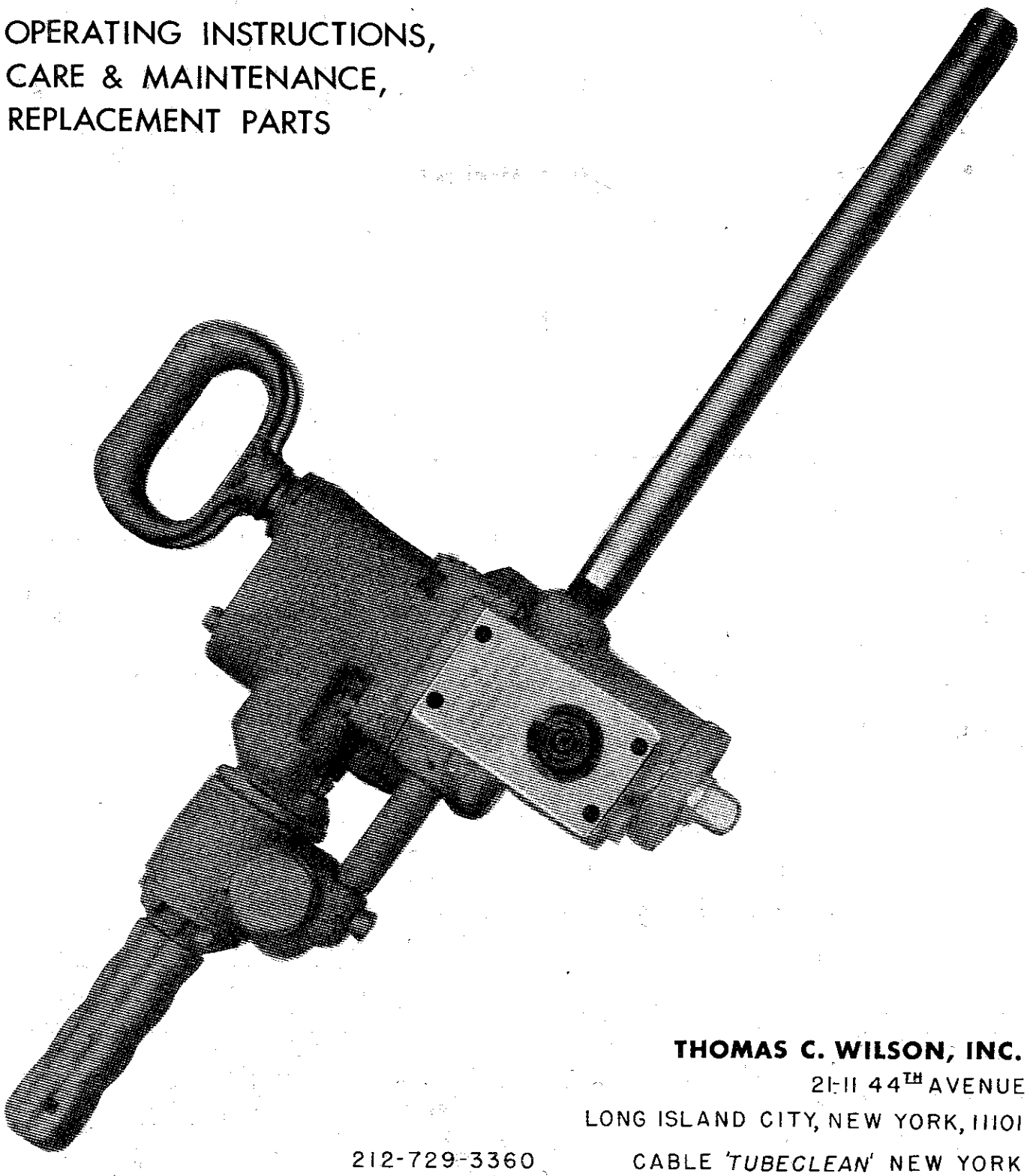
controlled torque tube expander drive models **2C-125 (125rpm)** and **2C-200 (200rpm)**

WILSON
TORQ-AIR-MATIC

SM-54D

OPERATING INSTRUCTIONS, CARE & MAINTENANCE, REPLACEMENT PARTS



THOMAS C. WILSON, INC.
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212-729-3360
CABLE *'TUBECLEAN'* NEW YORK

WILSON MODEL '2C' TORQ-AIR-MATIC EXPANDER CONTROL

introduction

This instruction manual should under most circumstances accord the user a means of avoiding potentially troublesome conditions and "trouble-shooting" against malfunctions. However, "an ounce of prevention is worth a pound of cure" and operators of Wilson Torq-Air-Matics should ascertain that only clean dry air is admitted to the machine. In addition, lubrication, air pressure at the tool and air compressor capacity should be as prescribed. After use, a liberal amount of oil should be introduced into the machine and distributed completely through air motor and valves before storing. It has been found that most of the machines which were returned to our factory for repairs had developed corrosion within the mechanisms, thus preventing their parts from performing their designed duties. This corrosion could only have come from wet dirty air and improper storage.

However, repairing or rebuilding a machine "to be as good as new" is an objective of a different character. A precision tool, the Wilson Torq-Air-Matic must first be able to sense torque and its magnitude (simultaneously with rotation of a tube expander) and then actuate either a servo valve shut-off mechanism or an uncoupling mechanism. It must then "telegraph" this information to the motive power, which must respond accordingly by stopping and then reversing. Then of course, the cycle of operation must repeat again and again.

This is quite an accomplishment for an air driven tube expander driver with an integral mechanical torque control, an accomplishment that can be done day in and day out by the Wilson Torq-Air-Matic when it is properly used and cared for. Admittedly, pneumatic tools operate under very trying conditions. Notwithstanding, pneumatic tools are very rugged machines and, basically, require very little correct attention and maintenance. When coupled with instrumentation devices, however, they should be accorded their respective extra care. Most repairs are necessitated by the lack of this "little correct attention and maintenance" for air motor and throttle valve and the little "extra care" for the torque sensing and control devices together with their servo and reversing valves.

The "repair to be as good as new" objective would dictate a policy of always returning the Torq-Air-Matics to our factory for repairs. Who else would know the intricate details but the Company who makes this machine? Who else would have a greater stake in its satisfactory performance? Therefore, while we believe that each user can help himself considerably, the "good as new" repair objective is always a factory job. In our factory many checks are made that would not be within the realm of the ordinary user's testing equipment and procedures, such as torque calibration on a mechanical prony brake and over 500 simulated forward and reverse cycles of tube rolling. However, these checks or trips to our factory for repairs can be reduced and kept to an absolute minimum by proper use on the job and adequate care after each job of the Wilson Torq-Air-Matic.

Before proceeding to disassemble any machine, one should obtain particular details concerning the malfunction since much time and unnecessary work may thereby be eliminated. Above all, ascertain whether air was filtered clean and that adequate lubrication prevailed. Also, check that a volume of approximately 55 cubic feet per minute of air at 85 to 90 pounds per square inch pressure was available at the machine and an air hose connection of the maximum size is used, that is a connection which is not choked down with either reducing fittings or nipples. On maximum or high torque settings the inherent designed power output is based on availability of a sufficient volume of air at 90 PSI. At high load settings, low air pressure or volume will cause the machine to visibly slow down into an ultimate stall before reaching its preset dial torque. In this event, since the servo valve did not shut off the air to the motor, the tool would not reverse automatically. However, it could be reversed manually or caused to reverse automatically by releasing the trigger and thereby shutting off the air supply to the motor. This system of operation very definitely precludes the possibility of continuous rolling with the impression that all tubes are tight and only finding them not tight when a hydrostatic test is applied. There is an inherent guarantee in that the operator is "tipped off" not to continue rolling under circumstances that will not produce a tight joint.

