GALION MANUFACTURING COMPANY, Galion, Ohio 44833, U.S.A.
a Jeffrey Galion Inc. Company

CIRCLE REVERSE GEAR CASE ASSEMBLY

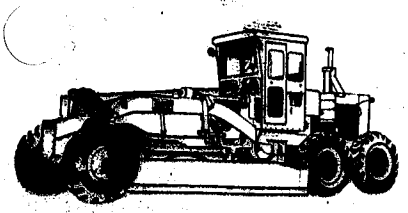
This circle reverse gear case is on the Galion graders listed below:

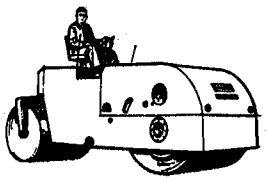
Model No.	Serial No.
118B, 104B	9619 & Up
All 104C	
All 118C	
160B	2464 & Up
All 160C	
160L	2601 & Up
All T400A	
T500A, T500L	3230 & Up
T600B	1823 & Up

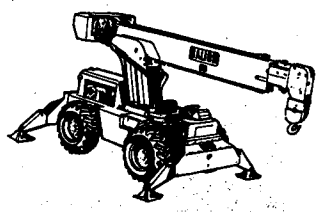
Galion grader with power circle reverse are equipped with a circle reverse gear case and a nine piston hydraulic motor.

For service procedures on the nine piston hydraulic motor, refer to File E, Section 4.10 of this Shop Manual.

CONTENTS



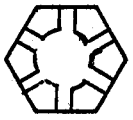
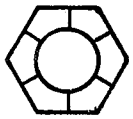




SUBJECT: Torque tightening of Bolts, and Screws

The following general torques are to be used in all cases where specific requirements are not set forth.

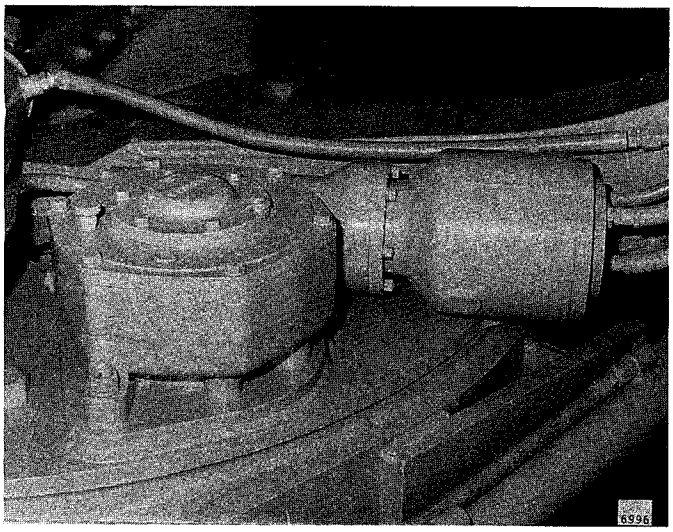
Torque values in foot pounds

Size	Threads per inch	Std. Heat Treated Bolts & Screws (GM260M-280M) 	Special Heat Treated Bolts, Screws, & Placed Allen Hd. Screws (GM300 or better) including Self Locking Capscrews   
1/4	20	6- 8	9-11
	28	8-10	10-12
5/16	18	15-18	17-20
	24	17-20	19-23
3/8	16	26-32	36-43
	24	33-40	41-49
7/16	14	42-50	54-65
	20	50-60	64-77
1/2	13	67-80	81-97
	20	83-100	96-115
9/16	12	85-100	103-123
	18	100-120	122-146
5/8	11	117-140	164-192
	18	134-160	193-225
3/4	10	180-210	284-325
	16	213-250	337-385
7/8	9	315-360	490-550
	14	372-425	575-650
1	8	445-500	685-770
	14	535-600	830-925

DISASSEMBLY:

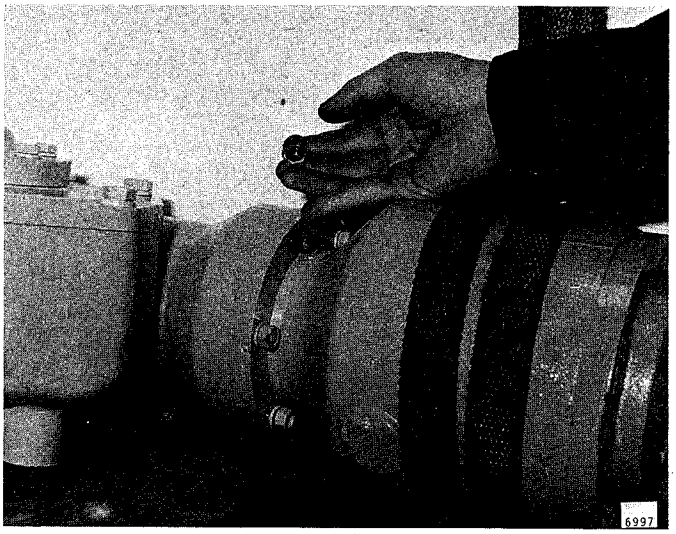
1

This circle reverse gear case is removed to facilitate photographic purposes. For complete tear down and replacement of bottom seal, this gear case housing need not be removed from grader. Should the gear case have to be removed for some reason, it is necessary to remove the grader circle before attempting gear case removal, since three (3) cap screws holding gear case housing are covered by the circle. *Note: Mark hoses and motor for correct reinstallation position.*



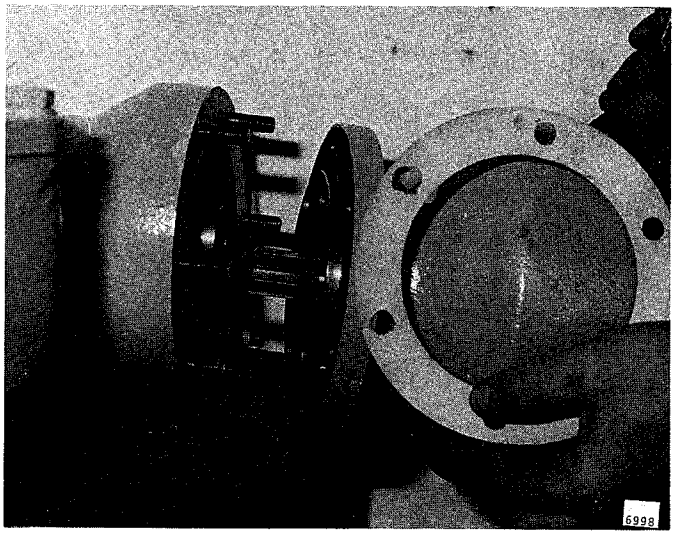
2

Suspend hydraulic circle reverse motor by suitable means. Remove six (6) nuts and lock washers holding flange of motor to gear case.



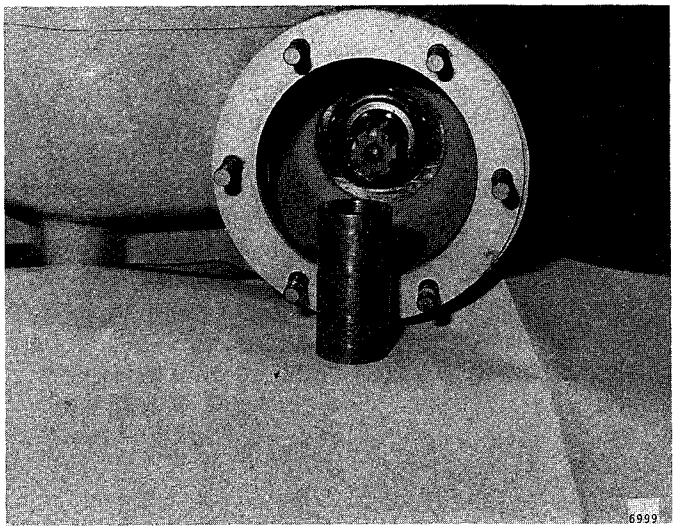
3

Remove hydraulic motor and gasket from gear case. *Note: If motor is to be left attached to grader, do not leave it suspended by the hoses or hoses may be damaged.*



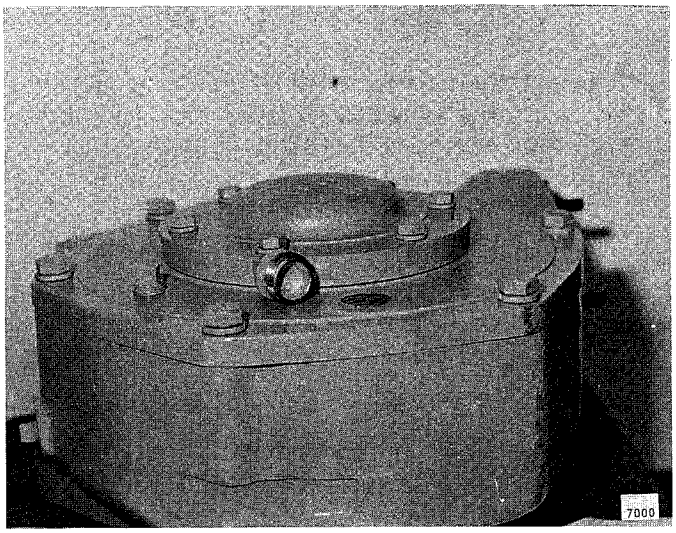
4

The circle reverse worm is coupled to the hydraulic motor shaft with a splined coupling. Remove this coupling.



