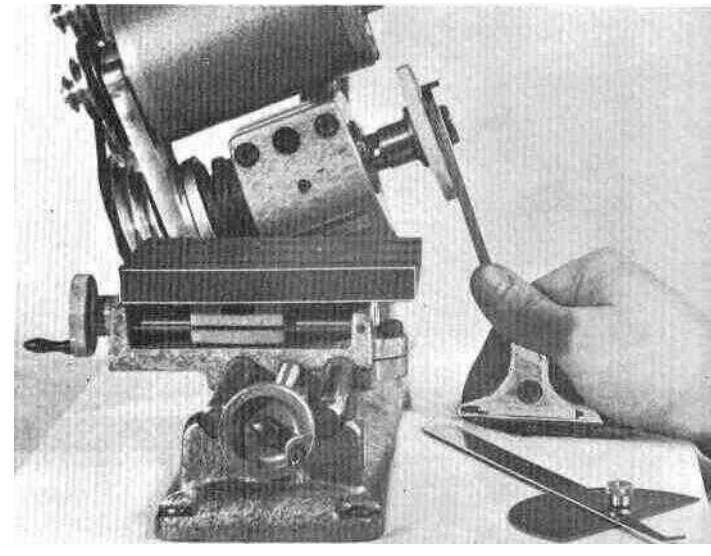
An unusual example of Unimat versatility is the setup for grinding drills, above. This drill grinding swivel attachment is typical of many such units on the market. The drill holder is adjustable at point "A" to 88, 69, 59 and 49 degree settings which correspond to the angles produced at the drill point.

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.

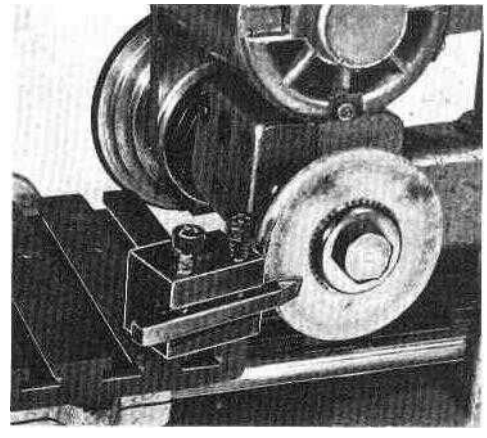


Useanordinaryheavydutyhanddrill on this kind of job, and you risk breaking through the aluminum and damaging partswithin.TheUnimatownerinthis case drilled a starting hole with a $^1/_4$-inch center drill, followed by a $^3/_8$-inch and $^1/_2$-inch drill, each on $^1/_4$-inch step down shanks. The drill 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.



