



Tool Products

# OPERATOR'S MANUAL

INCLUDING: OPERATION, INSTALLATION & MAINTENANCE

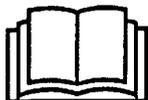
Released: 2-21-92

Revised: 5-13-94

Form: 4007-2

## 20 SERIES RIGHT-ANGLE NUTSETTERS

Models: AR028A-2L-1



### **⚠ WARNING**

**READ THIS MANUAL CAREFULLY BEFORE INSTALLING, OPERATING OR SERVICING THIS EQUIPMENT.**

### **FAILURE TO OBSERVE THE FOLLOWING WARNINGS COULD RESULT IN INJURY.**

Pneumatic tools should always be installed and used in accordance with A.N.S.I. B186.1 "Safety Code For Portable Air Tools."

#### **⚠ WARNING**

- Operate this tool at 90 p.s.i.g. (6.2 bar) maximum air pressure at the air inlet of the tool.
- Disconnect air supply from tool before removing/installing bit, socket or device attached to tool or performing maintenance procedures.
- Keep hands, clothing and long hair away from rotating end of tool.
- Anticipate and be alert for sudden changes in motion during start up and operation of any power tool.
- Never exceed rated r.p.m. of tool.
- Wear suitable eye and hearing protection while operating tool.
- Tool shaft can continue to rotate briefly after throttle is released.
- Do not lubricate tools with flammable or volatile liquids such as kerosene, diesel or jet fuel.
- Do not remove any labels. Replace any damaged label.
- Use only accessories recommended by ARO.

#### **⚠ WARNING**

Repeated prolonged operator exposure to vibrations which may be generated in the use of certain hand-held tools may produce Raynaud's phenomenon, commonly referred to as Whitefinger disease. The phenomenon produces numbness and burning sensations in the hand and may cause circulation and nerve damage as well as tissue necrosis. Repetitive users of hand-held tools who experience vibrations should closely monitor duration of use and their physical condition.

#### **NOTICE**

- The use of other than genuine ARO replacement parts may result in safety hazards, decreased tool performance and increased maintenance and may invalidate all warranties.
- ARO is not responsible for customer modification of tools for applications on which ARO was not consulted.
- Tool maintenance and repair should be performed by authorized, trained, competent personnel. Consult your nearest ARO authorized servicer.
- It is the responsibility of the employer to place the information in this manual into the hands of the operator.

For parts and service information, contact your local ARO distributor, or the Customer Service Dept. of the Ingersoll-Rand Distribution Center, White House, TN at PH: (615) 672-0321, FAX: (615) 672-0601.

**ARO Tool Products**

**Ingersoll-Rand Company**

1725 U.S. No. 1 North • P.O. Box 8000 • Southern Pines, NC 28388-8000

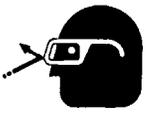
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**FAILURE TO OBSERVE THE FOLLOWING WARNINGS COULD RESULT IN INJURY.**

**⚠ WARNING**



Wear eye protection when operating or performing maintenance on this tool.

**⚠ WARNING**



Wear hearing protection when operating this tool.

**⚠ WARNING**



Turn off air supply and disconnect air supply hose before installing, removing or adjusting any accessory on this tool, or before performing any maintenance on this tool.

**⚠ WARNING**



Air powered tools can vibrate in use. Vibration, repetitive motions or uncomfortable positions may be harmful to your hands and arms. Stop using any tool if discomfort, tingling feeling or pain occurs. Seek medical advice before resuming use.

**⚠ WARNING**



Do not carry the tool by the hose.

**⚠ WARNING**



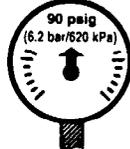
Do not use damaged, frayed or deteriorated air hoses and fittings.

**⚠ WARNING**



Do not overreach when operating this tool. Keep body stance balanced and firm.

**⚠ WARNING**



Operate at 90 p.s.i.g. (6.2 bar/620 kPa) maximum air pressure.

**NOTICE**

<p><b>⚠ WARNING</b></p> <p>Read the manual before operating this tool. Operate at 90 psig/6.2 bar max.</p>	<p>This label must appear on the tool at all times. If it is lost or damaged, a replacement label is available at no cost.</p>
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PN 48176-1 LABEL

**WARNING** = Hazards or unsafe practices which could result in severe personal injury, death or substantial property damage.

