

# SHOP MANUAL

**BINDER**

GRADER

**GALION MANUFACTURING COMPANY, Galion, Ohio 44833, U.S.A.**  
DIVISION OF DRESSER INDUSTRIES, INC.

**FILE****F****SECTION**  
**9.10**<sup>R3</sup>

6/74

## TANDEM CASE SINGLE REDUCTION - DOUBLE STRAND CHAIN WITH TAPERED AXLES & KEY

The instructions contained in this section are effective on the following model graders and respective serial numbers.

104HB -----	9857-10693	160 B, C -----	2404 & Up
104 B, C -----	9857-11214	T-400 A -----	A11
118 B, C -----	9857 & Up	T-500 A, L -----	3290 & Up
160 L -----	2601 & Up	T-600 B -----	1823 & Up
	(Cummins only)		(Cummins - IHC)

**NOTE:** *Tandem housings need not be removed from machine for procedures shown. However, we have removed the final drive and tandems from the grader for photographic purposes only.*

### CAUTION

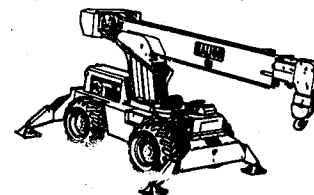
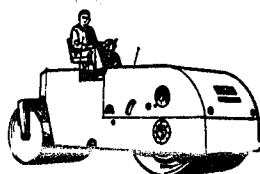
- ALL** COMPONENTS MUST BE PROPERLY SUPPORTED DURING DISASSEMBLY AND ASSEMBLY.
- ALL** JACKING HOISTING AND GENERAL WORKSHOP EQUIPMENT REQUIRED FOR THIS OPERATION MUST BE IN GOOD WORKING ORDER.
- EXTREME** CAUTION TO BE OBSERVED AT ALL TIMES TO PREVENT INJURY.
- SAFE** WORKSHOP PRACTICES ARE A MUST.

Standard torque specifications apply unless otherwise stated.

### CONTENTS

Torque Sheet -----	Back of Cover
Disassembly -----	1 - 17
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R3



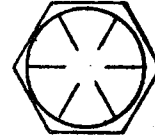
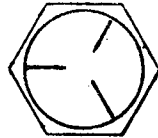
## SUGGESTED ASSEMBLY TORQUE VALUES

The following general torques are to be used in all cases where specific torques are not given. (Tightening Dry)

Size:

Grade 5  
Ft.-Lb.  
Torque

Grade 8  
Ft. - Lb.  
Torque



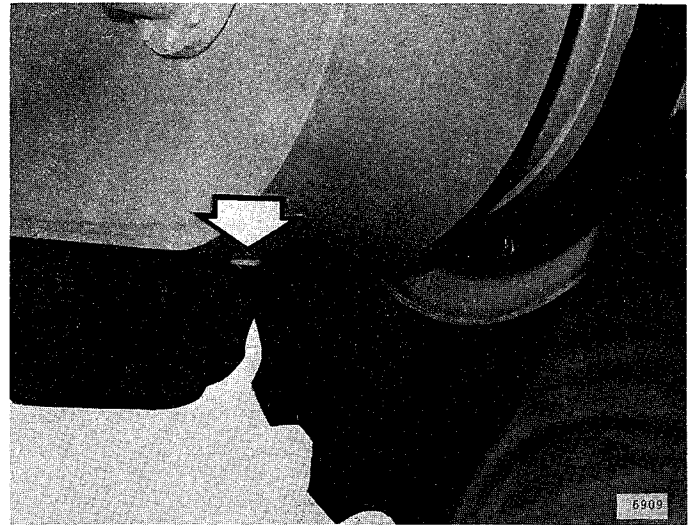
1/4 - 20	8	12
1/4 - 28	12	14
5/16 - 18	17	25
5/16 - 24	19	25
3/8 - 16	30	45
3/8 - 24	35	50
7/16 - 14	50	70
7/16 - 20	55	80
1/2 - 13	75	110
1/2 - 20	90	120
9/16 - 12	110	150
9/16 - 18	120	170
5/8 - 11	150	220
5/8 - 18	180	240
3/4 - 10	260	380
3/4 - 16	300	420
7/8 - 9	400	600
7/8 - 14	440	660
1 - 8	580	900
1 - 12	640	1000
1 1/8 - 7	800	1280
1 1/8 - 12	880	1440
1 1/4 - 7	1120	1820
1 1/4 - 12	1240	2000
1 3/8 - 6	1460	2380
1 3/8 - 12	1680	2720
1 1/2 - 6	1940	3160
1 1/2 - 12	2200	3560

*We have removed the final drive and tandems from the unit for photographic purposes only. The procedure shown can be done without removing the tandem unit from the grader.*

## DISASSEMBLY:

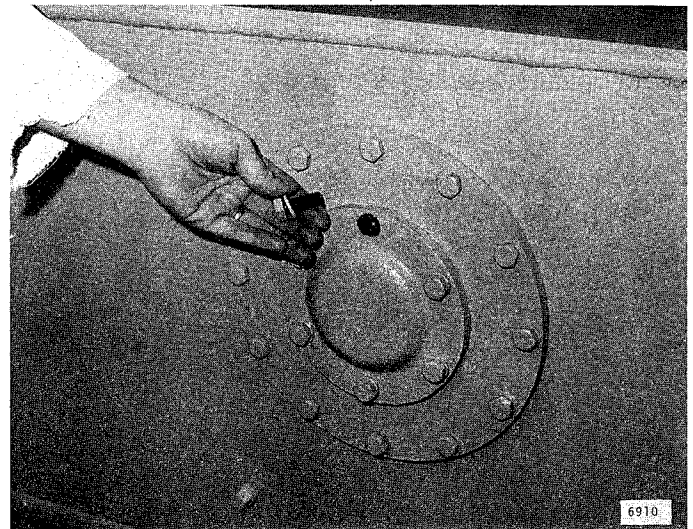
1

Drain lubricant from tandem drive case by removing pipe plug at the bottom of the case. (Arrow)



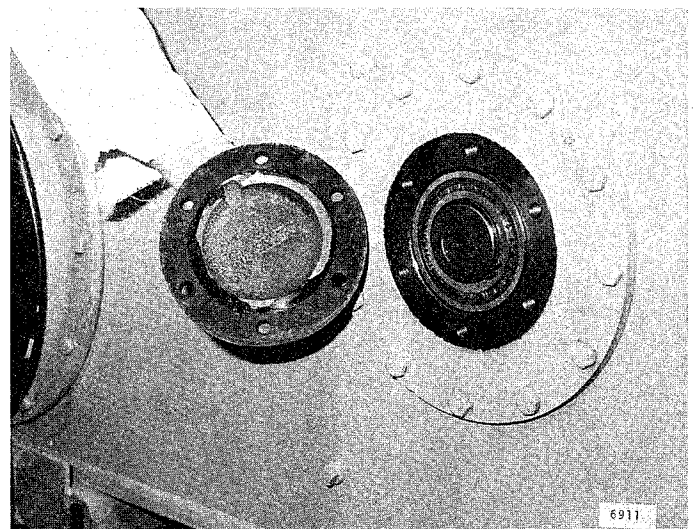
2

Remove six (6) grade 5 cap screws and lock washers from rear drive axle bearing cover.



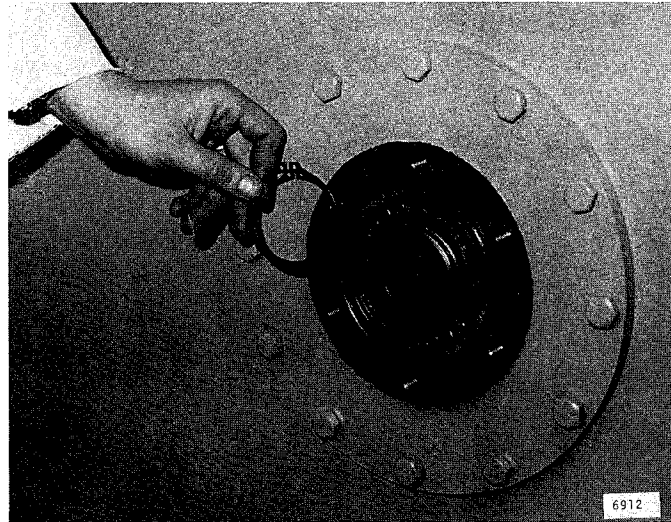
3

Remove bearing cover and gasket from axle bearing carrier. Gasket may remain attached to cover.



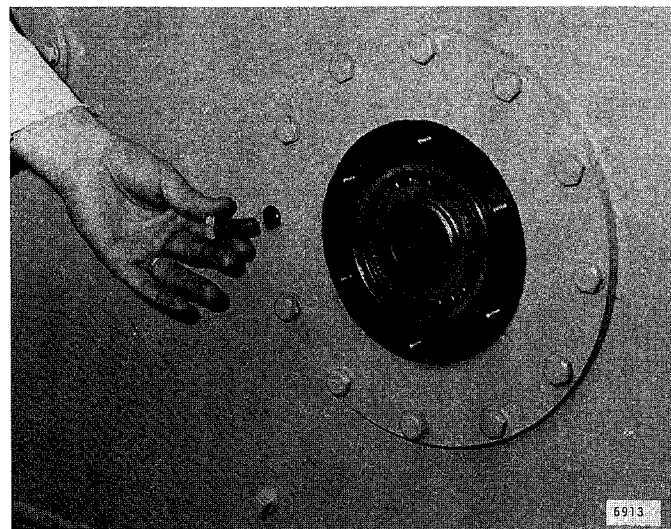
4

Remove bearing locating snap ring from rear drive axle.



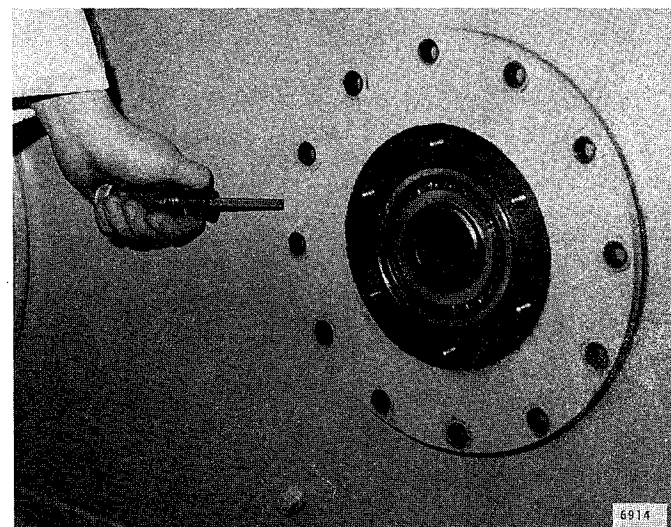
5

Remove twelve (12) grade 5 self-locking cap screws (1/2" x 1 1/4") from axle bearing carrier. *(Some units will not have self-locking cap screws but regular cap screws and lock washers.)*



6

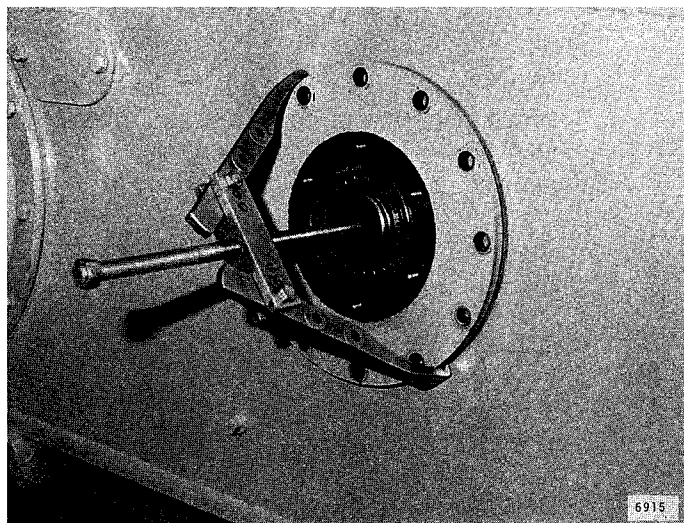
Using a suitable tool, move bearing carrier away from case to facilitate using a puller. Be careful not to damage carrier gasket when doing this operation.





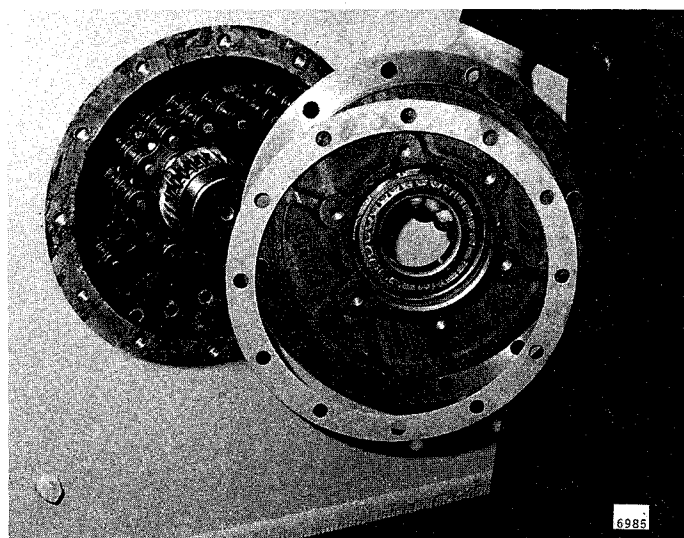
7

Using a suitable puller, remove axle bearing carrier. Remove gasket.



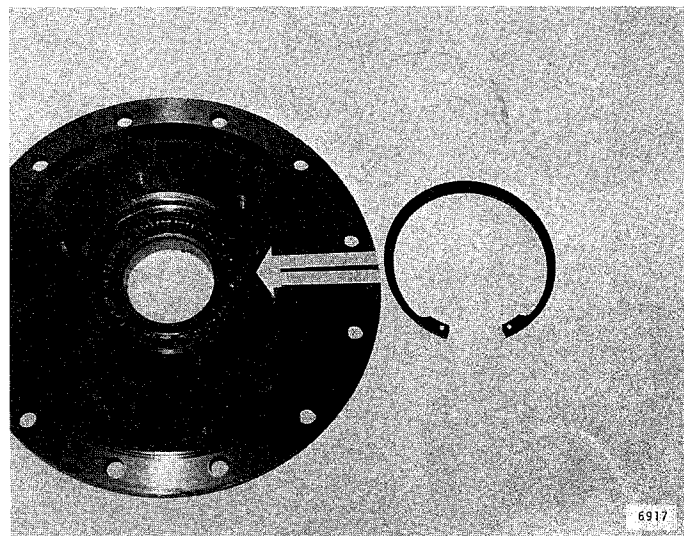
8

Axle bearing carrier removed from tandem case.



