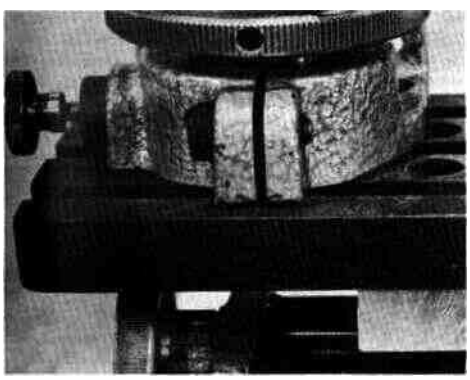
Next, we mount the chuck on the Index Attachment and using the drill press handlever, we bring the center drill (mounted in drill chuck) down to the center punch mark. Lathe feeds are used in both directions to bring work to exactly the right place. Lathe cross slide and carriage locking screws are now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

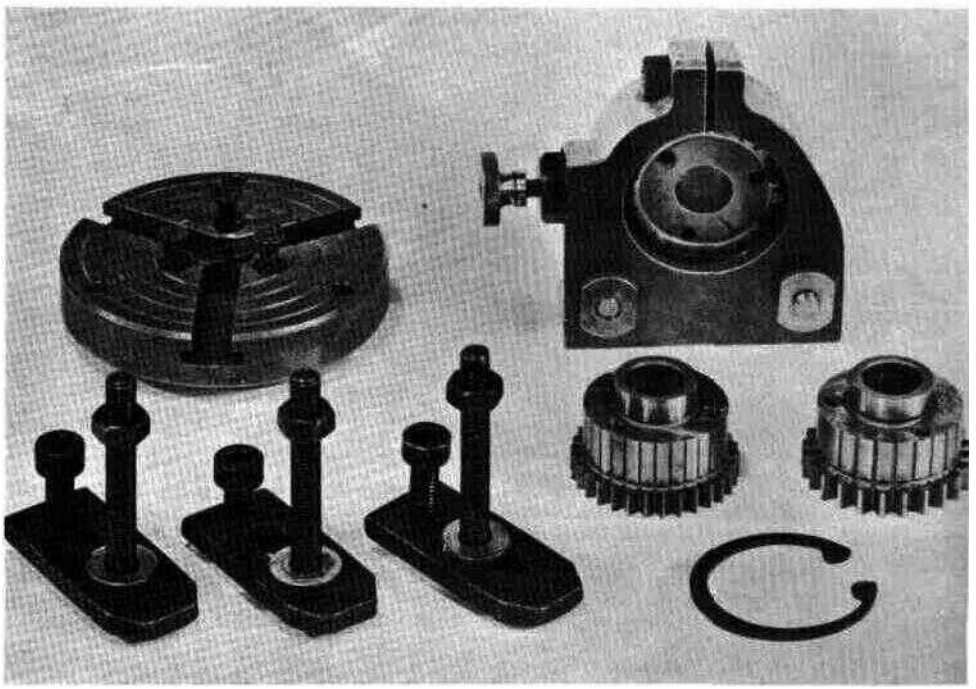
Now we tighten the Allen head locking screw on the attachment. This locks the assembly tightly in place and prevents the slightest rotation. The first hole is drilled, followed by the second and third holes. In each instance, a starting hole is made with the center drill, followed by the regular drill. 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.

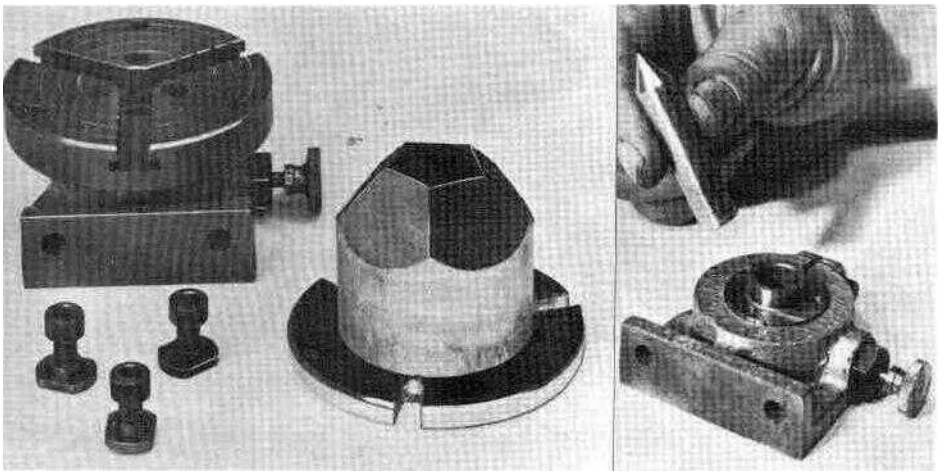
Square bolt heads can be made by this method, as well as hexagonal bolts of any size. A pyramid shape can be milled by setting the headstock at an angle. Gears require a milling cutter shaped to the exact profile of the desired gear tooth. If the gear teeth are to be milled at an angle, you'll need to 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.