**CAUTION** = Hazards or unsafe practices which could result in minor personal injury or product or property damage.

**NOTICE** = Important installation, operation or maintenance information.

## ROUTINE LUBRICATION REQUIREMENTS

Lack of or an excessive amount of lubrication will affect the performance and life of this tool. Use only recommended lubricants at below time intervals:

**EVERY 8 HOURS OF TOOL OPERATION** – Fill lubricator reservoir of recommended F.R.L. with spindle oil (29665). If an in line or air line lubricator is not used, apply several drops of spindle oil (29665) in air inlet.

**EVERY 160 HOURS OF TOOL OPERATION** – Lubricate clutch parts with Molycote G-N grease (40036-1). Lubricate gearing. Pack bearings, coat shafts and lubricate gears with NLGI #1 "EP" grease (33153). Gearing should contain approximately 5/32 oz. (4.4 g) of grease. Right-angle assembly should contain approximately 1/8 oz. (3.5 g) of grease. Clutch should contain approximately 1/16 oz. (1.8 g) of grease.

## AIR SUPPLY REQUIREMENTS

For maximum operating efficiency, the following air supply specifications should be maintained to this air tool:

- AIR PRESSURE – 90 p.s.i.g. (6.2 bar)
- AIR FILTRATION – 50 micron
- LUBRICATED AIR SUPPLY
- HOSE SIZE – 5/16" (8 mm) I.D.

An ARO® model C28231-810 air line FILTER/REGULATOR/LUBRICATOR (F.R.L.) is recommended to maintain the above air supply specifications.

## RECOMMENDED LUBRICANTS

After disassembly is complete, all parts, except sealed or shielded bearings, should be washed with solvent. To relubricate parts, or for routine lubrication, use the following recommended lubricants:

Where Used	ARO Part #	Description
Air Motor	29665	1 qt Spindle Oil
"O" Rings & Lip Seals	36460	4 oz. Stringy Lubricant
Gears and Bearings	33153	5 lb. "EP" – NLGI #1 Grease
Clutches	40036-1	1 lb. "EP" Molybdenum Disulfide

## INSPECTION, MAINTENANCE AND INSTALLATION

Disconnect air supply from the tool or shut off air supply and exhaust (drain) line of compressed air before performing maintenance or service to the tool.

It is important that the tools be serviced and inspected at regular intervals for maintaining safe, trouble-free operation of the tool.

Be sure the tool is receiving adequate lubrication, as failure to lubricate can create hazardous operating conditions resulting from excessive wear.

Be sure that the air supply lines and connectors are of proper size to provide a sufficient quantity of air to the tool.

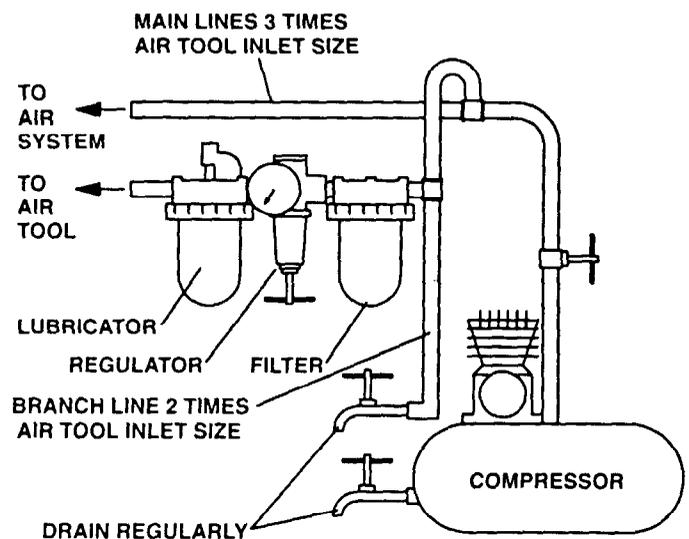
Tool maintenance and repair shall be performed by authorized, trained, competent personnel. Tools, hose and fittings shall be replaced if unsuitable for safe operation and responsibility should be assigned to be sure that all tools requiring guards or other safety devices shall be kept in legible condition. Maintenance and repair records should be maintained on all tools. Frequency of repair and the nature of the repairs can reveal unsafe application. Scheduled maintenance by competent authorized personnel should detect any mistreatment or abuse of the tool and worn parts. Corrective action should be taken before returning the tool for use.