These machines do not depend upon friction, ratcheting, magnetic or electric devices to trip off or stop rotation at a preset torque. Neither do they rely upon a differential in air pressure at the throttle to cause stalling to stop rotation at a predetermined load. There can be no slipping under the method of drive and control used in the Wilson Torq-Air-Matics. If they are mechanically correct and operable, they will produce as to the torque set or will not produce at all. What better assurance can be had against a potentially false impression of rolling tubes to optimum tightness? The Wilson Torq-Air-Matic is an excellent producer and a time saver. When treated with proper care, trouble-free performance is assured.

WILSON MODEL '2C' TORQ-AIR-MATIC EXPANDER CONTROL

calculating the required expansion

The amount of expansion desired may usually be determined from past experience. Records will indicate that there is quite a variable between installations. This variable may be due to personal preference as well as service conditions. The type and hardness of tube metal and the tube sheet will also have a bearing on the amount of expansion. Depending on tube O.D., sheet thickness, pressure and service, etc., a three percent wall reduction (thinning of the tube wall after expanding) may suffice. In another case a six percent reduction or greater may be required.

The amount of tube wall reduction generally considered most desirable for the average ferrous tube application is approximately seven to ten percent. Extensive experimentation has established that the most reliable method of determining what a joint should be and its effectiveness is to measure displacement of tube metal, after metal to metal contact of tube wall with tube seat has been made.

An example of how to determine the desired expanded diameter for a 2" x 12 gauge (.109) tube is shown.

2.015 Tube Sheet Hole
minus - 2.000 Tube O.D.

equals .015 Clearance (Diametral)
plus + 1.782 Tube I.D.

equals 1.797 Tube I.D. at metal to metal contact.

plus + .022 Increase in I.D. to obtain 10% tube wall reduction. (10% x .109 wall x 2).

equals 1.819 Desired expanded diameter of I.D.

This calculation is a fair first approximation for illustrative purposes but it does not take into account tube wall thinning which accompanies the increase in tube I.D. necessary to reach metal to metal. When tube wall thinning is taken into account, a closer approximation for the increase in tube inner diameter is given by the following:

$$\left\{\begin{array}{l}\text{increase in tube inner}\\ \text{diameter to reach}\\ \text{metal to metal}\end{array}\right\} = \frac{\text{Tube O.D.}}{\text{Tube I.D.}} \times \text{clearance}$$

For the above example:

$$\left\{\begin{array}{l}\text{increase in tube inner}\\ \text{diameter to reach}\\ \text{metal to metal}\end{array}\right\} = \frac{2}{1.782} \times .015 = .017$$

The tube I.D. at metal to metal contact is increased to 1.782 + .017 = 1.799, or .002 more than the approximate calculation. The required 10% tube wall reduction to complete tube expansion is still based on the tube wall thickness prior to thinning and is 10% x .109 x 2 = .022. The required tube I.D. after tube expansion is 1.799 + .022 = 1.821 or .002 greater than given by the approximate calculation.

The torque setting of the Torq-Air-Matic can be adjusted to obtain this dimension. For expanding the 2" x 12 gauge steel tube in a 1" sheet and using 1" effective roll length, the torque setting for trial purposes would be just about 35 foot pounds. If a 10% tube wall reduction is satisfactory, expanding may continue, otherwise the torque may be reset.

The example is based on using Wilson's revolving ball bearing collar type expander, Models 41 or 44. It is the ball bearing collar type which is most suitable for use with the torque control. There is nothing to prevent using other types, such as a flaring expander. Only a very small additional amount of torque will be required with the latter. Even using universal joints, very little additional torque is required.

typical torque settings

TUBE		MATERIAL	TUBE SHEET	TORQUE FT. LBS.
O.D.	GA.			
1"	13	Steel	1-1/2"	35
1-1/4"	11		2"	45
2"	10		2"	50
2-1/2"	12		1/2"	52
3"	12		5/8"	55

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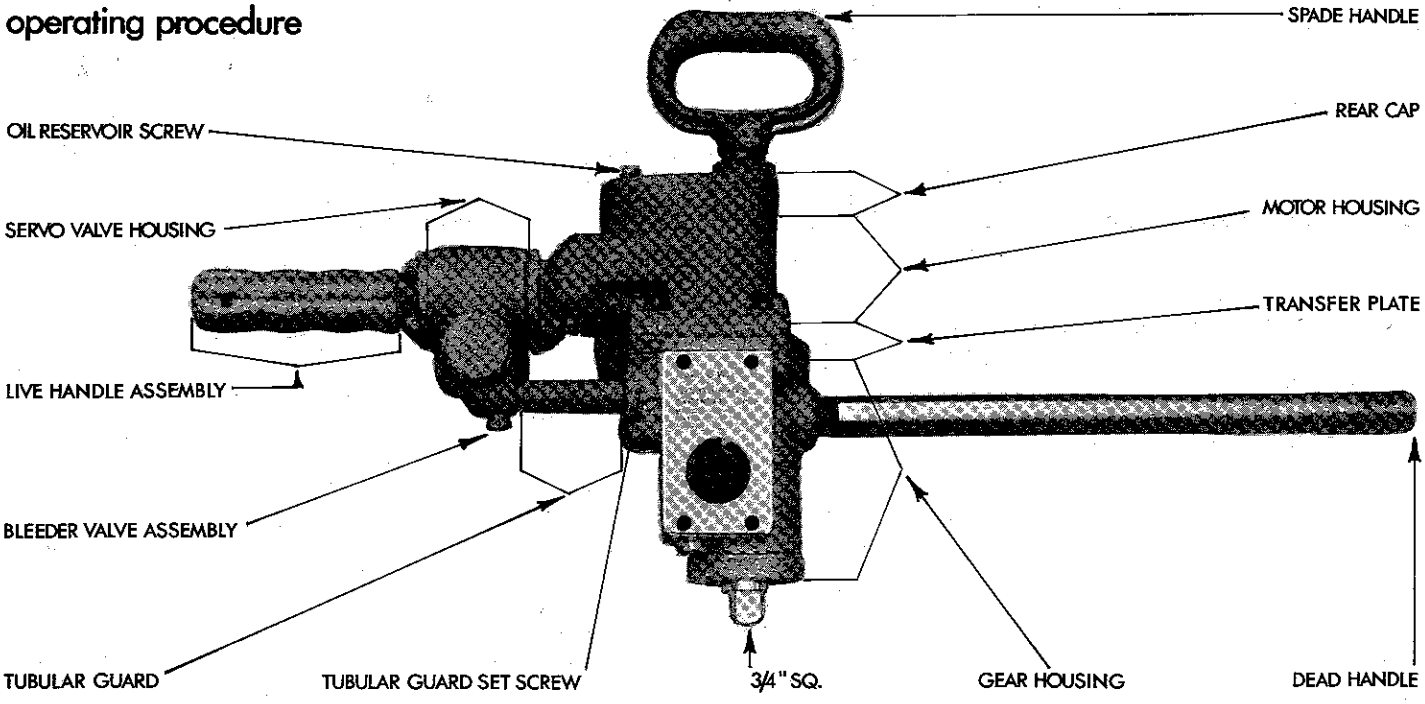
specifications

MOD. NO.	CAT. NO.	FREE SPEED (RPM)	MAXIMUM TORQUE (FT.-LB.)	AIR PRESSURE AT RATED POWER	AIR INLET	SPECIAL 3/4" I.D. HOSE	FREE SPEED AIR FLOW	SPINDLE
2C-125 2C-200	39620-0125 39620-0200	125 200	125 90	90 PSI	1/2"-14 NPT	25 ft. lg. CAT. NO. 21190	80 CFM (55 CFM AT MAX. TORQUE)	3/4" Sq. with 2 spots

operating procedure



1. Remove oil filler screw in housing cap and fill oil reservoir with light machine oil of SAE 10 viscosity. This should be done before all long runs of tube expanding and after every 4 hours of continuous use. The use of an air line lubricator is recommended.

