

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

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OPERATOR'S MANUAL

BORING MACHINE, ENGINE CYLINDER

(ROTTLER BORING BAR CO., MODEL DA-4)

(4910-223-9734)

This copy is a reprint which includes current pages from Changes 1.

HEADQUARTERS, DEPARTMENT OF THE ARMY

JANUARY 1965

TAGO 7238-A-February

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DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 19 January 1965

TM-9-4910-41-10 is published for the information and use of all concerned.

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General, United States Army,
Chief of Staff.

Official

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Major General, United States Army,
The Adjutant General.

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Units org under fol TOE:

11-587 (2)

NG: None.

USAR: None.

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

TAGO 7238-A-February

CHANGE

No. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D. C., 22 January 1973

**Operator's Manual
BORING MACHINE, ENGINE CYLINDER:
(ROTTLER BORING BAR CO., MODEL DA-4)
(4910-223-9734)**

This change is current as of 5 December 1972

TM 9-4910441-10, 19 January 1965, is changed as follows:

Page 1. Add the following paragraph at the beginning of page 1.

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, Rock Island, IL 61201.

Add the following after last paragraph under "Description".

The items in the following table, formerly included as part of the Basic Issue Items List on pages 23 and 24, are now designated as components or part of the end item configuration. All items are manufactured by the Rottler Boring Bar Company (Manufacturer's Code 52014).

Part	Part Number
ADAPTER, ELECTRICAL CONNECTOR: plastic dielectric, 2 fl parallel male contacts and ground lead w/term one end, 2 fl parallel and one U female contacts other end, ac/dc, 125 v. 15 amp	501-65
BIT, CUTTER: carbide, R-H	501-59
BIT, CUTTER: carbide, R-8	501-31
BOLT SET, HOLD-DOWN: set of 3, 5/8-11 X 3-1/2, 4, and 5-1/2 in. lg	501-14
COMPOUND, SHARPENING:	100
DRIVER, HEXAGON: screwdriver type	501-73
FINGER, CENTERING: 3-1/16 in. lg. 4 per set	200-21-1
FINGER, CENTERING: 4-1/8 in. lg. 4 per set	200-21-2
HANDLE, CRANK: hand feed	500-98
HOLD-DOWN CLAMP ASSEMBLY: c/o	
BODY, HOLD-DOWN:	501-16
SCREW, ADJUSTING, HOLD-DOWN: 3/8-18 thd X 3-1/4 in lg	501-13
SCREW, ADJUSTING, HOLD-DOWN: 1 in. thd	501-11
WING, HOLD-DOWN: lg	501-8
WING, HOLD-DOWN: med	501-9
WING, HOLD-DOWN: short	501-10
HOLDER, TOOL: 3 in, short	200-1-5
HOLDER, TOOL: 3-9/16 in., med	200-1-6
HOLDER, TOOL: 4-1/8 in, lg	200-1-7
HOLDER, TOOL: 4-3/4 in, extra lg	200-1-8
HOOK, LIFT:	501-46
JIG, SHARPENING:	501-35
KEY, MICARTA:	500-62
MICROMETER:	100-34
NUT, THRUST: bz	500-41
PULLER, TOOL HOLDER:	100-24
WASHER, HOLD-DOWN:	201-15
WRENCH, T-HANDLE:	501-12
WRENCH, TOOL HOLDER:	100-23

Page 22. Paragraph 5 is deleted.

Page 23, Appendix. Section II is superseded as follows:

Section II. BASIC ISSUE ITEMS LIST

(1) Source Maint. And Recov. Code			(2) Federal Stock No.	(3) Description	(4) Unit of Issue	(5) Qty Inc. in Unit	(6) Illustration	
(a) Source	(b) Maint.	(c) Recov					(a) Fig. No.	(b) Item No.
C	O/C	-	NA	BASIC ISSUE ITEMS LIST-SECTION II BIIL is a list in alphabetical sequence of items which are furnished with, and which must be turned in with, the end item				
C	O/C	-	NA	STANDARD, MICROMETER: (52014: 503-25)	EA	1	1	16
C	O/C	-	NA	TOOL BOX: (52014: 501-7)	EA	1	1	1
C	O/C	-	NA	WRENCH, MICROMETER: (52014: 501-43)	EA	1	1	19
				Federal stock numbers are being assigned for items marked NA and then numbers will be published at a later date				

Page 25, figure 1. Delete the following item numbers from figure 1: 2 thru 15, 17, 18, and 20.

Page 26. Delete figure 2.

By Order of the Secretary of the Army:

CRIEGHTON W. ABRAMS
General, United States Army
Chief of Staff

Official:

VERNE L BOWERS
Major General, United States Army
The Adjutant General

Distribution:

Active Army

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COE (6)
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CONARC (3)
USAMC (12)
ARADCOM (2)
ARADCOM Rgn (2)
Armies (3) except
 7th USA (5)
 8th USA (5)
OS Maj Comd (1)

AVSCOM (10)
LOGCOMD (3)
WECOM (10)
ANAD (2)
LEAD (2)
LBAD (1)
RRAD (2)
TEAD (16)
Units org under fol TOE:
 11-587 (2)

NG: None

USAR: None

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

DESCRIPTION

The Model DA-4 bar is a portable precision boring unit. The automotive model is complete with single point tooling and accessories for standard engine reboring work. The industrial model is equipped with a flange spindle nose and precision ball bearing spindle for a wide variety of work. All feeds and traverses are power operated and controlled from the upper gear housing unit. An auxiliary hand travel is located at the base of the feed screw. Power is furnished by end mounted AC single phase 110-220 Volt General Electric motor of 1/2 to 1-1/2 HP depending upon spindle speeds required. 3 phase motor is also available. A quick change lever selects two spindle speeds.

Gear housings are aluminum alloy in order to incorporate the lightest possible weight without sacrificing rigidity.

NOTE: When bar is shipped from factory the machined surfaces are protected with rust veto. After uncrating use clean cloth dampened with kerosene and remove the protective oil.

CONTROLS

We suggest, before attempting to bore, you clamp the bar over an open area and actuate the controls to become familiar with them.

1. Feed lever is latching lever on side of bar. Press down until lever latches to engage cutting feed. To disengage press (3) feed release arm which will unlatch lever and allow it to return to neutral position. Lift feed lever (2) until it latches to engage rapid return travel. Bar will automatically return to neutral upon reaching top of travel. If you wish to return bar to neutral while it is in rapid up travel, again press (3) feed release which will unlatch lever and allow it to return to neutral position.

You will note stop rod that is held in base casting by thumb screw has a cone shaped end which will release cutting feed when it contacts lever. This is most conveniently raised up and locked by thumb screw in proper position on completion of first bore cut. This rod should not be used to hold close tolerance shoulders. Optional equipment for this is available.

2. The fast down travel lever is located next to feed lever. Check feed lever to see that it is in neutral position before actuating. Lever should be pulled down quickly and firmly and not allowed to ratchet. Control is spring loaded and will release when you release pressure. This control should be used on slow speed only on automotive and high RPM machines.

3. Spindle clutch control is located opposite side of feed lever. A rapid down movement will engage spindle rotation and a reverse action will disengage. In that this is a jaw clutch we recommend stopping the motor or jogging the motor to engage clutch on the high RPM of the higher speed machines. Standard procedure is to throw out clutch upon completion of the bore. Align marks by turning spindle knob, then reverse travel.

The small knob on top of the upper housing may be used for manually turning spindle when necessary. On the automotive type units this knob is also used for centering.

4. 2-1/2" manual travel is actuated by rotating handle attached to spline at top of base. This travel should always be left in full up position after using bar. Normal procedure is to rapid travel or feed bar to point requiring manual travel. If back feeding is necessary run band travel down first and then rapid travel down to where tool can be inserted.

5. Speed control is operated by pulling knob at motor gear housing and raising for low speed and lowering for high. These may be changed when bar is running although it is desirable to jog motor when changing from low to high on higher speed machines.

OPERATING INSTRUCTIONS - AUTOMOTIVE

We recommend, particularly for operators unfamiliar with the DA-4 bar, to practice on a junk block in order to become acquainted with all controls and details connected with the use of the machine.

1. Carefully clean and file off high spots, thread burrs, etc., on top of cylinder blocks. When using the vacuum chip remover take care to remove oil and grease film from cylinders in order to prevent eventual loading of air passages and vacuum filters.

2. Measure each cylinder. Determine the amount of metal to be removed from the measurement of cylinder which shows the most wear.

3. Insert the proper size wing in the hold down clamp for the diameter of cylinder and adjust hold down length so that 5/8" anchoring screw will have at least a 3/8" length of thread holding. After placing through bar base, reach through cylinder and make sure there is an adequate square surface where you intend to set hold down. Beware of fillets and chamfers around clamping area. In blocks which have relief for connecting rod clearance the hold down lug will most often straddle the relief with adequate holding surface on each corner. It is convenient to insert one of the 5/8" bolts in the hold down to hold it while expanding the wing with the T wrench. Use light tension on T wrench. Excessive tightening will result in distortion of bore and marks in finished cylinders. In many blocks it is possible to utilize the stud holes to anchor the bar.

In any event attempt to set the hold down device so the boring bar can be pivoted to bore adjacent cylinders on either side and hold down bolt is as close to spindle as practical.

Check also to make sure there is good contact of boring bar base and block on all sides of hold down. If this is questionable, particularly on long industrial jobs, it is advisable to use additional clamps after centering bar such as milling machine type clamp on the steps of the base.

It is likely you will encounter some complicated clamping problems in boring occasional industrial and heavy wet sleeve engines and compressors. Clamping can often be most effectively handled by bolting a sub-plate to the block surface and clamping the boring machine to the sub-plate.