Disassembly should be done on a clean work bench with a clean cloth spread to prevent the loss of small parts. After disassembly is completed, all parts should be thoroughly washed in a clean solvent, blown dry with air and inspected for wear levels, abuse and contamination. Double sealed or shielded bearings should never be placed in solvent unless a good method of re-lubricating the bearing is available. Open bearings may be washed but should not be allowed to spin while being blown dry.

Upon reassembling, lubricate parts where required. Use 33153 grease, or equivalent, in bearings. Use 36460 lubricant for "O" ring assembly. When assembling "O" rings or parts adjacent "O" rings, care must be exercised to prevent damage to the rubber sealing surfaces. A small amount of grease will usually hold steel balls and other small parts in place while assembling.

When replacement parts are necessary, consult drawing containing the part for identification.

Always use clean, dry air. Dust, corrosive fumes and/or excessive moisture can damage the motor of an air tool. An air line filter can greatly increase the life of an air tool. The filter removes rust, scale, moisture and other debris from the air lines. Low air pressure (less than 90 p.s.i.g.) reduces the speed of the air tool. High air pressure (more than 90 p.s.i.g.) raises performance beyond the rated capacity of the tool and could cause injury. Shown below is a typical piping arrangement.

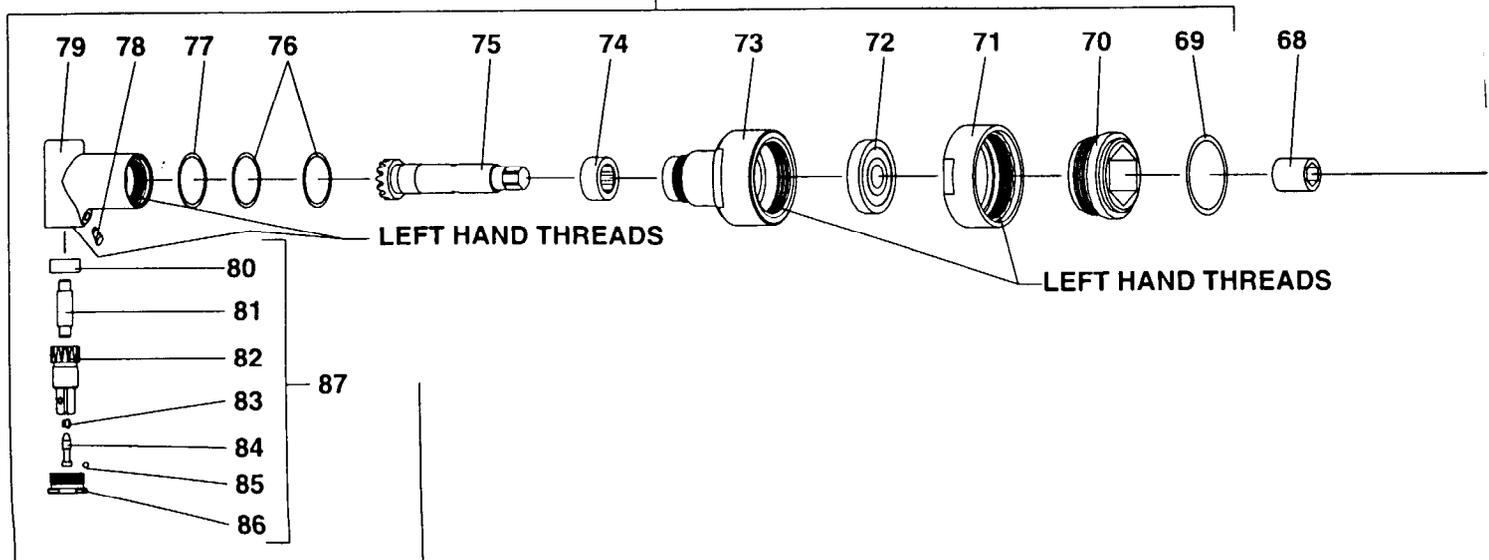


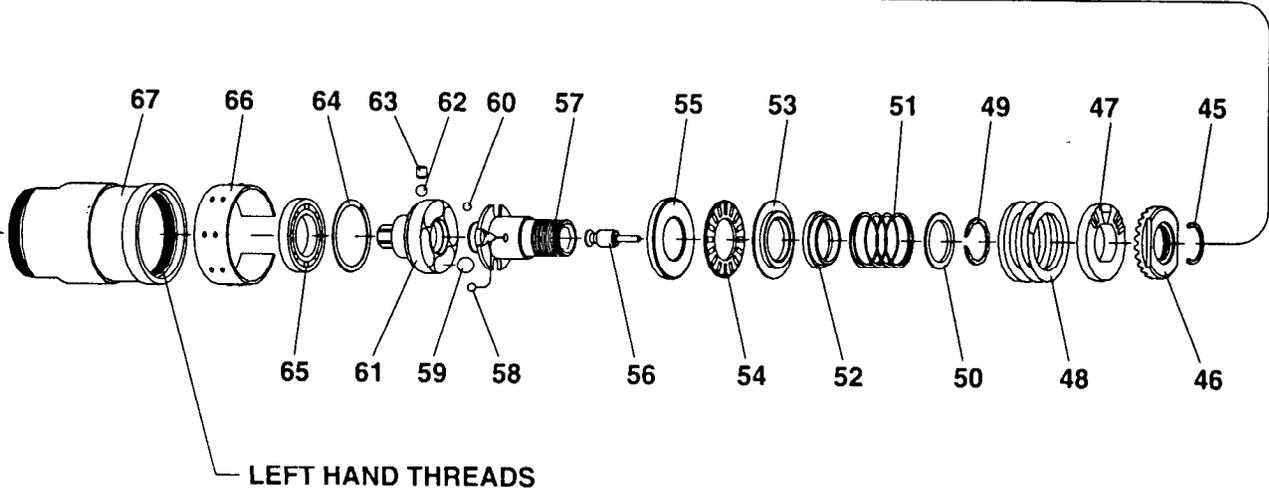
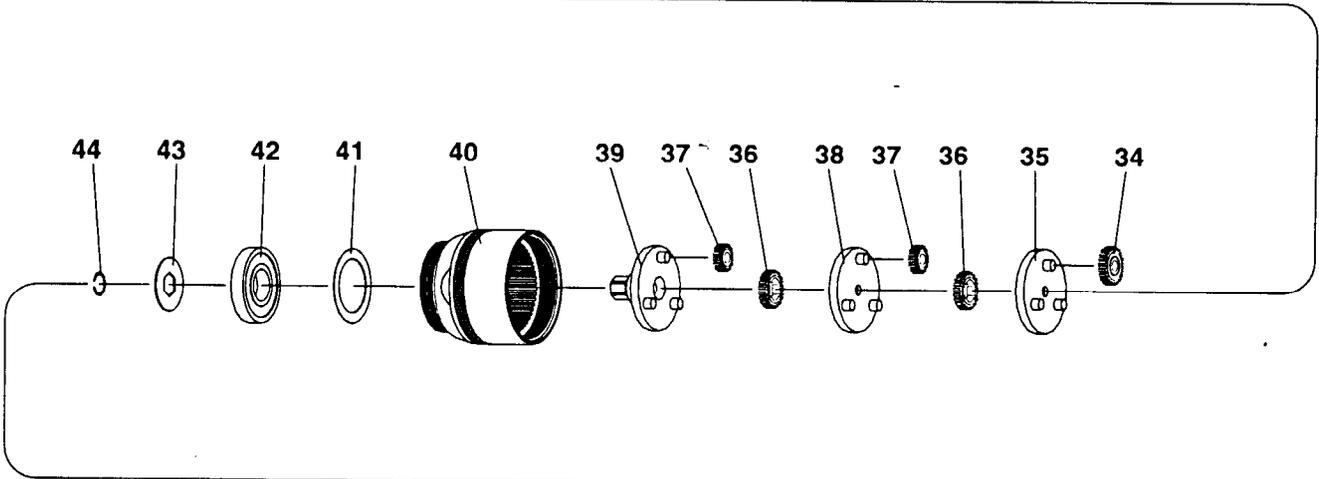
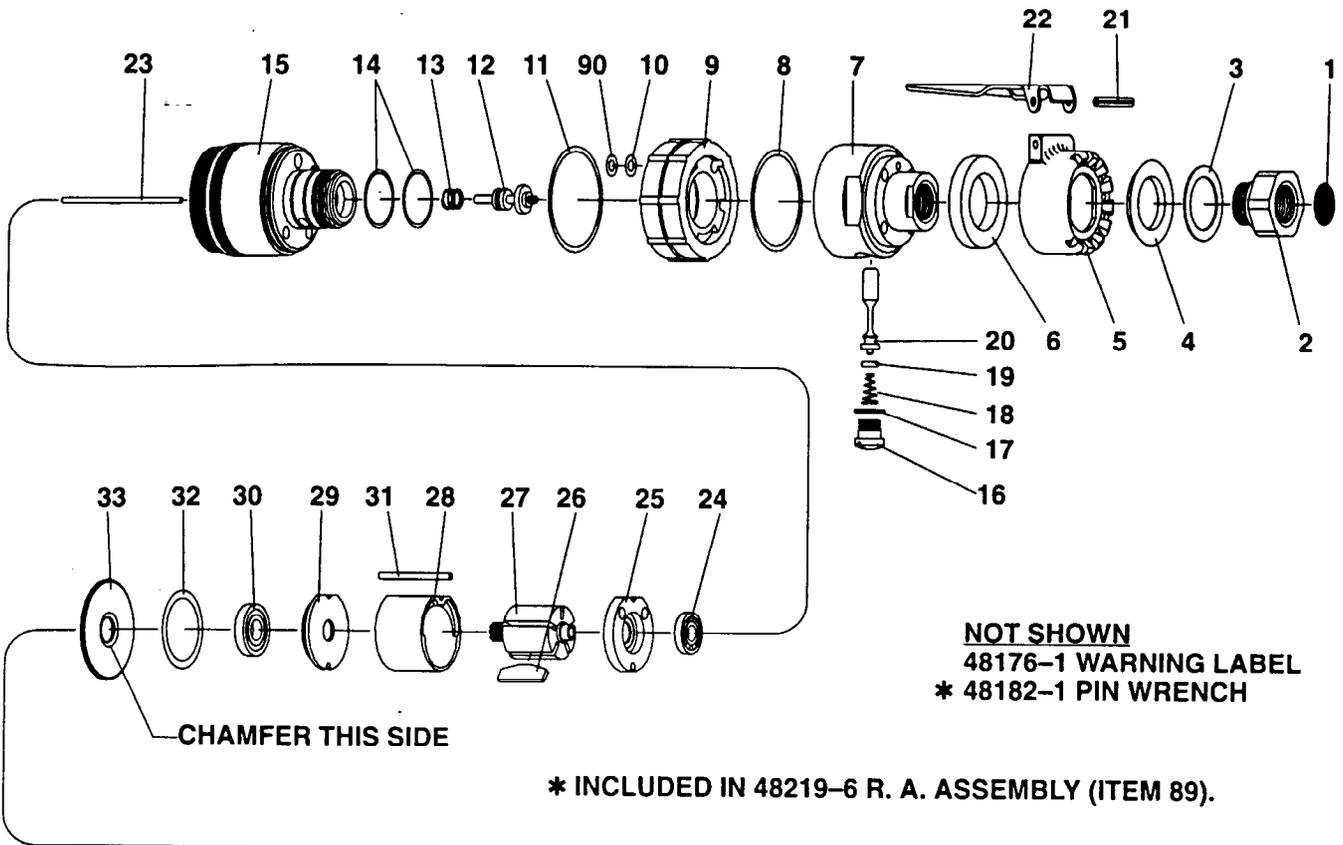
PART NUMBER FOR ORDERING

