



# C302 Rivnut<sup>®</sup> & Plusnut<sup>®</sup> Header Operating Instructions & Parts List



**ISO 9001:2000 CERTIFIED**

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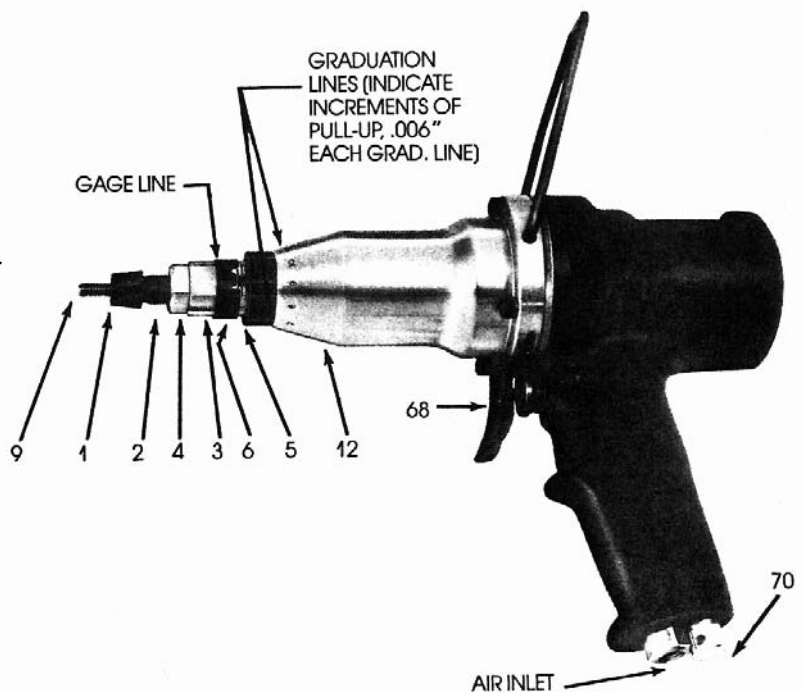
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**Figure 1**  
Rivnut and Plusnut Header  
Weight - 6.4 lbs

- 1 Anvil
- 2 Anvil hex nut
- 3 Thread engagement indicator
- 4 Pull-up stud housing
- 5 Pull-up stud housing locknut
- 6 Pull-up indicator
- 9 Pull-up stud
- 12 Jackscrew housing
- 68 Throttle
- 70 Oil filter



# 1. Introduction

## General

This publication describes the operation, adjustment, maintenance and repair of the Bollhoff-Rivnut C-302 Tool.

It is important to note that there are two C-302 model tools in service (identified on name plates).

### C-302 Model B

- Designed for Rivnut<sup>®</sup> Fastener installation
- Pull-Up stroke .300"
- Internal modifications required to convert tool to Model P

### C-302 Model P

- Designed for both Rivnut<sup>®</sup> and Plusnut<sup>®</sup> Fastener Installation
- Pull-Up stroke .550"

The Bollhoff-Rivnut Model P Pneumatic Header Tool is intended for use to install Rivnut<sup>®</sup> and Plusnut<sup>®</sup> Fasteners. This tool will give long service with minimum care when kept clean, lubricated and in proper adjustment as indicated in the instructions that follow.

## NOTE

The two basic C-302 Models have been identified. This publication is directed to Model P; however the operation and adjustments cover both tool models. Further reference to Model B and Model P will be noted in Section IV (Disassembly and Assembly) and Section V (Parts List).

## Preliminary Adjustment

The C-302 Model P Tool can be used for installation of Rivnuts #4 thru 1/4" (5/16 aluminum) unified thread and 3mm thru 8mm metric thread. Plusnut #4 thru 3/8" unified thread and 5mm thru 10mm metric thread .

## CAUTION

Adjustments for change of Rivnut and Plusnut fastener size or material thickness will be required. Do not attempt adjustment until you are thoroughly familiar with procedures described in this publication. Failure to follow instructions may result in rejected work and possible damage to the tool.

## Air Supply Requirements

1. Provide 75 to 80 psi at the tool, measured with tool operating at full throttle. Use a regulator to assure that the correct pressure range is maintained at all times.
2. Use of an air filter-lubricator in supply line to tool is recommended. If lubricator is not used, tool must be lubricated daily as shown under "lubrication".

## Lubrication

### 1. Motor recommendations

- a. Use air line filter and lubricator if available. Lacking these, use good grade SAE 10 oil.
- b. When putting new or old tool into service, fill air inlet (figure 1) with oil.
- c. Daily, or after each 8 hours of service, remove oil filter plug (70,fig 1) and saturate wicking with oil.

### 2. Gearing and clutch assembly recommendations

- a. Gearing and clutch assembly are properly lubricated during manufacture.
- b. If tool is disassembled, all old grease should be removed and the assembly repacked with National Lubrication Institute No. 1 or 2 grease or equivalent.

# 2. Operation and Adjustments

## NOTE

The operating procedures and adjustments given in this section are vital to the correct, trouble-free performance of the header. The operator should be thoroughly familiar with the header and its adjustments before placing the tool in use.

## Operating the Header

The header is operated by a single trigger. The header is simple to operate and requires no lengthy training period to familiarize the operator with the operating sequence. A few practice cycles without using a Rivnut or Plusnut fastener are generally sufficient to master the operation of the throttle control. The header throttle is operated in two steps as follows:

1. Pull the trigger (68,fig 1) to the first stop, about half way down. This rotates the pull-up stud (9,fig 1) clockwise and threads it into the Rivnut or Plusnut. When the Rivnut or Plusnut fastener head touches the anvil (1,fig 1), pull-up stud rotation automatically stops and Rivnut or Plusnut upset occurs.
2. Pull the trigger all the way down and hold momentarily. The pull-up stud then automatically Rotates counterclockwise, unthreading itself from the Rivnut or Plusnut.

## CAUTION

In actual operation, the header must be held at right angles to the work until the entire upset-retract cycle is completed. Failure to do this results in excessive pull-up stud breakage and/or damaged fastener threads.

3. Release the trigger. The tool automatically stops pull-up stud rotation and is ready for the next installation.

## 2. Operation and Adjustments cont.

### Pull-Up Stud Size

Check that the correct size pull-up stud (9,fig 1) is installed in the header. If the pull-up stud is the wrong size or if it needs to be changed for a different Rivnut or Plusnut fastener size, proceed as follows:

### How to Change out Pull-Up Studs

1. Refer to Table I, Section V, and select the correct pull-up stud, anvil and coupling (if needed).
2. Loosen anvil hex nut (2,fig 1) and remove anvil.
3. Loosen pull-up stud housing lock nut (5,fig 1), unthread and remove pull-up stud housing from jackscrew housing. (12,fig 1)
4. With air line connected to tool, depress trigger completely and release. Pull-up stud will move forward so that pull-up stud pin is accessible. (fig 4A,pg 6)
5. For a 2 piece pull-up stud and coupling, measure dimension D (fig 4A,pg 6) on old stud. Remove pull-up stud pin (8,fig 4A,pg 6) and the pull-up stud. Install the new pull-up stud to dimension D measurement. Dimension D can be ignored for 1 piece pull-up studs.
6. Reinstall pull-up stud pin (8,fig 4A,pg 6).

### WARNING

**Be sure ends of pull-up stud pin do not protrude.**

7. Grasp pull-up stud drive chuck (22,fig 4A,pg 6) firmly with pliers, depress trigger *very slightly*. Pull-up stud drive chuck then will retract into jack screw housing (12,figure 4,pg 6).
8. Release trigger and pull-up stud drive chuck.
9. Thread pull-up stud housing (4,fig 4,pg 6) into jackscrew housing until a definite resistance is felt through the wrench.
10. Back the pull-up stud housing (4,fig 4,pg 6) out approximately 3/4 turn and tighten locknut (5,fig 1) securely.
11. Depress trigger *completely*, hold *momentarily*, and release.

### NOTE

All preceding steps must be followed in sequence prior to making the following adjustment.

### Anvil Adjustment

1. Run hex nut (2,fig 2) on anvil (1,fig 2) as far as it will go and insert threaded end of anvil in pull-up stud housing (4,fig 2)
2. Screw anvil into housing as far as it will go.
3. By hand, thread fastener on exposed end of pull-up stud until all threads are engaged. See fig 2.

### NOTE

When using closed-end fasteners, bottom stud in fastener and back out one turn.

4. Hold fastener with fingers to prevent turning and begin to unscrew anvil from housing. Face of anvil will contact flange of fastener.