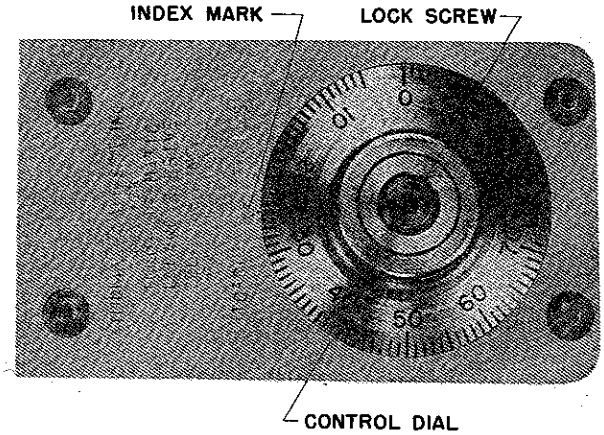
2. Periodically, oil servo valve mechanism at oil hole behind the bleeder valve boss.

3. An air line strainer or filter is required for maximum power and efficiency. Wilson's vitalizer unit (Cat. No. 28147) consisting of a filter and lubricator for use on a 3/4" I.D. air line is recommended.

4. The fine mesh screen inside the throttle cap should be periodically checked and completely cleaned of all foreign matter as necessary.

5. Always blow out the air hose thoroughly before attaching to the throttle cap, which takes the 1/2" pipe coupling on the 3/4" hose supplied with the tool. Always use a 3/4" or larger line when maximum power is desired and be sure that the air pressure at the tool is at least 90 P.S.I. gauge.

6. Loosen lock screw of control dial with 5/32" hexagon key supplied and set dial, which is calibrated in foot-pounds of torque, to the trial setting. (See section preceding entitled "Calculating the Required Expansion".) After setting, lock control dial securely with lock screw.



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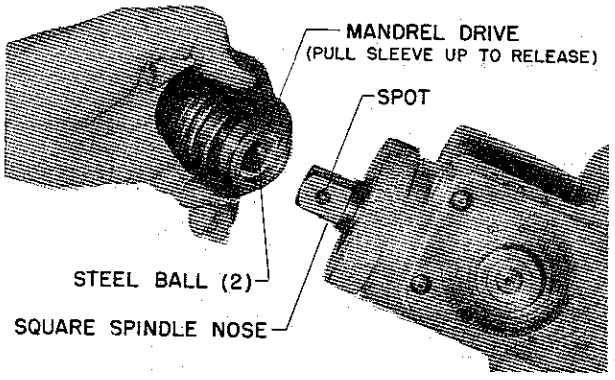
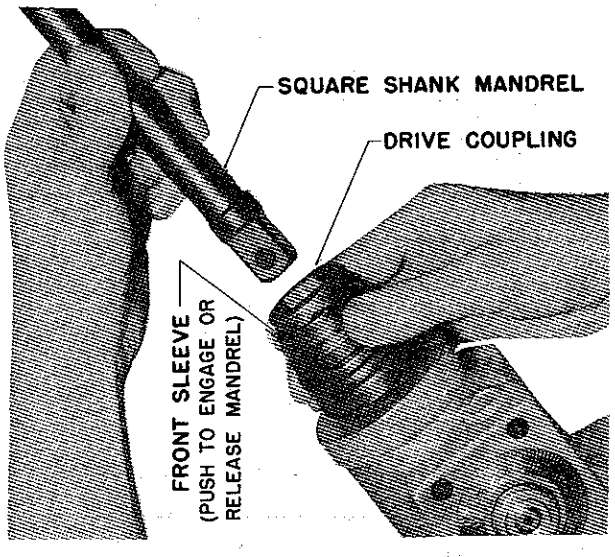
7. To avoid the possibility of over-rolling, it is best to make the trial setting low and work up to the desired setting. A record of this setting should then be kept for future use.

8. Attach either dead handle or spade handle as desired.

9. Select required snap-on mandrel drive. Insert it on the square spindle nose, being sure to align the steel balls within the mandrel drive with the spots drilled for them on the spindle nose. (Instructions for releasing the balls and detents are on the mandrel drive sleeves.)



10. Attach mandrel to drive by engaging detent in drive coupling with drilled spot of mandrel's square shank.



11. Position expander as required in tube to be expanded.

12. Roll live handle throttle sleeve forward and allow self-feeding action of expander to expand the tube.

13. When the pre-set torque has been reached, the servo valve mechanism will shut off the motor.

14. Then release the throttle, wait for the click of the control valve being reset and roll throttle sleeve backwards. This will reverse the motor and retract the mandrel so that the expander may then be removed from the tube.

15. If, after measurement of the tube I.D., the amount of expansion is found to be insufficient, reset the control dial to a slightly higher value and roll the next tube.

16. When the desired expansion has been attained, maintain the setting and roll the entire lot. Reroll all trial tubes which were not completely expanded.

17. Always record settings used and tube data, such as O.D., gauge, tube sheet thickness and hole size, for future use.

maintenance and servicing

IMPORTANT: For maximum service life:

Keep air motor and servo valve mechanism well lubricated.

Use strainers in air lines.

Always blow out air line before connecting to motor.

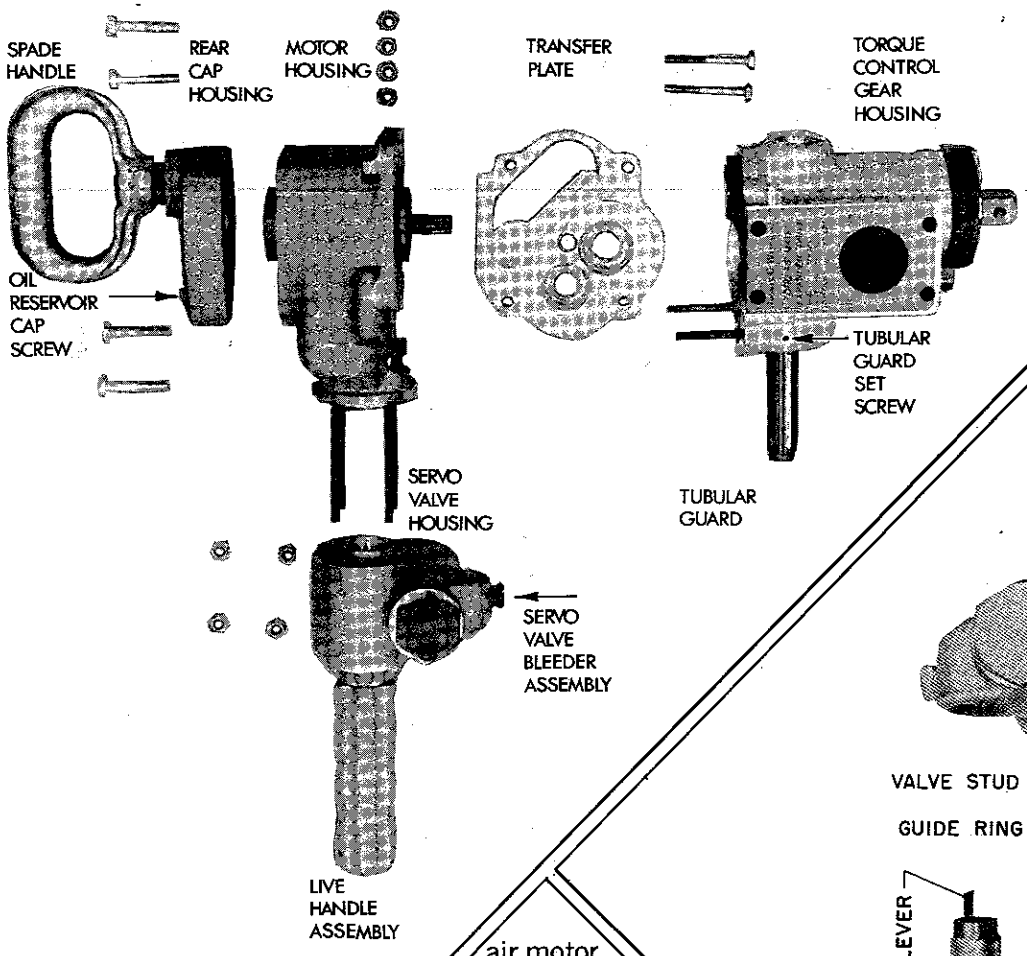
BEFORE STORING MOTOR, clean it of any moisture; oil both motor and servo valve mechanism well.