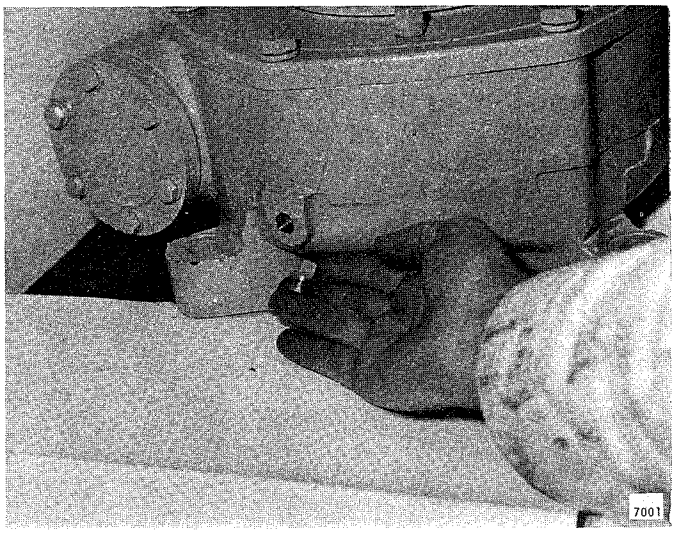
5

Remove fill plug on top of gear case.



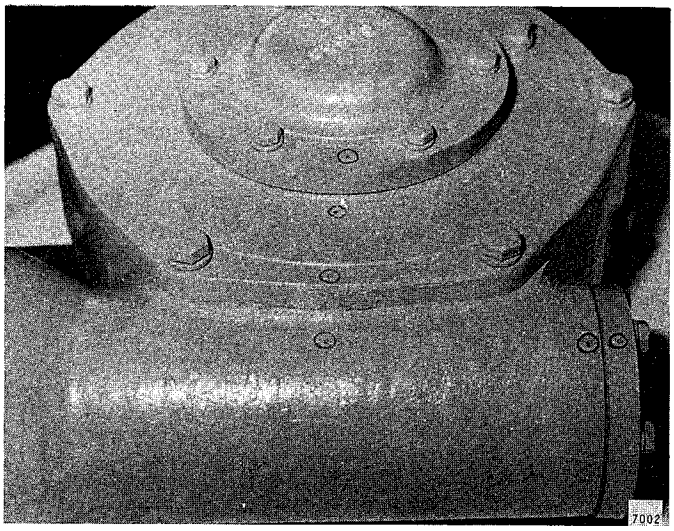
6

Remove check level plug at side of gear case.



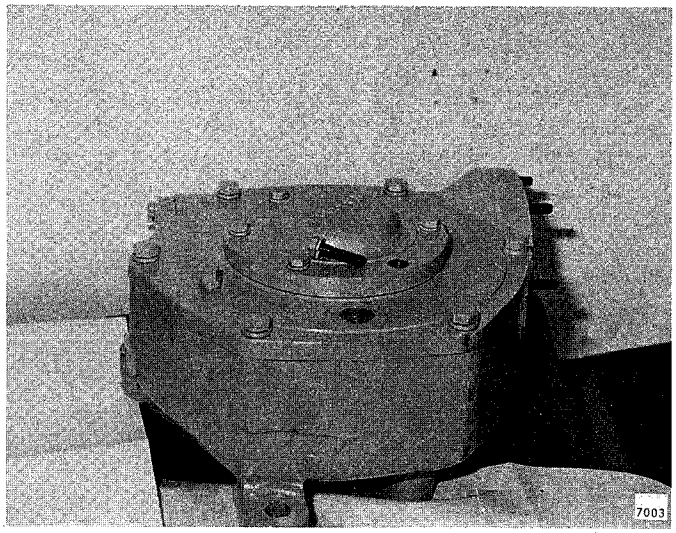
7

To aid in the reassembly of gear case, center punch caps and gear case to mark their location.



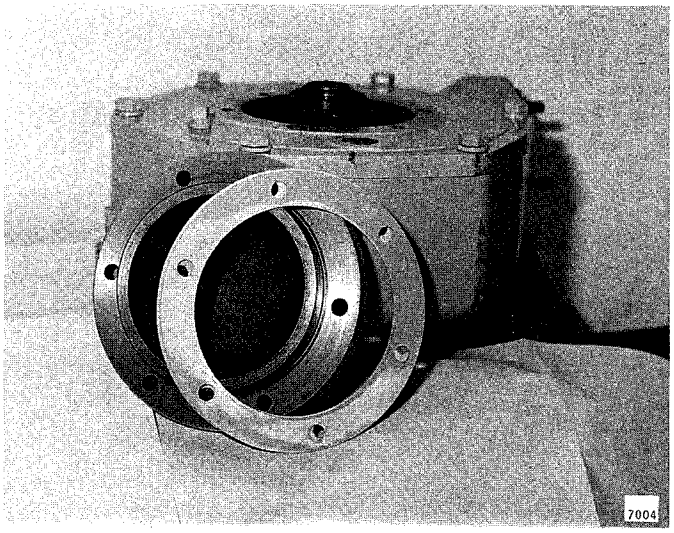
8

Remove six (6) 3/8" - 16 UNC x 1 1/2 cap screws and lock washers from bearing retainer.



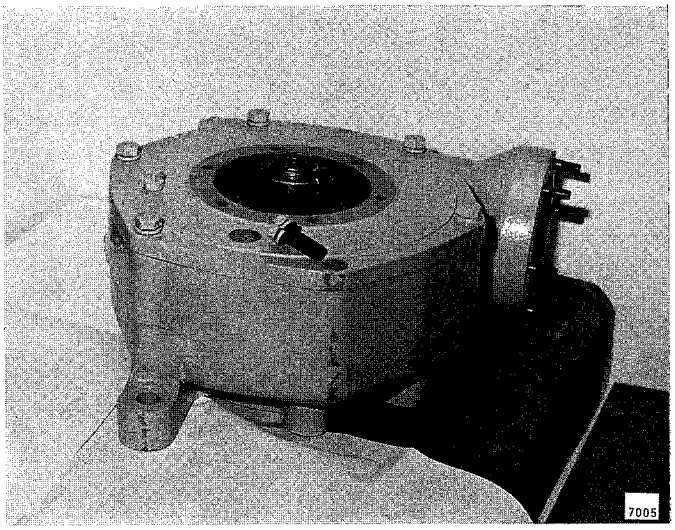
9

Remove bearing retainer and shims. Use extreme care not to damage shims. These shims will be used in reassembly to preload bearings.



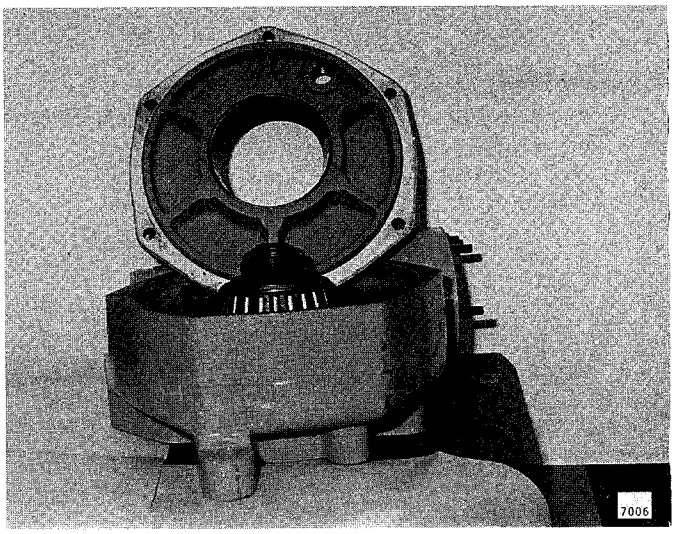
10

Remove six (6) 1/2" - 20 UNF cap screws and lock washers from case cover.



