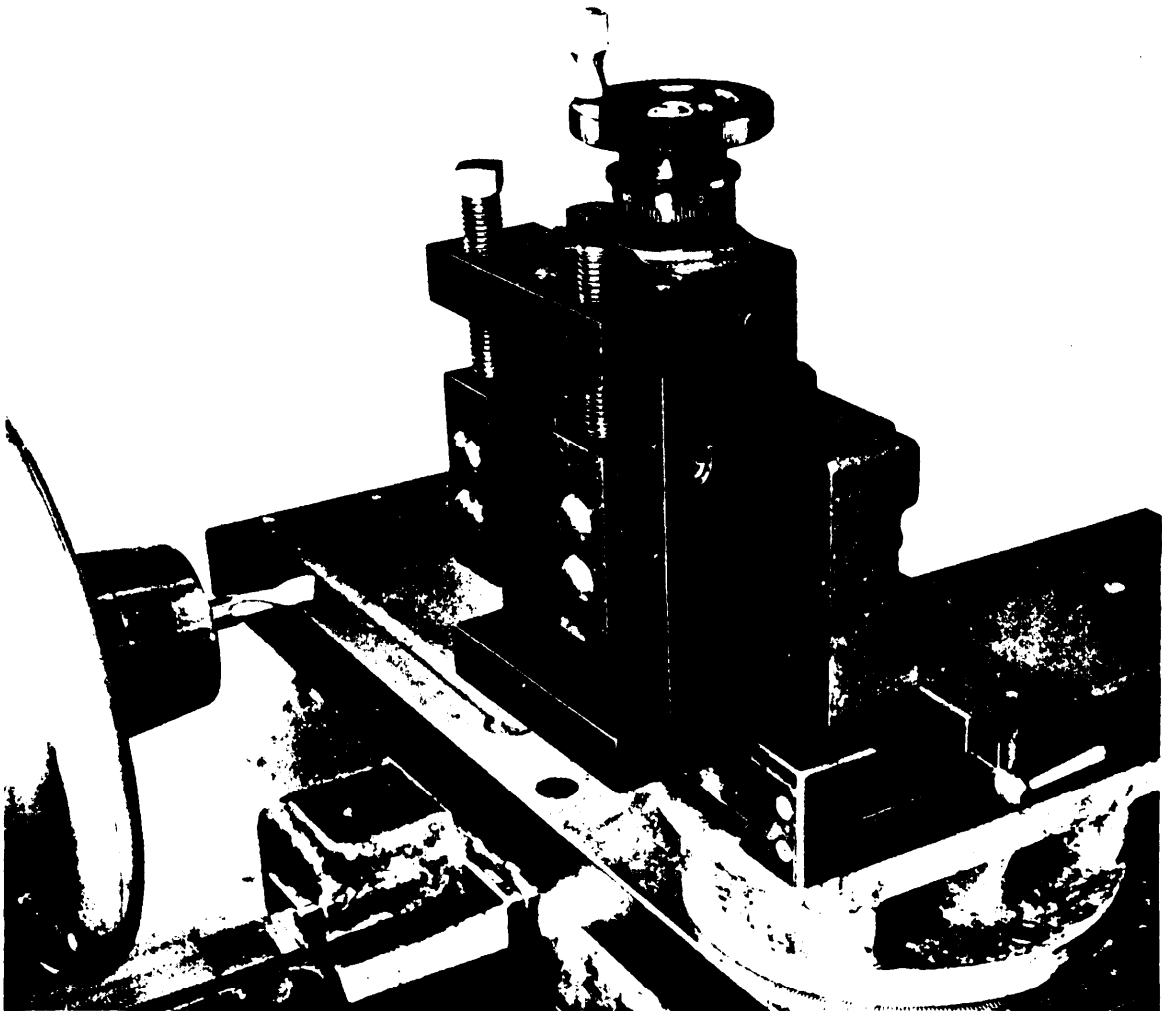


OPERATOR'S MANUAL
FIXTURE, LATHE, METAL CUTTING FOR 2 INCH
DIAMETER ROUND OR 2 INCH SQUARE STOCK,
360 DEGREE INDEX RING,
12-1/2 HIGH, 5 WIDE, 3-7/8 VERTICAL
TRAVEL (NUMERIC PRODUCTS COMPANY
MODEL 312) (3465-022-8817)

Headquarters, Department of the Army, Washington, D. C.
29 November 1967

This copy is a reprint which includes current
pages from Change 1

Model 312 - Milling Fixture



This manual illustrates some of the most common uses of this very versatile lathe attachment. It mounts quickly and firmly on the compound of an engine or a tool room lathe. It provides a convenient but rugged way of holding and locating different sizes and shapes of work pieces for machining. The machining is performed by cutting tools (i.e. end mills, drills etc.) held in and rotated by the spindle. The collets or chucks supplied with the lathe are normally used to hold these cutting tools.

In addition to holding the workpiece, the Model 312 Milling Fixture provides the means of moving the workpiece in a vertical direction. The amount of movement can be read on a calibrated collar and vernier assembly to one ten-thousandth of an inch (.0001). The cross-slide of the lathe is used for cross travel, and the carriage itself, together with the compound, is used to bring the workpiece to cutter and to set and measure the depth of cut.

Round workpieces as large as 2-1/16" in diameter may be rotated or indexed by a protractor unit supplied with the fixture. A vernier provides direct reading to one degree of arc.

Change }
No. 1 }

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, DC, 22 June 1973

**Operator's Manual
FIXTURE, LATHE, METAL CUTTING FOR 2 INCH
DIAMETER ROUND OR 2 INCH SQUARE STOCK,
360 DEGREE INDEX RING,
12-1/2 HIGH, 5 WIDE, 3-7/8 VERTICAL
TRAVEL (NUMERIC PRODUCTS COMPANY MODEL 312)
(3465-022-8817)**

TM 9-3465-200-10, 29 November 1967, is changed as follows:

Page 14. The following paragraphs are added:

Reporting of Equipment Publication Improvements

The reporting of errors, omissions, and recommendations for improving this publication by the individual user is encouraged. Reports should be submitted on DA Form 2028 (Recommended Changes to Publications and forwarded direct to Commander, US Army Weapons Command, ATTN: AMSWE-MAS-SP, Rock Island, IL 61201.

Components of the End Item

Parts included with the end item and considered as components of the end item configuration are listed in the following table.

Table 1. Components of the End Item

Components	Part No.	(FSCM)	Qty
BLOCK STEP:	NPC51	(22049)	2
CASE, CARRYING:	NPC70	(22049)	1
CLAMP, PRECISION:	NPC50	(22049)	2
PROTRACTOR CENTERING: C/O			1
CLAMP, RETAINER:	NPC32	(22049)	1
COLLAR, PROTRACTOR:	NPC33	(22049)	1
PROTRACTOR:	NPC30	(22049)	1

Pages A-1 through A-3. Appendix A is superseded as follows:

**APPENDIX A
BASIC ISSUE ITEMS LIST
AND
ITEMS TROOP INSTALLED OR AUTHORIZED LIST**

Section L INTRODUCTION

1. Scope

This appendix lists basic issue items and items troop installed or authorized required by the crew/operator for operation of the FIXTURE, LATHE, METAL CUTTING.

2. General

This Basic Issue Items List and Items Troop Installed or Authorized List is divided into the following sections:

a. Basic Issue Items List — Section II. A list

m alphabetical sequence of items which are furnished with, and must be turned in with, the end item.

b. Items Troop Installed or Authorized List. Not applicable.

