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## INTRODUCTION

This illustrated parts catalog covers the NAPCO 11,000-pound front driving axle unit; the axle and its associated parts. Use this catalog for disassembly and assembly, and for identifying and ordering service replacement parts.

When ordering parts, include the part name, the part number, and the serial number of the axle or the transfer case. Axle serial numbers are stamped on the axle at the axle right-hand spring pad. A metal plate fastened to the side of the transfer case housing contains the transfer case serial and B/M numbers.

Follow the above procedure for prompt parts service.

**NOTE:** The part names in the catalog that are preceeded by an asterisk (\*) means the part is not shown in the illustration.



# TABLE OF CONTENTS

## 11,000-LB. FRONT DRIVING AXLE UNIT (SINGLE AND DOUBLE REDUCTION)

### INTRODUCTION

- SECTION 1 - DESCRIPTION AND OPERATIONS
- SECTION 2 - MAINTENANCE AND ADJUSTMENTS
- SECTION 3 - FRONT AXLE MAINTENANCE
- SECTION 4 - MAJOR SERVICE OPERATIONS
- SECTION 5 - SERVICE DIAGNOSIS
- SECTION 6 - SPECIFICATIONS
- SECTION 7 - SERVICE PARTS LISTS

	<u>PAGE NO.</u>
<u>SECTION 1 - DESCRIPTION AND OPERATIONS</u>	
Front Axle, Controls, Transfer Case _____	1
Power Take-Off, Parking Brake, Control Lever Positions _____	2
Driving Instructions, Operating Power Take-Off, Towing Instructions _____	3
<u>SECTION 2 - MAINTENANCE AND ADJUSTMENTS</u>	
Lubrication, Lubricant Specifications, Lubrication Chart _____	4, 5, 6
Lubrication Table _____	6
<u>SECTION 3 - FRONT AXLE MAINTENANCE</u>	
Lubrication, Tie Rod and Toe In _____	7
Tie Rod Installation, Tie Rod Removal, Toe-In Adjustment _____	8
Hydraulic Brakes -	
Front Brake Adjustment, Adjustment Procedure, Lining	
Wear Adjustment, Shoe Removal _____	9
Cleaning and Inspection, Shoe Installation, Shoe Relining _____	10
Wheel Cylinders -	
Cylinder Removal, Inspection, Repair and Installation _____	10,11
<u>SECTION 4 - MAJOR SERVICE OPERATIONS (MAINTENANCE)</u>	
Service Instructions for Single and Double Reduction Banjo-Type Front Axle	
(Section I) - Description and Data	
Description _____	12
A.-Data _____	12
(Section II)-Disassembly of Axle	
B.-Removing Accessories _____	12,14
C.-Disassembling Axle into Subassemblies _____	14
D.-Disassembling Trunnion-Sockets _____	15,16
E.-Disassembling Differential Carrier Assembly (Double Reduction Axle Only) _____	17,18,19,20
(Section III)-Cleaning, Inspection and Repair	
F. Cleaning (a.-General, B-General Precautions in Cleaning) _____	20
G. Inspection of Axle Components _____	21
a. Axle Housing	
b. Differential Carrier (F, Fig. 36)	
c. Bevel Pinion Gear Cage (N, Fig. 36)	
d. Axle Shafts & Universal Joints (Fig. 22)	
e. Wheel Spindles (KK, Fig. 17)	
f. Trunnion Socket (XX, Fig. 17) _____	22
g. Steering Knuckle Flange (D, HH, Fig. 17)	
h. Differential Gear and Spur Pinion (Fig. 32)	
i. Bevel Pinion Gear & Bevel Drive Gear (H & Z, Fig. 36)	

# TABLE OF CONTENTS

(CONTINUED)

	<u>PAGE NO.</u>
H. Repair of Axle Components _____	23
a. Differential Housing	
(1) Stud Replacement	
(2) Bearing Cup Replacement	
b. Bevel Pinion Gear Cage Bearing Cup Replacement	
c. Wheel Spindle _____	24
(1) Bearing Replacement	
(2) Bearing Cone Replacement	
 (Section IV) - Assembly of Axle	
I. Assembling Differential Carrier Assembly _____	25, 26, 27
J. Assembling Differential Assembly _____	27
K. Installing Differential Assembly _____	27, 28
L. Assembling Trunnion Sockets _____	28, 29, 30, 31
M. Installing Accessories _____	31
N. Test and Adjustment _____	32
Inspection and Adjustment of Bevel Gears _____	34
Fig. 46	
1. - Spur Pinion Bearing Cage Cover	
2. - Bevel Pinion Bearing Cage	
3. - Bevel Pinion	
4. - Bevel Gear	
5. - Spur Pinion Bearing Cage	
Fig. 46A	
A. - Correct Tooth Contact	
B. - Short Heel Contact	
C. - Short Toe Contact	
D. - Low Narrow Tooth Contact	
E. - High Narrow Tooth Contact	
 (Section V) - Napco Two Ton Axle Carrier Assembly and Adjustment Procedure (Single Reduction, Banjo-Type Front Axle Only)	
Pinion Assembly _____	36
Differential Carrier Assembly _____	36, 37
Checking Pinion Depth _____	37
Ring Gear, Thrust Pad Adjustment _____	38
 (Section VI) - T-223-C-1, C-2, C-3, C-4 Transfer Case Assembly	
T-223 Transfer Case Power Take-Off Installation and Disassembly (Timken Model) _____	39
T-223 Transfer Case Maintenance _____	40
T-223 Transfer Case Removal _____	40
T-223 Transfer Case Disassembly _____	40, 41
T-223 Transfer Case Cleaning and Inspection _____	41
T-223 Transfer Case Reassembly _____	42, 43
T-223 Transfer Case Installation _____	43
T-223 Transfer Case Parking Brake _____	43
Adjustment, Shoe Removal, Lining Replacement, Shoe Installation _____	44
Disassembly, Assembly Instructions _____	45
T-223 C-3, C-4 Transfer Case Power Take-Off Installation Instructions (Ramsey Model) _____	46

# TABLE OF CONTENTS

(CONTINUED)

	<u>PAGE NO.</u>
T-223 Transfer Case Power Take-Off Assembly Pump Installation with #37524 (earlier Timken Model) Check Valve Assembly _____	47
T-223 Transfer Case Power Take-Off Assembly Pump Installation with #502863 (later Timken Model) Check Valve Assembly _____	48
(Section VII) - Service Instructions for T-77 Transfer Case Assembly with Power Take-Off Assembly	
(Section I) Description and Data	
1. Description	
(a.) - Description _____	49
(b.) - Operation	
(1) High Range Power Flow	
(2) Low Range Power Flow	
(3) Neutral	
(4) Front Axle Declutch	
(5) Power Take-Off _____	50
2. Data	
(Section II) Disassembly of Transfer Case	
3. Cleaning and Draining _____	50
4. Removal of Accessories _____	51
5. Disassembly of Transfer Case into Subassemblies _____	51, 53
6. Disassembly of accessories _____	53, 54
7. Disassembly of subassemblies _____	54
(Section III) Cleaning, Inspection and Repair	
8. Cleaning _____	54, 55
9. Inspection _____	55
10. Repair _____	58
(a.) - Power Take-Off	
(b.) - Front Axle Declutch	
(c.) - Transfer Case Cover	
(d.) - Transfer Case	
(e.) - Main Shaft _____	59
(f.) - Idler Shaft	
(g.) - Front Axle Driven Shaft _____	60
(Section IV) - Assembly of Transfer	
11. Assembly and Installation of Subassemblies	
(a) - General _____	61
(b) - Power Take-Off Assembly (Fig. 16) _____	61
(c) - Front Axle Declutch Assembly _____	62
(d) - Main Shaft and Front Axle Driven Shaft Temporary Installation (Fig. 7) _____	62
(e) - Installation of Idler Shaft, Main Shaft, and Front Axle Driven Shaft Assemblies _____	64
(f) - Installation of shifter shaft and fork (Fig. 7) _____	64, 65
12. Lubrication and Operation Test	
(a) - Lubricate _____	65
(b) - Transfer Shift Test (Power Take-Off and Front Axle Declutch Disengaged) _____	65
(c) - Power Take-Off Shift Test, (d) Front Axle Declutch Test _____	65
13. Disassembling Front Axle Declutch Unit	
(a) - Removing Universal Joint Yoke (Fig. 21) _____	65
(b) - Removing Front Axle Declutch Bearing Cage Assembly (Fig. 21) _____	65, 66
(c) - Removing Shifter Fork (Fig. 21) _____	66
14. Inspection	
(a) - Front Axle Declutch Shaft Bearing Carrier Assembly _____	66

# TABLE OF CONTENTS

(CONTINUED)

	<u>PAGE NO.</u>
15. Assembling Front Axle Declutch Unit Assembly	
(a) - Installing Declutch Shifter Fork (Fig. 21)	66
(b) - Installing Declutch Bearing Cage Assembly (Fig. 21)	66
(c) - Installing Companion Flange (Fig. 21)	67
16. Assembling Subassemblies	
(a) - Installing Front Axle Declutch Unit	67
T-77 Transfer Case Power Take-Off Assembly Oil Pump Installation Instructions	68
Service Instructions for T-76-2 Transfer Case Assembly w/out Power Take-Off Assembly	
1. Transfer Case Description	69
2. Transfer Case Breather	
(a) - Description	69
(b) - Cleaning	70
3. Transfer Case Removal	
(a) - Draining Oil	71
(b) - Disconnecting Front and Rear Axle Propeller Shafts	71
(c) - Removing Propeller Shaft Between Transmission and Transfer Case	71
(d) - Removing Exhaust Tube, Muffler and Tailpipe	71
(e) - Disconnecting Speedometer Cable	71
(f) - Disconnecting All Transfer Case Controls	71
(g) - Positioning Hoisting Chain	71
(h) - Disconnecting Front Transfer Case Support From Frame or Frame Brackets	72
(i) - Disconnecting Rear Transfer Case	72
(j) - Lowering Transfer Case to Floor	72
4. Transfer Case Installation	
(a) - Lifting Transfer Case into Position on Vehicle	72
(b) - Fastening Rear Transfer Case Support to Frame or Frame Brackets	72
(c) - Fastening Front Transfer Case Support	72
(d) - Removing the Chain from the Transfer Case Assembly	72
(e) - Alignment	72
(f) - Reinstalling Transfer Case Control Rods, Emergency Brake Controls	72
(g) - Connecting Speedometer Cable	72
(h) - Installing Exhaust Tube Manifold and Tail Pipe	72
(i) - Installing Propeller Shaft between Transmission and Transfer Case	72
(j) - Connecting Front and Rear Axle Propeller Shafts	72
(k) - Lubrication of Transfer Case	72
<b><u>SECTION 5 - SERVICE DIAGNOSIS</u></b>	
Hard Steering	73
Front Wheel Shimmy	73
Road Wander	73
Rapid Tire Wear	73
Noisy Axle	73
Loose Steering	74
Noisy Transfer Case	74
Lubricant Leakage	74
Faulty Brakes	74

# TABLE OF CONTENTS

(CONTINUED)

PAGE NO.

## SECTION 6 - SPECIFICATIONS

11,000 Lb. Single Reduction Axle _____	75
11,000 Lb. Double Reduction Axle _____	76
T-223 C1, C-2, C-3, C-4 Transfer Case _____	77
T-76-2, T-77-3-170 Transfer Case _____	77
300 OC Transfer Case Power Take Off _____	78
300-OC Transfer Case _____	78A

## SECTION 7 - SERVICE PARTS LIST

11,000 Lb. Front Axle & Differential Assembly (Single Reduction) _____	80,81
11,000 Lb. Front Axle and Differential Assembly (Single Reduction) (Basic-6-8 3/4" B.C.) _____	81B
11,000 Lb. Front Axle & Differential Assembly (Double Reduction) _____	83,84,85
Outer End, Six Stud _____	87,88,89
Outer End, Ten Stud _____	90,91,92,93
Hydraulic Brake-Ten Stud or Six Stud _____	95,96
Air Brake-Ten Stud (single, double reduction axle) _____	97,98
T-223, C-1, C-2 Transfer Case Assembly _____	100,101,102,103, 104,105 <sup>105A</sup>
T-223, C-3, C-4 Transfer Case Assembly _____	106,108,109,110,111,112,113,114
T-223 C-3, C-4 Transfer Case Power Take-Off Assembly (Ramsey Model) _____	116,117
T-223 Transfer Case Power Take-Off Assembly (with earlier and later model used check valve assembly)(Timken Model) _____	118,119,120
Model 300-OC Transfer Case Assembly _____	122,123,125,126
Model 30450 Power Take-Off Assembly for Model 300-OC Transfer Case Assembly _____	128,129,130
Model 300-OC Emergency Brake - Used on Model 300-OC Transfer Case Assembly _____	131,132
T-76-2 Transfer Case Assembly _____	134,135,136,137
T-76-2 Transfer Case Power Take-Off Assembly _____	138,139
T-77-3-170 Transfer Case Assembly _____	142,143,144
T-77-3-170 Transfer Case Declutch Assembly and Parts _____	146
T-77-3-170 Transfer Case Power Take-Off Assembly _____	148,149
T-76-2, T-77-3-170 Transfer Case Assembly Emergency Brake _____	151

# ILLUSTRATIONS

## SECTION 1 - DESCRIPTIONS AND OPERATIONS

PAGE NO.

Figure 1 - Control Lever Positions Plate _____	2
--	---

## SECTION 2 - MAINTENANCE AND ADJUSTMENTS

Figure 2 - Lubricant, Symbol Descriptions Chart _____	4
Figure 3 - Lubrication Chart _____	5

## SECTION 3 - FRONT AXLE MAINTENANCE

Figure 4 - Yoke Type Tie Rod End _____	7
Figure 5 - Ball Stud Type Tie Rod End _____	7
Figure 6 - Toe-In Measurements _____	8
Figure 7 - Brake Adjustment (Hydraulic Brake) _____	9
Figure 8 - Shoe Removal _____	9
Figure 9 - Wheel Cylinder _____	11

(CONTINUED)

# ILLUSTRATIONS

(CONTINUED)

## SECTION 4 - MAJOR SERVICE OPERATIONS

PAGE NO.

FIGURE 10 - Double Reduction Banjo Type Front Axle Assembly	13
FIGURE 11 - Arrangement of Gears to Obtain Double Reduction	14
FIGURE 12 - Removing Trunnion Assembly	14
FIGURE 13 - Removing Differential Assembly(Double Reduction Axle Only)	15
FIGURE 14 - Brake Drum and Hub Assembly Removed	16
FIGURE 15 - Removing Axle Shaft Drive Flange	17
FIGURE 16 - Removing Brake Shoe Return Spring	17
FIGURE 17 - Trunnion Socket	18
FIGURE 18 - Removing Wheel Spindle	19
FIGURE 19 - Axle Shaft and Universal Joint Assembly Removal	19
FIGURE 20 - Removing Steering Arm	20
FIGURE 21 - Disassembling Steering Knuckle Flange	21
FIGURE 22 - Axle Shaft and Universal Joint	22
FIGURE 23 - Removing Axle Shaft and Ball Retainer	23
FIGURE 24 - Removing Universal Joint Ball	24
FIGURE 25 - Removing Universal Joint Ball Cage Pilot	24
FIGURE 26 - Removing Inner Race	24
FIGURE 27 - Removing Ball Cage	25
FIGURE 28 - Marking Differential Carrier and Cap for Assembly	25
FIGURE 29 - Disassembling Differential Assembly	25
FIGURE 30 - Removing Differential Case Half	26
FIGURE 31 - Removing Spider and Gears from Differential Case	27
FIGURE 32 - Differential Assembly	28
FIGURE 33 - Removing Bevel Pinion Gear Cage	29
FIGURE 34 - Removing Universal Joint Yoke	29
FIGURE 35 - Pressing Bevel Pinion Gear from Cage	31
FIGURE 36 - Bevel Pinion Gear and Bevel Drive Gear	31
FIGURE 37 - Removing Spur Pinion Bearing Small Cage	31
FIGURE 38 - Removing Spur Pinion Gear Bearing Large Cage	32
FIGURE 39 - Removing Bearing Cup from Large Cage	32
FIGURE 40 - Removing Front Bearing Cup	32
FIGURE 41 - Removing Rear Bearing Cup	32
FIGURE 42 - Installing Bearing in Wheel Spindle	33
FIGURE 43 - Checking Spur Pinion Gear Bearing Preload	33
FIGURE 44 - Checking Bevel Pinion Gear Bearing Preload	33
FIGURE 45 - Checking Bevel Gear Backlash	33
FIGURE 46 ] Inspection and Adjustment of Bevel Gears	34



# ILLUSTRATIONS

(CONTINUED)

	<u>PAGE NO.</u>
FIGURE 47 - Spider Gears and Differential Gears _____	35
FIGURE 48 - Installing Spider Assembly _____	35
FIGURE 49 - Installing Differential in Carrier _____	35
FIGURE 50 - Backlash Check (Single Reduction Axle) _____	38
FIGURE 51 - Single Reduction Banjo - Type Front Axle _____	38

## T-223 TRANSFER CASE

FIGURE 52 - T-223-C-1, C-2, C-3, C-4 Transfer Case Disassembly, Reassembly _____	39A
FIGURE 53 - T-223 Transfer Case Parking Brake _____	44
FIGURE 54 - T-223 Transfer Case Power Take-Off Oil Pump Installation (Ramsey Model) _____	46
FIGURE 55 - T-223 Transfer Case Power Take-Off Assembly Oil Pump Installation (Timken Model) with #37524 Earlier Model Used Check Valve Assembly _____	47
FIGURE 56 - T-223 Transfer Case Power Take-Off Assembly Oil Pump Installation (Timken Model) with #502863 Later Model used Check Valve Assembly _____	48

## T-77 TRANSFER CASE ASSEMBLY WITH POWER TAKE-OFF ASSEMBLY

FIGURE 1. Transfer Case-Front View _____	50
FIGURE 2. Transfer Case-Rear View _____	51
FIGURE 3. Transfer Case-Sectional View _____	52
FIGURE 4. High Range Power Flow _____	52
FIGURE 5. Low Range Power Flow _____	52
FIGURE 6. Removing Main Shaft Yoke Slotted Nut _____	54
FIGURE 7. Transfer Case with Accessories Removed _____	56
FIGURE 8. Removing Shifter Fork Cover _____	57
FIGURE 9. Loosening Shifter Fork Bolt _____	57
FIGURE 10. Removing Shifter Shaft _____	57
FIGURE 11. Removing Transfer Case Cover _____	57
FIGURE 12. Transfer Case with Cover Removed _____	57
FIGURE 13. Removing Main Shaft Assembly _____	57
FIGURE 14. Removing Idler Shaft Front Bearing Cap _____	60
FIGURE 15. Removing Front Axle Drive Shaft Assembly _____	60
FIGURE 16. Power Take-Off Unit _____	61

# ILLUSTRATIONS

PAGE NO.

(CONTINUED)

FIGURE 17. Removing Power Take-Off Shaft	62
FIGURE 18. Main Shaft	63
FIGURE 19. Idler Shaft	63
FIGURE 20. Front Axle Driven Shaft	63
FIGURE 21. Front Axle Declutch Unit	67
FIGURE 22. Transfer Case and Driven Gear Shaft	67
FIGURE 23. Transfer Case w/Power Take-Off Assembly Pump Installation Diagram	68

## T-76-2 TRANSFER CASE ASSEMBLY W/OUT POWER TAKE-OFF ASSEMBLY

FIGURE 57 - T-76-2 Transfer Case Assembly w/out Power Take-Off Assembly	69
--	----

FIGURE 58 - Removing Transfer Case Breather	70
---	----

FIGURE 59 - Lifting Transfer Case on Hoist	71
--	----

SECTION 5 - SERVICE DIAGNOSIS	NOT ILLUSTRATED
-------------------------------	-----------------

SECTION 6 - SPECIFICATIONS	75,76,77,78
----------------------------	-------------

SECTION 7 - SERVICE PARTS LISTS	78A
---------------------------------	-----

FIGURE 60 - 11,000 lb. Front Axle & Differential Assembly (Single Reduction)	79
FIGURE 60A- Single Reduction Axle Housing and Differential Assembly (Basic-6-8 3/4" B.C.)	81A
FIGURE 61 - 11,000 Lb. Front Axle & Differential Assembly (Double Reduction)	82
FIGURE 62 - Outer End, Six Stud	86
FIGURE 63 - Outer End, Ten Stud	93
FIGURE 64 - Hydraulic Brake, Ten Stud or Six Stud	94
FIGURE 65 - Air Brake, Ten Stud	98
FIGURE 66 - T-223 C-1, C-2 Transfer Case Assembly	99
FIGURE 67 - T-223 C-3, C-4 Transfer Case Assembly	107
FIGURE 68 - T-223 C-3, C-4 Transfer Case Power Take-Off Assembly (Ramsey Model)	115
FIGURE 69 - T-223 Transfer Case Power Take-Off Assembly (Timken Model)	121
FIGURE 70 - Model 300-OC Transfer Case Assembly	124
FIGURE 71 - Model 30450 Power Take-Off Assembly for Model 300-OC Transfer Case Assembly	127
FIGURE 72 - Model 300-OC Emergency Brake (used on Model 300-OC Transfer Case Assembly)	132
FIGURE 73 - T-76-2 Transfer Case Assembly	133
FIGURE 74 - T-76-2 Transfer Case Power Take-Off Assembly	140
FIGURE 75 - T-77-3-170 Transfer Case Assembly	141
FIGURE 76 - Declutch Assembly & Parts (T-77-3-170 Transfer Case Ass'y)	145
FIGURE 77 - T-77-3-170 Transfer Case Power Take-Off Assembly	147
FIGURE 78 - T-76-2, T-77-3-170 Transfer Case Assembly Emergency Brake	150

# *Napco*

## **FOUR WHEEL DRIVE**

This manual is designed to provide owners, operators, and service men with complete information on the construction, operation, maintenance and repair of Napco Four Wheel Drive units.

An effort has been made to produce a shop manual that will not only serve as a ready reference book for the experienced service man, but also cover, step-by-step procedure for the guidance of less experienced men.

The index on the previous page enables the user to quickly locate any desired section. The page numbers indicate the initial page of the pertinent section. This arrangement, we believe, will make it easy for the service man to turn directly to the desired information and applicable illustrations.

Keep this manual in a handy place for ready reference. If properly used, it will enable the mechanic to better serve owners of Napco Four Wheel Drive units.

Tool numbers 88-15 and 88-3 referred to in Section 4 are available from Napco Industries, Inc., Minneapolis, Minnesota.

## *Section 1 - Description & Operations*

The Napco Four Wheel Drive unit is composed of a live front axle, transfer case, propeller shafts, control lever, control lever linkage and the necessary mounting hardware. Power take-off is available for every model and the parking brake is an optional feature on some models.

### **FRONT AXLE**

The front axle is a full-floating, integral or banjo type axle unit with steel housing and two-piece cast steel steering knuckle housings. The tie rod ends have a coarse thread on the one end and a fine thread on the opposite end to permit accurate toe-in adjustment. Caster and camber are inherent in the axle design and need not be adjusted. The integral steering arm is designed to accommodate the existing drag link. The axle unit is equipped with constant-velocity axle joints, propeller shaft yoke, hypoid gear drive differential and hydraulic brakes.

### **CONTROLS**

All mechanical features of a Napco Four Wheel Drive unit are controlled by the driver seated in the cab. Control levers, mounted on a bracket beneath the cab floor, are attached to linkage connected to the power take-off, parking brake or transfer case.

### **TRANSFER CASE**

The transfer case is the unit which receives power from the transmission and transmits it to the front and rear axles. The design of the case includes an interlocking feature that makes it impossible to engage only front wheels without the rear wheels being engaged. It is the unit to which the parking brake or power take-off can be attached if required. Engagement of the front wheel drive, power take-off, or parking brake is accomplished through control levers located within reach of the driver seated in the cab. The case is mounted through rubber insulators to the first crossmember to the rear of the transmission.

# NAPCO 11,000-LB. AXLE MAINTENANCE INSTRUCTIONS

## POWER TAKE-OFF

The power take-off, when used, can be installed on the rear face of the transfer case on most models and on the front or side of the transfer case on some models. Suitable linkage connects the control lever in the cab to the power take-off declutch shaft.

## PARKING BRAKE

The internal expanding band type parking brake is mounted on the transfer case rear face. The brake bands and actuating lever mount on the backing plate securely attached to the transfer case. The brake drum revolves on the rear end of the front wheel output shaft. A hand lever is located on the cab floor and is attached to the parking brake lever through suitable linkage and a bellcrank on the transfer case pivot pin.

## CONTROL LEVER POSITIONS

### Neutral

Both axles are disengaged for operation of Power Take-off, with vehicle remaining in a stationary position.

### All Wheel Drive

This position provides a four wheel drive with no change in gear ratio and must be used only for off-the-road operation or when the road and load conditions make additional traction necessary. It should NEVER be used on dry or hard surfaced roads.

### Low All Wheel Drive

These lever positions provide a four wheel drive with greater gear reduction than is obtained in the ALL WHEEL DRIVE position. These positions are used for off-the-road operation when ALL WHEEL DRIVE is unable to keep the truck moving. LOW ALL WHEEL DRIVE is NEVER used on dry, hard surfaced roads.

### Rear Wheel Drive

This position provides a rear wheel drive with no change in gear ratio and must be used when driving under normal road and load conditions. The control lever will be left in this position at all times except when it is necessary to use one of the ALL WHEEL DRIVE positions, when engaging the Power Take-off, or when the truck is being towed.




NAPCO POWR-PAK		
WARNING		
DO NOT SHIFT TRANSFER CASE INTO LOW RANGE UNLESS FRONT AXLE IS ENGAGED IN ALL WHEEL DRIVE.		
TRANSFER CASE	ALL WHEEL DRIVE	POWER TAKE-OFF
 DIRECT NEUTRAL LOW	 ENGAGE DIS-ENGAGE	 ENGAGE DIS-ENGAGE
NEUTRAL FOR P.T.O. USE	DIS-ENGAGE FOR NORMAL HIGHWAY USE	WHEN P.T.O. EQUIPPED

Figure 1. Control Lever Positions Plate

# NAPCO 11,000-LB. AXLE MAINTENANCE INSTRUCTIONS

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## DRIVING INSTRUCTIONS

The transfer case control lever positions are illustrated in Fig. 1. When selecting any given position, carefully follow the instructions outlined below.

To shift from a NEUTRAL position to any drive position:

The truck must be stopped. Depress the clutch pedal to shift transmission to NEUTRAL. Move the transfer case selector levers to the desired positions then shift transmission as required.

To shift into LOW ALL WHEEL DRIVE position:

The truck must be stopped. Depress the clutch pedal to shift transmission to NEUTRAL. Move the front axle drive lever to the IN position and the transfer case speed selector lever to LO position. Shift transmission as required.