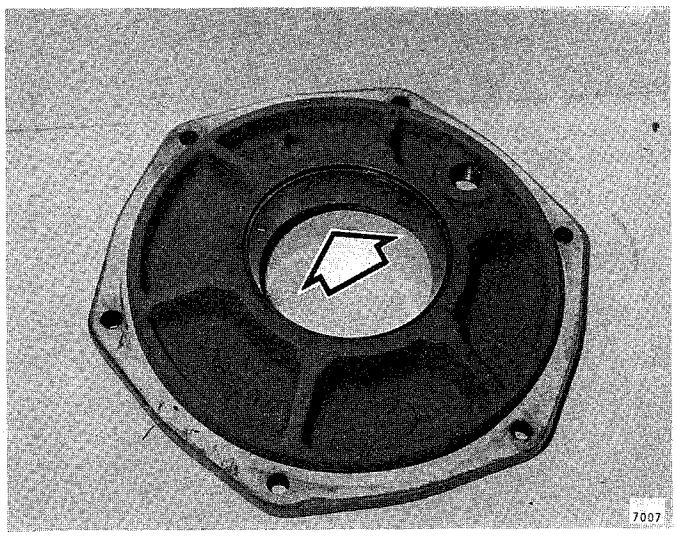
11

Remove cover and cover gasket from gear case. Use care not to damage cover gasket. Bearing cup will also be removed with cover.



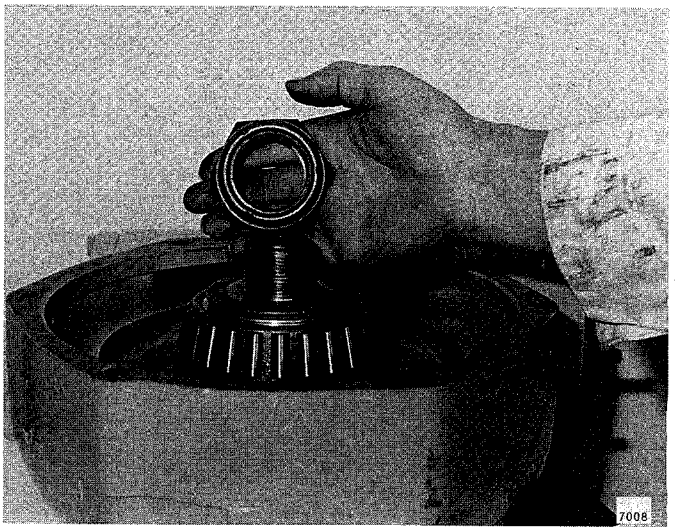
12

Inspect bearing cup, (arrow) remove and replace cup if necessary.



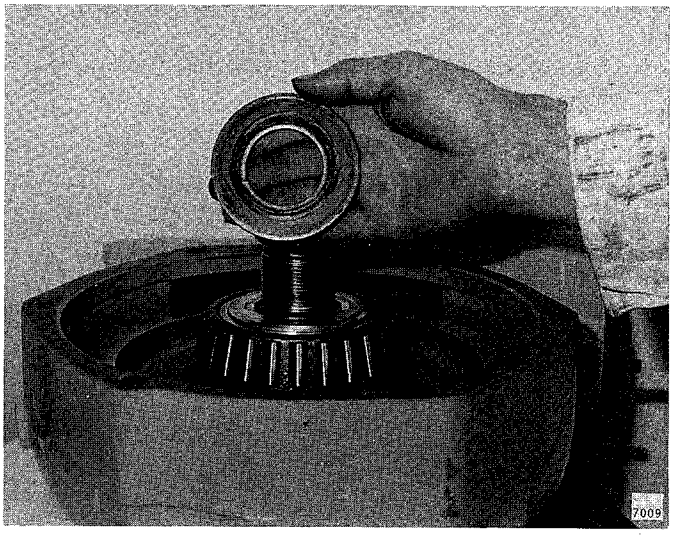
13

Remove pinion shaft lock nut.



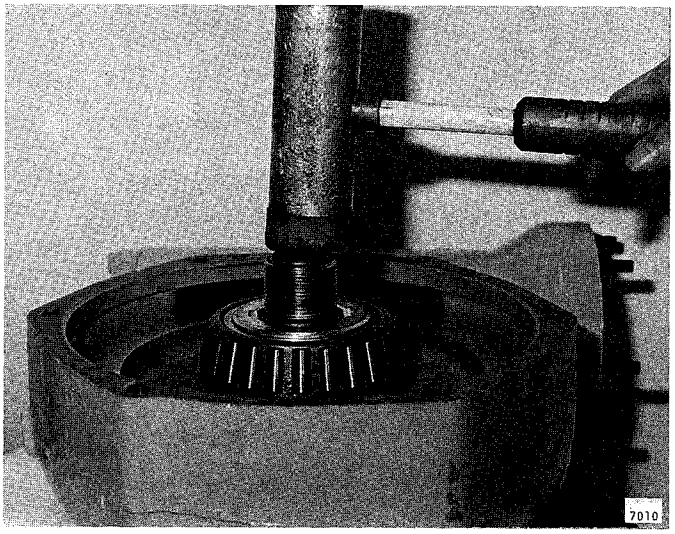
14

Remove flat washer.



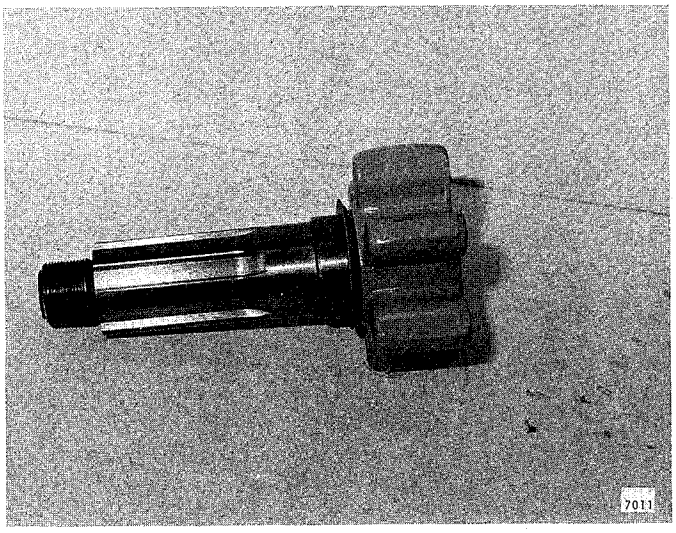
15

Using a soft head hammer, remove pinion shaft from gear case. *CAUTION: If gear case is attached to grader, support pinion shaft from underside as shaft is driven out.* Note: Oil slinger seal removes with shaft. Oil will drain from case at this time.



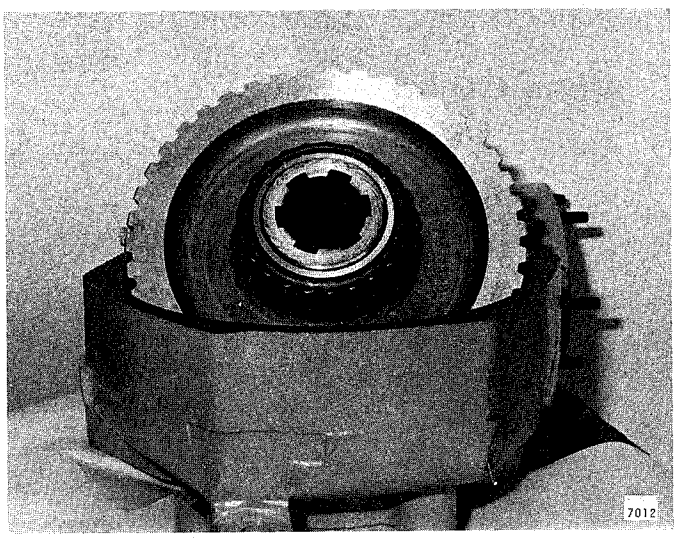
16

Inspect pinion shaft. Inspect (1) splines; (2) the teeth; (3) oil seal sealing surface; (4) the oil slinger seal. If any portion of pinion is damaged or unserviceable, replace the pinion shaft. *Note: Oil slinger seal may not be on all machines. It is only on later serial numbered graders.*



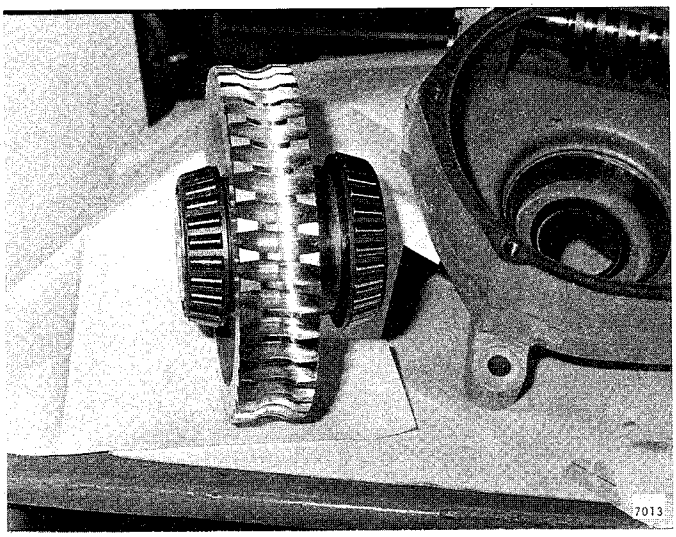
17

Remove circle reverse gear and bearing assembly.