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1	Screen	33911	47	Adjustment Washer	48089
2	Inlet Adapter	46377	48	Clutch Spring	48291-1
3	Spacer	47205	49	Snap Ring	48480-1
4	Diffuser Washer	46371	50	Guide	48295-1
5	Exhaust Cap	46366-1	51	Spring	47064
6	Filler	46375	52	Ball Sleeve	48294-1
7	Head	48339-1	53	Thrust Race	48085
8	"O" Ring	Y325-23	54	Thrust Bearing	42363
9	Reverse Ring	48204-1	55	Thrust Race	48297-1
10	"O" Ring	Y325-6	56	Plunger	48293-1
11	"O" Ring	Y325-24	57	Spindle	48288-1
12	Valve Assembly (includes Y325-6 "O" ring)	48411-1	58	Ball (6 req'd)	Y16-203
13	Spring	47587	59	Ball (4 req'd)	Y16-206
14	"O" Ring (2 req'd)	48882	60	Ball (10 req'd)	Y16-203
15	Housing Assembly (includes Y178-19 Roll Pin)	48393-1	61	Driven Jaw	49382
16	Throttle Valve Screw	33023	62	Ball (9 req'd)	Y16-204
17	Seal	32886	63	Pin	48080
18	Spring	31125	64	Retainer Ring	48084
19	"O" Ring	Y325-7	65	Ball Bearing	46243
20	Valve Stem	48388-1		AUTO SHUT-OFF CLUTCH ASSEMBLY (includes	
21	Roll Pin	Y178-28		items 45 thru 65)	49383
22	Lever	48246-1	66	External Adjustment Sleeve	46390
23	Throttle Rod	46511-327	67	Housing Assembly (includes item 66)	48395-1
24	Ball Bearing	41643	68	Coupling	48184-1
25	Rear End Plate	46245	69	"O" Ring	Y325-19
26	Blade (5 req'd)	46301	70	Adapter	48186-1
27	Rotor	46338-1	71	Lock Nut	48185-1
28	Cylinder	46244	72	Ball Bearing	Y65-8
29	Front End Plate	47718	73	Right-Angle Body	48196-1
30	Ball Bearing	Y65-10	74	Needle Bearing	46222
	MOTOR ASSEMBLY (includes items 24 thru 30)	47720	75	Pinion	48178-1
31	Locating Pin	47719-1	76	Right-Angle Shim (.005" thick) (2 req'd)	48197-1
32	"O" Ring	Y325-116	77	Right-Angle Shim (.003" thick)	48197-2
33	Spacer	47632	78	Grease Fitting	35967
34	Planet Gear (3 req'd) (21 teeth)	46875	79	Right-Angle Housing	48206-1
35	Carrier Assembly	46336	80	Ball Bearing	41643
36	Sun Gear (2 req'd) (21 teeth)	46560	81	Shaft	48183-1
37	Planet Gear (6 req'd) (15 teeth)	46904	82	Spindle (1/4" square drive)	48801-1
38	Carrier Assembly	46493	83	Pin	47028
39	Spindle Assembly	47742	84	Insert	46749
40	Ring Gear	49381	85	Ball (22 req'd)	32594
41	Spacer	46496	86	Lock Nut	48188-1
42	Ball Bearing	Y65-13	87	Spindle Assembly	48802-1
43	Washer	47694	88	Pin Wrench (not shown)	48182-1
44	Snap Ring	Y142-2	89	Right-Angle Assembly (includes item 88)	48219-6
45	Snap Ring	Y110-105	90	"O" Ring	Y328-6
46	Adjustment Nut	46294			