component parts and accessories

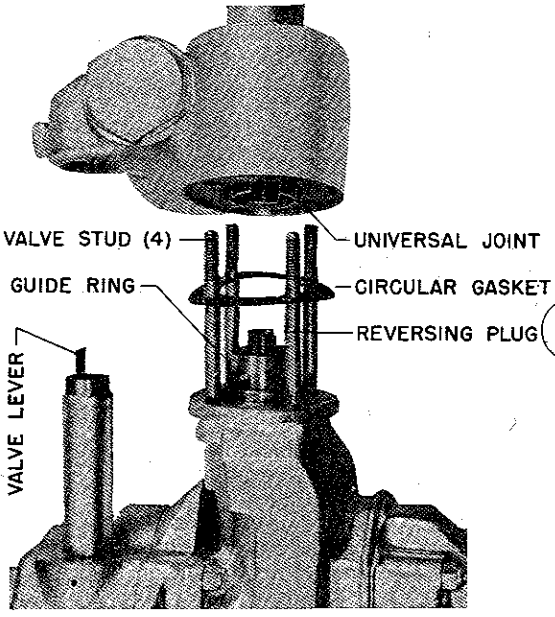
PART/ACCESSORY DESCRIPTION	CAT. NO.
Mandrel Drive	
For 1" Square Drive Mandrels	21489
For 3/4" Square Drive Mandrels	21137
For 1/2" Square Drive Mandrels	21138
For 3/8" Square Drive Mandrels	21139
Hose Assembly	
Special 3/4" Operating Air Hose Through 1/2" Hose Coupling - 25 Ft. Long	21190
Rotor Blades (Set of 4)	21142

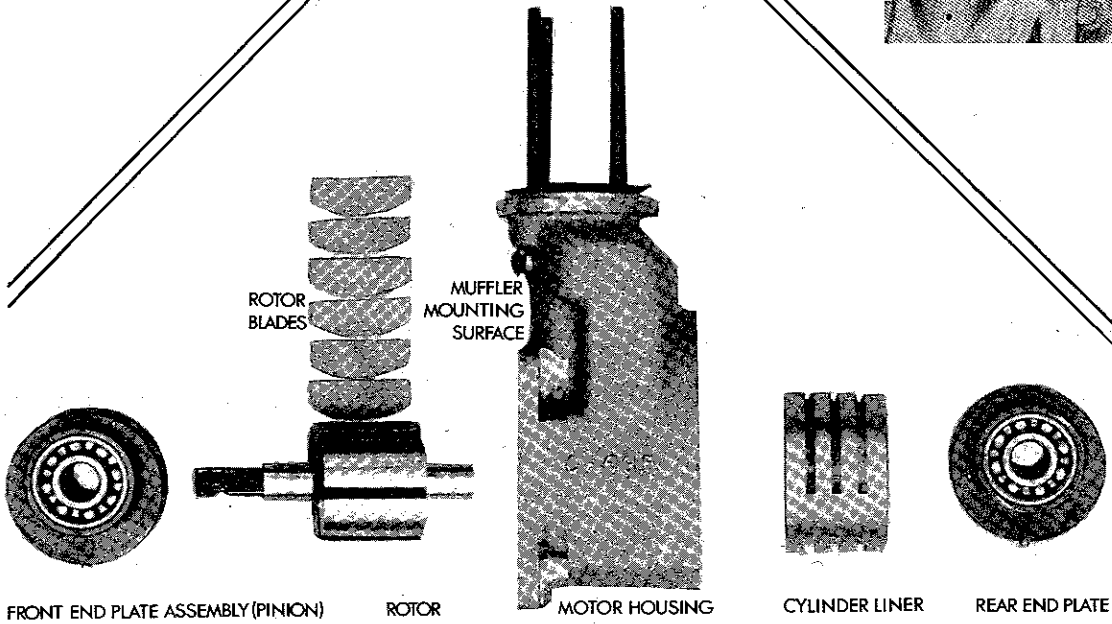
WILSON MODEL '2C' TORQ-AIR-MATIC EXPANDER CONTROL

disassembly procedure



air motor disassembly procedure





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disassembly procedure

1. Remove live handle assembly and valve housing together by pulling on the valve housing alone. Never pull on the live handle assembly as this may damage the links in the valve housing. Remove the circular gasket, guide ring and reversing plug from the motor housing.

2. Next, remove transfer plate and gear housing together from the motor housing by tapping and pulling on the transfer plate only. Do not pull on either the gear housing or the square drive as this will separate the two castings and allow grease to come out and dirt to get in. Be sure to remove the transfer plate gasket along with the transfer plate.

3. Remove the rear housing cap assembly. Be sure to remove the rear housing cap gasket from the motor housing.

air motor disassembly procedure

1. Tap the drum end of the rotor with a soft-faced mallet and drive out rotor, blades, and front end plate, which will slide easily off the rear end plate. (See Step 5.)

2. Use mallet handle to gently tap rear end plate out of motor housing. (See Step 5.)

3. The cylinder liner can now be pressed out from either end if necessary. This can be accomplished easily by the application of heat to the motor housing assembly.

4. Be sure to remove and save the key dowels from the cylinder liner and the two end plates.

5. Disassembly of the motor can be more easily done when heat is applied to the motor housing casting. Heat carefully and evenly to about 250 degrees Fahrenheit.

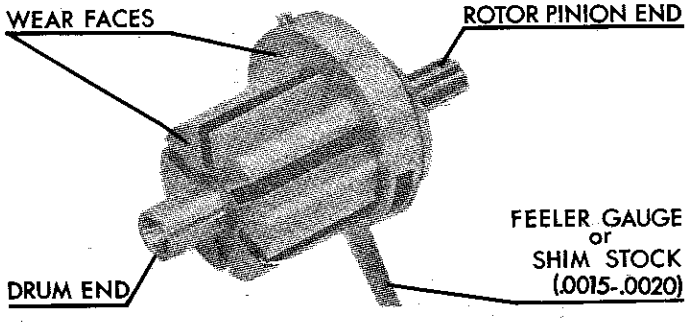
reassembly procedure

1. Check all six new rotor blades to see that they fit freely in the rotor slots. Soak them in light machine oil of SAE 10 viscosity for a while before assembly. (Wilsolube - Catalog No. 9047.)

2. Also check ball bearings in their end plates to see that they run freely without excessive play and are properly lubricated. This should not necessitate further disassembly of either ball bearing from its end plate except for replacement.

3. Press pinion end of rotor shaft into ball bearing in end plate from wear surface side. This pinion shaft is a tight press-fit in either ball bearing bore. Tap rotor with a soft-faced mallet on either end until there is a clearance of from .0015" to .0020" between end plate and rotor drum wear surfaces as illustrated. Check this clearance carefully all around. Be sure key dowel is pressed in place.

rotor and end plate assembly



4. Orient and support motor housing such that the housing's rear face is approximately 1" above a clean flat surface. (Note: The housing's rear face is the face opposite gear and muffler mating surfaces.)

5. Heat motor housing carefully and evenly to about 250 degrees Fahrenheit.

6. Lower drum end of rotor and end plate assembly into motor housing and align end plate key dowel with keyway. Press end plate into motor housing gently but firmly so that end plate's flange surface is flush with motor housing's front face. Be careful to maintain the preset clearance between the wear surfaces.

7. Support this partially assembled air motor 2" above the clean flat surface upon housing's front face where rotor pinion protrudes.

