

# **Shop Manual**

# **150A 150FA**

## **CRANE**

### **SERIAL NUMBERS**

**150A -09695 - 10827**

**150FA -09695 - 10827**

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October 2002

# Shop Manual Set SMC-150FA

Covers Model 150-FA  
S/N All Serial Numbers

## Contains the sections listed below:

1	A-01.20	ROSS POWER STEERING GEAR (G-R-C)
2	B-02.10	TORQUE CONVERTER (MODEL C272 & C273) (G-C)
3	C-07.00	TRANSMISSION (CLARK 2420) (G-C)
4	C-10.00	TRANSMISSION (TT-2241-1) ALLISON (C)
5	E-02.03	PRIMARY MANIFOLDS AND CONTROLS (C)
6	E-02.04	PRIMARY MANIFOLD AND CONTROLS (C)
7	E-02.40	SECONDARY MANIFOLD ASSEMBLY (C)
8	E-03.10	HYDRAULIC CRANE CYLINDERS (C)
9	E-03.11	POLYURETHANE ONE PIECE ROD SEAL USED ON BOOM CYLINDERS (C)
10	E-03.12	HYDRAULIC CRANE BOOM LIFT CYLINDER (C)
11	E-03.13	DUAL CROWD CYLINDER - FOUR SECTION POWER BOOM (C)
12	E-10.10	HYDRAULIC WINCH MOTOR (COMMERCIAL SHEARING) (C)
13	E-11.30	SWING DRIVE MOTOR (COMMERCIAL SHEARING) (C)
14	E-12.01	TANDEM PUMP (COMMERCIAL SHEARING MODEL 25X) (C)
15	E-14.00	SWING COUNTERBALANCE VALVE (C)
16	E-15.00	HYDRAULIC TROUBLESHOOTING (C)
17	F-06.20	BOOM WINCH ASSEMBLY (C)
18	F-10.00	SPRING MOTORS (C)
19	G-06.00	PLANETARY DRIVE AXLE (CLARK SERIES DS-12152) (C)
20	G-07.00	ROCKWELL AXLE ASSEMBLY (C)
21	G-07.10	CLARK AXLE ASSEMBLY (C)
22	J-02.00	LUBRICATION SPECIFICATIONS (G-R-P-C-M)
23	K-02.00	WAGNER POWER MASTER CYLINDER USED WITH FOUR WHEEL SERVICE BRAKES (G-C)
24	K-06.00	DELCO MORAINÉ HYDRAULIC POWER BRAKE ASSEMBLY (WITH ROCKWELL AXLES ONLY) (C)
25	K-06.50	BENDIX MASTER CYLINDER & POWER BOOSTER (C)
26	K-07.00	MINNESOTA BRAKE VALVE (G-P-C)
27	K-10.30	DELCO MORAINÉ POWER BOOSTER (C)
28	L-03.00	WIRING DIAGRAMS - CRANES (C)
29	L-10.00	TROUBLESHOOTING & REMOVAL OF CRANKING MOTORS (M-P-G-R-C)
30	L-11.00	TROUBLESHOOTING & REMOVAL OF ALTERNATORS (M-G-P-R-C)
31	N-03.40	PRE-DELIVERY PROCEDURES (C) (NOT INCLUDED - LISTED FOR REFERENCE ONLY)
32	O-01.00	HEAD AND HOOK BLOCK (C)
33	O-03.00	DRESSER HYDRAULIC CRANE - WIRE ROPE SPECIFICATION (C)
34	Y-01.00	GENERAL TORQUE VALUES (G-R-P-C-M)

# Shop Manual

# A-1.20 C6

## ROSS POWER STEERING GEAR

<b>APPLICABLE GRADER MODELS</b>	<b>SERIAL NUMBERS..</b>
118A	07245 thru 07600
118B	07601 thru 10750
118C	10751 thru 12013
104A	07245 thru 07600
104B	07601 thru 10750
104C	10751 thru 12013
104HA	07245 thru 07619
104HB	07620 thru 10693
160B	02155 thru 02714
160C	02715 thru 03029
160L	02121 thru 03083
T500A	02601 thru 07994
T500L	02944 thru 07994
T600B	01501 thru 02535
<b>APPLICABLE ROLLER MODELS</b>	<b>SERIAL NUMBERS</b>
PTR 9-Wheel Roller	00101 thru 05678
<b>APPLICABLE CRANE MODELS</b>	<b>SERIAL NUMBER§</b>
80	01001 thru 03131
90 thru 125	01150 thru 08774
90A thru 125A	02006 thru 08774
125F	07247 thru 08774
125FA	07990 thru 08774
140F	07571 thru 08774
150A	02832 an3 Up
150FA	07305 and Up
200FA	09401 and Up

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# CAUTION

**ALL** COMPONENTS MUST BE PROPERLY SUPPORTED DURING DISASSEMBLY AND ASSEMBLY.

**ALL** JACKING, HOISTING, AND GENERAL WORKSHOP EQUIPMENT REQUIRED FOR THIS OPERATION MUST BE IN GOOD WORKING ORDER.

**EXTREME** CAUTION TO BE OBSERVED AT ALL TIMES TO PREVENT INJURY.

**SAFE** WORKSHOP PRACTICES ARE A MUST.

## GENERAL TORQUE VALUES

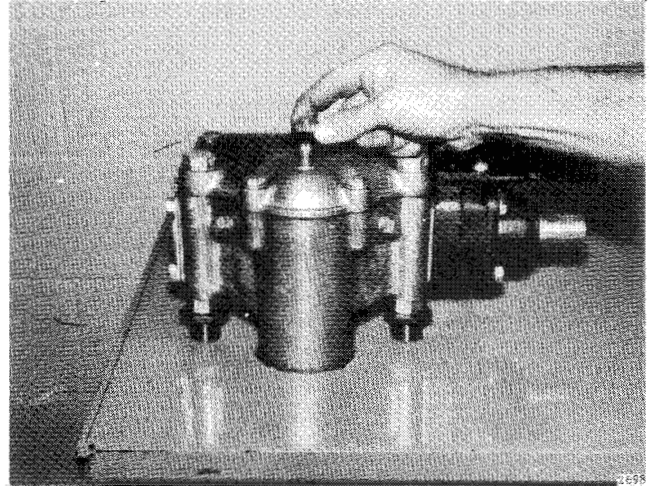
The following General Torques are to be used in all cases where SPECIFIC TORQUES are not given.

NOTE: Torque Values listed throughout this manual are Lubricated (Wet) Threads; values should be increased 1/3 for Non-Lubricated (Dry) Threads.				
Thread Size	Heat treated material Grade 5 & Grade 8			
	Grade 5 (3 radial dashes on bolt or cap screw head)		Grade 8 (6 radial dashes on bolt or cap screw head)	
	Foot Pounds (Ft. Lbs.)	Newton Meters (Nm)	Foot Pounds (Ft. Lbs.)	Newton Meters (Nm)
1/4 - 20	6	8	9	12
1/4 - 28	7	9	11	15
5/16 - 18	13	18	18	24
5/16 - 24	15	20	21	28
3/8 - 16	24	33	34	46
3/8 - 24	27	37	38	52
7/16 - 14	38	52	54	73
7/16 - 20	42	57	60	81
1/2 - 13	58	79	82	111
1/2 - 20	65	88	90	122
9/16 - 12	84	114	120	163
9/16 - 18	93	126	132	179
5/8 - 11	115	156	165	224
5/8 - 18	130	176	185	251
3/4 - 10	205	278	290	393
3/4 - 16	230	312	320	434
7/8 - 9	305	414	455	617
7/8 - 14	335	454	515	698
1 - 8	455	617	695	942
1 - 14	510	691	785	1064
1 1/8 - 7	610	827	990	1342
1 1/8 - 12	685	929	1110	1505
1 1/4 - 7	860	1166	1400	1898
1 1/4 - 12	955	1295	1550	2102
1 3/8 - 6	1130	1532	1830	2481
1 3/8 - 12	1290	1749	2085	2827
1 1/2 - 6	1500	2034	2430	3295
1 1/2 - 12	1690	2291	2730	3701
1 3/4 - 5	2370	3213	3810	5166
2 - 4 1/2	3550	4813	5760	7810