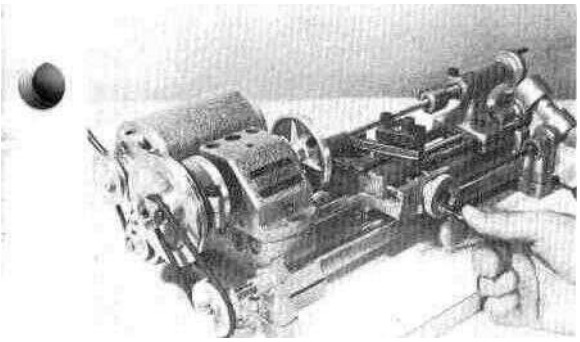
Grinding at Angles

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

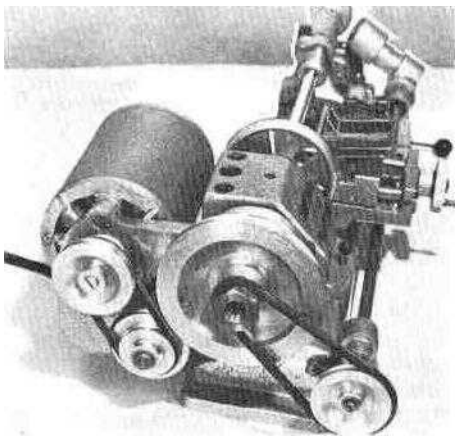
POWER FEED

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

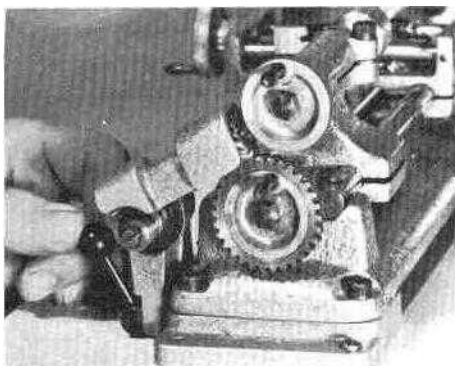


17A Power Feed Attachment gives ultra-smooth finish to motor shaft.

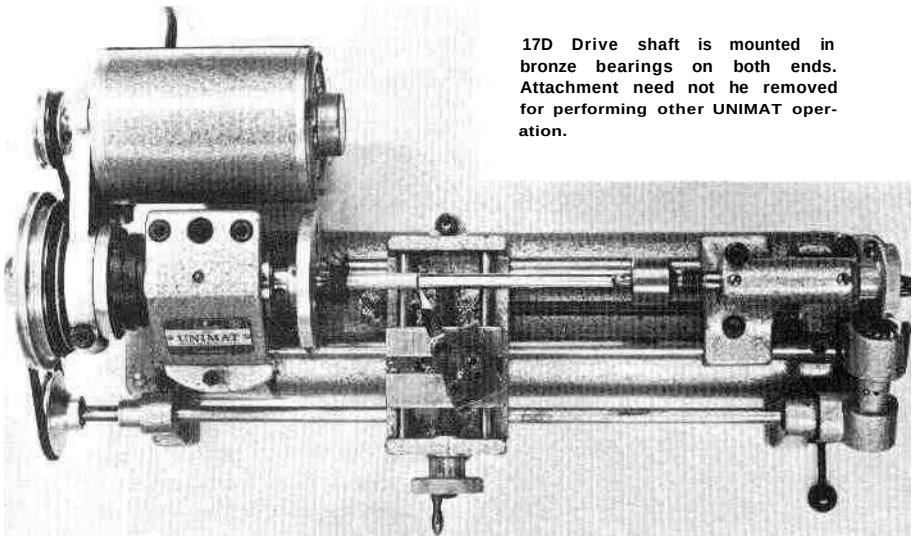
Designed to fit all Unimat models, the Power Feed Attachment is belt driven from the spindle and drives the carriage toward the headstock for super-fine lathe work. Lathe turning, boring, and many operations in machining hard materials, and very small work can be handled with minimum effort and extreme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

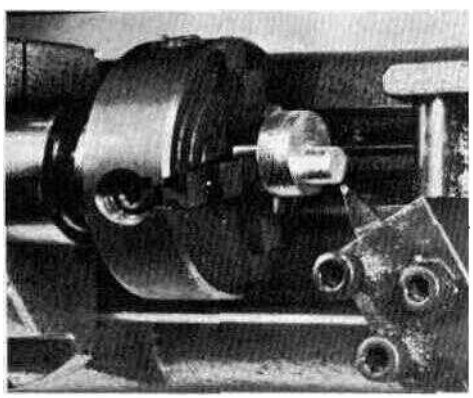
1. Remove complete spindle from headstock by loosening clamping screws and set screw. Remove motor bracket and clamp headstock pulley in a vise between pieces of scrap wood.
2. Remove the spindle nut with an adjustable wrench and replace with Pulley Nut DB 270-13. Replace the spindle assembly as it was 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)

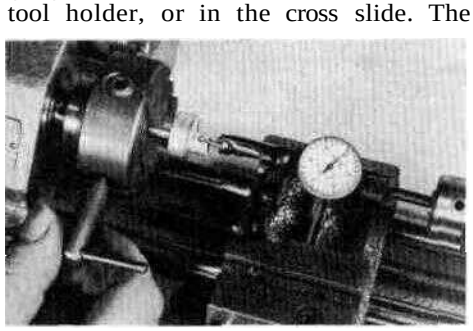


18A Turning off-center crank .