Place the bar with spindle over the hole to be bored and insert the bolt in the hold down without tightening. Check to make sure tool holder is not in bar and centering fingers are not extended.

Start motor and rapid travel bar into cylinder for centering. It is usually desirable to locate fingers just under the ring wear ridge. Bear in mind that No. 2 and 4 centering fingers are slightly higher than others and must be under the ridge. The best method of centering when little stock is left for clean up is to rotate spindle with top knob so that 2 fingers straddle the greatest wear under the ridge. These wear pockets generally occur in line with the block.

After locating fingers properly, extend them by turning top centering knob and exert tension on the knob while tightening hold down bolt. Do not over tighten. Approximately 25 lb. tension on 8" wrench is adequate. Before tightening hold down bolt it is advisable to rock bar slightly to make sure fingers are making positive contact with cylinder wall. Retract fingers into head and return bar to up position by latching feed lever in up position.

4. It is necessary to change fingers to accommodate the entire range. The most convenient method is to lay bar on bench, control side up. Run spindle down a few inches with the rapid down travel, shut off motor and run the fingers out with top knob. Insert the other fingers in the slots being careful to match the numbers on the fingers to the numbers on the slots. Hold all fingers inward with one hand and rotate centering knob first to right and then to left retracting then into the head. Check to see that all fingers are retracted equally and return bar to up position.

SHARPENING CUTTER

5. The performance of your boring bar and quality of work it will do is almost entirely dependent on the care of the cutting tool. It is the most frequent cause of size and finish problems in boring.

To sharpen the carbide bit insert tool holder in sharpening jig slot. Insert the jig shank in the hole provided in the upper housing and sharpen bit on the small diamond wheel provided on the large knob. Always sure you sharpen the tool on the side of the diamond that is running toward the top face of the bit. Sharpening on the wrong side can readily chip the point. When sharpening use very light pressure, moving the tool back and forth across the diamond wheel to improve cutting and prevent grooving of diamond. After sharpening a number of times dress excess steel away from carbide on grinding wheel. This will facilitate use of chip over hoods and make for quicker sharpening. Diamond wheel is designed for carbide only. Steel tends to load it.

BORING - AUTOMOTIVE ONLY

If tool is properly sharpened place cutter and proper tool holder in micrometer. Hold tool bit lightly against mike anvil and loosen Allen screw with wing wrench. Gently let tool holder slide back to make contact with micrometer spindle. This procedure will prevent chipping carbide. This micrometer is .050 to a revolution rather than .025 as on a conventional mike. Set mike to size you wish to bore and tighten set screw lightly. Back off mike and tighten set screw. Here again excessive tightening only tends to nick mike anvil and make future setting difficult. After tightening recheck size. (Note: See Micrometer Page for re-setting mike to high or low range.)

Make sure tool holder and tool holder slot in head are free from dirt. Insert tool in slot making sure it is completely back and latched. Lock set screw, for heavy cuts only, with socket type screw driver provided with tools.

BORING

Engage spindle clutch and latch feed lever in down position. When bar has completed boring, set stop rod so lever will be thrown into neutral position. Stop rod will then be set for the other holes on the same cylinder block.

Disengage spindle clutch. Turn spindle to align marks at knob and latch feed lever in up position, allowing machine to return to top. Turn off motor. Remove tool holder with tool puller. (Always remove tool holder after boring.) Loosen anchor bolt and proceed to next cylinder. If bore is to be chamfered with bar this should be done before loosening anchor bolt.

BORING HARD SLEEVES

Hard sleeves up to 500 Brinell Hardness can be bored with DA-4 boring bars equipped with a slow 80 RPM spindle speed, using the R-H tool bit.

CHAMFERING

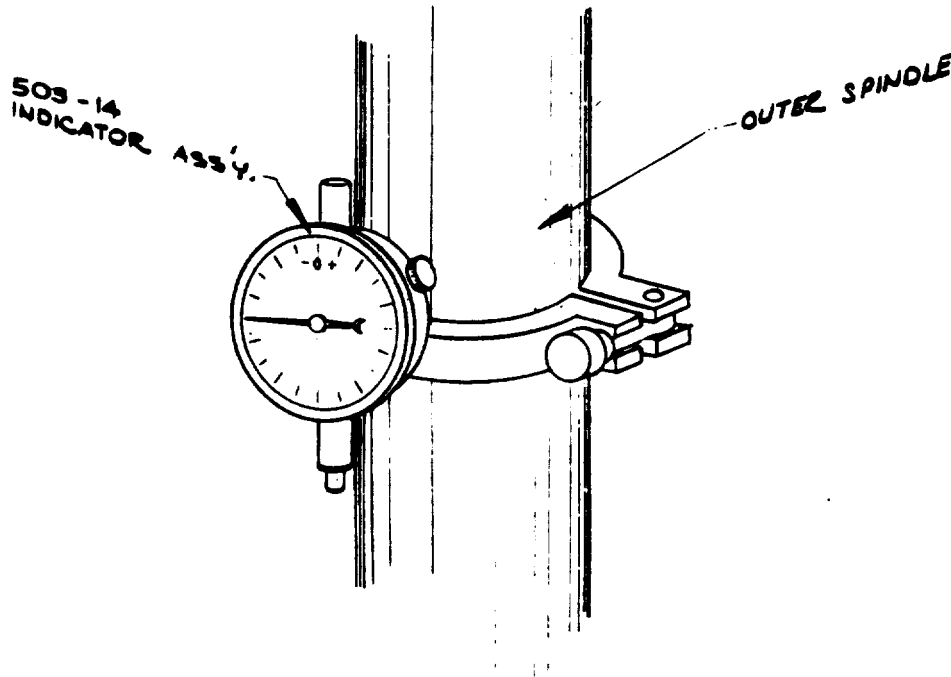
A special tool is available for chamfering. Tool may be set by either inserting in head and approximating setting or place in mike and set approximately .100 over bore size. Chamfering may be done either by using feed and releasing when adequate chamfer has been developed or by use of hand feed.

Chamfering may also be simply done most efficiently with a Model CH-3 abrasive tool driven by a drill motor. This method will not require boring bar and develop a smooth burr-free entry for rings.

COUNTER BORING

Counterboring will often be required in re-sleeving large engine blocks on your Model DA-4 machine and frequently a close tolerance depth must be maintained in order to properly secure the sleeve installation.

This may be best accomplished by the attachment of a 1" travel or longer dial indicator to read the spindle travel of the machine. You may wish to mount your own indicator or a 503-14 indicator assembly may be purchased for this.



To counterbore to a close tolerance depth, carefully hand feed the RF-type cutter bit down until the cutter is lightly touching the block surface. Adjust the dial reading to 0 and hand feed cut down to within .003 to .007 of desired depth. Check the exact depth of counterbore at this point with your depth micrometer and hand feed the remaining depth required by reading the proper number of graduations on the indicator.

AUTOMOTIVE

DA-4 Boring Bar - OPERATING INSTRUCTIONS

CENTERING FINGERS

Centering fingers are adequate to center the new bore within .002 of the centering of old bore; providing the old bore is reasonably round and if you follow operating instructions properly. Centering fingers can be lapped periodically to obtain near perfect centering. Use the following procedure in an undersize bore or junk block.

TO LAP FINGERS

1. Bore hole and remove cutter but do not unclamp bar.
2. Rapid traverse bar down into hole.
3. Extend fingers and exert pressure on them against cylinder wall while rotating inner spindle knob to left by hand (counter-clockwise).
4. After rubbing. examine points on all fingers to make sure they are all making contact.

MICROMETER

Your boring bar micrometer, as with any other measuring tool, should be used delicately and with care to be assured of the greatest accuracy. Particular attention should be paid to inserting the tool in micrometer without allowing tool bit to snap into mike anvil. Care should be used in the method of lightly locking tool bit before tightening.

After a period of use you will note that the tool bit tip will force a depression in the micrometer anvil. This, of course, will result in inconsistent sizes, particularly after resharpener the bit. Periodically we would recommend turning the anvil slightly and finally end for end so that a flat surface is exposed to the tool bit tip.

SPECIAL INSTRUCTIONS

for setting DA-4 mike to high and low reading
using micrometer with 2.9" to 6.000" reading.

CAUTION

The standard for your DA-4 bar is set. Do not change it.

To bore from 3-5/16" to 6.000" place Standard in micrometer and adjust mike anvil so that mike reads 6.000". NOTE: Read directly as shown on micrometer sleeve. To bore from 6.000" to 8.000" place Standard in mike and adjust mike anvil so that mike reads 4.000". The mike reading of 2.9" to 6" will now actually gauge tool from 4.9" to 8". When micrometer is set for larger bores remember that bar will bore 2" larger than mike reads.

SETTING MICROMETER

1. Bore a hole.
2. Remove tool holder and bit and place in mike.
3. Adjust mike so that it reads the same size as the hole you have bored, small variations may be made by turning the mike sleeve with spanner wrench provided. Larger changes should be made by moving the anvil.

DIAMOND WHEEL

Care of Diamond Sharpening Disk

If the diamond disk is handled with care it will provide many years of service.

Occasionally diamond surface can load up if steel part of tool bit is not ground back as sharpening instructions indicate. To clean disk apply a small amount of solvent or thinner and rub off.

LUBRICATION

Upper Housing should be packed with LUBRIPLATE 930-AAA grease, 1 part 30 weight machine oil approximately every 25,000 boring cycles.

Motor gear housing should be re-packed with LUBRIPLATE 930-AAA grease, 1 part 30 weight machine oil approximately every 50,000 boring cycles. A very occasional drop of oil in the motor gear pot (socket head screw near bottom) will help maintain lubrication at right consistency.

Every 2 days of operation fitting at top of spindle should be lubricated with LUBRIPLATE 930-AA grease for top inner spindle bearing.