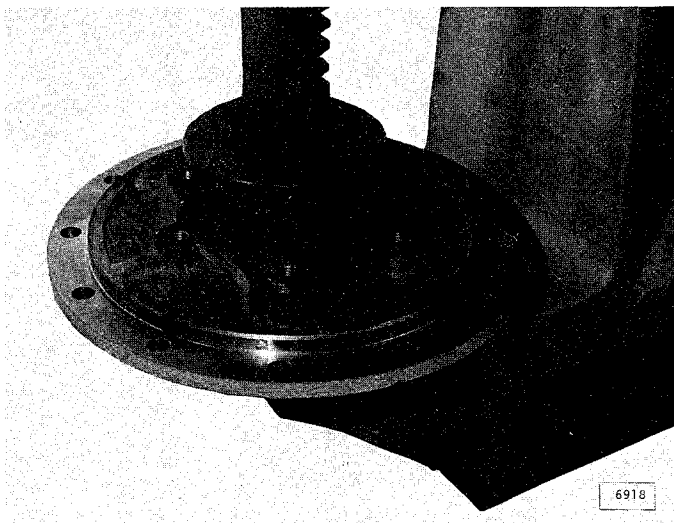
9

Remove bearing locating ring from axle bearing carrier.



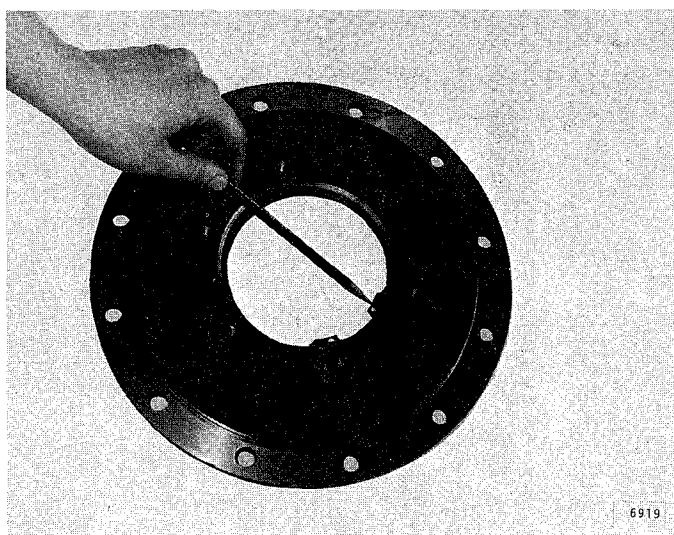
10

Press bearing from housing if bearing replacement is required. Press bearing from housing as shown, from inner side toward outer side of housing.



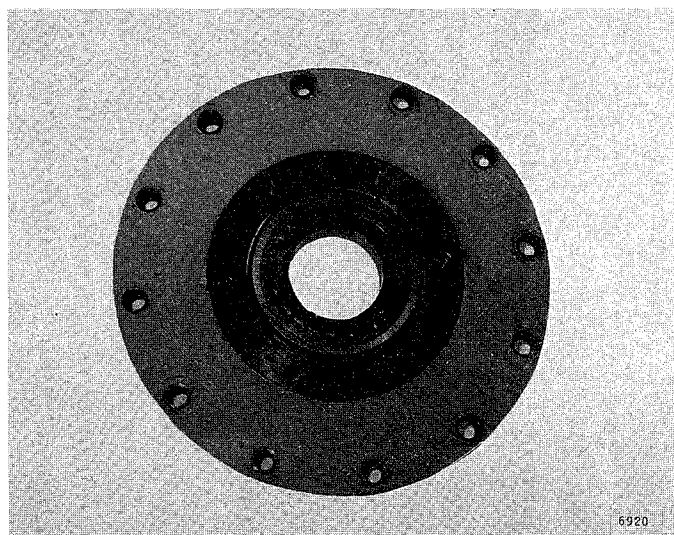
11

Install bearing locating ring in inner bore of axle bearing carrier.



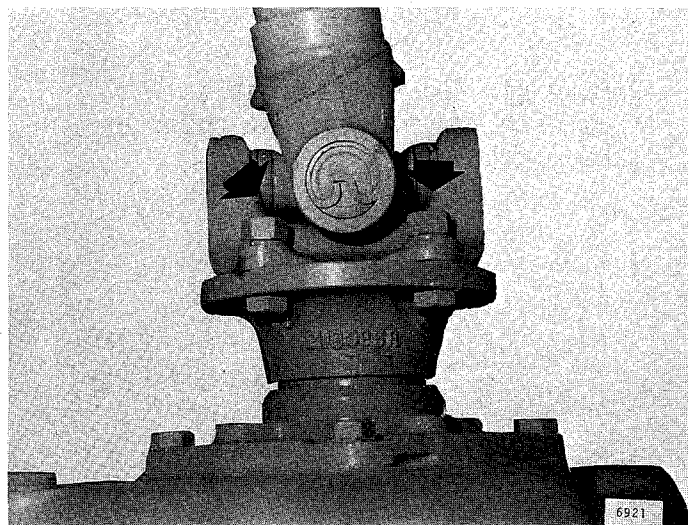
12

Install outer axle bearing in bore of axle bearing carrier with beveled edge of bearing toward the inside of the axle bearing carrier. Make certain outer axle bearing is properly seated against inner bearing locating ring.



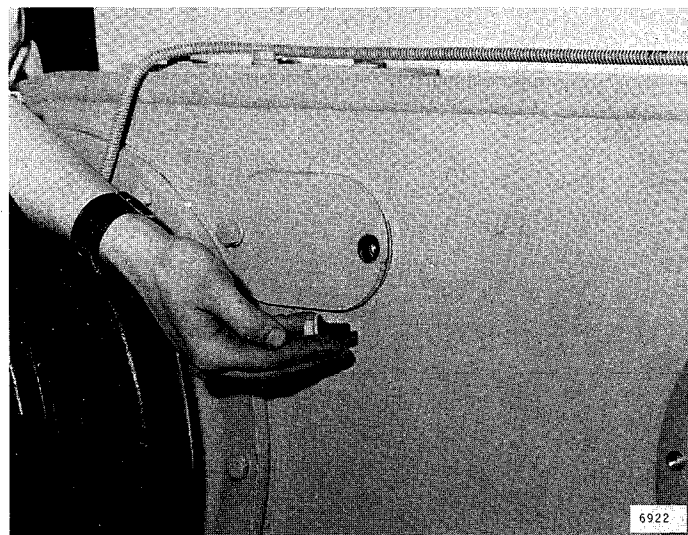
13

If tandem unit has not been removed from grader it will be necessary to disconnect lower drive shaft or put transmission shift levers in neutral to allow tandem wheel rotation. Place blocks under tandems so wheels are clear of ground and can be rotated. Remove four (4) bolts, nuts, lock-washers (arrows) if lower drive shaft is removed.



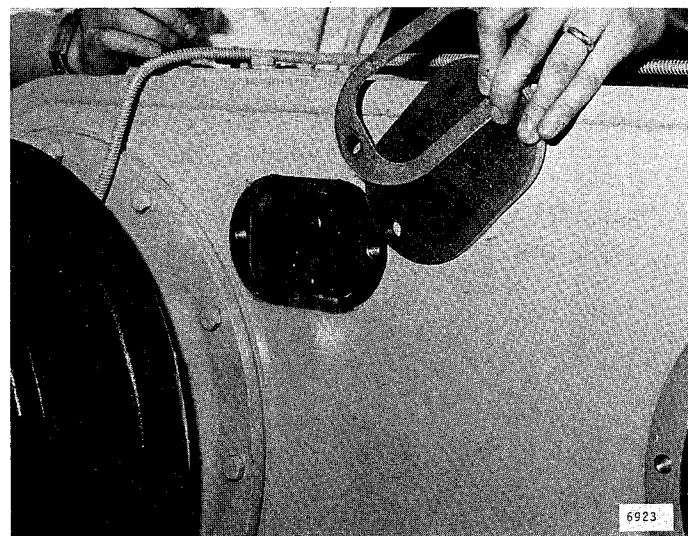
14

Remove two (2) grade 5 cap screws from each of the four (4) covers to the side access holes.



15

Remove four (4) covers to side access holes and four (4) gaskets.



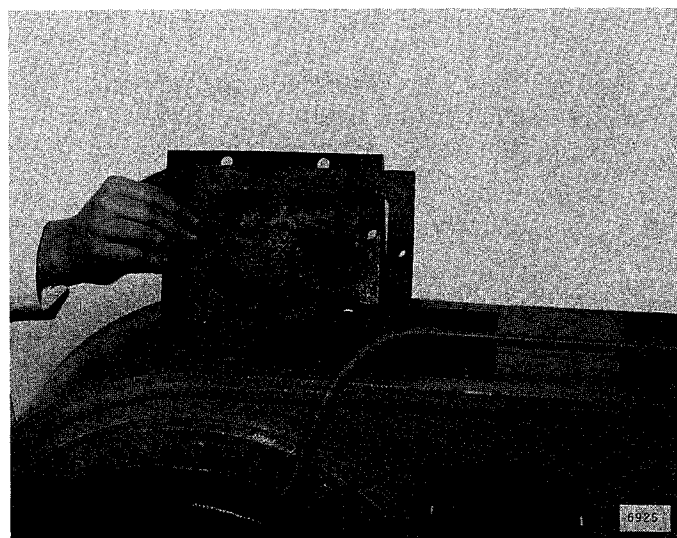
16

Remove six (6) grade 5 cap screws from each top access hole cover on tandem case.



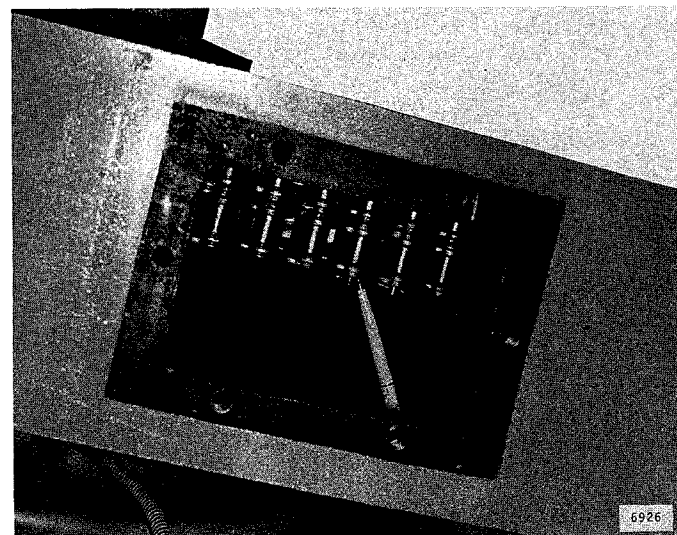
17

Remove top access hole cover(s) and gasket(s).



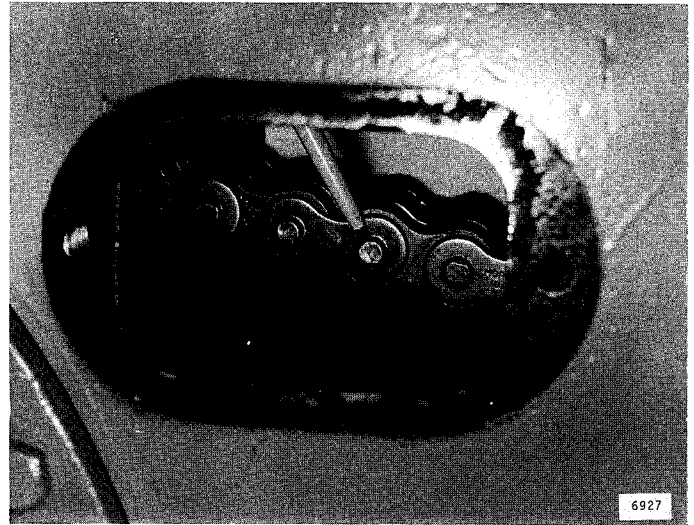
18

Rotate prop shaft until connecting link of one chain appears in top access hole of tandem case. Remove two (2) cotter pins from connecting link via top access hole.



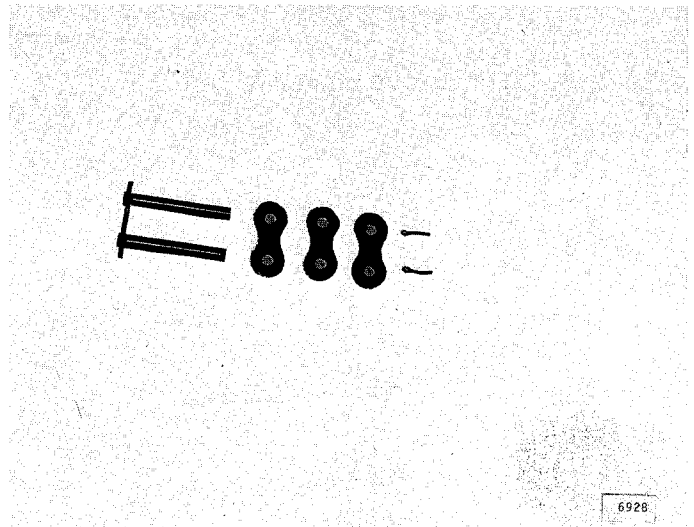
19

Remove connecting link to separate chain.



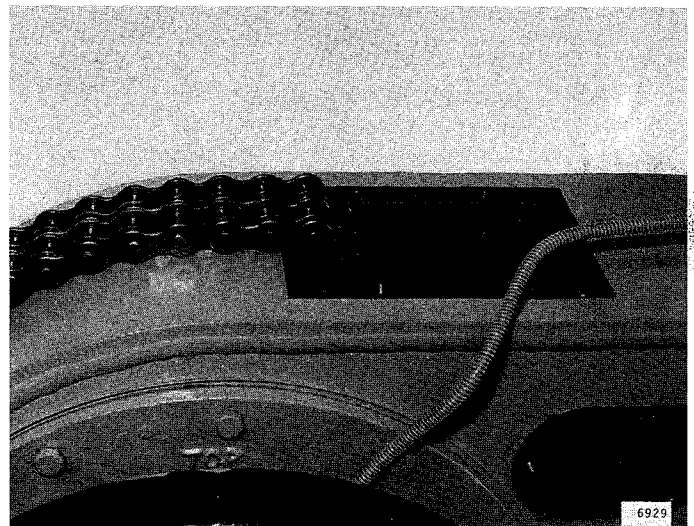
20

Figure (20) shows components of connecting link as they are removed.