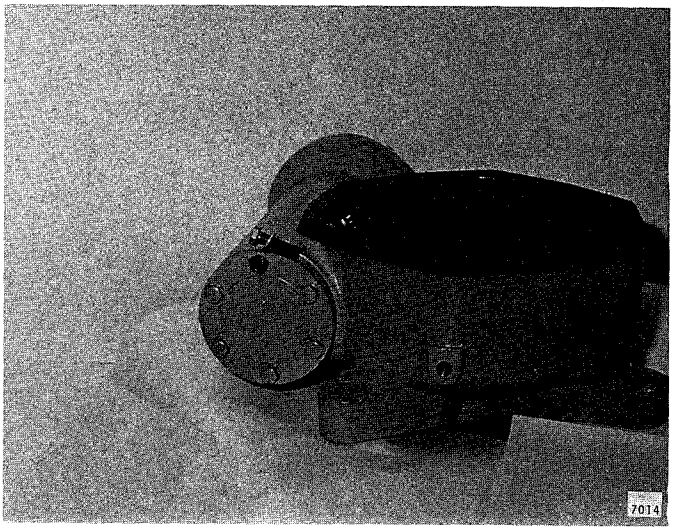
18

Inspect gear and bearings. If gear or bearings are damaged, replace them. Use care in replacing bearings. *Note: If a cup or bearing is damaged and replaced, the companion cup or bearing must be replaced also. Bearings must be seated tightly against shoulders on gear.* *CAUTION: Use only suitable pullers in removing bearings and cups.*



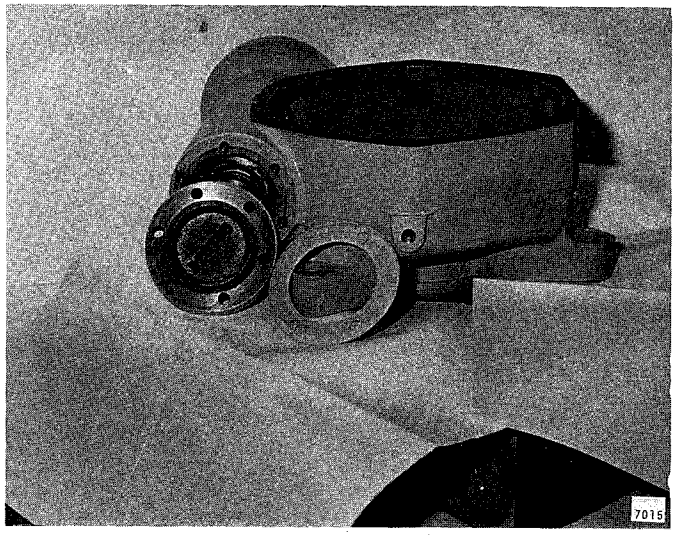
19

Remove six (6) 3/8 - 16 UNC x 1 1/2" cap screws and lock washers from end cap.



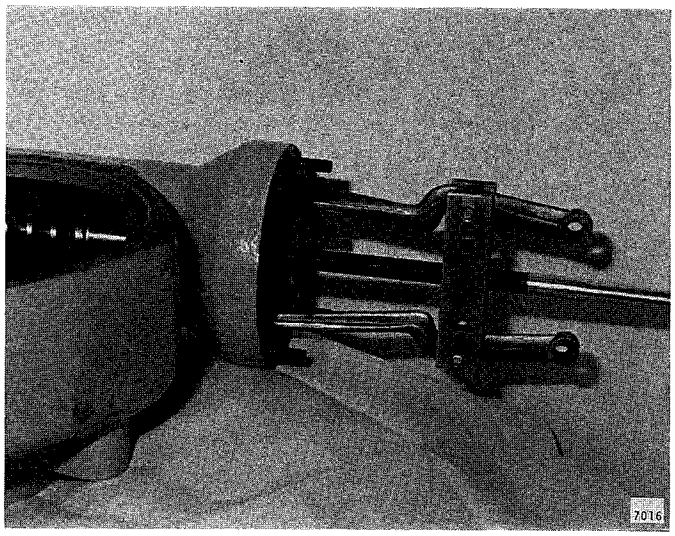
20

Remove end cap and shim stack from gear case. Use care not to damage shims.



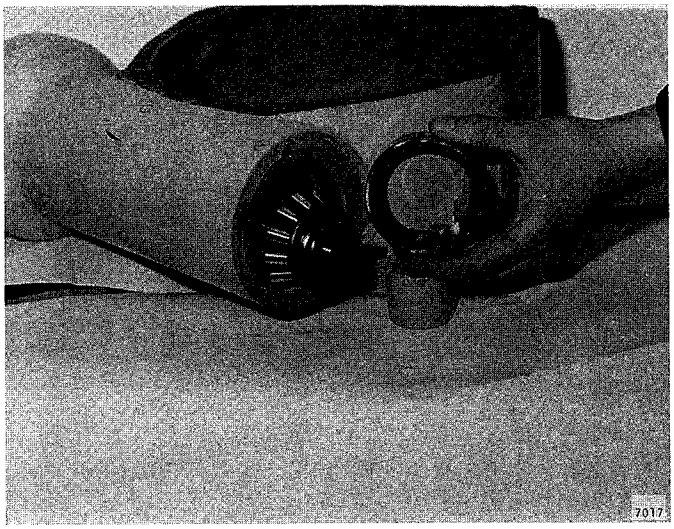
21

With suitable press (or puller) press from motor flange end, the worm gear from gear case.



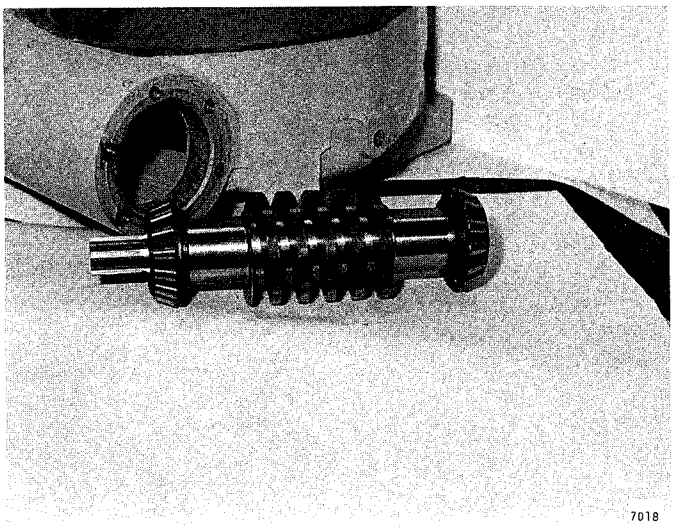
22

Remove bearing cup from cap end and inspect for damage.



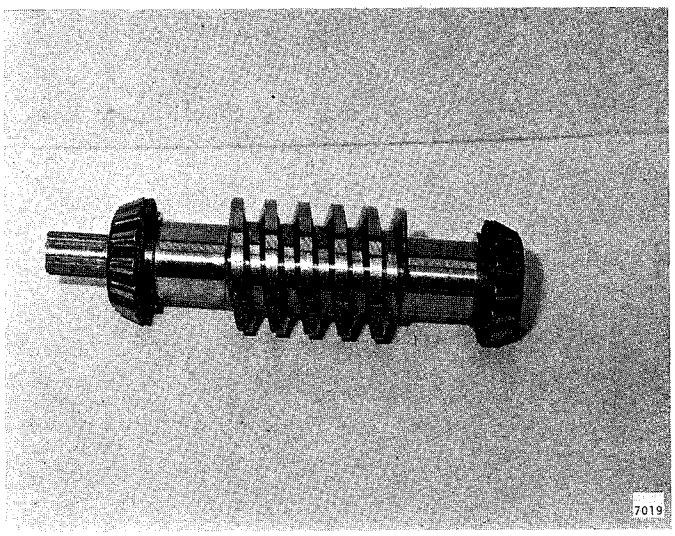
23

Remove worm gear and accompanying two (2) bearing cones.