3. Explanation of Columns

The following provides an explanation of columns found in the tabular listings:

a. Federal Stock Number. Indicates the Federal stock number assigned to the item and will be used for requisitioning purposes,

b. Description. Indicates the Federal item name and a minimum description required to identify the item. The last line indicates the reference number followed by the applicable Federal Supply Code for Manufacturer (FSCM) in parentheses. The FSCM is used as an element in item identification to designate manufacturer or distributor or Government agency, etc., and is identified in SB 708-42. Items that are included in kits and sets and listed below the name of the kit or set with quantity of each item in the kit or set indicated in front of the item name,

c. Unit of Measure (U/M). indicates the standard or basic quantity by which the listed item is used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation, e.g., ea, in., pr, etc., and is the basis used to indicate quantities. When the unit of measure differs from the unit of issue, the lowest unit of issue that will satisfy the required units of measure will be requisitioned.

d. Quantity Furnished with Equipment (Basic Issue Items Only). Indicates the quantity of the item furnished with the equipment.

e. Quantity Authorized (Items Troop Installed or Authorized Only), Indicates the quantity authorized to be used with the equipment.

f. Illustration (Basic Issue Items Only). This column is divided as follows:

(1) *Figure Number,* Indicates the figure number of the illustration. in which the item is shown.

(2) *Item Number.* Indicates the item number used to identify each item called out in the illustration.

Section II. BASIC ISSUE ITEMS

(1) Federal stock No.	(2) Description: Usable on Code	(3) Unit of meas	(4) Qty furn with equip	(5) Illustration	
				(a) Fig. No.	(b) Item No.
5120-240-5292	KEY, SOCKET HEAD SCREW: hex type, L-hdl, 1/8 across fl, 2-5/32 nom lg arm lg.	EA	1	A-1	7
5120-240-5300	KEY, SOCKET HEAD SCREW: hex type, L-hdl, 3/16 across fl, 2-21/32 nom lg arm lg.	EA	1	A-1	6
5120-240-5274	KEY, SOCKET HEAD SCREW: hex type, L-hdl, 5/16 across fl, 3-21/32 nom lg arm lg.	EA	1	A-1	5
5120-198-5390	KEY, SOCKET HEAD SCREW: hex type, L-hdl, 3/8 across fl, 4-11/32 nom lg arm lg.	EA	1	A-1	4

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DCSLOG (3)	Ft Knox Fldms (10)
CNGB (1)	Units org under fol TOE: - 1 ea.
TSG (1)	3-400 (EA, EB, FA, FB, FC, FD)
COE (5)	7
Dir of Trans (1)	17
ACSC-E (1)	29-1
USA Armor Bd (2)	29-11
CONARC (2)	29-15
ARADCOM (2)	29-16
ARADCOM Rgn (2)	29-21
OS Maj Comd (2)	29-25
USASETAF (1)	29-26
LOGCOMD (2)	29-27
AMC (5)	29-35
WECOM (10)	29-36
AVSCOM (2)	29-37
USACDCEC (10)	29-41
Armies (3) except	29-51
Seventh & Eighth USA (5)	29-55
Corps (2)	29-56
USATCFE (1)	29-85
Ft Story (1)	29-86
JPG (1)	29-105
USMA (1)	37
USACMLCS (2)	55-458
USAMMCS (2)	57
USAQMS (2)	57-100
TOAD (5)	

ARNG: State AG (3).

USAR: None.

For explanation of abbreviations used, see AR 310-50.

In Many Situations, This Milling Fixture Can Be a Necessity

It happens frequently that machined parts must be made or repaired and the lathe is the only machine tool that is available. This is particularly true in remote or forward areas and on the smaller river and ocean going boats and vessels.

It is also true that the lathe is the only machine tool provided for maintenance shops that support some very large industrial and commercial plant operations.

Experience with maintenance or manufacturing operations has shown that even though parts can be turned and threaded on lathe, very few such parts can be used without further, machining operations. These parts will usually require that a keyslot, or keyway, a hole or a flat, a hex or a square, a spline or that some other type of cut must be made in addition to the turning operations before the part can actually be put into service.

The Model 312 Milling Fixture “described in this manual provides a way around such limitations. This fixture has been designed to give the shop that has only a lathe, the capability of performing the bulk of those additional operations required to finish turned pieces, as well as performing milling operations on pieces of any shape, so long as these pieces fall within the size capabilities of the lathe, the milling fixture itself, and cutting tools provided.

The cutters used for milling are held and rotated by the spindle of the lathe. The workpiece to be milled (drilled and/or bored) is located and held in the milling fixture. The milling fixture in turn is securely mounted on the lathe compound.

The lathe, therefore, not only provides the power to turn the cutter, but also, since it has powered lengthwise and cross slide travel, can be made to feed the work into the cutter or past the cutter as required. The lathe power feed system can thus be used to power the movement for smooth and even the milling operations.

In Other Situations, This Milling Fixture Can Be a Valued Convenience

It is interesting to note, that although the Model 312 Milling Fixture was designed to meet the needs of a very limited shop, it has also found use in much more complex production shops. This is particularly true where experimental parts, maintenance parts, or special parts are required from time to time.

For example, a busy shop never seems to have enough milling capacity. When a mill is running on production, it becomes quite costly to stop production, teardown a working set up, make or finish one or more special pieces, set up the job again, and resume production.

But almost all such shops have one or more engine or tool room lathes. These lathes are seldom set up for production in the same way as are milling machines, and consequently are available most of the time with little delay. Should this be the case, it then becomes possible to make many priority parts on the lathe alone without disturbing machines set up and running of specific production jobs. Such a device can on occasion save not only the tempers of production personnel but tangible amounts of time and cash.

Fixture Designed For Small as Well as Large Lathes

The Numeric Products Co. Model 312 Milling Fixture has been designed and proportioned to operate effectively on a wide range of sizes of lathes. Its weight and rigidity allows it to steady the cutting action when used on small light duty machines. Its strength and rigidity allow its use on high horsepower heavy duty lathes.

Mounting the Milling Fixture

The Model 312 Milling Fixture is a ruggedly constructed precision tool. The accuracy of the parts machined using this tool will depend on the basic accuracy of the lathe to which it is set-up and the care with which the work is performed.

As the fixture mounts on the compound of the lathe, the machined surface of the compound is checked for trueness. Any burrs or surface bruises are removed with an India Stone or a fine file carefully used.

A cam type self-adjusting "T" nut fits in the "T" slot of the lathe. A 3/4 inch stud and nut, hold the fixture on the compound.

The fixture is snugged down but not tightened until it has been properly aligned with the lathe spindle.

Alignment of the Lathe Compound and the Milling Fixture with the Lathe Spindle Holding the Work

In most applications the lathe compound, together with its calibrated collar and lead screw, is used to move the milling fixture with the workpiece into the cutting tool a measured amount. The lathe carriage is used to bring the work into the effective range of movement of the compound and is most usually locked in the position.

In order that the compound can be used in this way, it is swung so that its motion is parallel to the spindle axis and locked. Normally the angular graduations on the compound will be sufficiently accurate for this purpose. Should a greater degree of accuracy be demanded, a precision arbor can be "indicated in" between centers. The compound travel is in turn aligned with the arbor and adjusted until the travel is parallel to the arbor. A dial type indicator with a magnetic base would normally be used to make this adjustment.

The face of the work table of the Model 312 Fixture can of course be turned so as to be either parallel or perpendicular to the lathe spindle axis, or if need be, to any desired intermediate angle.

By far the most common position for the fixture is that in which the face of the table is perpendicular to the spindle axis. It is normally sufficient to place the face of the table, either directly or with parallels, against the spindle nose itself, a chuck, or a face plate. Where a greater accuracy must be assured, the alignment adjustment may be checked with the use of a dial indicator of the desired sensitivity.