8. If the press-fitted cylinder liner was removed from the motor housing, it should be reinstalled. Be sure key dowel is tightly in place so that it will slide easily in the motor housing keyway and correctly align cylinder liner.

9. Press cylinder liner firmly against the rotor pinion end plate wear surface. The rotor's drum wear surface should be just below cylinder liner edge.

10. Insert well-oiled rotor blades into the rotor drum slots; straight edge of rotor blades should be toward cylinder liner.

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11. Press drum end plate, whose bearing will slide on rear rotor shaft easily, into motor housing after aligning press-fitted key dowel to motor housing keyway. This assembly should be done quickly in order to gain full advantage of the hole expansion resulting from heating the motor housing.

12. Be sure that both end plate flanges are flush with the motor housing faces and their wear surfaces are tight against the cylinder liner within. Turn rotor by hand to see that it rotates free and easy with no rubbing.

13. If binding or rubbing does occur, rotor is improperly located between the end plates. Disassemble motor completely; reset required clearance between the wear surfaces; and reassemble again. Apply heat to casting for easy removal per Step 5.

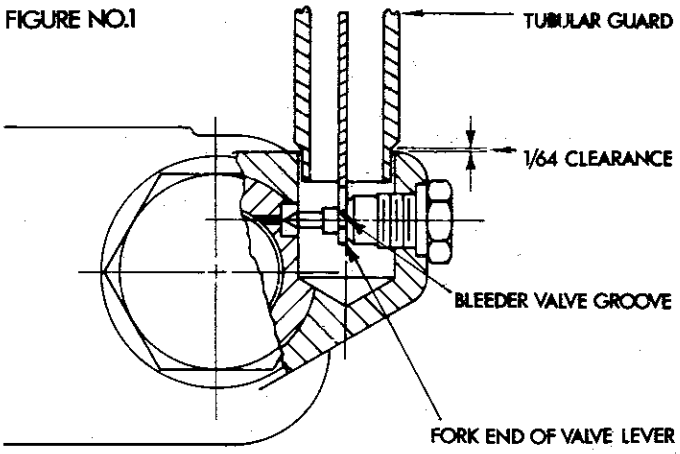
14. Assemble the front end assemble gasket, transfer plate and gear housing.
Note: This sub-assembly must be held 3/16" away from the motor housing in order to start the 1/4"-20 N.C. lock nuts on their studs. When this assembly is drawn up tight, loosen the set screw in the tubular guard boss and push tubular guard into the casting as far as it will go.

15. Insert reversing plug with the larger or exhaust cut-out facing the exhaust port and the two lugs facing away from the motor housing.

16. Put guide ring in place around the reversing plug and place circular gasket over the studs onto the flat face of the casting.

17. Carefully lower the valve housing and live handle assembly over the studs toward the face with the gasket on it.

FIGURE NO.1



18. Engage the projecting lugs of the reversing plug in the deep slot of the universal joint and continue lowering (Caution - Before bringing the valve housing home, insert the fork end of the valve lever, which extends out of the tubular guard, into the groove of the bleeder valve as shown in Figure 1.)

19. Tighten valve housing and live handle assembly down with 1/4"-20 N.C. lock nuts.

20. Tubular guard should now be inserted into hole of valve housing and locked in place with set screw. Leave a clearance of about 1/64" between the hole edge and the shoulder of the tubular guard as in Figure 1.

21. Assemble cap housing assembly and gasket to rear end of motor housing assembly.

maintenance and repair tools

QTY.	TOOLS
1	4 Oz. Ball Pein Hammer
1	4 Oz. Soft Faced Hammer (Brass and Plastic Tip)
1	Set of Screwdrivers: 1/8" w. x 4" lg. blade 1/4" w. x 4" lg. blade
1	7/16" Open End Wrench for close quarter work
1	9" Smooth Jaw Adj. Wrench (with 2" min. opening)
1	Set of Allen Wrenches (5/64, 3/32, 1/8, 5/32, 3/16 Hex.)
1	9-1/2" Channel Lock Pliers
1	Long Needle Nose Pliers
1	6-1/2" Half Round Needle File for Deburring
1	Small Hand Scraper for Deburring
2	Sheets fine emery cloth for polishing
1	Bench Arbor Press (1 ton capacity) (This is essential if certain work is to be performed without extreme difficulty, such as pressing motor assembly out of motor housing.)
1	.0015" Feeler Gage (use feeler gage stock)