Use LOW ALL WHEEL DRIVE position for off-the-road operation when ALL WHEEL DRIVE does not supply enough power to keep the truck moving.

CAUTION: Do not use LOW ALL WHEEL DRIVE on dry, hard surfaced roads.

To shift from LOW ALL WHEEL DRIVE position to REAR WHEEL DRIVE position:

The truck must be stopped. Depress the clutch pedal to shift transmission to NEUTRAL. Move the front axle drive lever to the OUT position and the transfer case speed selector lever to DIRECT position. Shift transmission as required.

To shift into ALL WHEEL DRIVE position:

The truck must be stopped. Depress the clutch pedal to shift transmission to NEUTRAL. Move the front axle drive lever to the IN position and the transfer case speed selector lever to DIRECT position. Shift transmission as required.

Use ALL WHEEL DRIVE position for all off-the-road operation except when hilly country or heavy loads cause stalling.

CAUTION: Do not use ALL WHEEL DRIVE on dry, hard surfaced roads.

To shift from ALL WHEEL DRIVE position to REAR WHEEL DRIVE position:

The truck must be stopped. Depress the clutch pedal to shift transmission to NEUTRAL. Move the front axle drive lever to the OUT position and the transfer case speed selector lever to DIRECT position. Shift transmission as required.

## TO OPERATE POWER TAKE-OFF

1. Place the transmission control lever in NEUTRAL (N) position.
2. Shift the transfer case control lever to NEUTRAL (N) position.
3. Shift the Power Take-off lever to the ENGAGE position.
4. If the vehicle is to be moved, shift the transfer case into the desired range. If the vehicle is to remain stationary, leave the transfer case in NEUTRAL (N) position.
5. Shift the transmission into the correct range (1st or 2nd).

CAUTION: Do not operate the Power Take-off with the transmission in a higher range than 2nd gear.

6. Accelerate the engine as is required.

## TOWING INSTRUCTIONS

To tow the vehicle for distances up to 10 miles at speeds of no more than 20 MPH, place the transfer case in NEUTRAL position.

For greater towing distances, disconnect the propeller shafts from the axles.

## Section 2 - Maintenance and Adjustments

This section contains information relative to the lubrication and the adjustments of the four wheel drive components.

### LUBRICATION

The lubrication charts in this section will show the location of all lubrication points. Each numbered point is keyed to a table in the chart.

Each item appearing in the lubrication tables is shown with a corresponding lubricant symbol. An explanation of these symbols are found in the text following the charts.

No particular brand of lubricant is recommended as many reputable oil dealers can furnish the right lubricants when advised of the correct specifications or descriptions. The lubricant manufacturer must be held responsible for the quality and satisfactory performance of his product. His reputation is your best indication of quality.

The charts below will also show recommended intervals for servicing various points. These intervals are recommended for "normal" use, however, and severe operating conditions may require more frequent intervals. The recommended intervals should be followed until operating experience indicates a change is necessary.

LUBRICANT	
Symbol	Description
C	Chassis Lubricant
MP	Multipurpose Lubricant
E	Engine Oil
SG	Steering Gear Lubricant
GP	General Purpose Grease
G	Straight Mineral Oil

Figure 2. Lubricant-Symbol, Description Chart

### LUBRICANT SPECIFICATIONS

#### Symbol "C" - Chassis Lubricant

The lubricant indicated by a symbol "C" must be a high grade calcium or aluminum soap pressure gun type. A sodium soap grease may be used, but more frequent applications of the latter may be required during wet weather.

Lubrication fittings must be cleaned before applying the lubricant. Also, always be sure that all equipment used in applying the lubricant is clean. All precautions should be taken to prevent entry of dirt, grit, lint or any other foreign matter into the lubricant containers.

Fittings that have become broken or damaged should always be replaced with a new part. Broken fittings can be removed with a wrench or other suitable extracting tool.

When hard steering is encountered as a result of cold weather, the steering system should be lubricated in the following manner:

Use a steering gear lubricant (symbol "SG") or multipurpose gear lubricant (symbol "MP") at such points as steering knuckles and the tie rod and drag link ends. In warmer weather, re-lubricate linkage with regular chassis grease.

#### Symbol "MP" - Multipurpose Lubricant

Multipurpose gear lubricant must be of the latest non-corrosive type and of proven high quality. The lubricant manufacturer must be responsible for the quality and satisfactory performance of his product.

A viscosity of SAE 90 may be used the year around. If the truck is operated constantly below 0°F., use SAE 80. If the truck is to be operated in consistently high temperatures (above 100°F.), SAE 140 may be used.

# NAPCO 11,000-LB. AXLE MAINTENANCE INSTRUCTIONS

## Symbol "E" - Engine Oil

Engine oils must be of high quality heavy duty oil. The oil industry markets several types of oil which they designate by type of service. Typical designations marked on the containers are "MS", "ML", etc.

For maximum protection, use only the oils designated as "MS" or "DG". Under severe start-and-stop operations during cold weather, oils marked for service "DS" may be used. Oils designated for service "ML" and "MM" are not recommended for use.

Atmospheric temperatures and severity of service determine the viscosity grade of oil to use. The SAE viscosity numbers (5W, 10W, 20, etc.) constitute a clarification of oils in the terms of viscosity of fluidity, but without the reference to any other characteristics of properties. Do not use multiviscosity (5W-20, 10W-30) oils.

## Symbol "SG" - Steering Gear Lubricant

The lubricant indicated by the symbol "SG" is a special steering lubri-

cant; No.1 grade with low cold test and extreme pressure characteristics. This type of lubricant is marketed by many oil companies. Use "SG" lubricant as a cold weather alternative for a chassis lubricant "C".

## Symbol "GP" - General Purpose Grease

The lubricant indicated by the symbol "GP" is a general-purpose grease utilizing lithium soap grease base. The adaptability of the lubricant to temperature ranges from moderate to high. Its operating characteristics from low to high speeds make it desirable for a wheel bearing application. Always use a NO. 2 grade.

## Symbol "G" - Straight Mineral Oil

Lubricants indicated by the symbol "G" should be steam-refined or bright stock of SAE 140 viscosity, manufactured by a reputable concern. This lubricant is recommended for needle bearing types of universal joints. It gives a satisfactory performance the year around.

## LUBRICATION CHART

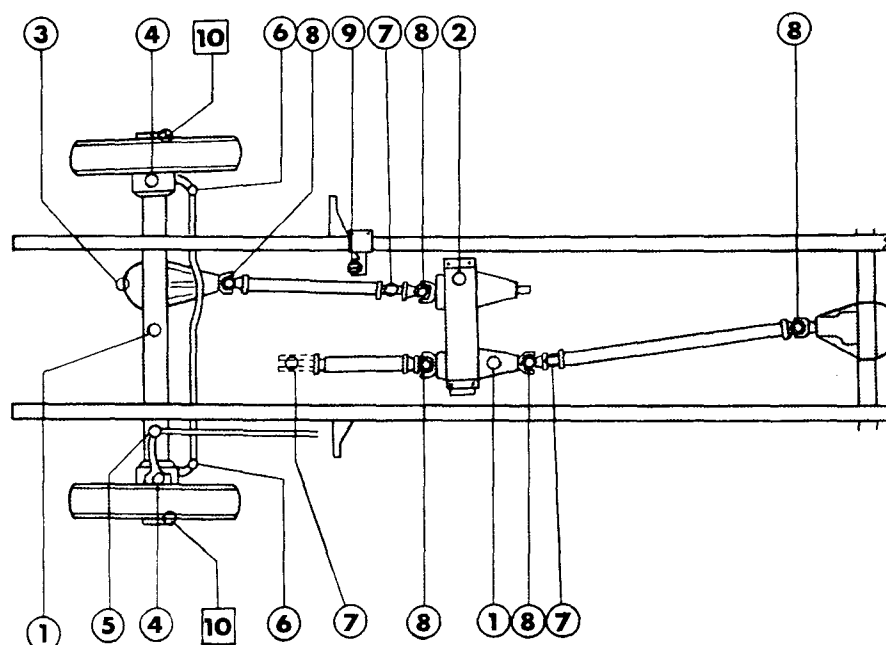


Figure 3. Lubrication Chart

NAPCO 11,000-LB. AXLE  
MAINTENANCE INSTRUCTIONS

**LUBRICATION TABLE**

No.	Lubrication Points	Lubrication Period	Type of Lubrication	Quantity	Remarks
1	Air Vents- Front Axle & Transfer Case	1000 miles			Clean in solvent; dip in engine oil.
2	Transfer Case	1000 miles	"MP"	Keep level at filler plug. Use 6 pts. W/O PTO, use 7 pts. with PTO and pour last 1/2 pint in PTO fill plug.	Drain and refill each 10,000 miles; drain only while case is hot.
3	Differential	1000 miles	"MP"	Hot: Up to filler plug. Cold: 1/2" below filler plug. Capacity: 6-1/2 pts.	Add lubricant as required. Drain and refill each 10,000 miles.
4	Steering Knuckles	1000 miles	"C"	As Required	Remove the slotted pipe plugs from ball ends of axle housing. Lubricate through top fittings until lubricant comes out of the plug holes. Replace pipe plugs securely.
5	Drag Link	1000 miles	"C"	As Required	One fitting at each end.
6	Tie Rod Ends	1000 miles	"C"	As Required	One fitting at each end.
7	Propeller Shaft Slip Joint	1000 miles	"C"	As Required	
8	Propeller Shaft Universal Joints	1000 miles	"G" SAE 140	As Required	Do not use chassis lubricant.
9	Control Linkage Points	1000 miles	"E"	As Required	Use brush or spray to apply engine oil on the linkage. Apply chassis lube through fitting provided.
10	Wheel Bearings	10,000 miles or semi- annually	"GP"	1/16 inch coat of lubricant on spindle hub and knead into the bearings.	Apply by hand.



## *Section 3 - Front Axle Maintenance*

### LUBRICATION

Lubrication intervals, methods of filling and draining, types of lubricants and capacities for the front axle are covered in the Lubrication Tables in Section 2. All rear axle lubrication instructions are described in the manufacturer's applicable shop manual.

The front axle, like the rear axle, is initially filled with special lubricant which should be drained at the end of the first 1,000 miles and refilled with SAE 90 "Multipurpose" Gear Lubricant. It is recommended that the axle housing be drained and refilled after each 10,000 miles thereafter with the above specified lubricant.

When checking the front axle lubricant level, the unit should be at operating temperature. The lubricant should be level with the bottom of the filler plug hole. If the level is checked on a cold unit, the lubricant should be approximately one-half inch below the filler plug hole.

Front axle constant velocity joints are lubricated through grease fittings located on top of the joints. First removing the pipe plugs from the axle housing ball ends, then force chassis lubricant through the top fittings until grease comes out of the plug holes. Replace the pipe plugs securely.

Check for lubricant leaks at the companion flange or rear yoke seal; at the sealing area of the joint between the differential carrier and axle housing; at the lubricant filler plug; at axle shaft bearings. The correction of these leaks consists of replacing defective seals or gaskets involved.

### TIE ROD&TOE-IN

#### Tie Rod

Refer to the manufacturer's applicable shop manual instructions for tie rod repair and maintenance information. The maintenance and repair information as it applies to the "self-adjusting"

tie rod ends is applicable to the four wheel drive front axles. Correct toe in is referred to in the "Toe-in Adjustment" paragraph below.

#### Tie Rod Ends

Two types of tie rod ends are used on Napco Four Wheel Drive units; yoke and ball stud type.

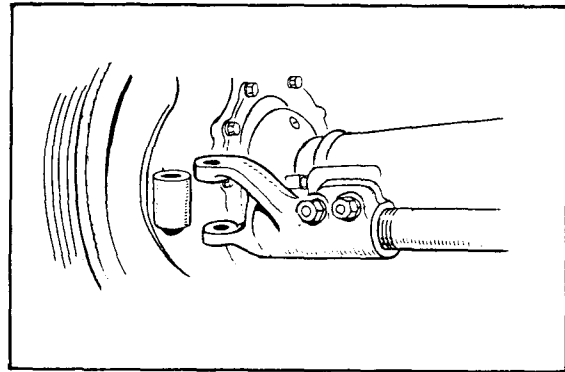


Fig.4 - Yoke Type Tie Rod End

On the yoke type tie rod ends, the rod is solid, threaded at each end and offset to clear the differential housing. The rod is connected to the steering knuckle housing by means of yoked ends and bolts. The threaded portions of each yoke are split and held tightly to the rod by clamp bolts.

On the ball stud type tie rod ends, the rod is hollow, internally threaded at each end and is offset to clear the differential housing. Rod ends thread into the rod and anchor to the steering knuckle housing by the ball stud and a nut.

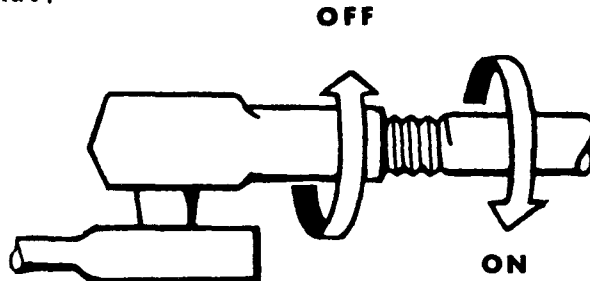


Fig.5 - Ball Stud Type Tie Rod End

# NAPCO 11,000-LB. AXLE MAINTENANCE INSTRUCTIONS

## Tie Rod Installation

Toe-in must be adjusted at the time the tie rod is installed. Refer to the toe-in chart below for correct spacing of the tie rod ends. Clamp the tie rod ends securely to the rod when correct toe-in is reached and anchor the ball stud or yoke to the steering knuckle housing, using a new cotter pin.

## Tie Rod Removal

Move the truck on a level surface, set the hand brake and raise the front of vehicle to remove weight from the wheels. Disassemble tie rod ends from the steering knuckle housing.

On the yoke type ends, loosen the two clamping bolts, turn yoke from the tie rod. Loosen the clamping bolt then turn the end off the tie rod on all ball stud types.

## Toe-in Adjustment

Toe-in is the amount in fractions of an inch that wheels are closer together in front than in the rear. BEFORE CHECKING THE TOE-IN, WHEELS MUST BE IN A STRAIGHT AHEAD POSITION, CORRECTLY INSTALLED AND TIRES PROPERLY INFLATED. Measure the toe-in from inside

of tires at height of wheel centers, points  $X_1$  and  $X_2$  (Fig. 6), using an accurate toe-in gage.

If a toe-in checking machine or a gauge is not available, locate points  $X_1$ , chalk mark and measure across these points with a telescoping rod equipped with a set screw. The vehicle may then be moved straight ahead to the revolve marks at  $X_1$  to position  $X_2$  and a measurement similarly obtained at points  $X_2$ .

The fine thread on one end of the tie rod and the coarse thread on the other end permit accurate adjustment. One turn of the fine thread end affects toe-in by approximately  $1/4"$  or  $9/32"$ ; the coarse thread end by approximately  $9/32"$  or  $3/8"$ .

Adjust to  $1/32"$  to  $5/32"$  for correct toe-in.

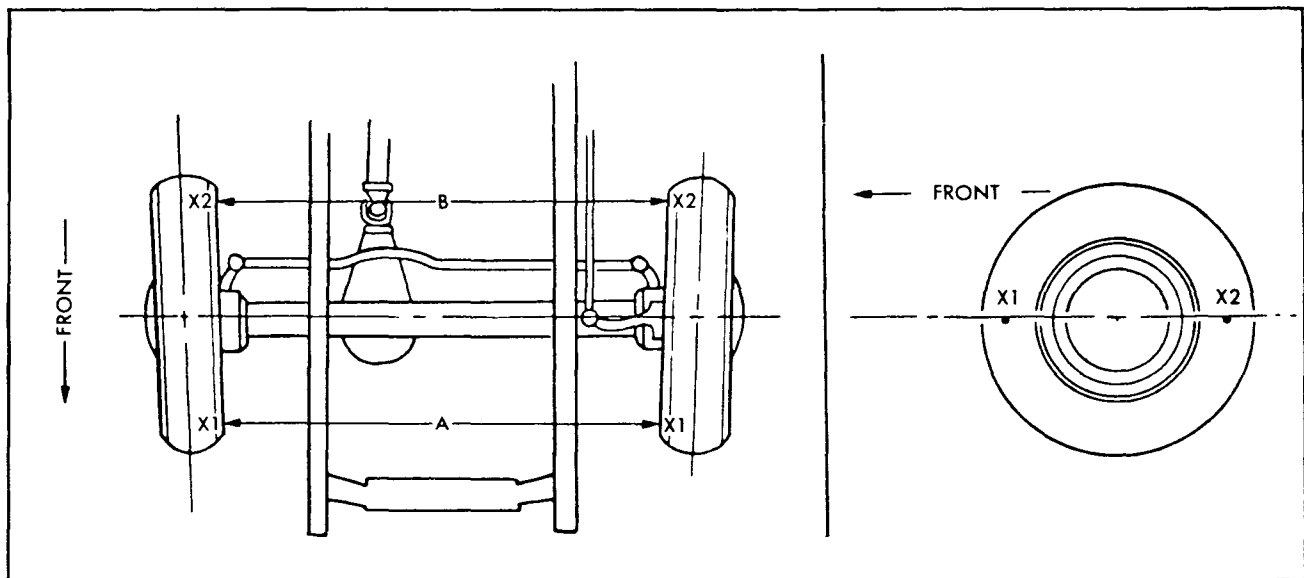


Fig.6 - Toe-in Measurements

NAPCO 11,000-LB. AXLE  
MAINTENANCE INSTRUCTIONS

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## HYDRAULIC BRAKES

### FRONT BRAKE ADJUSTMENT

(Before making any brake adjustments:)

1. Permit drums to cool.
2. Check wheel bearings and adjust if necessary.
3. Examine and adjust pedal linkage on hydraulic master cylinder.
4. Inspect hydraulic fluid level and bleed the system if it is required.

### ADJUSTMENT PROCEDURE

1. Turn brake shoe anchor pins (1) until the punch marks are next to one another. Return toe adjusting cams (2) to fully retracted position. (See Fig. 7 ).
2. Rotate forward shoe toe adjusting cam away from axle and towards shoe until lining drags on the drum. (See Fig. 7 ).
3. Back-off the shoe anchor pin until drag is relieved.
4. Repeat step 2 until drag can no longer be relieved. Back-off the toe adjusting cam (2) and anchor pin adjustment (1) until drag is relieved, then lock the adjustments.
5. Repeat adjustment sequence for second brake shoe. Perform same adjustment procedure on the other front wheel.

### LINING WEAR ADJUSTMENT

1. Adjust forward shoe toe cam (2) upwards until the lining drags.
2. Back-off the shoe as required to relieve drag and lock the adjustment. Repeat the same procedure on other shoe.

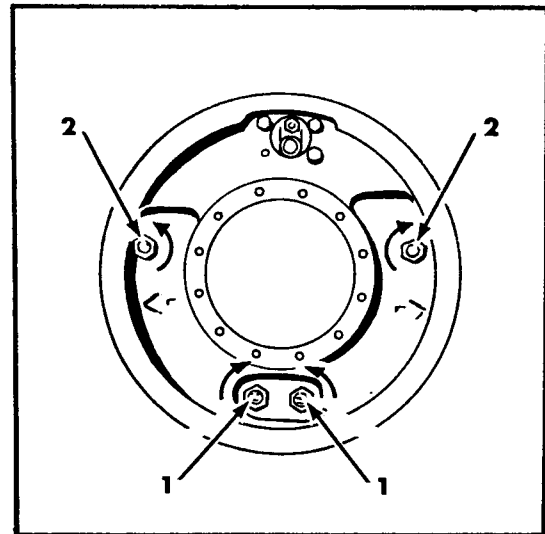


Figure 7. Brake Adjustment

### SHOE REMOVAL

(Fig 8)

1. Install the wheel cylinder clamp to hold pistons in the cylinder.
2. Use the brake spring pliers to remove shoe return springs (1). (Fig. 8 ).
3. Disassemble anchor pins (3) from backing plate assembly. (See Fig. 8 ).

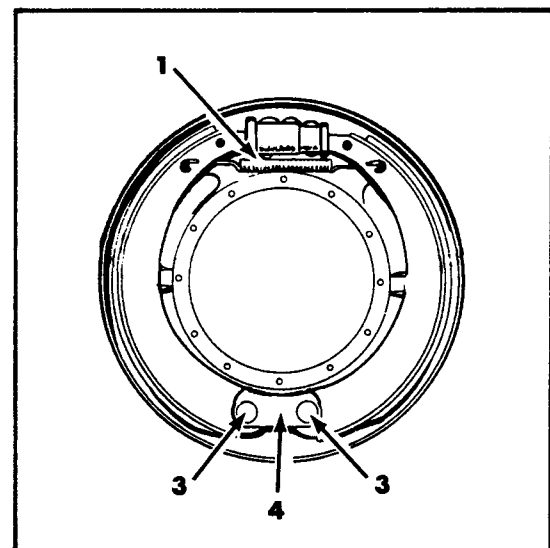


Figure 8. Shoe Removal

# NAPCO 11,000-LB. AXLE MAINTENANCE INSTRUCTIONS

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## CLEANING & INSPECTION

1. Clean all dirt out of the brake drum and inspect the drum for roughness, scoring or out-of-round. Replace or re-condition drum if necessary.
2. Inspect the wheel bearings and oil seals, as directed in the truck manufacturer's service manual.
3. Carefully pull lower edge of wheel cylinder boots away from cylinders and examine the interior for excessive dampness from brake fluid. Excessive amounts of fluid indicates leakage past piston cups, requiring overhaul of the wheel cylinder. A slight amount of leakage nearly always is present and acts as lubricant for pistons.
4. Examine the brake backing plate for security of mounting. Clean rust and dirt from the brake shoe contact surfaces on the backing plate. Coat the shoe contact surfaces lightly with lubricate.
5. Examine the brake shoe return springs and replace them if they are broken, cracked or weakened.
6. Replace brake shoe linings whenever necessary and always make replacements in sets.

## SHOE INSTALLATION

1. Assemble the anchor pins (3) to plate (4); the brake shoes to the pins and then, the entire assembly to the backing plate. Mount and tighten the anchor pin nuts. (See Fig. 8 ).
2. Use the brake spring pliers to assemble the brake shoe return spring (1) to shoes.
3. Adjust the brakes as previously described under the heading "Brake Adjustments."

## SHOE RELINING

Brake linings are riveted to the shoe and may be replaced with parts specified in the service parts, hydraulic brake, ten stud, six stud section of this manual. When relining, be sure the shoes are clean and that the linings are installed in a manner that will prevent air pockets between the lining and shoe.

Use conventional relining equipment when performing this operation and make certain the lining fits firmly against the shoe, and the rivets are properly upset.

If the brake drums have been refinished, oversize linings should be used or shims must be inserted under the lining.

## **WHEEL CYLINDERS**

### CYLINDER REMOVAL

1. Raise the vehicle and remove wheels and drums. The drive flange, wheel bearings and hubs must also be removed.
2. Disconnect the brake hoses from the truck frame.
3. Remove brakes as directed in "Brake Shoe Removal" section.
4. Loosen and remove the capscrews and lockwashers anchoring the wheel cylinders to the backing plate.

### INSPECTION, REPAIR & INSTALLATION

Wheel cylinder repair kits are now available and are listed in the brake section-service parts lists. The kits contain all necessary replacement parts for wheel cylinder overhaul.

1. Disassemble the wheel cylinder.

## NAPCO 11,000-LB. AXLE MAINTENANCE INSTRUCTIONS

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2. Inspect the cylinder bore for dirt, scores, scratches or corrosion. All light scratches or slightly corroded spots may be polished out using a crocus cloth or sandpaper. Replace the cylinder if scratches or corrosion are deep.
3. Lubricate all parts and the cylinder wall with clean brake fluid and assemble as shown in Fig. 9. Mount wheel cylinders securely to the backing plate and attach brake hoses.
4. Mount the brake shoes in the manner described in the "Brake Shoe Installation" section.

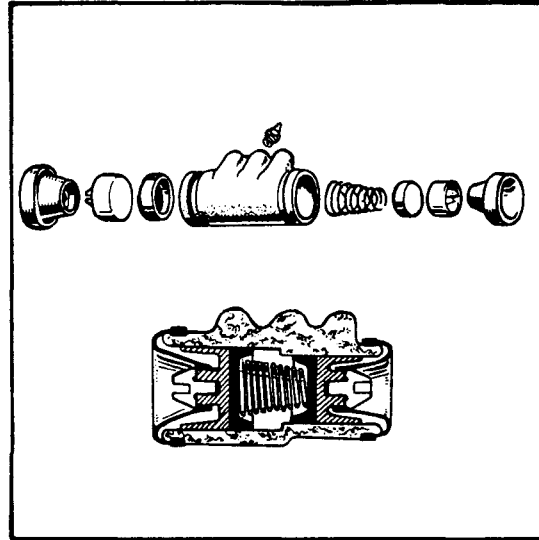


Figure 9. Wheel Cylinder

# Section 4 - Major Service Operations

## SERVICE INSTRUCTIONS FOR DOUBLE REDUCTION BANJO-TYPE FRONT AXLE

### Section I. DESCRIPTION AND DATA

NOTE: The service instructions for the Single Reduction Axle are the same as the Double Reduction Axle with the exception of the AXLE CARRIER ASS'Y AND ADJUSTMENT PROCEDURE which are explained on pages 36, 37, and 38.

#### Description

The double reduction banjo-type front axle (fig. 10) is provided with a differential carrier assembly which is detachable from the axle housing as a unit. The axle is of the full floating type being jointed at the outer ends to permit steering the vehicle. The differential carrier is located to one side of the axle housing to permit the propeller shaft to clear the engine. Double reduction is achieved by four gears arranged as shown in figure 11. The bevel pinion gear drives the bevel gear which, being on a common shaft with the spur pinion gear, drives the differential spur pinion gear which drives the differential gear.

#### A. Data

Make .....	Napco
Type .....	Full Floating, Banjo Type,
Drive .....	Through springs.
Differential:	
Drive .....	Spiral and Spur Gears
Bearings .....	Ball Bearings
Spur pinion gear:	
Bearings .....	Tapered Roller
Adjustment .....	Shims.
Bevel pinion gear:	
Bearings .....	Tapered Roller
Adjustment .....	Shims.
Steering knuckle:	
Bearings .....	Tapered Roller
Adjustment .....	Shims.

### Section II. DISASSEMBLY OF AXLE

#### B. Remove Accessories

a. Remove Brake Slack Adjuster (fig. 10). Remove the cotter pin and clevis pin that attaches each brake cylinder yoke to the brake slack adjuster. Remove the two nuts and lock washers that attach the brake air cylinder to mounting bracket and remove cylinder. Remove the snap ring that secures each brake slack adjuster to the brake camshaft. Slip the slack adjuster off the brake camshaft. If Hydraulic Brakes are used, Disconnect brake hoses at Frame.