Socket set screw in key way of spindle should be removed and a few drops of oil put in approximately every 500 bores. Do not over fill. The oil cup on top of the motor adjacent to the feed screw should be oiled with 30 weight machine oil approximately every 50 bores.

DA-4 BORING BAR

ADJUSTMENT OF OUTER SPINDLE

Main spindle bearings are tapered split cast iron rings held in seat by adjustment nut. Tension on bearings is normally adequate to require no adjustment for many boring cycles.

Caution should be used in adjusting these bearings in order to avoid a too tight spindle which only serves to wear out machine and make control operation difficult. If it should be necessary to adjust proceed as follows:

Upper bearing is adjusted by removing felt retaining nut at top of base forcing felt up and adjust nut with punch.

For lower bearing first back off 8-32 nut lock screw at bottom spindle bearing. Then remove felt retainer at bottom of base and turn nut with punch.

1. Place and clamp bar over hole or overhang so spindle can be run down. Loosen both adjusting nuts and set screw.
2. Tighten upper bearing until additional pressure is required to operate hand feed.

Repeat this sequence on lower bearing taking care that hand feed operates only slightly tighter.

3. Traverse bar at all points of travel and make sure hand feed works easily. Spindles are ground slightly tapered to secure maximum rigidity at lower limits of travel where it is most required.

4. Spindle adjustment may also be checked by feeding spindle down and pulling slack out of feed mechanism by forcing down upper housing. Pressure required should be 50-75 lbs.

DA-4 BORING BAR

ADJUSTMENT OF INNER SPINDLE

1. Remove two screws and small cover on back side of upper housing.
2. Remove pin restricting up travel of spindle clutch lever and move lever to full up position.
3. Insert pin (diam. .180 or less) in one of the holes provided in the O D of take up nut. (See inner spindle nut.) Hold spindle knob with one hand and turn take up nut to right (clockwise). You will note the nut ratchets in notches as you take up. Take up until spindle is tight and back off 3/4 to 1 1/2 notches. Run bar on high speed making sure there is only slight heating at bottom of spindle. In the case of ball bearing spindles, the same heat condition exists at top of spindle. If heat is excessive, back off one notch further.
4. Replace cover and pin.

EXCESSIVE LOADS

Note:

If excessive loads are imposed on your Model DA-4 Boring Bar

1. Thrust loads - If bar is fed or rapid-travelled into object that imposes an excessive thrust load on spindle, the Brass Thrust Nut Part No. 500-41 will probably be sheared and require replacing. This accident could happen with spindle either rotating or stationary.

The effect of this will be for the bar to continue to run but with no feed or down travel working. If bar is left in feed or down travel, drive spline will be pulled completely out of mesh at which point motor will continue to run but feed screw will not turn at all.

2. Radial loads - If bar has a tool in cutter head that turns into an object an excessive radial shock will be imposed on spindle and will probably shear motor drive key No. 500-62. This would likely happen only when spindle drive clutch is in.

The immediate effect of this will be for the motor only to run not turning any visible parts of the boring bar. A movement of the speed change lever will indicate the lower gear box is entirely inoperative.

REMOVAL OF MOTOR FIELD ASSEMBLY

Note: This is the only disassembly required to replace Micarta Motor Drive Key in cases of excessive radial load on machine spindle.

SECTION B

Remove 4 long motor screws and lift off motor field assembly. Be careful not to lose spring washer on top bearing, and replace properly in reassembly.

Lay blocks on bottom end bell and pry up stator out of drive to remove stator.

DISASSEMBLY OF DA-4 MOTOR HOUSING

Note:

Motor housing may be removed without disassembly of upper housing and feed screw.

SECTION A-1

Remove 2 hex socket screws on bottom of 500-97 hand feed bracket and 2 screws holding 500-96 plate to 500-70 housing. Turn out (counter clockwise) bevel gear.

Remove 4 flat head hex socket screws in 500-70 housing. Lift out screw, or if upper housing is still intact hold in rapid down lever, 500-30, and rotate screw counter clockwise until feed screw is clear of motor unit. On reassembly it may be necessary to rotate motor and screw, using care in aligning spline in gear to match screw spline. Make sure threaded key does not jam on entering slot.

REMOVAL OF FEED SLEEVE AND BEARING

Note:

For removal of brass nut only. (This disassembly is not necessary to remove motor housing).

SECTION A-2

Remove snap ring 5002-185, and press sleeve assembly, 500-73, off bearing. Back out socket set screw from brass thrust nut and screw off nut. Bearing may now be removed from shaft.

REMOVAL OF MOTOR HOUSING

To remove motor housing back off 2 base set screw supports and take out 4 bolts in housing flange. Note: In reassembly motor alignment must be checked after screw sleeve is in place before flange bolts are permanently locked. Use surface plate over screw and spindle.

To disassemble housing, remove pin and 6 Filluster screws and bottom screw in middle of bottom of gear pot. Remove set screw and pin on speed shifter lever.

Tap lightly on motor pinion, 501-51, and screw drive gear, 500-88, and housing will come apart. Pinion shaft, 500-87, with clutch and gears may be tapped out with small punch through center hole in bottom of gear pot.

DISASSEMBLY OF DA-4 UPPER HOUSING & SPINDLE REMOVAL

Remove 500-16 knob by releasing socket set screw. Remove 500-17 knob by releasing socket set screw. (On automotive units you may then draw out centering rod). Unscrew spindle clutch lever stop pin, 500-3. Raise lever to extreme top, which will allow removal of countersunk screw and lever assembly. Remove cap screw to disassemble trip lever, 500-35. (Caution: Do not lose trip spring). Remove 6 screws holding upper housing sections together and lift off upper lid, 503-8.

Now parts shifting lever, 500-38, with springs may be removed along with 500-25 upper fast return gear with plunger and spring, spindle clutch and key, 500-3, ball bearing with take-up spring, 500-18, (be sure spring is reassembled properly), sleeve gear, 500-1, feed nut, 500-2, and feed gear with thrust washer, 503-9.

If the bar is in a vertical spindle position we suggest you place something under the spindle nose to prevent lubrication from running out and then remove 500-5 spindle nut. Nut can be started off through adjusting access hold and then hand turned. Now drive gear, 503-6, may be worked off along with 500-4 spacer and woodruff key.

Inner spindle may now be removed. Ball bearing type will have to be lightly driven out.

Hex cap screws in upper housing should be removed and housing may be driven off spindle. Heat on housing will simplify removal of this sweat fit.

Lift off of feed screw.

Nut should be removed from 500-29 shaft and shaft may be pressed out with gear.

500-19 long gear with radial and thrust bearings may be removed along with oil seal.

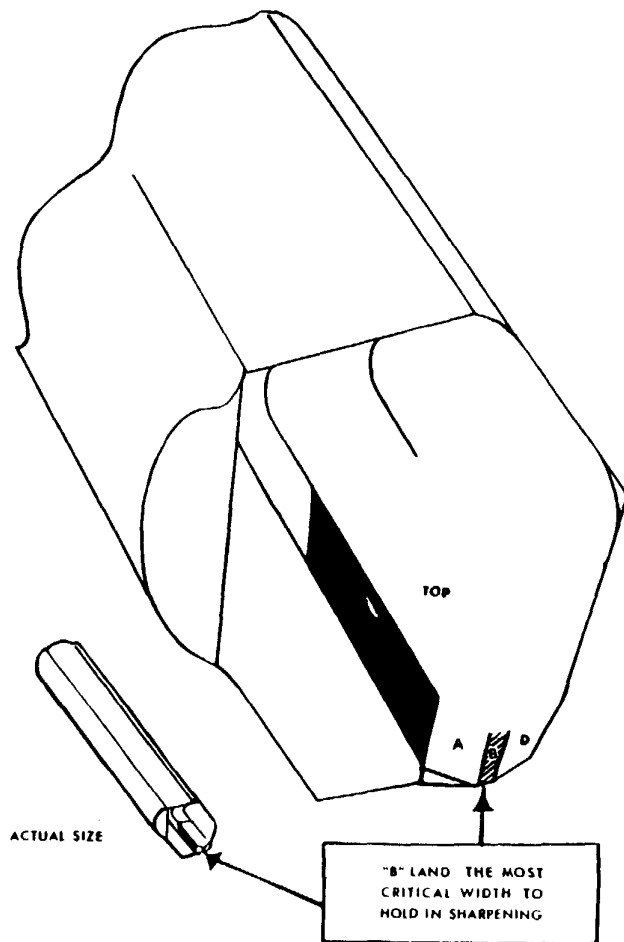
Extreme care should be taken when removing long gear out of seal or seal out of housing. Seal is fragile and garter spring will come out easily. When reassembling, open seal as long gear is pushed in to prevent garter spring from snapping out.

RAPID RETURN TRAVERSE

If the boring bar should ever fail or hesitate to return to top of travel when shift lever is lifted and latched, the following procedure may be used to adjust return traverse clutches.

1. Run bar down into hole a few inches.
2. Loosen set screw at top of upper housing. (Refer SC Sec. A-A.)
3. This will allow you to tap rapid return tumbler assembly, (Top of shaft located on top of upper housing opposite spindle aid*) down slightly which will result in deeper engagement of clutches. Adjust tumbler shaft so that when shift lever is in neutral, clutches do not clatter. Clutches should engage immediately upon latching lever.
4. Tighten set screw to relock shaft. Check to see adjustment has not been changed by set screw.

SHARPENING OF THE CUTTING TOOL



The performance of your boring bar and the quality of work it will do is almost entirely dependent on the care of the cutting tool.

In the accompanying sketch, letters A. B. D correspond to the letters indicated on your sharpening jig, in other words, when your jig is set in the A position it will sharpen the "A" land as shown in the sketch.