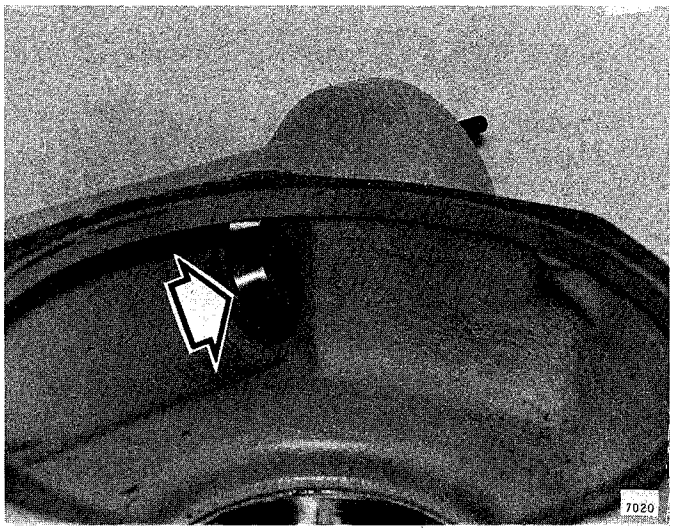
24

Inspect two (2) bearing cones on worm gear. Remove and replace bearing cone(s) if necessary with the use of a suitable puller. Make certain worm gear is not worn and that gear is in a serviceable condition.



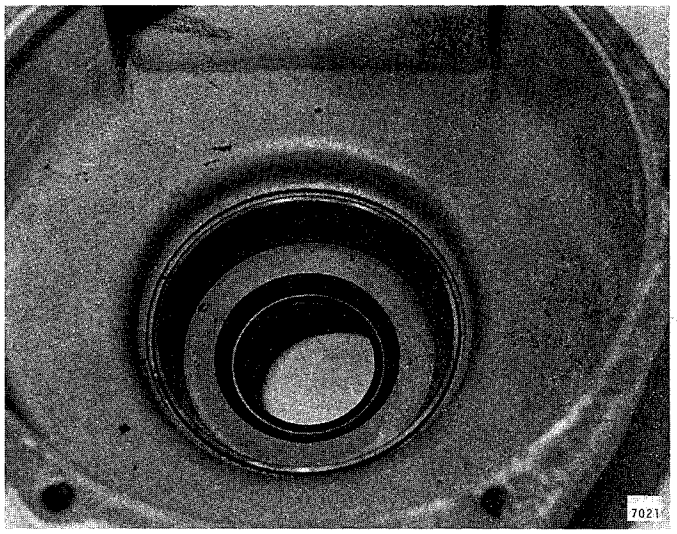
25

Inspect bearing cup on flange end of case. If necessary, remove and replace at this time. Remove with a suitable puller. (arrow) If bearing cones on worm gear shaft were replaced (Fig. 24) this cup must also be replaced.



26

Inspect lower bearing cup in gear case. Remove and replace at this time, with the use of a suitable puller, if cup or bearing requires replacement. If bearings were replaced in Fig. 18 this cup must also be replaced.



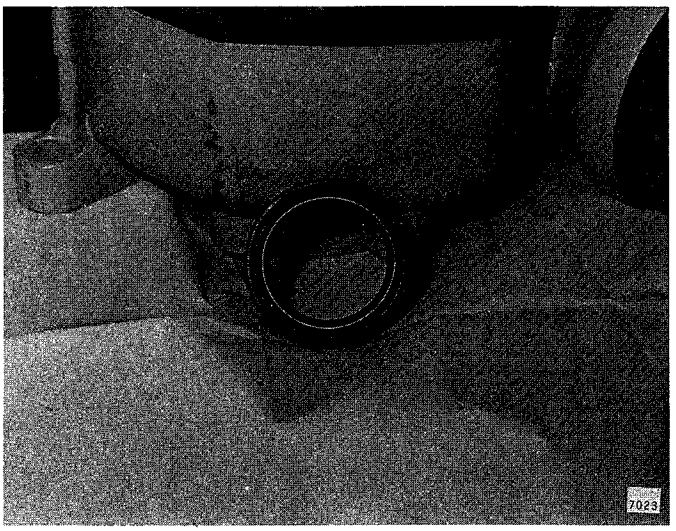
27

Remove pinion shaft seal at this time.

ASSEMBLY: Clean and inspect case thoroughly prior to assembly.

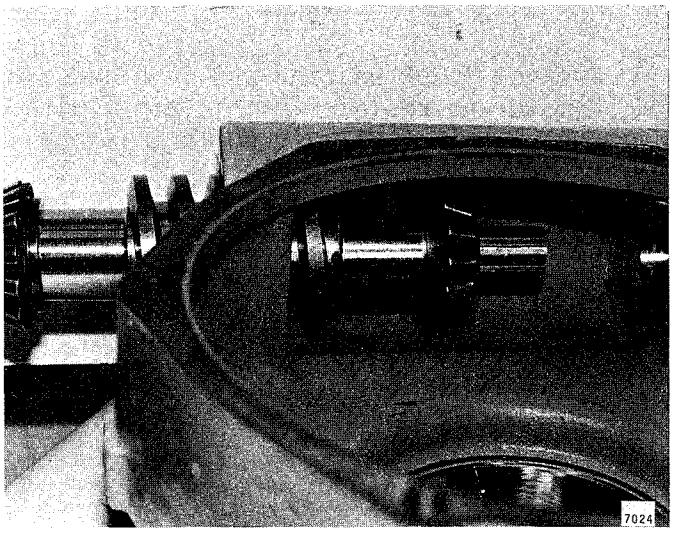
28

Install new pinion shaft seal with a light coat of non-hardening sealant on the outer diameter. Be certain that pinion shaft seal is installed with lip of seal facing toward the inside of the case.



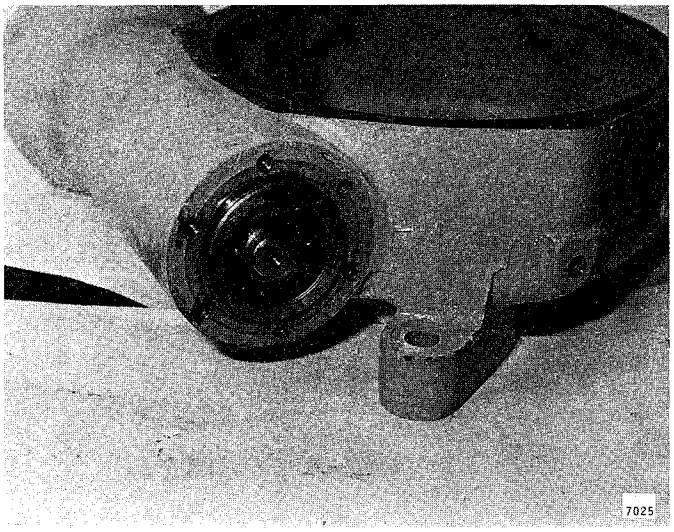
29

Install worm gear in case with two (2) bearing cones properly seated on worm gear. Be certain that bearing cup in flange end of case was installed prior to installation of worm gear (See figure 25). Worm gear should be installed in case with splined end of worm gear towards flange of case.



30

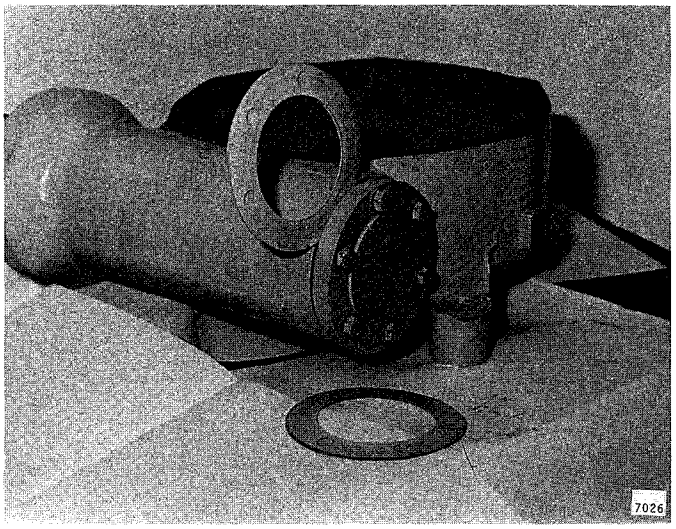
Install bearing cup in cap end of worm gear housing.