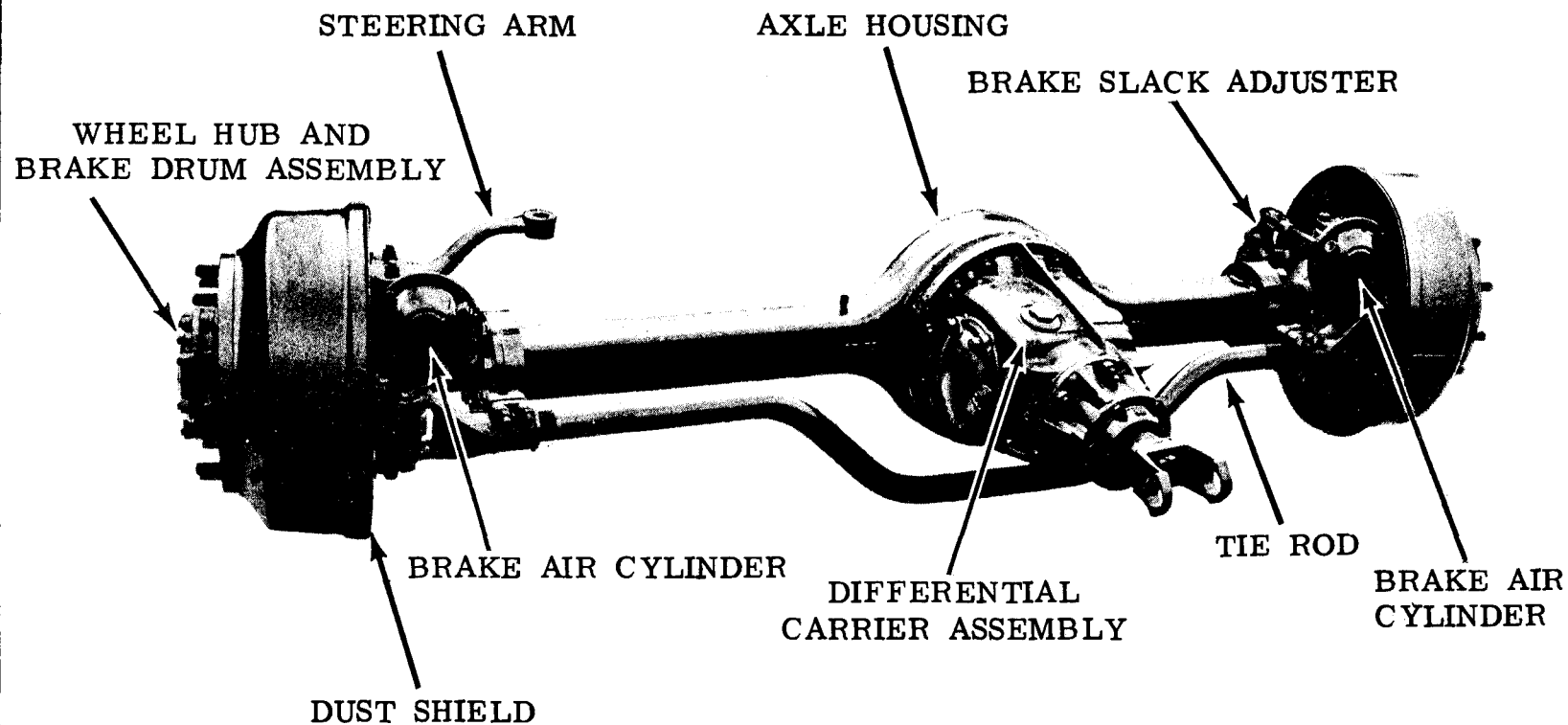


Figure 10. Double reduction banjo type front axle assembly

b. Remove Tie Rod. Remove the cotter pin, nut, and bolt that attaches each end of tie rod to the trunion assembly and remove the tie rod.

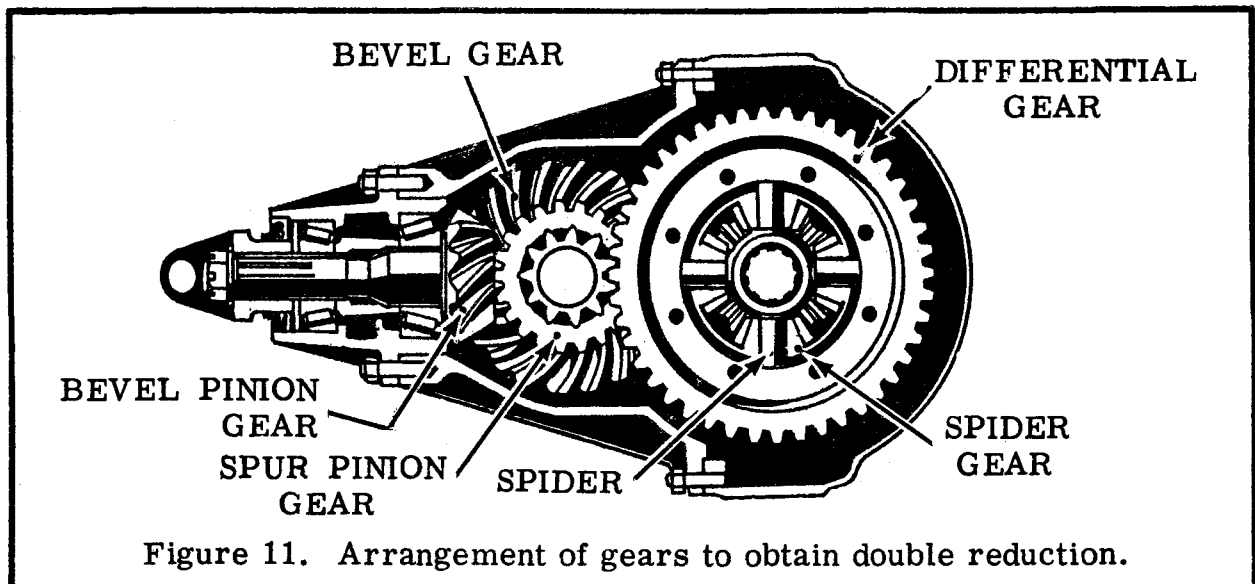


Figure 11. Arrangement of gears to obtain double reduction.

**C. Disassemble Axle Into Subassemblies**

a. Remove Trunion Assembly. Support axle assembly on wood blocks as shown in figure 12. Remove drain plug and allow lubricant to drain into container. Remove the nuts, lock washers, and bolts that attach trunion assembly to the axle housing flanges. Support the trunion assembly with chain hoist and strike the bosses of the trunion with a hammer to free the axle shafts. Lift the trunion assemblies from the axle housing with chain hoist.

b. Remove Differential Carrier Assembly. Attach a chain hoist to the propeller shaft yoke. Remove the nuts, lock washers and bolts that attach the differential carrier assembly to the axle housing. Carefully lift the differential carrier assembly from the axle housing (fig. 13.)

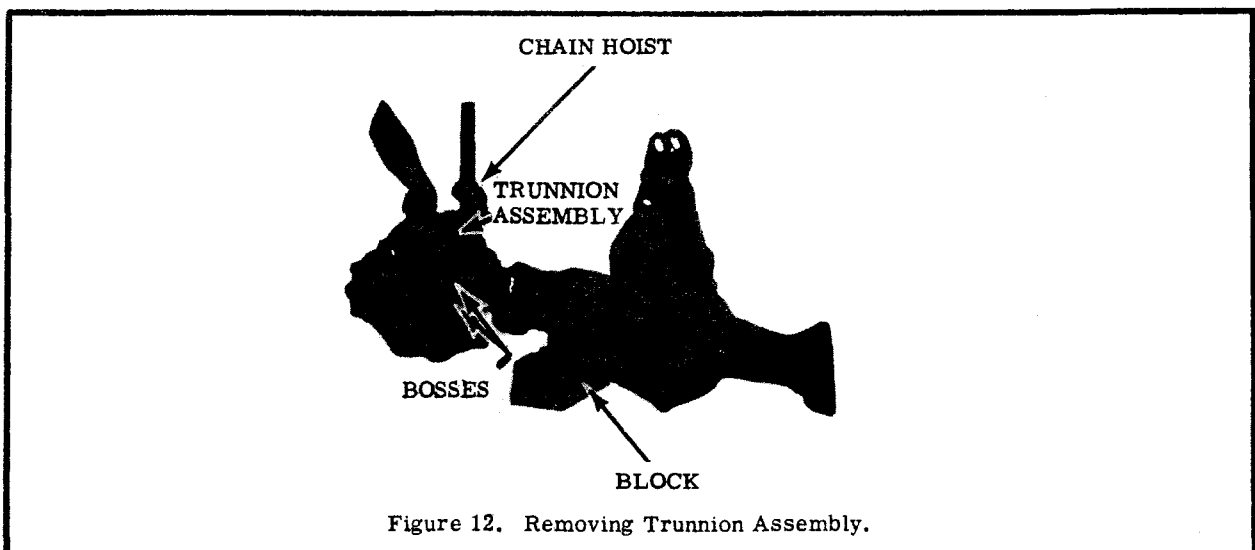


Figure 12. Removing Trunion Assembly.



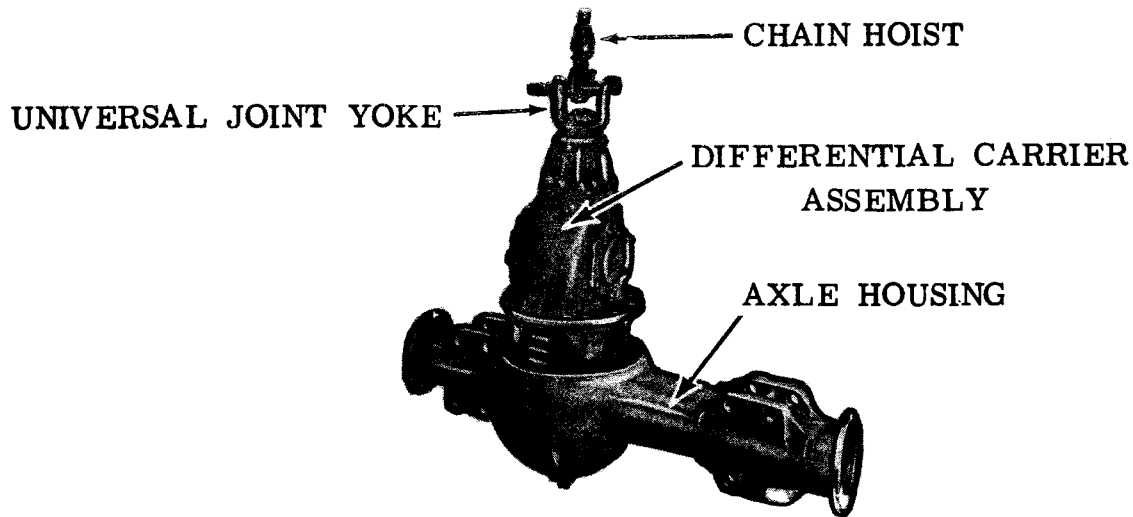
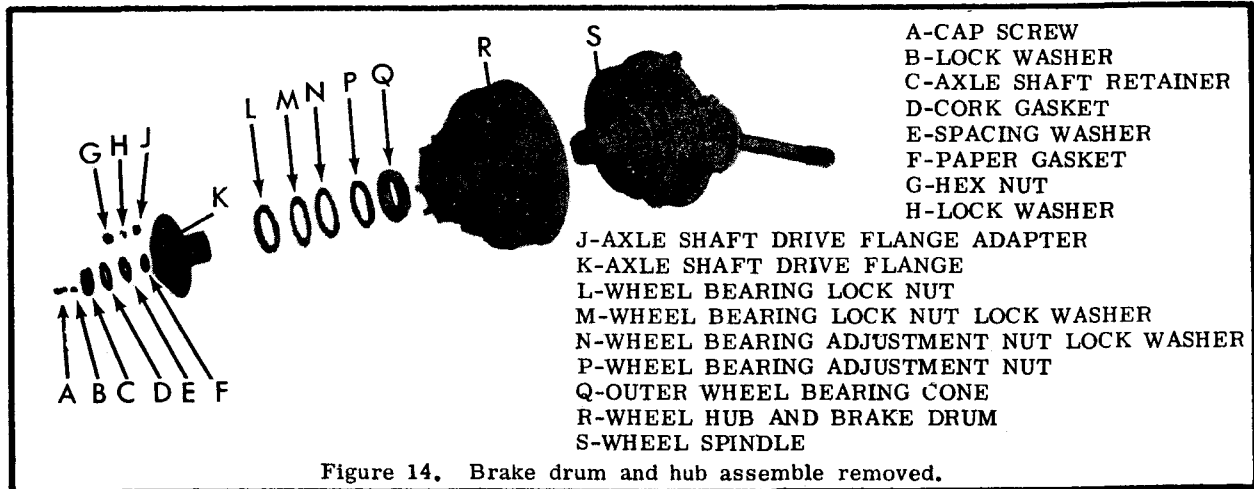


Figure 13. Removing differential assembly.

#### D. Disassemble Trunnion Sockets

- a. Remove the cap screws (A, fig. 14) and lock washers (B) that attach axle shaft retainer (C) to the axle shaft and remove retainer, cork gasket (D), spacing washer (E) and paper gasket (F).
- b. Remove the hex nuts (G) and lock washers (H) that attach the axle shaft drive flange (K) to the wheel hub and brake drum assembly (R).
- c. Install two puller screws into the axle shaft drive flange (fig. 15) to force it off the axle shaft and out of the wheel hub and remove flange.
- d. Straighten the wheel bearing lock nut lock washer (M, fig. 14); then remove the wheel bearing lock nut (L), wheel bearing lock nut, lock washer (M), wheel bearing adjusting nut lock washer (N) and wheel bearing adjustment nut (P). Lift wheel hub and brake drum assembly (R) and outer wheel bearing cone (Q) off the wheel spindle (S).
- e. Remove brake shoe return spring (fig. 16). Remove the nut, lock washer, and bolt that attaches the brake shoe anchor pin link to the trunnion assembly and remove the link. Slide the brake shoes off the brake shoe anchor pins.
- f. Remove the nut (H, fig. 17) and lock washer (J) that attach each brake shoe anchor pin (MM) to the steering knuckle inner flange (D) and remove the anchor pins.
- g. Remove the nuts (SS) and lock washers (TT) that attach the wheel spindle (KK) to the steering knuckle outer flange (HH). Tap the wheel spindle (fig. 18) lightly with a soft hammer; then carefully pry it off the axle shaft.
- h. Remove the cap screws (V, fig. 17) and lockwashers (W) that attach the brake dust shields (U) to the steering knuckle flange and remove the shields.



i. Slip the axle shaft and universal joint assembly out of the steering knuckle flange assembly (fig. 19).

j. Remove the nuts (T, fig. 17) and lock washers (S) that attach the steering arm and upper bearing cap to the steering knuckle flange. Pry them off the steering knuckle flanges being careful not to damage the steering knuckle bearing cap shims (C). Tie the shim pack to the respective bearing cap or steering arm to facilitate bearing adjustment when assembling. Remove the steering cap screws (A) that attach the steering knuckle lower bearing caps (B) and steering knuckle bearing cap shims (C) to the steering knuckle flanges. Remove them in the same manner as the steering arm (fig. 20) and upper bearing cap.

k. Remove nut (WW, fig. 17), lock washers (VV), and bolts (UU) that secure the two halves of the steering knuckle flange. Tap the flanges with a soft hammer to separate the inner and outer halves as shown in figure 21.

l. Remove the locking wire from the ball retainer screws. Remove the ball retainer screws from the ball retainer (fig. 22) and lift the axle shaft, and component parts from the universal joint outer race (fig. 23).

m. Remove the pilot pin seat from the universal joint end of axle shaft (fig. 22). Remove the pilot pin, pilot pin spring plunger, pilot pin plunger spring, and pilot pin spring from the universal joint outer race.

n. Tilt the universal joint ball cage enough to remove universal joint ball (fig. 24). Remove the remaining five balls in the same manner.

o. Rotate the universal joint ball cage until upside down in the universal joint outer race; then lift the universal joint ball cage pilot off the cage (fig. 25.)

p. Rotate the universal joint inner race until one of the lugs of the inner race engages one of the elongated slots in the universal joint ball cage (fig. 26.) Lift the inner race from the cage.

q. Rotate the universal joint ball cage until the elongated slots engage one of the lugs on the universal joint outer race (fig. 27); then lift the cage from the universal joint outer race.

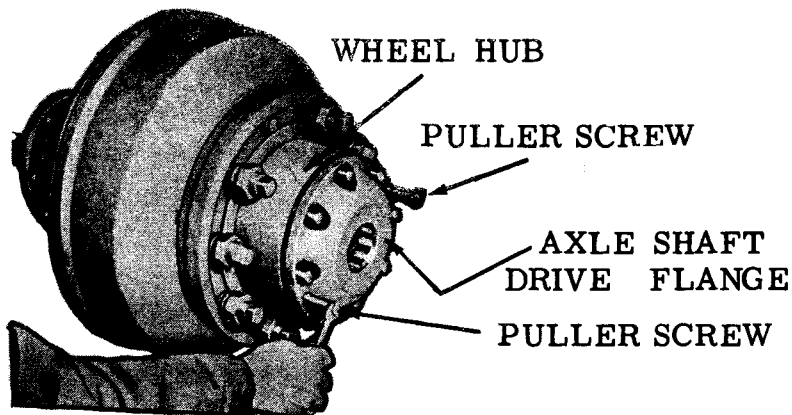


Figure 15. Removing Axle Shaft Drive Flange

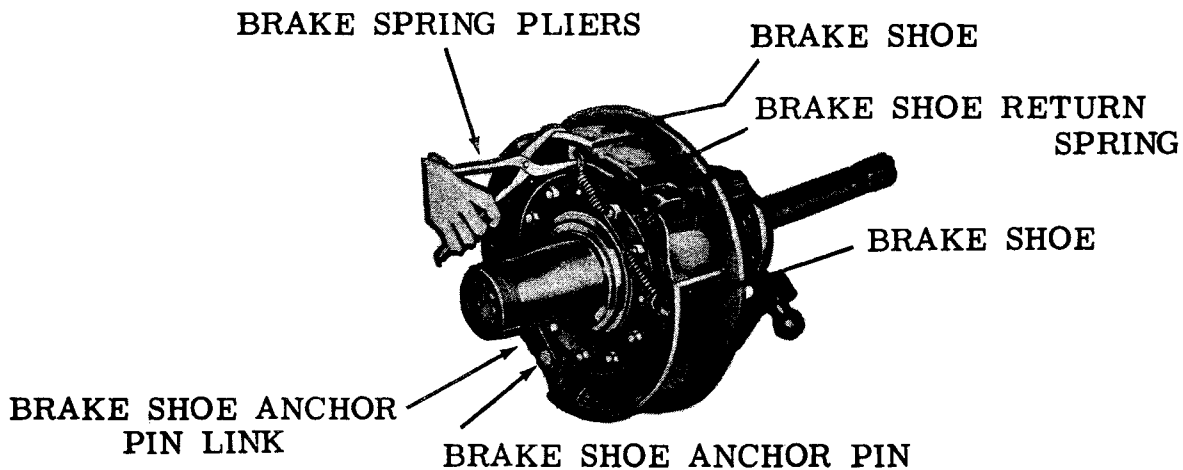


Figure 16. Removing Brake Shoe Return Spring.

E. Disassemble Differential Carrier Assembly

- a. Make a punch mark on each differential bearing cap and each side of differential carrier (fig. 28) to insure original alinement of caps when reassembling.
- b. Remove the locking wire that secures each differential bearing cap nut
- c. Remove the four differential bearing cap nuts. Tap each differential bearing cap with a soft hammer to loosen it on the studs. Remove the two bearing caps, and the differential assembly.

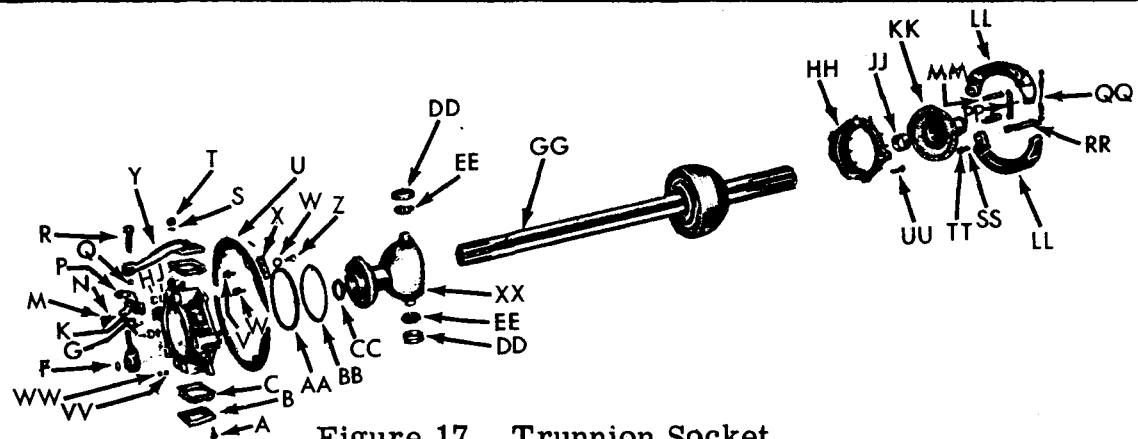


Figure 17. Trunnion Socket

A-Cap screw	BB-Trunnion socket seal pressure spring
B-Steering Knuckle lower bearing cap	CC-Trunnion socket axle shaft oil seal
C-Steering knuckle bearing cap shims	DD-Steering knuckle bearing cup
D-Steering knuckle inner flange	EE-Steering knuckle bearing cone
E-Brake slack adjuster	
F-Snap ring	
G-Lubrication fitting	
H-Nut	GG-Axle shaft and universal joint assembly
J-Lock washer	HH-Steering knuckle outer flange
K-Nut	JJ-Wheel spindle bearing
L-Lock washer	KK-Wheel spindle
M-Cap screw	LL-Brake shoe
N-Lock washer	MM-Brake shoe anchor pin
P-Brake air cylinder mounting bracket	NN-Brake shoe anchor pin link
Q-Nut	PP-Bolt
R-Steering arm ball stud	QQ-Brake shoe return spring
S-Lock washer	RR-Brake camshaft
T-Nut	SS-Nut
U-Brake dust shield	TT-Lock washer
V-Cap screw	UU-Bolt
W-Lock washer	VV-Lock washer
X-Brake dust shield mounting plate	WW-Nut
Y-Steering arm	XX-Trunnion socket
Z-Cap screw	
AA-Trunnion socket felt seal	

d. Place the differential assembly in a vise. Make a punch mark on each side of differential gear and differential case (fig. 29) to assure original alinement when assembling.

e. Remove the cotter pins from the slotted nuts and bolts that attach the differential case to the differential gear. Remove bolts and nuts attaching differential case to differential gear (fig. 29). Separate the two halves of case from the gear (fig. 30) by tapping on the case with a hammer and brass drift.

f. Remove the spider, spider gears and spider gear thrust washers from the differential case (fig. 31) by prying them out with a screwdriver. Remove the differential side gear (fig. 32) and differential side gear thrust washer (fig. 32) from each half of the case.

g. Remove the nuts and lock washers that attach the bevel pinion gear cage to the differential housing.

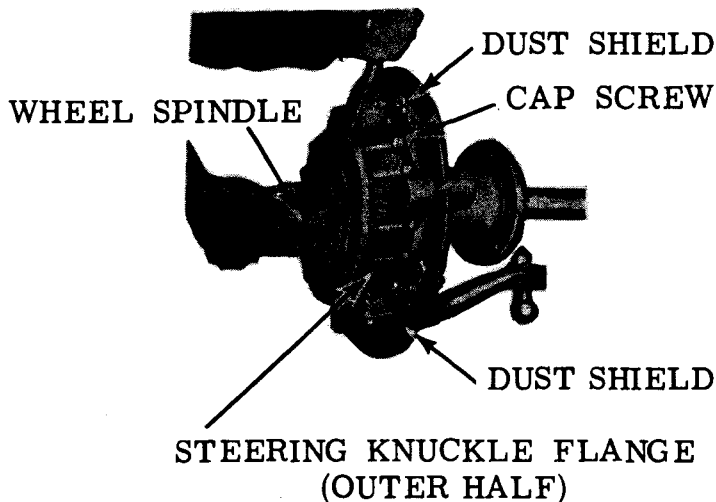


Figure 18. Removing wheel spindle.

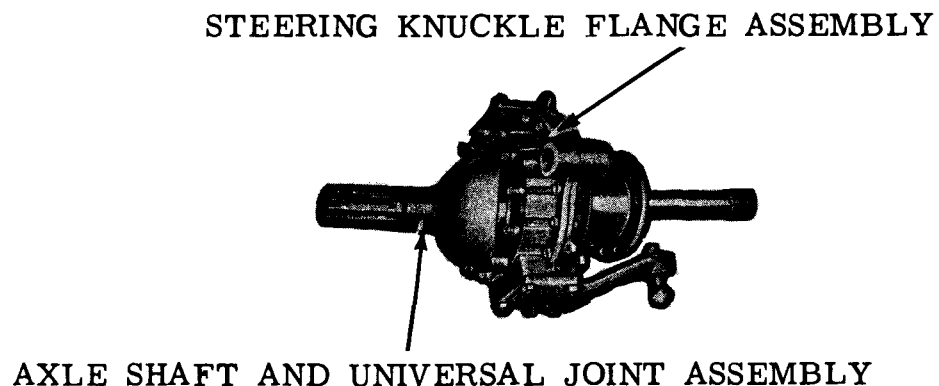
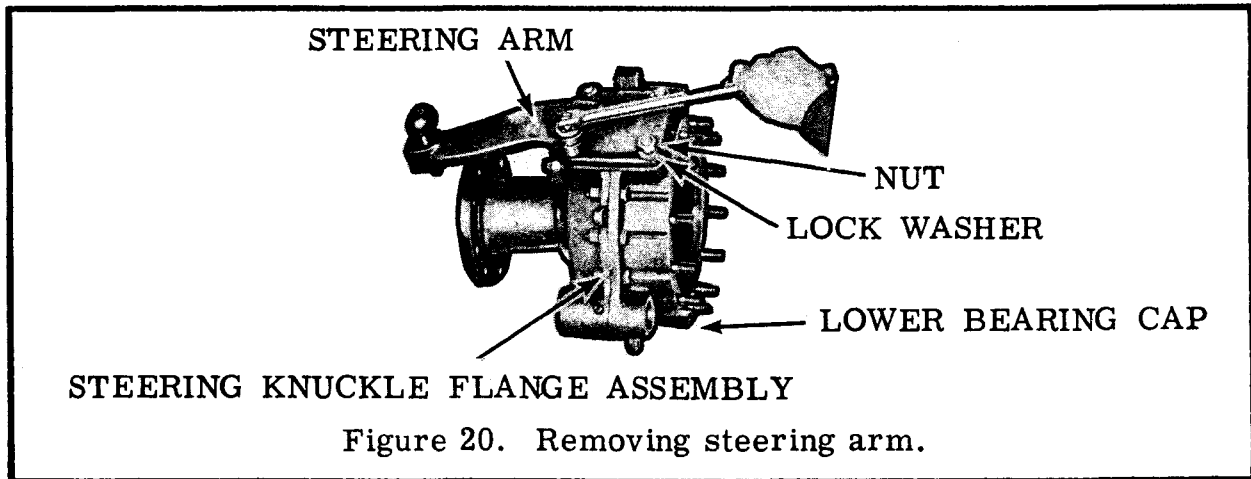


Figure 19. Axle shaft and universal joint assembly removal.