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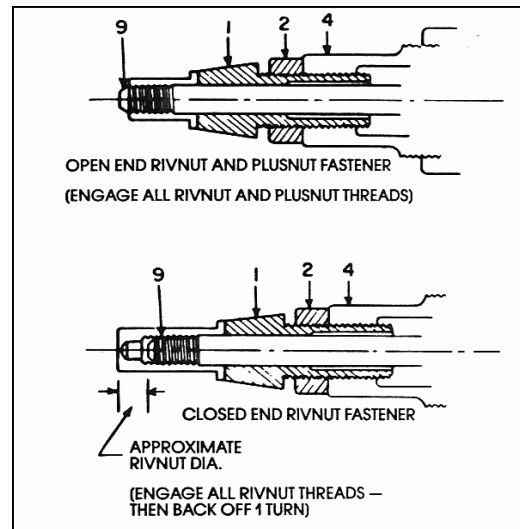


Figure 2 - Adjusting the Anvil

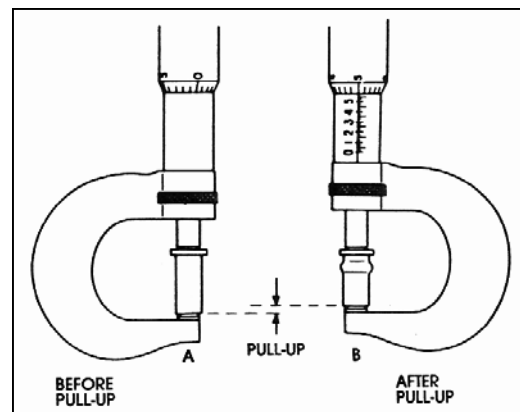


Figure 3 - Measuring Rivnut Pull-Up

5. Continue to turn anvil, overcoming spring tension, until a *definite* stop is felt. (This takes up all spring tension and slack.)
6. Prevent anvil from turning while using wrench to lock anvil hex nut (2,fig 2) against base of pull-up stud housing (4,fig 2).

### NOTE

The above procedure adjusts anvil to the correct position for a particular type of Rivnut or Plusnut fastener. It need not be changed unless a different type of Rivnut or Plusnut fastener is to be used.

### Measuring Rivnut® or Plusnut® Pull-Up

1. Measure and record over-all length of Rivnut or Plusnut fastener (A,fig 3).
2. Connect header to air line.
3. Grasp shank end of Rivnut or Plusnut fastener with fingers to prevent turning. Place it head-first on pull-up stud.

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## 2. Operation and Adjustments cont.

### Note

Hold Rivnut or Plusnut fastener tightly throughout the following cycle.

- a. Depress trigger halfway, hold momentarily. This causes the pull-up stud to rotate and threads Rivnut or Plusnut fastener on the pull-up stud against the anvil. As the head of the Rivnut or Plusnut draws up *tight* against anvil, pull-up stud rotation will cease and automatic pull-up stroke will upset the fastener.
  - b. Depress trigger fully. Hold momentarily, then release. This reverses the motor, unthreads pulled -up Rivnut or Plusnut fastener and positions pull-up stud forward for another fastener.
4. Measure and *record* over-all length of pulled-up Rivnut or Plusnut fastener (B,fig 3). Record the difference between measurement of Rivnut or Plusnut fastener before pull-up, (A,fig 3) and after pull-up, (B,fig 3). *This is the amount of pull-up for which the Header is now adjusted.* This information is essential to the next step of determining the amount of pull-up required.

### Determining Required Pull-Up

1. Each Rivnut or Plusnut fastener will accommodate thickness of materials between the minimum and maximum grip limits.

### WARNING

**Excessive pull-up may break pull-up stud, strip fastener threads or both. Inadequate pull-up may result in loose installations.**

2. Refer to Chart I to determine correct *pull-up factor* needed as explained below.

**Chart I**

Fastener Thread Size	PULL-UP FACTOR - INCHES			
	Round Rivnut	Heavy Duty Hex Rivnut	Standard Hex Rivnut	Plusnut
#10	.080	—	.060	.195
1/4	.095	.080	.075	.215
5/16	.120	.120	.085	.270
3/8	.155	.120	.110	.310
1/2	.185	—	.120	—
	Round Rivnut	Hex Shank Rivnut		Plusnut
M5	.095	.065		.200
M6	.115	.070		.215
M7	.115	—		—
M8	.125	.120		.270
M10	.150	.120		.310
M12	.180	—		—

- a. Measure with micrometer overall thickness of materials in which fastener will be installed. For dimpled or countersunk holes, measure from top surface of metal to underside of dimpled

hole. Always include air gaps, paint or any burrs which cannot be removed.

- b. Determine recommended *maximum* grip of Rivnut or Plusnut fastener (stamped on the fastener box label or refer to Bollhoff-Rivnut Design Guide).
- c. Subtract material thickness from recommended *maximum* grip.
- d. Add difference to applicable pull-up factor from Chart I. This sum is a close approximation of the pull-up required to attain a proper bulge.

### Examples

S25P-280 Plusnut fastener to be installed in .125 inch material:

Material thickness.....	.125
Maximum grip of Plusnut.....	.280
Difference (.280 - .125).....	.155
Sum (.155 + .215 pull-up factor).....	.370
Pull-up required.....	.370

S10-180 Rivnut fastener to be installed in .060 inch material:

Material thickness.....	.060
Maximum grip of Rivnut.....	.080
Difference (.080 - .060).....	.020
Sum (.020 + .080 pull-up factor).....	.100
Pull-up required.....	.100

- e. Compare pull-up recorded during 'Measuring Rivnut or Plusnut Pull-Up #4' with amount required as determined using Chart I. The *difference* indicates amount of pull-up increase or decrease necessary.
- f. Slight differences ( $\pm .005$ ) may require no further adjustment. Install several fasteners in sample material for checking.

### Adjusting for Correct Pull-Up

1. *To increase pull-up*
  - a. Note relative position of gage line on pull-up stud housing and corresponding numbered graduation line on jackscrew housing (fig 4, pg 6). Graduation lines represent increments of .006" pull-up.
  - b. Determine amount of increase of pull-up needed as in paragraph e above.
  - c. Loosen pull-up stud housing nut (5,fig 4,pg 6), unthread pull-up stud housing *out of* jackscrew housing the required amount. (Each graduation line increases pull-up by .006 and complete revolution of pull-up stud housing results in .072 pull-up).
  - d. Tighten pull-up stud housing nut (5,fig 4,pg 6).
  - e. Depress trigger all the way and release.
  - f. Install several fasteners in sample material for checking

## 2. Operation and Adjustments cont.

### Note

First Rivnut or Plusnut fastener installed after an adjustment must be ignored.

- g. If pull-up is still inadequate, repeat this adjustment.
- h. If pull-up is too great proceed with next section.

### 2. To reduce pull-up

- a. Determine amount of reduction of pull-up needed (paragraph 2-e, pg 5).
- b. Place Rivnut or Plusnut fastener on pull-up stud. While holding shank end of fastener (to prevent turning), depress trigger *only halfway*, then release. This will accomplish pull-up. The header is now ready for adjustment.

### Note

Do not complete the cycle.

- c. Note relative position of gage line on pull-up stud housing and corresponding numbered graduation line on jackscrew housing (fig 4).
- d. Loosen pull-up stud housing nut (5,fig 4), thread pull-up housing *into* jackscrew housing desired amount. Note that each graduation will reduce pull-up .006", each complete revolution will result in .072" reduction in pull-up.
- e. Tighten pull-up stud housing nut, discard Rivnut or Plusnut fastener from stud.
- f. Depress trigger all the way and release.
- g. Install several fasteners in sample material for checking.

### Note

Again, ignore first Rivnut or Plusnut fastener installed after adjustment.

- h. If pull-up is still too great, repeat this adjustment.
- i. If pull-up is inadequate, increase pull-up as directed in previous section.

### How to Replace Worn or Damaged Pull-Up Studs

1. Note, (fig 4, pg 6), distance C and relative position of gage line on pull-up stud housing to corresponding graduation line on jackscrew housing.
2. Loosen pull-up stud housing nut (5,fig 4) unthread and remove pull-up stud housing from jackscrew housing.
3. With air line connected to tool, depress trigger *completely* and release. Pull-up stud will move forward so that pull-up stud pin is accessible, as in figure 4A.

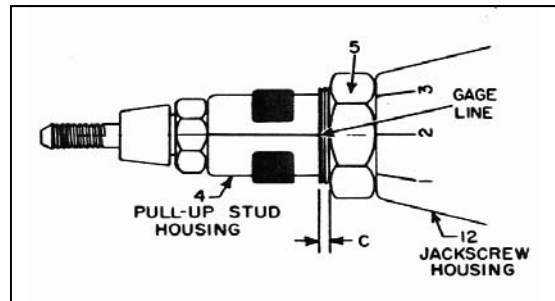


Figure 4 - Pull-Up Stud Housing Gage Line & Graduation Lines.