DISASSEMBLY:

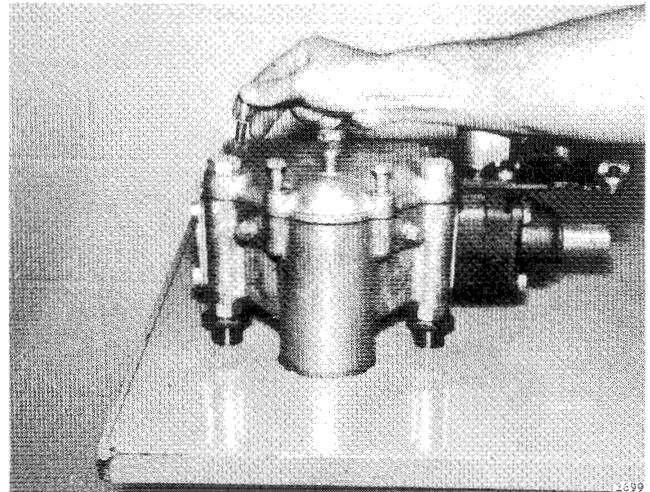
1

Remove adjusting screw lock nut.



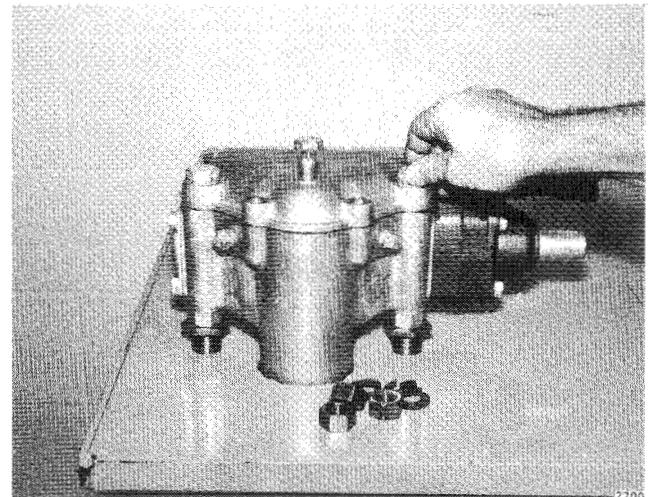
2

Remove small cap screws from cover.



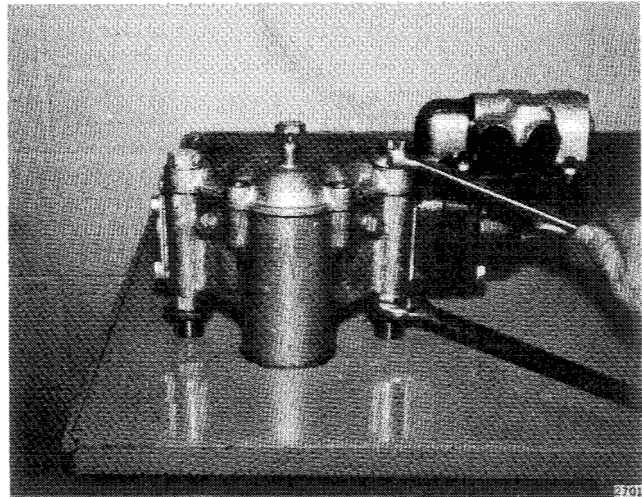
3

Remove nuts and washers from ends of larger cover bolts (beneath steering gear mounting pad), if so equipped.



4

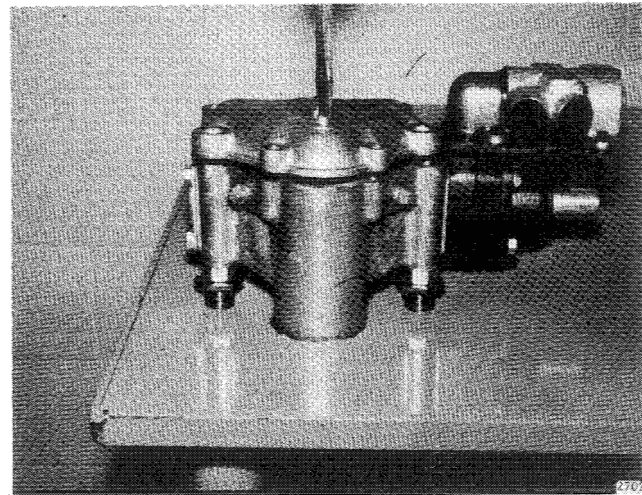
Remove large cover retaining bolts: **if so** equipped.



5

On previous models (with shim-adjusted lever shaft), cover may now be lifted off. Proceed to Step 9 on page 4.

On later models (with screw-adjusted lever shaft), use screwdriver to turn adjusting screw clockwise. This **will lift** cover from housing. Screw must be turned all the way through the housing. Proceed to Step 6 on page 3.

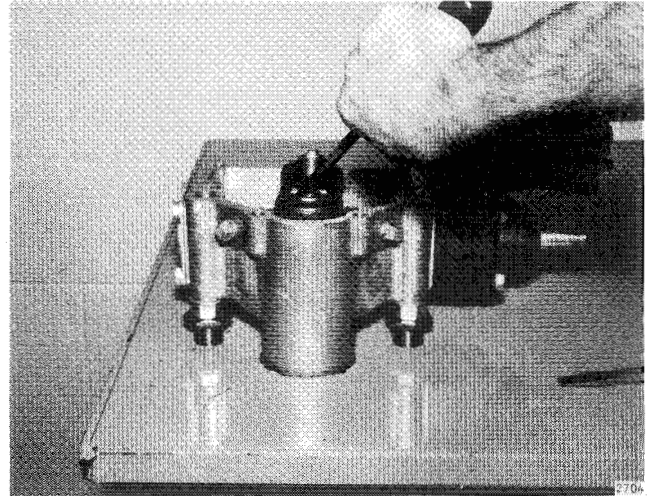


Some previous model motor graders and all rollers and cranes with the Ross unit are equipped with a one-piece steering shaft. The pitman arm is splined to the lower end of the lever shaft in these models.

To remove the pitman arm from the lever shaft, remove nut and washer from splined end. Raise lever shaft and insert wood block under splined end to raise stud roller bearing away from cam. This prevents damage to stud roller bearing and cam. Then drift pitman arm from shaft.

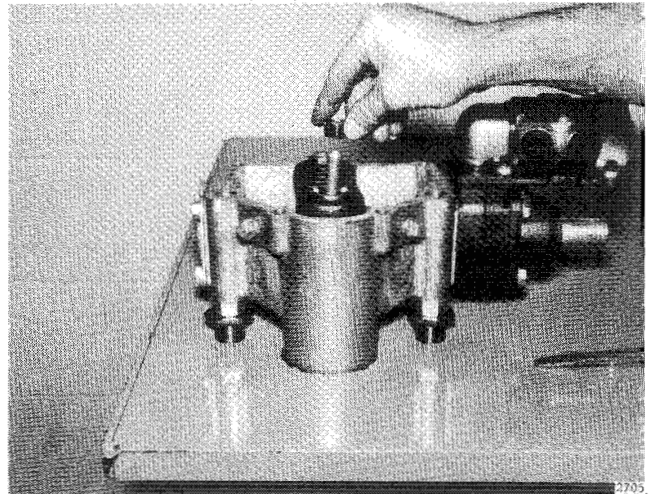
6

Pry staked portion of adjusting screw lock nut from slot in lever shaft.