- i. Install two puller screws into the bevel pinion gear cage as shown in figure 33. Turn the screws in until the bevel pinion gear cage is free of the differential carrier. Tie the shim pack to bevel gear cage to facilitate adjustment when assembling.
- j. Place the bevel pinion gear cage in a vise and remove the cotter pin and nut that secured the universal joint yoke to the bevel pinion gear. Using a universal puller, remove the universal joint yoke as shown in figure 34.
- k. Place the bevel pinion gear cage in an arbor press on support blocks and press the bevel pinion gear from the cage (fig. 35).
- l. Remove the nuts (A, fig. 36) and lock washers (B) that attach the spur pinion gear bearing small cage (C) to the differential carrier (F).
- m. Pry against the bevel drive gear (fig. 37) to force the spur pinion bearing small cage out of the differential carrier. Tie the shim pack to the bearing cage to facilitate bearing adjustment when assembling.
- n. Remove the nuts (A, fig. 36) and lock washers (B) that attach the spur pinion bearing large cage (AA) to the differential carrier (F).



o. Press or drive the spur gear and cross shaft assembly with a suitable tool or wood block to force the spur pinion bearing large cage out of the differential carrier (fig. 38). Lift the spur pinion gear and cross shaft assembly out of the differential carrier. Further disassembly of the differential if necessary is detailed in paragraph H.

### Section III. CLEANING, INSPECTION, AND REPAIR

#### F. Cleaning

a. General. Any special cleaning instructions required for specific mechanisms or parts are contained in the pertinent section. General cleaning instructions are as follows:

- (1) Use dry-cleaning solvent or volatile mineral spirits to clean or wash grease or oil from all parts of axle.
- (2) A solution of one part grease-cleaning compound to four parts of dry cleaning solvent or volatile mineral spirits may be used for dissolving grease and oil from axle housings. After cleaning, use cold water to rinse off any solution which remains.
- (3) After the parts are cleaned, rinse and dry them thoroughly. Apply a light grade of oil to all polished metal surfaces, to prevent rusting.
- (4) Before installing new parts, remove any preservative materials, such as rust-preventive compound, protective grease, etc.

#### b. General Precautions in Cleaning.

- (1) Dry-cleaning solvent and volatile mineral spirits are flammable and should not be used near an open flame. Fire extinguishers should be provided when these materials are used. In addition, they evaporate quickly and have a drying effect on the skin. If used without gloves, they may cause cracks in the skin and, in case of some individuals, a mild irritation or inflammation. Use only in well ventilated places.
- (2) The use of diesel fuel oil, gasoline, or benzine (benzol) for cleaning is prohibited.

STEERING KNUCKLE FLANGE (OUTER)

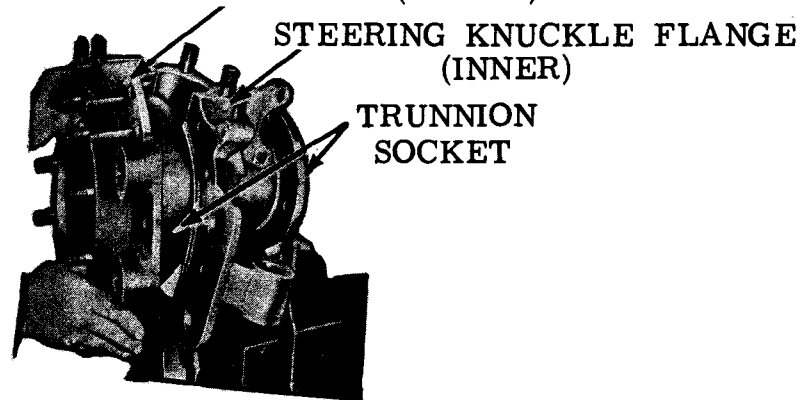


Figure 21. Disassembling steering knuckle flange.

#### G. Inspection of Axle Components

a. Axle Housing. Replace an axle housing that is cracked, broken, or if the sleeves are loose in the housing. Replace damaged or broken studs (par. H). Smooth machined surfaces that are nicked or burred must be polished with a fine stone.

b. Differential Carrier (fig. 36). Replace a differential carrier (F) that is cracked or damaged. Replace damaged or broken studs (par. H). Smooth machined surfaces that are nicked or burred must be polished with a fine stone. Inspect the bearing cup (E) in the spur pinion gear gearing cages (C and AA) and replace (par. H) if cracked, scored, pitted, corroded or discolored due to overheating.

c. Bevel Pinion Gear Cage. Replace a bevel pinion cage large and small (N, fig. 36) that is cracked, or damaged. Smooth machined surfaces that are nicked or burred must be polished with a fine stone. Inspect the bearing cups (K, fig. 36) and replace (par. H) if cracked, scored, pitted, corroded or discolored due to overheating.

d. Axle Shafts and Universal Joints (fig. 22). Replace an axle shaft that is bent, twisted or has damaged splines. Splines that are nicked or burred must be polished with a fine stone. Inspect universal joint outer race for being bent, damaged, worn, or scored and replace as necessary. Inspect universal joint ball cage pilot, universal joint ball cage, universal joint balls, and universal joint inner race for wear, scores, cracks, or damage, and replace as necessary. Replace a pilot pin plunger spring, pilot pin spring, pilot pin spring plunger or pilot pin that is broken or damaged.

e. Wheel Spindles (KK, fig. 17). Replace wheel spindle if it is bent, damaged or if threads are damaged beyond repair. If inner diameter of wheel spindle bearing (JJ) is more than 0.014 inch larger than the diameter of the bearing surface of universal joint outer race, bearing must be replaced (par. H).

f. Trunnion Socket (XX, fig. 17). Replace trunnion socket if broken, damaged or scored. Replace a trunnion socket bearing cone (par. H) if any of the rollers are missing, scored, corroded or pitted. Replace steering knuckle bearing cups (DD) that are cracked, pitted or scored.

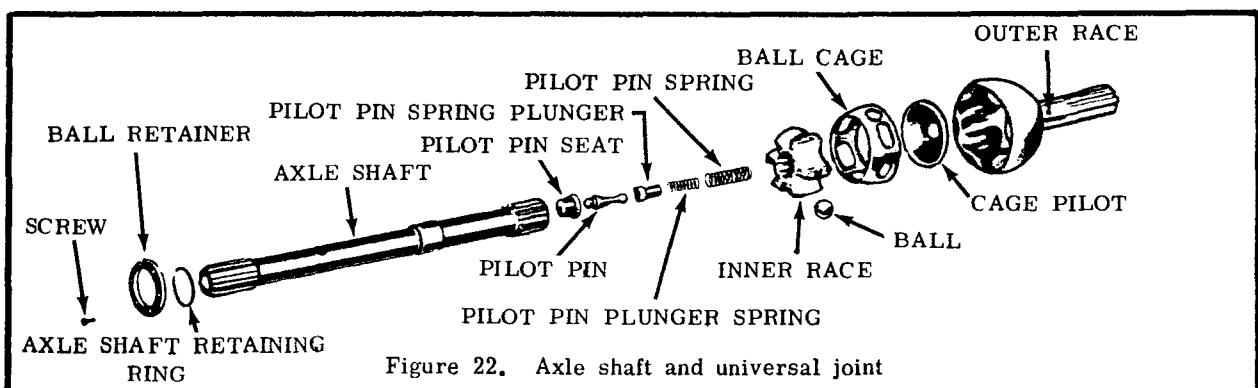
g. Steering Knuckle Flange. Replace either half of the steering knuckle inner or outer flange (D, or HH, fig. 17) if cracked, scored, or damaged. Replace studs (par. H) that are broken or stripped.

h. Differential Gear and Spur Pinion. Replace a differential gear (fig. 32) that is chipped, broken, or visibly worn. Replace spur pinion gear (Y, fig. 36)(par. H), if chipped, broken or visibly worn or if cross shaft splines are damaged. Replace all four spider gears or spider gear thrust washers if any are worn or scored. Replace the two differential side gear thrust washers (fig. 32), if either is worn or scored. Place spider gear on the spider. If any looseness is noted between spider and gears, replace gears and/or spider. Position spider in the differential case. If any radial movement is noted, replace spider and/or case. Replace a differential case if scored. Replace differential side gears (fig. 32) that are visibly worn, broken or chipped. Replace differential bearing cones (par. H) if any of the rollers are missing, pitted, corroded, or discolored due to overheating. Replace differential bearing cups that are cracked, pitted, corroded or discolored due to overheating. Replace a bearing adjusting ring if stripped, broken or damaged.

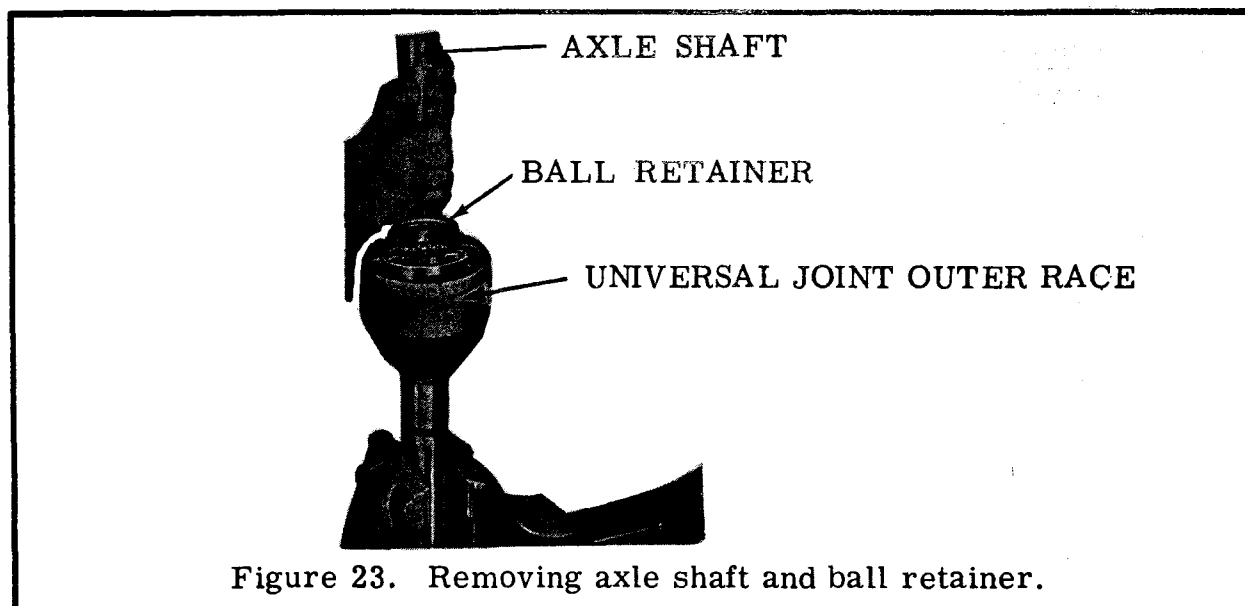
i. Bevel Pinion Gear and Bevel Drive Gear. Replace bevel pinion gear and bevel drive gear (H and Z, fig. 36) (par. H) if either is chipped, broken or worn.

Note. The bevel pinion gear and bevel drive gear are matched gears, therefore, if necessary to replace either gear, both gears must be replaced.

Replace bearing cones (J, fig. 36) if any of the rollers are missing, pitted, corroded or discolored due to overheating.







#### H. Repair of Axle Components

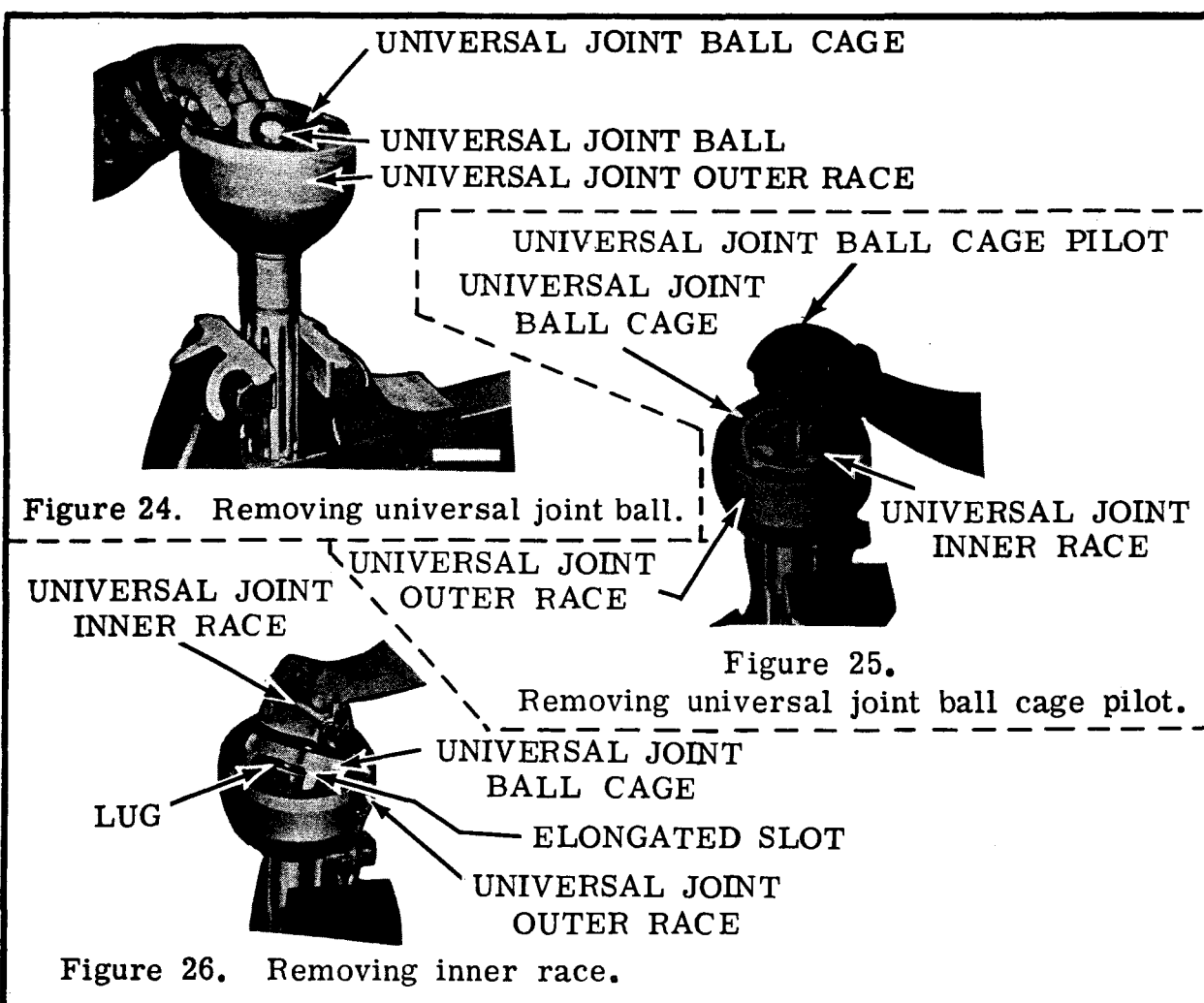
##### a. Differential Housing.

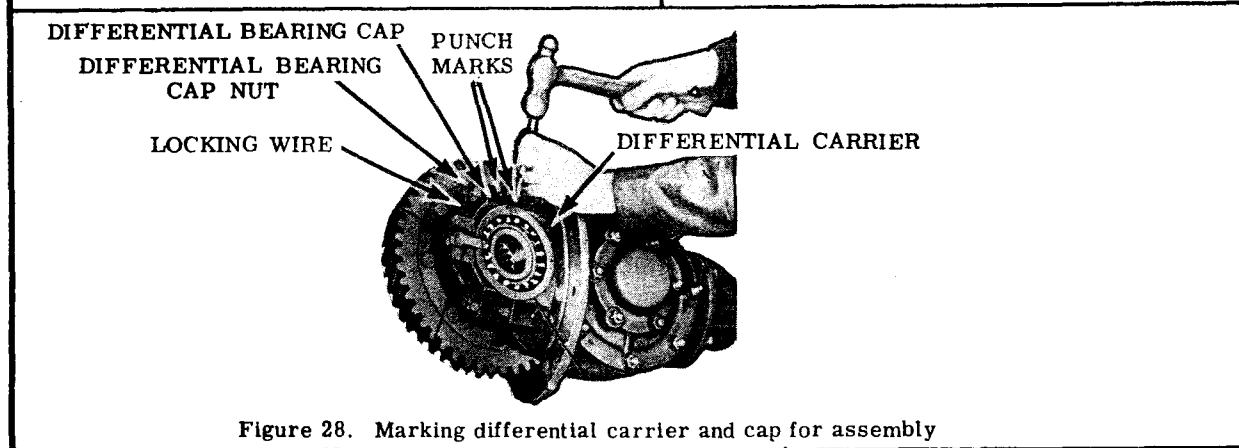
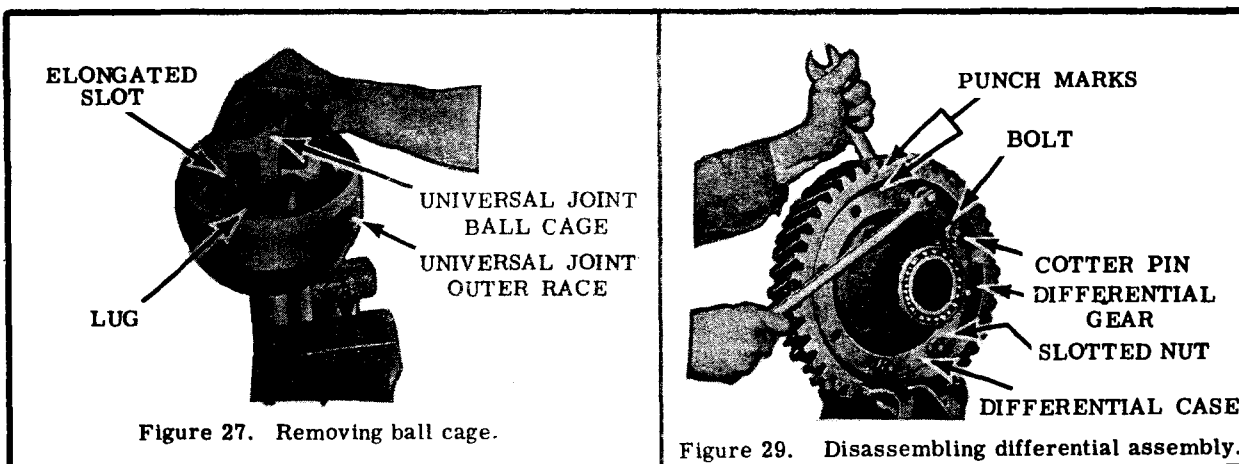
- (1) Stud replacement. Remove all damaged studs with a standard stud puller. To remove a broken stud, indent the end of the broken stud in the center with a prick punch. Using a small drill as a guide, drill to a depth of two thirds of the broken portion of the stud. Select a larger drill that will leave a wall slightly larger than the threads. Select a screw extractor of the proper size and remove the broken stud. Coat the treads of the new stud with a suitable sealing compound, and thread it in, until no threads are visible at lower end of stud.
- (2) Bearing cup replacement (fig. 36). If replacing the bearing cup (E) in the spur pinion gear bearing large cage (AA), remove the nuts (A) and lock washers (B) that attach the spur pinion bearing cage cover (EE) to the cage and remove the cover and shims (BB). Keep the shim pack intact to facilitate bearing adjustment when assembling. Place the bearing cage in a vise. Using a brass drift, tap alternately around the cup (fig. 39) until the cup is free of the cage. If working on the spur pinion gear bearing small cage, remove the bearing cup with a suitable puller. Place a new bearing cup in the large cage with large part of taper facing away from the outside of cage. Press the cup approximately three-quarters of the way in the cage. Place a new gasket and the shim pack that was removed, in place on the cage. Install the cover and secure with lock washers and nuts. Place a new bearing cup in the small cage with the large end of taper facing outward. Press the bearing cup in the cage until firmly seated.

b. Bevel Pinion Gear Cage Bearing Cup Replacement. Place the bevel pinion gear cage in a vise and remove the oil seal (R, fig. 36), bearing cone (J), and bearing cup (K) by tapping alternately on the cup with a brass drift as shown in figure 40. Pull the rear bearing cup from pinion gear cage with a universal puller as shown in figure 41. Position the new bearing cups in place in the pinion gear cage with the large end of taper facing away from cage. Press them into the cage until seated on the shoulder.

c. Wheel Spindle.

- (1) Bearing replacement. Position the wheel spindle in a press with the spindle portion facing down. Place a heavy washer or suitable tool that is slightly smaller than the bore in the steering knuckle. Press on the washer or tool to remove the bearing. Place a new bearing in the wheel spindle. Using a suitable stop, press the bearing in the spindle (fig. 42) until bearing is seated. Remove all rough edges from edge of bearing with a bearing scraper.
- (2) Bearing cone replacement. Start the bearing cone off the trunnion by carefully driving a chisel between the cone and trunnion socket to provide room for a puller. Remove the bearing cone with a suitable puller. Press a new bearing cone on the trunnion, being careful to exert pressure on the inner race only.





#### Section IV. ASSEMBLY OF AXLE

##### I. Assemble Differential Carrier Assembly

**Note.** The key letters noted in parentheses are in figure 36. Except where otherwise indicated.

a. Install the original shim pack (D) and the spur pinion gear gearing small cage (C) on the differential carrier making sure the oil groove in shims and cage is in alignment with oil groove in carrier.

b. Position the spur pinion gear and cross shaft assembly (Y) and bevel drive gear (Z) with bearing cup (E) in the differential carrier. Place shims (W) on the studs and install the spur pinion bearing large cage (AA) on the carrier. Secure the retaining washer (CC) to the cross shaft with cap screws (DD) and locking wire. Install the shims (BB) that were removed during disassembly on the large bearing cage. Install the spur pinion bearing cage cover (EE) on the spur pinion bearing large cage (AA).

c. Rotate spur pinion several revolutions before checking bearing preload. Check bearing preload by wrapping cable of tester around the spur pinion gear as shown in figure 43. While pulling on a horizontal plane, note the reading on tester scale. Bearing preload should be between 12 to 18 inch pounds. To obtain the bearing preload, multiply the radius of the spur pinion gear by the reading on the tester scale.

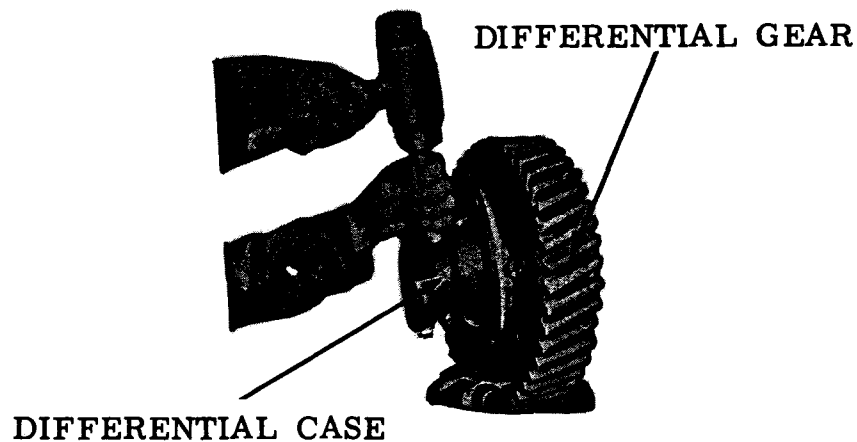


Figure 30. Removing differential case half.

d. To adjust the bearing preload, remove shims (BB) from under the spur pinion bearing cage cover (EE) on the spur pinion bearing large cage (AA) to increase the preload, or add shims under the cover to decrease the preload.

e. Install bevel pinion gear (H) and bearing cone (J) in the bevel pinion gear cage (N). Install the bearing cone spacer (L) and shims (M) that were removed from gear shaft. Using a collar that will exert pressure on the inner race of the cone, press the other bearing cone (J) on the pinion gear shaft until the bearing cone is seated on the shims (M). Install a suitable metal collar that will contact inner race of bearing cone and a washer and the slotted nut on the pinion gear shaft and tighten the nut to check the bearing preload.

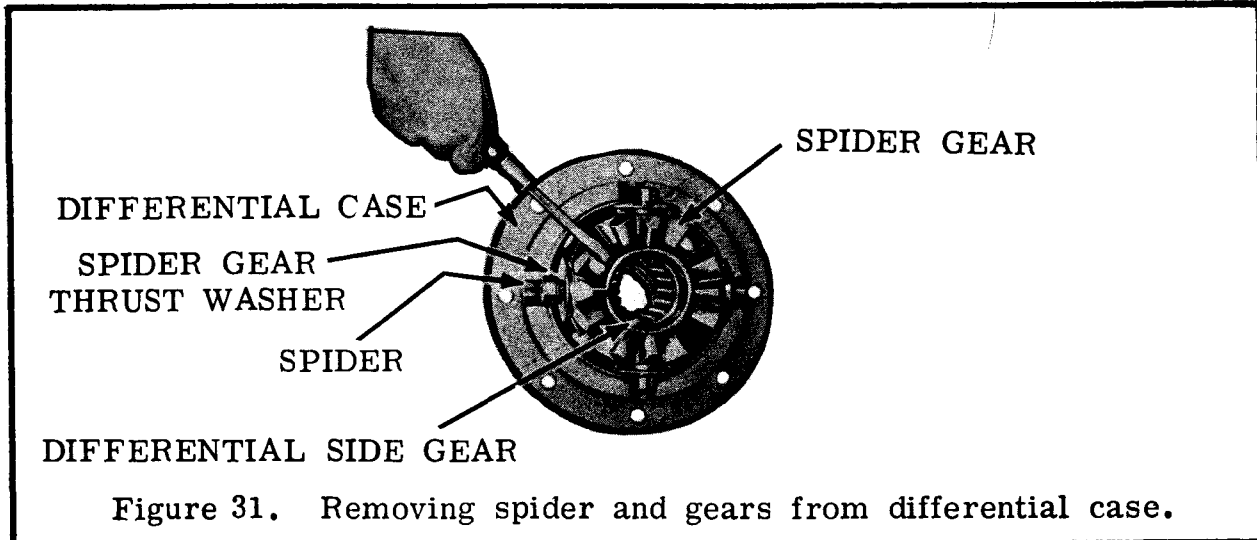
f. Rotate the bevel pinion gear cage several revolutions before checking bearing preload. Check bearing preload by inserting the hook end of a scale 41-S-507-25 (fig. 44) in one of the pinion bearing cage mounting holes. While pulling on a horizontal plane, note the reading on the scale. Bearing preload should be between 12 to 18 inch pounds. To obtain the bearing preload, multiply the radius of the pinion cage by the reading on the scale.

g. To increase the bearing preload, remove shims (M). To decrease the bearing preload, add shims (M).

h. Remove the slotted nut, washer, and collar from pinion gear shaft. Install a new oil seal (R) in the bevel pinion gear cage (N), making certain that the lip of leather seal is facing the bearing cone. Lubricate the seal with oil and install the universal joint yoke (S), plain washer (T), slotted nut (U) on the pinion gear shaft. Tighten the nut and secure with new cotter pin (V).

i. Place the shims (G) that were removed during disassembly on the bevel pinion gear cage (N).