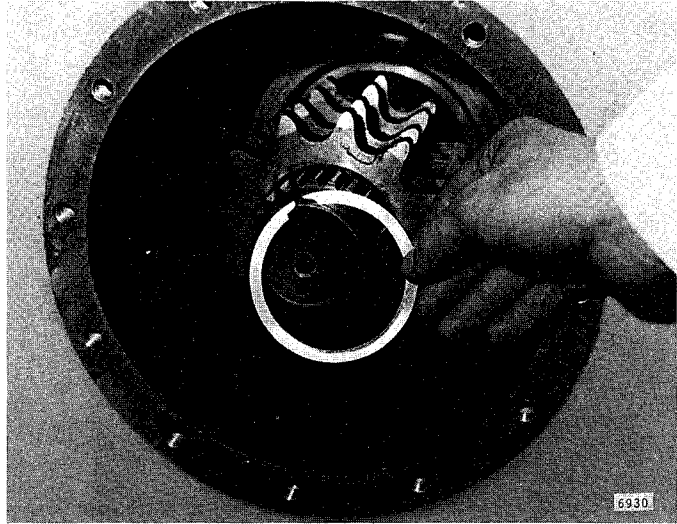
21

Remove chain from top access hole of tandem drive case. (Repeat steps 17 through 21 to remove companion chain at other end of case.)



22

Remove sprocket retaining snap ring from rear drive axle.



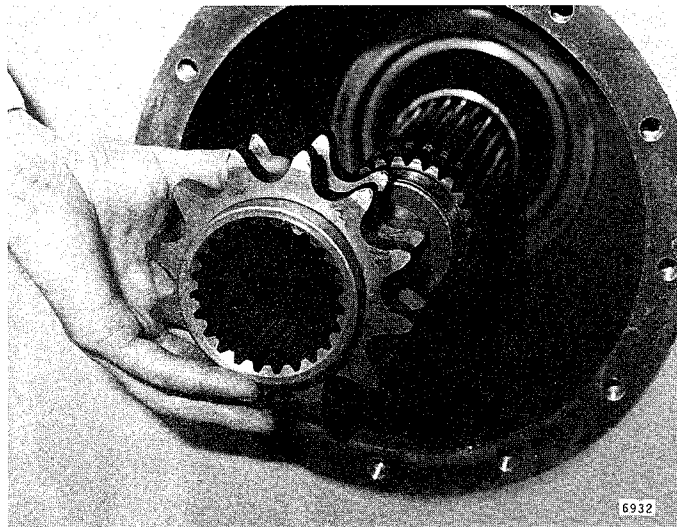
23

Remove outer drive sprocket.



24

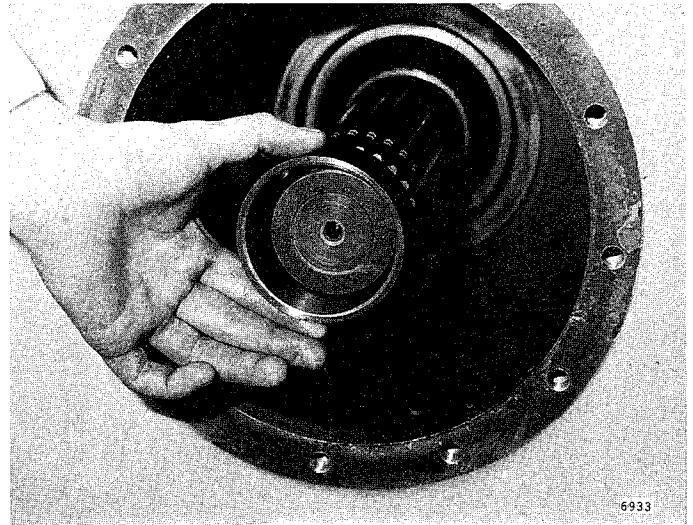
Remove inner drive sprocket.





25

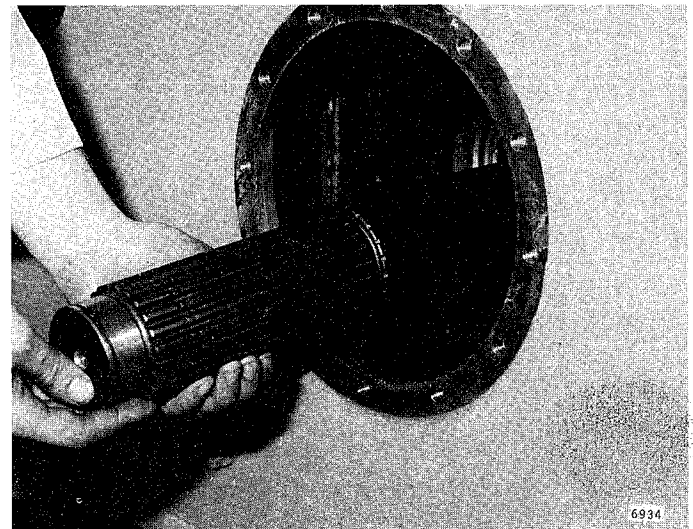
Remove spacer.



26

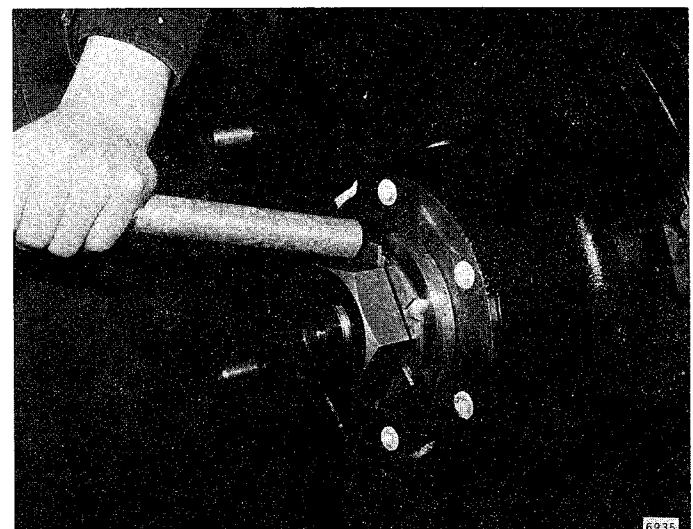
Remove rear axle. Use care not to damage seal in axle housing as axle is removed.

If replacement of seal is required, see File G, Section 4 for proper procedure.



27

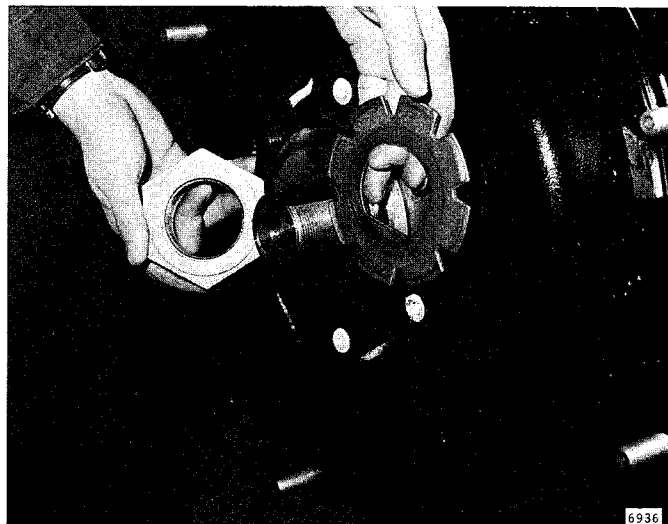
Straighten bent tang of lock washer on tandem axle.





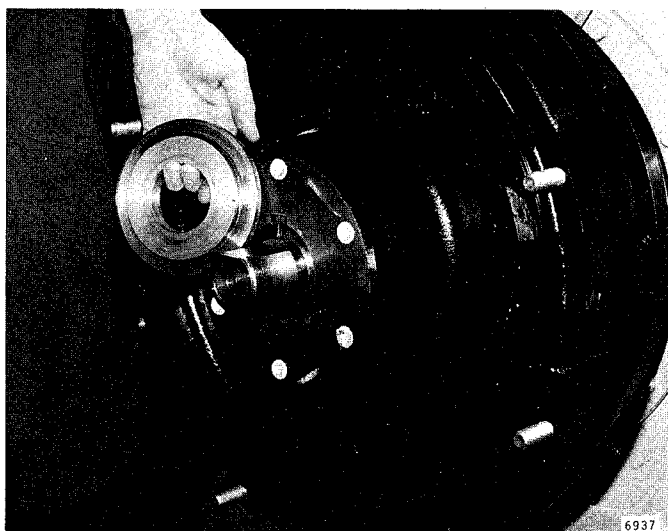
28

Remove tandem axle nut and lock washer.



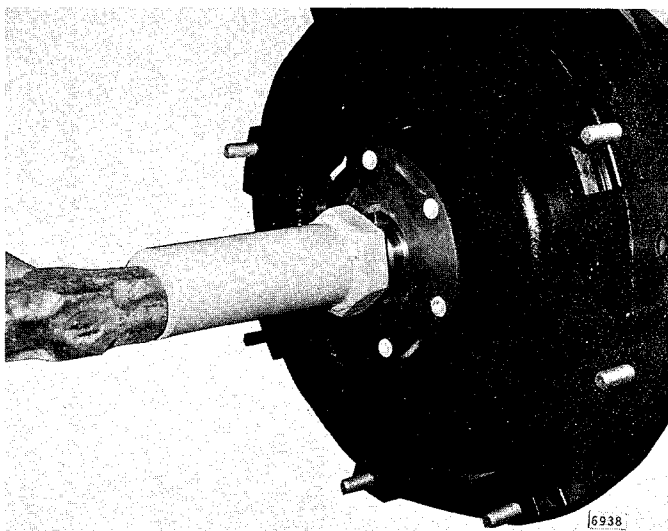
29

Remove washer.



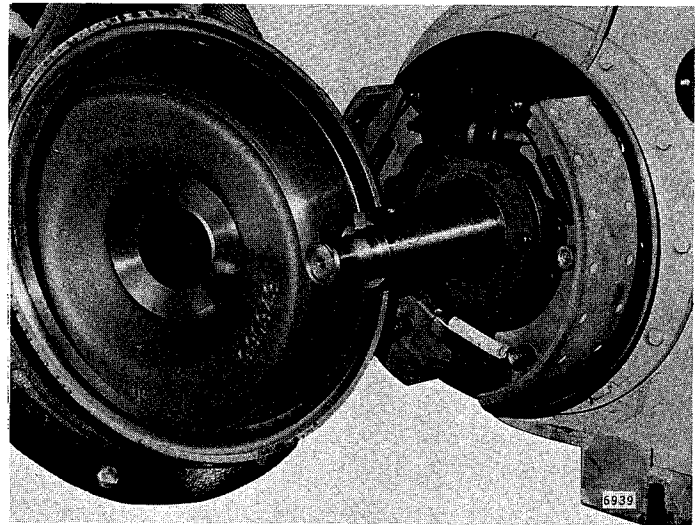
30

To remove tapered axle wheel, use wheel "knocker" as shown in photograph. Photo shows tire and rim removed from wheel, it is not necessary to remove tire and rim from wheel to do this step. See back cover for correct use of wheel knocker.



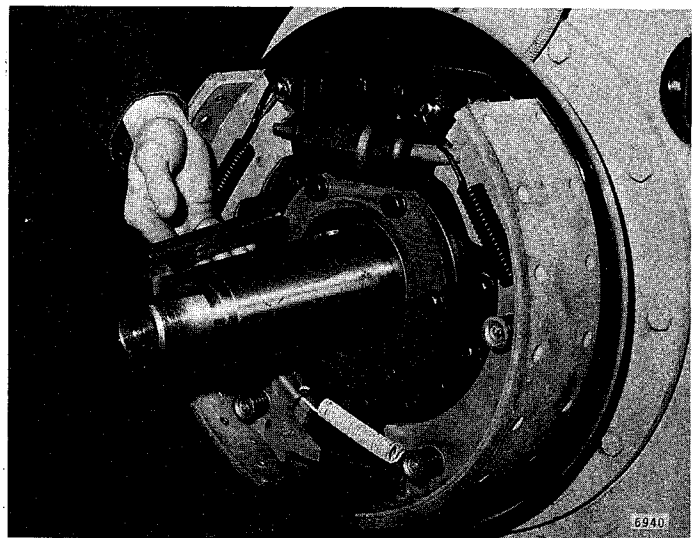
31

Remove wheel.



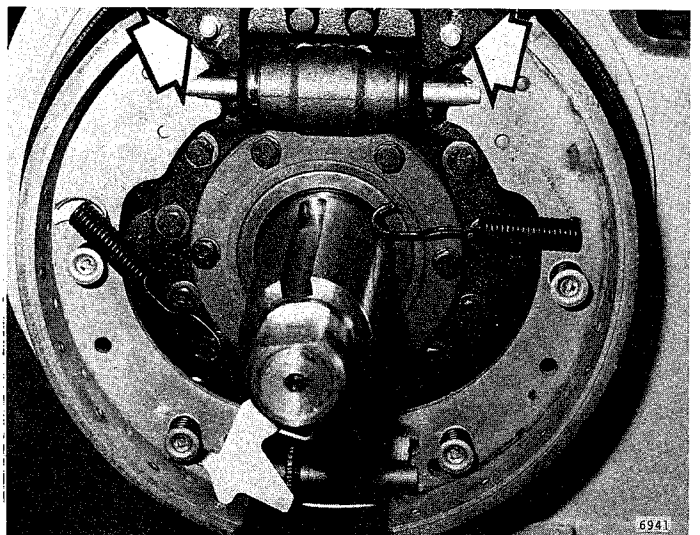
32

Remove key from axle.