WILSON MODEL '2C' TORQ-AIR-MATIC EXPANDER CONTROL

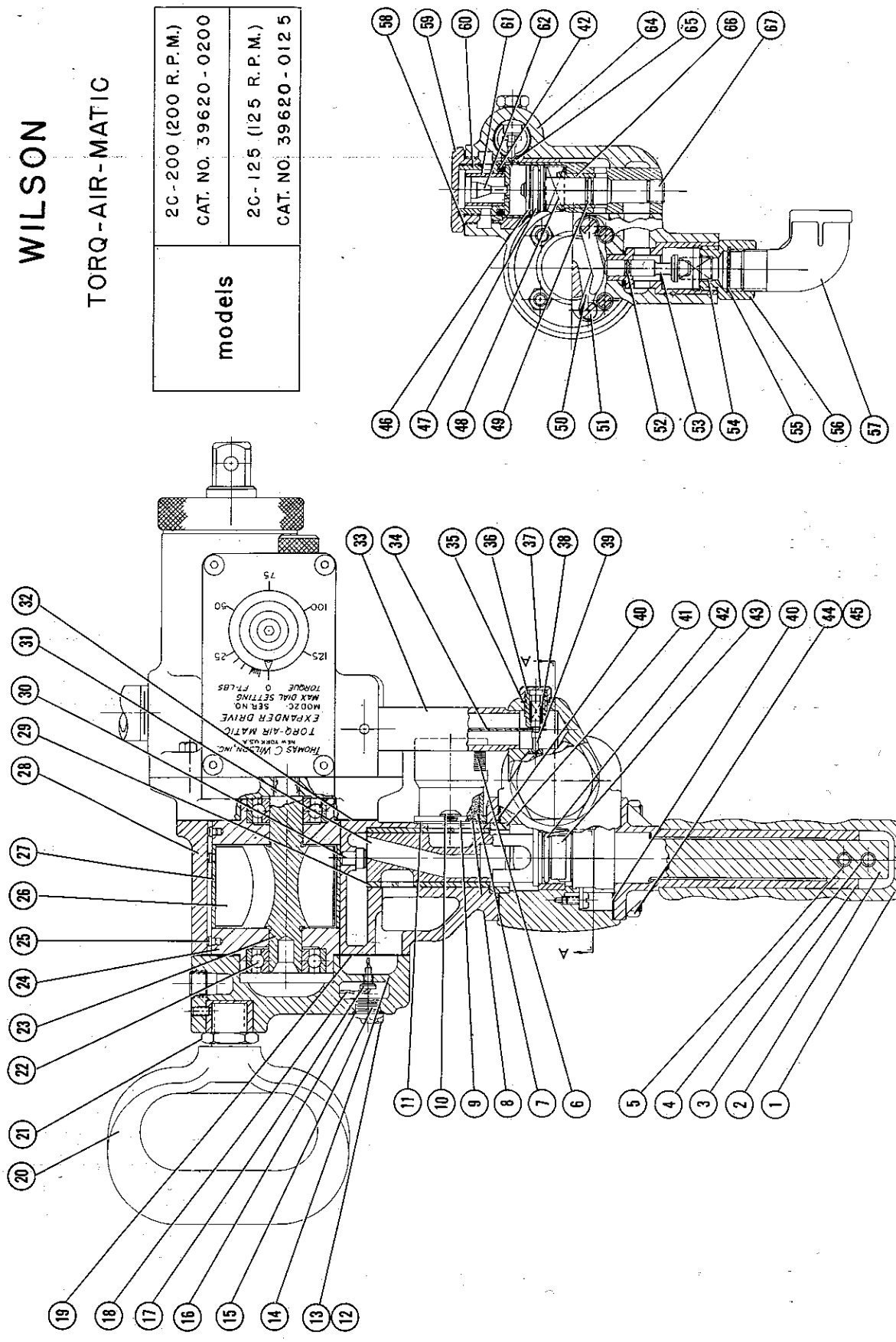
trouble shooting chart

TROUBLE	PROBABLE CAUSE	REFER TO PROCEDURE
1. Fails to stop rotating	Failure of Servo Valve. Note: Failure of Servo Valve to automatically stop machine rotation at high torque settings usually indicates lack of power; refer to No. 4. When stalling occurs, air will continue to flow from exhaust port.	PROCEDURE A Steps A-1 thru A-7
2. Stops rotating before it develops sufficient torque.	Premature Servo Valve shutoff. Note: If air still flows through exhaust port when spindle stops rotating, machine has stalled; refer to No. 4.	PROCEDURE B Step B-1 thru B-14
3. Servo Valve trips, but motor only slows down and does not stop rotating.	Servo Valve interference. Servo Valve seal surfaces leak.	PROCEDURE C Part 1 Steps C-1 thru C-9 Part 2 Steps C-10 thru C-16 Part 3 Steps C-17 thru C-23
4. Fails to develop sufficient power for high torque tube rolling.	Deficient air supply. Air motor leakage.	PROCEDURE D Part 1 Steps D-1 thru D-4 Part 2 Steps D-5 thru D-16
5. Motor will not run.	Air supply. Broken, worn, nicked rotor blades.	PROCEDURE D Steps D-1 thru D-4 Check 90 PSI and 80 CFM (free speed) air supply (55 CFM at max. torque). Replace rotor blades. See Procedure D. Steps D-5 thru D-16

WILSON MODEL '2C' TORQ-AIR-MATIC EXPANDER CONTROL

WILSON
TORQ-AIR-MATIC

models	2C-200 (200 R.P.M.) CAT. NO. 39620-0200	2C-125 (125 R.P.M.) CAT. NO. 39620-0125



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KEY NO.	DESCRIPTION	PART NO.
	Live Handle Assembly (Consists of Key Nos. 1 thru 5)	21178
1	Throttle Sleeve	21099
2	Throttle Operating Shaft	21101
3	Handle Stem	21100
4	Spring Pin	25165
5	Dowel Pin	6636
	Muffler Ass'y. (Consists of Key Nos. 6 thru 9)	40569
6	Outlet Screen	40572
7	Steel Wool	40573
8	Inlet Screen	40571
9	Muffler Body	40570
10	Button Head Screw (2)	40574
11	Muffler Gasket	40575
	Housing Cap Assembly (Consists of Key Nos. 14 thru 18)	39636
12	Cap Screw (4)	39639
13	Lock Washer (4)	21946
14	Housing Cap	39637
15	Oil Plug	50694
16	Seal Ring	8779
	Oil Wick Ass'y.	50985-0002
17	Fitting	50695
18	Oil Wick	50721-0002
19	Housing Cap Gasket	39638
20	Spade Handle	21135
21	Nut	21136
	Air Motor Assembly (Consists of Key Nos. 22 thru 27)	21462
22	Motor Ball Bearing (2)	21469
23	Rotor	21463
24	Motor End Plate (2)	21465
25	Key Dowel (3)	21467
26	Rotor Blade (Set of 6)	21468
27	Cylinder Liner	21464
	Motor Housing Assembly (Consists of Key Nos. 28 thru 30)	40567
28	Motor Housing	40566
29	Reversing Valve Bushing	39642
30	Thrust Plug	39635
31	Reversing Plug	21169
32	Transfer Plate Gasket	39624

KEY NO.	DESCRIPTION	PART NO.
33	Tubular Guard	21098
34	Valve Lever	21078
	Bleeder Valve Sub-Assembly (Consists of Key Nos. 36 thru 39)	39845
35	Bleeder Valve Bushing Gasket (0-2)	39801
36	Bleeder Valve Guide Bushing	39846
37	Bleeder Valve Cap	39847
38	Bleeder Valve Spring	21111
39	Bleeder Valve Plunger	40025
40	Circular Gasket (2)	21157
41	Valve Housing Guide Ring	41075
42	Seal Ring (2)	28177
43	Universal Joint	21160-0001
44	Valve Stud (4)	21113
45	Stop Nut (4)	21114
46	Servo Valve Plunger	21105-0001
47	Seal Ring	21492
48	Servo Valve Spring	21106
49	Seal Ring	21112
50	Throttle Control Link (2)	21102
51	Shoulder Screw (2)	21096
52	Seal Ring	21989
53	Throttle Plunger	21103-0001
54	Throttle Spring	21480
55	Throttle Cap Strainer	21677
56	Throttle Cap	21121
57	Street Elbow (1/2-14)	21187
58	Servo Valve Seat Gasket	6562
	Servo Valve Seat Assembly (Consists of Key Nos. 59 thru 62 and 42)	21180
59	Servo Valve Plug	21109
60	Servo Valve Seat	21107
61	Filter Bearing	21170
62	Choke Pin	21166
	Valve Housing Sub-Assembly (Consists of Key Nos. 41 and 64 thru 66)	21704
64	Valve Housing	21115
65	Bleeder Valve Seat	40022
66	Servo Valve Bushing	21454
67	Pipe Plug	51189

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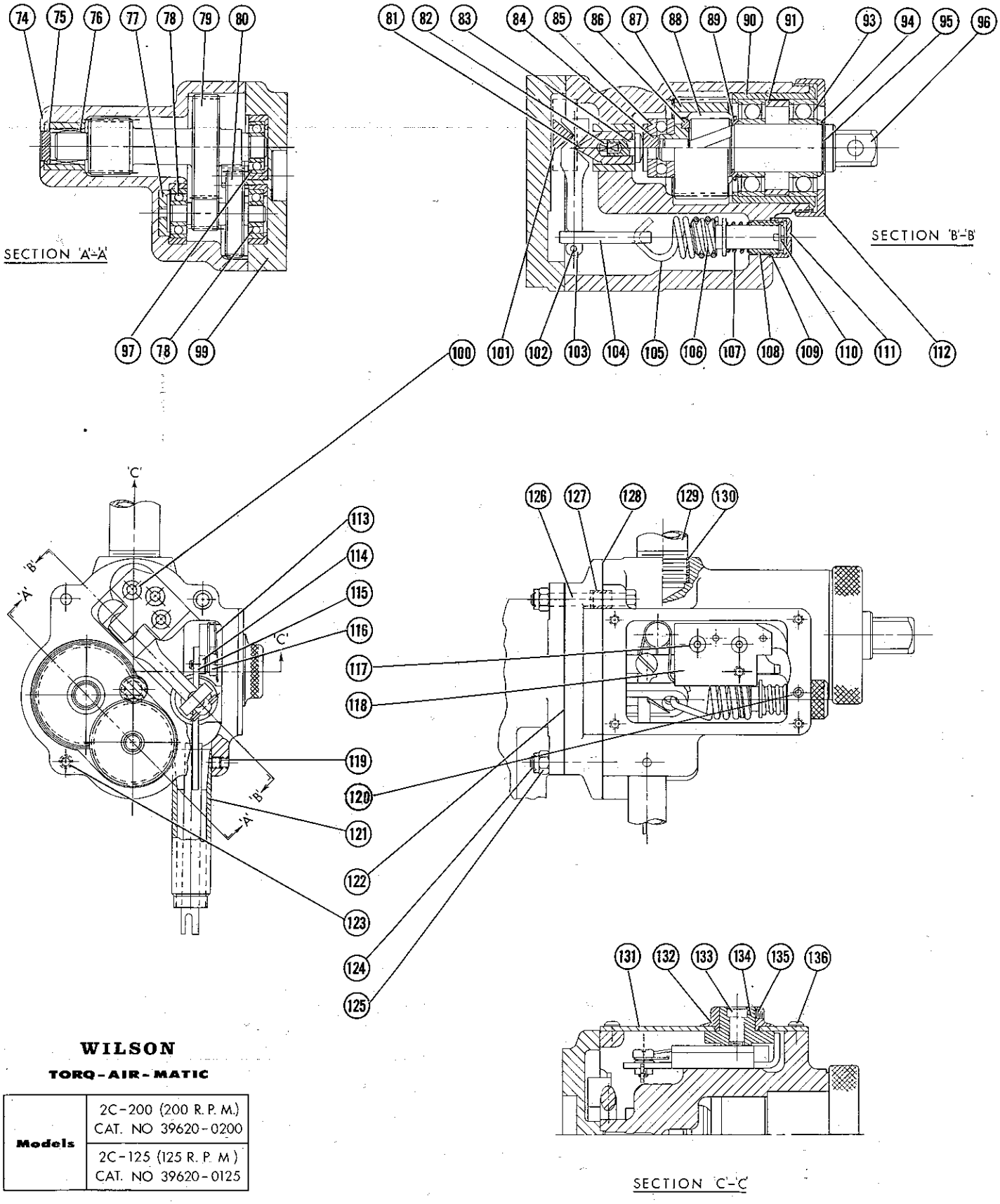