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.

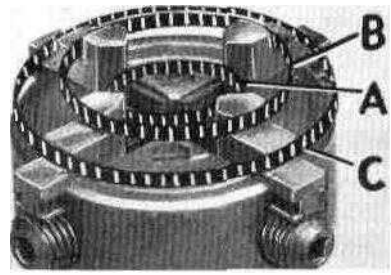
By far, the most convenient way of centering offset work is by using a dial gauge mounted in the tailstock. on the tool holder, or in the cross slide. The



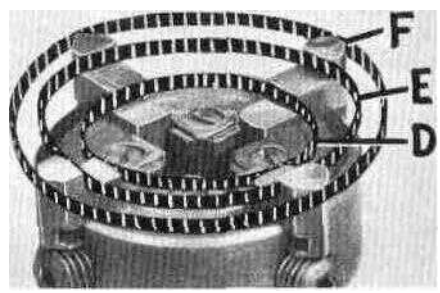
13B Indicator dial movement shows work is not centered.

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

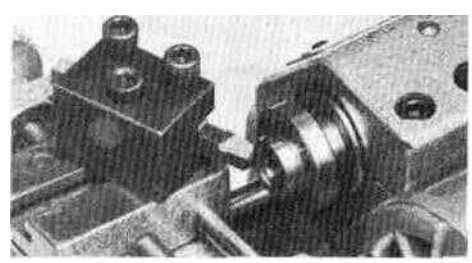


JAWS REVERSED



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*

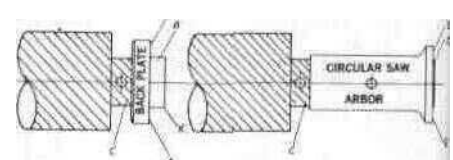
Note: Capacities are greater with Raising Block (DB 1310) is used and when chuck is mounted on cross slide or on vertical setup.

***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

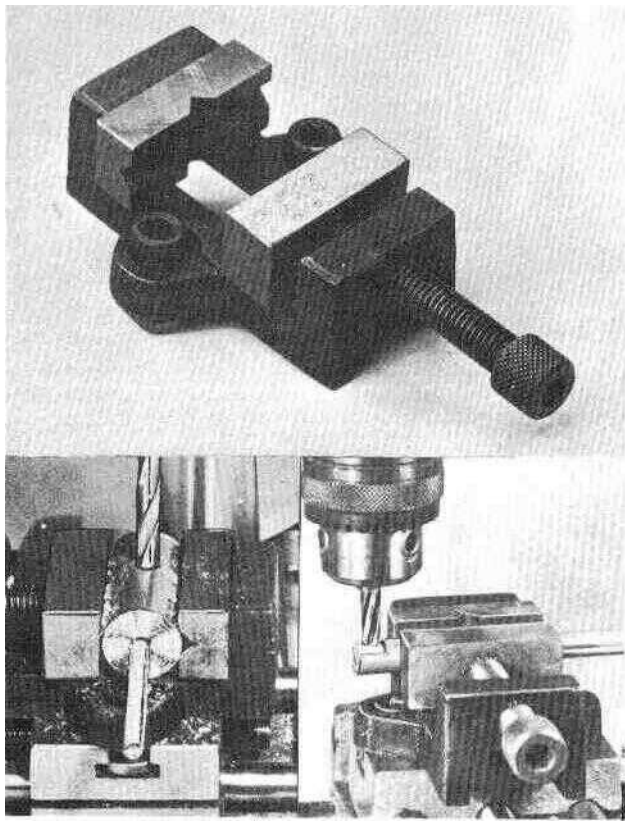
The following steps apply to lathe chucks DB 1001 & DB 1001 A, and also to the DB 1020 Collet attachment, DB 1030 Polishing Arbor and also DB 1230, 1230A Circular Saw Arbor.