Adjustment of Fixture

The model 312 Milling Fixture is adjusted at the factory on the snug side. However, since wear, use, or personal preference might require periodic adjustment, the following sequence can be used.

Lead Screw Thrust Bearing Assembly

The leadscrew nut closing screws are loosened and the gib clamp screw and the two gib retaining screws are slightly loosened. The 1/2 x 20 Stop Nut in the center of the handwheel is then tightened so that the pressure exerted on the roller thrust assembly produces a slight amount of drag. Do not over tighten, a slight, barely noticeable drag is all that is needed.

Lead Screw Nut

The lead screw nut is split so that lead screw and nut backlash can be removed. The two socket head cap screws are used to close the nut on the leads crew and the center set screw, or jack screw, is used to hold the settings of the cap screws. Both of the cap screws are tightened individually so that they each contribute a small amount of frictional drag. When the setting is correct tightening the center jack screw should remove most but not all of this drag.

Gib Retaining Cap Screws

The gib is positioned vertically by a stub dowel pin. Its tightness setting adjustment is maintained by two self-locking cap screws that work against two small stiff springs. These cap screws are adjusted so that the setting of each independently contributes a small amount of drag which can be felt at the handwheel.

Using the Table Position Locking Features

Gib Locking Screw

Between the two gib retaining cap screws is the gib locking cap screw. This cap screw is used to lock the table in a given position before a cut is made so that cutter induced vibration or tool chatter will not cause the vertical location of the work to change.

Anti-Rotation Collar

In addition to the use of the gib locking feature a leadscrew anti-rotation collar is provided. This feature is very valuable where heavy cuts are used for fast stock removal rates. Here the gib locking friction, which is all that is required for holding position while using small machine, is supplemented with the positive position locking capability.

Holding the Work

The ease with which characteristic work-pieces may be held or mounted on the table of the fixture is one of the basic features of the Model 312. The table, with the slotted clamps, pressure screws, and button head cap screws, can be made into a precision milling vise.

Alternatively, the slotted clamps are used with the step blocks and hold down studs to firmly hold round shapes against the 90° "V" formed by the table and table end. The step blocks and straddle clamps can be used independently to hold irregular or odd shaped pieces. Many different arrangements will improvise to meet particular problems. Several examples of the vise set up and the "V" arrangements are illustrated below.

HOLDING RECTANGULAR SHAPES IN VISE SET-UP

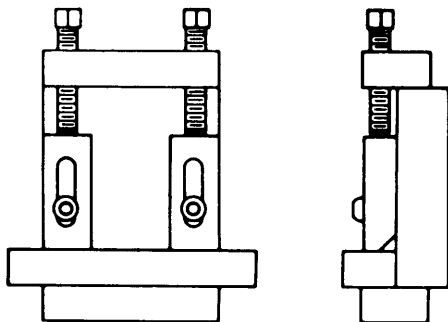


Fig. 1 - Holding large regular piece in vise

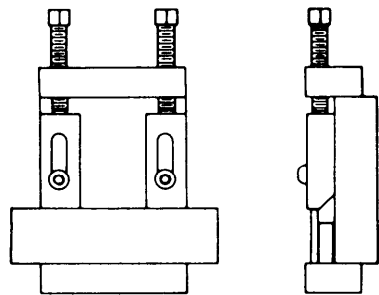


Fig. 2 - Holding thin piece on parallel

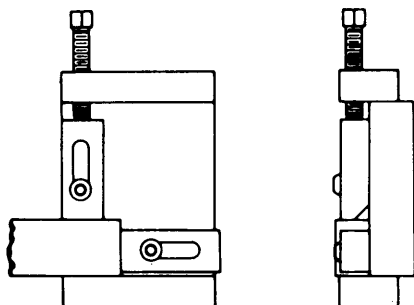


Fig. 3 - Vise arrangement modified to suit shape of piece

HOLDING ROUND WORKPIECES IN BOTTOM "V"

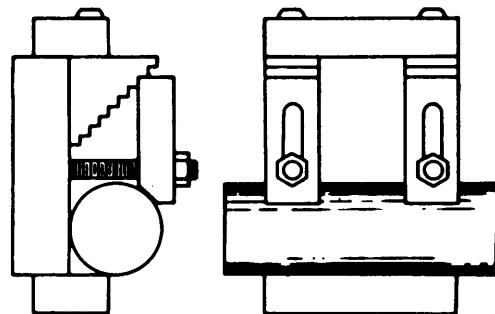


Fig. 4 - Large round work piece securely held aligned in bottom "V"

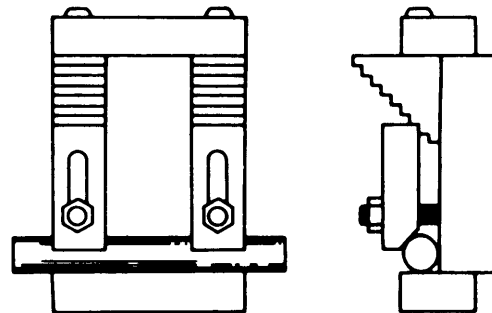


Fig. 5 - Small round bar held securely and aligned

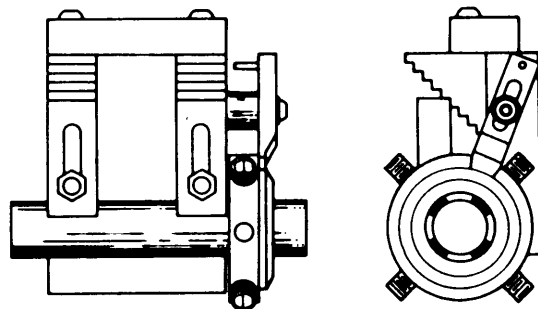


Fig. 6 - Round piece held in fixture with protractor attached for indexing angular position