**Caution:** Make certain that the oil hole in the gasket and shims is in alinement with oil passage in carrier. Install the bevel pinion gear



cage assembly on the differential carrier and temporarily secure with two lockwashers and nuts.

j. Install dial indicator on differential carrier as shown in figure 45 to check bevel pinion gear and bevel drive gear backlash. While holding the yoke, rotate the bevel gear back and forth as far as possible without moving the yoke, and at the same time note the reading on the dial indicator. The correct backlash is 0.006 to 0.012 inch. Backlash is adjusted by removing or adding shims (G) to move the gears closer or away from each other.

k. Check gear teeth contact by applying a light coat of oiled red lead to approximately 12 of the bevel drive teeth (drive side only). Rotate the bevel pinion clockwise and compare the teeth contact marks with those shown in figure 46.

#### J. Assemble Differential Assembly

a. Place a differential side gear thrust washer (E, fig. 47) on each differential side gear (D, fig. 47) and install a side gear in each half of differential case.

b. Assemble the four spider gears (B, fig. 47) and spider gear thrust washers (A, fig. 47) on the spider (C, fig. 47).

c. Position the differential gear on one half of the differential case.

d. Position the spider assembly in the differential case (fig. 48).

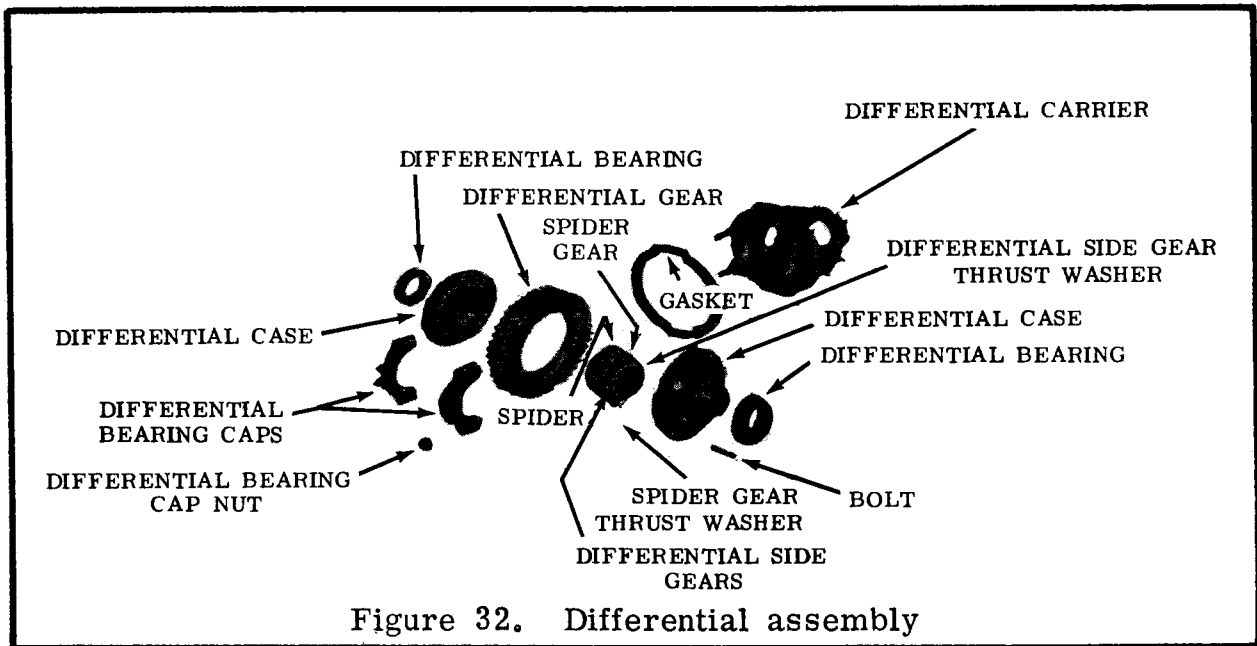
e. Assemble the two halves of differential case, making certain that the index marks (punch) on each half of case are in alignment.

f. Insert the bolts through the differential case and gear, making sure the thickest part of bolt head is seated against shoulder of differential case. Install and tighten the slotted nuts and secure with cotter pins.

#### K. Install Differential Assembly

a. Install differential bearings on differential case. Make sure that retainer rings on outer race come on the outside from case.

b. Place differential assembly in the differential carrier with retaining rings properly seated in the grooves in the carrier.



c. Carefully install the two differential caps, making sure that the retaining rings become properly seated and that the punch mark on each cap is aligned with punch marks on the differential carrier.

d. Install the differential bearing cap nuts and tighten snugly. Recheck that differential turns smoothly and secure nuts with locking wire.

e. Place a new gasket on the axle housing. Lift the differential carrier assembly and lower it into the axle housing (Fig. 13). Secure the differential with the attaching bolts, lock washers, and nuts. Tighten the nuts evenly and alternately to prevent distortion of the differential carrier.

f. Place a new gasket on the axle housing. Lift the differential carrier assembly and lower it into the axle housing (fig. 13). Secure the differential with the attaching bolts, lock washers, and nuts. Tighten the nuts evenly and alternately to prevent distortion of the differential carrier.

#### L. Assemble Trunnion Sockets

Note. The key letters noted in parentheses are in figure 17, except where otherwise indicated.

a. Place the shaft portion of the universal joint outer race in a vise. Hold the universal joint ball cage in a vertical position with the elongated slots engaging the lugs of the universal joint outer race (fig. 27), and position it in the race. Insert one of the lugs of the universal joint inner race in one of the elongated slots of the universal joint ball cage (fig. 26), and work the inner race into the cage.

# NAPCO 11,000-LB. AXLE MAINTENANCE INSTRUCTIONS

# DOUBLE REDUCTION BANJO-TYPE FRONT AXLE

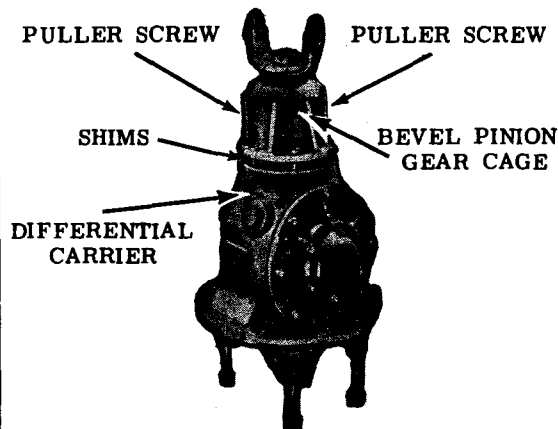


Figure 33. Removing bevel pinion gear cage.

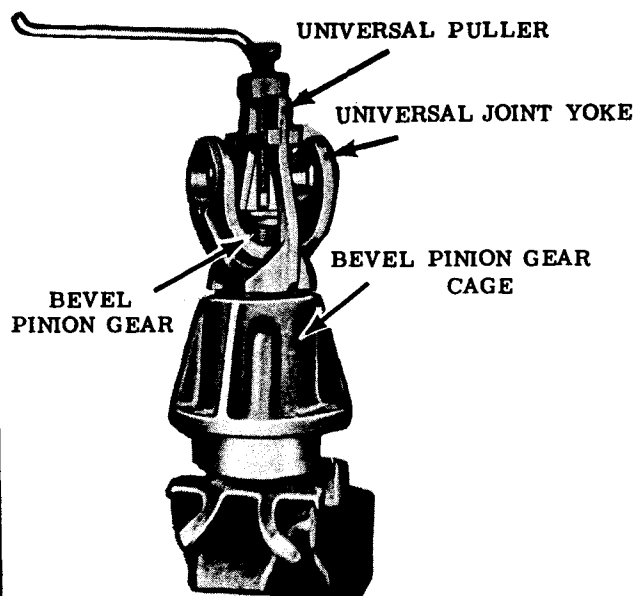


Figure 34. Removing universal joint yoke.

**Caution:** Do not attempt to force the parts into place. When installed properly they will slip into place easily.

b. Rotate the universal joint inner race so that the threaded holes for the ball retainer are at the bottom. Place the universal joint ball cage pilot on the universal joint ball cage (fig. 25); Then rotate the entire assembly to place the pilot at the bottom and the threaded holes of the universal joint inner race at the top.

c. Tip the universal joint ball cage and universal joint inner race enough to insert one of the universal joint balls (fig. 24) into a socket. Tip the cage and inner race and insert a ball in the opposite socket. Repeat this procedure until all of the balls are in place.

d. Install the universal joint pilot pin plunger spring, pilot pin spring, pilot pin spring plunger, and pilot pin with the small end of pin facing down in the outer race (fig. 22).

e. Place the axle shaft retaining ring in place on the inner race. Pack the universal assembly with required grease.

f. Insert the pilot pin seat into the universal joint end of the axle shaft. Insert the axle shaft into the splines of inner race. Install the ball retainer and secure to inner race with screws and locking wire.

g. Position a new trunnion socket seal pressure spring (BB) in the groove provided in the steering knuckle inner flange. Carefully install a new trunnion socket felt seal (AA), making sure it is seated in the groove of the flange.

h. Position the axle shaft and universal joint assembly in place in the trunnion socket (XX). Pack the trunnion with required grease.

- i. Slip the steering knuckle inner flange (D) over the flange on the trunnion socket (XX). Secure the steering knuckle outer flange (HH) to the steering knuckle inner flange (D) with bolts (UU) lock washers (VV), and nuts (WW). Do not tighten the bolts at this time.
- j. Slip the steering knuckle bearing cups (DD) in the knuckle flange; then tighten the steering knuckle flange.
- k. Place the steering knuckle bearing cap shims (C) that were removed from under the steering arm during disassembly, over the studs located on the upper end of the knuckle flange. Position the steering arm (Y) over the same studs and secure with lock washers (S) and nuts (T).
- l. Secure the original steering knuckle bearing cap shims (C) and steering knuckle lower bearing cap (B) to the lower end of the steering knuckle flange with cap screws (A).
- m. Place the wheel spindle (KK) over universal joint outer race and on to the studs of the steering knuckle outer flange (HH). Make sure the keyway in wheel spindle is facing upward. Secure wheel spindle steering knuckle outer flange with lockwashers (TT) and nuts (SS).
- n. With a socket and torque wrench installed on one of the steering knuckle upper bearing cap nuts, turn the steering knuckle flange assembly back and forth and note the reading on the torque wrench. If higher than 75 pounds, steering knuckle bearing cap shims (C) must be added under the steering arm (Y) and steering knuckle lower bearing cap (B). If less than 50 pounds, shims (C) must be removed. Remove or install shims as necessary to establish the proper turning torque.
- o. Install the two brake shoe anchor pins (MM) in the steering knuckle flange assembly and secure with lock washers (J), and nuts (H). Install the lubrication fittings (G) in the brake shoe anchor pins.
- p. Slip the brake shoes in position on the brake shoe anchor pins (MM). Install brake shoe anchor pin link (NN) over the brake shoe anchor pins (MM) and secure with bolt (PP), lock washer (L), and nut (K). Tighten the nut, to secure brake shoe anchor pin link. Install brake shoe return spring with brake spring pliers (fig. 16).
- q. Position the brake dust shields (U) on the steering knuckle inner flange and secure with lock washers (W) and cap screws (V).
- r. Position the wheel hub and brake drum assembly (R, fig. 14) and outer wheel bearing cone (Q, fig. 14) in place on the wheel spindle (S, fig. 14). Install the wheel bearing adjustment nut (P, fig. 14) and tighten it. Then, back it off approximately 45 degrees to obtain the correct wheel bearing adjustment. Install the wheel bearing adjustment nut lock washer (N, fig. 14), wheel bearing lock nut lock washer (M, fig. 14) and wheel bearing lock nut (L, fig. 14). Tighten lock nut; then bend lock washer (M, fig. 14) over lock nut.
- s. Tap the axle shaft drive flange (K, fig. 14) into place with a soft hammer. Install the axle shaft drive flange adapters (J, fig. 14) (where used) in the flange. Secure the flange to the wheel hub with lock washers (H, fig. 14) and nuts (G, fig. 14).



t. Secure the paper gasket (F, fig. 14), spacing washer (E, fig. 14), cork gasket (D, fig. 14), and axle shaft retainer (C, fig. 14) to the axle shaft with lock washers (B, fig. 14) and cap screws (A, fig. 14).

### M. Install Accessories

a. Install Brake Air Cylinders. Attach the brake air cylinders to the mounting brackets with cap screws and lock washers.

b. Install Brake Slack Adjusters. Slip the brake slack adjusters in place on the brake cam shaft and secure with snap rings. Connect each brake air cylinder rod to the slack adjusters with clevis pins and cotter pins.

c. Install Tie Rod. Position the tie rod in place on the trunnion assemblies and secure with bolts, nuts, and cotter pins.

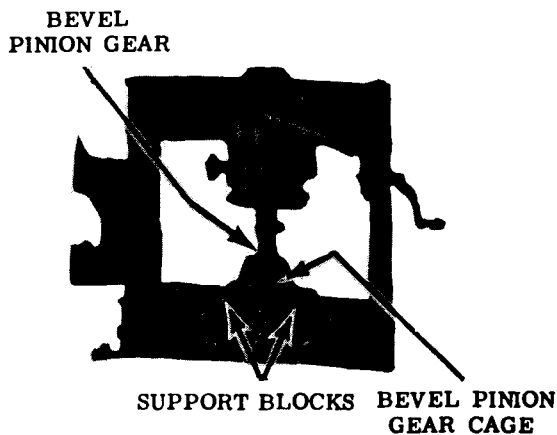


Figure 35. Pressing bevel pinion gear from cage.

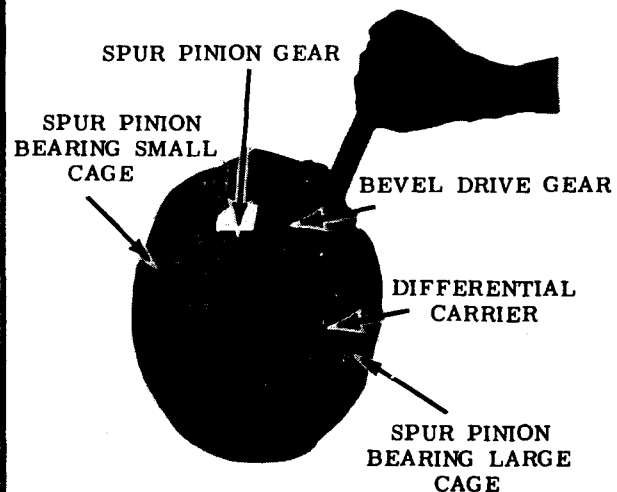
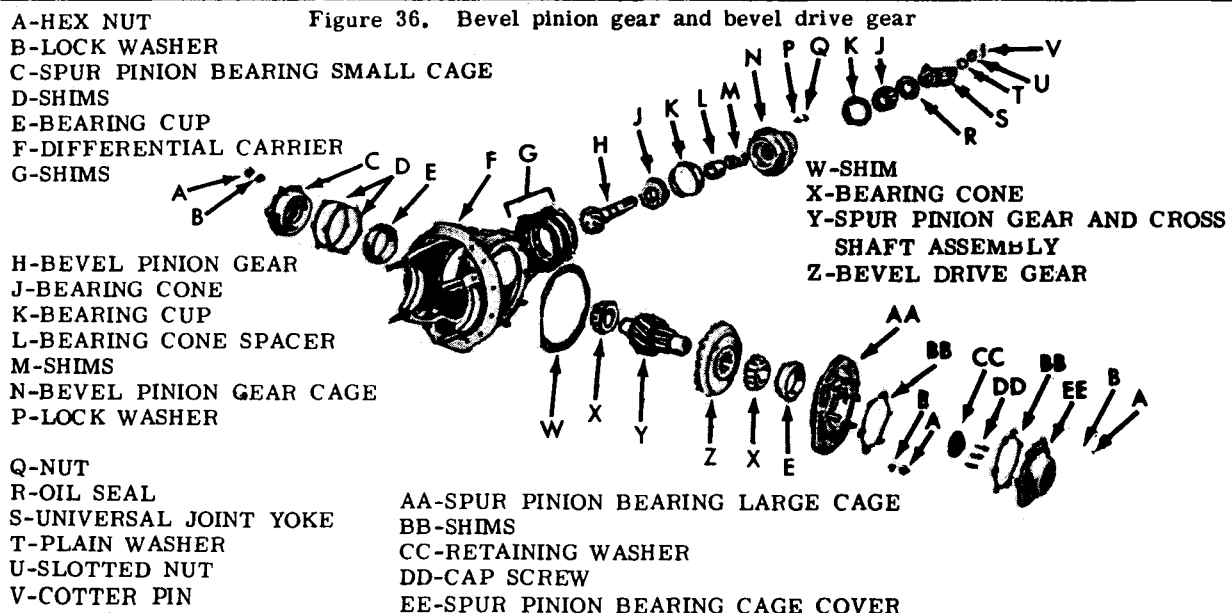


Figure 37. Removing spur pinion bearing small cage.



**N. Test and Adjustment**

a. Lubricate. Remove filler plug and pour approximately one quart of universal gear lubricant through filler plug opening in axle housing. Indicate on a tag, that the axle has not been completely lubricated and fasten the tag in a conspicuous place on the axle assembly. Complete lubrication will be accomplished after the axle has been installed in a vehicle.

b. Check Brakes. Rotate each brake drum to make certain that the brakes are adjusted properly and are not dragging. Adjust brakes as necessary. Check all external parts of the brake to make certain that they are present and securely mounted.

c. Check Gear Train. Rotate the pinion gear shaft to make certain it turns without binding and that the brake drums turn.

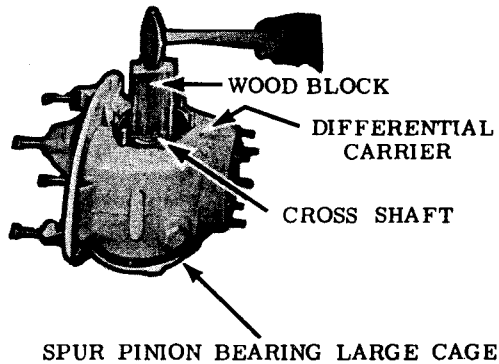


Figure 38. Removing spur pinion gear bearing large cage.

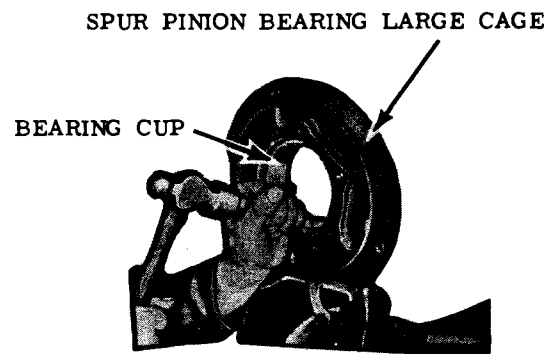


Figure 39. Removing bearing cup from large cage.

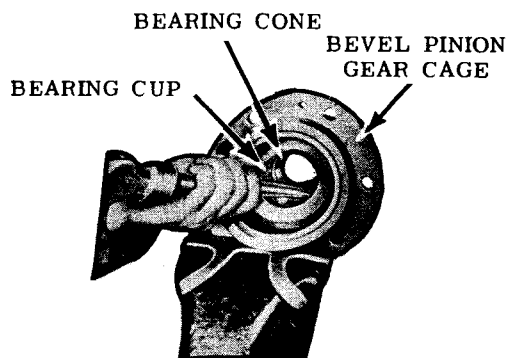


Figure 40. Removing front bearing cup.

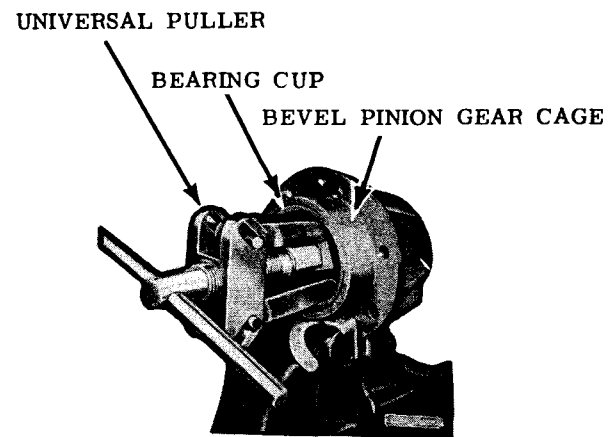


Figure 41. Removing rear bearing cup.

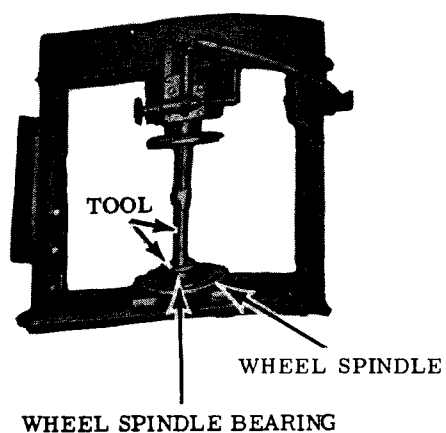


Figure 42. Installing bearing in wheel spindle.

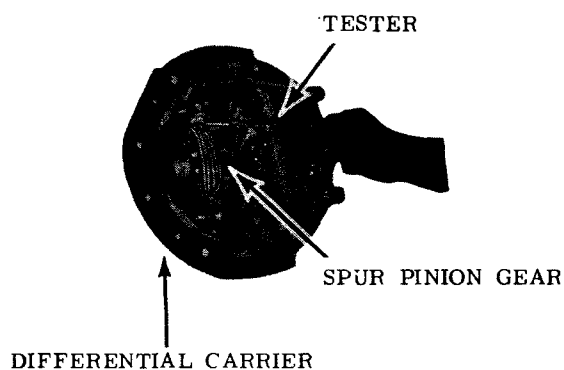


Figure 43 Checking spur pinion gear bearing preload.

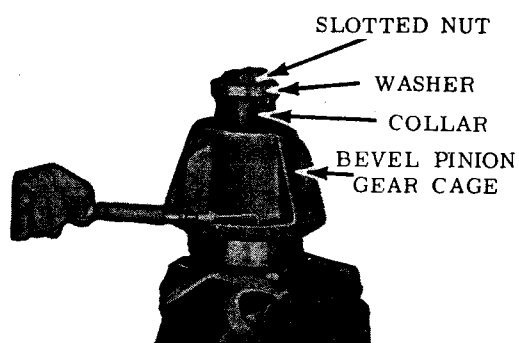


Figure 44. Checking bevel pinion gear bearing preload.

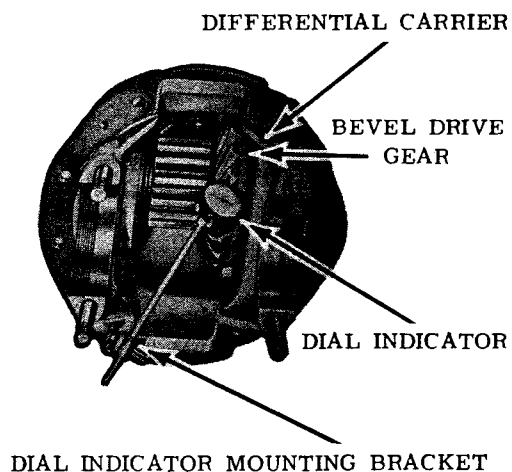


Figure 45. Checking bevel gear backlash.

# NAPCO 11,000-LB. AXLE MAINTENANCE INSTRUCTIONS

# DOUBLE REDUCTION BANJO-TYPE FRONT AXLE

- 1-SPUR PINION BEARING CAGE COVER
- 2-BEVEL PINION BEARING CAGE
- 3-BEVEL PINION
- 4-BEVEL GEAR
- 5-SPUR PINION BEARING CAGE

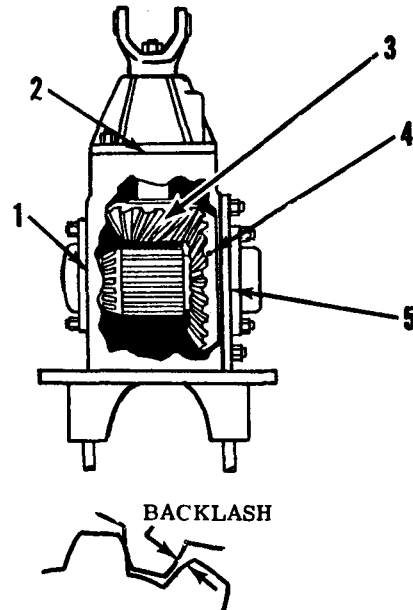
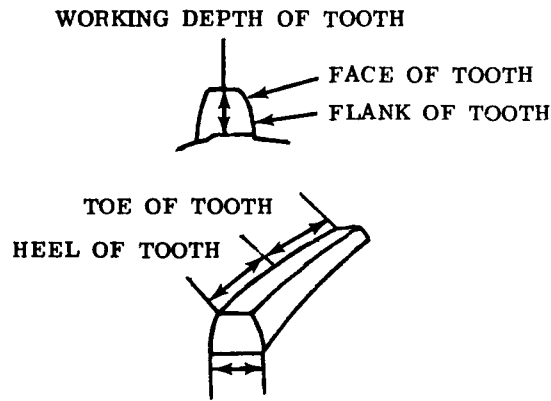
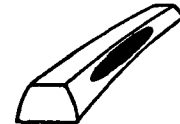


Figure 46. Inspection and adjustment of bevel gears.