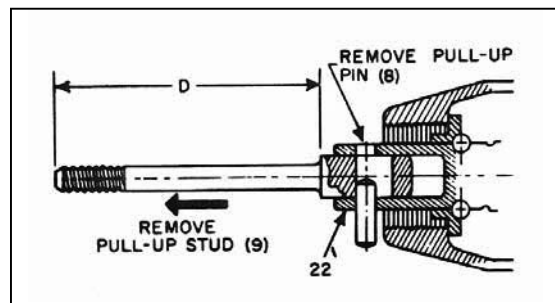


Figure 4A - Replacement of Pull-Up Stud

4. Remove pull-up stud pin (8,fig 4A). For 2 piece pull-up stud and coupling, measure dimension D (fig 4A) and remove damaged pull-up stud. Install new pull-up stud to dimension D measurement. Dimension D can be ignored for 1 piece pull-up studs.
5. Reinstall pull-up stud pin (8,fig 4A).

### WARNING

**Be sure ends of pull-up stud pin do not protrude.**

6. Grasp pull-up stud drive chuck (22,fig 4A) firmly with pliers, depress trigger *very slightly*. Pull-up stud drive chuck then will retract into Jackscrew housing.
7. Release trigger and pull-up drive chuck.
8. Thread pull-up stud housing into jackscrew housing until distance C fig 4A and gage line are in same relative positions as previously noted.
9. Tighten pull-up stud housing nut, depress trigger *completely*, hold momentarily and release.
10. Header is now ready for use again.

## 2. Operation and Adjustments cont.

### How to Use Visual Indicators

The tool has two visual indicators:

1. A manually set sliding sleeve (fig 5) intended to show thread engagement of pull-up stud in the fastener.
2. A pull-up travel indicator (fig 7) intended to show the amount of pull-up of fastener in blind applications.

Inspection procedure:

1. Slide the thread engagement indicator (3, fig 6) back against the threads of the pull-up stud housing, as in figure 5.
2. While installing a Rivnut or Plusnut fastener, observe that both indicators move forward together until the proper number of Rivnut or Plusnut threads have been engaged (fig 6) and pull-up action starts. Pull-up travel indicator then reverses direction and stops when pull-up is complete, showing the amount of pull-up travel (fig 7).
3. Unthreading cycle returns pull-up travel indicator to original position (fig 8). Thread engagement indicator will stay in "out" position until returned by hand for another inspection.
4. Observe that with each subsequent installation, forward position of thread engagement indicator and rearward position of pull-up travel indicator will be the same with each properly pulled up Rivnut or Plusnut fastener.

### Operating Cautions

1. Be sure you have 75-80 psi air pressure at the tool when it is running at full throttle. Use an air pressure regulator.
2. Guard against bending pull-up stud or damaging its threads.
3. Hold tool lightly and squarely in line with work. Exert on light pressure.
4. It is advisable to brush threaded end of pull-up stud occasionally with lubricating oil.
5. Be sure to hesitate *momentarily* after pull-up action before reversing tool.
6. When reversing, allow adequate time for stud to unthread completely from Rivnut or Plusnut fastener.
7. Do no attempt to pull-up a Rivnut or Plusnut fastener a second time.

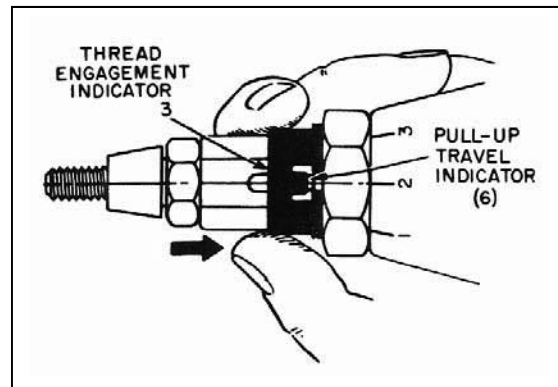


Figure 5 - Visual Indicators - Starting Position

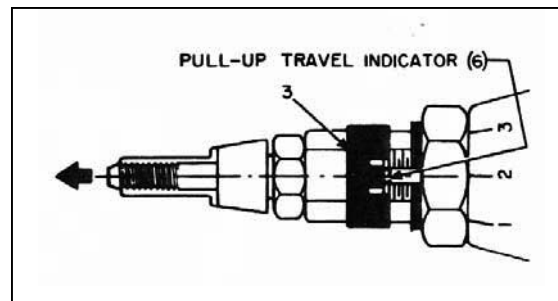


Figure 6 - Visual Indicators - Full Thread Engagement

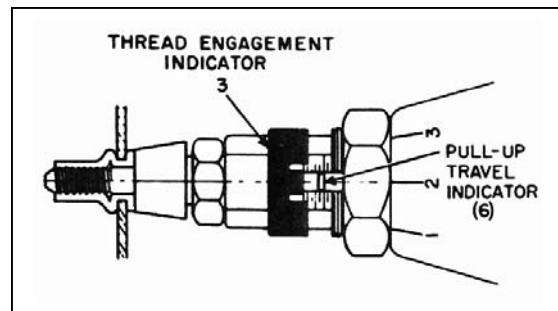


Figure 7 - Visual Indicators - After Fastener Pull-Up

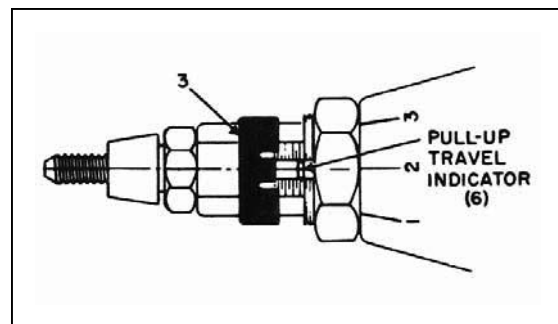


Figure 8 - Visual Indicators - At Completion of Fastener Installation

### 3. Trouble Shooting

Malfunction	Probable Cause	Remedy
Erratic or no pull-up action	Improper anvil adjustment Improper pull-up adjustment  Damaged or weak pull-up drive chuck springs Inadequate air supply Improper clutch adjustment Clutch drag ring damaged or improperly assembled	See “Anvil Adjustment” pg 4. See “Determining Required Pull-up” pg 5. Replace - see “Jackscrew and Jack screw housing” pg 9. See “Air Supply Requirements” pg 3. See “Clutch” pg 11. Replace or assemble correctly, See “Clutch” pg 11 and fig 9, pg 10.
Excessive stud breakage	Excessive pull-up  Incorrect or wide variations in material thickness Failing to hold tool square with work or bending stud while under load	See “Determining Required Pull-up” pg 5. Use material of correct, uniform thickness. Use greater care in handling header.
Stripped Rivnut or Plusnut threads	Excessive pull-up  Improper anvil adjustment (too few threads engaged by pull-up stud) Damaged or worn stud  Incorrect or wide variations in material thickness	See “Determining Required Pull-up” pg 5. See “Anvil Adjustment” pg 4.  Replace - see “How to Replace Worn or Damaged Pull-Up Studs” pg 6. Use material of correct, uniform thickness.
Loose Rivnut or Plusnut fasteners	Inadequate pull-up  Erratic pull-up  Incorrect or wide variations in material thickness	See “Determining Required Pull-up” pg 5 and “To increase pull-up” pg 5. See 1st malfunction “Erratic or no pull-up action.” Use material of correct, uniform thickness.
Loss of power or erratic motor action	Inadequate air supply Improper lubrication Worn rotor blades Worn or dirty motor	See “Air Supply Requirements” pg 3. See “Lubrication” pg 3. Replace - see “Motor removal” pg 11. Replace or clean - see “Motor removal” pg 11.

## 4. Disassembly and Reassembly

### WARNING

The C-320 Model B and Model P headers are highly efficient machines. Their small precision-built parts must operate at high speed with close tolerances and in perfect alignment.

In disassembly and reassembly, guard carefully against distortion, burring or scoring of parts. Such damage will seriously affect performance.

### Before Reassembly:

1. *Be sure* all parts are *clean* and in serviceable condition.
2. Coat all motor parts with oil.
3. Coat other parts with grease.
4. Repack ball bearings with National Lubrication Institute No. 1 or 2 grease or equivalent.

### NOTE

In disassembly and reassembly of Rivnut and Plusnut Header, keep exploded view (figure 10) on pages 16 & 17 open to help you identify parts. Install them in proper sequence and recognize worn or damaged parts.