HOLDING CUTTING TOOLS IN SPINDLE

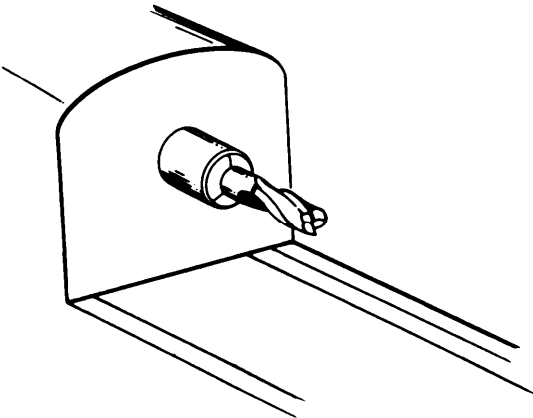


Fig. 7- End Mill held in lathe collet

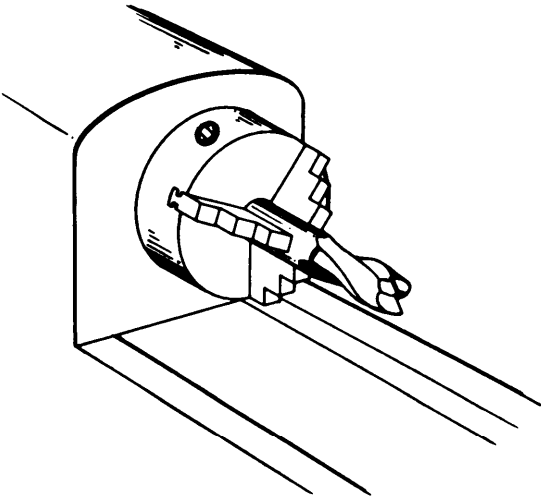


Fig. 8- End Mill held in 3 jaw chuck

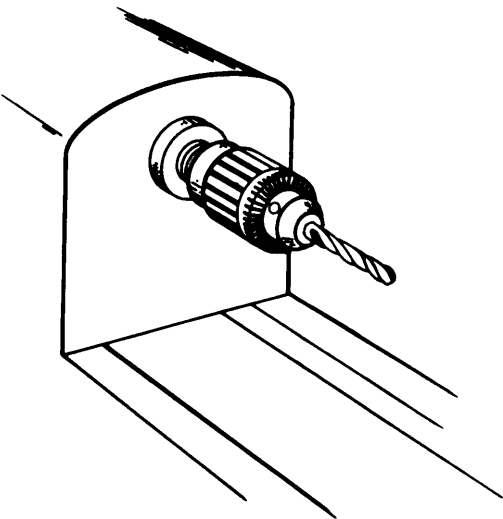


Fig. 9- Drill held in drill chuck

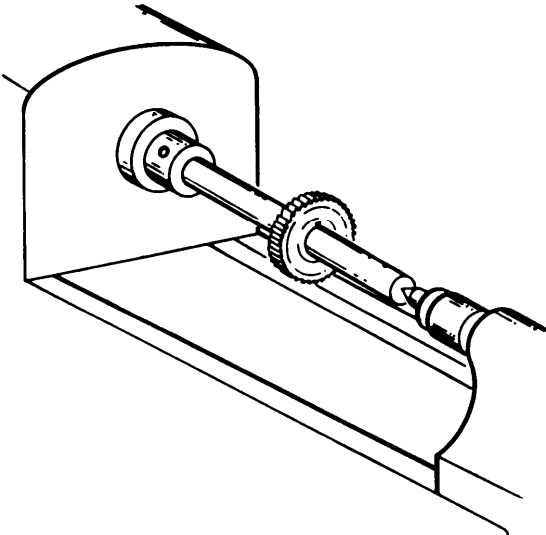


Fig. 10- Milling cutter mounted on milling arbor

LOCATION OF WORK WITH RESPECT TO CUTTER

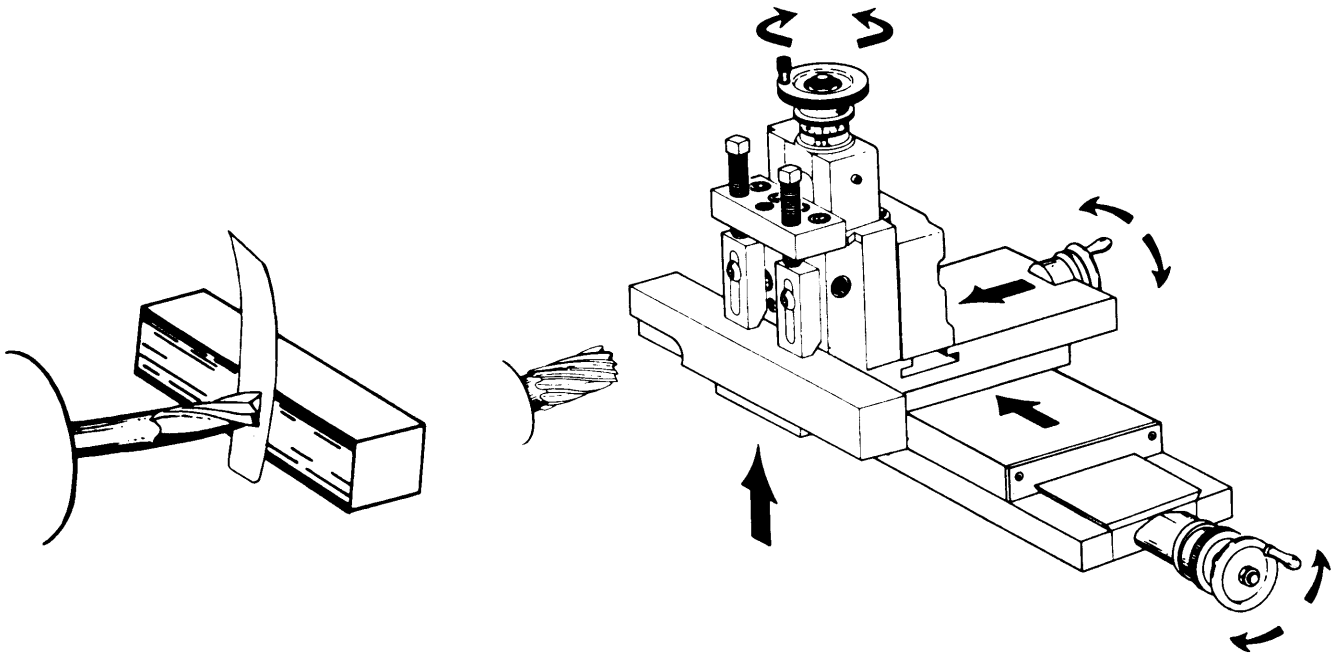


Fig. 11 - Adjustment of the three mutually perpendicular axes bring work into measured relationship to the cutting tool

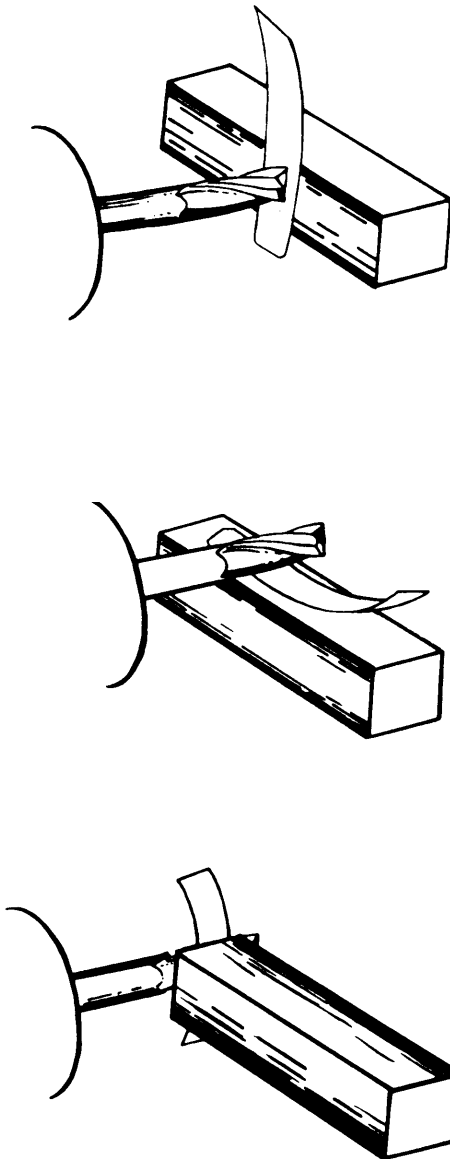


Fig. 12

The work is located to the cutter by bringing the work into contact with the cutter. Usually a piece of thin shim stock or paper of a measured thickness is used to “feel” this contact as the cutter is rotated slowly by hand.

If the location of the cutting edges themselves are required only than all the collars are set to zero position (minus the thickness of the shim or paper).

In many cases, however, we are interested in the position of the center of the cutter, or drill or reamer, or other tool. In such a situation one half the diameter of the cutter plus the shim or paper thickness must be subtracted from the top and side dial readings when the dials are “zeroed” to the spindle location.

Alternatively this correction could be added as a fixed amount to each of the settings as the work is moved.

Again, it is sometimes convenient to use a separate piece of round stock, such as a dowel pin, or length of drill rod, instead of the actual cutter, when setting up work location.