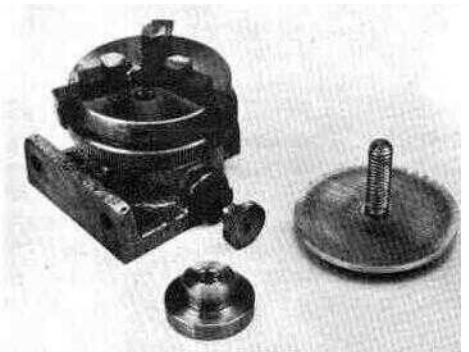
# ACCESSORIES INDEXING DIVIDING cont'd and GEAR CUTTING

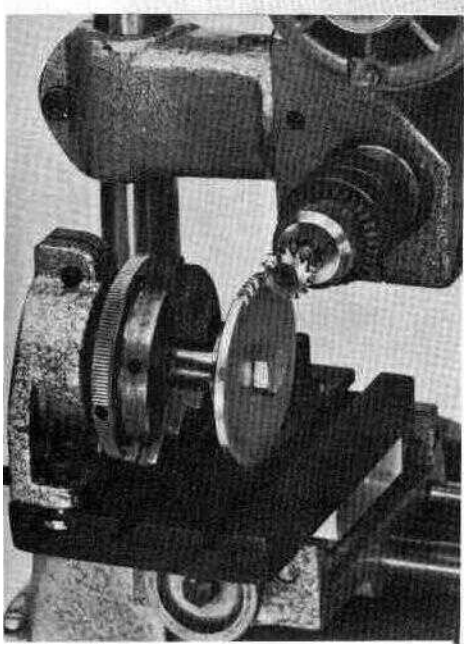


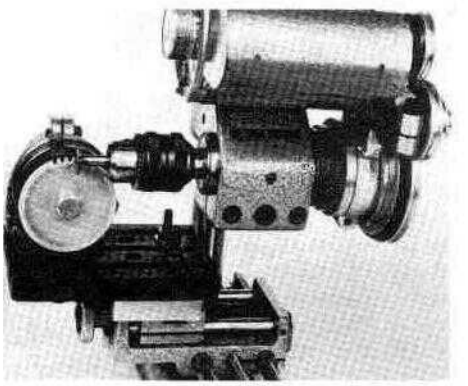
The intermediate mounting plate shown at top left was turned on the Unimat lathe to fit over the Indexing Attachment plate. Made of 1/4-inch aluminum, it has a 1/2-inch center hole. The wooden workpiece, in this case, a 1 3/4-inch maple dowel would have been marred if mounted in the regular 3-jaw chuck. 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.

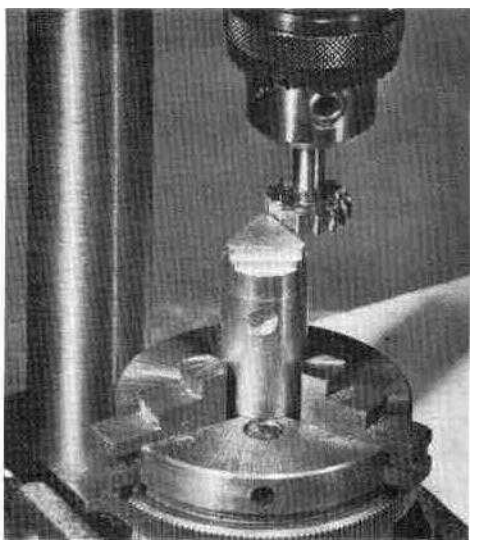






Three views of gear cutting selup show a general procedure. The first step Is to make your own gear blank holder. This one (above left) was turned on the Unirnat lathe from a piece of 1-inch round cold-rolled steel. The flat rear face rests solidly against the top of the 3-|aw chuck providing o precise 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.