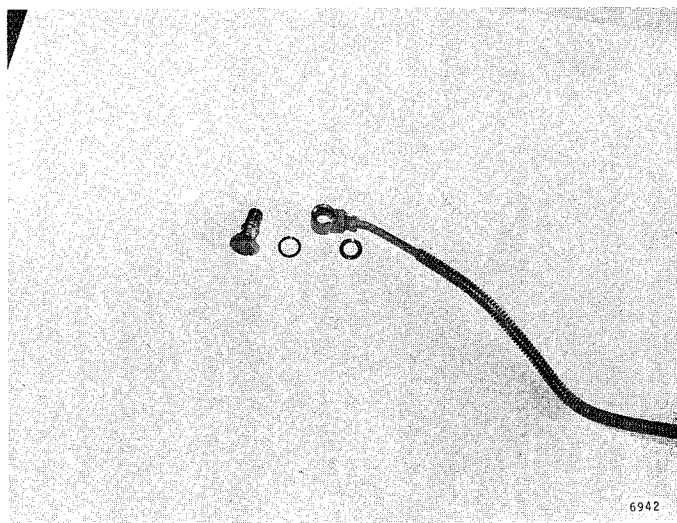
33

Remove two brake shoe return springs and one (1) self-adjusting cable from shoe return spring pins. (arrows)



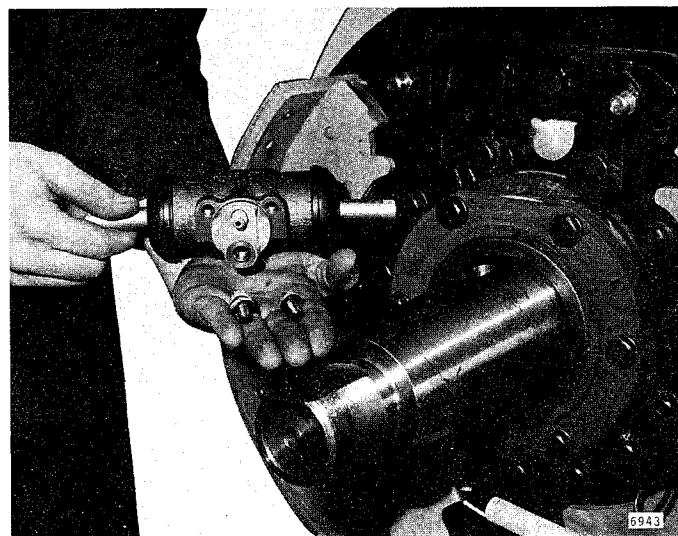
34

Remove brake line to wheel cylinder by removing inlet bolt. Use care not to damage bolt gasket or fitting gasket on each side of inlet fitting.



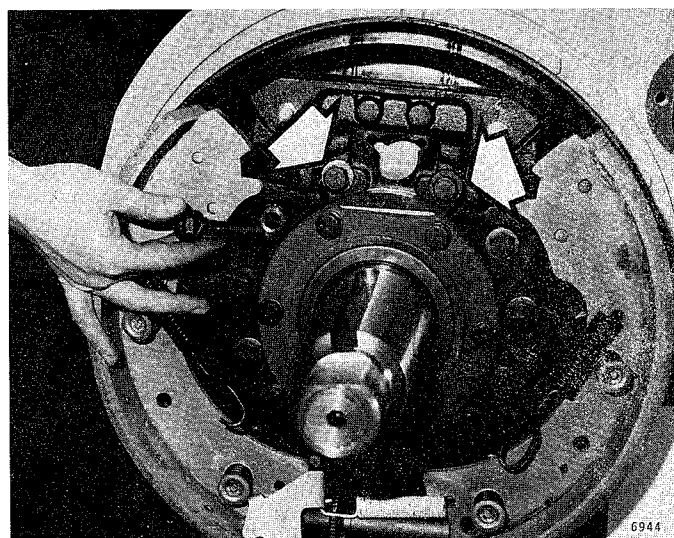
35

Remove two (2) 5/16" grade 5 cap screws holding wheel cylinder to brake backing plate. Remove wheel cylinder as complete assembly.



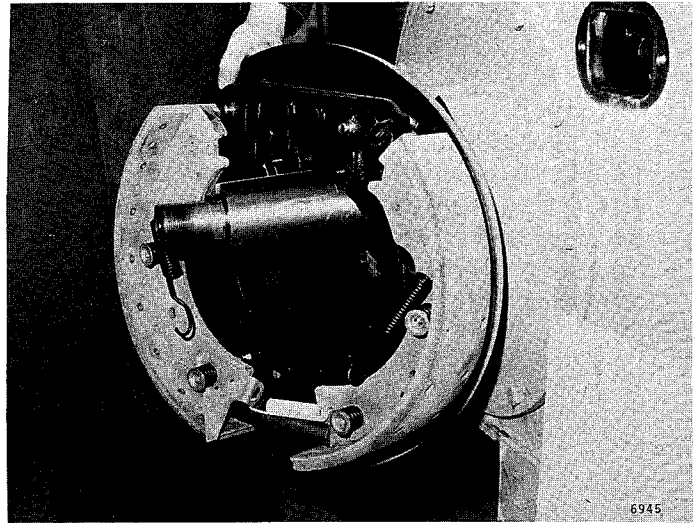
36

Remove thirteen (13) grade 8 cap screws and hardened flat washers, holding brake backing plate to brake and axle bearing housing. *Note: The two (2) cap screws at the top will be shorter than the rest. (arrows)*



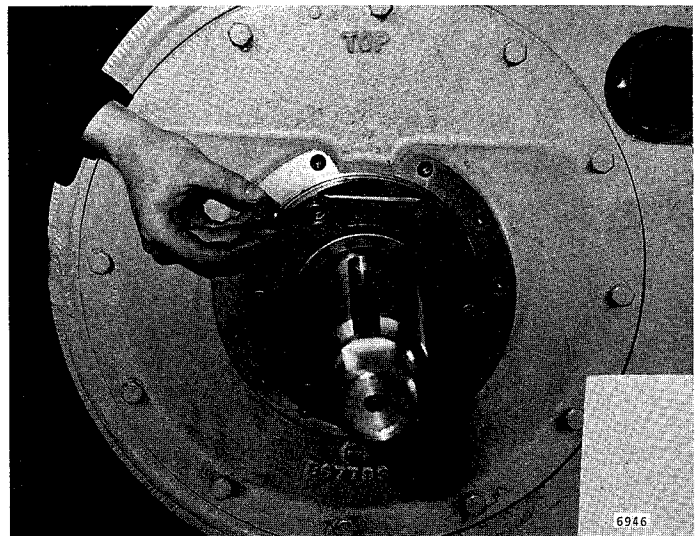
37

Remove brake backing plate assembly from brake and axle bearing housing.



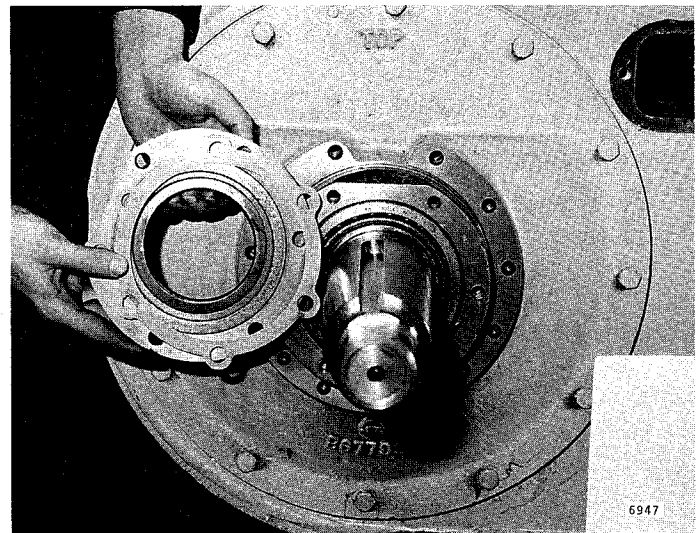
38

Remove six (6) grade 5 cap screws and lock washers from wheel bearing retainer.



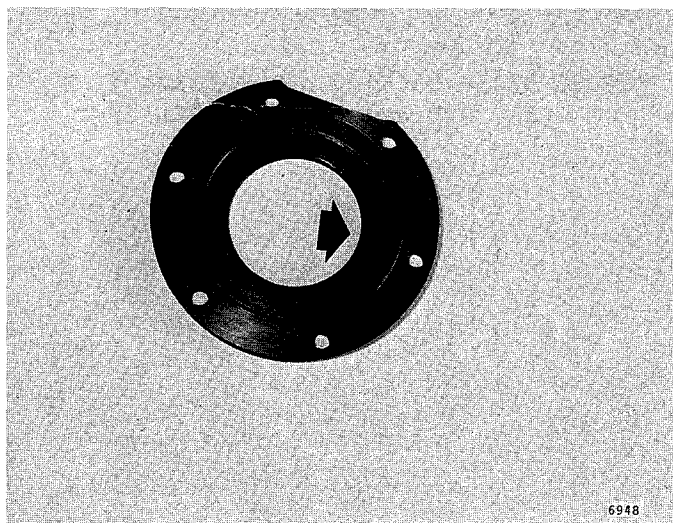
39

Remove wheel bearing retainer and wheel bearing retainer shim(s).



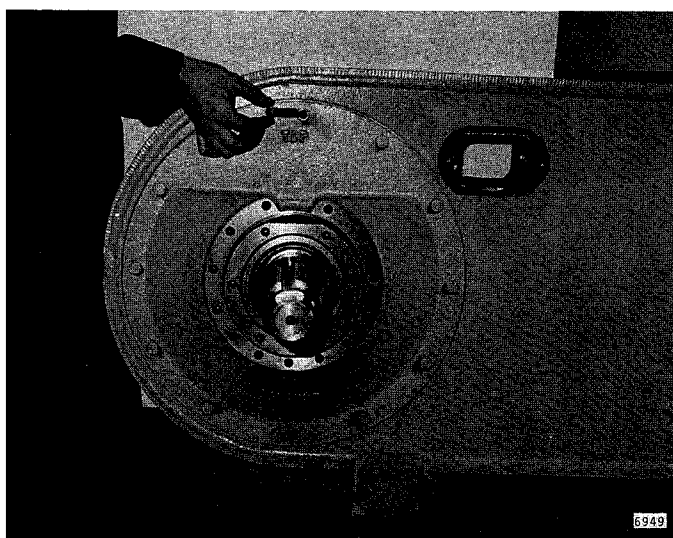
40

If axle shaft seal in wheel bearing retainer needs to be replaced, remove and replace at this time. If seal is replaced, apply a light coat of non-hardening sealant to outer diameter of seal prior to installation. Seal installs with lip of seal toward tandem case. (arrow to seal)



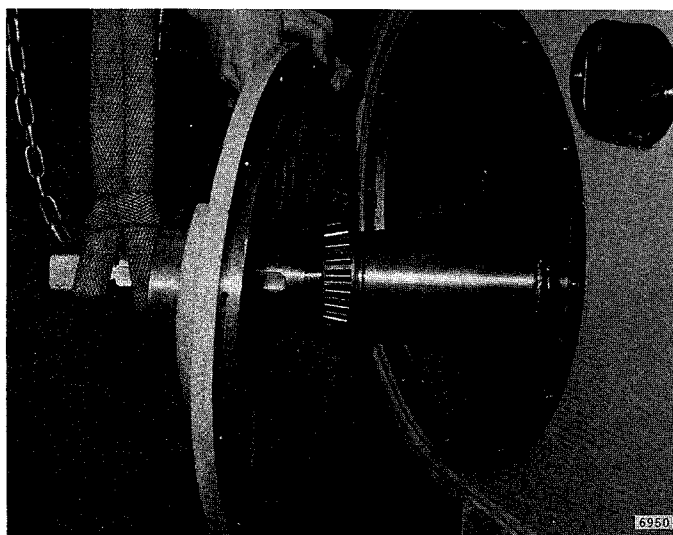
41

Remove twelve (12) grade 5 self-locking cap screws from brake and axle bearing housing.



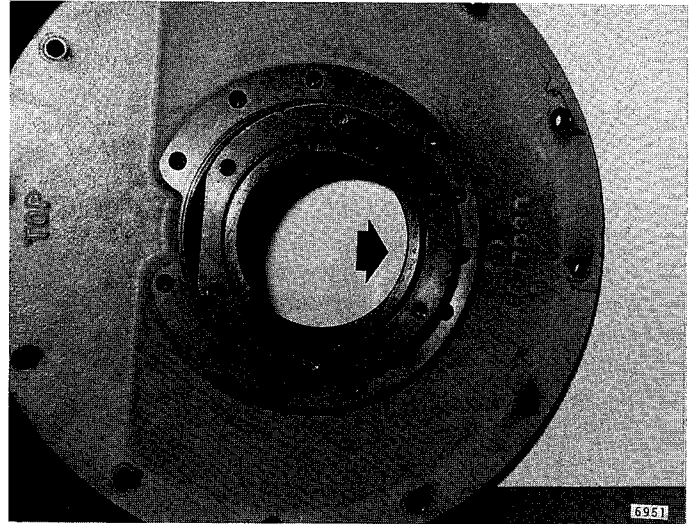
42

Remove brake and axle bearing housing and retainer gasket. Support tandem axle during this operation to prevent axle and sprocket from falling from tandem case. Gasket may remain with case.