REPRESENTATIVE CUTS

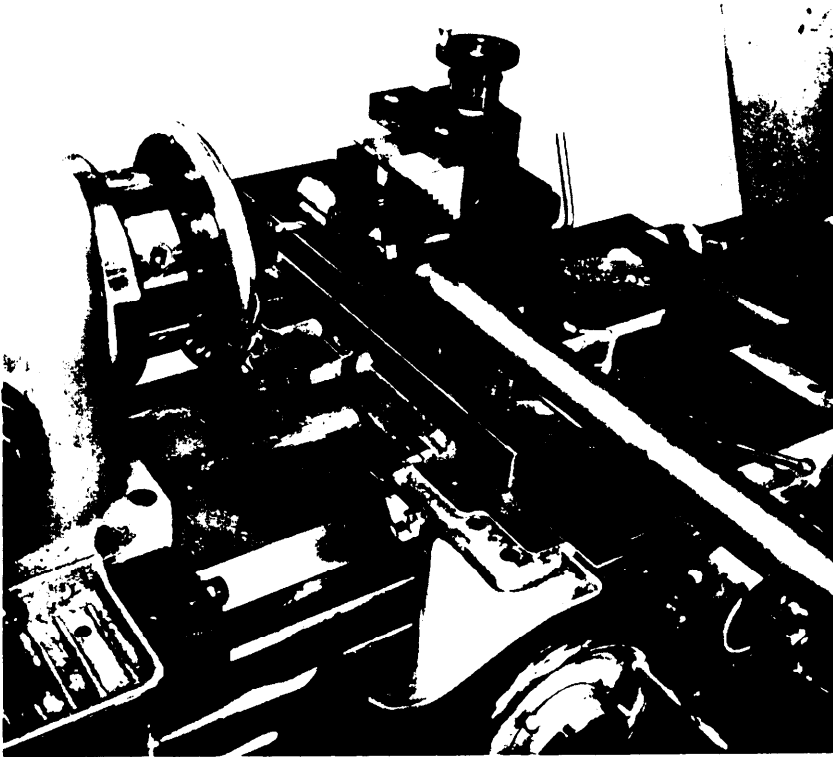
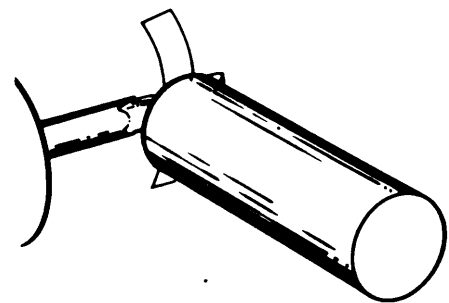
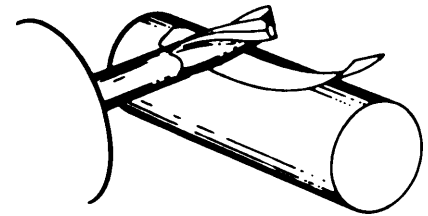
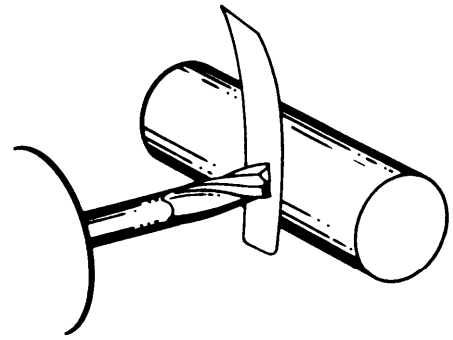


Fig. 13 - Keyseat being milled in 2 inch shaft



Although the cutter can be brought into direct contact with the work, a piece of thin shim stock (.0015 or .002) gives the operator a sensitive feel in locating the surfaces of the work. (Fig. 14)

When the shaft has been located in all three axes, it is raised vertically $1/2$ the cutter diameter, plus $1/2$ the shaft diameter, plus the thickness of the shim stock feeler.

Normal practice is to use a cutter size that is smaller than the key way width desired. One or more roughing cuts can be made and then light finishing cuts both top and bottom to bring keyway to depth and width.

NOTE: Make sure that direction of cross travel pushes work against the rotation of the cutter (for example, when making the finishing cuts, cut top of keyway with cross-slide moving work into cutter and cut bottom of keyway with cross-slide moving work back out.)

Fig. 14 - Steps in locating shaft with respect to cutter. Shim or paper if known thickness.

REPRESENTATIVE CUTS

Fig. 15- Woodruff Keyseat

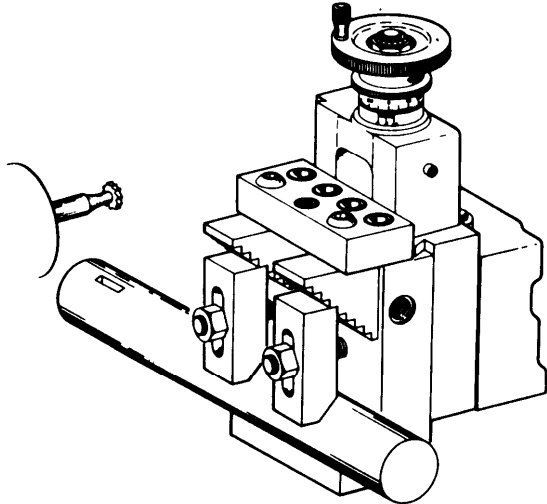


Fig. 16- Keyway

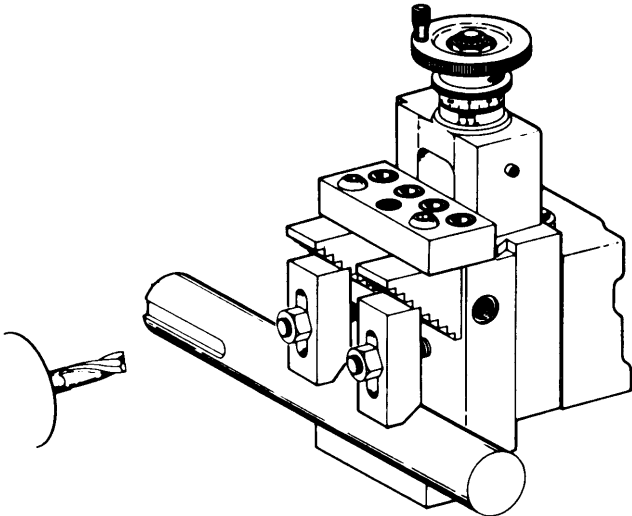
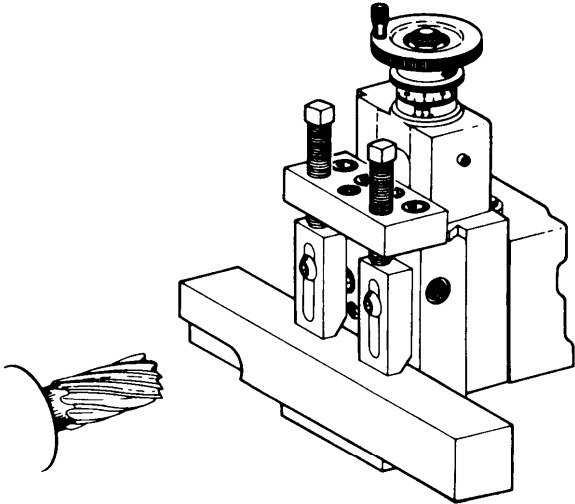
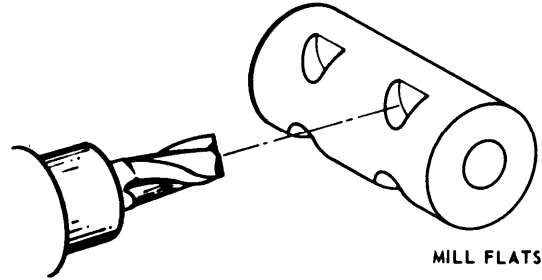
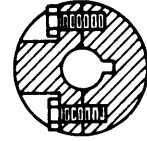
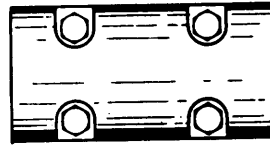
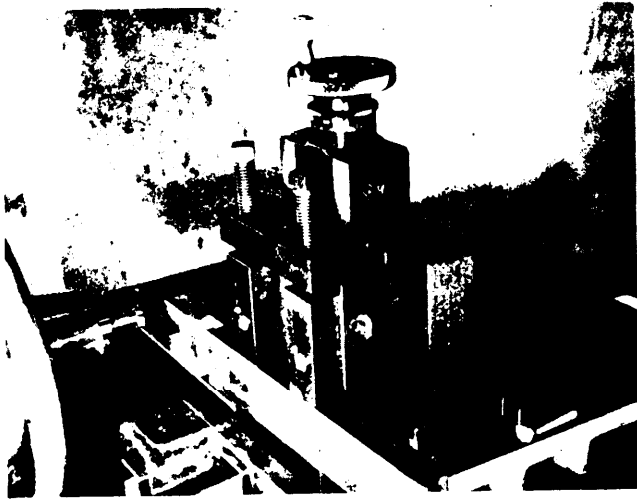