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# DISASSEMBLY/ASSEMBLY INSTRUCTIONS

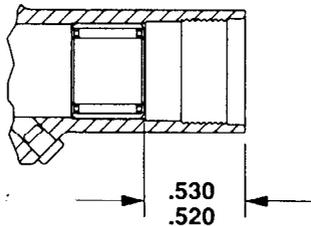
- Never apply excessive pressure by a holding device which may cause distortion of a part.
- Apply pressure evenly to parts which have a press fit.
- Apply even pressure to the bearing race that will be press fitted to the mating part.
- Use correct tools and fixtures when servicing this tool.
- Don't damage "O" rings when servicing this tool.
- Use only genuine ARO replacement parts for this tool. When ordering, specify part number, description, tool model number and serial number.

## RIGHT-ANGLE DISASSEMBLY

- Using wrenches on flats of clutch housing (67) and lock nut (71), unthread and remove right-angle section from tool – LEFT HAND THREADS.
- To disassemble right-angle section, grasp right-angle housing (79) lightly in a vise. Using a wrench on flats of body (73), unthread body from housing – LEFT HAND THREADS.
- DO NOT remove pinion (75) from housing (79) unless damage is evident. To remove pinion, grasp pinion in a vise and tap housing with a soft face hammer.
- Pull pinion (75) from body (73).
- Unthread and remove adapter (70) – LEFT HAND THREADS – releasing bearing (72).
- To disassemble drive assembly, unthread lock nut (86) – LEFT HAND THREADS – and pull drive assembly from housing (79). Do not disassemble further unless damage is evident. NOTE: Drive assembly contains 22 small balls which will fall out if drive assembly is disassembled.