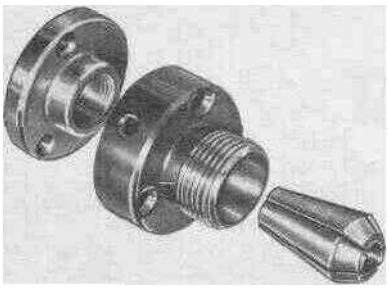
Instrument gears requiring mare accuracy than is obtainable on this setup would be mounted on your own thread-center, or taper center backplates turned to fit the Indexing Attachment. The cutting tool for greatest accuracy, should be mounted in a special holder or in DB 1020 Collet Attachment. The 1/4-inch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

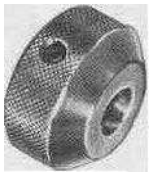


[Above) 3-Jaw Chuck screws directly to attachment collar to automatically center work. Two step triangular insignia plate is milled with Woodruff cutter. Object is setting for ring,
(Below)Unimatversatilitysolvesmachineshop problem. In seconds, Indexing Attachment bolts to DB 1 2 1 0 Milling Table which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

DB 1020

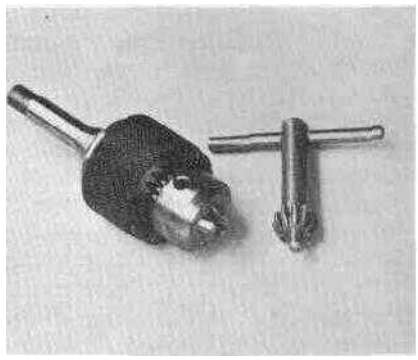
# COLLET ATTACHMENT AND COLLETS





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.

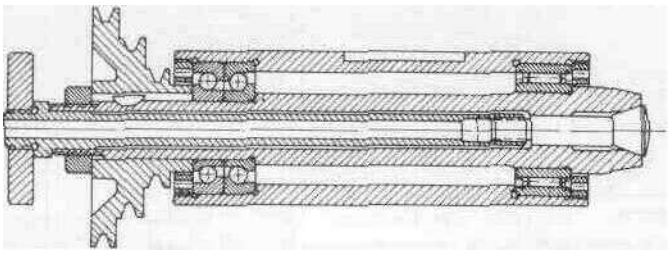
Quarter-inch and 1/8-inch collets will grip the most popular size tool shanks. Never chuck anything but the rated size in any collet. An attempt to grip work more than a few thousandths over or under can cause damage to the collet. Collets are available in all 64th-inch sizes up to 5/16-inch and in all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



DB 2600

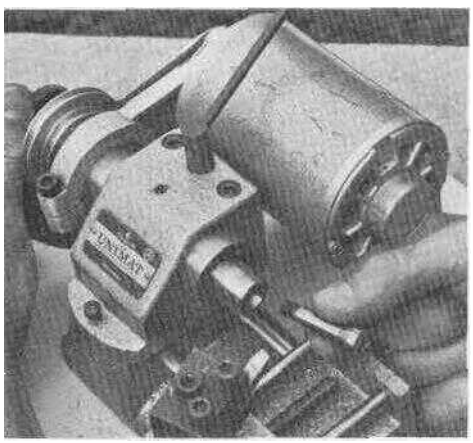
# DRAW BAR SPINDLE

for ultra-fine precision work

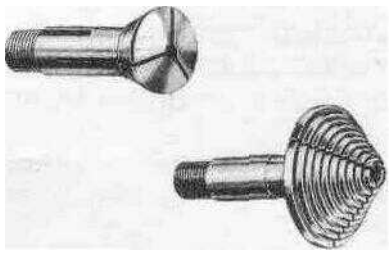


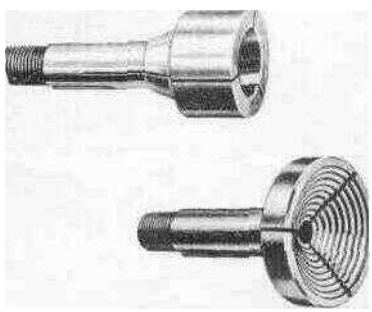
This accessory replaces the standard Unimat headstock spindle. It takes less than a minute to install the assembly which converts your Unimat into a machine capable of watchmaker's precision. The spindle accommodates all standard WW (watchmakers) size lathe collets, chucks and accessories, shown. Like 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.