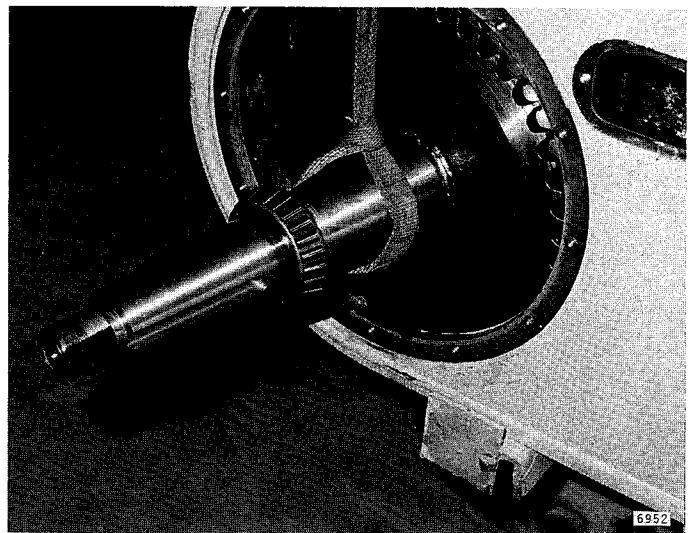
43

If bearing cup in brake and axle bearing housing needs to be replaced, remove and replace at this time. (arrow)



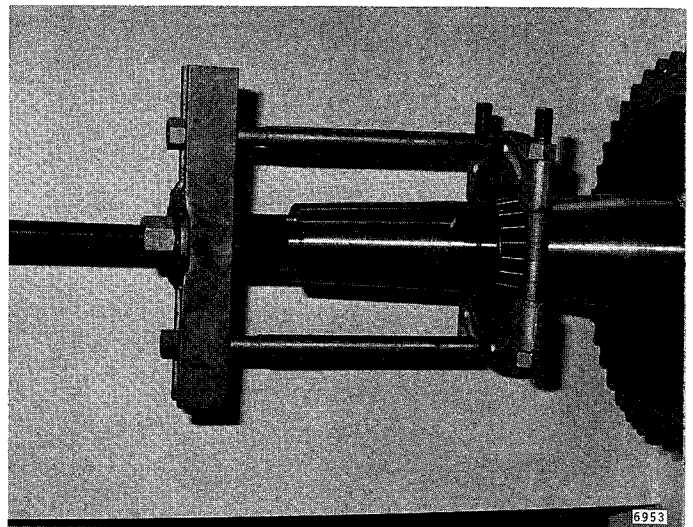
44

Remove axle and sprocket assembly from tandem case.



45

If outer bearing cone of axle shaft needs to be replaced, remove and replace at this time. If new bearing cone is to be installed be certain that bearing cone is fully seated against shoulder on axle shaft.

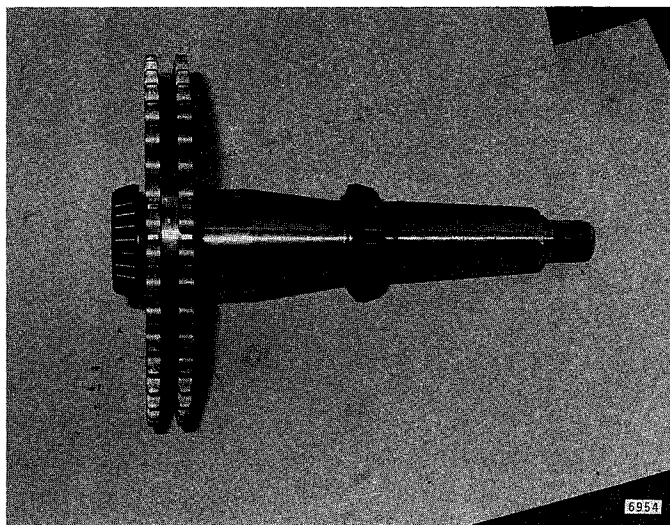




46

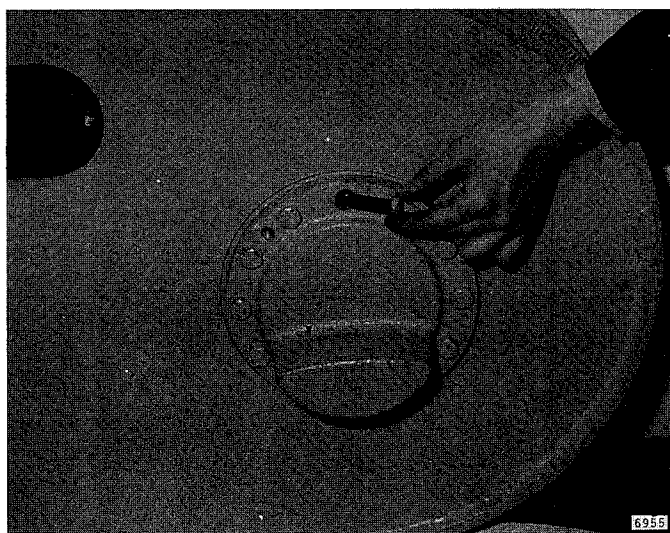
If inner bearing cone needs to be replaced, remove and replace at this time. If new bearing cone is installed be certain that bearing cone is fully seated against shoulder on axle shaft.

*Note: If a bearing cone needs to be replaced, then the accompanying bearing cup must also be replaced and vice versa. This will be true for all bearing cones and cups.*



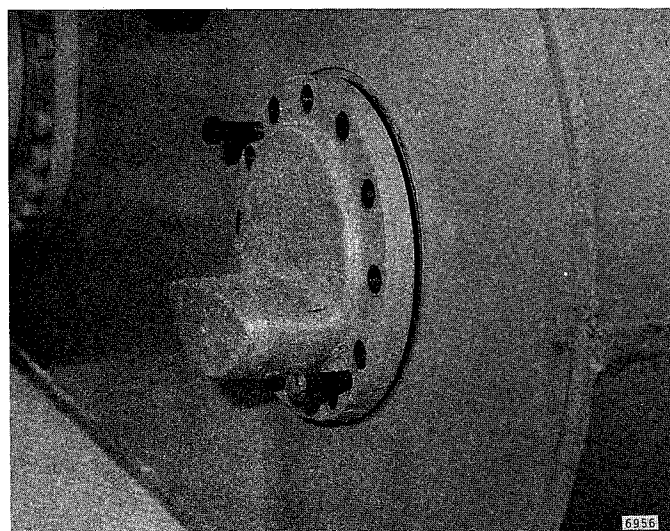
47

Remove twelve (12) grade 5 self locking cap screws from inner axle bearing retainer on the inner edge of the tandem case.



48

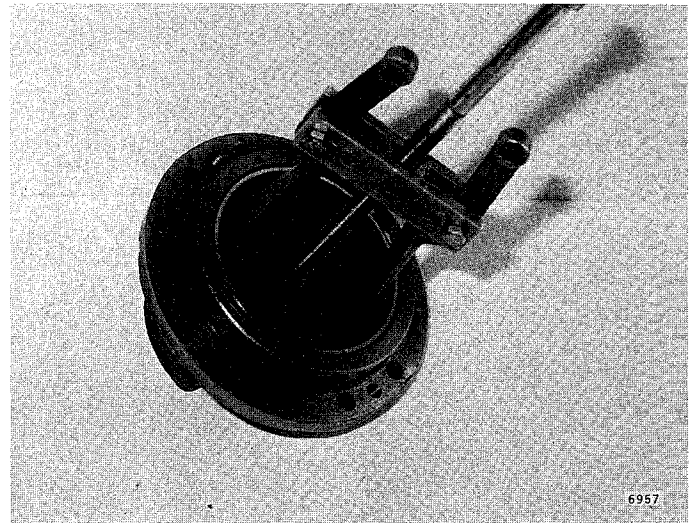
Using two (2) 1/2" UNC thread cap screw with 2" of thread, pull axle bearing retainer from case. Remove shim pack taking care not to damage shims. Retain shim pack with proper axle bearing retainer. Remove gasket.





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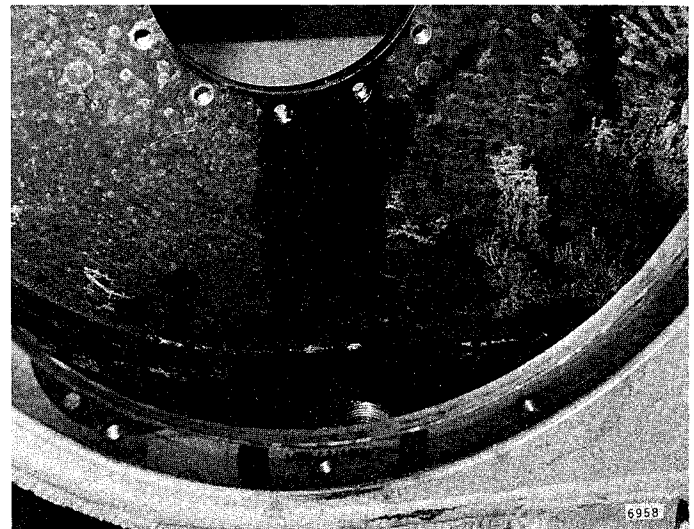
If necessary, remove and replace inner axle bearing cup from axle bearing retainer. Insure bearing cup is completely seated in retainer when installed.



**ASSEMBLY:**

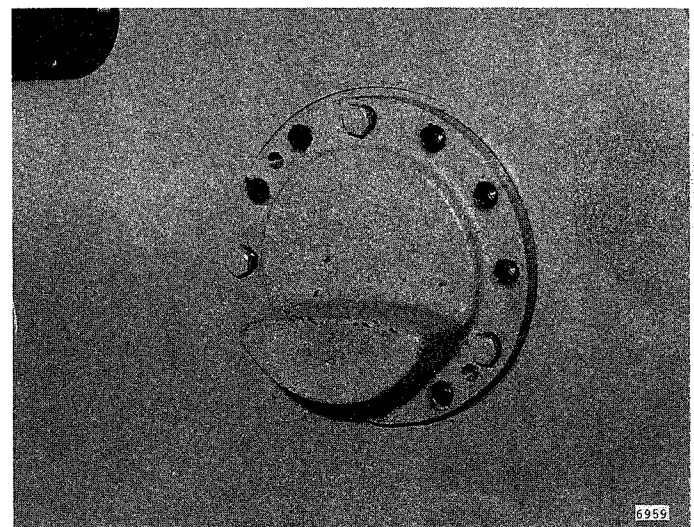
50

Clean and inspect all parts to determine serviceability; replace if necessary. Clean tandem drive case prior to re-assembly.



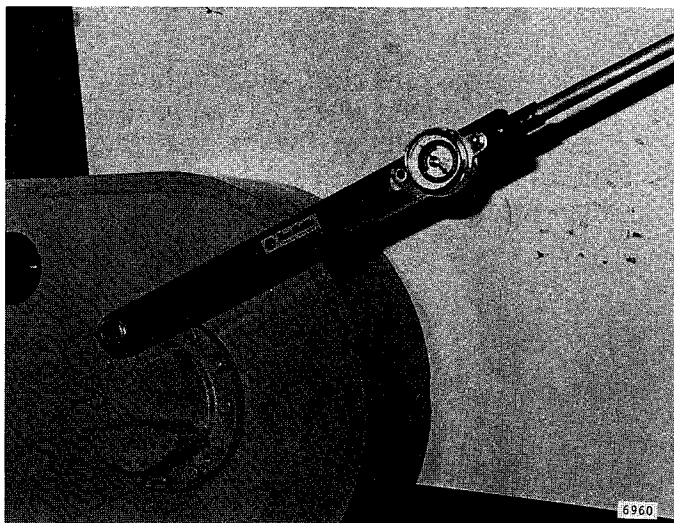
51

Install axle bearing retainer, previously removed shims, and gasket on inner edge of tandem case using a light coat of non-hardening sealant on gasket. Gasket installs between shims and case.



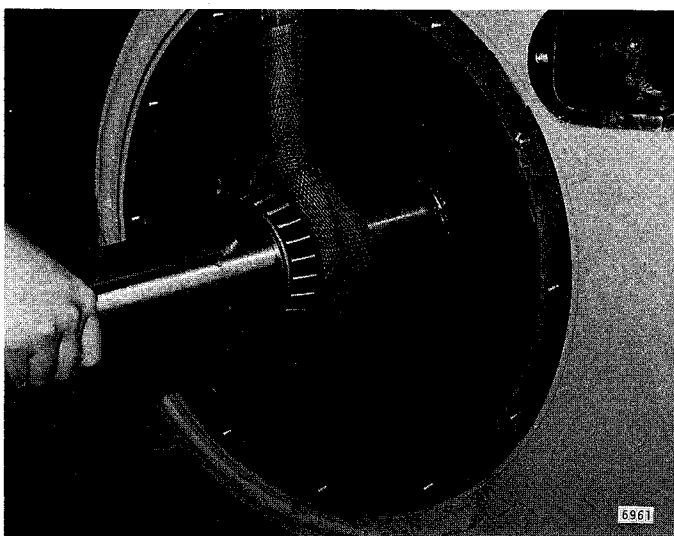
52

Install twelve (12) grade 5 self-locking cap screws in axle bearing retainer, cross tighten, and torque to 75 ft-lbs.



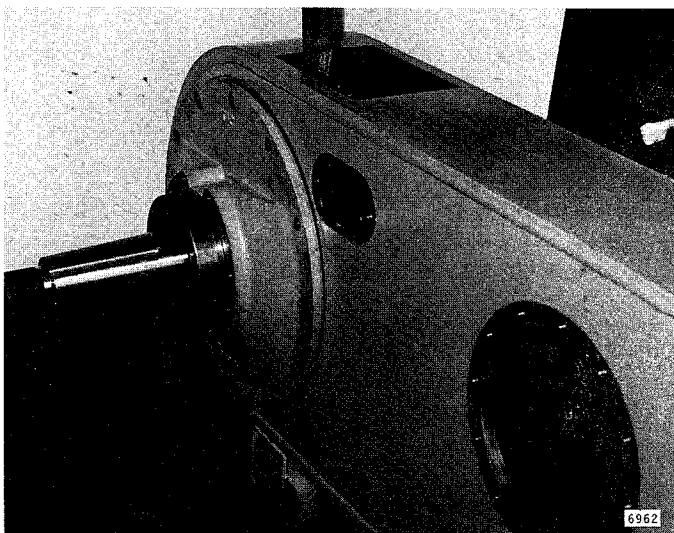
53

Install axle and sprocket assembly in tandem case. Support axle assembly in some manner to allow installation of brake and axle bearing housing as shown in next step.



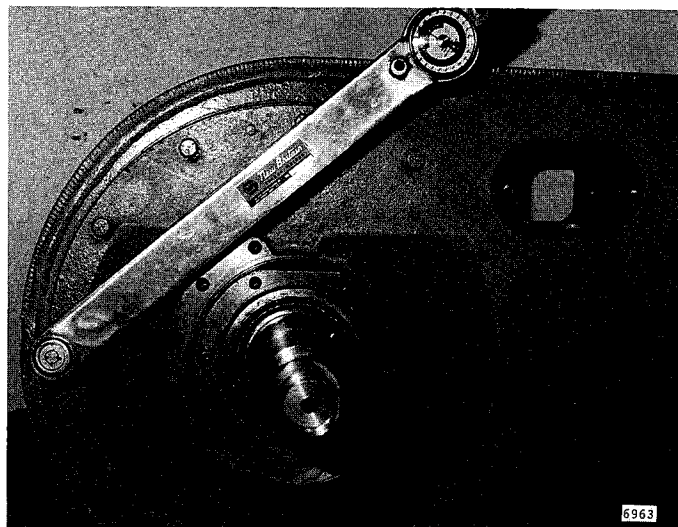
54

Apply a light coat of non-hardening sealant to retainer gasket and install brake and axle bearing housing over axle and to tandem case. Position housing so "top" is properly located.