#### Tools needed:

- Vise with copper-covered jaws
- Truarc pliers
- Screwdrivers
- Rods 1/16", 3/16" and 3/8 diameter
- 13/16" open end wrench
- Torque wrench, 150 lb-in capacity
- Torque adapter, part 67-6000
- Allen wrenches
- V-plate
- V-block
- Spring assembly tool, part 67-6002

### Jackscrew and Jackscrew Housing

1. Removal
  - a. Loosen pull-up stud housing lock nut (5).
  - b. Back pull-up stud housing (4) out of jackscrew housing (12 or 12A).
  - c. With airline connected to tool, depress trigger completely and release. Pull-up stud will move forward so that pull-up stud pin (8) is accessible. Remove pull-up stud pin and pull-up stud (9).
  - d. Place handle of tool in vise, pull-up stud end up.
  - e. Remove the four cap screws (10) and washers (11) that secure the jackscrew housing (12) to motor housing (61); lift jackscrew housing free.

### 2. Disassembly

- a. Insert 3/8" diameter rod in projecting end of pull-up stud drive chuck (22,fig10); tap 3/8" rod lightly to force jackscrew assembly from housing.
- b. Degrease jackscrew assembly with an approved, non-rusting solvent.
- c. Slip lower race (13) of thrust bearing off pull-up stud drive chuck (22); with screwdriver, force the 12 steel balls (14) from the upper bearing race (15), or use the 67-6002 spring assembly tool to depress drive chuck springs (17) for easy removal of steel balls. Slip upper race and springs off drive chuck.
- d. Press roll pin (18) out of jackscrew sleeve (21) with 1/16" diameter rod; then remove jackscrew sleeve pin (19) from sleeve and work steel balls (20 or 20A) out of jackscrew sleeve through sleeve pin hole. (Vibrate or jar assembly if necessary) Slip jackscrew sleeve (21) and pull-up stud drive chuck (22) off jackscrew (31) and separate. Remove segment ball seat (23) and nut thrust plate (24).
- e. Using Truarc pliers, remove bearing retaining ring (25).
- f. Hold jackscrew (31) gear end up; alternately tap ends of two jackscrew idler gear pins (28) with 3/16" diameter drift rod to drive ball bearing (26) off jackscrew.
- g. Remove bearing (26), bearing clamp plate (27), idler gear pins (28) and idler gears (29).
- h. If idler gear needle bearings (30) are to be replaced, press old bearings out of idler gears.

### NOTE

Do not remove idler gear bearings unless new bearings are to be installed.

### 3. Assembly of jackscrew and component parts

- a. If jackscrew idler bearings(30) were removed, press new bearings into place, flush with gear face.
- b. Place jackscrew (31) gear end down. Slip idler gears (29) into position and insert gear pins (28) through gears.

### NOTE

Be sure heads of gear pins are against inner face of jackscrew flange (side facing ball bearings)

## 4. Disassembly and Reassembly cont.

- c. Drop bearing clamp plate (27) over jackscrew (31) to rest on exposed idler gear faces.
- d. Press ball bearing (26) down on jackscrew until seated. Secure in position with ball bearing retaining ring (25).
- e. Slip nut thrust plate (24) over jackscrew, permitting it to rest on ball bearing (26).
- f. Insert pull-up stud drive chuck (22) into jackscrew sleeve (21).
- g. Insert *short* tang of segment ball seat (23) into 5/32" hole in jackscrew (31), with long tang of segment ball seat following ball groove toward bearing (26).
- h. Fill thread type ball groove in jackscrew with recommended grease and thread (left hand) assembled jackscrew (31) into jackscrew sleeve (21).
- i. Turn jackscrew (31) until hole in flange in diameter of jackscrew sleeve (21) lines up with ball groove in jackscrew. Feed steel balls (5/32" diameter) through hole into jackscrew groove. Insert jackscrew sleeve pin (19) into hole and secure by tapping .078 roll pin (18) into cross hole in flange of jackscrew sleeve.

### NOTE

Model B tool requires 46 steel balls (20). Model P tool requires 31 steel balls (20A).

- j. Assemble two sets of spring washers (17) and one spring shim (16) over pull-up stud drive chuck (22). A "set" consists of two spring washers (16) placed cup to cup.
- k. Slip upper bearing race (15) over pull-up stud drive chuck with flat face of race against spring shim (16).
- l. Assemble 67-6002 tool as illustrated in figure 10A. Lift the pull-up stud drive chuck upward, clearing ball bearing groove, as machine screw is tightened.
- m. Insert 12 - 5/32" diameter steel balls (14) in the ball groove around the pull-up stud drive chuck (22), then remove 67-6002 assembly tool.
- n. Insert a 3/16" diameter rod in the hole provided for the pull-up stud drive chuck pin (8) and rotate the pull-up stud drive chuck (22) in a clockwise direction. There must be a turning *resistance* of approximately 13 in-lbs torque between the tapered portions of the pull-up stud drive chuck (22) and jackscrew sleeve (21) for proper tool operation. *If torque resistance is low, the addition of one or two spring washers (17) may be necessary.*
- o. Grease steel balls (14) and install lower bearing race (13).

- p. Liberally coat outside of jackscrew (31) with grease, packing splines of jackscrew sleeve (21), all around pull-up stud drive chuck springs and both ball bearing and upper face of jackscrew sleeve (21).

### 4. Installation

- a. Grasp handle of motor housing (61) in copper covered vise jaws, clutch end up.
- b. Assemble fixed internal gear (32) on motor housing (61), lining up both holes in gear with tapped holes in housing. Half fill internal gear cavity with recommended grease.
- c. Slip assembled jackscrew onto stem of clutch housing (33).

### NOTE

Be sure jackscrew idler gears mesh properly with pinion cut on clutch housing and with fixed internal gear.

- d. Assemble jackscrew housing (12 or 12A) on motor housing (61).

### NOTE

Be sure bolt holes in jackscrew housing are aligned with tapped holes in motor housing BEFORE forcing jackscrew housing onto flange of fixed internal gear.

- e. Secure with four No. 10 cap screws (10) and lock washers (11).
- f. Assemble pull-up stud (9) and pull-up stud housing (4) on tool.

### NOTE

Follow recommended procedures for adjustment before putting tool back into service.

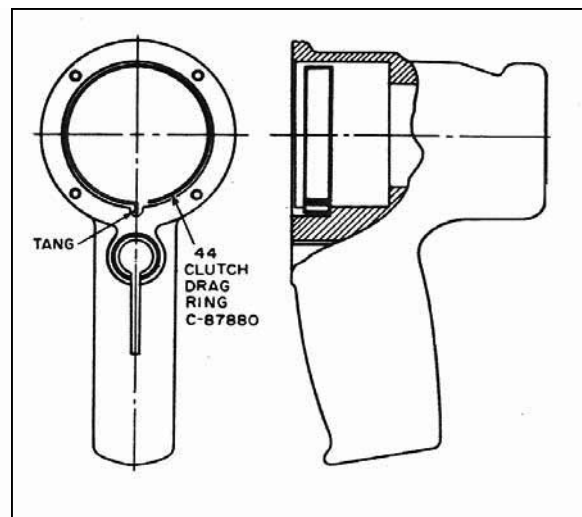


Figure 9 - Clutch Drag Ring Installation

## 4. Disassembly and Reassembly cont.

### Clutch

1. Removal
  - a. Remove jackscrew (31), jackscrew housing (12) and fixed internal gear (32).
  - b. Grasp stem of clutch housing (33) and pull clutch assembly out of motor housing (61).
2. Disassembly
  - a. Using a small screwdriver, pry out and remove internal lock ring (34) from lock nut (35).
  - b. Unscrew and remove lock nut (35). Remove clutch spring (36), clutch spring seat (37) and clutch internal gear (38).
  - c. Lift pull-up stud spindle (39) out of clutch housing (33).
  - d. Remove one retaining ring (40) from each clutch idler gear pin (41), slip pins out of pull-up stud spindle (39) and remove clutch idler gears (42).
  - e. Slip clutch drag ring (33) off clutch housing (33).
  - f. *Only if new bearings are to be installed:* press old needle bearings (43) out of clutch idler gears (42).
3. Assembly
  - a. If new needle bearings (43) are to be installed in clutch idler gears, press bearings into clutch idler gears (42) flush with face of gears.
  - b. Assemble pull-up stud spindle (39).
    - (1) Assemble idler gears (42) in place in pull-up stud spindle.
    - (2) Insert gear pins (41) through gears and pull-up stud spindle flange. Secure gear pins with retaining rings (40).
  - c. Loosely fill clutch housing cavity with recommended grease.

### NOTE

Be sure conical clutch face is well coated. Push clutch internal gear (38) *into position* in clutch housing (33) and assemble pull-up stud spindle (39) in clutch housing.

- d. Assemble clutch spring seat (37) in housing and wavy type clutch spring (36) on seat; screw clutch lock nut (35) into housing.

### NOTE

Tool performance depends on the clutch slipping within a definite torque range. Torque range is in turn dependent on correct setting of clutch lock nut (35). A torque wrench and clutch adjustment adapter (Part 67-6000) must be used according to the following procedure:

- e. Clamp flats milled on hub of clutch housing (33) in vise.
- f. Insert clutch adjustment adapter (67-6000) into assembly, being sure pinion on adapter engage slots in upper shoulder of pull-up stud spindle (39).