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

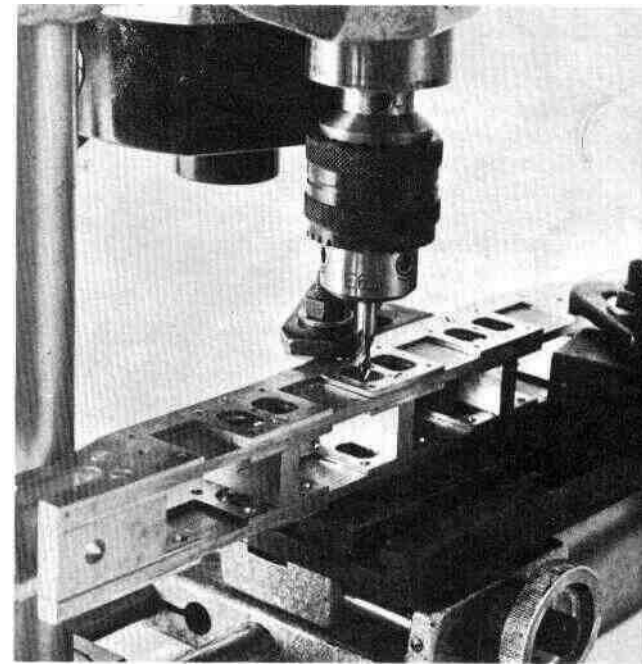
The 3 x 5-inch Milling Table is a true flat surface on which round stock, machine parts, model castings and practically any irregularly shaped part can be clamped. The T-slots in the table are the same size as the one in the Unimat cross slide. This makes it possible to use the slotted screw chuck mounting 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.

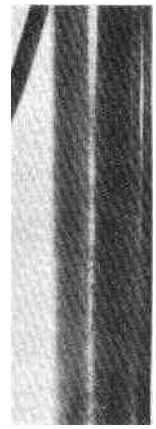
A very unusual Unimat technique is possible with the milling table. A part can be chucked in any Unimat, chuck, collet attachment, or mounted on the faceplate. Then, without upsetting the centering, you can remove the chuck from the lathe, mount it on the milling table for a cut, and again return to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

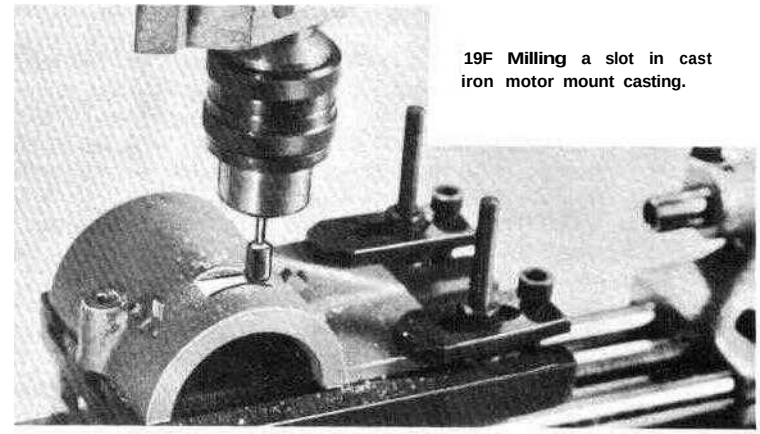
Two T-nuts hold the milling table to the cross slide in 8 *different, ways,* lengthwise, vertical or at a 45-degree angle to the lathe axis. When mounting your work, arrange the T-slot, clamps so that the longest possible straight surface is in contact with the top of the table.

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.