The most critical point of this sharpening is the width of the "B" land (as indicated by the diagonal line shading). This width should be maintained at about .015 to .020 or 1/64". This width is held by cutting back the D land as required.

In the event your bar chatters or bores a rough finish at the bottom of the cylinder, it is very probable this "B" land is too wide.

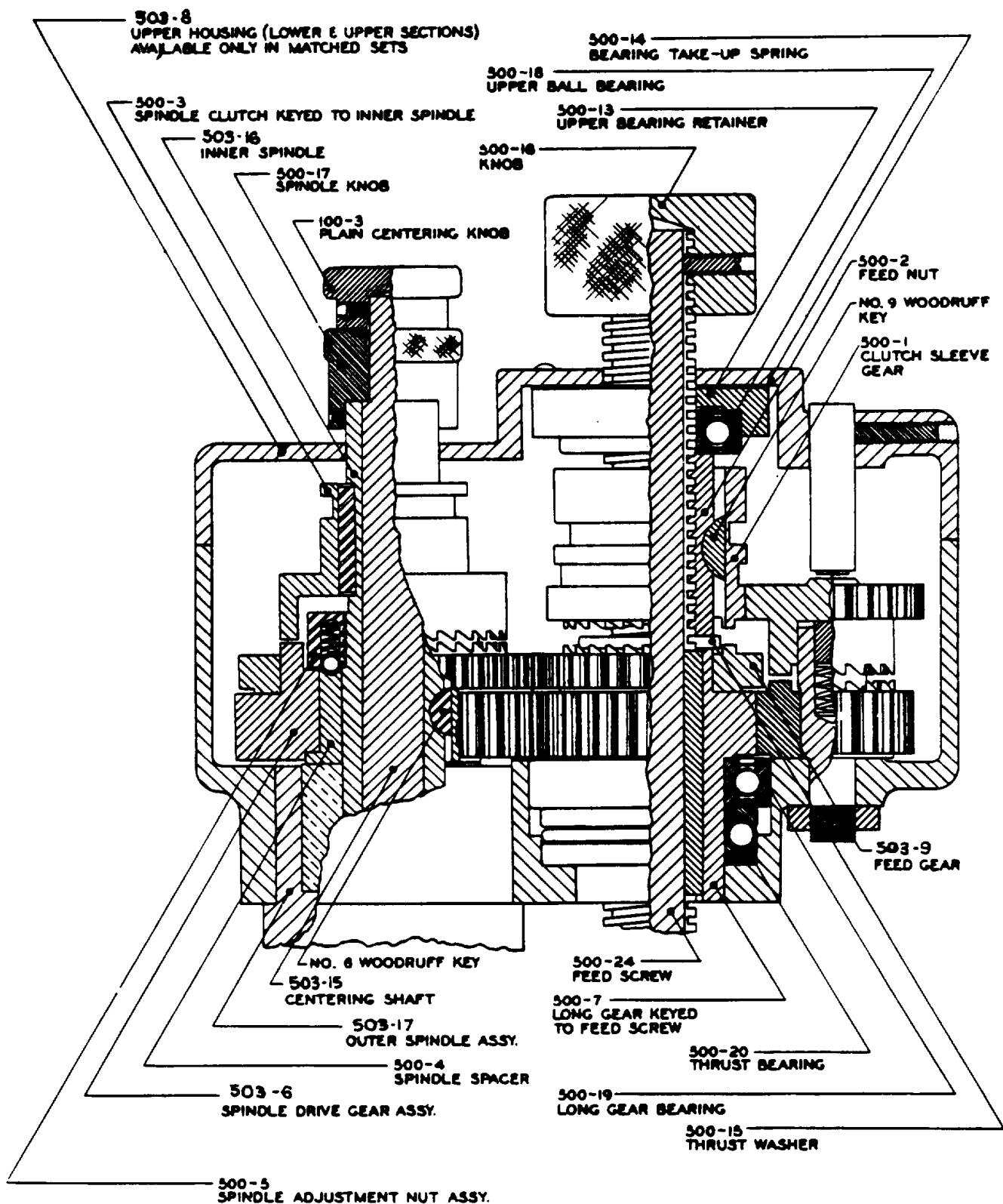
The A cutting land is not critical as to width but should be maintained in good condition to obtain free cutting, particularly on heavy cuts.

The top surface of the bit is finely finished at the factory and requires no further resurfacing. This also means no honing or in any way attempting to break off the chip that sometimes seems to be apparent.

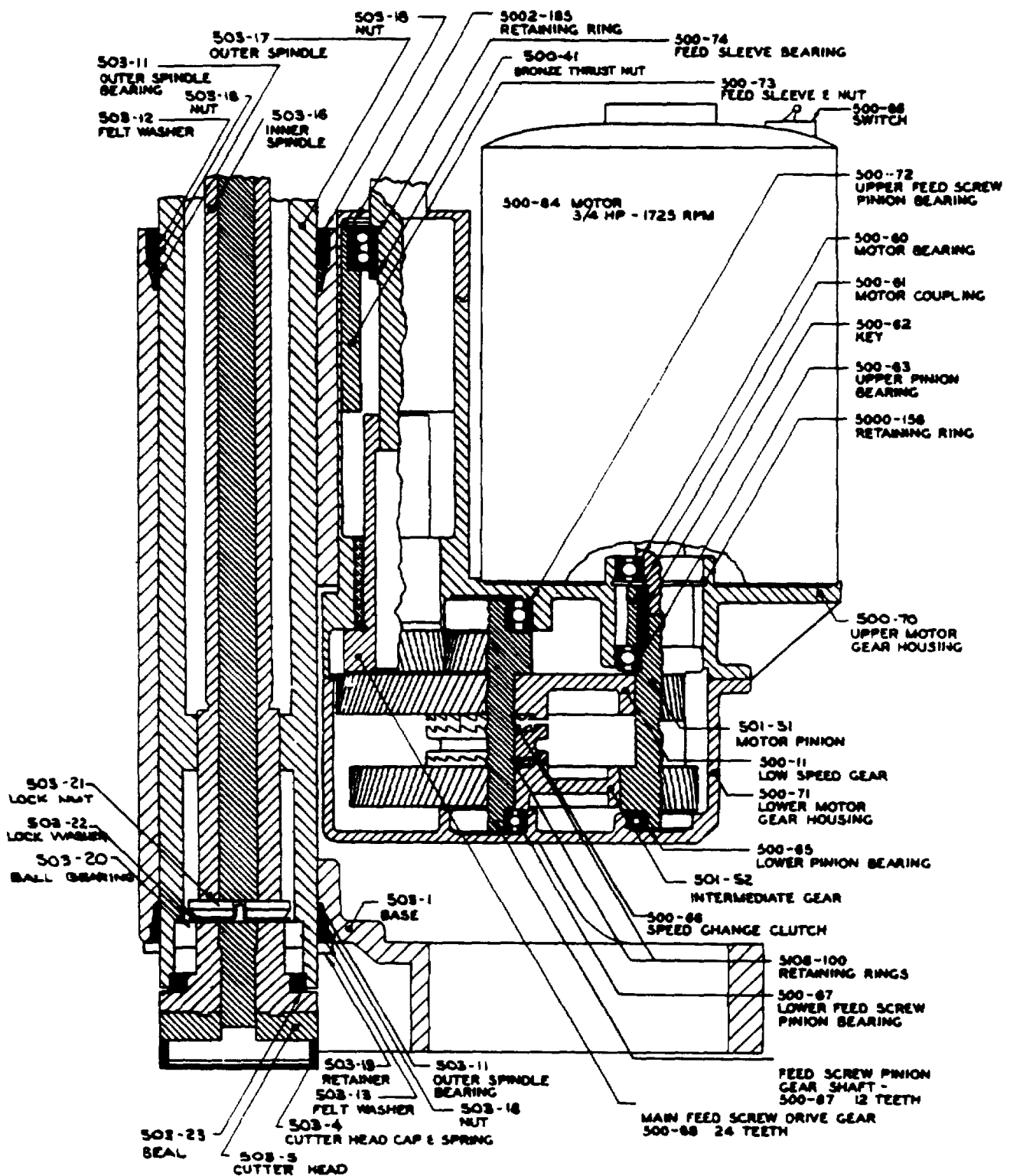
The practice of doing these things will inevitably result in poor surface finish and impair the accuracy of the machine.

The frequency of sharpening the bit required will vary depending on the type of iron being bored. A six cylinder block can sometimes be bored without resharpener, and often it is advisable to touch up the cutting tool on every hole for best results.