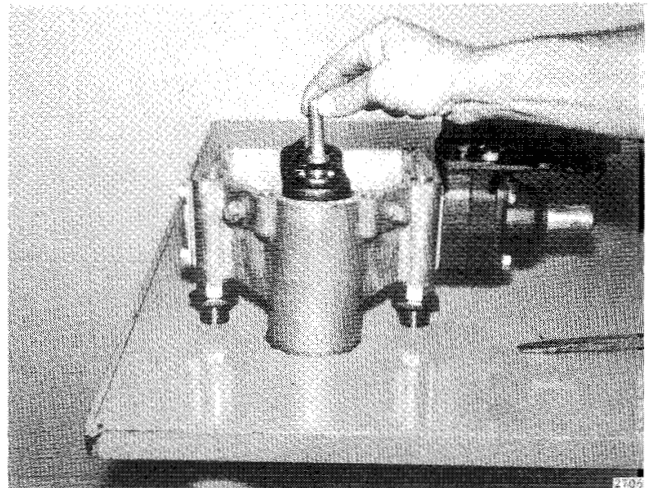
7

Remove adjusting screw lock nut.



8

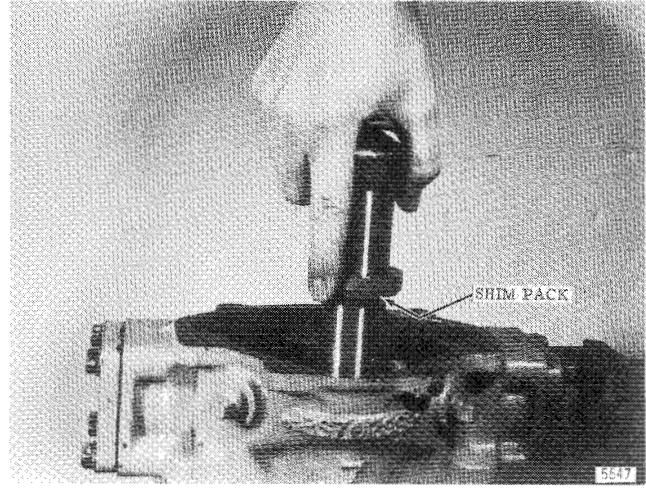
Lift adjusting screw from pocket in lever shaft.



9

On previous models (with shim-adjusted lever shaft), remove lever shaft and shim pack from gear housing. Keep shim pack intact.

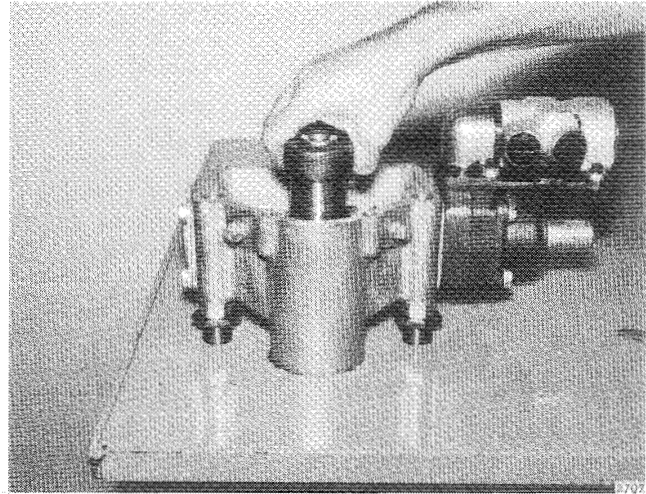
This step is normally done only if to replace shaft, bushings or seal. If none of these replacements are required, slide lever shaft up, rotate 180°, and rest lever on back of case.



10

On later models (with screw-adjusted lever shaft), no shim pack is used to adjust lever shaft stud roller to cam. Adjusting screw holds lever shaft in position.

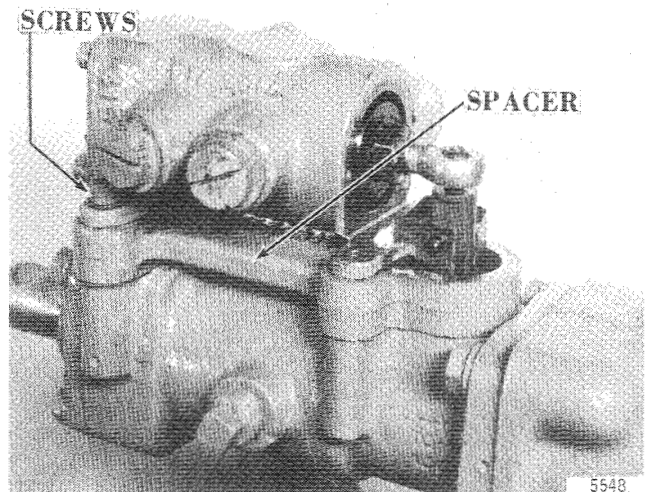
Remove lever shaft only if to replace shaft, bushings or seal. If not required, then slide lever shaft up, rotate 180°, and rest lever on back of case.



11

Remove four (4) socket head cap screws holding valve, valve spacer, and cover to control (or actuator) housing. Actuating lever, pin, seal and washer will be removed with the valve.

Previous valve configuration is pictured. Service to this assembly is illustrated on page 11.

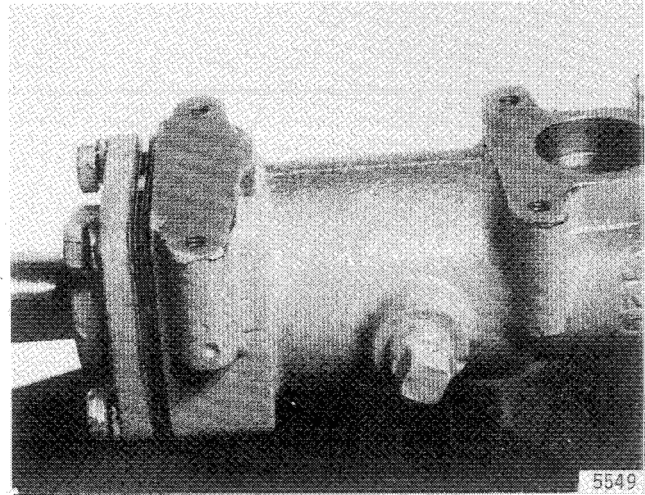




12

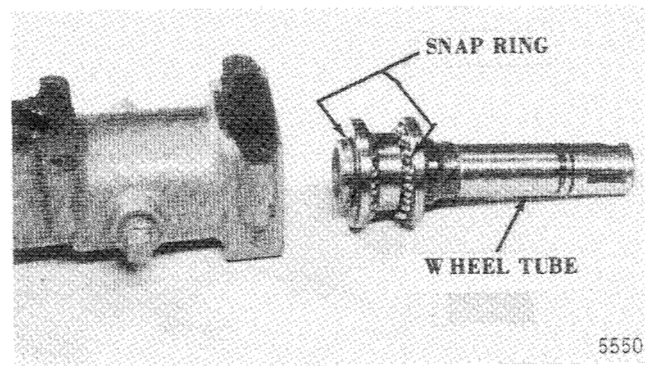
On previous models (with one-piece control or actuator housing) remove four (4) cap screws, cover, shims, and gaskets. Wheel tube can now be removed. Inspect bearings and splines for serviceability.

On models with two-piece (separate upper cover and actuator) actuator housing, proceed to Step 18 on page 7.