WILSON

TORQ-AIR-MATIC

Models	2C-200 (200 R. P. M.) CAT. NO 39620-0200
	2C-125 (125 R. P. M.) CAT. NO 39620-0125

THOMAS C. WILSON, INC. 212-729-3360

21-11 44TH AVENUE, LONG ISLAND CITY, NEW YORK, 11101 CABLE 'TUBECLEAN' NEW YORK

WILSON MODEL '2C' TORQ-AIR-MATIC EXPANDER CONTROL

KEY NO.	DESCRIPTION	MODEL 2C-0200 PART NO.	MODEL 2C-0125 PART NO.
	Gear Housing Ass'y. (Consists of Key Nos. 74 thru 77, 119, 120, 123, 124, 130)	21127	21127
74	Gear Housing	21085	21085
75	Bearing Knockout Plug	21108	21108
76	Needle Bearing	21090	21090
77	Bearing Knockout Plate	21140	21140 — 53254
78	Ball Bearing (No. 1) (2)	21091	21091
79	Second Intermediate Gear	21061	39626
80	First Intermediate Gear	21134	39625
	Thrust Pivot Ass'y. (Consists of Key Nos. 81 thru 83)	21179	21179
81	Thrust Pivot	21071	21071
82	Thrust Pivot Spring	21175	21175
83	Thrust Pivot Plunger	21174	21174
84	Torque Thrust Pad	21070	21070
	Torque Drive Shaft Sub-Ass'y. (Consists of Key Nos. 85 thru 96)	21177-0200	21177-0125
85	Torque Thrust Bearing	21089	21089
86	Torque Thrust Collar	*	**
87	Spindle Gear	*	**
88	Torque Drive Pin (8)	*	**
89	Pin Stop Collar	21065	21065
90	Ball Bearing Case	53453	53453
91	Bearing Safety Spacer	21172	21172
93	Torque Drive Bearing (2)	21088	21088
94	Bearing Shim Washer	21066	21066
95	Spirolox Ring	21117	21117
96	Torque Drive Shaft	*	**
	Transfer Plate Assembly (Consists of Key Nos. 78 thru 80, 97 and 99)	21184-0200	21184-0125
97	Ball Bearing (No. 2)	21189	21189
99	Transfer Plate	21084	21084
	Control Spring and Main Lever Sub-Ass'y. (Consists of Key Nos. 110, 111 and 100 thru 108)	21182	21182
100	Socket Head Cap Screws (3)	21068	21068
101	Fixed Pivot	21072	21072
102	Roll Pin	28062	28062
103	Main Lever	21073	21073
104	Control Spring Link	21074	21074
105	Spring	21075	21075
106	Calibrator	21076	21076
107	Calibrator Spring	21408	21408
108	Calibrator Bushing	21450	21450
109	Calibrator Bushing Gasket (0-3)	39799	39799
110	Retaining Ring	20712	20712
111	Calibrator Seal	21713	21713
112	Retaining Cap	21086	21086
	Bleeder Valve Lever Sub-Ass'y. (Consists of Key Nos. 113 thru 116)	21183	21183
113	Torque Spring	21104	21104
114	Cam Control Arm	21079	21079
115	Bleeder Valve Lever Ass'y.	21078	21078
116	Spring Retaining Screw	21077	21077
117	Cap Screws (2)	31803	31803
118	Guide Plate	21080	21080
119	Socket Set Screw	39806	39806 — 42854 & 42877
120	Set Screw (Nylon Point)	40015	40015
121	Tubular Guard	21098	21098
122	Transfer Plate Gasket	39624	39624
123	Heli-Coil Insert (5)	28208	28208
124	Control Stud (2)	39643	39643
125	Stop Nut (4)	21114	21114
126	Cap Screw (2)	39644	39644
127	Tube Dowel	21087	21087
128	Gear Housing Gasket	21155	21155
129	Dead Handle	21123	21123-0001
130	Heli-Coil Pipe Insert	7844	7844
131	Cover Plate	39629	39629
132	Control Knob	39630	39630
133	Cam Lock Screw	21082	21082
134	Control Cam	39750	39750
135	Socket Set Screw (2)	25232	25232
136	Button Head Socket Screws (4)	21092	21092

* Part of 41111-0200 ** Part of 41111-0125

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repair procedures

procedure A

Reference: Page No. 9

A-1 Unscrew and completely remove servo valve seat assembly (Key No. 59 thru 62) from end of valve housing subassembly (Key No. 64).

A-2 Disassemble servo valve seat assembly by unscrewing bronze servo valve seat (Key No. 60) from steel servo valve plug (Key No. 59) and thoroughly clean or replace air filter (porous bronze cylinder - Key No. 61). When clogged, this filter will prevent servo valve from automatically shutting machine off.

A-3 Clean Bleed Hole in servo valve seat (Key No. 60) but do not enlarge it.

A-4 Oil servo valve cavity in Steel Insert with light oil (SAE No. 10) and press servo valve plunger (Key No. 46) up and down several times to insure free operation.

A-5 Hole on side of valve housing subassembly (Key No. 64) must be free and unobstructed.

A-6 Reassemble servo valve seat assembly and replace it. Be careful not to crush porous bronze air filter (Key No. 61). Tighten valve seat assembly securely; do not hand-tighten this assembly.

A-7 Test machine under load and it should now function correctly.

procedure B

Reference: Page No. 9

B-1 With machine connected to live air line, loosen servo valve seat assembly (Key No. 59 thru 62) 7/8" of a turn out of the valve housing subassembly (Key No. 64).

B-2 Then roll live handle throttle sleeve (Key No. 1) forward with a steady and firm grip to operate the tool.

B-3 If it still stops rotating prematurely, release trigger and listen for a clicking sound which indicates that servo valve plunger (Key No. 46) has been reset.

B-4 Tighten servo valve seat assembly approximately 1/8 of a turn into valve housing subassembly and repeat test of tool as in Step No. 2 above.

B-5 Repeat Step No. 4 until a point of proper action is found and machine does not stop rotating prematurely.

B-6 Then put tool to use under load and tighten servo valve seat in stages periodically during use until machine runs correctly with servo valve seat fully tightened.

NOTE:

If the preceding steps do not correct premature servo valve shut off of unit or if the tool has not been used recently and corrosion of parts is a possibility, proceed as follows:

B-7 Unscrew and completely remove servo valve seat assembly from valve cap assembly.