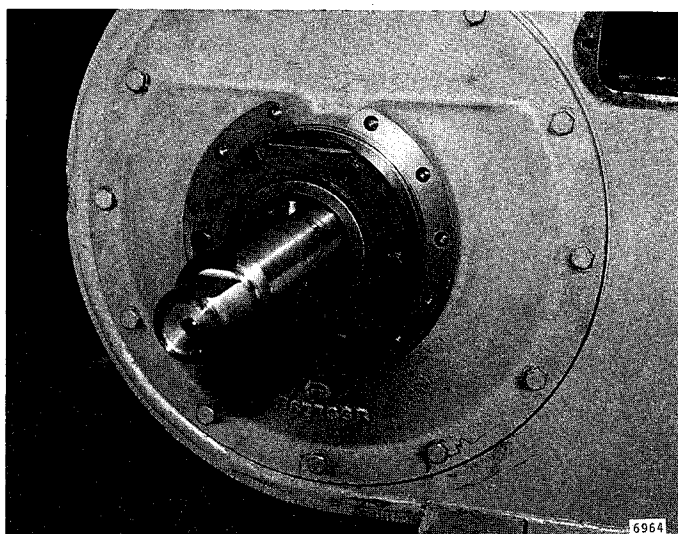
55

Install twelve (12) grade 5 self-locking cap screws in brake and axle bearing housing, cross tighten, and torque to 75 ft-lbs.



56

Install wheel bearing retainer and seal on axle shaft without shim(s). Install six (6) grade 5 cap screws without lock washers. Tighten cap screws until axle shaft has slight preload but no end play. Use care not to damage seal as it is installed over axle. *Note: If old bearings and cups are used, there should be no pre-load and no end play on tandem axle bearings.*

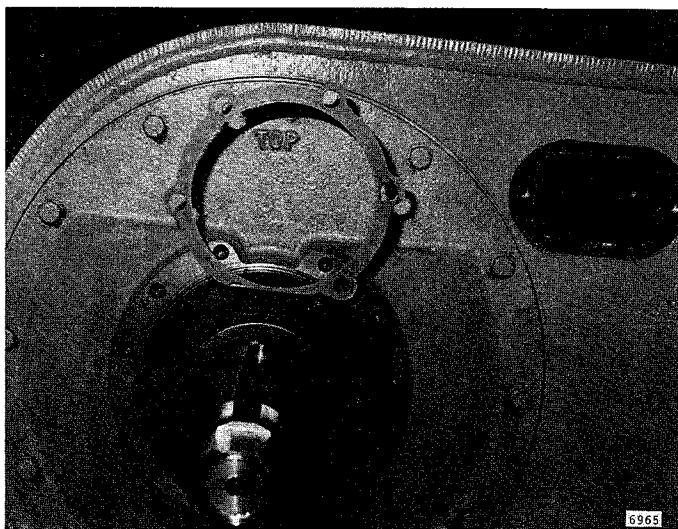


57

Insert enough shims into gap between retainer and housing to fill gap.

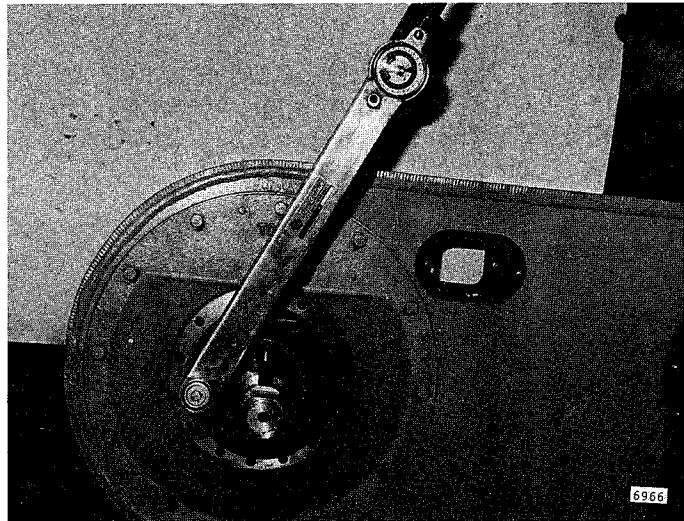
Add one .005" shim to this shim pack.

Shims come in .030 (coral), .015 (pink) and .005 (blue) thickness.



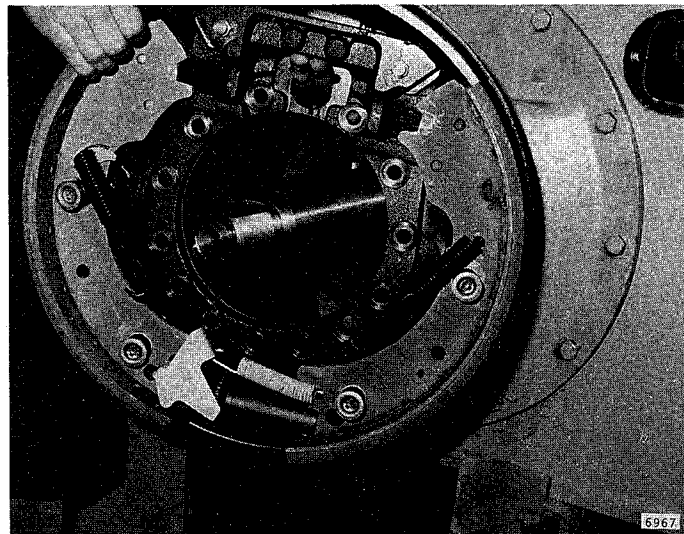
58

Remove six (6) grade 5 cap screws from wheel bearing retainer and insert previously determined shim stackup. Install cap screws and lock washers, cross tighten, and torque to 75 ft-lbs. When correct bearing adjustment is obtained there will be a slight preload and no end play as axle is rotated. Re-adjust if necessary to obtain proper preload.



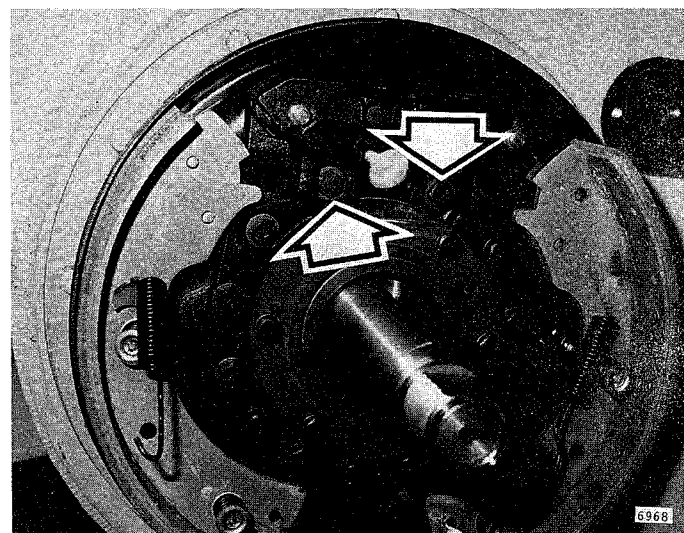
59

Install brake backing plate assembly.



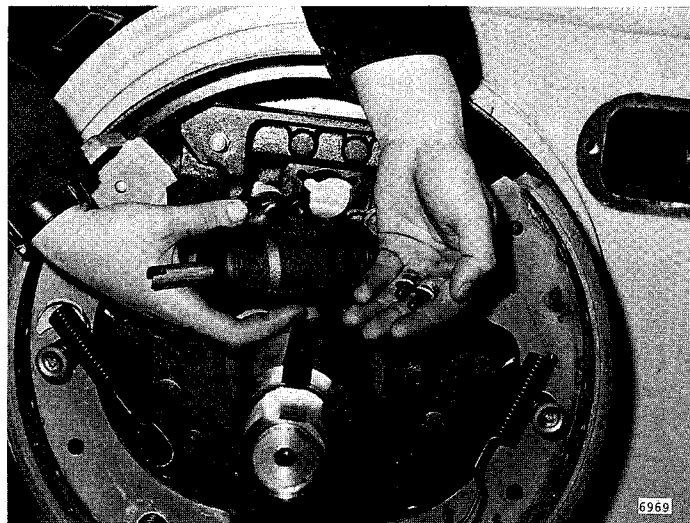
60

Install eleven (11) 2 3/4" long grade 8 cap screws and two (2) 2" long grade 8 cap screws and accompanying hardened flat washers in brake backing plate. Cross tighten and torque all cap screws to 100 ft-lbs. The two (2) 2" cap screws install at the top holes in backing plate assembly (arrows).



61

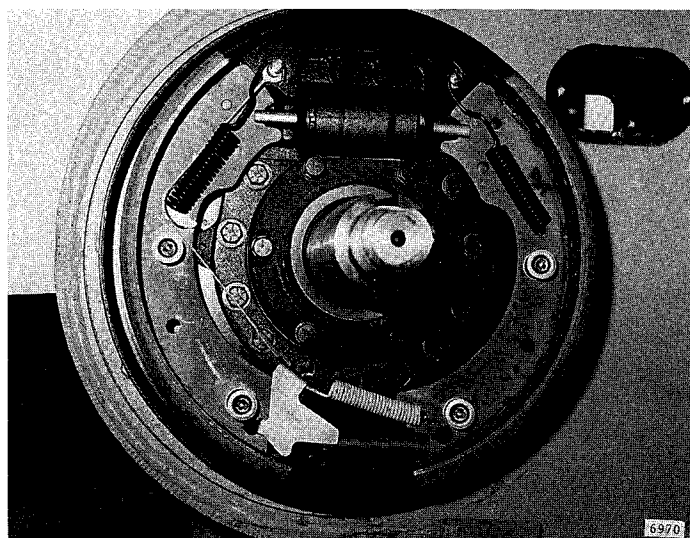
Install wheel cylinder to brake backing plate with two (2) grade 5 cap screws and lock washers. Locate wheel cylinder links in appropriate notch in each brake shoe. Slots in links must align freely into notch.



62

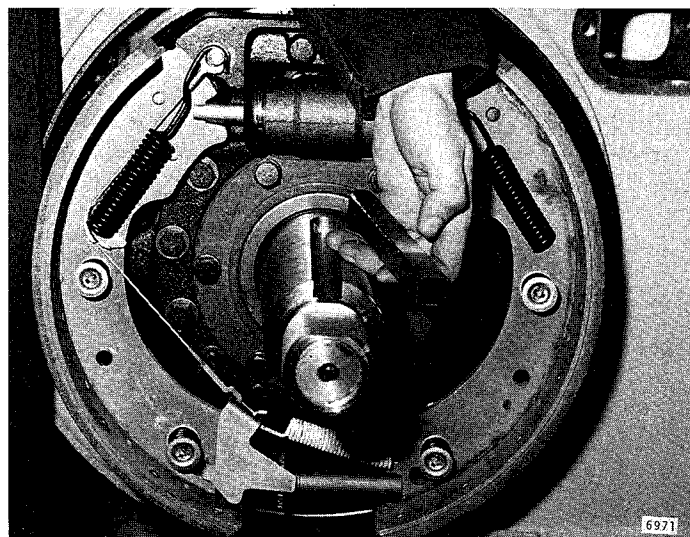
Install brake self-adjusting cable and three (3) brake return springs to brake shoes. For removal and replacement of entire brake assembly, see Shop Manual File K Section 1.10. Adjust shoes in to facilitate installation of wheel and brake drum.

*Note: Picture shown is for the right rear wheel. The cable on the wheel on the left side will be opposite. The adjusting cable will always be attached to the rear brake shoe.*



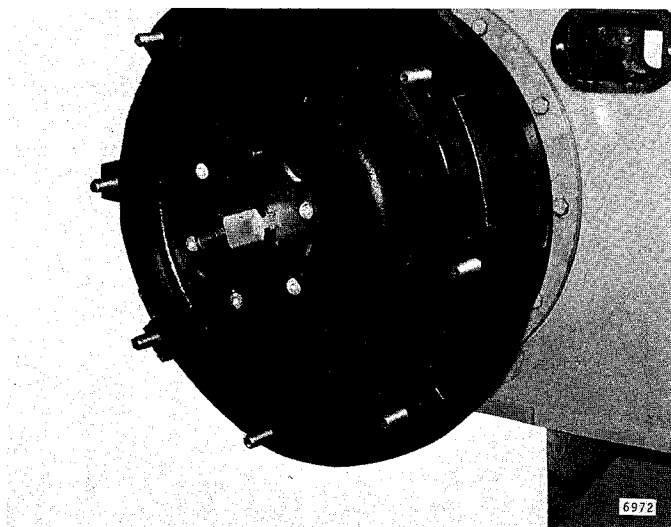
63

Install key in slot in axle shaft with rounded end of key mated to round end of slot in axle.



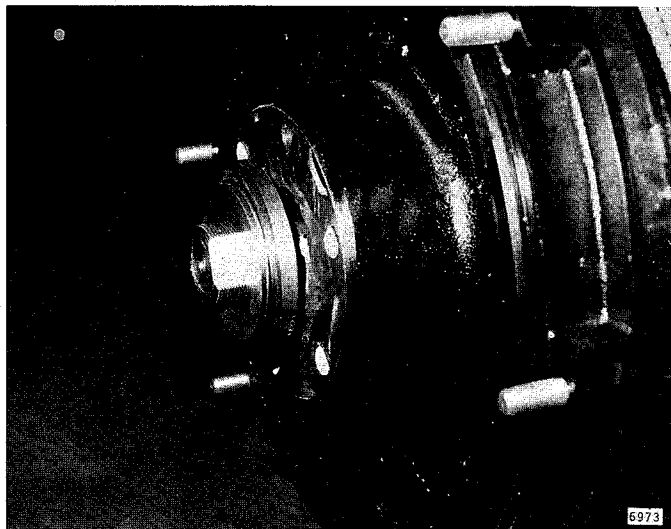
64

Install wheel on axle shaft, making certain that axle key and keyway in wheel are aligned correctly.