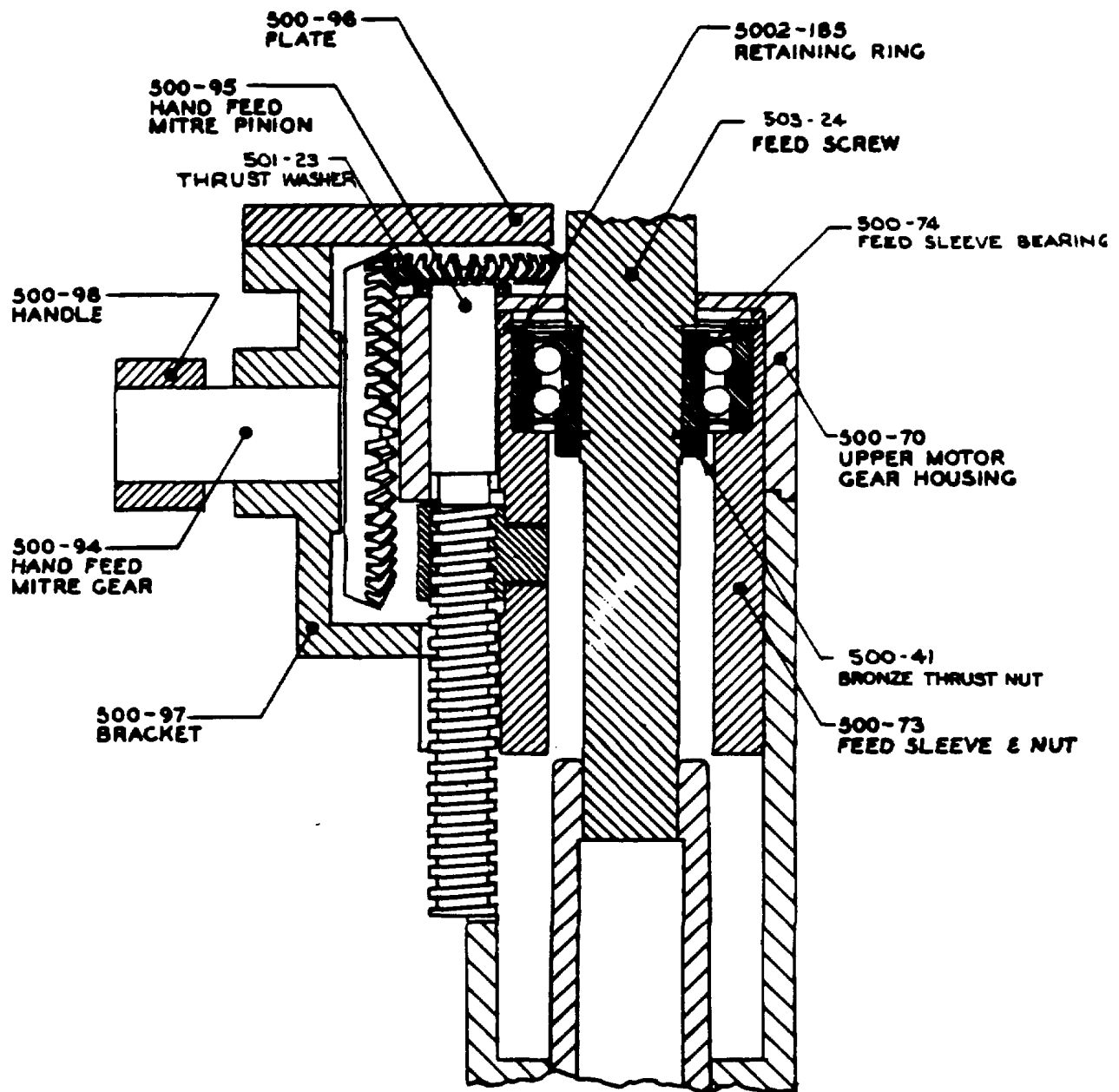
**WHEN SHARPENING CA 000 CUTTERS MAINTAIN
THE B LAND FROM .003 TO .010**



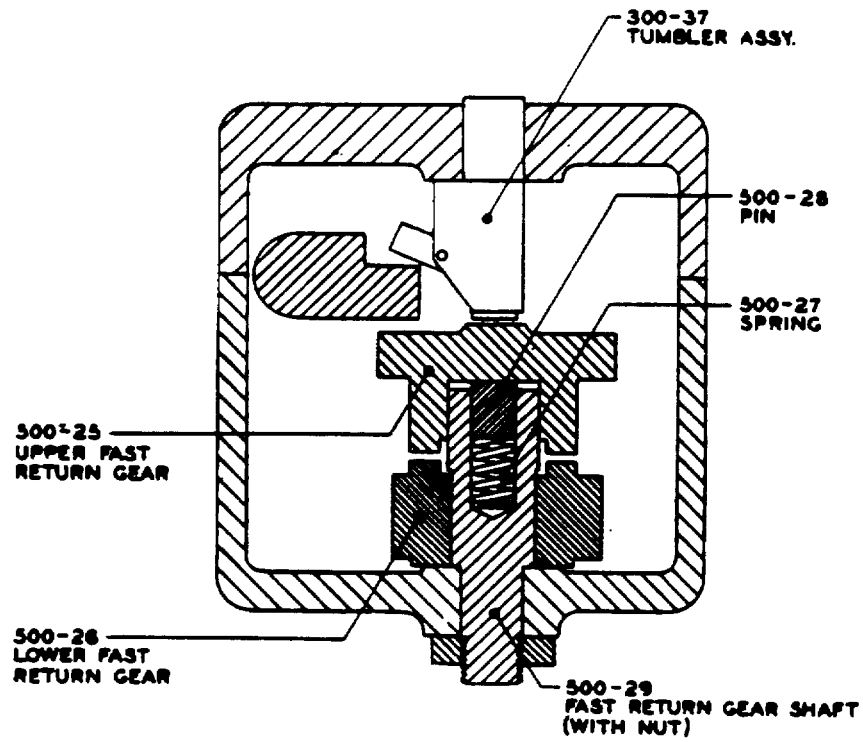
SECTION A-A



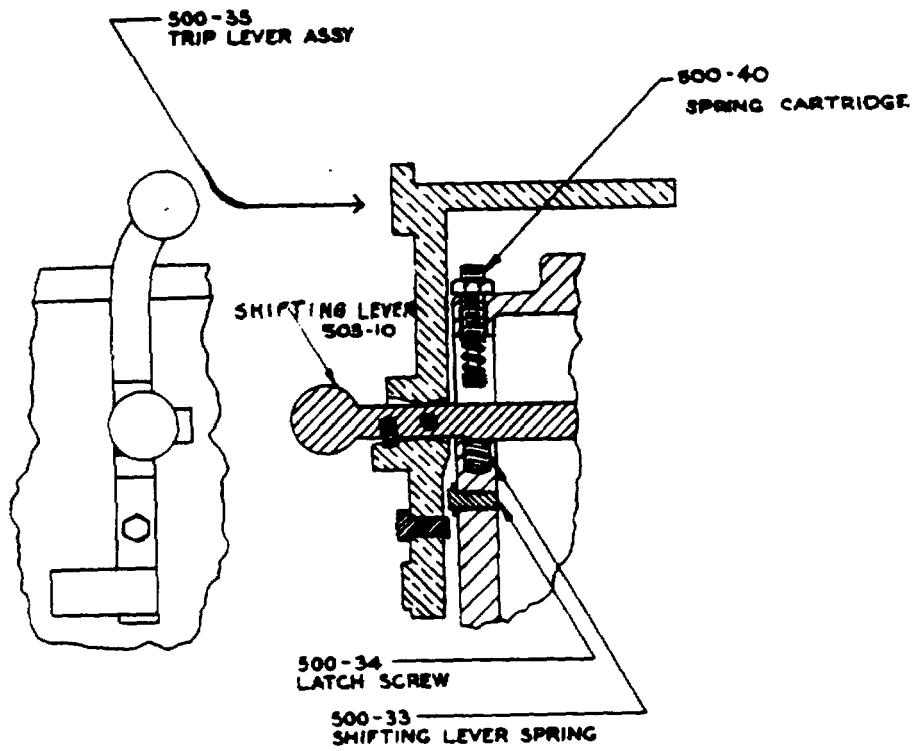
SECTION B-B



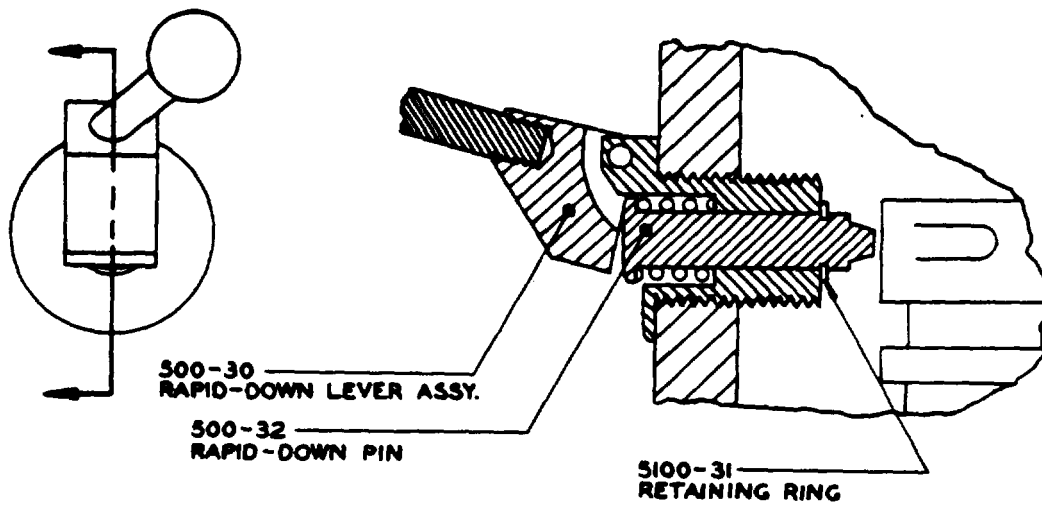
SECTION C-C



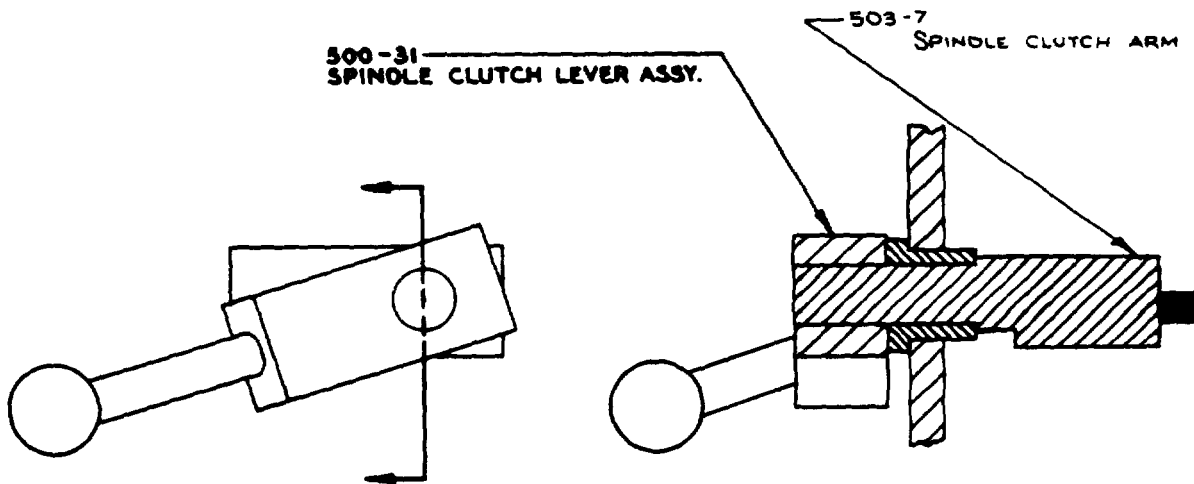
SECTION D-D



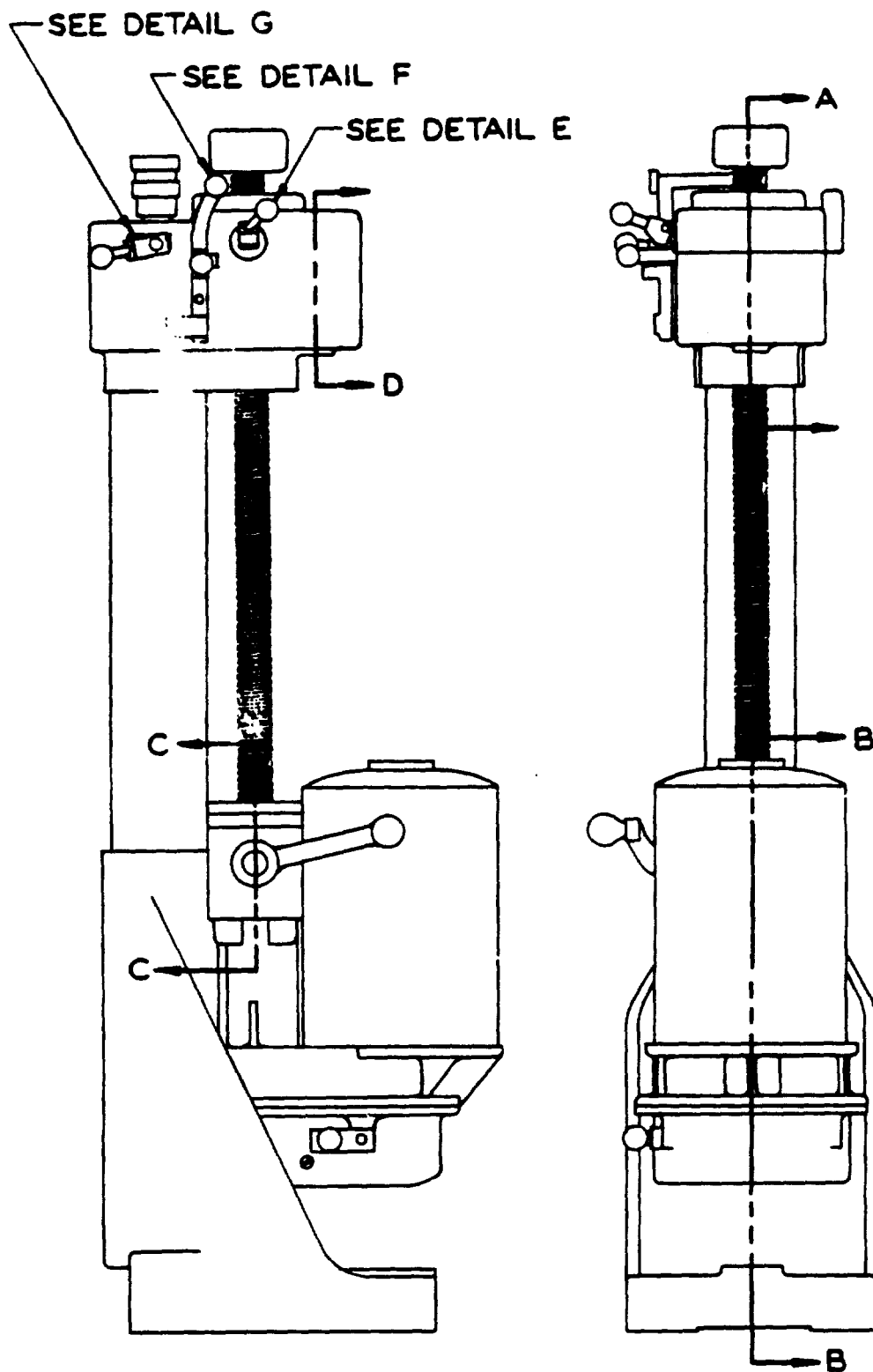
DETAIL F



DETAIL E



DETAIL G



PARTS LIST

MODEL DA-4

BASE AND SPINDLE UNIT

503-1	Base	503-18	Nut, Outer Spindle
503-11	Outer Spindle Bearing	503-19	Retainer, Lower Felt Wiper
503-12	Felt Wiper, Upper	503-20	Spindle Ball Bearing
503-13	Felt Wiper, Lower	503-21	Bearing Lock Nut
503-15	Centering Shaft	503-22	Bearing Lock Washer
503-16	Inner Spindle	503-23	Seal, Spindle
503-17	Outer Spindle		

UPPER HOUSING

100-3	Centering Knob	500-28	Pin.
300-37	Tumbler Assembly	500-29	Past Return Gear Shaft w/Nut
500-1	Clutch Sleeve Gear	500-30	Rapid Down Lever Assembly
500-2	Feed Nut	500-31	Spindle Clutch Lever Assembly
500-3	Spindle Clutch	500-32	Rapid Down Pin
500-4	Spindle Spacer	500-33	Shifting Lever Spring
500-5	Spindle Adjustment Nut	500-34	Latch Screw
500-7	Long Gear	500-35	Trip Lever Assembly
500-13	Upper Bearing Retainer	500-40	Spring Cartridge
500-14	Bearing Take-Up Spring	503-4	Cutter Head Cap & Spring
500-15	Thrust Washer	503-5	Cutter Head
500-16	Knob	503-6	Spindle Drive Gear Assembly
500-17	Spindle Knob.	503-7	Spindle Clutch Arm
500-18	Upper Ball Bearing	503-8	Upper Housing - Matched Set Upper & Lower Portions
500-19	Long Gear Bearing		
500-20	Thrust Bearing	503-9	Feed Gear
500-25	Upper Fast Return Gear	503-10	Shifting Lever
500-26	Lower Fast Return Gear	503-24	Feed Screw.
500-27	Spring		

MOTOR HOUSING

500-11	Low Speed Gear, Micarta	500-70	Upper Motor Gear Housing
500-41	Bronze Thrust Nut	500-71	Lower Motor Gear Housing