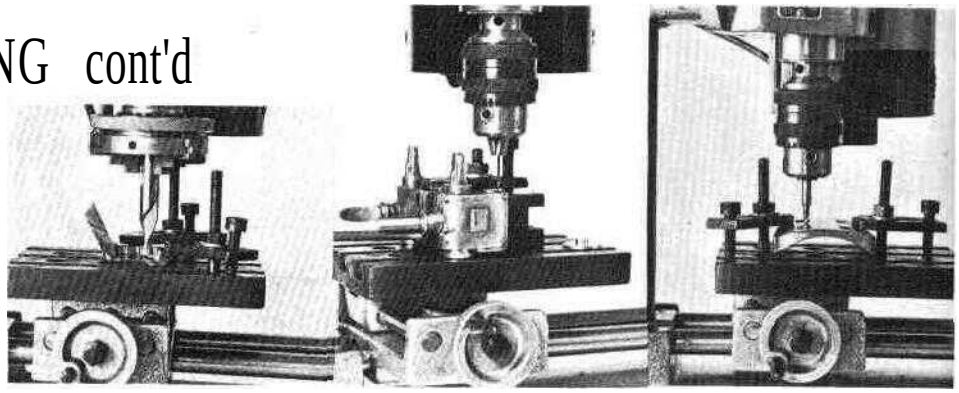


19F Milling a slot in cast iron motor mount casting.

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.

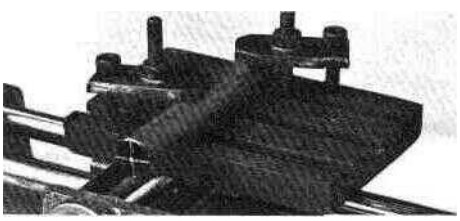
One way to roughly estimate the proper R.P.M. is to divide the recommended drilling speed for the same diameter tool by 2. Milling requires the same cutter lubrication recommended for lathe work and drilling. Always be sure that machine and work are solidly locked down, and make your starting cuts lightly. 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.



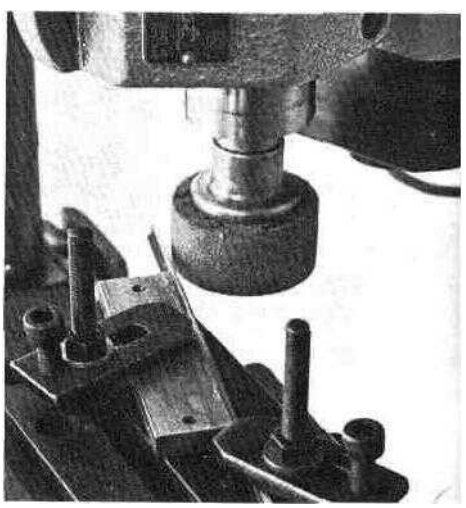
10A, B, C Complex shapes milled In parts for a working model steam locomotive. Use the drill chuck, or Collet Attachment, for mills under 1/4-inch, and the 3-jaw lathe chuck for larger sizes. The bigger the mill the slower the R.P.M.

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.

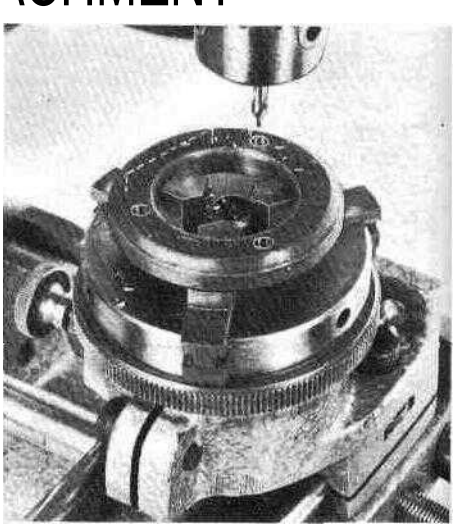
You can use your Basic Unimat 3-Jaw Lathe Chuck on the attachment. It has a built-in backplate. Just remove the lathe chuck backplate, place the chuck on the attachment, line up the holes and mount with the three screws. Be sure to tighten them a few turns each at a time, instead of running them all 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.