## RIGHT-ANGLE ASSEMBLY

- Lubricate bearings with ARO 33153 grease upon assembly.
- Apply adhesive such as Loctite 609 to shaft (81) and assemble to spindle (82).
- Assemble bearing (80) to shaft (81).
- Assemble gear and components to lock nut (86), securing balls (85) in groove in spindle.
- Assemble lock nut (86) to housing (79) – LEFT HAND THREADS.
- Assemble bearing (72) and lock nut (71) to body, securing with adapter (70) – LEFT HAND THREADS.
- Assemble bearing (74) to pinion (75).
- Assemble pinion to housing (79).
- Assemble housing (79) to body (73) to seat needle bearing (74). Unthread and remove body. NOTE: Bearing is to be located .525" from end of housing (79) (see illustration below).
- Assemble shims (76 and 77) to body.



- Assemble housing (79) to body (73) – LEFT HAND THREADS.
- Assemble coupling (68) to pinion and assemble right-angle section to tool, securing with lock nut (71) – LEFT HAND THREADS.

## CLUTCH DISASSEMBLY

- Remove right-angle assembly from tool.
- Clamp tool in a smooth face vise, clamping on tool inlet adapter (2).
- Remove clutch housing (67) using a strap type wrench – LEFT HAND THREADS.

- Remove clutch assembly from tool.
- Clamp drive end of driven jaw (61) in a vise.
- Remove snap ring (45).
- Using a 5/8" wrench, remove adjustment nut (46).
- Remove adjustment washer (47) and clutch spring (48).
- Remove snap ring (49).
- Slide off guide (50), spring (51), ball sleeve (52), thrust race (53) and thrust bearing (54). NOTE: Removal of ball sleeve (52) releases six balls (58) and plunger (56).
- Remove thrust race (55), releasing four balls (59).
- Remove retainer ring (64) and pin (63), then rotate driven jaw to remove nine balls (62). Separate driven jaw and spindle (57), releasing ten balls (60).

## CLUTCH ASSEMBLY

- For clutch part lubrication, use Molycote G-N type grease on parts as pointed out in this section.
- Lubricate ball grooves of clutch spindle (57).
- Install ten balls (60) into groove.
- Assemble spindle into driven jaw (61), securing balls.
- Assemble nine balls (62) and pin (63) into driven jaw, then secure with retainer ring (64).
- Lubricate ball pockets of driven jaw and install four balls (59) into pockets, securing with thrust race (55).
- Lubricate and assemble thrust bearing (54) and thrust race (53) to spindle (57).
- Coat plunger (56) with ARO 29665 spindle oil and assemble to spindle, securing with balls (58). NOTE: Assemble two balls per hole.
- Secure balls with ball sleeve (52).
- Assemble spring (51) and guide (50) to spindle, securing with snap ring (49).
- Install clutch spring (48).
- Lubricate face of adjustment washer (47) and install on spindle (57).
- Thread adjustment nut (46) onto spindle, securing with snap ring (45).
- Lubricate bearing (65) with ARO 33153 grease and assemble to driven jaw (61), pressing on inner race of bearing.
- Assemble clutch assembly to tool.
- Assemble clutch housing (67) to tool – LEFT HAND THREADS.
- Assemble right-angle assembly to tool – LEFT HAND THREADS
- See "Clutch Adjustment".

## CLUTCH ADJUSTMENT

### EXTERNAL:

- Rotate sleeve (66) until opening in housing is visible.
- Rotate drive spindle of right-angle assembly until notch in adjustment washer (47) is visible.
- Insert a no. 1 Phillips screwdriver in notch to turn gear teeth on nut (46).
- Clockwise = decrease torque.
- Counterclockwise = increase torque.

### INTERNAL:

- Remove clutch housing and clutch assembly from tool. NOTE: Clutch housing has left hand threads.
- Clamp drive end of driven jaw (61) in a vise.
- Hold clutch assembly from turning, then rotate adjustment nut (46), using a 5/8" wrench.

## GEARING DISASSEMBLY

- Remove right-angle section and clutch assembly from tool.
- Remove ring gear (40) using a wrench on flats.
- Remove snap ring (44) and washer (43).