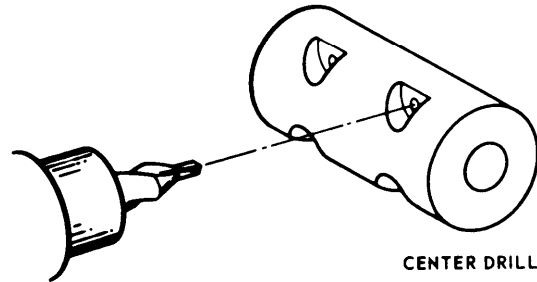
Fig. 17- Horizontal Milling



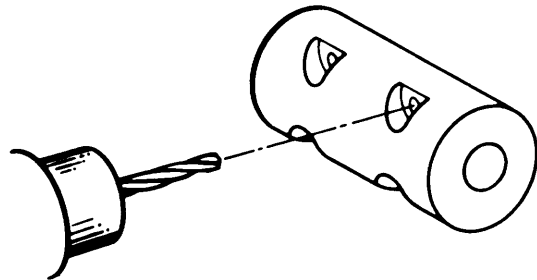
REPRESENTATIVE CUTS



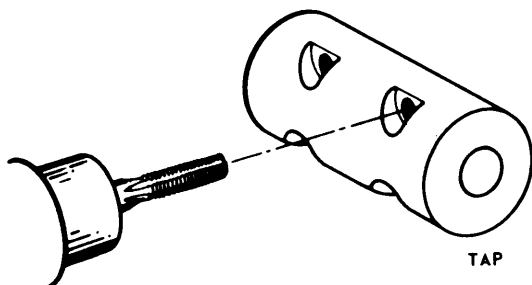
MILL FLATS



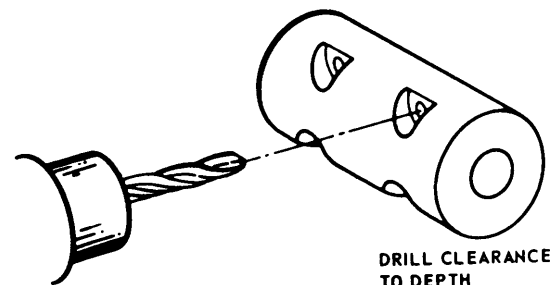
CENTER DRILL



DRILL - TAP SIZE



TAP



DRILL CLEARANCE TO DEPTH

The vertical motion provided by the Model 312 Milling Fixture can be used for milling in the vertical precision positioning of the work.

By using an end mill to produce a true flat surface and a center drill to locate the drill point for drilling, precise hole patterns can be made directly from drawing without complicated layout procedures.

If the accuracy required is high for the hole location and/or hole diameter, a boring head may be used to achieve this precision.

Fig. 18

REPRESENTATIVE CUTS

Figure 19
VERTICAL
MILLING

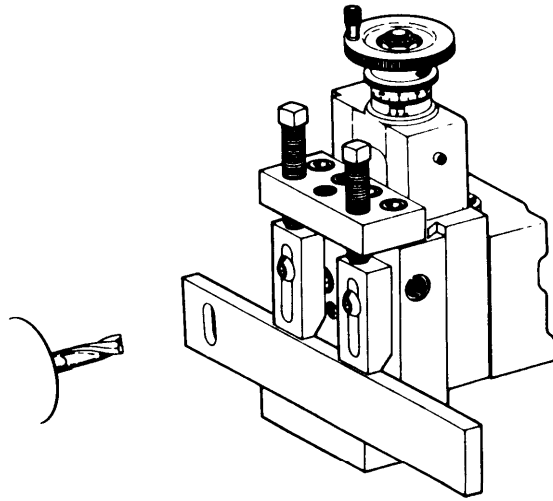


Figure 20
DRILLING
HOLE PATTERN

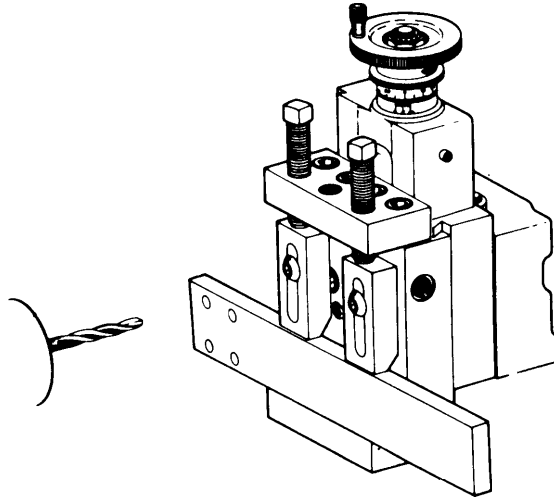
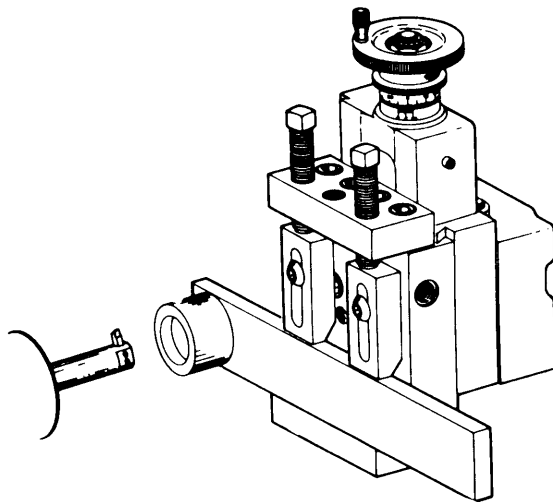
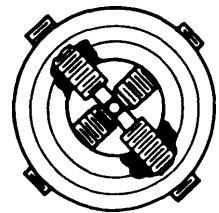
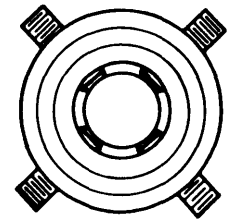
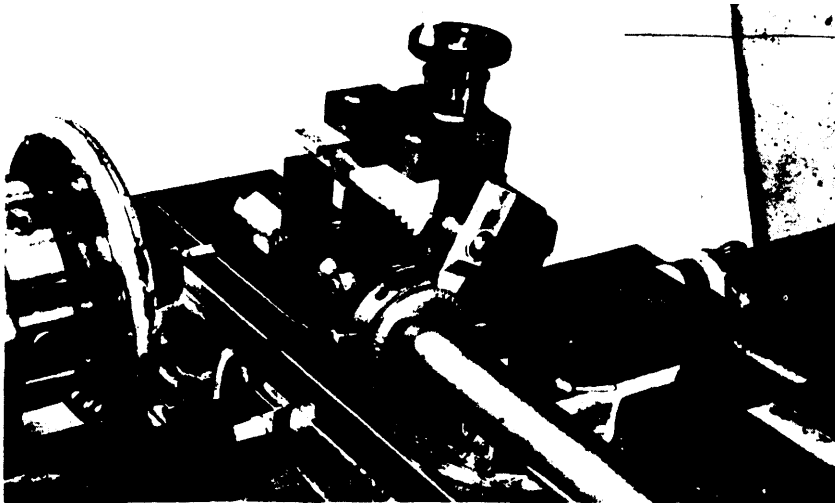