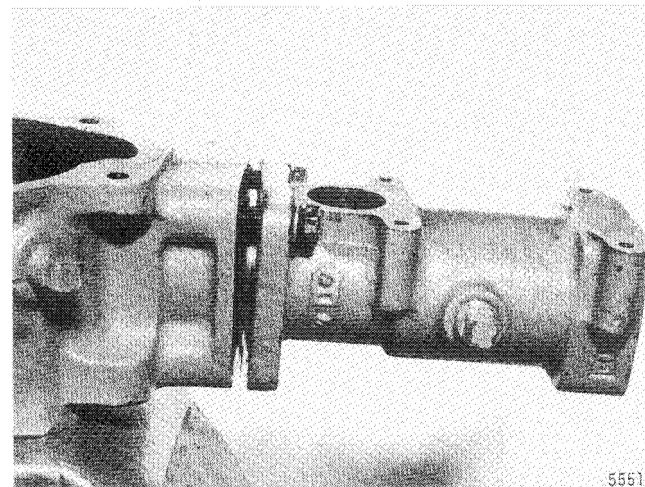
13

Wheel tube bearings can be replaced by removing retaining snap rings. It appears that each bearing is missing one ball--this is correct. Balls must be replaced by sets only.



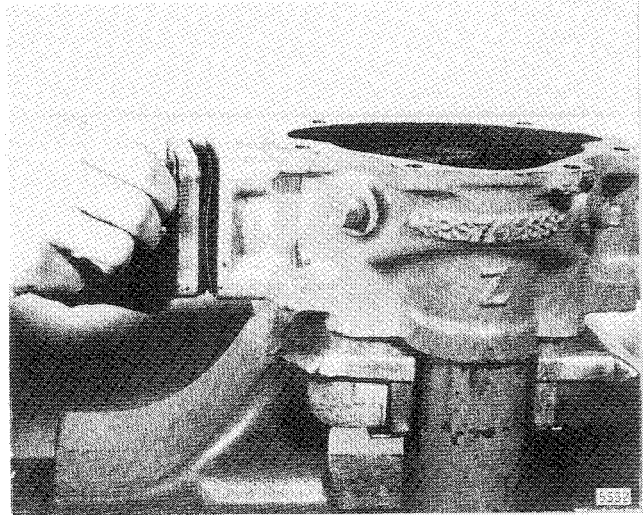
14

Remove cap screws, control housing, and gasket. Inspect control housing for internal bearing race wear.



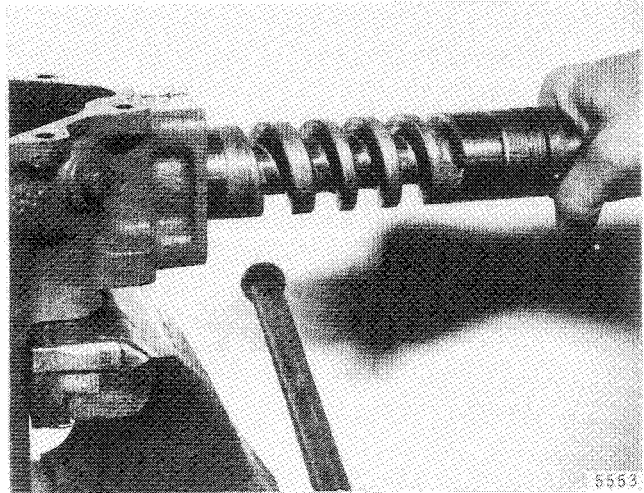
15

Remove cap screws, shims, gaskets, sleeve retainer, and end cover. Cam assembly can now be removed.



16

Remove cam assembly.

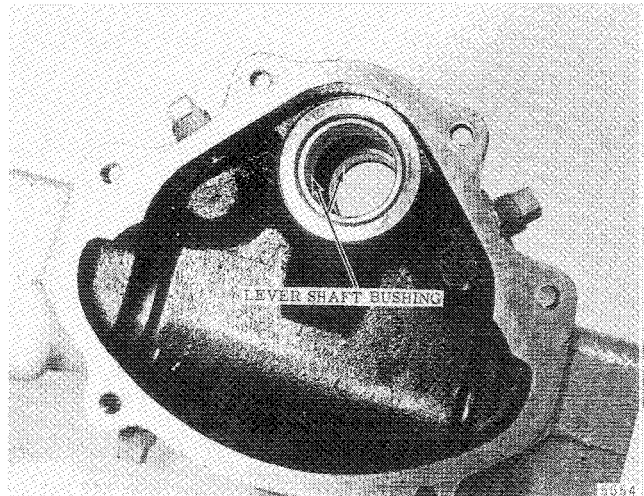


17

Inspect case at mounting for wear or breakage.

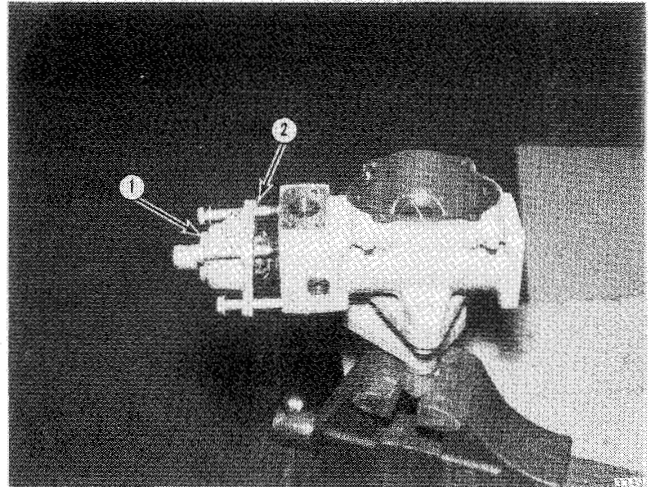
Inspect lever shaft bushing for wear or damage and replace as required.

Proceed to Step 24 on page 9.



18

On models with two-piece (separate upper cover and actuator) actuator housing, remove cover (1) and gasket (2).



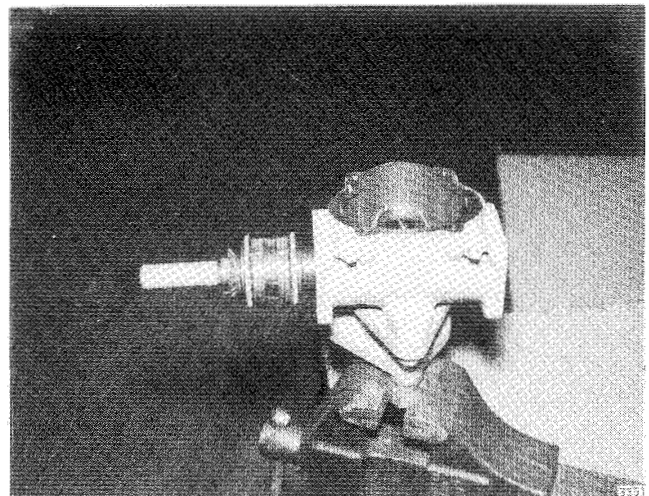
19

Remove actuator retainer screw and washer, then remove actuator housing and gasket.



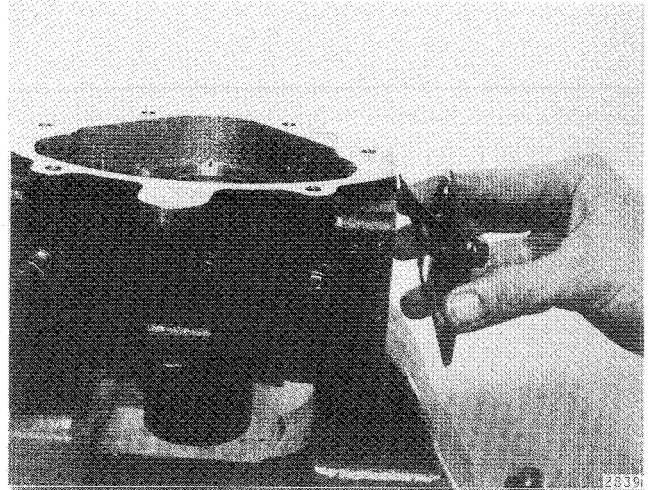
20

Remove cam and actuator assembly.