500-58	Motor Cord	500-72	Upper Feed Screw Pinion Brg
500-60	Motor Bearing	500-73	Feed Sleeve & Nut
500-61	Motor Coupling	500-74	Feed Sleeve Bearing
500-62	Key, Micarta	500-84	Motor 3/4 HP, 1725 RPM.
500-63	Upper Pinion Bearing.	500-86	Switch
500-65	Lower Pinion Bearing	500-87	Feed Screw Pinion Spiral Gear Shaft
500-66	Speed Change Clutch		
500-67	Lower Feed Screw Pinion Brg	500-88	Main Feed Screw Drive Gear

MOTOR HOUSING (Continued)

500-94	Hand Feed Mitre Gear	501-51	Motor Pinion
500-95	Hand Feed Mitre Pinion.	501-52	Intermediate Gear, Micarta
500-96	Plate, Hand Feed		
500-97	Bracket, Hand Feed	5000-156	Retaining Ring
500-98	Handle, Hand Feed	5002-185	Retaining Ring
501-23	Thrust Washer	5108-100	Retaining Ring

MISCELLANEOUS ITEMS

100	Sharpening Compound	501-11	1" Screw
100-23	Wing Wrench	501-12	T Wrench
100-24	Tool Puller	501-13	3/8" Adjusting Screw
100-34	Micrometer	501-14	Holddown Bolts
100-44	Tool Box	501-15	Holddown Washers
		501-16	Holddown Body Only
200-1-5	Tool Holder, Short, 3"	501-31	R-8 Carbide Bit
200-1-6	Tool Holder, Medium, 3-9/16"	501-35	Sharpening Jig
200-1-7	Tool Holder, Long, 4-1/8"	501-39	Diamond Sharpening Knob
200-1-8	Tool Holder, Extra Long, 4-3/4"	501-40	Tool Kit, Complete w/Standard Equipment
200-21-1	Centering Fingers, 3-1/16"	501-43	Mike Wrench
200-21-2	Centering Fingers, 4-1/8"	501-46	Lift Hook
		501-59	R-H Carbide Bit
501-7	Holddown Clamp, Complete	501-65	Electric Plug
501-8	Long Wing	501-73	Hex Driver
501-9	Medium wing	503-25	Mike Standard
501-10	Short wing		

APPENDIX BASIC ISSUE ITEMS

Section I. INTRODUCTION

1. General

This appendix is a list of basic issue items. It is composed of those items which make up the major end item of equipment, and the operator's tools and equipment that are issued with the equipment, and are required for stockage.