- g. The adapter acts as a lock to prevent turning and in turn transmits torque to the clutch internal gear (38).
  - (1) With a torque wrench on clutch adjustment adapter, tighten clutch lock nut (35) with a spanner wrench until internal gear slippage occurs at some point between *55 and 60* inch-pounds torque reading.
  - (2) Align a slot in clutch housing (33) with nearest radial hole in clutch lock nut (35).
  - (3) Insert tang end of clutch lock ring (34) through aligned hole and snap ring into its groove in lock nut.
- h. Remove clutch adjustment adapter from assembly and take assembly from vise.
- i. Place assembled clutch, gear end down, and slip clutch drag ring (44) into position on reduced diameter of clutch housing (33).

### CAUTION

The drag ring must extend clockwise (to left) from the tang, and plain end of ring must be to right of tang when clutch housing is viewed from stem end. (see fig 9, page 10).

### 4. Installation

- a. Grasp handle of motor housing (61) in vise, open end of housing up.
- b. Quarter fill housing cavity with recommended grease.
- c. Assemble clutch in motor housing.

### NOTE

Be sure idler gears (42) mesh with pinion on rotor (53) and that tang of clutch drag ring (44) enters slot in motor housing.

- d. Complete assembly of jackscrew (31) and jackscrew housing (12).

### Motor

1. Removal
  - a. Remove clutch assembly.
  - b. Unscrew four No. 6 cap screws (45) seen in cavity of motor housing. Remove screws, lock washers (46), motor clamp plate (47) and end plate gasket (48).
  - c. Remove air motor carefully to avoid damaging interior of housing. Before removal, heat motor housing to 180°-212°F (hot water is suitable) and use either of the following methods to remove air:
    - (1) Bump open end of housing with soft face mallet. Air motor should jar from open end of housing.
    - (2) Bump open end of housing on block of wood to jar motor free.

## 4. Disassembly and Reassembly cont.

### 2. Disassembly

- a. Grasp cylinder liner (57), preferably in V-plate and press pinion end of rotor (53) from upper end plates (51) and bearing (52). Remove cylinder liner (57) and rotor blades (54).
- b. Remove lockscrew (left hand threaded) (49) and washer (50) from rear end plate (51). Press rotor from end plate.
- c. *Only if new parts are required*, press ball bearing (52) from end plates (51).
- d. If end plates (51) or cylinder liner (57) replacement is necessary, install new dowel (55) in one front end plate (51) and roll pins (56) in both ends of cylinder liner (57).

### 3. Assembly

- a. Install rear end plate (51) bearing (52) end plate/bearing (*without* dowel pin) first. Press partially onto end of rotor.
- b. Screw (left hand thread) rotor lock screw (49) without washer (50) into end of rotor (53) and draw end plate (51) and bearing (52) down until there is .0015" between rotor and end plate. Note: use .0015" feeler gage.
- c. Dip or coat rotor blades (54) with clean SAE 10 oil and insert in each slot or rotor. Note: Be sure blades slide freely in slots.
- d. Place cylinder liner (57) over rotor, engaging roll pins in line with dowel tabs in end plates. Note: Be sure air vains in cylinder liner (57) align to air vains in both front & rear end plates (51).
- e. Place front end plate & bearing containing end plate dowel (55) on pinion end of rotor and apply pressure against ball bearing races until end plate binds against cylinder liner.
- f. Grasp rotor pinion with fingers. Rotor should spin freely within cylinder liner.

### 4. Installation

- a. Heat housing to 180°-212°F in hot water.
- b. Insert assembled motor into motor housing (61) aligning dowel pin (55) in front end plate (51) with dowel slot in housing.
- c. Place end plate gasket (48) on motor clamp plate (47), securing with light coat of grease. Holes in gasket must be aligned with holes in clamp plate.
- d. Insert motor clamp plate, with gasket into motor housing. Secure in place with four No. 6 cap screws (45) and lock washers (46). Tighten all screws equally.
- e. Complete clutch assembly.

### Motor Housing

#### 1. Removal and disassembly

- a. Removal and/or disassembly of most handle parts is obvious.

#### NOTE

Do not disassembly handle unless new parts are to be installed.

- b. Remove trigger roll pin (80) and trigger (68).
- c. Remove reverse valve (66) as follows:
  - (1) Press out throttle lever pin (62) and remove throttle lever (63).
  - (2) Remove locating screw (64) from side of handle.
  - (3) Remove reverse valve and throttle trigger assembly (66,67,68). Slip reverse valve spring (65) off reverse valve (66).
  - (4) Drive trigger lock pin (67) out of reverse valve (66) and separate reverse valve and throttle trigger pin (78).

#### 2. Assembly and Installation

- a. Assemble and/or installation of most handle parts is obvious.
- b. Assemble and install reverse valve (66) and trigger (68) as follows:
  - (1) Insert trigger pin in reverse valve, align flat on stem of trigger with small hole in reverse valve and press in trigger lock pin (67).
  - (2) Place reverse valve spring (65) over reverse valve (66) and insert assembled reverse valve into handle, aligning slot in reverse valve so as to permit throttle lever (63) to enter.
  - (3) Depress reverse valve to align shallow slot in reverse valve with tapped hole in side of handle and screw reverse valve locating screw (64) into handle.

#### NOTE

Be sure dog end of screw enters shallow slot in reverse valve.

- (4) Replace throttle lever (63) and secure by pressing throttle lever pin (62) through holes in handle and in throttle lever.
- (5) Replace throttle trigger (68) by pressing trigger roll pin (80) in place.

#### NOTE

Be sure throttle valve pin (75) and valve pin cap (79) are in place before assembling throttle lever (63). Removal of throttle (72) is required if realignment of valve pin cap (79) and/or valve pin is necessary.

## 5. Parts List

Index #	Current Part #	Old Part #	Part Description	Quantity
1	<b>See Table II Page 17</b>	See Table II page 17	Anvil	1
2	<b>RP91</b>	C-88367	Anvil hex nut (1/2"-20)	1
3	<b>69-1025</b>	C-88427	Thread engagement-sleeve stroke indicator	1
4	<b>62-3010</b>	C-87912	Pull-up stud housing	1
5	<b>53-4001</b>	C-87913	Pull-up stud housing locknut	1
6	<b>55-5002</b>	C-87915	Pull-up indicator and pull-up stud spring seat	1
7	<b>54-1010</b>	C-87914	Pull-up stud spring	1
8	<b>52-1214</b>	C-87899	Pull-up stud pin	1
9	<b>See Table I page 16</b>	See Table I page 16	Pull-up stud coupling (may be one piece or two piece assembly)	1
10	<b>53-9004</b>	C-88366	Screw (No. 10-24 x 1/14")	4
11	<b>55-1198</b>	S-269	Lock washer (No. 10)	4
12	<b>59-1005</b>	XC-55906	Jackscrew housing (Model B)	1
12A	<b>59-1005</b>	RP-154	Jackscrew housing (Model P)	1
13	<b>50-6000</b>	C-87898	Lower race, thrust bearing	1
14	<b>54-2001</b>	S-8613	Steel balls (5/32" diameter)	12
15	<b>50-6001</b>	C-87897	Upper race, thrust bearing	1
16	<b>55-1632</b>	C-90281	Pull-up stud drive chuck spring shim	1
17	<b>54-4001</b>	C-90282	Pull-up stud drive chuck spring	4
18	<b>52-4078</b>	C-87894	Roll pin	1
19	<b>52-1155</b>	C-87893	Jackscrew sleeve pin	1
20	<b>54-2001</b>	S-8613	Steel balls (5/32" diameter)	46
20A	<b>54-2001</b>	S-8613	Steel balls (5/32" diameter)	31
21	<b>70-3010</b>	RP-221	Jackscrew sleeve	1
22	<b>63-1001A</b>	C-87895	Pull-up stud drive chuck	1
23	<b>69-1012</b>	C-88439	Segment ball seat	1
24	<b>55-1140</b>	C-87889	Nut thrust plate	1
25	<b>53-5787</b>	C-88409	Retaining ring	1
26	<b>50-1787</b>	C-13654	Ball bearing	1
27	<b>55-1175</b>	C-87890	Bearing clamp plate	1
28	<b>52-1249</b>	C-87886	Jackscrew idler gear pin	2
29	<b>58-1007</b>	C-87884	Jackscrew idler gear	2
30	<b>50-2250</b>	C-87885	Needle bearing	2

### PLEASE NOTE:

Always order by Current Part # (second column, all bold).

After identifying part in exploded view, check index # against Current Part # and use the latter to order.

Or if you have the old part #, find it in the table and use the corresponding Current Part # to order parts.