## DISASSEMBLY/ASSEMBLY INSTRUCTIONS

- Remove spindles and gears from ring gear (40). NOTE: Keep gears grouped with mating spindle.
- Do not remove bearing (42) or spacer (41) unless damage is evident.
- To remove bearing (42) and spacer (41) from ring gear, press on spacer (41) from inside splined end of ring gear.
- Do not remove gear (36) from carrier assembly unless damage is evident. Gear (36) is press fit onto carrier assembly.
- Assemble end plate (29) to rotor, pressing on inner race of bearing. Be sure rotor turns without binding.
- Insert pin (31) into .081" diameter blind hole at bottom of motor cavity in housing.
- Align notches of end plates and cylinder and install motor into housing, aligning notches with locating pin (31).
- Grease and assemble "O" ring (32) to end plate (29).
- Assemble spacer (33) to motor, with chamfer on inside diameter facing motor.
- Coat throttle rod (23) with ARO 29665 spindle oil and insert into rotor.
- Assemble gearing, clutch assembly and right-angle section to tool.

### GEARING ASSEMBLY

- Assemble spacer (41) into ring gear.
- Assemble bearing (42) into ring gear, pressing on outer race of bearing.
- Coat shafts of spindles with ARO 33153 grease.
- Assemble gears to shafts of mating spindle.
- Assemble carrier assemblies to spindle assembly.
- Lubricate sets of gears liberally with ARO 33153 grease (see "Routine Lubrication Requirements", page 3).
- Assemble spindles and gearing into ring gear. Rotate spindle and gears to align gear teeth with splines of ring gear.
- Assemble washer (43) to spindle, securing with snap ring (44).
- Thread ring gear (40) to tool, tightening with wrench on flats.
- Assemble clutch assembly and right-angle section to tool.

### MOTOR DISASSEMBLY

- Remove right-angle section, clutch assembly and gearing from tool.
- Remove spacer (33), "O" ring (32) and throttle rod (23).
- Tap front edge of housing to remove motor assembly. Locating pin (31) should also come out.
- Tap splined end of rotor (27) with a soft face hammer; motor will come apart. NOTE: Bearing (30) is light press fit on rotor.
- Remove end plate (25) and bearing (24) from rotor.

### MOTOR ASSEMBLY

- Lubricate bearing (24) with ARO 33153 grease.
- Assemble bearing (24) to end plate (25), pressing on outer race of bearing.
- Assemble end plate (25) to rotor, pressing on inner race of bearing.
- Coat five rotor blades (26) with ARO 29665 spindle oil and assemble to rotor slots – straight side out.
- Coat inside diameter of cylinder (28) with ARO 29665 spindle oil and assemble over rotor. NOTE: Air inlet slots of cylinder must be aligned with two air inlet holes in end plate (25).
- Assemble bearing (30) to end plate (29), pressing on outer race of bearing.

### HOUSING DISASSEMBLY

- Clamp air inlet adapter (2) in a smooth face vise.
- Unthread head (7), using a wrench on flats.
- Remove spacer (3), diffuser washer (4), exhaust cap (5) and filler (6).
- Remove screen (1) from inlet adapter (2).
- Remove screw (16) and seal (17), releasing spring (18) and valve stem (20).
- Clamp head (7) in a smooth face vise, clamping on flats.
- Using a strap type wrench, unthread and remove housing (15) from head.
- Remove reverse ring (9) and "O" rings (90 and 10), allowing removal of "O" ring (11) and "O" rings (14).
- Remove valve assembly (12) and spring (13).

### HOUSING ASSEMBLY

- Grease "O" ring of valve assembly (12) and assemble spring (13) and valve assembly to housing (15).
- Grease and assemble "O" rings (14) to housing.
- Grease and assemble "O" rings (10 and 90) to reverse ring (9) and assemble reverse ring to housing.
- Grease and assemble "O" ring (8) to head (7).
- Assemble housing (15) to head (7), tightening with a wrench on flats of head and a strap wrench on housing.
- Grease and assemble "O" ring (19) to valve stem (20).
- Lubricate valve stem (20) with ARO 29665 spindle oil and assemble to head (7).
- Assemble spring (18) to head (small diameter towards valve stem), securing with seal (17) and screw (16).
- Install filler (6) to exhaust cap (5).
- Assemble exhaust cap (5) to head, aligning lever with valve stem (20).
- Assemble diffuser washer (4) and spacer (3) to head, securing with inlet adapter (2).
- Clean and replace screen (1) in inlet adapter.