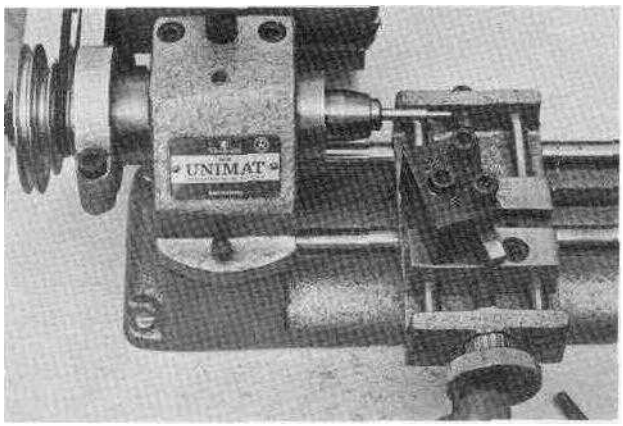
Like the Collet Attachment, collet chucks for the Draw Bar Spindle must not be forced or distorted by use on any size other than the exact diameter stamped on the nose. Bar stock up to 4mm diameter (.157-inch) can be fed through the hollow center of the draw bar. Spindle runout is rated at .0004 or less.



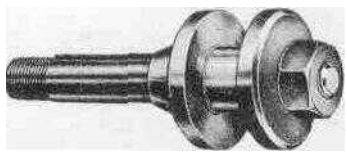
**Before installing collet make sure spindle recess is perfectly clean. Collet keyway must line up with spindle bore key.**








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



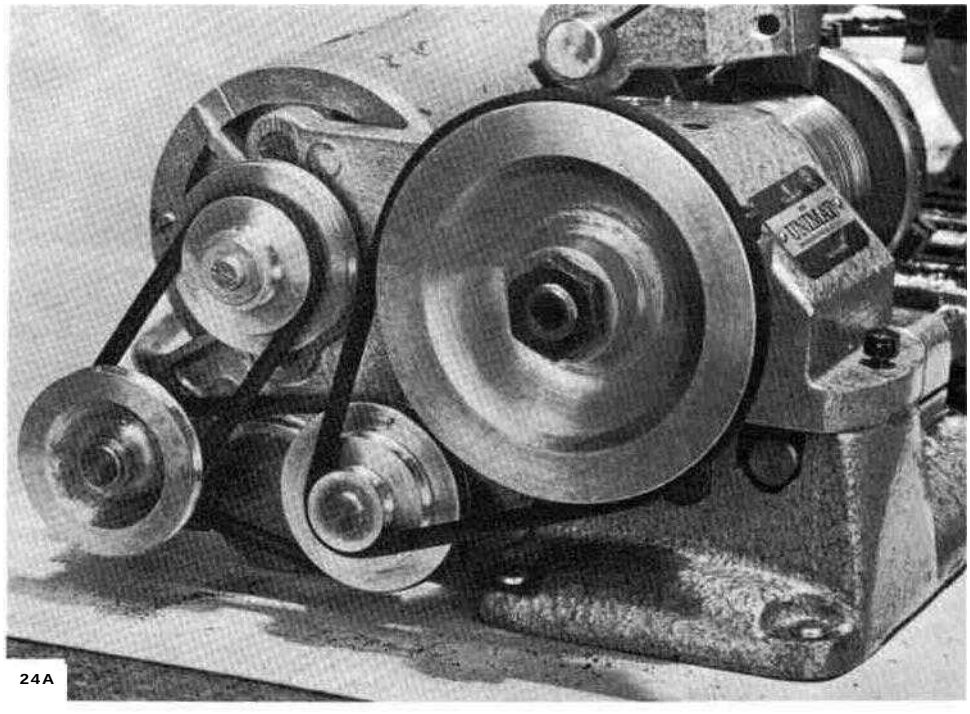
## DB 1280
# SLOW SPEED ATTACHMENT

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.