31

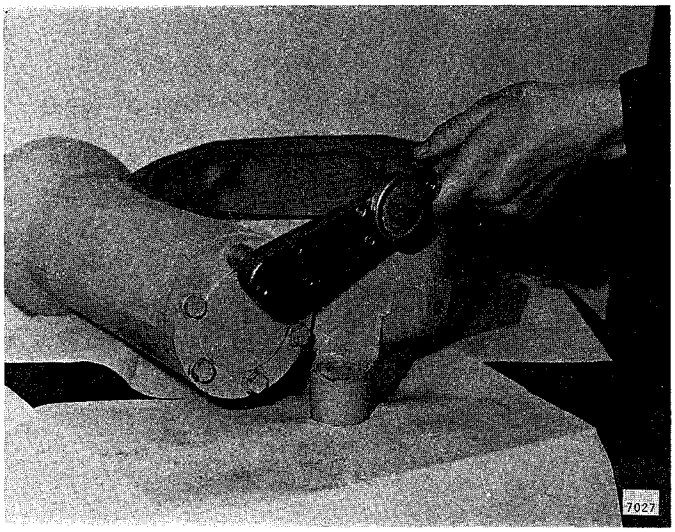
Install end cap on gear case with six (6) grade 5 cap screws without lock washers and without shim(s).

Cross tighten six (6) grade 5 cap screws of end cap until slight drag is felt when rotating worm gear. Check also for no shaft end play. Determine proper shim stack by inserting correct number of shims between end cap and gear case. (Shims come in two thicknesses - .005" and .020")



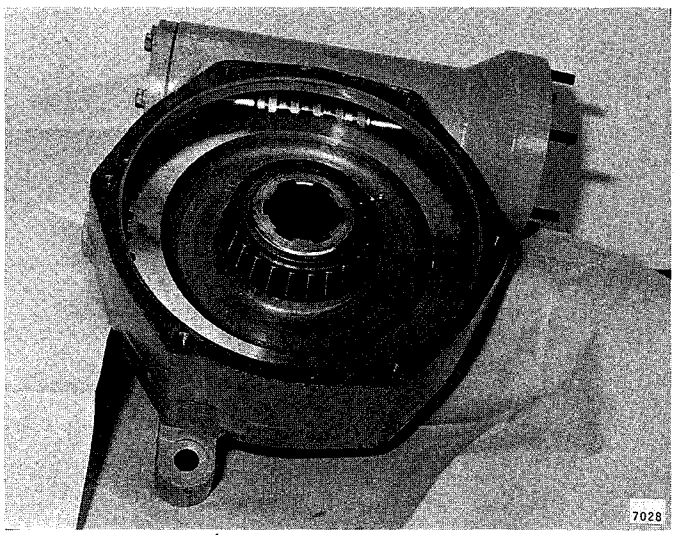
32

Remove end cap and six (6) grade 5 cap screws. Insert predetermined shim stack plus one more shim of the smallest thickness (.005") between end cap and gear case. Insert six (6) grade 5 cap screws with lock washers, cross-tighten and torque to 26-32 ft. lbs. Check again for proper preload and no shaft endplay. If more than a slight drag is felt when rotating worm gear, repeat above steps adding shim(s) as required until proper preload and no shaft endplay is reached.



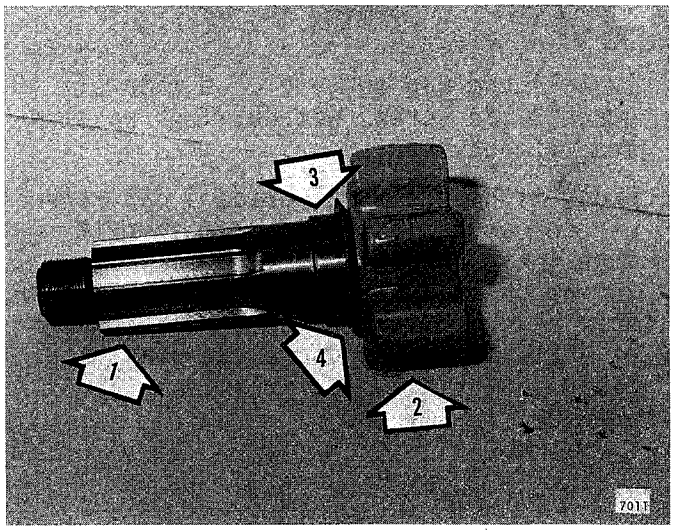
33

Insert circle reverse gear in gear case with longer shoulder to the bottom of case. Bearing cones on this gear should be fully seated against gear shoulders prior to installation. Circle reverse gear should be engaged with worm gear as it is inserted in gear case.



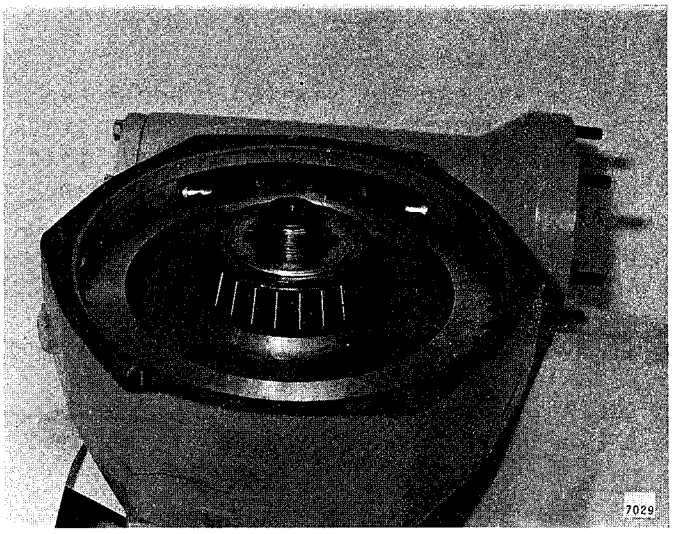
34

Install oil slinger on pinion shaft, making certain it is properly seated on shaft. Flat side of slinger installs toward oil seal.



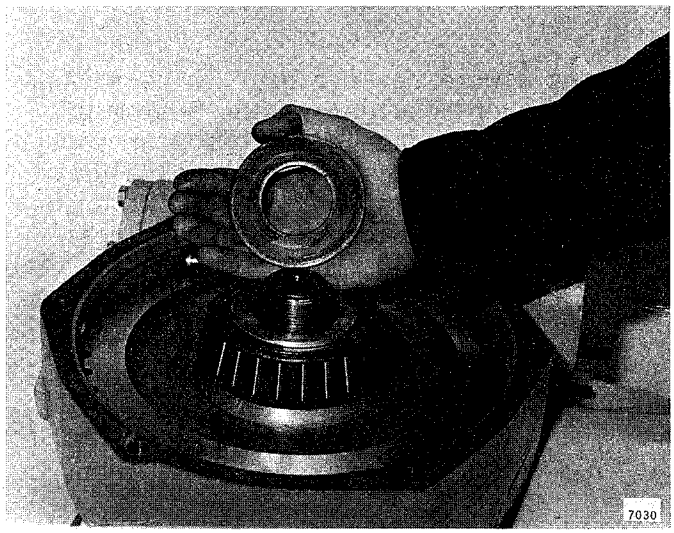
35

Insert pinion shaft into bottom of gear case through circle reverse gear. A light coat of grease should be applied to lower seal prior to installation of pinion shaft. Be certain that during this installation the lower seal and oil slinger are not damaged.



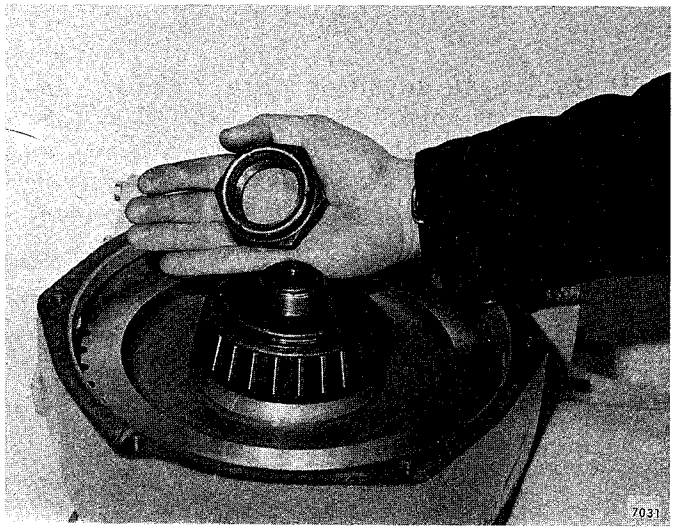
36

Install washer on pinion shaft.