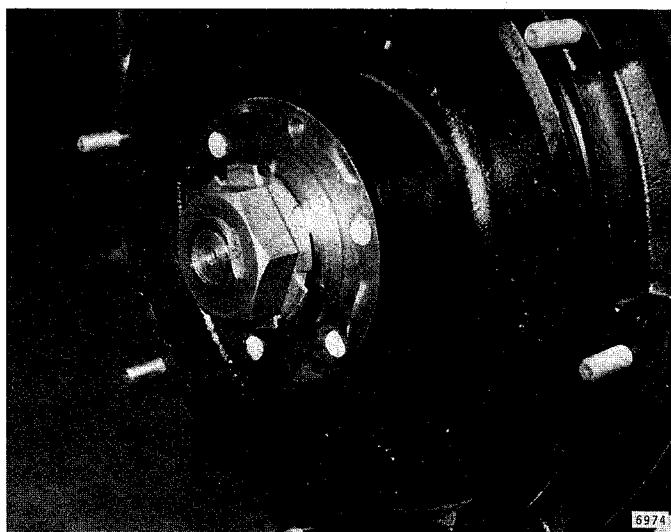
65

Install washer on axle shaft.



66

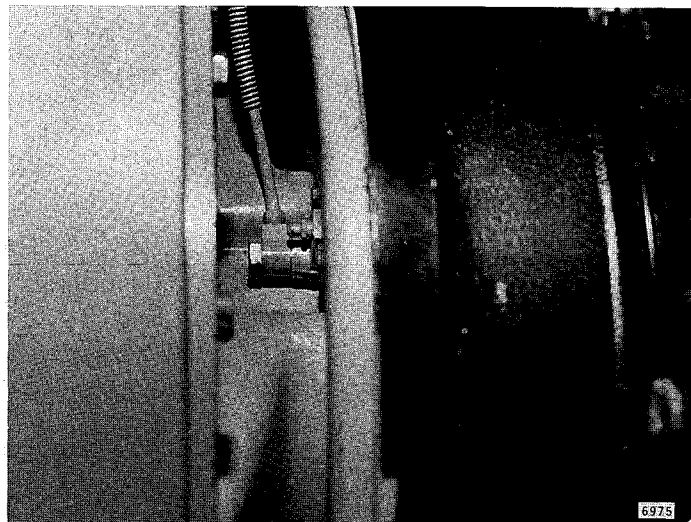
Install tanged lock washer and axle shaft nut. Torque axle nut after the completion of the entire assembly to 1950 ft-lbs. This 1950 ft-lbs torque is mandatory.





67

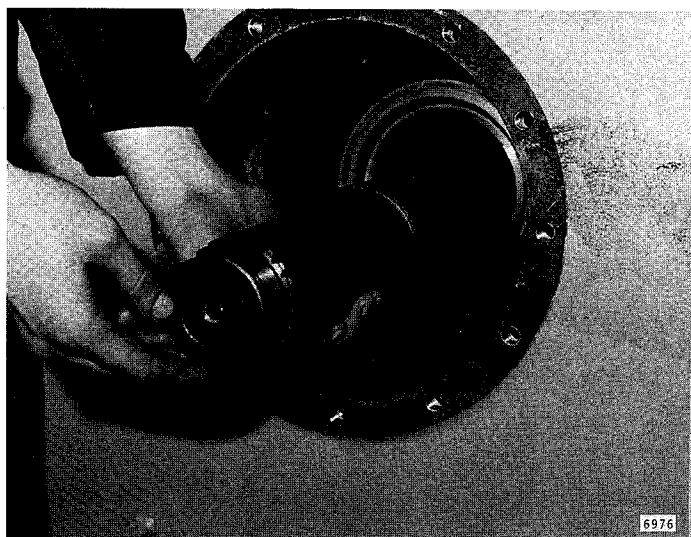
Install brake line to wheel cylinder with inlet bolt. Install gasket on each side of inlet fitting, using care not to damage bolt, gaskets or inlet fitting. Connect other end of brake line to fitting on top of tandem case.



68

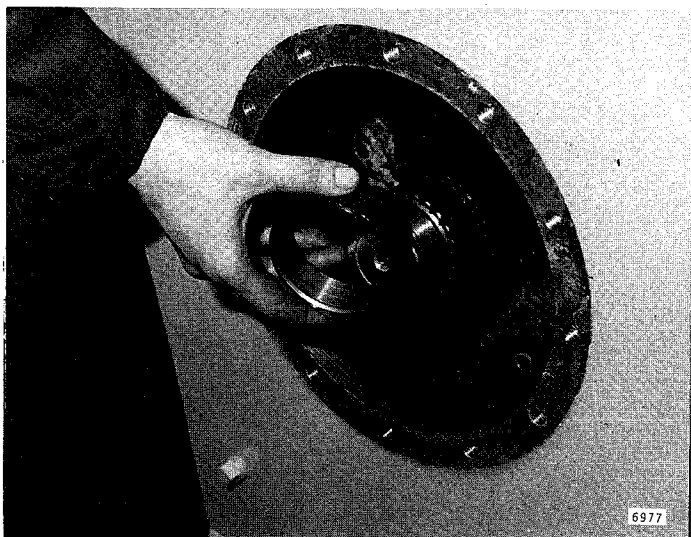
Install rear drive axle in axle housing. *CAUTION: Use care not to damage seal in housing.*

If replacement of drive axle is required, refer to File G, Section 4 for replacement procedure.



69

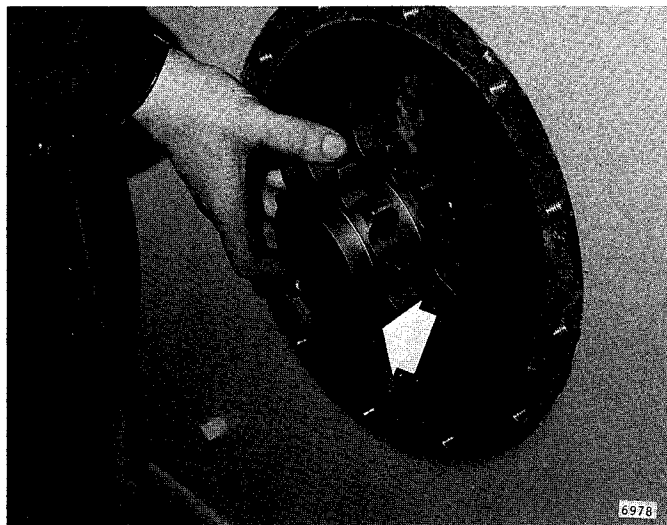
Install spacer on axle.





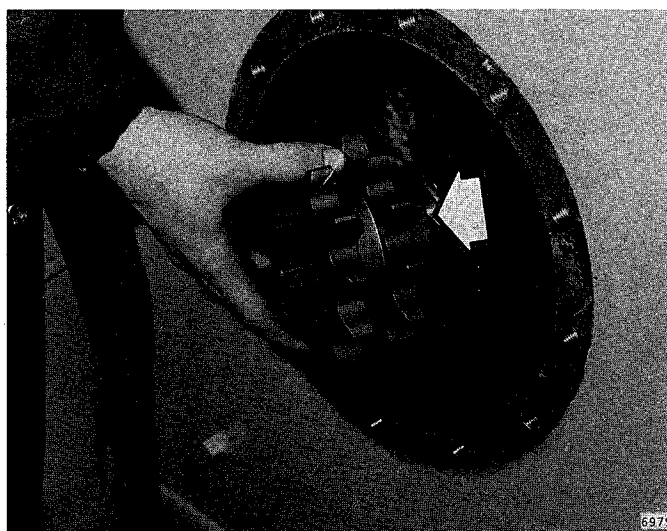
70

Install inner drive sprocket with flange side out. (arrow)



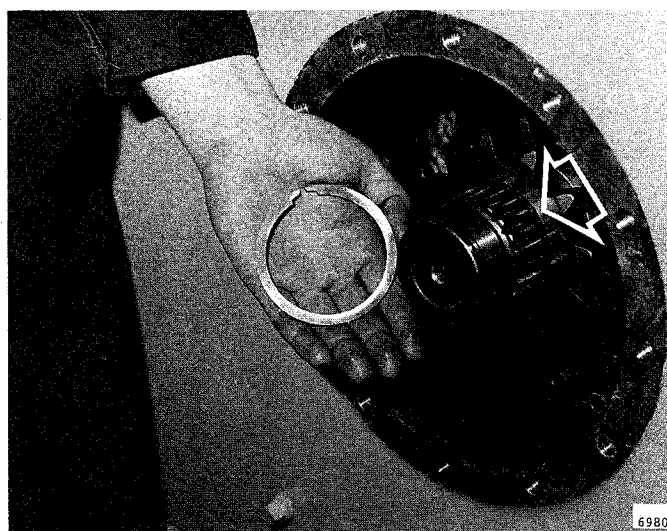
71

Install outer drive sprocket with flange side in. (arrow) (These sprockets must be in this position to provide correct alignment with front and rear tandem axle sprockets.)



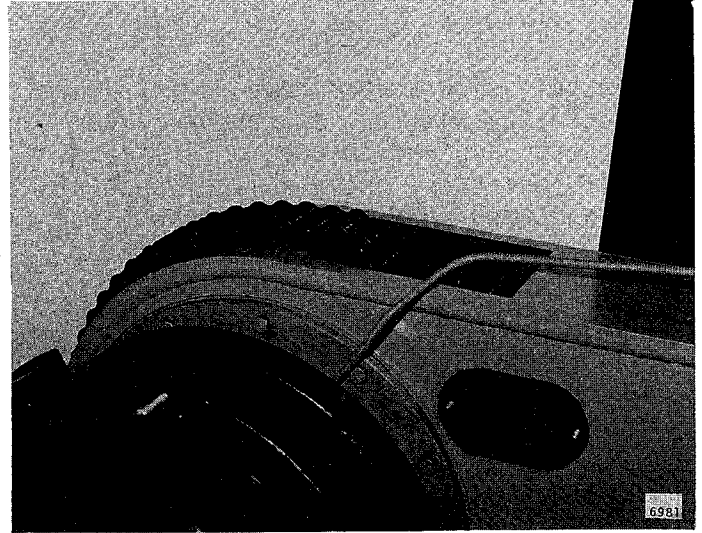
72

Install sprocket retaining snap ring. Be certain that snap ring is fully seated in groove on axle (arrow).



73

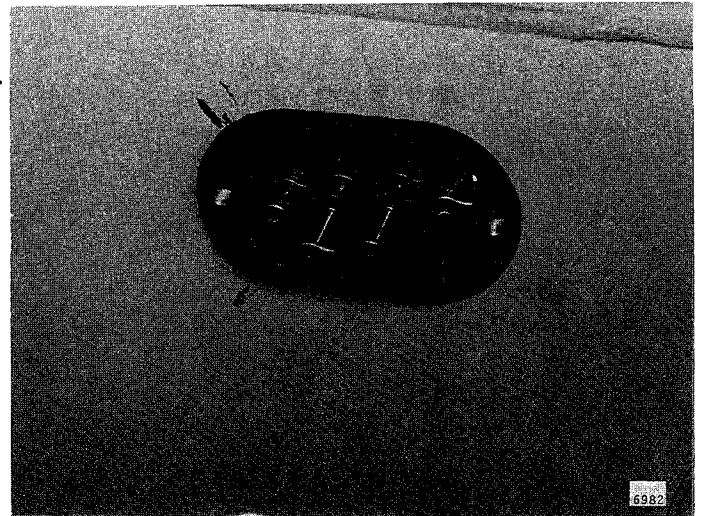
Install chain in tandem drive case through top access hole. After chain is placed on wheel sprocket, wheel may be revolved to feed chain around sprocket.



74

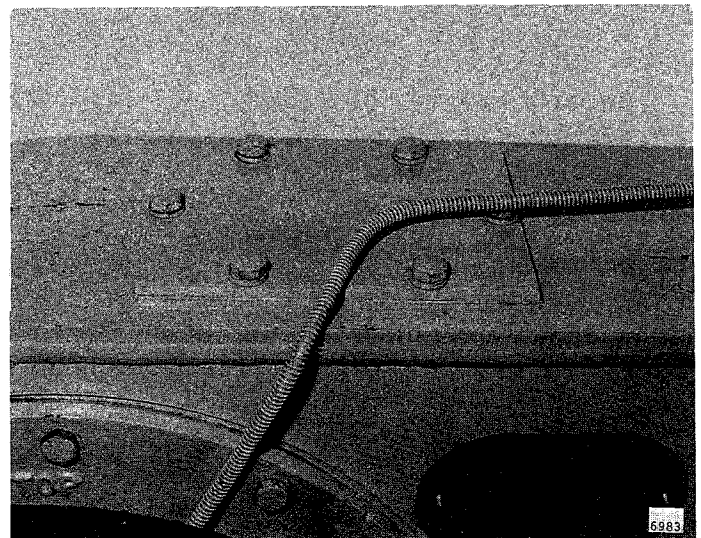
Bring chain ends together and install connecting link. Slide link through one strand only. Install two (2) link side plates (stamped "C") over connecting link pins. Align the other strand holes with pins and tap connecting link pins through second strand. Install side plate link (stamped "CON"). Install cotter pins and spread.

Both connecting links must be installed so the cotter pin holes are toward the center line of the tandem case. Care must be taken so that both connecting links do not pass over the center drive axle sprockets at the same time. Interference of chain connecting links could result.



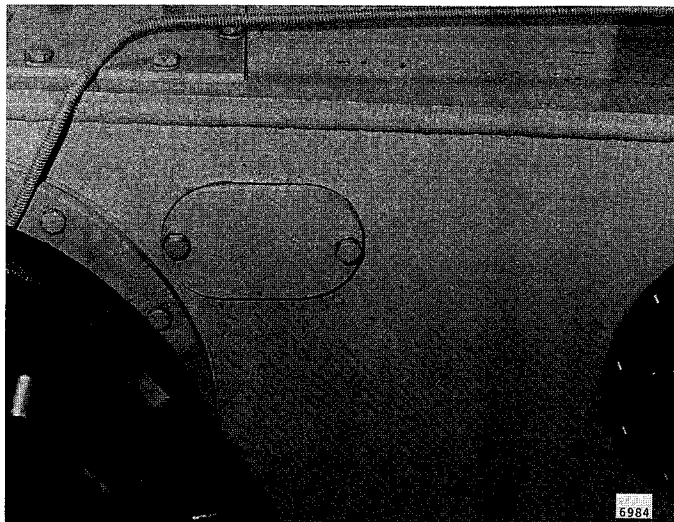
75

Install top access hole cover(s) and top hole cover gasket with six (6) grade 5 cap screws and lock washers and torque to 75 ft-lbs. (If necessary apply a light coat of non-hardening sealant to gasket(s).)