2. Requisition Notes

a. *Repair Part Identified by Federal Stock Number.*

- (1) If the item requisitioned is not furnished, or if other action is necessary, the nature of the action taken by the commodity command will be indicated by standard symbols on prescribed forms.
- (2) When requisitioning an item, the requesting agency will order the listed item. However, the commodity command will take action to issue the exhaust stock item until stock is exhausted, whether it be an individual item, kit, set, or assembly.
- (3) Requisition for replacement of items that are the responsibility of commodity commands will be submitted to the commodity command indicated in column 1a (materiel code number).

b. *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:

- (1) Manufacturer's code number (5-digit number preceding the colon in description column).
- (2) Manufacturer's part number (the number, and sometimes letters, following the colon (1) above). Dashes, commas, or other marks must be included exactly as listed.
- (3) Nomenclature exactly as listed herein, including dimensions, if necessary.

- (4) Name of manufacturer of end item (from cover of TM or manufacturer's nameplate).
- (5) Federal stock number of the end item (from TM).
- (6) Manufacturer's model number (from T or name/data plate, preferably name,; data plate).
- (7) Manufacturer's serial number (from name data plate).
- (8) Any other information such as type, frame number, and electrical characteristics, if applicable.
- (9) If DD Form 1348 is used, fill in all blocks except 4, 5, 6, and remarks field in accordance with AR 725-50. Complete form as follows:
 - (a) In blocks 4, 5, and 6, list manufacturer's code and part number (as listed in description column).
 - (b) 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.

3. Explanation of Columns

a. *Source, Maintenance, and Recoverability Code* (col. 1).

- (1) *Materiel numerical codes (col. 1a).* This column indicates the responsible commodity command for the materiel. The commodity command responsible for supply of items in this list is-

Code	Type material
9.....	Ordnance
- (2) *Source (col. 1b).* This column indicates the selection status and source for the listed item. Source code used in this list is-

Code	Explanation
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 .

(3) *Maintenance level* (col. 1c). This column indicates the category of maintenance authorized to install the listed item. Maintenance level code used in this list is-

Code	Explanation
O/C.....	Operator or crew maintenance.

(4) *Recoverability* (col. 1d). This column indicates whether unserviceable items should be returned for recovery or salvage. When no code is indicated, the item will be considered expendable. Recoverability code used in this list is-

Code	Explanation
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* (col. 2). This column indicates the Federal stock number which has been assigned by the Cataloging Division, Defense Logistics Services Center.

c. *Description* (col. 3). This column indicates the Federal item name and any additional description required for supply operations. The manufacturer's code and part number are also included for reference.

Code	Explanation
52014	Rottler Boring Bar Company.

d. *Unit of Issue* (col. 4). This column indicates the quantity to be requisitioned

e. *Quantity Authorized* (col. 5). This column indicates the quantity of the listed item authorized for stockage to constitute the prescribed load.

f. *Illustration* (col. 6). This column indicates the figure number of the illustration that depicts the listed item. When more than one item appears on an illustration, the item number is also indicated.

4. Abbreviations

ac	alternating current
amp	ampere(s)
b	bronze
c/o	consist of
de	direct current
fl	flat
in	inch(es)
lg	long
med	medium
term.	terminal
v	volts
w.....	with

5. Suggestions and Recommendations

The direct reporting, by the individual user, of errors, omissions, and recommendations for improving this manual is authorized and encouraged. DA Form 2028 (Recommended Changes to DA Publications) will be used for reporting these improvements. This form will be completed in triplicate using pencil, pen, or typewriter. The original and one copy will be forwarded direct to Commanding General, Headquarters, U.S. Army Weapons Command, ATTN: AMSWE-SMM-P, Rock Island Arsenal, Rock Island, Ill. 61202. One information copy will be provided to the individual's immediate supervisor (e.g., officer, noncommissioned officer, supervisor, etc.).

Section II. BASIC ISSUE ITEMS LIST

(1) Source, Maintenance, and Recoverability Code				(2)	(3)	(4)	(5)	(6) Illustration	
(a)	(b)	(c)	(d)	Federal stock No.	Description	Unit of issue	Quantity author- ized	(a)	(b)
Material Code	Source	Mainten- ance level	Recover- ability					Figure No.	Item No.
9			R	4910-223-9734	<p style="text-align: center;">MAJOR COMBINATION</p> <p>The major combination listed below is requisitioned for initial issue only.</p> <p>BORING MACHINE, ENGINE CYLINDER: (52014:DA-4).</p> <p style="text-align: center;">COMPONENTS OF MAJOR COMBINATION</p> <p style="text-align: center;">None authorized.</p> <p style="text-align: center;">REPAIR PARTS</p> <p style="text-align: center;">None authorized.</p> <p style="text-align: center;">TOOLS AND EQUIPMENT FOR:</p> <p style="text-align: center;">BORING MACHINE, ENGINE CYLINDER: (52014:DA-14)</p>	ea	1		
9	C	O/C		5935-545-3886	ADAPTER, ELECTRICAL CONNECTOR: plastic dielectric, 2 fl parallel male contacts and ground lead w/term. one end, 2 fl parallel and 1 u female contacts other end, ac/dc, 125 v, 15 amp (5201:501-5).	ea	1	1	3
9	C	O/C			BIT, CUTTER: carbide, R-8 (52014:501-31)	ea	1	1	12
9	C	O/C			BIT, CUTTER: carbide, R-H (52014:501-59)	ea	1	1	13
9	C	O/C			BOLT SET, HOLD-DOWN: set of 3, 5/8-11 x 3 1/2, 4, and 5 1/2 in. lg (52014:501-14).	st	1	2	2
9	C	O/C			COMPOUND, SHARPENING: (52014:100)	jr	1	1	2
9	C	O/C			DRIVER, HEXAGON: screwdriver type (52014:501-73).	ea	1	1	18
9	C	O/C	R		FINGER, CENTERING: 3 1/6 in. lg, 4 per set (52014:200-21-1).	st	1	1	10
9	C	O/C	R		FINGER, CENTERING: 4 1/8 in. lg, 4 per set (52014:200-21-2).	st	1	1	9
9	C	O/C	R		HANDLE, CRANK: hand feed (52014:500-98)	ea	1	2	11
9	C	O/C	R		HOLD-DOWN CLAMP ASSEMBLY: c/o	ea	1	2	6
9	C	O/C			BODY, HOLD-DOWN: (52014:501-16)	ea	1	2	4
9	C	O/C			SCREW, ADJUSTING, HOLD-DOWN: 3/8 18 thd x 3/4 in. lg (52014:501-13).	ea	1	2	
9	C	O/C			SCREW, ADJUSTING HOLD-DOWN: 1 in. thd (52014:501-11).	ea	1 2	3	
9	C	O/C			WING, HOLD-DOWN: lg (52014:501-81)	ea	1	2	7
9	C	O/C			WING, HOLD-DOWN: med (52014:501-9)	ea	1	2	5
9	C	O/C			WING, HOLD-DOWN: short (52014:501-10).	ea	1	2	8
9	C	O/C	R		HOLDER, TOOL: 3 in., short (52014:200-1-5)	ea	1	1	8
9	C	O/C	R		HOLDER, TOOL: 3 9/16, in., med (5014:200-1-6)	ea	1	1	7
9	C	O/C	R		HOLDER, TOOL: 4 1/8 in., lg (52014:200-1-7)-	ea	1	1	6
9	C	O/C	R		HOLDER, TOOL: 4 3/4 in., extra lg (52014:200-1-8).	ea	1	1	5

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(1) Source, Maintenance, and Recoverability Code				(2)	(3)	(4)	(5)	(6) Illustration	
(a)	(b)	(c)	(d)	Federal stock No.	Description	Unit of issue	Quantity author- ized	(a)	(b)
Material Code	Source	Mainten- ance level	Recover- ability					Figure No.	Item No.
					TOOLS AND EQUIPMENT FOR:-Continued				
					BORING MACHINE, ENGINE CYLINDER: (52014:DA-14)-Continued				
9	C	O/C	R		HOOK, LIFT: (52014:501-46)	ea	1	2	9
9	C	O/C	R		JIG, SHARPENING: (52014:501-35)	ea	1	1	4
9	C	O/C			KEY, MICARTA: (52014:50062)	ea	1	1	15
9	C	O/C	R		MICROMETER: (52014:100-34)	ea	1	1	20
9	C	O/C			NUT, THRUST: bz (52014-5002)	ea	1	1	14
9	C	O/C			PULLER, TOOL HOLDER: (52014:100-24)	ea	1	1	11
9	C	O/C			STANDARD, MICROMETER: (52014:503-25)	ea	1	1	17
9	C	O/C			TOOL BOX: (52014:501-7)	ea	1	1	1
9	C	O/C			WASHER, HOLD-DOWN: (52014:201-15)	ea	3	2	1
9	C	O/C			WRENCH, MICROMETER: (52014:501-43)	ea	1	1	19
9	C	O/C			WRENCH, T-HANDLE: (52014:501-12)	ea	1	2	10
9	C	O/C			WRENCH, TOOL HOLDER: (52014:100-23)	ea	1	1	17