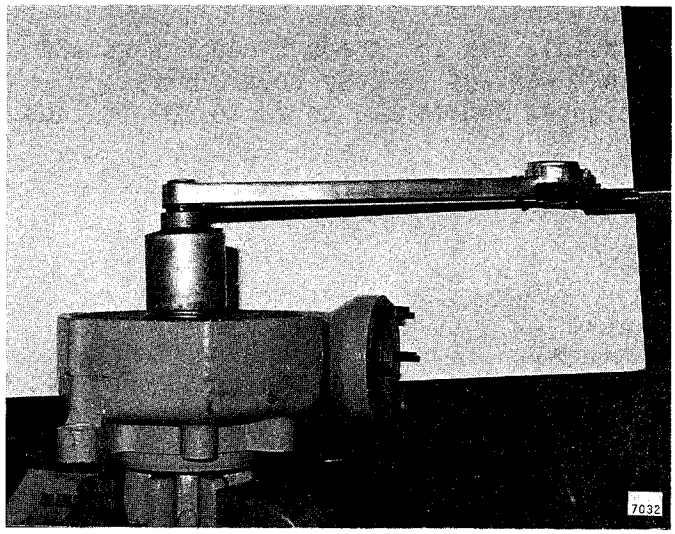
37

Install pinion shaft lock nut on pinion shaft.



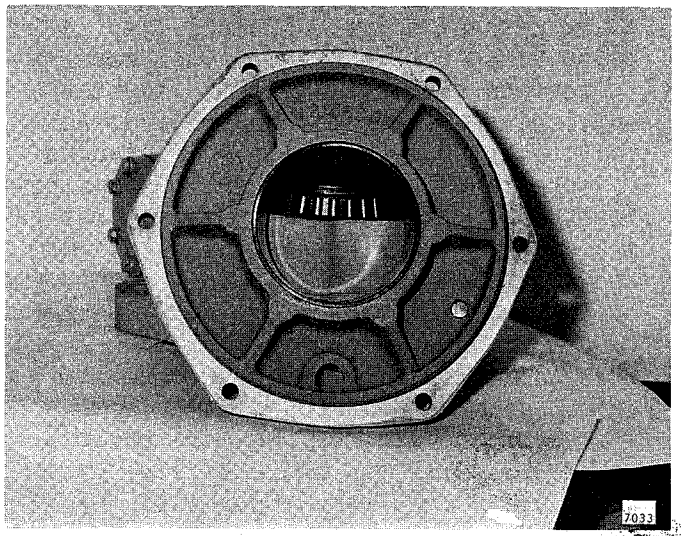
38

Torque pinion shaft lock nut to 950 to 1050 ft. lbs.



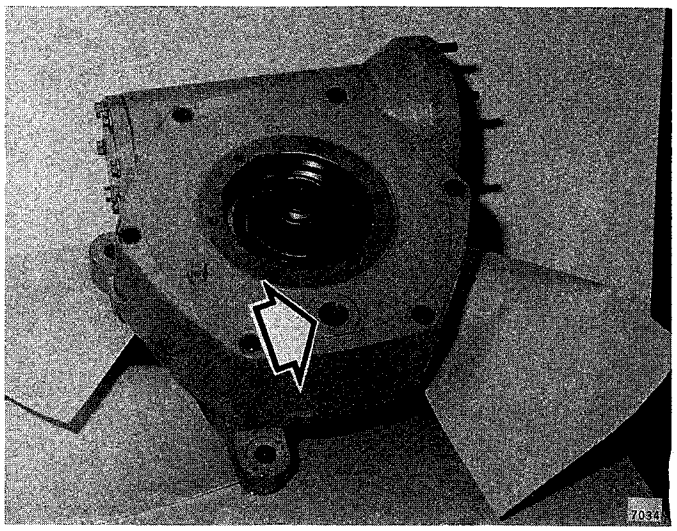
39

Apply a light coat of non-hardening sealant to gear case cover and install gasket.
NOTE: Bearing cup in case cover was previously installed.



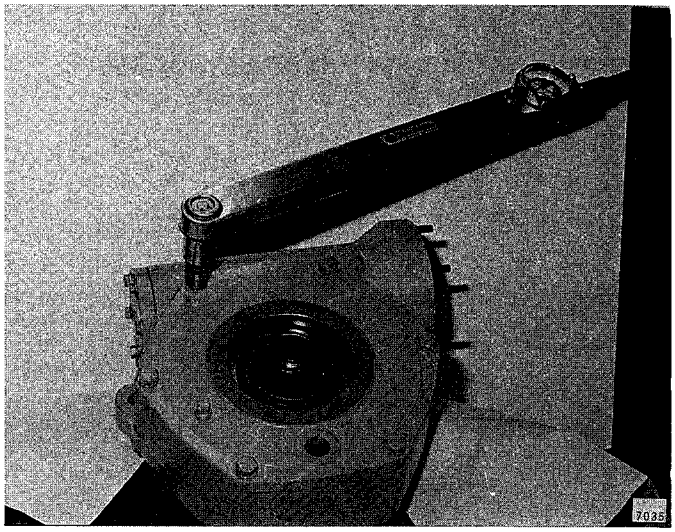
40

Install case cover on case. *Note: Install case cover so that fill plug (arrow) is directly across from worm side of case, or if parts were center punched (figure 7) this will also aid in correct alignment.*



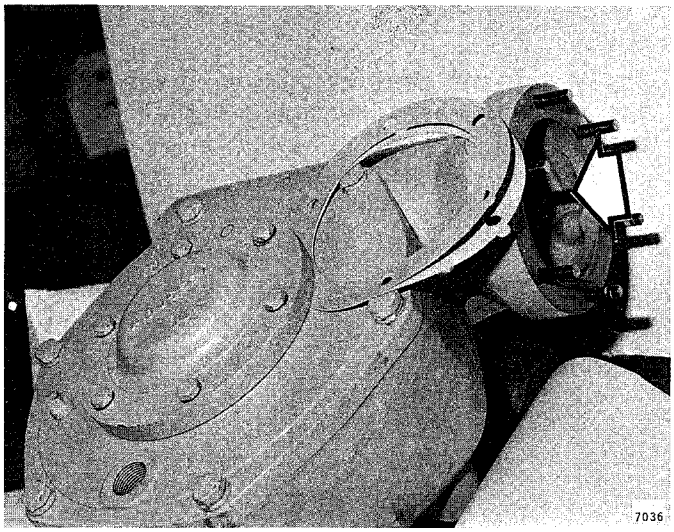
41

Install six (6) grade 5 cap screws and lock washers in case cover, cross tighten and torque to 83 to 100 ft. lbs.



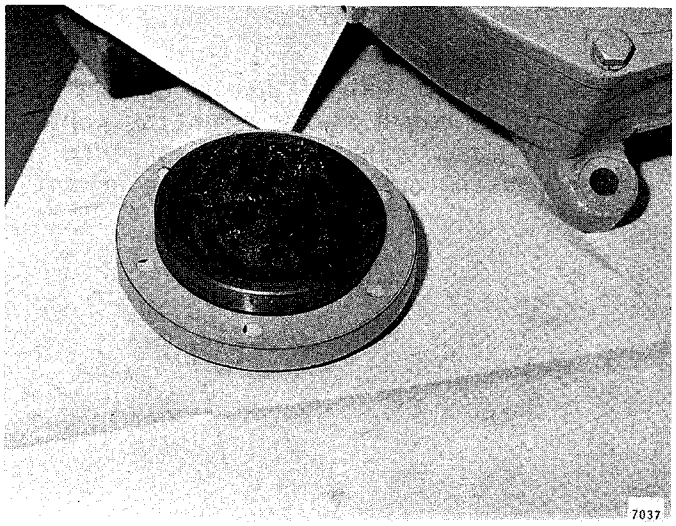
42

Insert bearing retainer in gear case cover without shims. Install six (6) grade 5 cap screws without lock washers in bearing retainer and cross tighten until pinion shaft has no preload, no shaft endplay. Determine shim stackup by inserting correct number of shims between gear case cover and bearing retainer. (Shims come in thicknesses of .020" and .003") *Note: The preload may be determined by rotating the splined shaft (arrow) in the hydraulic motor housing. The shaft should be easily rotated by hand. If it cannot be rotated, remove this bearing retainer and case cover and tap bearing cup out a little to loosen it. Then redo figures 40, 41 and 42 to get correct preload.*



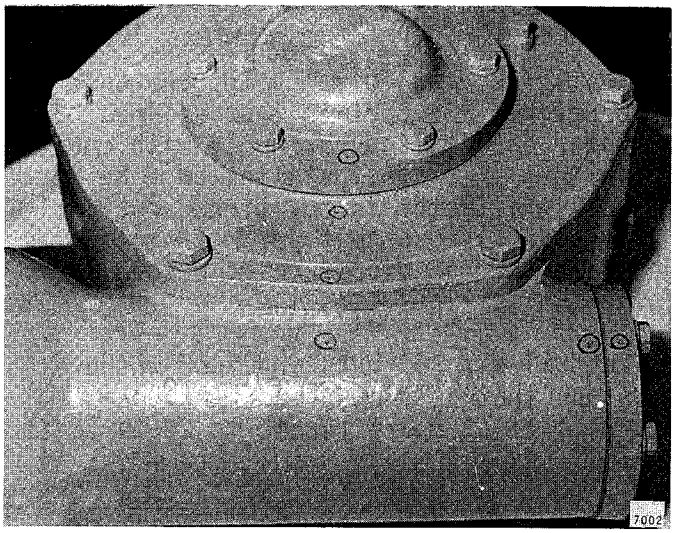
43

Remove six (6) grade 5 cap screws from bearing retainer. Remove bearing retainer from gear case cover. Place determined shim stack on bearing retainer plus one shim of the smallest thickness (.003"). Fill bearing retainer with multi-purpose grease prior to installation on gear case cover.