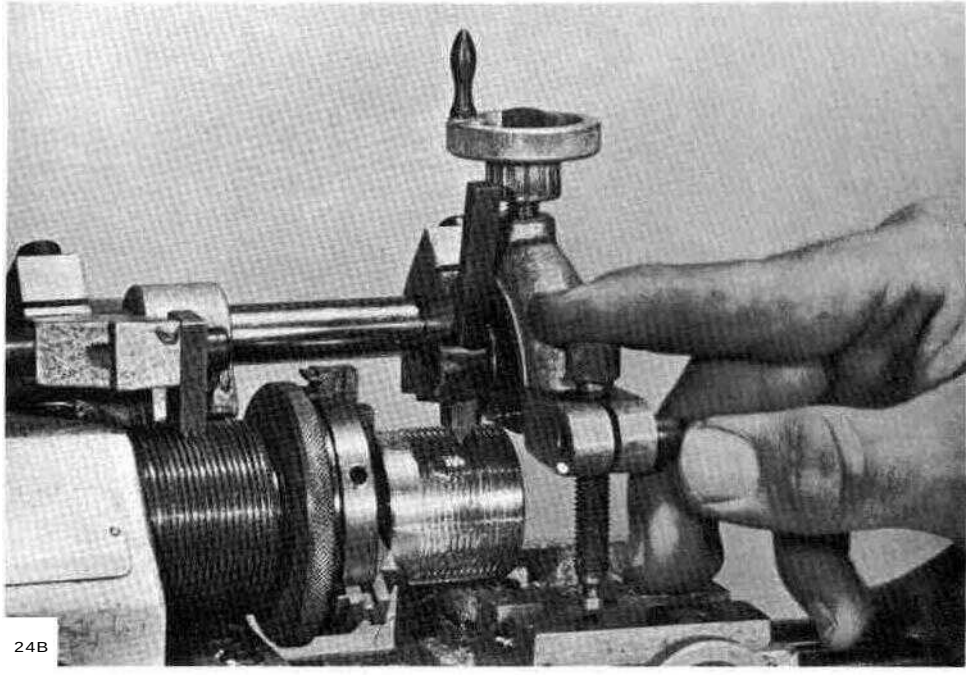
Use a straight edge to make sure the pulleys are in exact plane to one another. Avoid over tightening the Allen head screw which holds the idler pulley ball bearings. The bearings must spin freely without binding.

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.

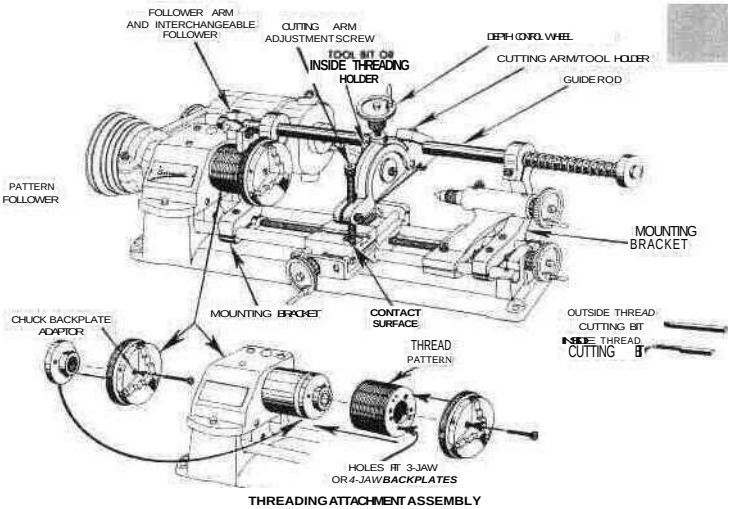
We start by checking the major diameter with a micrometer. In this case, a 1/4-inch screw has a nominal diameter of about .250-inch. Turn down the section of metal to be threaded to this diameter. If the work piece is a stub thread (Photo 24B), it is a good idea to file a rounded edge on the end of the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

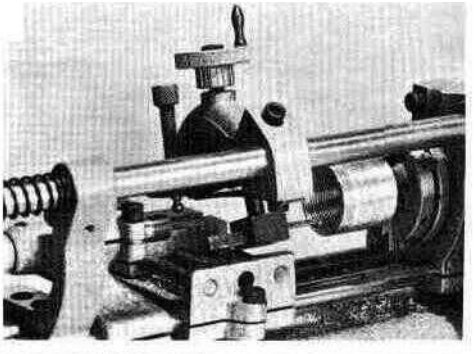
In all threading work, it is important to keep your threading bit tips sharp by touching up with a fine stone. Use light cutting oils for threading steel, and kerosene for aluminum. The workpiece and all parts of the Threading Attachment must always be solidly fastened in place. Whenever you set up for 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.