ALL REFERENCES REFER TO FIG. 46A

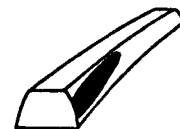
## A-CORRECT TOOTH CONTACT

Shows approximately 80% gear contact and centered on bevel gear.



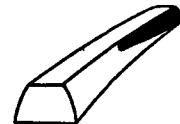
## B-SHORT HEEL CONTACT

Chipping, excessive wear and noise will result-correction-Remove shims at (5) add equal thickness of shims to (1) to maintain bearing pre-load. Add shims to (2) to maintain 0.006 to 0.012 inch backlash. NOTE: Several adjustments of both the bevel pinion and the bevel gear may be necessary before correct contact and backlash are established.



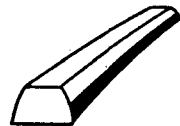
## C-SHORT TOE CONTACT

Chipping, excessive wear, and noise will result-correction- Add shims at (5) remove an equal thickness of shims to (1) that was removed from (5) to move bevel gear away from pinion and maintain bearing pre-load. Remove sufficient shims from (2) to maintain backlash of 0.006 to 0.012 inch.



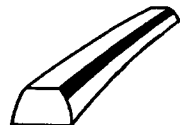
## D-LOW NARROW TOOTH CONTACT

Galling, grooving of teeth and noise will result- correction- Add shims at (2) to move bevel pinion outward. Add shims to (1) and remove an equal thickness of shims from (5) that were added to (1) to maintain correct bearing pre-load and also move bevel gear toward bevel pinion to establish 0.006 to 0.012 inch backlash.



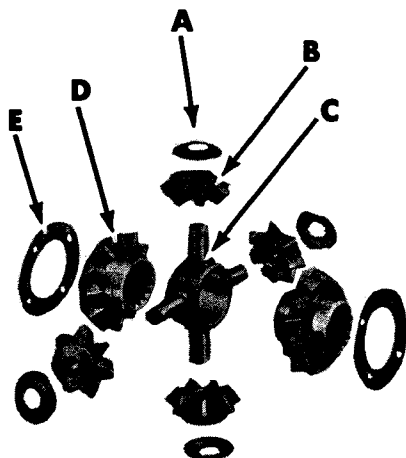
## E-HIGH NARROW TOOTH CONTACT

Noise, galling and rolling over top edge of gears will result-correction- Remove shims at (2) to move bevel pinion inward. Remove shims at (1) and add equal thickness of shims to (5) to maintain bearing pre-load and also move bevel gear away from bevel pinion to maintain 0.006 to 0.012 inch backlash.



NAPCO 11,000-LB. AXLE  
MAINTENANCE INSTRUCTIONS

DOUBLE REDUCTION  
BANJO-TYPE FRONT AXLE



A-SPIDER GEAR THRUST WASHER  
B-SPIDER GEAR  
C-SPIDER  
D-DIFFERENTIAL SIDE GEAR  
E-DIFFERENTIAL SIDE GEAR THRUST WASHER

Figure 47. Spider gears and differential gears

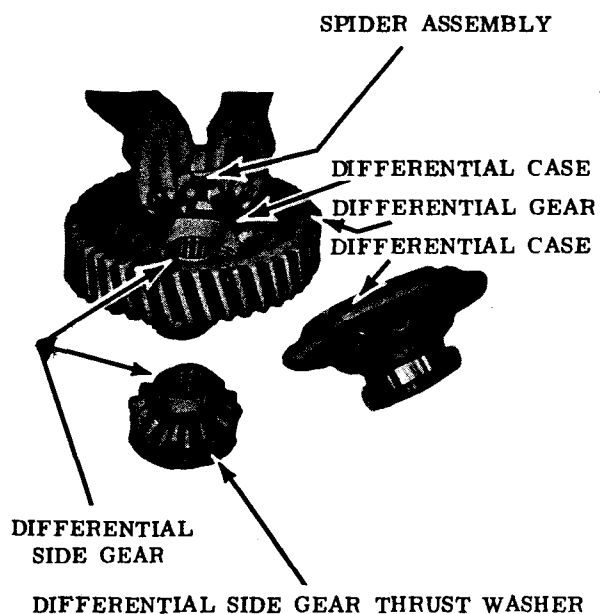


Figure 48. Installing spider assembly.

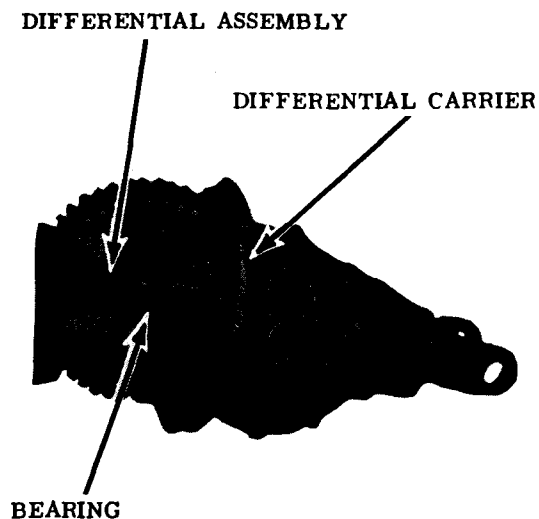


Figure 49. Installing differential in carrier.

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Section V  
NAPCO TWO TON AXLE CARRIER  
ASSEMBLY AND ADJUSTMENT PROCEDURE  
(SINGLE REDUCTION, BANJO-TYPE FRONT AXLE)

PINION ASSEMBLY

1. Soak a new oil seal in engine oil. Press oil seal into retainer with seal lip toward pinion bearing.
2. Install double row front pinion bearing assembly onto pinion shaft, using a piece of 2 inch pipe to press against inner race, until the collar on inner race seats against the pinion head.
3. Press rear pinion bearing on the pinion shaft until chamfered side of inner race seats against shoulder on pinion shaft.
4. Install rear pinion bearing and lock ring.
5. Slide oil seal retainer on pinion shaft, then tap flange yoke onto pinion splines.
6. Clamp flange yoke in benchvise and install washer and nut. Torque nut to 160 to 280 ft. lbs. and install cotter pin.
7. Lubricate pinion bearings with engine oil.

DIFFERENTIAL CARRIER ASSEMBLY

1. Mount carrier in bench vise.
2. Install pinion assembly in carrier using a new gasket under oil seal retainer. Torque bolts to 160 - 170 ft. lbs.
3. Lower differential assembly into carrier and install side bearing cups and adjusting nuts.
4. Install differential bearing caps, making sure the marks on the caps line up with marks on the carrier.
5. Install bearing cap bolts and lockwashers and tighten until lockwashers just flatten out.
6. To adjust ring gear and pinion backlash, loosen differential bearing cap bolts enough to permit turning bearing adjusting nuts. Remove all lash between ring gear and pinion.

DIFFERENTIAL CARRIER ASSEMBLY (Continued)

7. Back off left-hand adjusting nut one or two notches to a locking position.
8. Tighten right-hand adjusting nut firmly to force differential in solid contact with left-hand adjusting nut.
9. Back off right-hand adjusting nut until free of bearing, then re-tighten snugly against bearing.
10. Tighten right-hand nut from one to two additional notches to a locking position.
11. Mount a dial indicator on the carrier and check the backlash between ring gear and pinion. Backlash should be from .003" to .010". If backlash is more than .010", loosen right-hand adjusting nut one notch and tighten left-hand adjusting nut one notch. If backlash is less than .003", loosen left-hand adjusting nut one notch and tighten right-hand nut one notch. (See Figure 9).
12. Tighten bearing cap bolts to 190 - 220 ft. lbs. Recheck backlash and install both adjusting nut locks and torque to 11 - 18 ft. lbs.

CHECKING PINION DEPTH

1. Coat the ring gear teeth lightly with red lead or prussian blue. Then turn the pinion shaft several revolutions in both directions.
2. Examine the pattern on the ring gear teeth. If the pinion depth is correct, the tooth pattern will be centered on the pitch line and toward the toe of the ring gear.
3. If the pattern is below the pitch line on the ring gear teeth, the pinion is too deep and it will be necessary to remove the pinion assembly and increase the shim thickness between the pinion bearing and the carrier.
4. If the pattern is above the pitch line on the ring gear teeth, the pinion is too shallow and it will be necessary to remove the pinion assembly and decrease the shim thickness between the pinion bearing and the carrier.
5. Changing the pinion depth will make some change in the backlash; therefore, it will be necessary to readjust the backlash.

### RING GEAR THRUST PAD ADJUSTMENT

1. Inspect bronze tip of thrust pad and, if worn, install a new one.
2. Install thrust pad and tighten screw until bronze tip engages back face of ring gear while rotating gear.
3. Back off screw one-twelfth ( $1/12$ ), turn and tighten lock nut to 125 - 140 ft. lbs. Make sure screw does not turn during locking process. This adjustment provides .005" to .007" clearance between thrust pad and ring gear face.

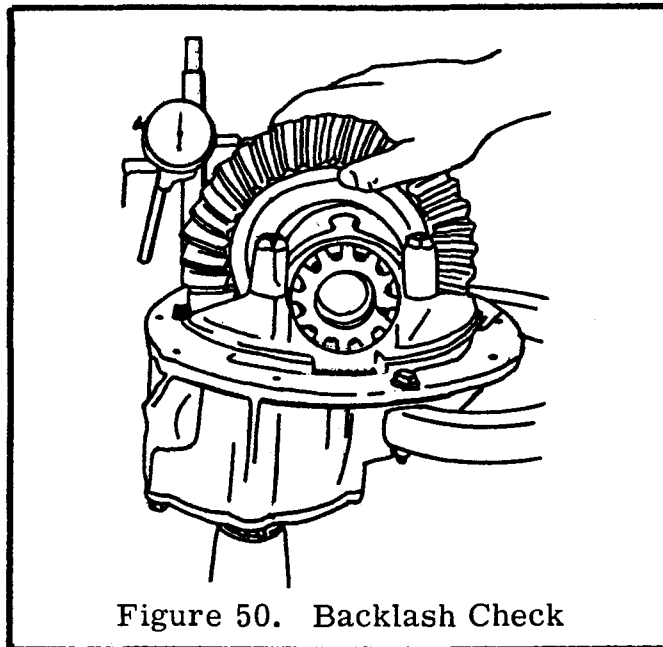


Figure 50. Backlash Check

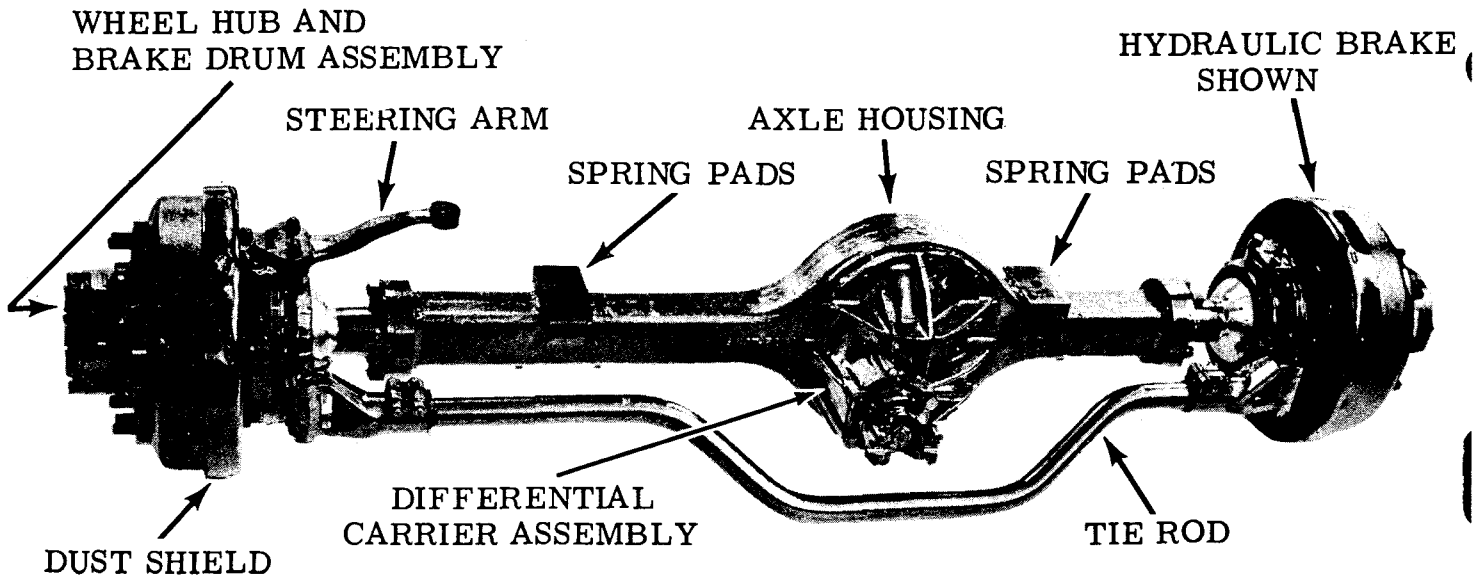


Figure 51. Single Reduction Banjo-Type Front Axle.



## Section VI

### SERVICE INSTRUCTIONS

#### T-223 TRANSFER CASE POWER TAKE-OFF ASSEMBLY (TIMKEN MODEL)

##### TO PUT POWER TAKE OFF ASSEMBLY ON UNIT NOT SO EQUIPPED

Remove Cage, Input Shaft Rear Bearing #4-20

If bearing 7307 stays in cover, it should be removed and driven back on shaft.

Put clutch #75-11 over bearing and into place, using original gasket. Put sliding clutch #75-9 onto shaft and secure in place with washer, lockwasher and capscrew.

Check with feeler gage between gasket and bearing adapter to see if there is any gap. If the adapter is snugged reasonably tight into place, shims will have to be added to allow input shaft to rotate freely, at opposite end cover.

Next assemble P.T.O. in place on to adapter and tighten up.

Be sure to add 1/2 pint of oil in P.T.O. as instructed on attached card. This added oil is to assure immediate lubrication to P.T.O. until proper oil circulation is established.

NOTE: Spacing of holes is such that P.T.O. cannot be assembled in wrong location.

##### P.T.O. TEARDOWN

With P.T.O. off case remove drive yokes and outer bearing cover.

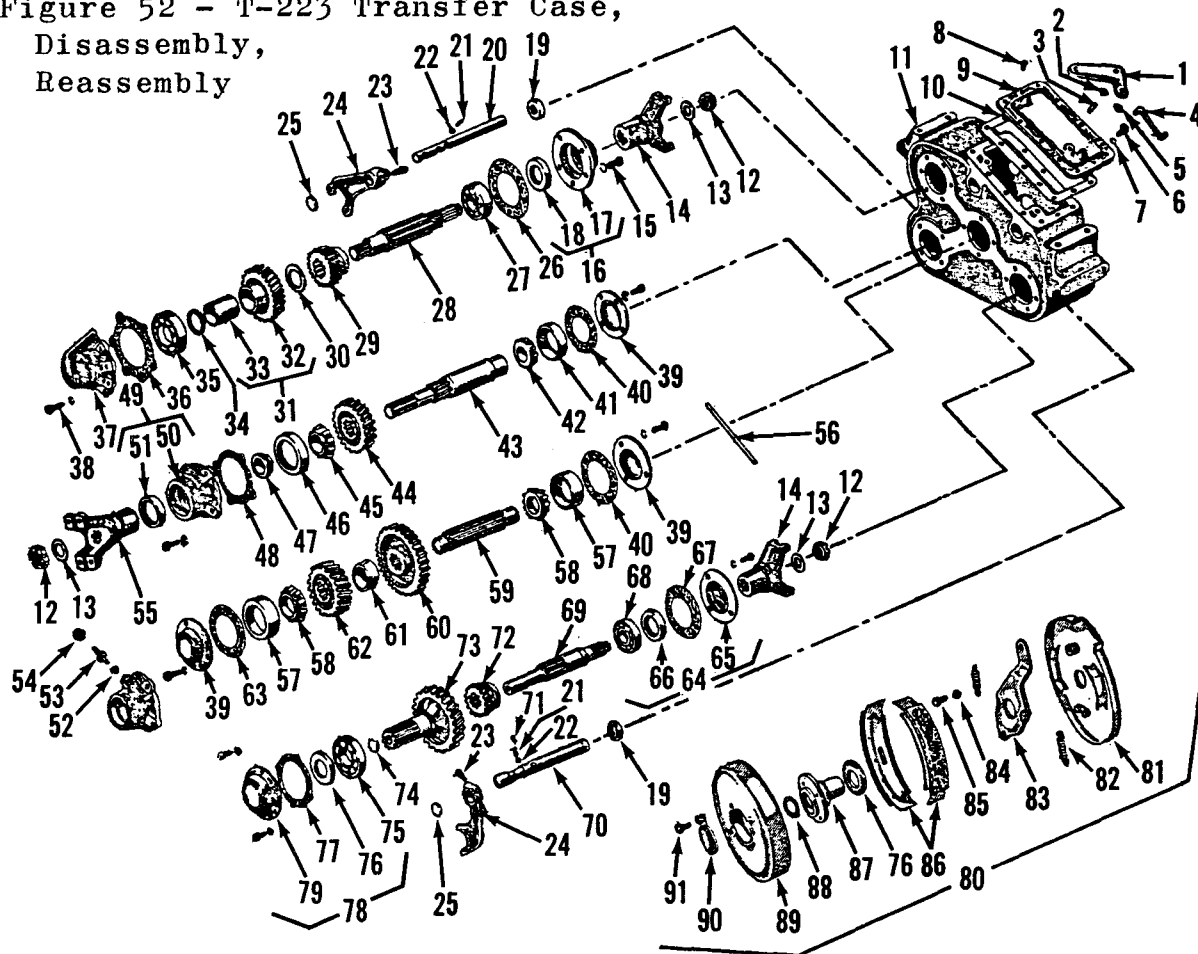
With soft hammer drive on inner end of shaft, driving shaft through sliding clutch collar and outer bearing cup out of housing. Remove keeper set screw in fork (through large pipe-tapped hole); remove shift rail and fork. Observe position of fork on rail so it can be properly reinstalled.

Inspect parts and replace where necessary. Reassemble in reverse order. Adjust bearings with shims under bearing retainer cover to get zero to .003 end play. Bearings should not be set up tight.

NAPCO 11,000-LB. AXLE  
MAINTENANCE INSTRUCTIONS

T-223 C-1, C-2  
T-223-C-3, C-4  
TRANSFER CASE ASSEMBLY

Figure 52 - T-223 Transfer Case,  
Disassembly,  
Reassembly



T-223 C-1, C-2  
T-223-C-3, C-4  
TRANSFER CASE ASSEMBLY

- |                          |                                |                             |                                  |
|--------------------------|--------------------------------|-----------------------------|----------------------------------|
| 1. Bellcrank             | 24. Shift Fork                 | 46. Rear Bearing Cup        | 69. Front Output Shaft           |
| 2. Washer                | 25. Expansion Plug             | 47. Speedometer Drive Gear  | 70. Declutch Shift Shaft         |
| 3. Pin                   | 26. Shim                       | 48. Gasket                  | 71. Inner Lock Spring            |
| 4. Brake Link            | 27. Front Bearing              | 49. Bearing Cap Assembly    | 72. Sliding Clutch               |
| 5. Washer                | 28. Input Shaft                | 50. Bearing Cap             | 73. Gear                         |
| 6. Capscrew              | 29. Low Sliding Gear           | 51. Oil Seal                | 74. Plug                         |
| 7. Lockwasher            | 30. Washer                     | 52. Bushing                 | 75. Bearing                      |
| 8. Oil Breather          | 31. Direct Drive Gear Assembly | 53. Speedometer Driven Gear | 76. Oil Seal                     |
| 9. Cover                 | 32. Direct Drive Gear          | 54. Sleeve                  | 77. Gasket                       |
| 10. Cover Gasket         | 33. Bushing                    | 55. Yoke                    | 78. Bearing Cap Assembly         |
| 11. Transfer Case        | 34. Washer                     | 56. Interlock Pin           | 79. Bearing Cap                  |
| 12. Nut                  | 35. Rear Bearing               | 57. Bearing Cup             | 80. Parking Brake Assembly       |
| 13. Washer               | 36. Gasket                     | 58. Bearing Cone            | 81. Backing Plate                |
| 14. Yoke                 | 37. Bearing Cage               | 59. Idler Shaft             | 82. Return Spring                |
| 15. Capscrew             | 38. Capscrew                   | 60. Low Speed Gear          | 83. Operating Lever              |
| 16. Bearing Cap Assembly | 39. Bearing Cap                | 61. Spacer                  | 84. Lockwasher                   |
| 17. Bearing Cap          | 40. Shim                       | 62. Gear                    | 85. Capscrew                     |
| 18. Oil Seal             | 41. Front Bearing Cup          | 63. Gasket                  | 86. Brake Shoe & Lining Assembly |
| 19. Oil Seal             | 42. Front Bearing Cone         | 64. Bearing Cap Assembly    | 87. Hub                          |
| 20. Gear Shift Shaft     | 43. Rear Output Shaft          | 65. Bearing Cap             | 88. Snap Ring                    |
| 21. Lock Spring          | 44. Gear                       | 66. Oil Seal                | 89. Brake Drum                   |
| 22. Lock Ball            | 45. Rear Bearing Cone          | 67. Gasket                  | 90. Plug                         |
| 23. Lockscrew            |                                | 68. Bearing                 | 91. Capscrew                     |

## T-223 TRANSFER CASE MAINTENANCE

This section is concerned with procedures necessary to disassemble, inspect and reassemble the transfer case. There are two distinct types of transfer cases and are identified as either a single-stick or two-stick control transfer case.

### T-223 TRANSFER CASE REMOVAL

1. Disassemble U-bolts connecting propeller shafts to transfer case. Drop propeller shafts away from transfer case. NOTE: When parking brake is mounted on front axle output shaft, capscrews, lockwashers, and nuts are used in place of U-bolts to connect propeller shaft to flange.
2. Disconnect all control linkage and the speedometer cable from transfer case.
3. Position a jack under transfer case for support. Remove the transfer case mounting stud, nuts, cotter pins, and mounting rubbers.
4. Lower transfer case and remove from under truck.

### T-223 DISASSEMBLY (SEE FIG. 1.)

1. Remove drain plug in bottom of transfer case to drain oil.
2. Remove cotter pins, nuts and washers from input and output shafts.
3. Pull end yokes (14) (55) from input and output shafts. Remove snap ring (88) located inside brake hub (87) of parking brake. Remove drum (89) and hub (87).
4. Disassemble parking brake actuating lever (4) and bellcrank (1). Remove capscrews (6) and lockwashers (7), then remove cover (9), gasket (10), detent springs (21) and ball (22) from transfer case.
5. Loosen rear output shaft shift fork screw (23) and withdraw shift rod (20) and fork (24). Follow same procedure on front output shaft shift fork rod (70).
6. Input Shaft (Items 15 through 18 and 26 through 38, Fig. 52).
  - (a) Remove capscrews (15) (38) and lockwashers, then remove input shaft front (16) and rear (37) bearing caps and gaskets (26) (36). Wire gaskets to bearing caps when disassembled. NOTE: Rear bearing cap (37) must be pried away from case one inch, with puller screws, to clear bearing (35).
  - (b) Tap on rear of input shaft (28), using a brass drift and hammer, until shaft and front bearing (27) clear transfer case. NOTE: Washer (34) may drop into case following shaft removal. Press front bearing from shaft if repair is required.

7. Idler Shaft (Items 39, 40 and 57 through 63, Fig. 52.)

(a) Remove capscrews and lockwashers, then remove idler shaft front and rear bearing caps (39), shim (40) and gasket (63). Wire gaskets and shims to bearing caps when disassembled.

(b) Tap on rear of Idler shaft (59), using a brass drift and hammer, until shaft and front bearing cone (58) clear transfer case. Remove sliding gear (29) and direct drive gear (62) from transfer case.

8. Front Axle Output Shaft (Items 64 through 79, Fig. 52.)

(a) Remove capscrews and lockwashers, then remove front axle output shaft front (65) and rear (79) bearing caps and gaskets (67) (77). Wire gaskets to bearing caps when disassembled.

(b) Tap front of front axle output shaft (69), using a brass drift and hammer, until rear shaft plug (74) comes undamaged from helical gear (73). With plug removed, tap on rear of shaft (69) until shaft and front bearing (68) clear transfer case. Press front bearing (68) from shaft if repair is required.

(c) Drive helical gear (73) from rear bearing (75) mount, using a brass drift and hammer. Remove helical gear from case.

9. Rear Axle Output Shaft (Items 39 through 54, Fig. 52.)

(a) Remove capscrews and lockwashers, then remove rear output shaft front (39) and rear (50) bearing caps and gaskets (40) (48). Wire gaskets to bearing caps when disassembled.

(b) Tap on rear of rear output shaft (43), using a brass drift and hammer, until shaft and front bearing (42) clear transfer case. Press front bearing (42) from shaft if repair is required.

(c) Remove rear output shaft gear (44) from transfer case.

## CLEANING AND INSPECTION

1. Wash bearings thoroughly in a cleaning solvent. Dry bearings and eliminate dust by blowing with compressed air. Do not spin bearings with air blast.

2. Lubricate bearings with light engine oil. Check bearings for cracks, chips or other deformities which might exist. Replace if necessary.

3. Replace all oil seals.

4. Wash transfer case inside and out with a cleaning solvent. Dry case by blowing with compressed air.

5. Inspect case for cracks, burrs or any other deformities which might exist. Replace case if necessary or, if only burring is noticed, dress down with a fine cut file.

6. Inspect all gears for wear or damage and replace wherever necessary. Check sliding gears on shaft to be certain they slide smoothly.