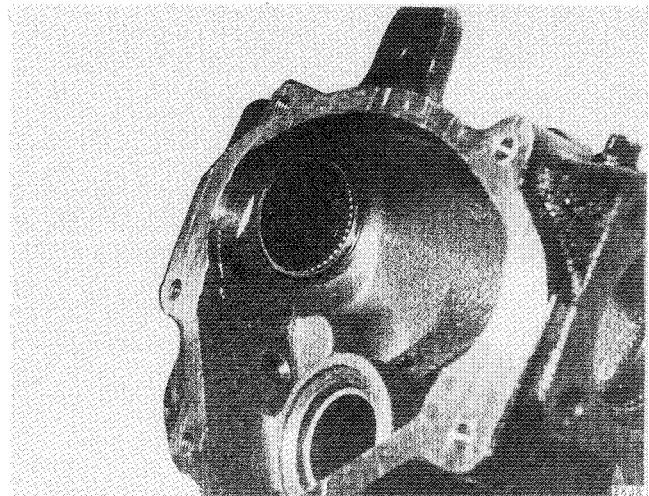
21

If cam assembly bearings require replacement, remove end cover and gasket.



22

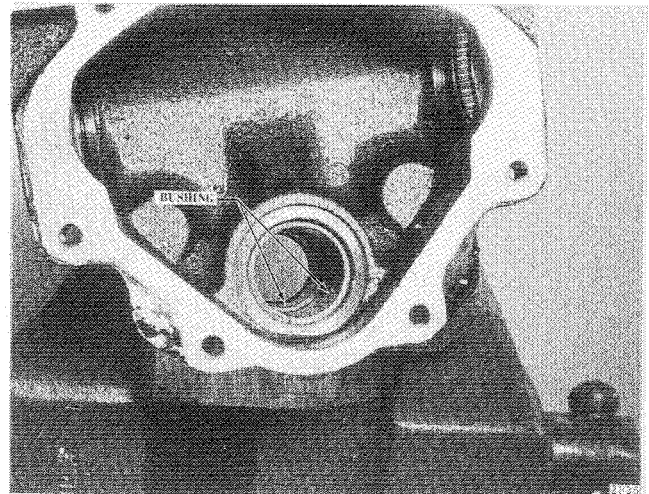
Reassemble needle bearings into housing. Press to locating ring with extreme care.



23

Inspect case at mounting for wear or breakage.

Inspect lever shaft bushing for wear or damage and replace as required.

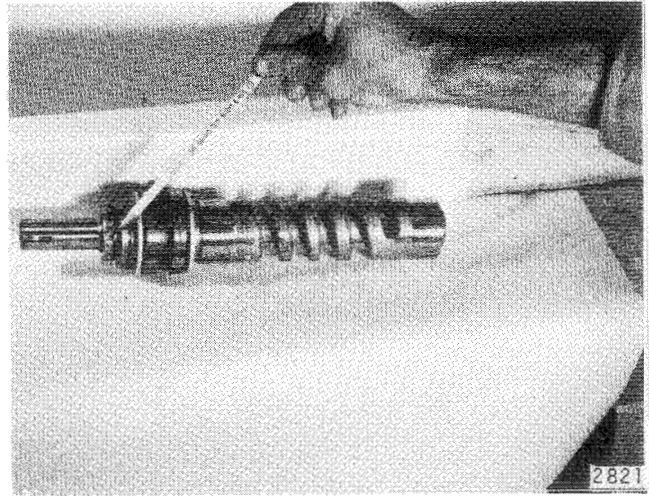


## SERVICE TO CAM & ACTUATOR ASSEMBLY

24

Later models with two-piece actuator housing employ an actuator unit assembled on the cam.

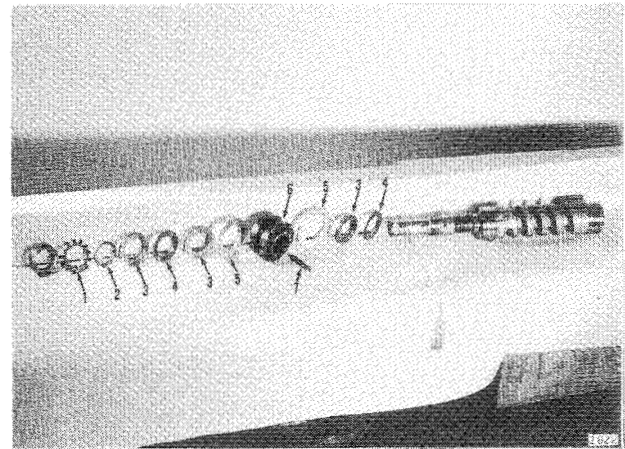
Remove adjusting nut after straightening bent prong on lock washer.



25

Remove lock washer (1), tongued washer (2), thrust washers (3), needle bearing (4), and upper centering washer (5) from above actuator. Do not lose springs (7) in actuator.

Remove lower centering washer (5), thrust washer (3), and needle bearing (4) after removing actuator (6).



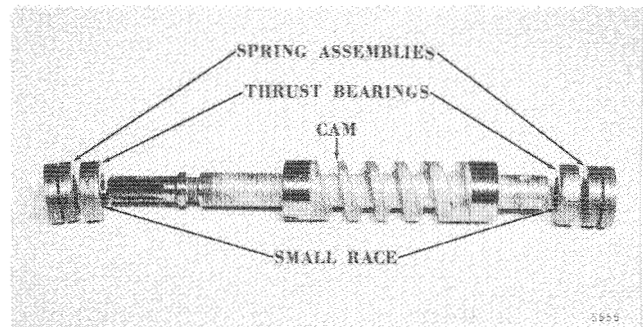
26

Inspect cam for damage and excessive wear. Check cam groove for chipping, scoring, or brinnelling. Check cam bearing surfaces and splines. Wearina away of copper platina is natural and will come in time to all cams.

Pictured is the cam assembly used in previous units with one-piece control housing. Spring assemblies are not adjustable. They are factory set. The smaller race of the thrust bearing should be located next to the cam.

On later models with two-piece actuator housing, reassemble actuator assembly on cam wheel tube assembly and adjust. Prior to assembly, make sure that threads are straight and that nut can be run down by finger torque all the way. Assemble in order shown in Step 25.

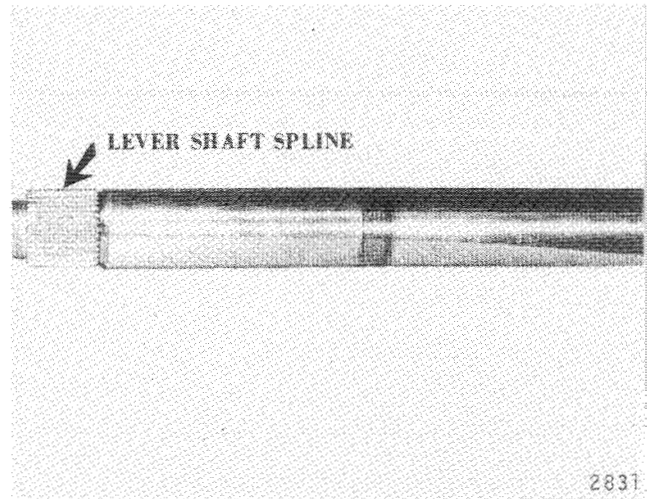
Tighten nut to 10 ft.-lbs. torque. Then back off nut 10° or 5/32" (the width of a lug on the locking washer). This adjustment must result in a light pre-load on bearings but allow NO end play of actuator on shaft.