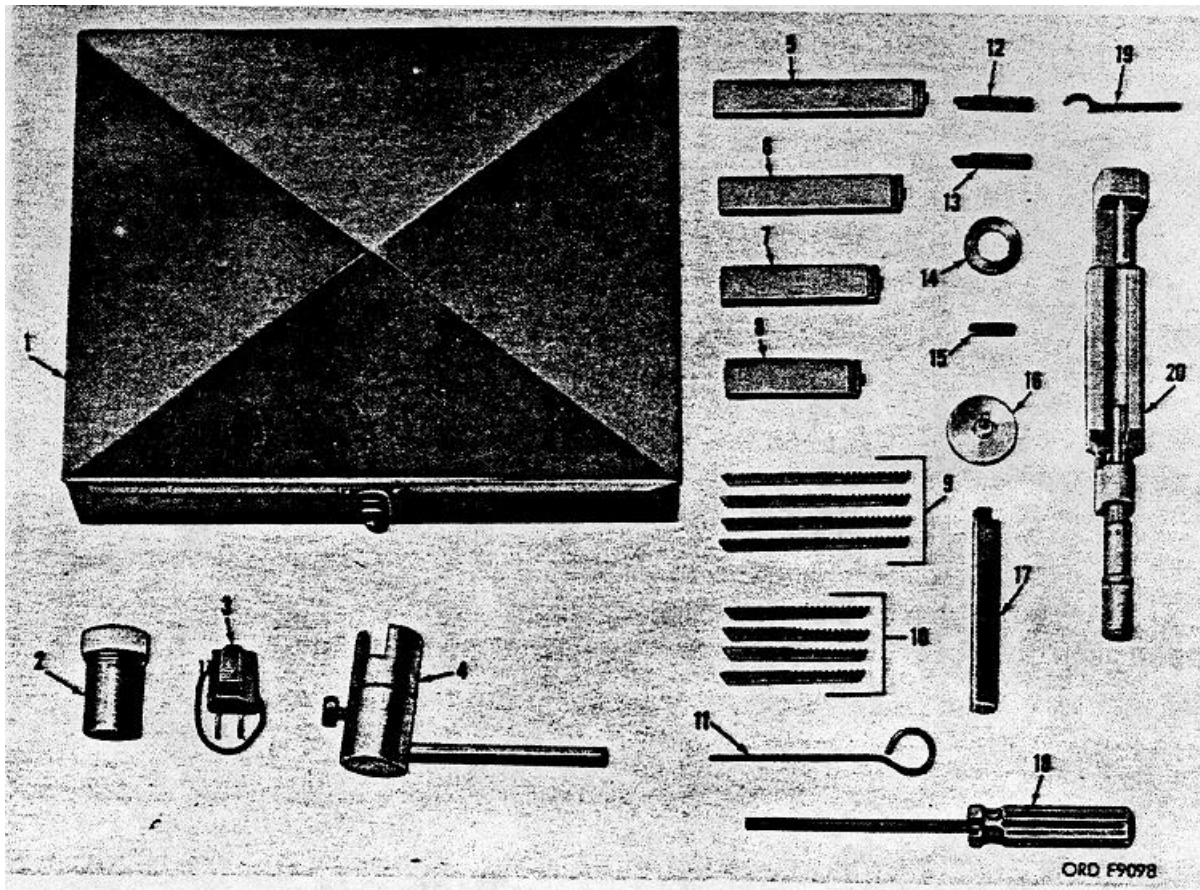


Figure 1. Tools and equipment for engine cylinder boring machines.

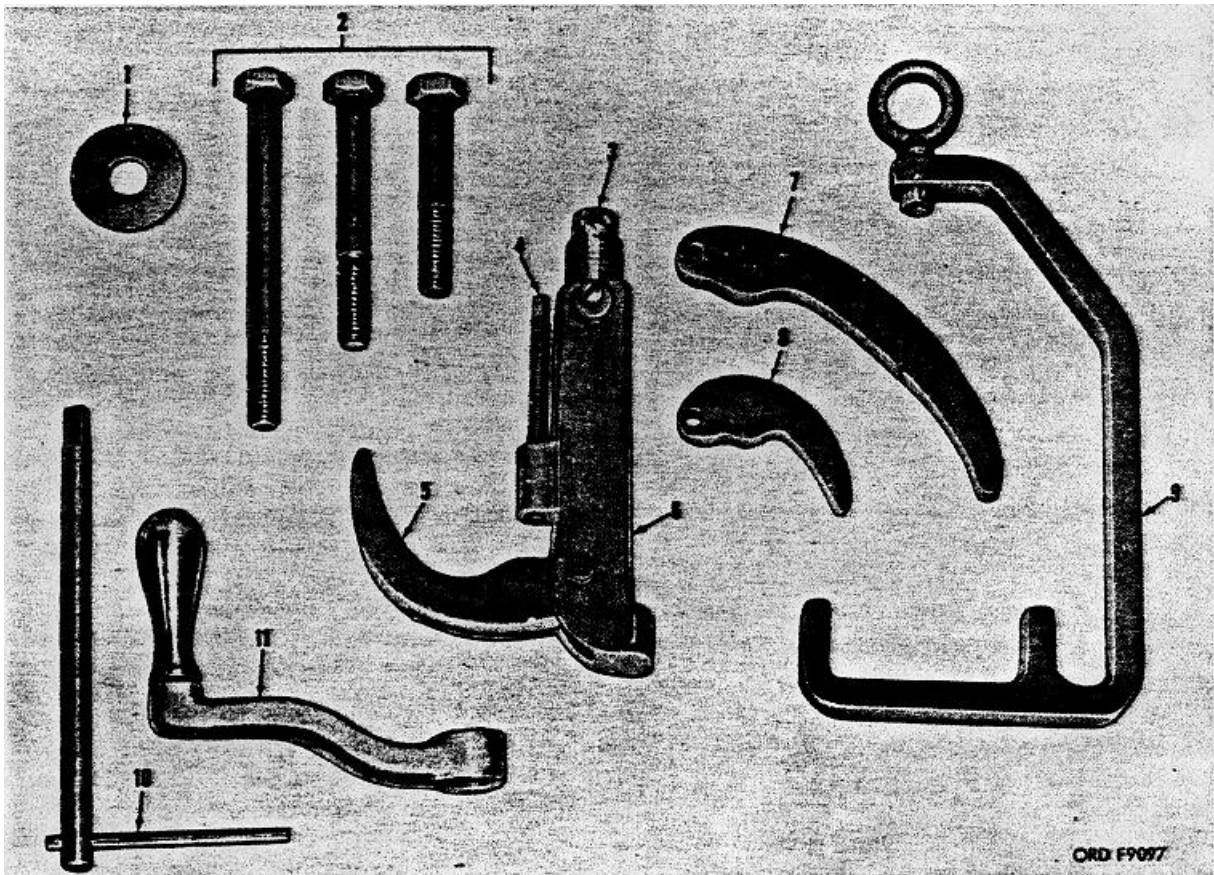
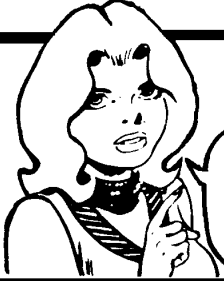


Figure 2. Tools and equipment for engine cylinder boring machine.

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 <div style="border: 1px solid black; border-radius: 15px; padding: 5px; margin: 10px auto; width: 200px;"> <p style="margin: 0;">THEN...JOT DOWN THE DOPE ABOUT IT ON THIS FORM. CAREFULLY TEAR IT OUT, FOLD IT AND DROP IT IN THE MAIL.</p> </div>		SOMETHING WRONG WITH PUBLICATION									
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PUBLICATION DATE		PUBLICATION TITLE									
<div style="display: flex;"> <div style="flex: 1; border-right: 1px solid black; padding-right: 5px;"> <p style="margin: 0; font-weight: bold; font-size: 0.8em;">BE EXACT PIN-POINT WHERE IT IS</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="padding: 5px; font-size: 0.7em;">PAGE NO.</th> <th style="padding: 5px; font-size: 0.7em;">PARA- GRAPH</th> <th style="padding: 5px; font-size: 0.7em;">FIGURE NO.</th> <th style="padding: 5px; font-size: 0.7em;">TABLE NO.</th> </tr> <tr> <td style="height: 500px;"></td> <td></td> <td></td> <td></td> </tr> </table> </div> <div style="flex: 3; padding-left: 5px;"> <p style="margin: 0; font-weight: bold; font-size: 1.1em;">IN THIS SPACE, TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT.</p> <div style="border: 1px solid black; height: 450px; margin-top: 10px;"></div> </div> </div>				PAGE NO.	PARA- GRAPH	FIGURE NO.	TABLE NO.				
PAGE NO.	PARA- GRAPH	FIGURE NO.	TABLE NO.								
PRINTED NAME, GRADE OR TITLE AND TELEPHONE NUMBER		SIGN HERE									

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P.S.--IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR
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The Metric System and Equivalents

Linear Measure

1 centimeter = 10 millimeters = .39 inch
 1 decimeter = 10 centimeters = 3.94 inches
 1 meter = 10 decimeters = 39.37 inches
 1 dekameter = 10 meters = 32.8 feet
 1 hectometer = 10 dekameters = 328.08 feet
 1 kilometer = 10 hectometers = 3,280.8 feet

Weights

1 centigram = 10 milligrams = .15 grain
 1 decigram = 10 centigrams = 1.54 grains
 1 gram = 10 decigrams = .035 ounce
 1 decagram = 10 grams = .35 ounce
 1 hectogram = 10 decagrams = 3.52 ounces
 1 kilogram = 10 hectograms = 2.2 pounds
 1 quintal = 100 kilograms = 220.46 pounds
 1 metric ton = 10 quintals = 1.1 short tons

Liquid Measure

1 centiliter = 10 milliliters = .34 fl. ounce
 1 deciliter = 10 centiliters = 3.38 fl. ounces
 1 liter = 10 deciliters = 33.81 fl. ounces
 1 dekaliter = 10 liters = 2.64 gallons
 1 hectoliter = 10 dekaliters = 26.42 gallons
 1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
 1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
 1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
 1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
 1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
 1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
 1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
 1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Approximate Conversion Factors

<i>To change</i>	<i>To</i>	<i>Multiply by</i>	<i>To change</i>	<i>To</i>	<i>Multiply by</i>
inches	centimeters	2.540	ounce-inches	Newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29.573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	Newton-meters	1.356	metric tons	short tons	1.102
pound-inches	Newton-meters	.11296			

Temperature (Exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C
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