7. Inspect needle bearings for wear or damage and replace where necessary.

TRANSFER CASE REASSEMBLY - T-223

1. Place helical gear (73) in case with splined end inserted through front output shaft rear hole. Press plug (74) into place in helical gear (73). Press bearing (75) over splined end until seated.
2. Press sliding gear (72) and front output shaft front bearing (68) over splined end of shaft (69). Insert shank end of shaft (69) through front face of transfer case into helical gear (73) and seat bearing (68).
3. Mount bearing cap (65), oil seal (66) and gasket (67) to front face of transfer case. Anchor cap using capscrews and lockwashers. Mount bearing cap (79), oil seal (76), and gasket (77) to rear face of transfer case. Anchor cap using capscrews and lockwashers. Test entire front output shaft assembly for free running action.
4. Start splined end of rear output shaft (43) through front of case. Slide gear (44) on shaft with helical teeth facing in same direction as helical gear (73). Insert shaft through rear of case.
5. Place film of heavy grease on inner surface of bearing cups (46) (41), then insert bearing cones (45) (42). Drive cone (42) and cup (41) bearing assembly on front end of shaft (43) until properly seated.
6. Mount bearing cap (39) and gasket (40) on front face of transfer case. Anchor securely, using capscrews and lockwashers.
7. Drive bearing cone (45) and cup (46) assembly on rear end of shaft (43) until properly seated. Mount bearing cap (50) and gasket (48) on face of transfer case. Anchor securely, using capscrews and lockwashers.
8. Install bushing (33) in hub of drive gear (32). Assemble sliding gear (29) inside drive gear (32) being certain washer (30) is placed between two gears.
9. Start splined end of input shaft (28) through front of case. Insert the shaft through sliding gear (29) and drive gear (32) assembly and out rear face of transfer case.
10. Slip thrust washer (34) over splined end of shaft and against hub of drive gear (32). Drive input shaft rear bearing (35) into place. Mount rear bearing cap (37) and gasket (36) on rear face of transfer case. Anchor securely, using capscrews and lockwashers, to insure proper seating of bearing (35).
11. Drive input shaft front bearing (27) on front of input shaft until properly seated. Mount front bearing cap (17) and gasket (26) on front face of transfer case. Anchor securely, using capscrews and lockwashers. Test entire input shaft assembly for free running action.
12. Insert idler shaft (59) through front face of transfer case. Slip straight toothed gear (60), spacer (61) and helical gear (62) on splined area of shaft (59).
13. Place a thin film of grease on inside surface of bearing cups (57), then assemble bearing cones (58). Drive rear bearing cup and cone assembly into rear case of transfer case. Insert idler shaft into rear bearing assembly, then seat bearing assembly.
14. Mount rear bearing cap (39) and gasket (63) to rear face of transfer case, using capscrews and lockwashers to anchor securely.

15. Drive front bearing cone and cup assembly into front face of transfer case until correctly seated. Mount front bearing cap (39) and shim (40) to front face of transfer case, using capscrews and lockwashers to anchor securely.

16. Insert rear axle shift rod (20) through front face of transfer case, being certain detent ball hole end enters first. When part way into case, slip shift fork (24) into position on shift rod and anchor by tightening screw securely. NOTE: Shift fork (24) must engage sliding gear (29).

17. Insert front axle shaft shift rod (70) through front of transfer case, being certain detent ball hole end enters case first. When part way into case, slip shift fork (24) into position on shift rod and anchor by tightening screw securely. NOTE: Shift fork (24) must engage sliding gear (72).

18. Press oil seals (19) into place being certain they are in no way damaged. Press expansion hole plugs (25) into place.

19. Drop detent balls (22) and springs (21) (71) into place. Install interlock rod (56) in cover. Mount cover (9) and gasket (10) and anchor securely using capscrews and lockwashers.

20. Assemble bellcrank (1) and link rod (4) to bellcrank pin (3).

21. Install yokes (14) (55) and anchor securely, using nuts (12), washers (13) and cotter pins. Slip parking brake drum (89) and hub (87) on shank end of front output shaft (69). Install snap ring (88) and seat correctly. Press plug (90) into place in brake drum hub.

## TRANSFER CASE INSTALLATION

1. Place transfer case on a jack, being certain the front output shaft and input shaft are facing forward, and raise into correct position on cross-member. Use mounting studs, rubbers, washers, nuts, and cotter pins to anchor securely.

2. Connect control linkage and speedometer cable to transfer case.

3. Connect all propeller shafts, using correct hardware to anchor securely.

## PARKING BRAKE

The T-223 model parking brake is mounted on a yoke splined to the rear face of the front output shaft and is actuated by linkage and a lever from the driver's seat.

The enclosed brake mechanism rarely requires servicing, but a brake may be dismantled for repairs without removing the whole transfer case. Disconnect all brake control linkage before attempting to separate the brake from the transfer case.

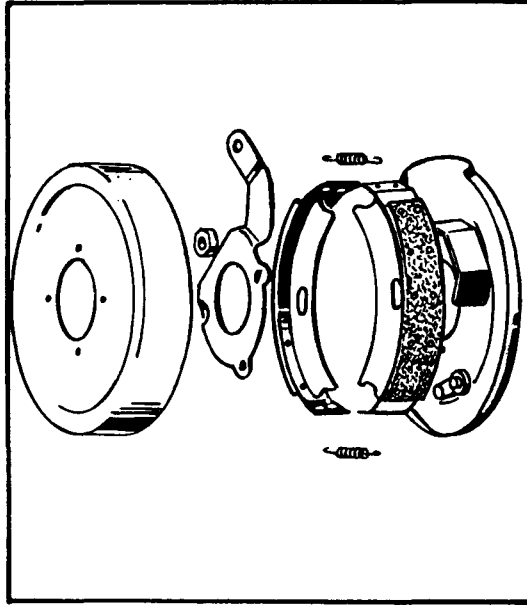


Fig. 53 Parking Brake

#### ADJUSTMENT

1. The brake is self adjusting and does not need attention for this reason.

#### SHOE REMOVAL

1. Remove the snap ring, then pull the brake drum and splined flange from the transfer case shaft.
2. Use brake spring pliers to remove brake shoe retracting springs.
3. Spread the brake shoes outward and remove from the backing plate.

#### LINING REPLACEMENT

Use the conventional brake relining equipment to dismount and replace riveted brake linings.

#### SHOE INSTALLATION

1. Mount brake shoes under the anchor brackets.
2. Assemble the retracting springs to the brake shoe ends.
3. Mount the flange and drum, then attach the snap ring.

T-223 TRANSFER CASE PARKING BRAKE

DISASSEMBLY

1. Remove snap ring on shaft and inside drum yoke.
2. Pull drum and yoke off shaft.
3. Remove brake shoe springs.
4. Put brake lever to greatest expanded position and lift out stationary shoe (that opposite lever).
5. Put lever in closest position and lift out other shoe.
6. Lift out lever. Note that end opposite lever or applying end is dropped onto pin in floating anchor.
7. Lift off roller from other floating anchor.
8. Make necessary corrections, put a slight smearing of lubriplate or other grease on abutment points and in bore of roller and reassemble.

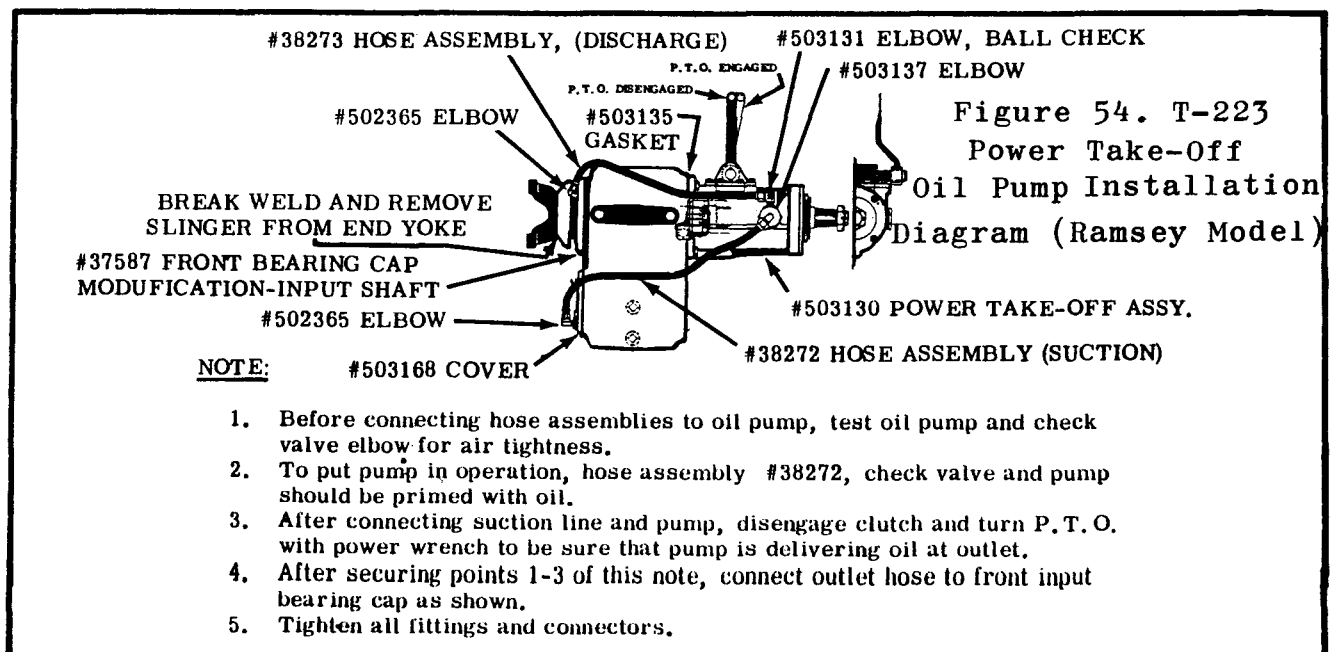
ASSEMBLY

1. Build up in a reverse of teardown..
2. If there is grease in brake, oil seal may have to be replaced.
3. Remove four (4) capscrews holding bakcing plate on bearing cover.
4. Remove capscrews holding bearing cover in place.
5. Remove and replace oil seal, and rebuild.
6. Note the "O" ring which acts as an oil retainer and which is in the end of the brake drum yoke. Some permatex applied to this when rebuilding is a good precaution.



INSTALLATION INSTRUCTIONS  
T-223 POWER TAKE OFF FOR T-223 TRANSFER CASE

1. **POWER TAKE OFF INSTALLATION:** Remove the cover plate from the back side of the transfer case. Install clutch on end of drive shaft in transfer case. Remove shims from cover and install on power take off so that same spacing is kept on bearings on drive shaft in transfer case. Attach power take off to transfer case and secure tightly.
2. **WIRE CONTROL INSTALLATION:** Power take off cover can be reversed to put shifter lever on either side extending up or down. Locate cable and knob on dash and run cable back under floor of cab to transfer case. Install cable bracket to transfer case in 5/8" tapped hole to rear of transfer case with 5/8" x 1" USS capscrew furnished. Screw cable eye about 3/4" back on armor and insert in bottom of bracket. Put four 1/4" washers on cable eye and secure with cotter pin. Cable eye should be free in bracket. Push cable knob all the way in. Pull shifter arm to rear of truck and PTO is in neutral. Install pivot pin through hole in shifter arm from back side. Insert cable wire and secure with set screw. Bend end of wire to prevent wire from coming out of pivot pin should set screw become loose. To engage PTO, it may be necessary to double clutch transmission to align jaws in PTO before they fully engage.
3. **LEVER CONTROL INSTALLATION:** Power take off cover can be reversed to put shifter lever on either side extending up or down. Mount lever securely in convenient location in cab and connect rod and clevises between PTO and lever. Check adjustment to be sure that PTO shifts properly. To engage PTO, it may be necessary to double clutch transmission to align jaws in PTO before they fully engage.
4. **PUMP INSTALLATION:** Hook up oil lines as per drawing below:



NAPCO 11,000-LB. AXLE  
MAINTENANCE INSTRUCTIONS

T-223 TRANSFER CASE POWER  
TAKE-OFF ASSEMBLY - TIMKEN MODEL  
WITH #37524 (EARLY MODEL) CHECK  
VALVE ASSEMBLY.

1. BEFORE CONNECTING HOSE ASSEMBLIES TO OIL PUMP, CHECK VALVE AND OIL PUMP MUST BE CHECKED FOR AIR TIGHTNESS.
2. TO PUT OIL PUMP IN OPERATING CONDITION CHECK VALVE, HOSE ASSEMBLY - #37585 (SUCTION) AND OIL PUMP MUST BE PRIMED WITH OIL.
3. AFTER CONNECTING SUCTION LINE AND PUMP, MOVE SHIFT LEVER TO "OFF" POSITION AND WHILE TURNING P. T. O. WITH POWER WRENCH, CHECK THAT PUMP IS DELIVERING OIL AT PUMP OUTLET.
4. AFTER SECURING POINTS 1-3 OF THIS NOTE, CONNECT HOSE ASSEMBLY - #37586 AS SHOWN.
5. TIGHTEN ALL FITTINGS AND CONNECTORS.

PUMP INSTALLATION: Hook Up Oil Lines As Per Drawing Below.

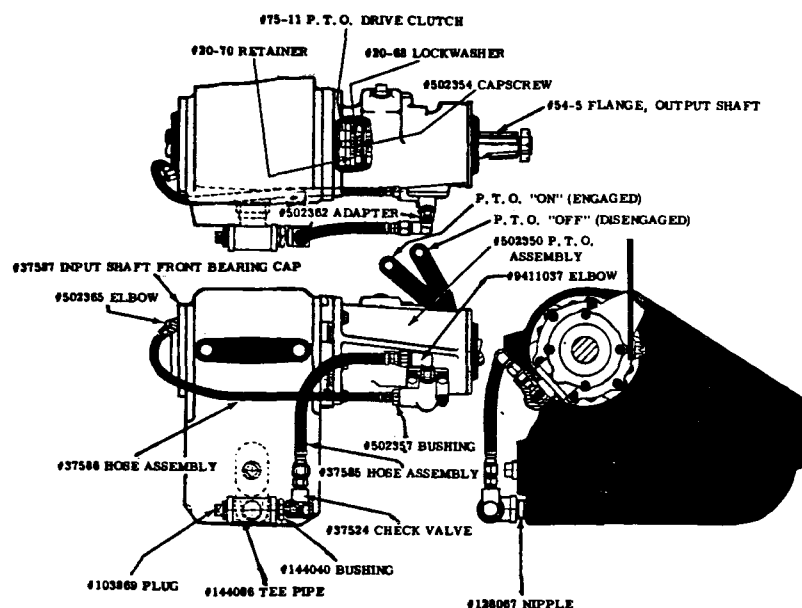


Figure 55. T-223 Power Take-Off Assembly Oil Pump  
Installation Diagram (Timken Model)W/#37524  
Earlier Model Used Check Valve Assembly.

NAPCO 11,000-LB. AXLE  
MAINTENANCE INSTRUCTIONS

T-223 POWER TAKE-OFF ASSEMBLY  
WITH #502863 (LATER MODEL) CHECK  
VALVE ASSEMBLY.  
(TIMKEN MODEL)

1. BEFORE CONNECTING HOSE ASSEMBLIES TO OIL PUMP, CHECK VALVE AND OIL PUMP MUST BE CHECKED FOR AIR TIGHTNESS.
2. TO PUT OIL PUMP IN OPERATING CONDITION CHECK VALVE, HOSE ASSEMBLY - #37964 (SUCTION), AND OIL PUMP MUST BE PRIMED WITH OIL.
3. AFTER CONNECTING SUCTION LINE AND PUMP MOVE SHIFT LEVER TO "OFF" POSITION AND WHILE TURNING P.T.O. WITH POWER WRENCH, CHECK THAT PUMP IS DELIVERING OIL AT PUMP OUTLET.
4. AFTER SECURING POINTS 1-3 OF THIS NOTE CONNECT HOSE ASSEMBLY - #37586 AS SHOWN.
5. TIGHTEN ALL FITTINGS AND CONNECTORS.

PUMP INSTALLATION: Hook Up Oil Lines As Per Drawing Below.

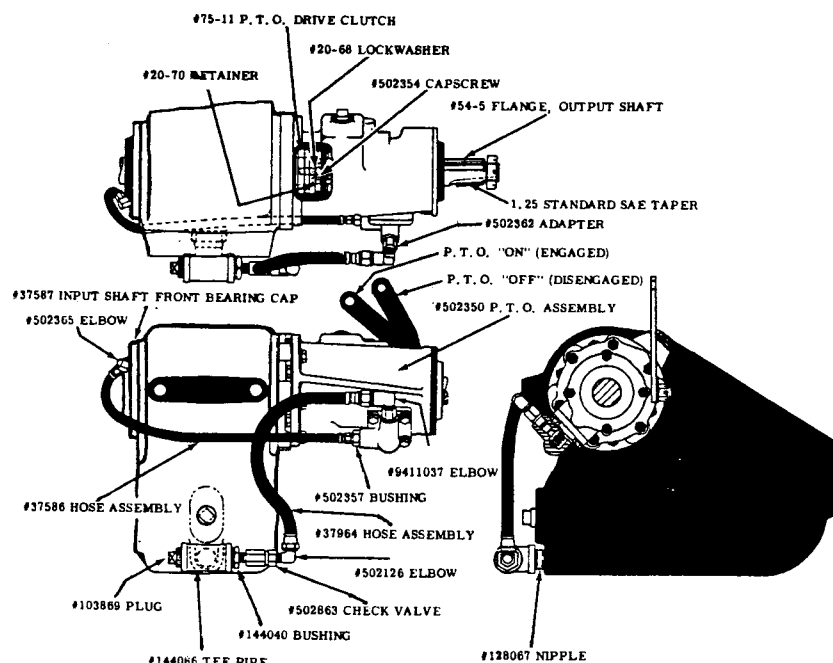


Figure 56. T-223 Power Take-Off Assembly Oil Pump  
Installation Diagram (Timken Model)W/#502863  
Later Model Used Check Valve Assembly.

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SECTION VII  
SERVICE INSTRUCTIONS  
FOR  
T-77 TRANSFER CASE ASSEMBLY  
WITH POWER TAKE-OFF

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Section 1. DESCRIPTION AND DATA

1. DESCRIPTION

a. Description. Model T-77 (Figs. 1, 2, and 3) is a typical two-speed transfer case. It has a Front Axle declutch unit. An optional power-take-off unit can be mounted to the rear of the main shaft. Other similar models may have different type gears and shafts. However, the rebuild operation is essentially the same for all T-77 models.

b. Operation. High and low range in the transfer, the front axle declutch unit, and the power-take-off are independently controlled by separate gear shift levers in the cab.

- (1) High range power flow (fig. 4). Shifting into high range moves the shifter fork toward the rear axle, causing the main shaft sliding gear to mesh with the internal splines on the main shaft driven gear. Through the idler gear, power is transmitted to the front axle driven shaft gear which actuates the front axle drive shaft.
- (2) Low range power flow (fig. 5). Shifting into low range moves the shifter fork toward the trans., causing the main shaft sliding gear to engage the idler shaft low speed gear. Through the idler gear, power is transmitted through the idler shaft gear to the front axle driven shaft gear which actuates the front axle drive shaft.

Note. The main shaft driven gear is mounted on bearings so it rotates freely on the main shaft when out of mesh with the main shaft sliding gear.

- (3) Neutral. Shifting into neutral moves the shifter fork to middle position, moving the main shaft sliding gear to a position between the idler gear and idler shaft low speed gear engaging neither of the gears. With the main shaft sliding gear in this position, no power is transmitted to the front axle drive shaft.
- (4) Front axle declutch.
  - (a) Front axle engaged. Moving the front axle declutch gear shift lever into engaged position moves the front axle declutch shifter fork (fig. 3) in the transfer backward toward the front axle driven shaft. This causes the declutch shaft sliding clutch to engage the front axle driven shaft driving clutch to actuate the declutch shaft and the front axle.
  - (b) Front axle disengaged. When the gear shift lever is moved into disengaged position, the front axle declutch shifter fork moves

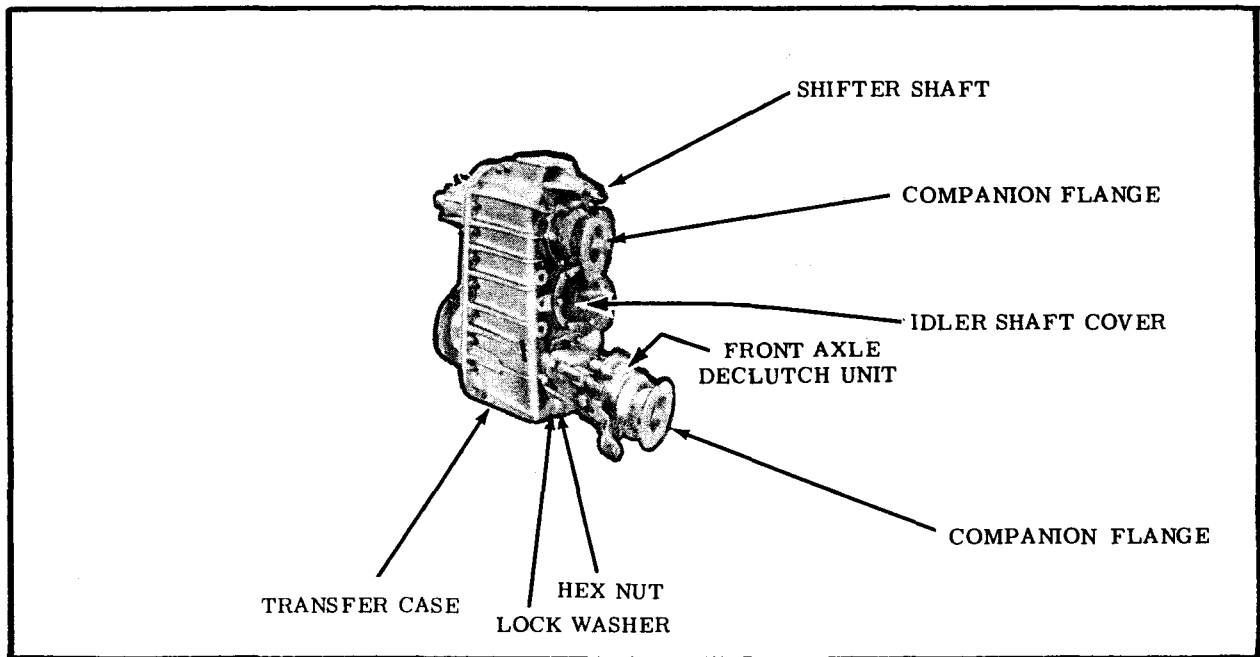


Figure 1. Transfer Case-Front View.

the declutch shaft sliding clutch forward disengaging it with the front axle driven shaft driving clutch. The declutch shaft then cannot transmit power to the front axle.

(5) Power-take-off.

- (a) Engaged. Moving the power-take-off gear shift lever into engaged position moves the power-take-off shifter fork (fig. 3) inward toward the main shaft. The power-take-off shaft sliding clutch then engages the main shaft driving clutch actuating the power-take-off shaft.
- (b) Disengaged. When the power-take-off gear shift lever is moved into disengaged position, the power-take-off shifter fork disengages the power-take-off sliding clutch from the main shaft driving clutch. The power-take-off shaft then cannot transmit power.

2. DATA

Type-----Two-speed with power-take-off and front axle drive.

Manufacturer-----Timken-Detroit.

Model-----T-77

Gear Ratios:

High range 1.00-1

Low range 2.55-1

Section II. DISASSEMBLY OF TRANSFER

3. CLEANING AND DRAINING

a. Cleaning. Before the transfer is disassembled, it must be thoroughly cleaned.

b. Draining. Remove drain plug and allow lubricant to drain from transfer.

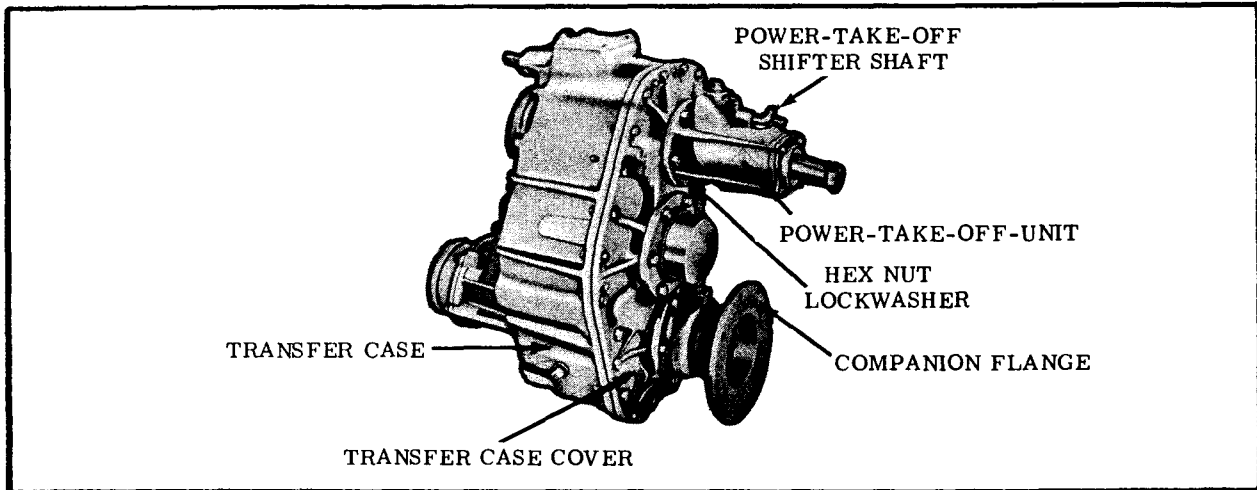


Figure 2. Transfer Case-Rear View.

#### 4. REMOVAL OF ACCESSORIES

a. Remove Power-Take-Off Unit. Remove the nuts and lock washers that secure the power take-off unit (fig. 2) to the transfer case cover. Lift the power-take-off unit, gasket, and shims from the transfer case cover. Tie the shims to the power-take-off unit to facilitate adjustment when assembling.

b. Remove Front Axle Declutch Unit. Remove the nuts and lock washers that secure the front axle declutch unit (fig. 1) to the transfer case. Remove the front axle declutch unit and gasket.

c. Remove Companion Flanges.

- (1) Remove the cotter pin and slotted nut that secures the main shaft Companion Flange (fig. 6). Remove the Companion Flange.
- (2) In similar manner, remove the front axle drive shaft companion flange.

#### 5. DISASSEMBLY OF TRANSFER INTO SUBASSEMBLIES

a. Remove Shifter Shaft and Shifter Fork.

- (1) Remove the cap screws and lock washers that secure the shifter fork cover (AA, fig. 7) to the transfer case.

Caution: The shifter fork cover is spring-loaded. It must be held down while the cap screws are being removed. Remove the shifter fork cover, breather plate, and gasket from the transfer case (fig. 8). Lift the detent ball, detent plunger, and detent plunger spring from the transfer case.

Note. In some cases the transfer case will have to be tilted to remove the detent ball.