## SERVICE TO LEVER SHAFT & STUD ASSEMBLY

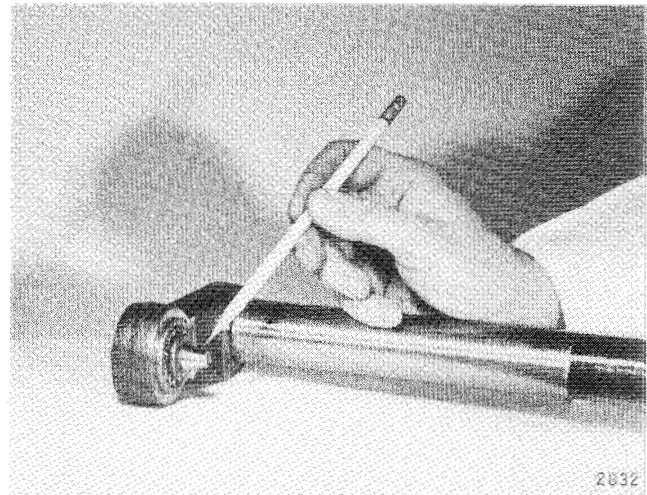
27

Check shaft splines and threads on lever shaft.  
Reolace if needed.



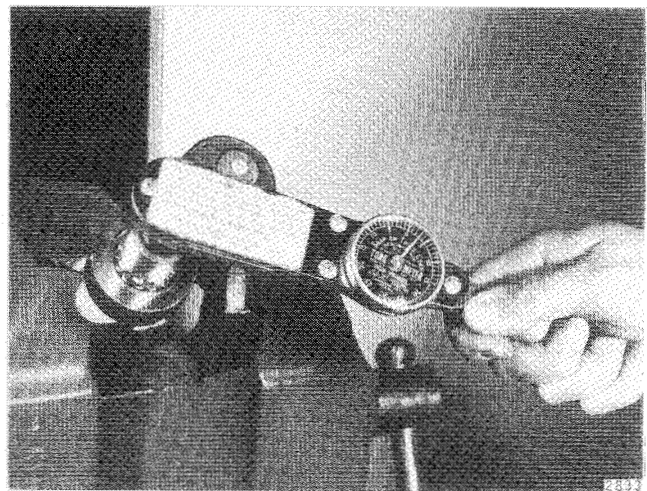
28

Check stud for flat spots, nicks, or spalling



29

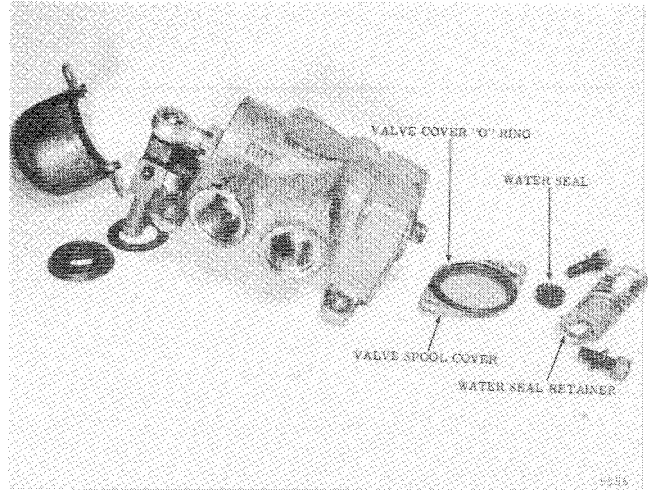
Adjustment of stud roller bearing must be set to  
three inch-pounds preload for correct ooperation.



## SERVICE TO VALVE ASSEMBLY

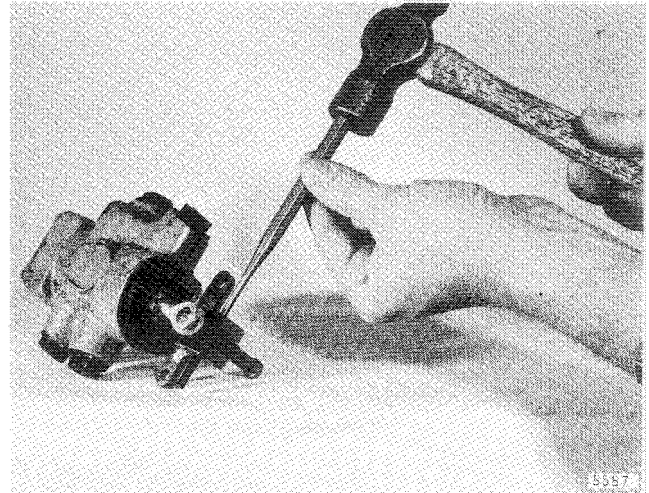
30

Remove water seal retainer, water seal, valve spool cover, and valve cover "O" ring by removing two(2) can screws.



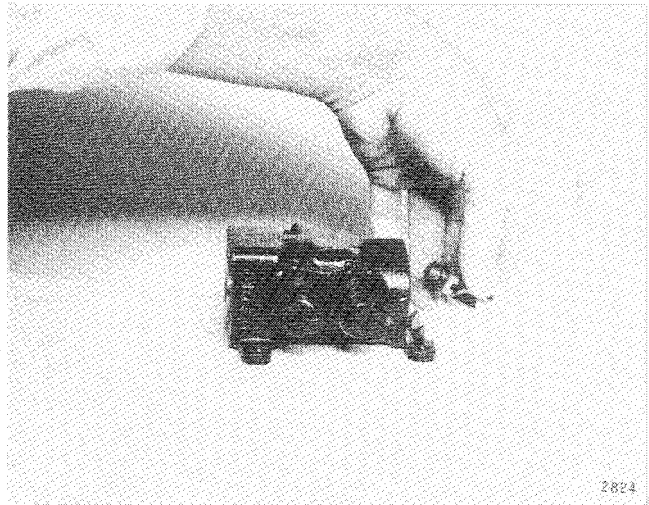
31

On some previous model valve assemblies, drift out pin with small punch and remove actuating lever from swivel bearing rod and valve body.



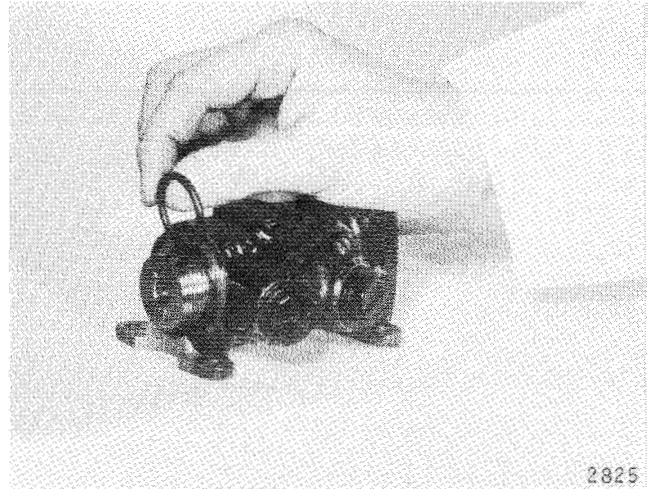
32

Remove clevis or swivel bearing rod from end of spool by removing cotter pin, loosening nut, and unscrewing rod from spool.



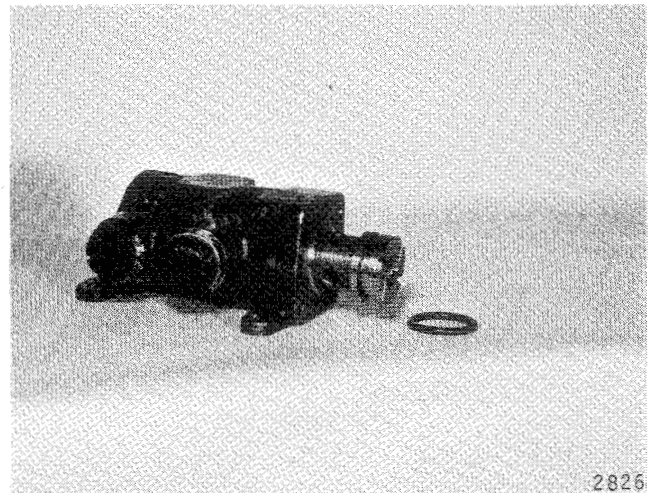
33

Push spool out clevis or swivel bearing rod end about 1/2" until "O" ring is exposed. Remove "O" ring.