B-8 Check Valve Seat surface in bronze servo valve seat (Key No. 60) for nicks, scratches or burrs which would prevent small valve chamfer of servo valve plunger (Key No. 46) from seating properly and producing an effective air seal.

B-9 Also check that Bleed Hole (.028 diameter maximum) above center hole in servo valve seat has not become enlarged.

B-10 After oiling servo valve cavity in Steel Insert with light oil (SAE No. 10), push servo valve plunger up and down a few times and check that it rises easily to the top of servo valve Steel Insert within the aluminum valve housing subassembly (Key No. 64).

B-11 Check Bleeder Valve Hole under bleeder valve plunger (Key No. 39) to see that it is clean and clear. Clean if necessary with a hooked wire from inside of steel servo valve insert (1/16 diameter wire or less).

B-12 Pull out servo valve plunger (Key No. 46) from within Steel Insert cavity with long-nosed pliers for inspection of seal rings. Do not damage seal surface of plunger.

B-13 Now check large seal rings (Key No. 42 and 47) on servo valve seat and servo valve plunger for wear or cuts and replace them where necessary. Improper sealing by either of these seals will cause premature shut off of the Torq-Air-Matic.

When replacing servo valve plunger into steel insert cavity, apply liberal coating of "O" ring lubricant (i.e. Super-O-Lube, Parker) to seal rings prior to insertion. Exercise caution to prevent damage to seal ring from inside edge of steel insert.

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B-14 When all above items have been checked and corrected as necessary, reassemble machine complete and first retest unit at about 25 foot pounds of torque. It should now function correctly.

procedure C

Reference: Page No. 9

Part 1

C-1 Unscrew and completely remove servo valve seat assembly (Key No. 59 thru 62) from end of valve housing subassembly (Key No. 64).

C-2 Oil servo valve cavity in Steel Insert with light oil (SAE No. 10) and press servo valve plunger (Key No. 46) up and down several times to insure free operation.

C-3 Pull servo valve plunger out from within Steel Insert with long-nosed pliers. Do not damage valve seal surface of plunger.

C-4 Remove servo valve spring (Key No. 48).

C-5 Replace servo valve plunger without servo valve spring.

C-6 Replace servo valve seat assembly and tighten it up.

C-7 Reset servo valve plunger by blowing air in oil hole with blow gun.

C-8 Connect tool to live air line and roll live handle throttle sleeve (Key No. 1) forward slowly to feather throttle for very slow machine start up. Do not apply any load on square spindle nose of tool.

C-9 Torq-Air-Matic will start up and servo valve will quickly cut off machine.

Part 2

If machine stops completely, previous failure was due to servo valve spring interference. That is, spring solid height is too great for servo valve spring cavity remaining after servo valve plunger has seated itself.

C-10 Grind each spring end down to reduce servo valve spring's solid height by 1/64" approximately.

C-11 Unscrew and completely remove servo valve seat assembly and pull out servo valve plunger from within Steel Insert cavity with long-nosed pliers. Do not damage seal surface of plunger.

C-12 Reassemble servo valve spring, plunger and seat assembly in given order. Tighten up servo valve seat.

C-13 Unscrew bleeder valve cap (Key No. 37) and remove completely.

C-14 Connect tool to live air line and test free of any load on square spindle nose. Roll live handle throttle sleeve forward firmly so that machine receives full air.

C-15 Depress bleeder valve plunger (Key No. 39) by hand to trip servo valve and stop rotation of tool.

C-16 If tool still fails to stop rotating when servo valve trips, repeat Steps No. 1, 3, 4, 10, 12 and 14.

Part 3

If Torq-Air-Matic did not stop completely but only slowed down when tested according to Steps No. 5 through 9, then failure is due to improper seating and sealing of the servo valve plunger at plunger seat.

C-17 Repeat Step No. 11 and examine valve chamfer on 9/16" diameter end of servo valve plunger for nicks, scratches or breaks which would cause imperfect valve sealing. Replace if such damage is found.

C-18 Check large and small seal rings on servo valve plunger (Key No. 47 and 49) and replace if they are found defective, that is cut or broken.

C-19 Look down into valve cap assembly through Steel Insert and examine valve seat surface of insert within valve housing subassembly. Lap servo valve plunger and this part together if major defects such as scoring of seat or heavy cuts are found, otherwise gently tap servo valve plunger and seat together to reform seat and obtain the necessary air seal. Rotate servo valve plunger a partial turn between taps.

C-20 Reassemble servo valve spring plunger with both seals and seat assembly in valve housing subassembly.

C-21 Connect assembled tool with bleeder valve cap still off to a live air line and test by rolling live handle throttle sleeve

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forward firmly to deliver full air to machine. Manually trip servo valve by depressing bleeder valve plunger (Key No. 39) all the way down. Tool should now function correctly.

C-22 Screw bleeder valve cap back onto guide bushing (Key No. 36) in valve housing subassembly.

C-23 Retest machine under load.

procedure D

Reference: Page No. 3

Part 1

D-1 Check air pressure at tool. For maximum power output, air pressure at tool should be at least 90 pounds per square inch.

D-2 Check air compressor capacity. Tool must receive approximately 55 cubic feet of air per minute to produce maximum torque.

D-3 Check size of air hose for conformity to manufacturer's recommendations. Hose should have a 3/4" minimum inside diameter and be no more than 25 feet in over-all length. However, a 1/2" inside diameter whip 8 feet long can be used as part of the 25 foot long hose. This is the hose presently supplied under our Part No. 21190.

D-4 Check that hose connection does not act as a choke and lower either air pressure or amount of air entering machine. This would be the case if small nipples or reducing fittings were used in place of a direct hose connection.

Part 2

If the above has been checked and found satisfactory but lack of power still persists with machine operating forward and reverse, proceed as follows:

D-5 Disassemble air motor (See procedure and illustration under Disassembly Procedure, Page 6) and check all four (4) rotor blades (Part No. 21468) for lateral grooves, nicks, scratches, burrs and excessive wear on edge or either side. Replace if necessary in a set of six (6) only.

D-6 Also check both motor ball bearings (Part No. 21469) for wear, dirt, excessive play or insufficient lubrication. Replace both bearings if any of the preceding are present in either one. If excessive wear occurs in ball bearings, rotor drum will drag on and score cylinder liner internal surface and end plate Wear Surfaces.

D-7 Check each motor end plate (Part No. 21465) for rubbing or scoring on Wear Surface and replace it when necessary.

D-8 Examine cylinder liner (Part No. 21464) for excessive blade scoring and replace if internal surface is no longer fairly true or is heavily scored.

D-9 Check that Rear Shaft of rotor (Part No. 21463) slips into ball bearing easily but snugly. There should be no play or looseness here.

D-10 Examine rotor Drum Surface for scoring, burning or other signs of wear.

D-11 Check fit of rotor blades in rotor slots. They should fit freely with minimum side play and should fall easily and evenly out of their slots. Stone blade slot edges where necessary to insure free fit and movement of rotor blades.

D-12 Check press fit of rotor Pinion Shaft in ball bearing. It should hold rotor in position securely without making inner bearing race tight on bearing balls. Tightness in this respect will slow down rotation of pinion shaft in ball bearing. Emery pinion shaft slightly where necessary to loosen press fit.

D-13 Replace rotor if Rear Shaft slip fit is sloppy, Pinion Shaft press fit is too loose, or excessive wear or damage shows on rotor Drum Surface.

D-14 Check all three key dowels (Part No. 21467) in cylinder liner and both end plates for damage or loose fit and replace where necessary.

D-15 Reassemble air motor as shown on Page 6. Be sure clearance specified between Wear Surfaces of rotor Drum and end plate assembly on rotor Pinion Shaft is maintained. Check this with a feeler gage.

D-16 Reassemble air motor in motor housing. See Reassembly Procedure on Page 6. Test Assembly by turning rotor pinion by hand, and it should turn very freely. Also, it should be possible to turn the 3/4" square spindle nose easily by hand after complete reassembly of tool.