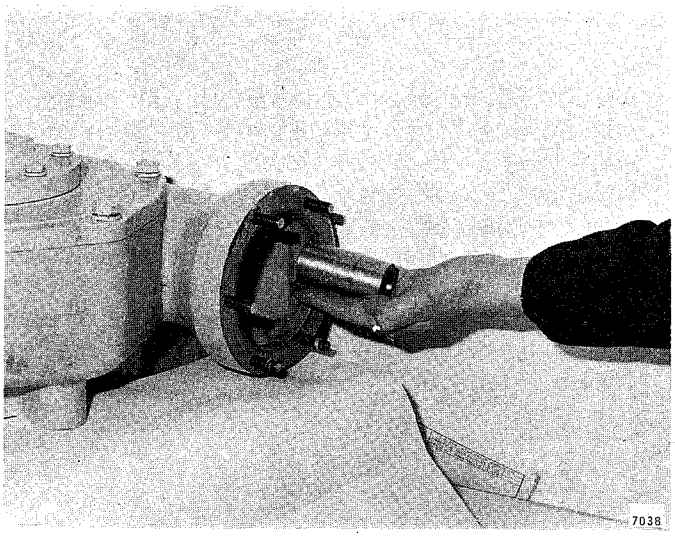
44

Install bearing retainer and shims to gear case cover with six (6) grade 5 cap screws and lock washers. Cross tighten and torque cap screws to 26 to 32 ft. lbs. Check for no preload, no endplay on pinion shaft after installation of bearing retainer. If preload or endplay is incorrect add or remove respectively, shims of the proper thicknesses to obtain correct bearing adjustment.



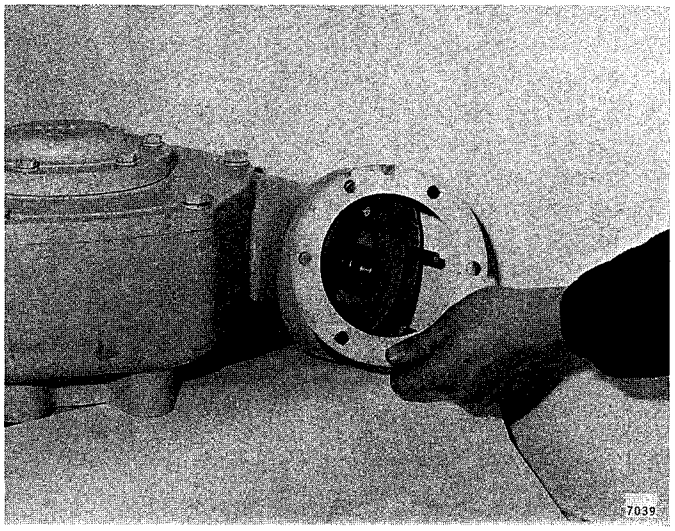
45

Install worm gear to motor coupling on worm gear.



46

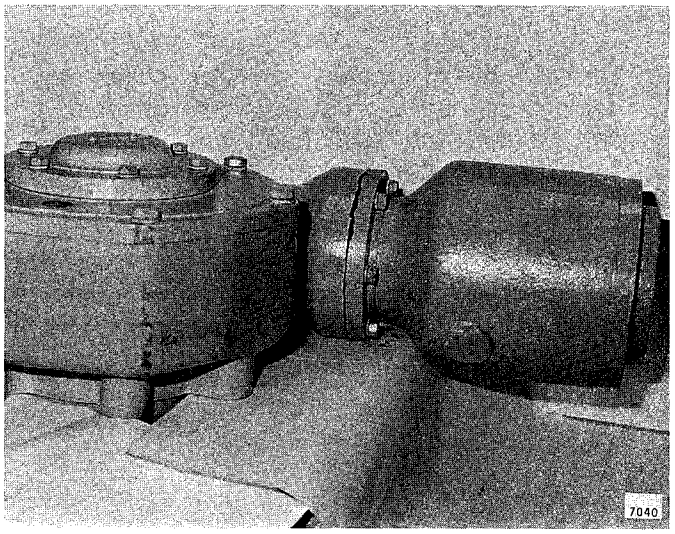
Apply a light coat of non-hardening sealant to motor flange mounting surface on gear case. Install the gasket to flange using care not to damage gasket.



47

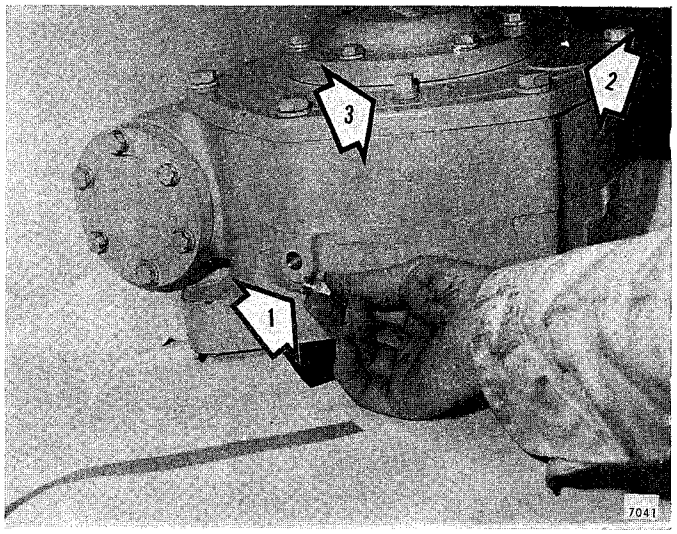
Install hydraulic motor to gear case and coupling. Be certain that splines of motor shaft align correctly with coupling splines prior to installation. Be certain that motor is positioned correctly to gear case so that ports in motor are positioned in proper relationship to hydraulic lines.

Install six (6) nuts and lock washers to studs that hold motor to gear case. Cross-tighten and torque to 26 to 32 ft. lbs.



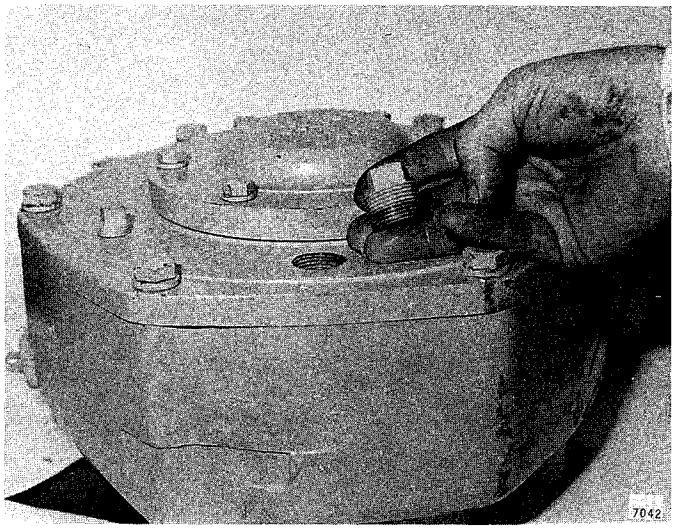
48

Add EP 90 to gear case until oil comes out of oil level check hole on side of gear case. Add oil through fill plug hole on top of gear case. (1) Level check plug; (2) fill plug; install level check after proper oil level is reached. Breather installs in case where plug (3) is shown. Breather must always be clean and in serviceable condition prior to installation.



49

Install fill plug in top of gear case.



50

Gear case and motor assembly shown after it is installed on motor grader.