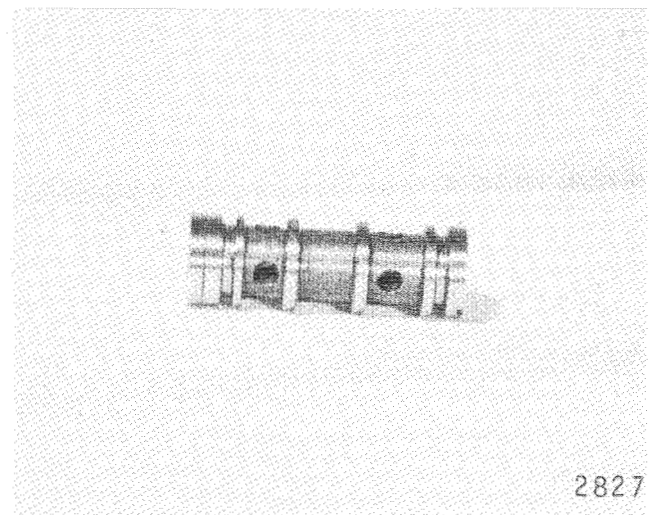
34

Push spool out other end to expose "O" ring. Remove "O" ring.



35

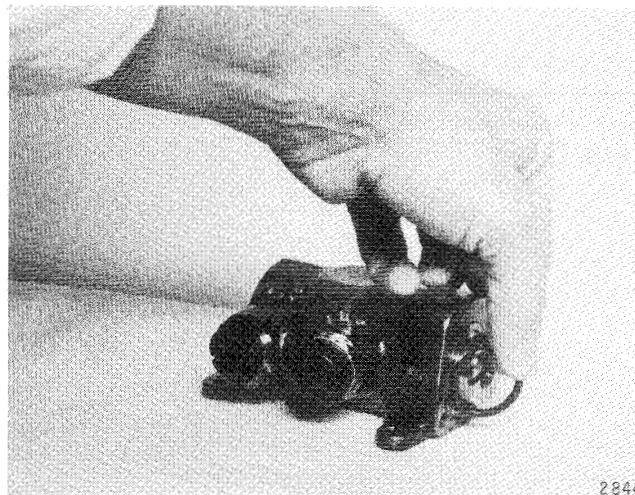
Remove spool and inspect for wear and scoring.





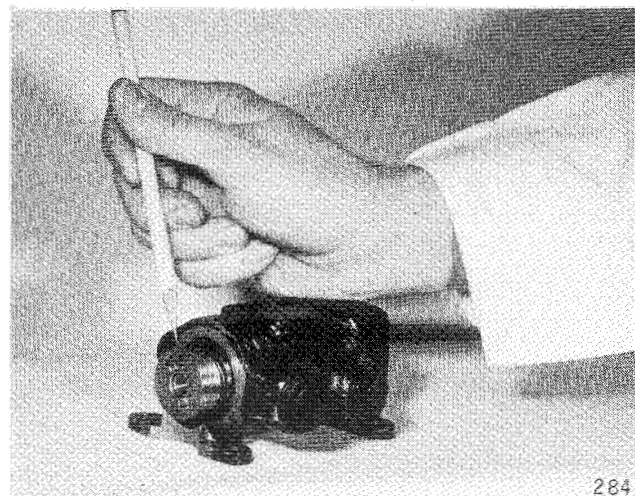
36

Install "O" ring on spool. Lubricate "O" ring with Dexron or Type A oil and then carefully insert spool in valve.



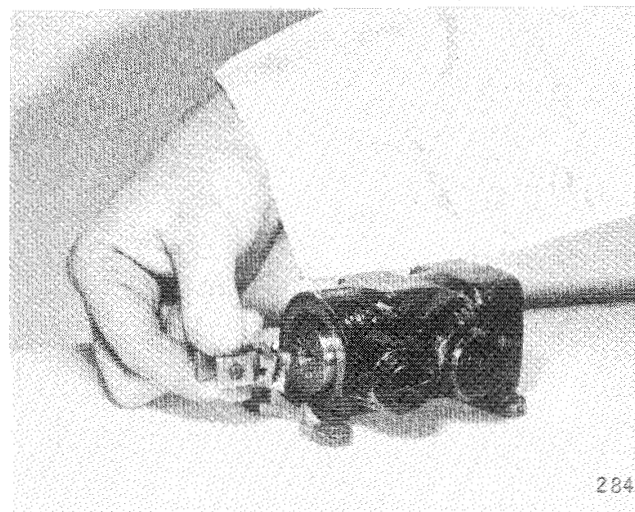
37

Push spool through the valve body until "O" ring groove on clevis or swivel bearing rod end is exposed. Install "O" ring in groove and lubricate with Dexron or Type A oil. Push into valve with care until "O" ring just enters body of valve.



38

Screw nut onto clevis or swivel bearing rod assembly, then place lock washer next to nut and screw clevis rod into threaded end of spool. Do not tighten.



## REASSEMBLY

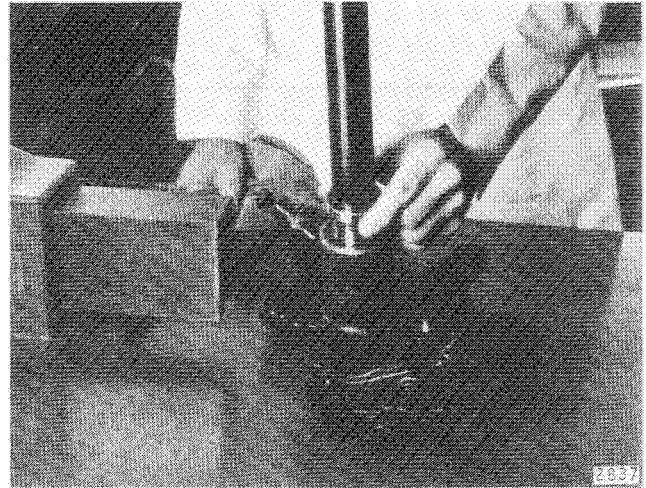
39

Clean housing thoroughly.

Check housing oil seal for damage or leakage. Replace if necessary.

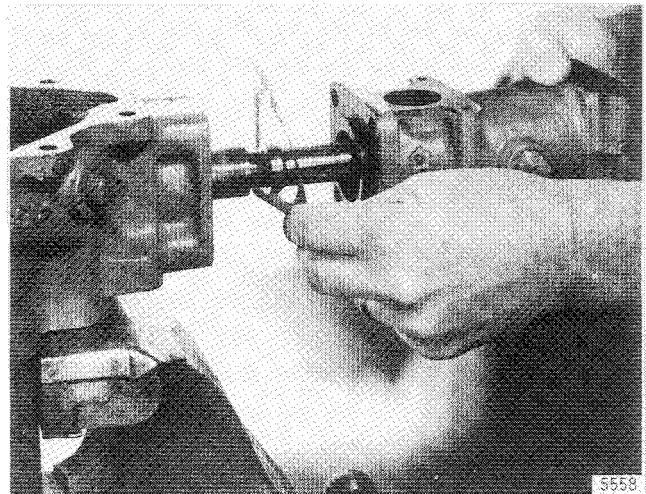
When replacing, install seal over shaft as shown

If gear is equipped with two-piece actuator housing, proceed to Step 47 on page 16.