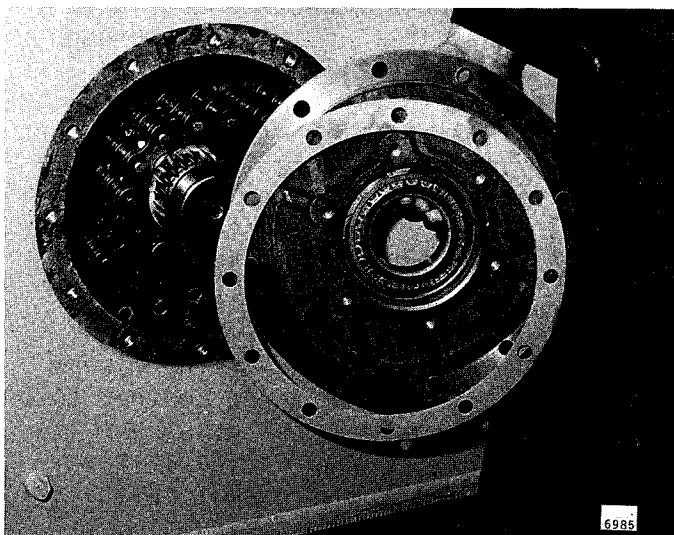
76

Install side access hole cover(s) and gasket(s) with two (2) grade 5 cap screws each and torque to 75 ft-lbs. (If necessary, apply a light coat of non-hardening sealant to gasket(s).)



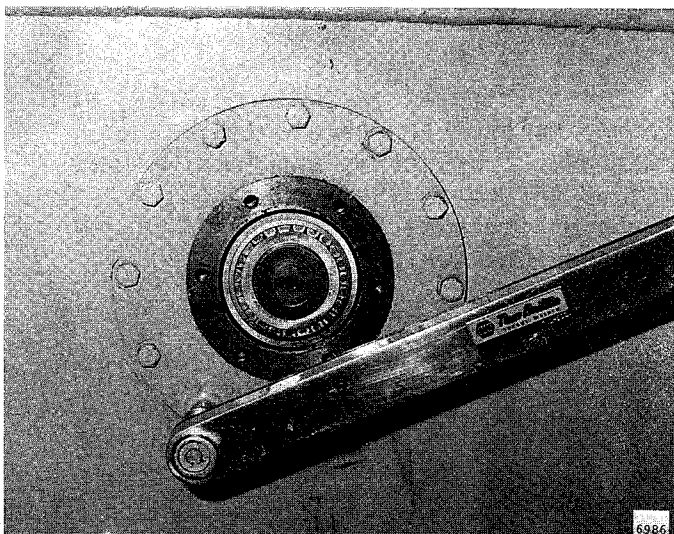
77

Install axle gasket and bearing carrier assembly to tandem case. Use a light coat of non-hardening sealant on gasket if necessary.



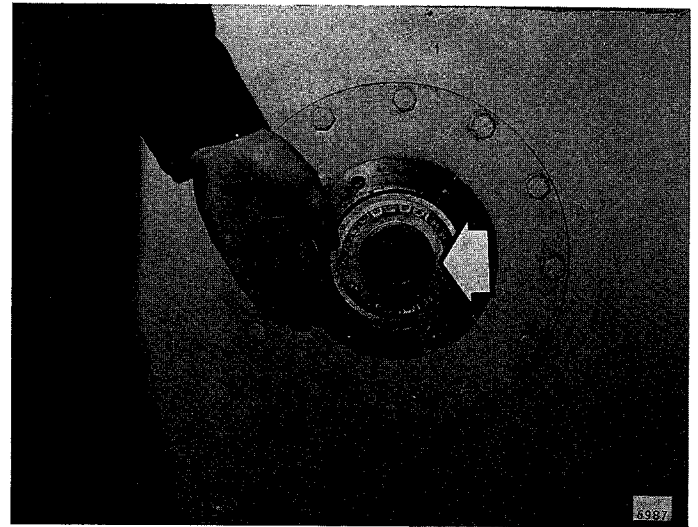
78

Install twelve (12) grade 5 self-locking cap screws in axle bearing carrier. Cross tighten and torque to 75 ft-lbs.



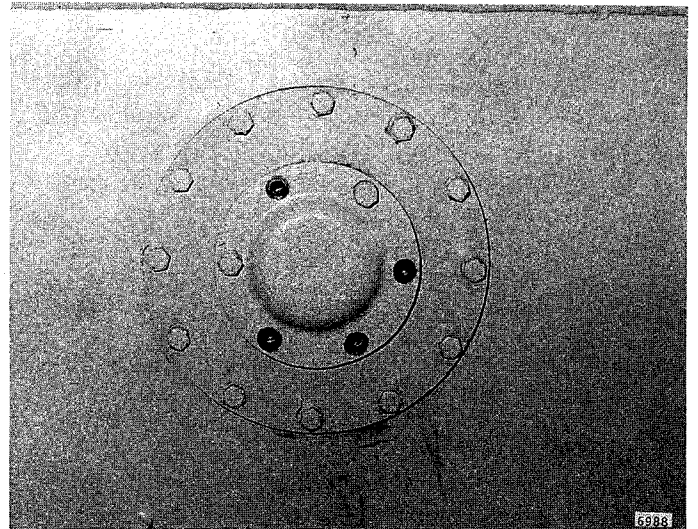
79

Install bearing locating ring on drive axle shaft. Make certain retaining ring is properly seated in groove on shaft (arrow).



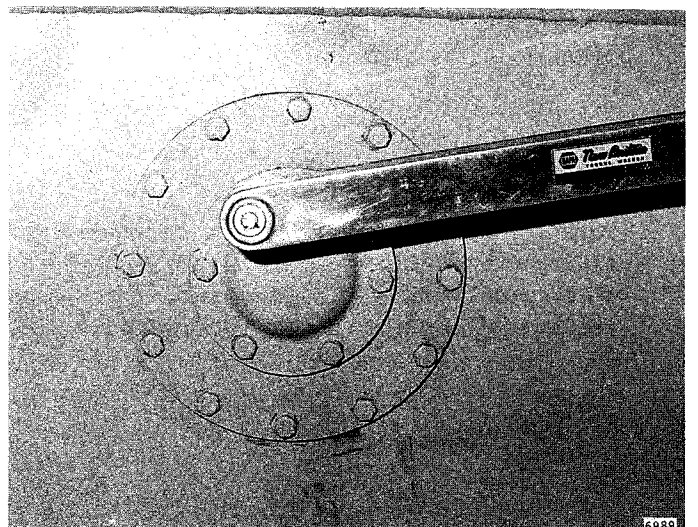
80

Install bearing cover and gasket with six (6) grade 5 cap screws with lock washers. If necessary, apply a light coat of non-hardening sealant to bearing cover gasket.



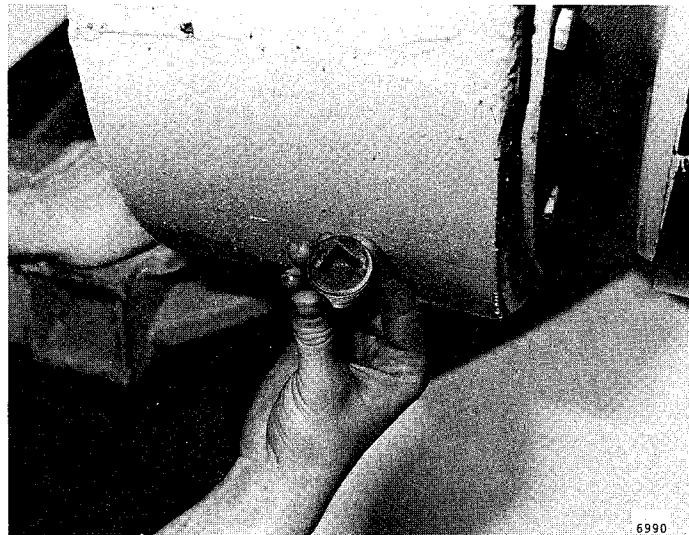
81

Cross tighten and torque to 75 ft-lbs. the six (6) grade 5 cap screws holding bearing cover.



82

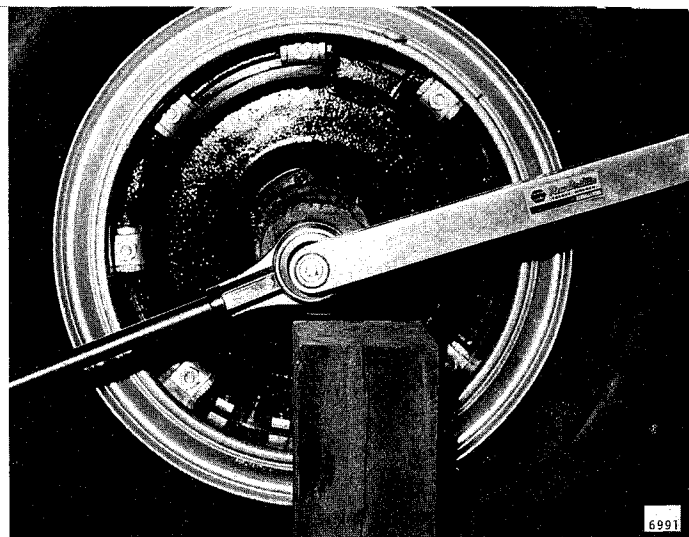
Install drain plug in bottom of tandem case and fill with 8 U.S. gallons of proper lubricant as specified on cover page. Check for proper oil level at oil level check plug. If the lower drive shaft was disconnected, it should now be re-connected.



83

Torque axle shaft nut to 1950 ft-lbs. Secure nut by bending tang on washer. THE 1950 FT-LBS OF TORQUE MUST BE MAINTAINED. AFTER UNIT HAS BEEN RUN FOR SEVERAL HOURS TORQUE MUST BE RECHECKED. TORQUE MUST BE RECHECKED AGAIN AFTER SEVERAL DAYS OF OPERATION TO ASSURE THAT 1950 FT-LBS IS MAINTAINED.

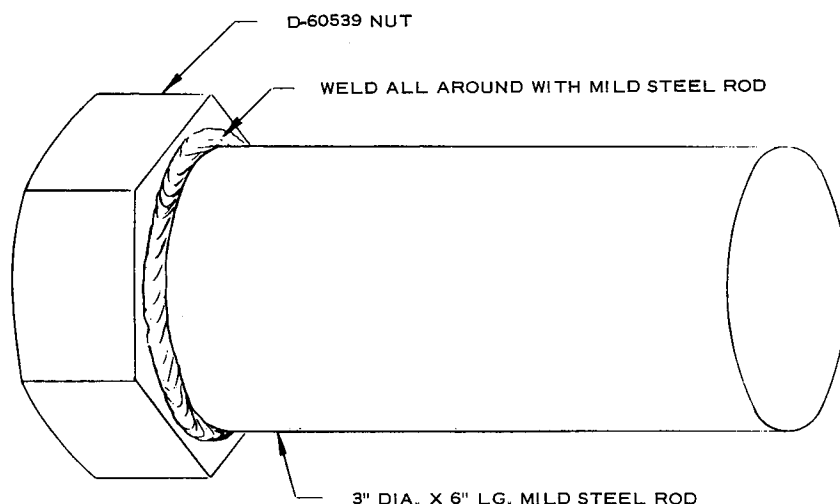
This torque can be maintained by using a standard 500 ft-lb torque wrench in conjunction with a 4 to 1 ratio torque multiplier. A tool of this type may be obtained from the



P.A. Sturtevant Co.  
Addison, Illinois 60101  
Model Number TM 2000

84

After all brake lines are properly connected and all brake shoes properly adjusted, the brake lines must be "bled" to remove all air that may be trapped in the lines, and the master cylinder filled with brake fluid. If new shoes were installed, these shoes must be burnished to insure proper stopping when brakes are applied. CAUTION: If grader is equipped with a powershift transmission, the brakes must also be "bled" at the top of the transmission, at the line leading from the master cylinder to the top of the transmission.



## GRADER TAPERED AXLE WHEEL REMOVAL

1. Screw "knocker" onto axle threads making certain that end of axle is bottomed on the inside of the "knocker". Failure to do this puts shock loading on the threads instead of the axle end and thread damage may result.
2. Raise both tandem tires clear of ground on the side opposite the axle on which the "knocker" is installed.
3. Strike the end of the "knocker" with a sledge hammer. Retighten the "knocker" after each blow of the sledge to assure that it remains tight against the axle. Continue this procedure until the wheel loosens on the axle.
4. Lower raised tandem wheels to ground. Raise loosened wheel off ground, remove "knocker", and remove loosened wheel and tire together.



## LUBRICATION FOR TANDEM CASES

Beginning with the following serial numbers the tandem cases were factory filled with Dexron:

118C -----	11721 & Up
T-400A -----	01414 & Up
T-500A -----	05239 & Up
160L -----	02961 & Up
160C -----	02961 & Up
T-600B -----	02043 & Up

The older machines were factory filled with SAE 80 Straight Mineral Gear Oil. DO NOT mix or top with Dexron or ATF Type A, Suffix A.

If a change is made from SAE 80 Straight Mineral Gear Oil to Dexron or ATF Type A, Suffix A, the following procedure must be followed:

1. Remove drain plug and drain lubricant completely only after the unit has been operated sufficiently to bring the lubricant to operating temperature.
2. After draining, flushing is desirable. Clean around and replace drain plug and fill both cases to correct level with a light flushing oil. Operate the unit for a short period of time (5-10 minutes) under extremely light or no load condition. Drain all of the flushing oil from the cases while it is warm and replace the drain plugs.
3. To refill, clean the area around the fill plug and fill the tandem cases to the level plug with the Dexron or ATF Type A, Suffix A fluid.

*DO NOT OVERFILL as excess quantity will serve no useful purpose.*

4. The same suggested level check period (50 hours) and drain interval (1000 hours) will suffice with the new lubricant.