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## 5. Parts List - cont

Index #	Current Part #	Old Part #	Part Description	Quantity
31	<b>58-7006</b>	C-87883	Jackscrew	1
32	<b>58-2002</b>	C-87881	Fixed internal gear	1
33	<b>63-1000</b>	C-87872	Clutch housing	1
34	<b>53-8000</b>	C-87879	Clutch lock ring	1
35	<b>62-1004</b>	C-87878	Clutch lock nut	1
36	<b>54-4000</b>	C-87873	Clutch spring	1
37	<b>55-5001</b>	C-87877	Clutch spring seat	1
38	<b>58-2003</b>	C-87875	Clutch internal gear	1
39	<b>58-7005</b>	C-87865	Pull-up stud spindle	1
40	<b>53-5187</b>	C-87871	Retaining ring	4
41	<b>52-1187</b>	C-87870	Clutch idler gear pin	2
42	<b>58-1008</b>	C-87868	Clutch idler gear	2
43	<b>50-2188</b>	C-87869	Needle bearing	2
44	<b>63-1002</b>	C-87880	Clutch drag ring	1
45	<b>53-2003</b>	S-9207	Screw (No. 6-32 x 1/2")	4
46	<b>55-1144</b>	S-25071	Lock washer (No. 6)	4
47	<b>55-5003</b>	C-87862	Motor clamp plate	1
48	<b>51-1001</b>	C-87863	End plate gasket	1
49	<b>53-2004</b>	C-66142	Rotor lock screw	1
50	<b>55-1168</b>	C-80513	Rotor screw washer	1
51	<b>57-4004</b>	C-76816	End plates	2
52	<b>50-1316</b>	S-13107	Ball bearing	2
53	<b>57-1004</b>	C-87864	Rotor	1
54	<b>57-3002</b>	C-76297	Rotor blade	4
55	<b>52-4092</b>	C-68488	End plate dowel pin (same as Roll pin)	1
56	<b>52-4092</b>	C-68086	Roll pin (same as End plate dowel pin)	4
57	<b>57-2002</b>	C-76835	Cylinder liner	1
58	<b>53-2000</b>	C-7653	Screw (No. 4-40 x 3/16")	4
59	<b>68-2004</b>	XC-110627	Name plate	1
60	<b>51-1000</b>	C-87917	Name plate gasket	1

**PLEASE NOTE:**

Always order by Current Part # (second column, all bold).

After identifying part in exploded view, check index # against Current Part # and use the latter to order.

Or if you have the old part #, find it in the table and use the corresponding Current Part # to order parts.

## 5. Parts List - cont

Index #	Current Part #	Old Part #	Part Description	Quantity
61	<b>59-1004</b>	XC-55911	Motor housing (including bushing)	1
62	<b>52-1156</b>	S-64117	Pin (5/32" x 13/16")	1
63	<b>56-4004</b>	C-79426	Throttle lever	1
64	<b>53-2005</b>	C-79429	Valve locating screw	1
65	<b>54-1011</b>	C-79427	Reverse valve spring	1
66	<b>56-2002</b>	C-79425	Reverse valve	1
67	<b>52-4092</b>	C-68488	Trigger lock pin (3/32" x 3/16")	1
68	<b>56-4003</b>	XC-55907	Throttle trigger	1
69	<b>56-3003</b>	C-79428	Reverse valve bushing	1
70	<b>54-3003</b>	C-85233	Oil filler plug	1
71	<b>51-2012</b>	C-87583	"O" ring	1
72	<b>56-6004</b>	S-86896	Throttle valve	1
73	<b>54-1012</b>	C-66135	Throttle spring	1
74	<b>54-2002</b>	C-36044	Steel ball (5/16" diameter)	1
75	<b>52-1122</b>	C-87916	Valve pin	1
76	<b>51-2011</b>	C-69083	Valve washer	1
77	<b>68-4003</b>	C-88750	Suspension bail	1
78	<b>52-1186</b>	XC-55908	Pin, throttle trigger	1
79	<b>52-1248</b>	XC-55909	Pin, valve cap	1
80	<b>52-4126</b>	C-71613	Trigger roll pin	1
—	<b>67-3000</b>	RP-105	Adjusting wrench	1
—	<b>67-6001</b>	C-80084	Pliers (Truarc)*	1
—	<b>67-6000</b>	C-87952	Clutch adjustment adapter*	1
—	<b>67-6002</b>	RP-101	Spring assembly tool**	1

\* Repair tool, not supplied with pneumatic header.

\*\* Repair tool, customer to provide.

### PLEASE NOTE:

Always order by Current Part # (second column, all bold).

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## Table I - Pull-up studs & couplings

### Unified Thread System (two piece assembly)

Thread Size	<b>Pull-Up Stud</b>	Old Part #	<b>Coupling</b>	Old Part #
4-40	<b>60-1000-440</b>	RP-70-440	<b>60-2000-1</b>	RP-88
6-32	<b>60-1000-632</b>	RP-70-632	<b>60-2000-1</b>	RP-88
8-32	<b>60-1000-832</b>	RP-70-832	<b>60-2000-1</b>	RP-88
10-24	<b>60-1000-1024</b>	RP-70-1024	<b>60-2000-1</b>	RP-88
10-32	<b>60-1000-1032</b>	RP-70-1032	<b>60-2000-1</b>	RP-88
12-24	<b>60-1000-1224</b>	RP-99-1224	<b>60-2000-2</b>	RP-100
1/4-20	<b>60-1000-2520</b>	RP-99-2520	<b>60-2000-2</b>	RP-100
1/4-28	<b>60-1000-2528</b>	RP-99-2528	<b>60-2000-2</b>	RP-100

### Unified Thread System (one piece assembly)

Thread Size	<b>Pull-Up Stud &amp; Coupling</b>	Old Part #
5/16-18	<b>60-1002-3118</b>	RP-71-3118
5/16-24	<b>60-1002-3124</b>	RP-71-3124

### Metric Thread System (two piece assembly)

Thread Size	<b>Pull-Up Stud</b>	Old Part #	<b>Coupling</b>	Old Part #
M4 x 0.5	<b>60-1005-M4</b>	RP-142-M4	<b>60-2000-1</b>	RP-88
M5 x 0.8	<b>60-1005-M5</b>	RP-143-M5	<b>60-2000-2</b>	RP-100
M6 x 1.0	<b>60-1005-M6</b>	RP-143-M6	<b>60-2000-2</b>	RP-100

### Metric Thread System (one piece assembly)

Thread Size	<b>Pull-Up Stud &amp; Coupling</b>	Old Part #
M7 x 1.0	<b>60-1002-M7</b>	RP-144-M7
M8 x 1.25	<b>60-1002-M8</b>	RP-144-M8

**PLEASE NOTE:**

Always order by the part # that is under **Pull-Up Stud** or **Coupling** columns (all bold).

Or if you have the old part #, find it in the table and use the corresponding **bolded part #** to order parts.

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## Table II - Anvils

### Unified Thread System

Thread Size	Rivnut Anvil	Old Part #	Plusnut Anvil	Old Part #	Hexnut Anvil	Old Part #
4-40	<b>60-3000-4</b>	RP-72-4	<b>60-3000-4</b>	RP-72-4	—	—
6-32	<b>60-3000-6</b>	RP-72-6		RP-72-6	—	—
8-32	<b>60-3000-8</b>	RP-72-8	<b>60-3000-8</b>	RP-72-8	—	—
10-24	<b>60-3000-10</b>	RP-72-10	<b>60-3000-10</b>	RP-72-10	<b>60-3004-10</b>	RP-122-10
10-32	<b>60-3000-10</b>	RP-72-10	<b>60-3000-10</b>	RP-72-10	<b>60-3004-10</b>	RP-122-10
12-24	<b>60-3000-12</b>	RP-72-12	—	—	—	—
1/4-20	<b>60-3000-25</b>	RP-72-25	<b>60-3005-2</b>	RP-140-25	<b>60-3004-25</b>	RP-122-25
1/4-28	<b>60-3000-25</b>	RP-72-25	<b>60-3005-2</b>	RP-140-25	<b>60-3004-25</b>	RP-122-25
5/16-18	<b>60-3000-31</b>	RP-72-31	<b>60-3005-31</b>	RP-140-31	—	—
5/16-24	<b>60-3000-31</b>	RP-72-31	<b>60-3005-31</b>	RP-140-31	—	—

### Metric Thread System

Thread Size	Rivnut Anvil	Old Part #	Plusnut Anvil	Old Part #	Hexnut Anvil	Old Part #
M4 x 0.7	<b>60-3003-M4</b>	RP-145-M4	<b>60-3003-M4</b>	RP-145-M4	<b>60-3004-M4</b>	RP-211-M4
M5 x 0.8	<b>60-3003-M5</b>	RP-145-M5	<b>60-3003-M5</b>	RP-145-M5	<b>60-3004-M5</b>	RP-211-M5
M6 x 1.0	<b>60-3003-M6</b>	RP-145-M6	<b>60-3005-M6</b>	RP-185-M6	<b>60-3004-M6</b>	RP-211-M6
M7 x 1.0	<b>60-3003-M7</b>	RP-145-M7	—	—	—	—
M8 x 1.25	<b>60-3003-M8</b>	RP-145-M8	<b>60-3005-M8</b>	RP-185-M8	<b>60-3004-M8</b>	RP-211-M8

**PLEASE NOTE:**

Always order by the part # that is under the **Anvil** column (all bold).