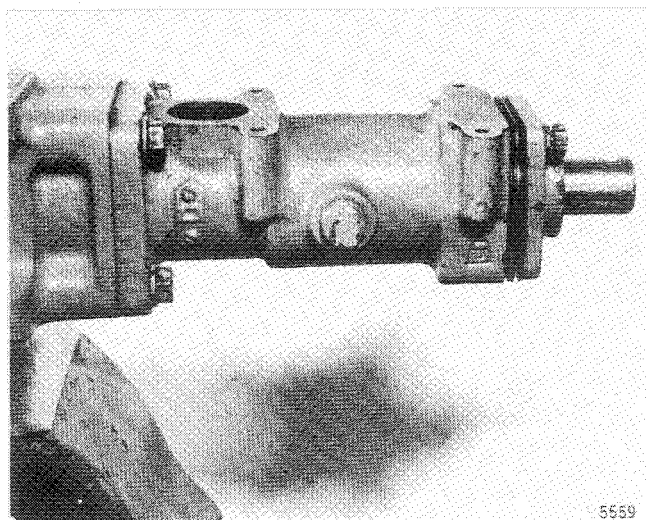
40

On previous models with one-piece control housing, install new gasket and control housing. Torque cap screws to 25 foot-pounds.



41

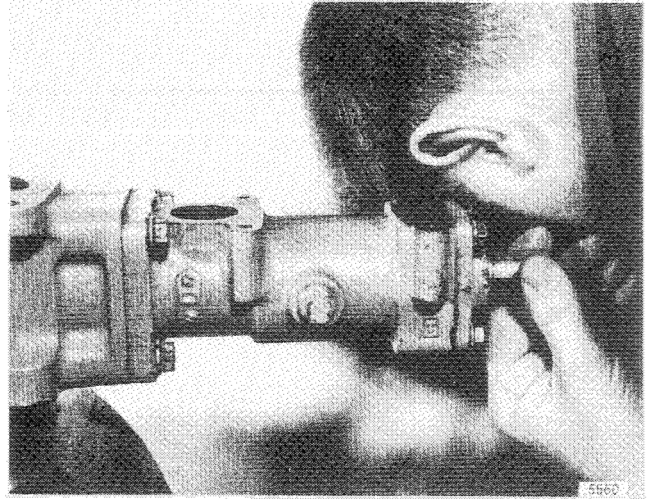
Install wheel tube assembly and replace cover. Care must be exercised during installation so as not to damage seal in cover.



42

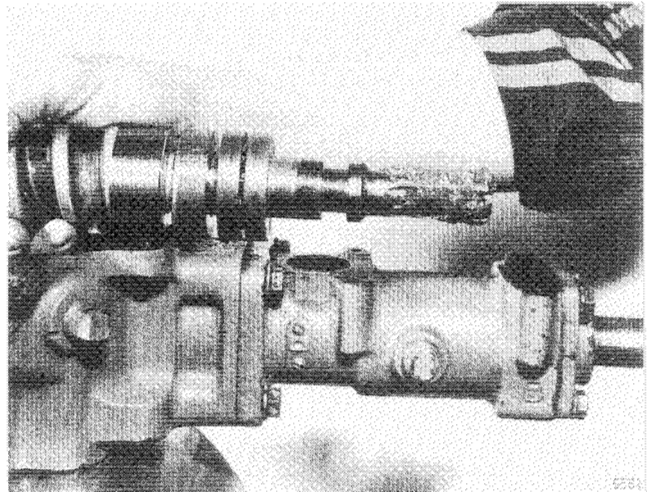
A shim pack is used between two gaskets to establish a mild preload on the wheel tube bearings.

Adjust by adding or removing shims until the bearings do not rattle as the wheel tube is slowly turned. Wheel tube must, however, turn freely without excessive drag. (Shims .002", and .010". Gasket .010" thick available.)



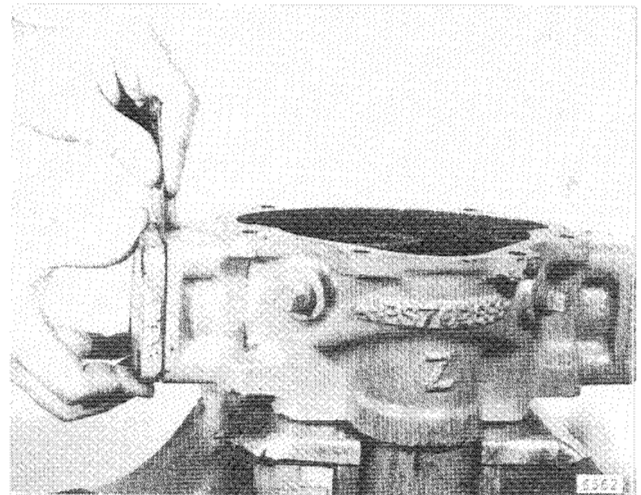
43

Coat cam shaft spline with grease and insert assembly into gear case.



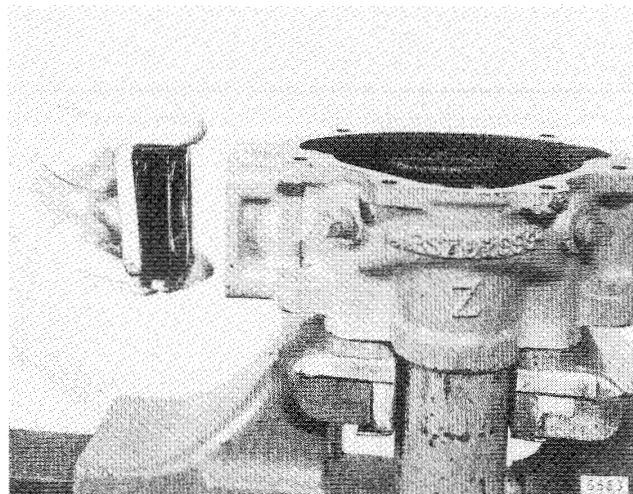
44

Place cover in position and measure gap with feeler gauge or shims. (This measurement will indicate the amount of shims necessary to eliminate end play of cam assembly.)



45

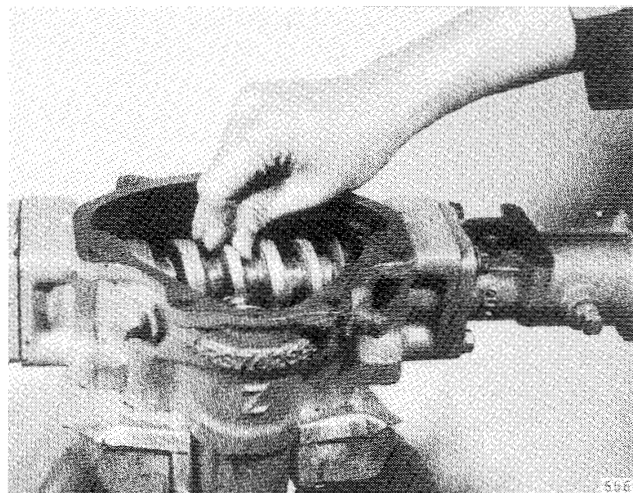
Install shims and gaskets (use a gasket on each end of shim assembly). Gaskets are .010" thick but each become only .006" when compressed. Shims are available in .002", .003", and .010" thickness. Torque cap screws to 25 foot-pounds.



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Cam should turn freely in housing by finger pressure. If it does not turn freely, add shims to end cover. Cam should have no end movement by finger pressure. If it does have end movement, remove shims from end cover.

Proceed to Step 50 on page 17.



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If steering gear is equipped with two-piece actuator housing, assemble cam in housing. Be certain that cam rotates and oscillates freely in housing.