Figure 21
BORING
INTERNAL
DIAMETER



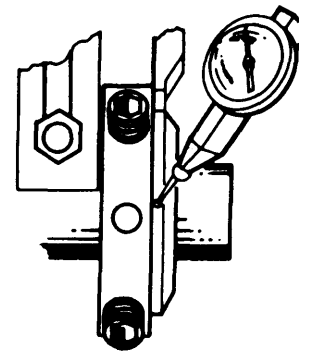
PROTRACTOR



CENTERING PROTRACTOR FOR INDEXING

The indexing protractor is attached to the round shaft with two sets of opposing set screw. Since these set screws work in opposition to each other they are easy center and to lock in position. The procedure is similar to locating a round piece in the center of four jaw chuck.

Centering can be accomplished most readily with a dial indicator. A dowel pin has been provided, however, to work with the protractor retaining clamp, collar so that a micrometer can be used to accurately measure the run out. The clamp is held just loose enough to follow the protractor rim as it is turned. When the run out has been eliminated, tighten the protractor vernier clamp so that vernier is aligned against the protractor graduations.



INDEXING

The vernier on the protractor retaining clamp is used to read the angular position of the work. The work holding clamps are normally loosened so that the work can be turned easily to the next desired angular position, then they are retightened.

If the protractor is carefully adjusted it is very accurate. Angles of $1/4^\circ$ can be set with little difficulty.

CIRCUMFERENTIAL CUTS

A round piece can be clamped in position and held sufficiently firm for milling but still be loose enough to be turned carefully by the protractor against the cutting action of an end mill.

The protractor is turned by using the extra-length set screw wrench (or any suitable piece of rod) inserted into the holes provided in the protractor rim and/or the hexagon holes in the set screws themselves. Care must be used to rotate the work slowly and evenly as the cut is made.

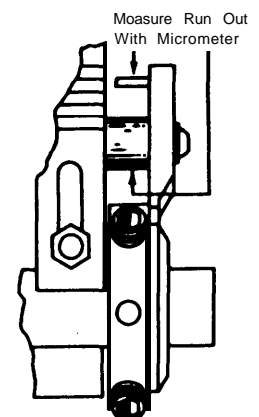


Figure 22

REPRESENTATIVE CUTS

Figure 23

**INDEXING -
Cutting hex head**

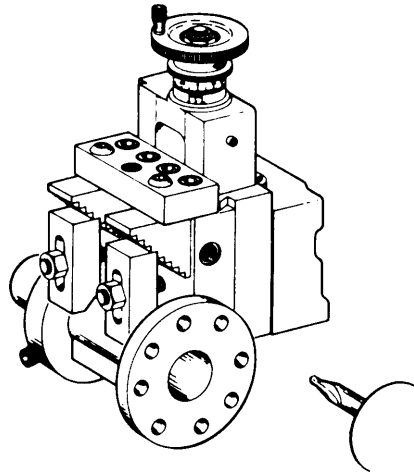
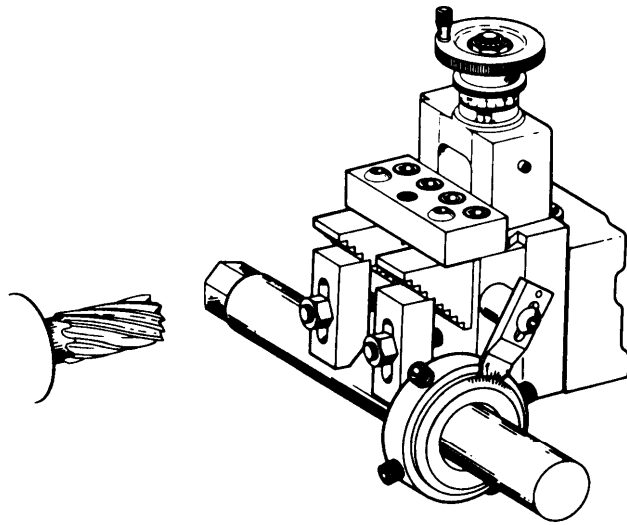
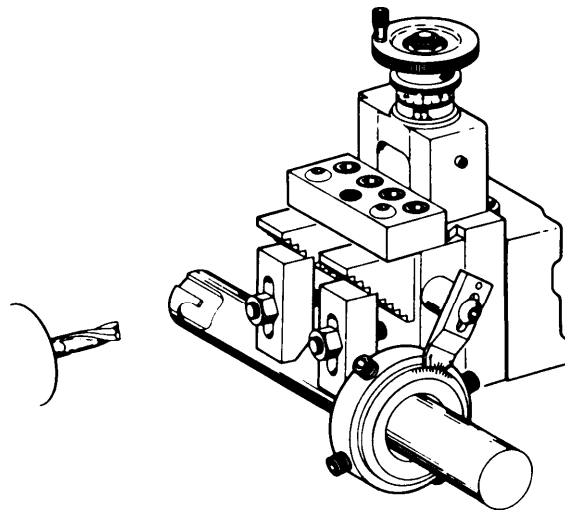


Figure 24

**INDEXING -
Bolt Circle**

Figure 25

**CIRCUMFERENTIAL CUT
- (Bayonet Lock)**



APPENDIX A

BASIC ISSUE ITEMS

Section I. INTRODUCTION

1. Scope

This appendix lists items which accompany the Lathe Fixture or are required for installation, operation, or operator's maintenance.

2. Explanation of Columns

The following provides an explanation of columns in the tabular list in section II.

a. Source, Maintenance, and Recoverability Codes, column 1, are as follows:

- (1) Source Code, column 1a, indicates the selection status and source for the listed item. Source codes are

<i>Code</i>	<i>Explanation</i>
C.....	Obtain through local procurement. If not obtainable from local procurement, requisition through normal supply channels with a supporting statement of nonavailability from local procurement.
P.....	Applied to repair parts which are stocked in or supplied from GSA/DSA, or Army Supply system, and are authorized for use at indicated maintenance categories.

- (2) Maintenance Code, column 1b, indicates the lowest category of maintenance authorized to install the listed item. The maintenance level code is—

<i>Code</i>	<i>Explanation</i>
C.....	Operator or crew maintenance
(3)	Recoverability Code, column 1c, indicates whether unserviceable items should be returned for recoverability or salvage. Items not coded are expendable. Recovery code is—

<i>Code</i>	<i>Explanation</i>
R.....	Items which are economically repairable at direct and general support maintenance activities and are normally furnished by supply on an exchange basis.

b. Federal Stock Number, column 2, indicates the Federal stock number for the item.

c. Description, column 3, indicates the Federal item name and any additional description required. A five-digit manufacturer's code and part number is included in parenthesis for reference.

d. Unit of Issue, column 4, indicates the unit used as a basis for issue.

e. Quantity Incorporated in Unit Pack, column 5, indicates the actual quantity contained in the unit pack.

f. Quantity Incorporated in Unit, column 6, indicates the total quantity of the item used on the equipment.

g. Quantity Furnished With the Equipment column 7, indicates the total quantity of an item to be furnished with the equipment in excess of the quantity incorporated in the unit and is not applicable for this fixture.

h. Illustration, column 8, is divided as follows:

- (1) Figure Number, column 8a, indicates the figure number of the illustration in which the item is shown.
- (2) Item Number, column 8b, indicates the callout number used to reference the item in the illustration.