Or if you have the old part #, find it in the table and use the corresponding **bolded part #** to order parts.

Figure 10 - exploded parts view

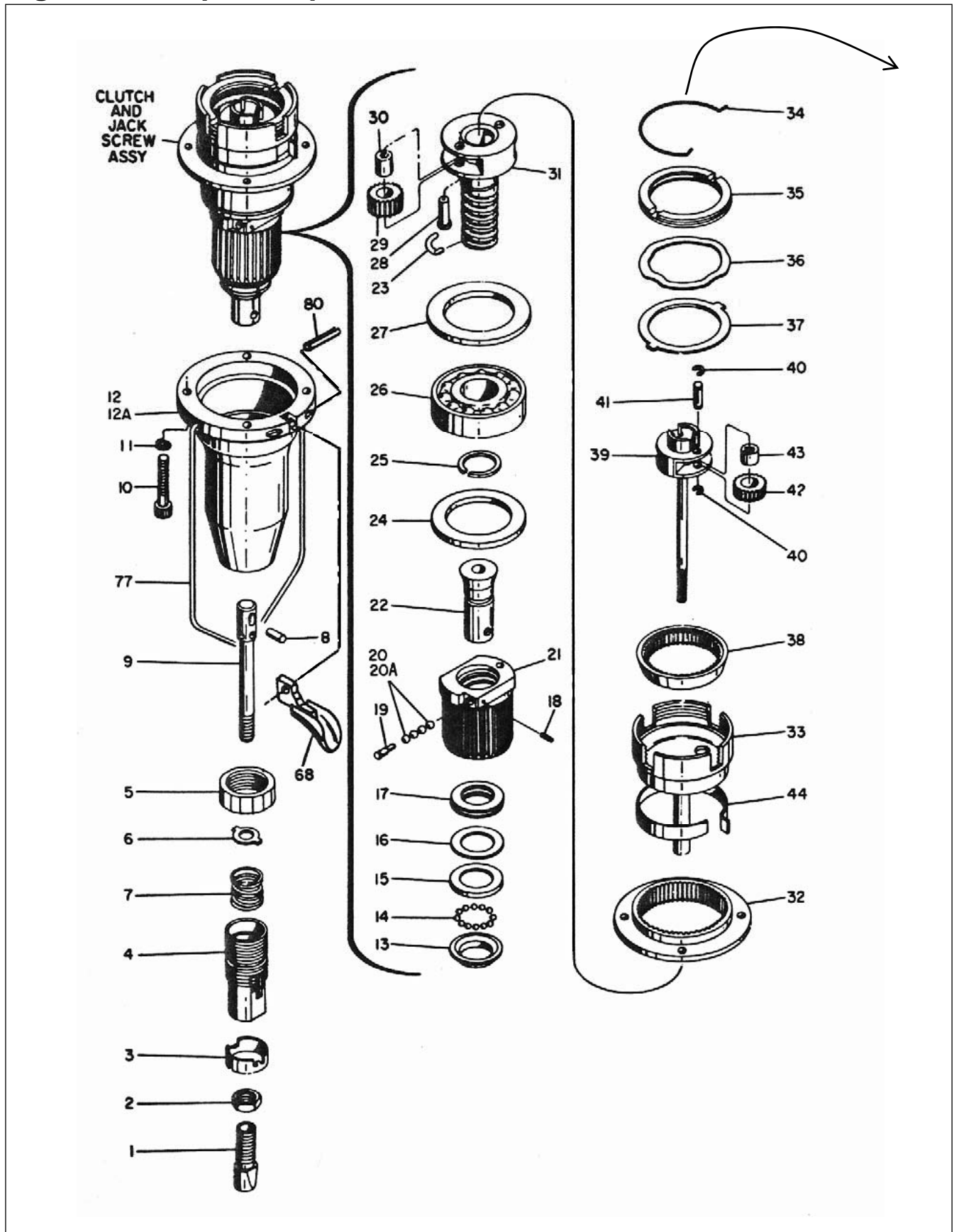


Figure 10 - exploded parts view cont.

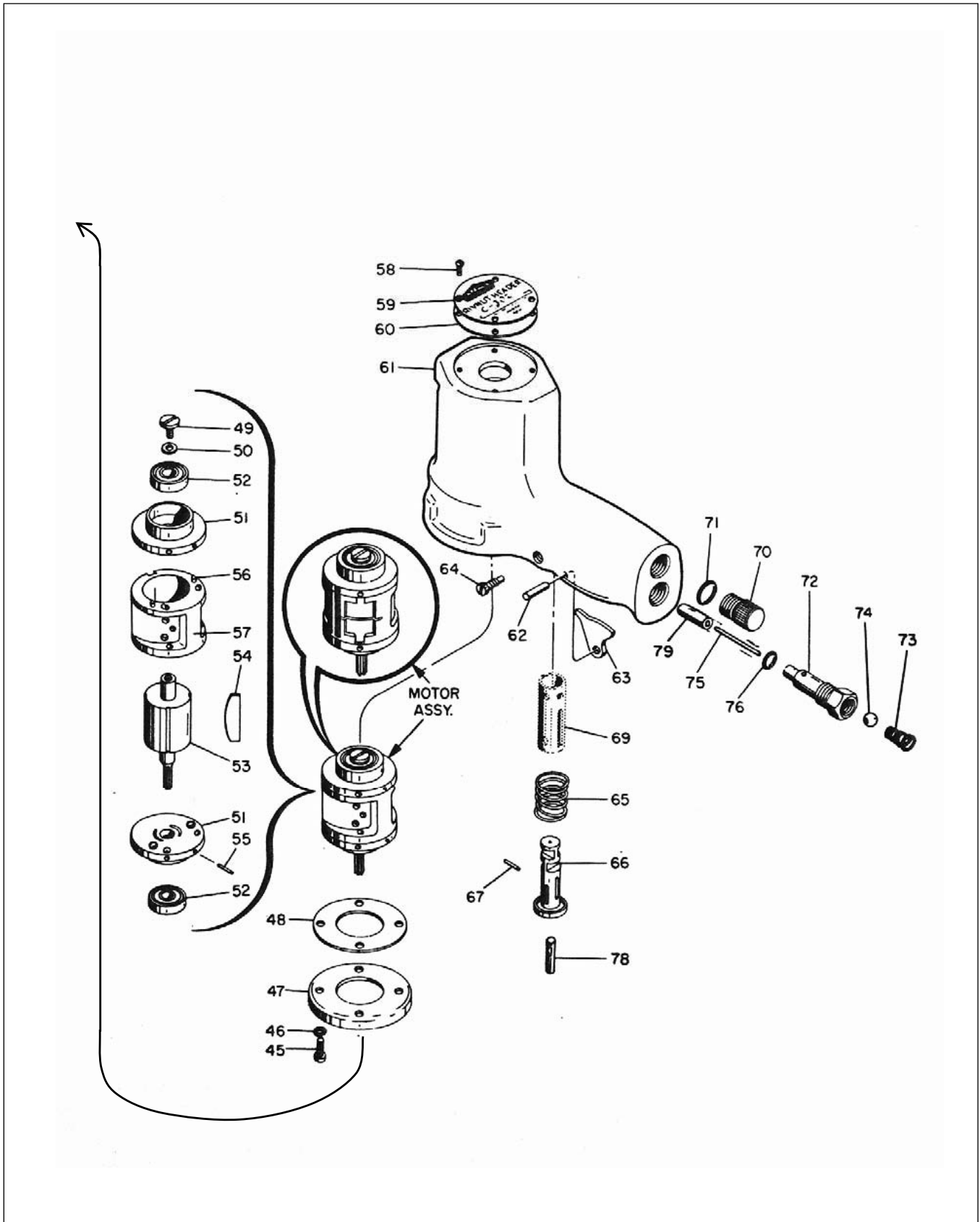
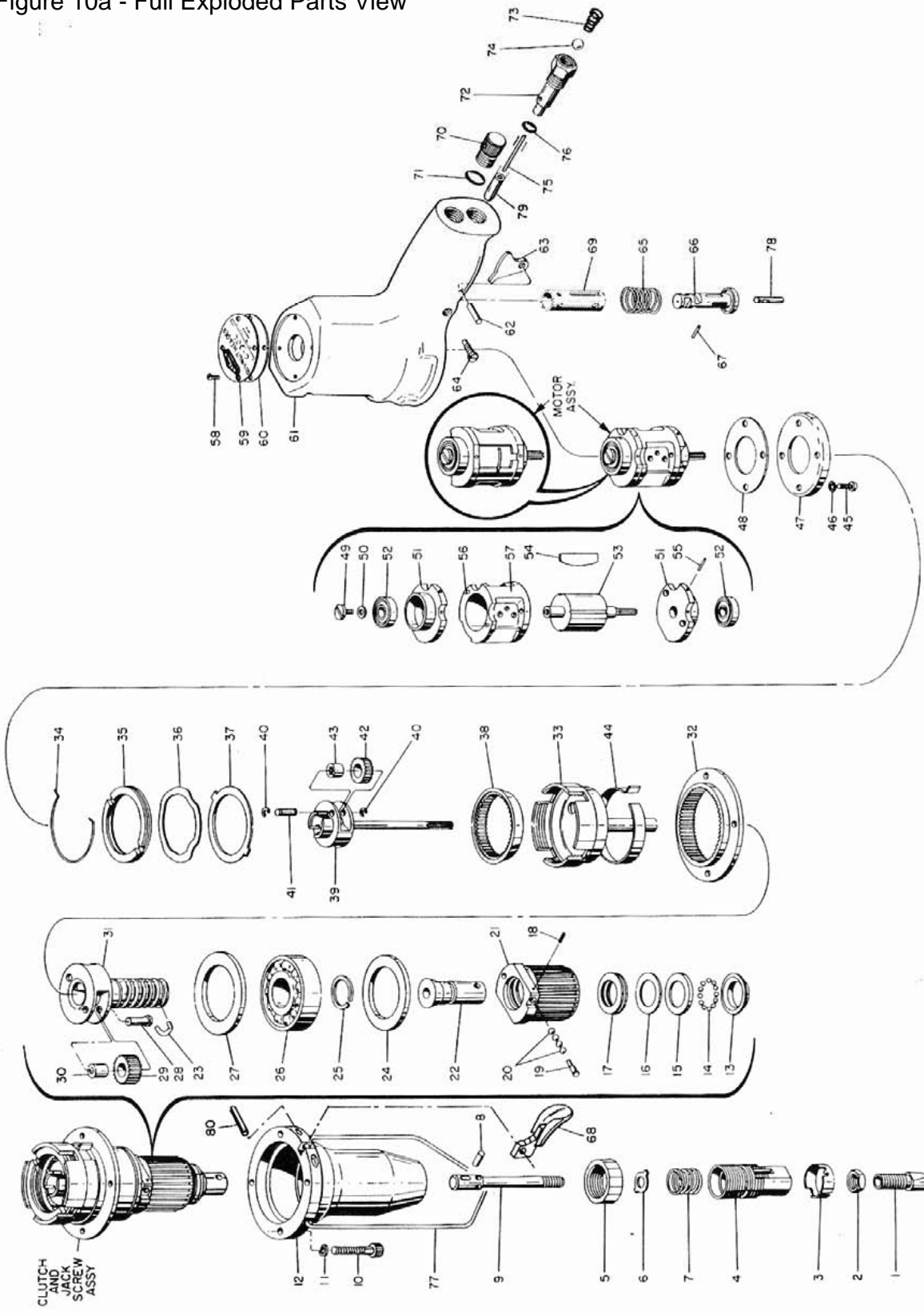


Figure 10a - Full Exploded Parts View



## Repair Tools - not supplied with header

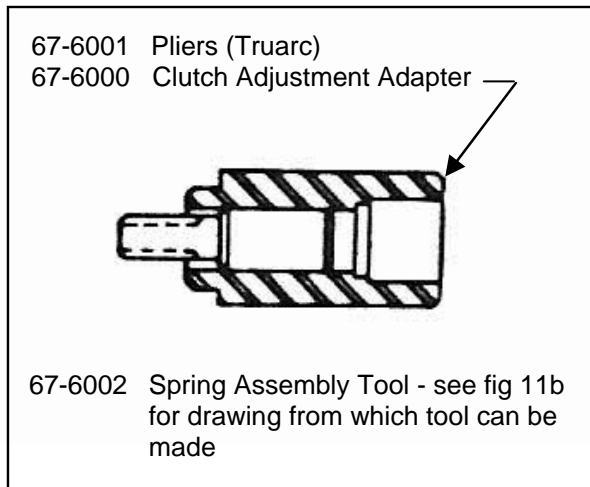


Figure 11 - Repair Tools

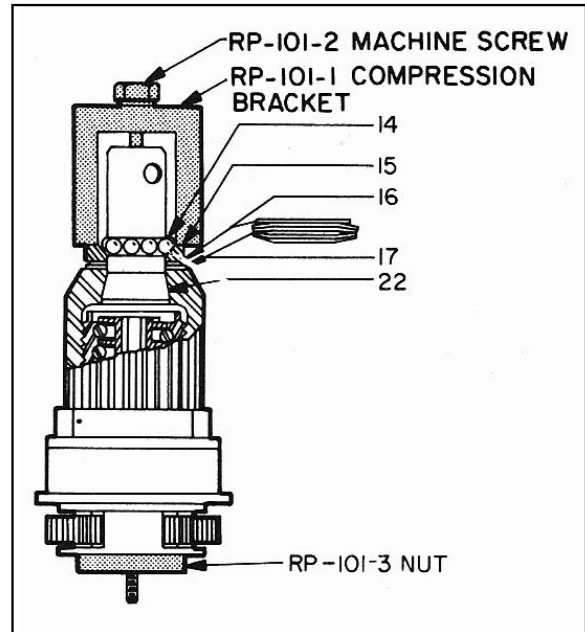


Figure 11a - Use of 67-6002 Tool

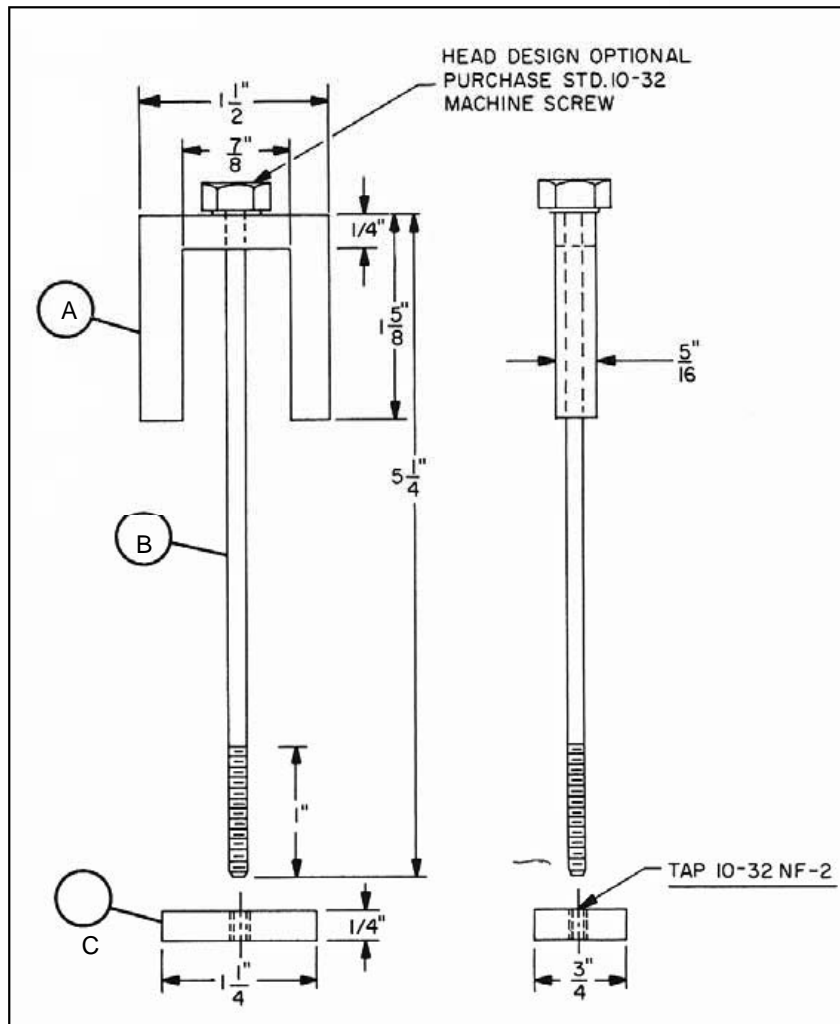


Figure 11b - Drawing, 67-6002 Spring Assembly Tool

- A - Compression bracket
- B - Machine Screw
- C - Nut