3. Requisitioning a Part to Which FSN Has Not Been Assigned

When requisitioning a C source (local procurement) item identified only by a manufacturer's part number, it is mandatory that the following information be furnished the Supply Officer:

a. Manufacturer's code number (5-digit number preceding the colon in the descriptive column).

b. Manufacturer's part number (the number, and sometimes letters, following the colon (*a* above)). Dashes, commas, or other marks must be included exactly as listed.

c. Nomenclature exactly as listed herein, including dimensions if necessary.

d. Name of manufacturer of end item (from cover of TM or manufacturer's nameplate).

e. Federal stock number of end item (from TM).

f. Manufacturer's model number (from TM or name/data plate, preferably name/data plate).

g. Manufacturer's serial number (from name, data plate).

h. Any other information such as type, frame number, and electrical characteristics, if applicable.

i. If DD Form 1348 (DOD Single Line Item Requisition System Document (Manual)) is used, fill in all blocks except 4, 5, 6, and Remarks field, in accordance with AR 725-50. Complete form as follows:

- (1) In blocks 4, 5, and 6, list manufacturer's code and manufacturer's part number (as listed in description column).
- (2) In Remarks field, list noun name (repair part), end item application (FSN of end item), manufacturer, model number (end item), serial number (end item), and any other pertinent information such as frame number, type, etc.

4. Abbreviations.

<i>Abbreviation</i>	<i>Explanation</i>
fl.....	flat
hdl.....	handle(d) (s)
nom.....	nominal
w.....	with

5. Federal Supply Code

<i>Federal Supply Code</i>	<i>Manufacturer</i>
22049.....	Numeric Products Co.

6. Reporting of Equipment Publication Improvements

Report of errors, omissions, and recommendations for improving this publication by the individual user is encouraged. Reports should be submitted on DA Form 2028 (Recommended Changes to DA Publications) and forwarded direct to Commanding General, U. S. Army Weapons Command, ATTN: AMSWE-SMM-P, Rock Island Arsenal, Rock Island, Ill., 61201.

SECTION II. BASIC ISSUE ITEMS LIST

SOURCE, MAINT. AND RECOV. CODE			FEDERAL STOCK NO.	DESCRIPTION	(4) UNIT OF ISSUE	(5) QTY. INC. IN UNIT PACK	(6) QTY. INC. IN UNIT	(7) QTY FURN WITH EQUIP	(8) ILLUSTRATION	
(a) SOURCE	(b) MAINT	(c) RECOV.							(a) FIG NO	(b) ITEM NO
1				TOOLS AND EQUIPMENT FOR FIXTURE, LATHE, METAL CUTTING: (22049:312)(3465-022-8817)						
C	C	---	---	BLOCK, STEP: work holding (22049: NPC51)	EA	1	2		A-1	1
C	C	R	---	CASE, CARRYING: metal, w/hdl (22049: NPC70)	EA	1	1		--	--
C	C	--	---	CLAMP, PRECISION: work holding (22049: NPC50)	EA	1	2		A-1	2
P	C	---	5120-240-5292	KEY, SOCKET HEAD SCREW: hex type, L-hdl, 1/8 across fl, 2-5/32 nom lg arm lg.	EA	1	1		A-1	7
P	C	---	5120-240-5300	KEY, SOCKET HEAD SCREW: hex type, L-hdl, 3/16 across fl, 2-21/32 nom lg arm lg.	EA	1	1		A-1	6
P	C	--	5120-240-5274	KEY, SOCKET HEAD SCREW: hex type, L-hdl, 5/16 across fl, 3-21/32 nom lg arm lg.	EA	1	1		A-1	5
P	C	--	5120-198-5390	KEY, SOCKET HEAD SCREW: hex type, L-hdl, 3/8 across fl, 4-11/32 nom lg arm lg.	EA	1	1		A-1	4
C	C	R	---	PROTRACTOR, CENTERING: indexing, c/o:					A-1	3
C	C	--	---	CLAMP, RETAINER: (22049: NPC32).	EA	1	1		A-1	--
C	C	--	---	COLLAR, PROTRACTOR: (22049: NPC33)	EA	1	1		A-1	--
C	C	--	---	PROTRACTOR: indexing (22049: NPC30)	EA	1	1		A-1	--

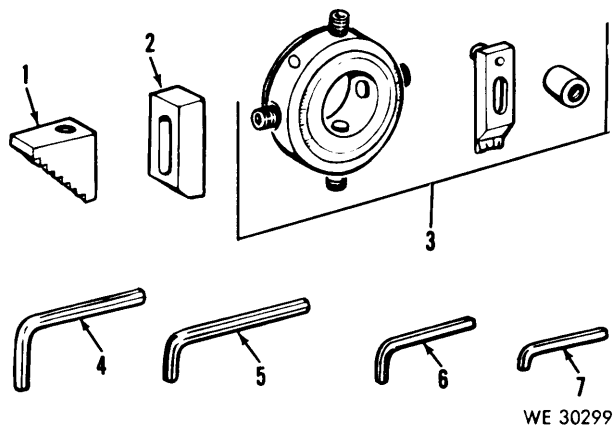


Figure A-1. Tools and equipment.

By Order of the Secretary of the Army:

Official:

KENNETH G. WICKHAM,
Major General, United States Army,
The Adjutant General.

HAROLD K. JOHNSON,
General, United States Army,
Chief of Staff.

Distribution:

Active Army:

	Units org under fol TOE (1 ea.):	
USASA (1)	3-47	29-35
DCSLOG (1)	3-500 (EA, EB, FA	29-36
CNGB (1)	FB, FC, FD)	29-37
TSG (1)	5-600	29-41
CofEngrs (3)	5-605	29-51
CofSptS (2)	5-607	29-55
Dir of Trans (2)	7	29-56
ACSC-E (1)	9	29-75
USCONARC (3)	9-7	29-79
USAMC (2)	9-9	29-85
ARADCOM (2)	9-25	29-86
ARADCOM Rgn (2)	9-26	29-105
OS Maj Comd (2)	9-65	29-311
USATRECOM (1)	9-66	37
USAAVCOM (5)	9-67	37-100
LOGCOMD (3)	9-75	47
USAWECOM (75)	9-127	55-458
USACDCEC (10)	9-197	55-500 (ID, IE, KE)
USASETAF (1)	9-227	57
USA Armor Bd (2)	9-317	57-100
Armies (3) except	10-237	
Seventh (5)	10-415	
Eighth (5)	10-445	
Corps (2)	10-448	
USAC (2)	10-500 (ED, HK, HO)	
USACMLCS (2)	11-155	
USA Msl & Muns Cen & Sch (2)	11-158	
USAQMS (2)	17	
USMA (1)	17-100	
JPG (1)	29-1	
USATCFE (1)	29-11	
Ft Story (1)	29-15	
Army Dep (3) except	29-16	
TOAD (5)	29-21	
MAAG (3)	29-25	
Arsenal (2)	29-26	
FLDMS (2) except	29-27	
Ft Knox (10)		

NG: State AG (3).

USAR: None.

For explanation of abbreviations used, see AR 320-50.