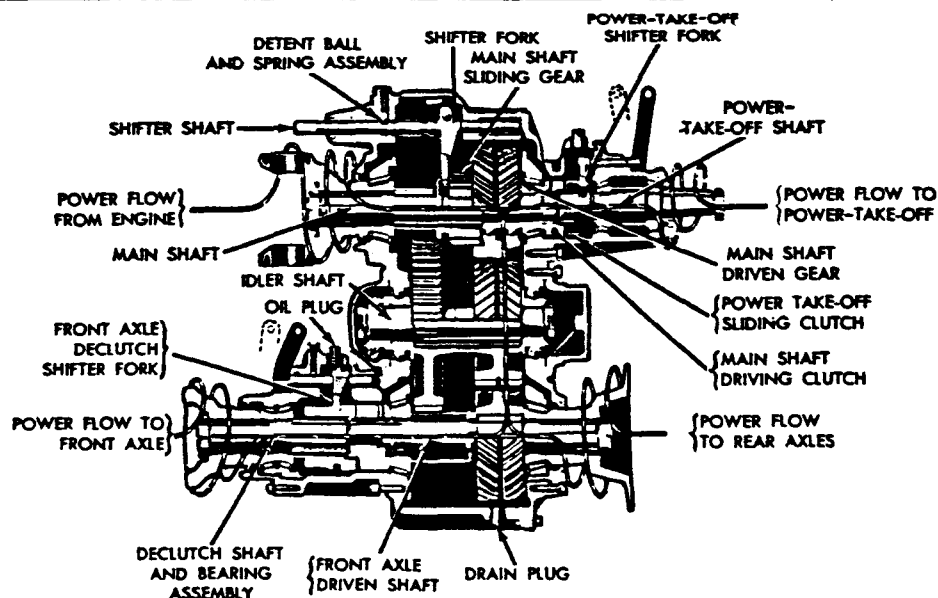


Figure 3. Transfer Case-Sectional View.

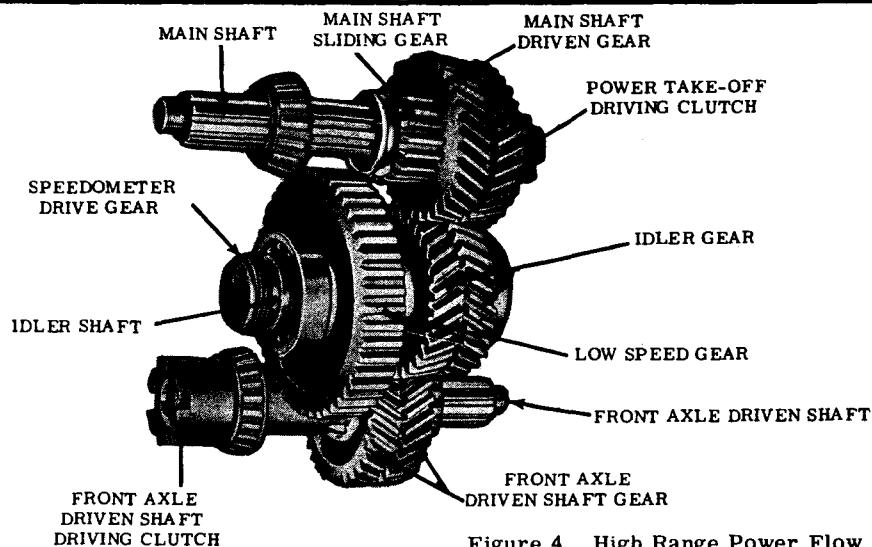


Figure 4. High Range Power Flow

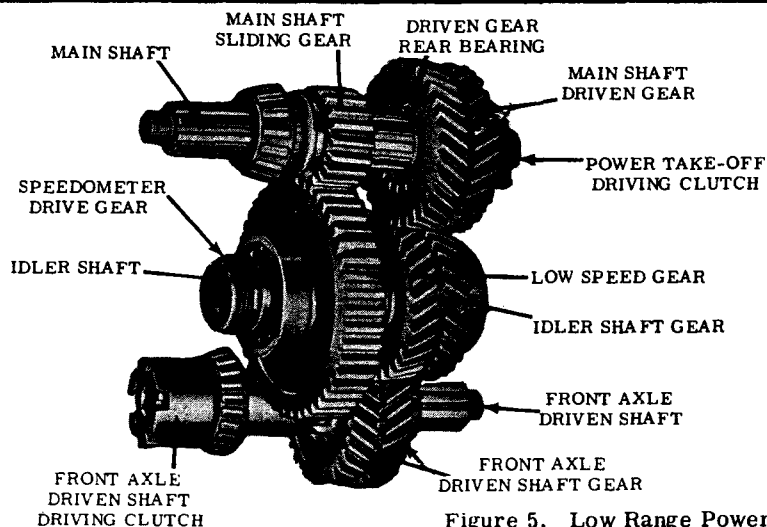


Figure 5. Low Range Power Flow.

- (2) Remove the cotter pin and loosen the slotted nut and bolt that secures the shifter fork to the shifter shaft (fig. 9). Screw the shifter shaft out of the shifter fork (fig. 10). Lift the shifter fork out of the transfer case and slide the shifter shaft from case.
- b. Remove Transfer Case Cover.
  - (1) Loosen the main shaft driving clutch set screw and remove the driving clutch. Remove the main shaft oil retaining ring.
  - (2) Drive the dowel pins (SS, fig. 7) from the transfer case cover (J, fig. 7).
  - (3) Remove the bolts (RR, fig. 7), nuts (PP, fig. 7), and lock washers (QQ, fig. 7) that attach the transfer case cover to the transfer case. Loosen the cover with pry bars (fig. 11). Lift the cover straight up from the case so it will not bind with any internal parts. Remove the transfer case cover gasket (fig. 12).
- c. Remove Main Shaft. Lift the main shaft assembly (fig. 13) from transfer case.

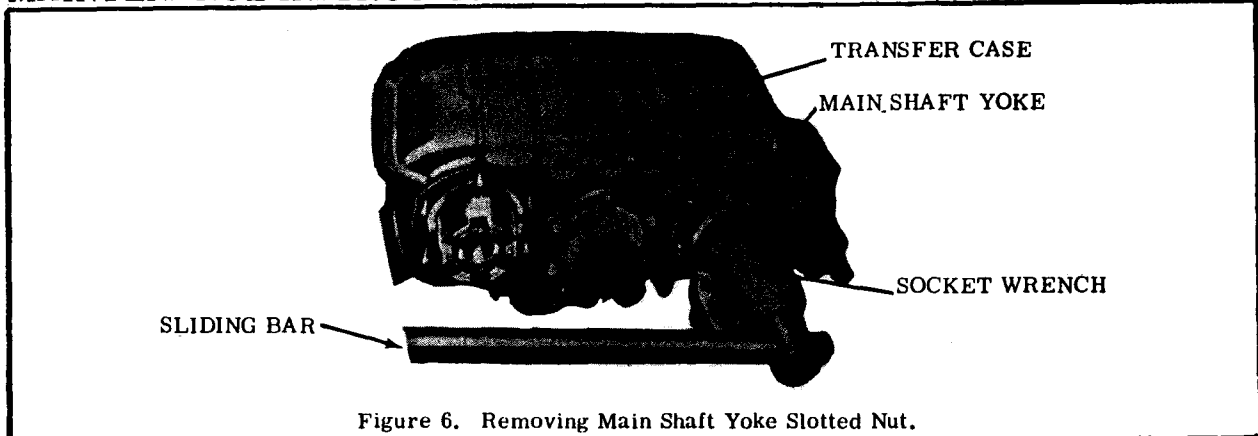
Note. Do not try to lift the idler or front axle drive shaft out of transfer case at this time.

- d. Remove Idler Shaft and Front Axle Drive Shaft.
  - (1) Remove the cap screws and lock washers that secure the idler shaft front bearing cap (Q, fig. 7) to the transfer case. Remove the idler shaft front bearing cap (fig. 14).
  - (2) Drive the idler shaft assembly from the front bearing bore of the transfer case.
  - (3) Lift the front axle drive shaft assembly from the transfer case (fig. 15). Then remove the idler shaft assembly.

## 6. DISASSEMBLY OF ACCESSORIES

- a. Disassembly of Power-Take-Off Unit Assembly (fig. 16).
  - (1) Remove the cotter pin and slotted nut from the end of the power-take-off shaft.
  - (2) Remove the key (H) from shaft (J).
  - (3) Remove the oil filler plug (R) from the cage (N).
  - (4) Remove cap screw (S) and lock washer (T). Remove the detent ball spring (U). Tilt the cage (N) to remove the detent ball (V).
  - (5) Remove the cap screws (A) and lock washers (B) that secure the bearing cap (D) to the cage (N). Remove the cap and the bearing cap gasket (E).
  - (6) Working through the oil filler plug opening in the cage with a screw driver, loosen the shifter fork set screw (Z). Pull the shifter shaft (DD) out of the cage.
  - (7) Carefully drive the shaft assembly out of the cage (fig. 17). Lift the shifter fork (CC) from the cage.
  - (8) Do not disassemble any further until inspection has been performed. Further disassembly will be described during the repair operation (par 10).





- b. Disassembly of Front Axle Declutch Unit. Refer to chapter 13 for disassembly of the front axle declutch unit.

## 7. DISASSEMBLY OF SUBASSEMBLIES

- a. Disassembly of Transfer Case Cover (fig. 7).

- (1) Remove the cap screws (VV) and lock washers (UU) that secure the idler shaft rear bearing cap (G) to the transfer case cover (J). Remove the cap and the gasket.
- (2) Remove the nuts (B) and lock washers (A) that secure the front axle driven shaft rear bearing cage (D) to the transfer case cover. Using puller screws, remove the cage. Remove the shims (E). Tie the shims to bearing cage to facilitate adjustment when assembling.

Note. Do not disassemble the transfer case cover any further at this point. Further disassembly, if necessary, will be described during repair operation (par. 10).

- b. Disassembly of Shaft Assemblies.

Note. Unless inspection of the main shaft assembly, front axle driven shaft assembly, or idler shaft assembly reveals some defective parts, do not disassemble any of these units. Disassembly of these units, if necessary, will be described during repair operation (par. 10).

## Section III. CLEANING, INSPECTION, AND REPAIR

### 8. CLEANING

a. General. Any special cleaning instructions required for specific mechanisms or parts are contained in the pertinent section. General cleaning instructions are as follows:

- (1) Use volatile mineral spirits to clean or wash grease or oil from all parts of transfer.
- (2) A solution of one part grease-cleaning compound to four parts of volatile mineral spirits may be used for dissolving grease and oil from all parts except oil seals. After cleaning, use cold water to rinse off any solution which remains.

- (3) After the parts are cleaned, rinse and dry them thoroughly. Apply a light grade of oil to all polished metal surfaces to prevent rusting.
  - (4) Before installing new parts, remove any preservative materials such as rust preventive compound, protective grease, etc.; prepare parts as required (oil seals, etc.); and for those parts requiring lubrication such as bearings, etc.
- b. General Precautions in Cleaning.
- (1) Volatile mineral spirits are inflammable and should not be used near an open flame. Fire extinguishers should be available when the material is used. In addition it evaporates quickly and has a drying effect on the skin. If used without gloves, it may cause cracks in the skin, and, in the case of some individuals, a mild irritation or inflammation. Use only in well ventilated places.
  - (2) The use of Diesel fuel oil, gasoline, or benzine (benzol) for cleaning is prohibited.

## 9. INSPECTION

- a. Ball Bearings, Bearing Cones and Cups. Inspect all bearing cups for cracks, pits, excessive wear, scoring or damage. Replace any bearing cup (par. 10) if any of these conditions are present. Inspect ball bearings and bearing cones for missing balls or rollers, or for excessive wear, pits, scoring or damage. Revolve each ball bearing or bearing cone slowly: the balls or cones must turn freely and smoothly. Replace any ball bearing or bearing cone (par 10) that does not meet the above inspection.
- b. Bearing Caps, Bearing Cages, Front Axle Declutch Carrier, and Power-Take-Off Cage. Inspect the power-take-off cage, all bearing cups, and declutch carrier for scratches or cracks. Replace caps, cage, or carriers that are cracked or have machined surface with scratches not removable with a fine hone stone.
- c. Transfer Case and Transfer Case Cover. Carefully inspect the transfer case and transfer case cover for cracks or deep scratches on machined surfaces. Replace the case or cover if cracked or if the scratches cannot be removed with a fine stone. Inspect each threaded bolt hole and repair those (par 10) that have stripped or damaged threads or broken portion of bolt. Inspect oil filler plug and drain plug and replace if damaged.
- d. Gears. Inspect all gears for damage and wear. Replace any gear (par. 10) that has chipped, cracked, broken or worn teeth. Small nicks must be removed from gears with a fine stone.
- e. Oil Seals. Replace seals (par. 10) if the leather contact surface is damaged or not pliable or if leaks are detected.
- f. Shafts. Replace shafts if machined surfaces are scored or pitted. Replace shafts that have broken, damaged, worn or twisted splines. Slide the main shaft sliding gear forward and back on the shaft. If any interference or binding is noted, replace the shaft or gear (par. 10), whichever is at fault. Inspect threads on the shaft ends, and repair or replace shafts (par. 10) as necessary. Inspect the pilot bushing which is recessed in the front end of the front axle driven shaft. Replace if visibly worn (par. 10).

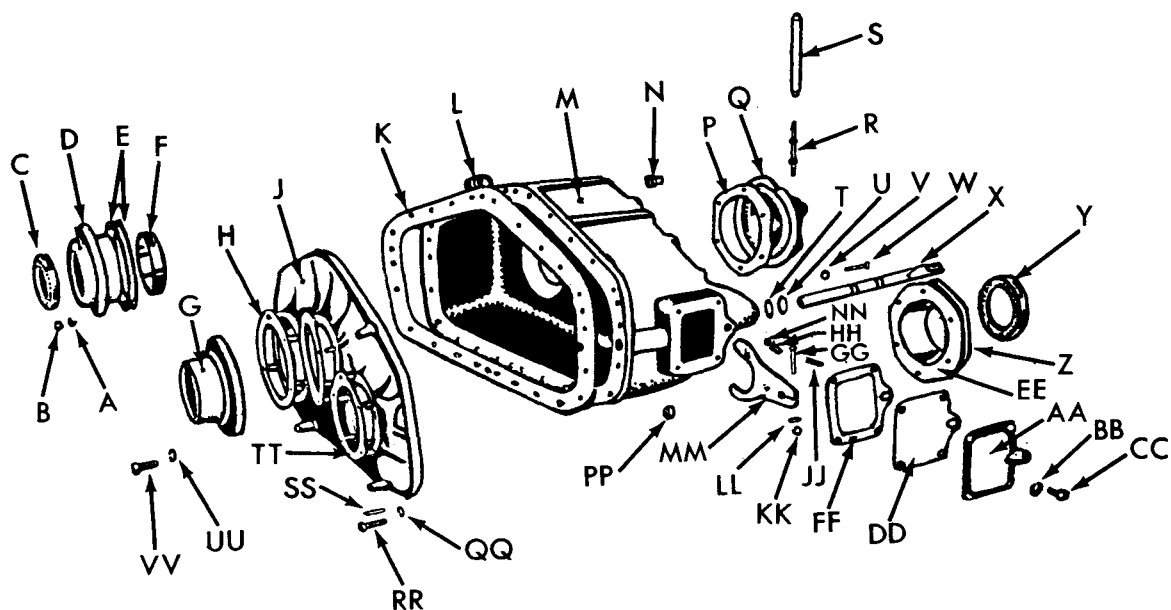


Figure 7. Transfer Case With Accessories Removed.

- |   |                                |
|---|--------------------------------|
| A—Lock washer                               | X—Shifter shaft                |
| B—Nut                                       | Y—Main shaft front oil seal    |
| C—Front axle driven shaft oil seal          | Z—Main shaft front bearing cap |
| D—Front axle driven shaft rear bearing cage | AA—Shifter fork cover          |
| E—Shims                                     | BB—Lock washer                 |
| F—Front axle driven shaft rear bearing cup  | CC—Cap screw                   |
| G—Idler shaft rear bearing cap              | DD—Breather plate              |
| H—Idler shaft rear bearing cap gasket       | EE—Gasket                      |
| J—Transfer case cover                       | FF—Shifter fork cover gasket   |
| K—Transfer case cover gasket                | GG—Bolt                        |
| L—Oil drain plug                            | HH—Detent plunger              |
| M—Transfer case                             | JJ—Detent plunger spring       |
| N—Oil filter plug                           | KK—Slotted nut                 |
| P—Idler shaft front bearing cap gasket      | LL—Lock washer                 |
| Q—Idler shaft front bearing cap             | MM—Shifter fork                |
| R—Speedometer driven gear                   | NN—Detent ball                 |
| S—Speedometer driven shaft extension sleeve | PP—Nut                         |
| T—Shifter shaft packing                     | QQ—Lock washer                 |
| U—Shifter shaft packing retainer            | RR—Bolt                        |
| V—Lock washer                               | SS—Dowel pin                   |
| W—Cap screw                                 | TT—Gasket                      |
|   | UU—Lock washer                 |
|   | VV—Cap screw                   |

# NAPCO 11,000-LB. AXLE MAINTENANCE INSTRUCTIONS

# T-77 TRANSFER CASE W/POWER TAKE-OFF

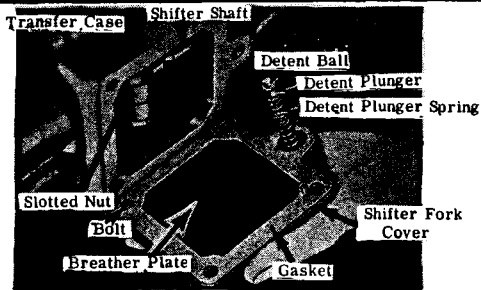


Figure 8. Removing Shifter Fork Cover

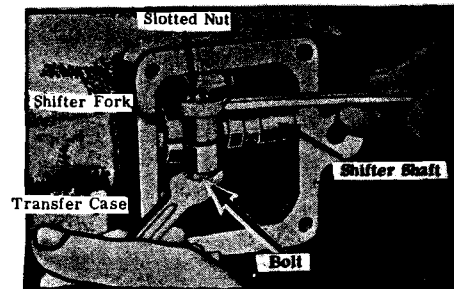


Figure 9. Loosening Shifter Fork Bolt

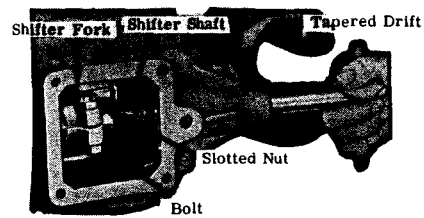


Figure 10. Removing Shifter Shaft

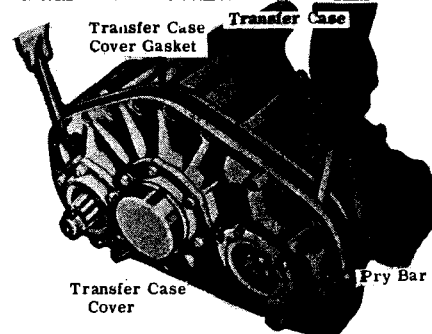


Figure 11. Removing Transfer Case Cover



Figure 12. Transfer Case With Cover Removed

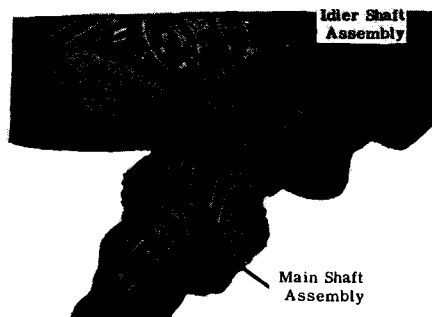


Figure 13. Removing Main Shaft Assembly

## 10. REPAIR

### a. Power-Take-Off (fig. 16)

- (1) If the bearing cup (F) required replacement, drive the old cup out of the bearing cap (D) using a brass drift and hammer. Press a new bearing cup into the cap until firmly sealed. The other bearing cup (L) was removed from cage (N) during disassembly (par. 6) and will be replaced during assembly (par. 11).
- (2) Remove defective bearing cones (G and K) from the shaft (J) with a suitable puller. Press new bearing cones onto the shaft, making sure all pressure is confined to inner race of bearing cone.
- (3) If the shaft oil seal (C) must be replaced, drive the old oil seal out of the bearing cap (D). Saturate the new oil seal with warm engine oil before installing. Press the new oil seal into the cap carefully to avoid damaging it.

b. Front Axle Declutch. Repair of the front axle declutch unit is described in chapter 13.

### c. Transfer Case Cover (fig. 7).

- (1) If the main shaft rear bearing cup is to be replaced press the cup out of the transfer case cover (J). Press the new cup into place in the cover.
- (2) Press a defective front axle driven shaft rear bearing cup (F) out of the front axle driven shaft rear bearing cage (D). Press a new cup into place in the cage.
- (3) If necessary, drive the front axle driven shaft oil seal (C) out of the front axle driven shaft rear bearing cage (D). Carefully press the new oil seal into the bearing cage.

### d. Transfer Case (fig. 7).

- (1) To remove a broken bolt, indent the broken end exactly in the center with a prick punch. With a small drill, drill into the broken bolt to a depth of about two-thirds of the remainder of the bolt. Follow up with a larger drill which will leave a wall thicker than the depth of the thread. Insert a screw extractor of proper size into the drilled hole and turn the broken bolt portion out of the threaded hole.
- (2) If the front axle driven shaft front bearing cup requires replacement, press the bearing cup out of the transfer case (M). Press a new bearing cup into the bore in the front of the transfer case.
- (3) If the main shaft front bearing cup in the front bearing cap (Z) needs replacement, carefully drive the old cup out of the cap. Carefully press the new bearing cup into the cap.
- (4) If the main shaft front oil seal (Y) in the main shaft front bearing cap (Z) is defective and has to be replaced, drive the old oil seal out of the cap. Saturate the new oil seal with warm engine oil before installing. Press the new oil seal into the cap carefully to avoid damaging it.
- (5) If the speedometer driven gear (R) in the idler shaft front bearing cap (Q) requires replacement, replace as follows:
  - (a) Screw the speedometer driven shaft extension sleeve (S) out of the idler shaft front bearing cap (Q). Then slide the speedometer

driven gear (R) out of the gear bearing (bushing type) and out of the idler shaft bearing cap.

- (b) Position the new speedometer driven gear in the idler shaft front bearing cap and screw the speedometer driven shaft extension sleeve into place.
- e. Main Shaft (fig. 18). Disassemble only as far as replacement of unserviceable parts requires. Use new parts wherever necessary (par. 9) when assembling.

- (1) Disassembly. Press main shaft front bearing cone (W) off the main shaft (V). Remove the main shaft sliding gear (L). Press the main shaft driven gear (K) main shaft driven gear front and rear bearings (G and J) and driven gear bearing spacer (H), main shaft rear bearing spacer (F) and main shaft rear bearing cone (E) from the shaft.
- (2) Assembly. Press driven gear rear bearing (J) into driven gear (K). Position driven gear bearing spacer (H) in driven gear. Press driven gear front bearing (G) into driven gear (K) until it seats against driven gear bearing spacer (H).

Caution: Make certain that all pressure is applied to outer race of bearings.

Press driven gear assembly onto main shaft (V) until the driven gear rear bearing (J) is seated against the shoulder of main shaft (V).

Caution: Make certain that all pressure is applied to inner race of driven gear rear bearing (G) while pressing driven gear onto shaft.

Slip rear bearing spacer (F) on main shaft (V); then press rear bearing cone (E) into place making certain that all pressure is applied to inner race of bearing cone.

- f. Idler Shaft (fig. 19). Disassemble only as far as replacement of unserviceable parts requires. Use new parts wherever necessary (par. 9).

- (1) Disassembly.
  - (a) Remove the locking wires (A and S), cap screws (B and R), and front and rear bearing retaining washers (C and Q) from each end of idler shaft (F). Remove the speedometer drive gear (P) and Woodruff key (G).
  - (b) Press low speed gear (K), speedometer drive gear spacer (N), front bearing (M), front bearing spacing washer (L) and gear spacer (J) from shaft.
  - (c) Press the idler gear (H), rear bearing spacing washer (E), and rear bearing (D) from the shaft.
- (2) Assembly.

- (a) Press low speed gear (K) into place on idler shaft (F). Position the front bearing spacing washer (L) on the shaft. Press front bearing (M) into place, then position Woodruff key (G) into the keyway on the idler shaft; then position speedometer drive gear spacer (N) on the shaft. Press speedometer drive gear (P) into place. Position front bearing retaining washer (Q) in place and secure with cap screws (R) and locking wire (S).
  - (b) Position the gear spacer (J) on the idler shaft; then press idler gear (H) on idler shaft (F). Install rear bearing spacing washer (E); then press rear bearing (D) into place on idler shaft. Position rear bearing retaining washer (C) and secure with cap screws (B) and locking wire (A).
- g. Front Axle Driven Shaft (fig. 20). Disassemble only as far as replacement of unserviceable parts requires. Use new parts whenever necessary (par. 9) when reassembling.
- (1) Disassembly. Press the rear bearing cone (B) and driven gear (C) off the front axle driven shaft (D). Remove the set screw (J) from the driving clutch (H). Press the front bearing cone (F) and the driving clutch (H) from the shaft. With a suitable puller remove the pilot bearing (E) from the bore in the front end of shaft.
  - (2) Assembly. Press the pilot bearing (E) into the bore at the front of the front axle driven shaft (D). Press the driven gear (C) and the rear bearing cone (B) into place on the shaft making sure all pressure is confined to the inner race of bearing cone. Press the front bearing cone (F) into place on the shaft making sure all pressure is confined to the inner race of bearing cone. Slide the driving clutch (H) onto the front of the shaft. Aline the set screw hole in the driving clutch with the shaft indentation, then install the set screw (J) to secure the driving clutch.

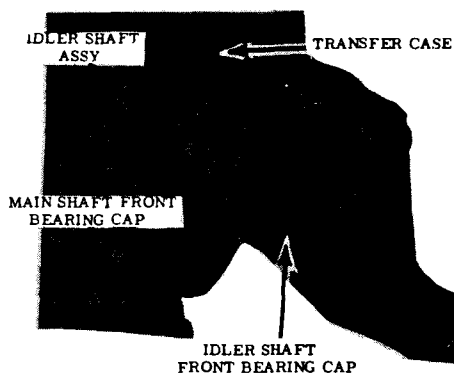


Figure 14.  
Removing Idler Shaft Front Bearing Cap.

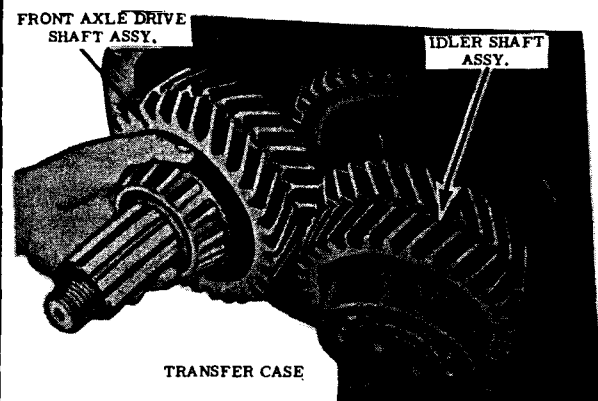
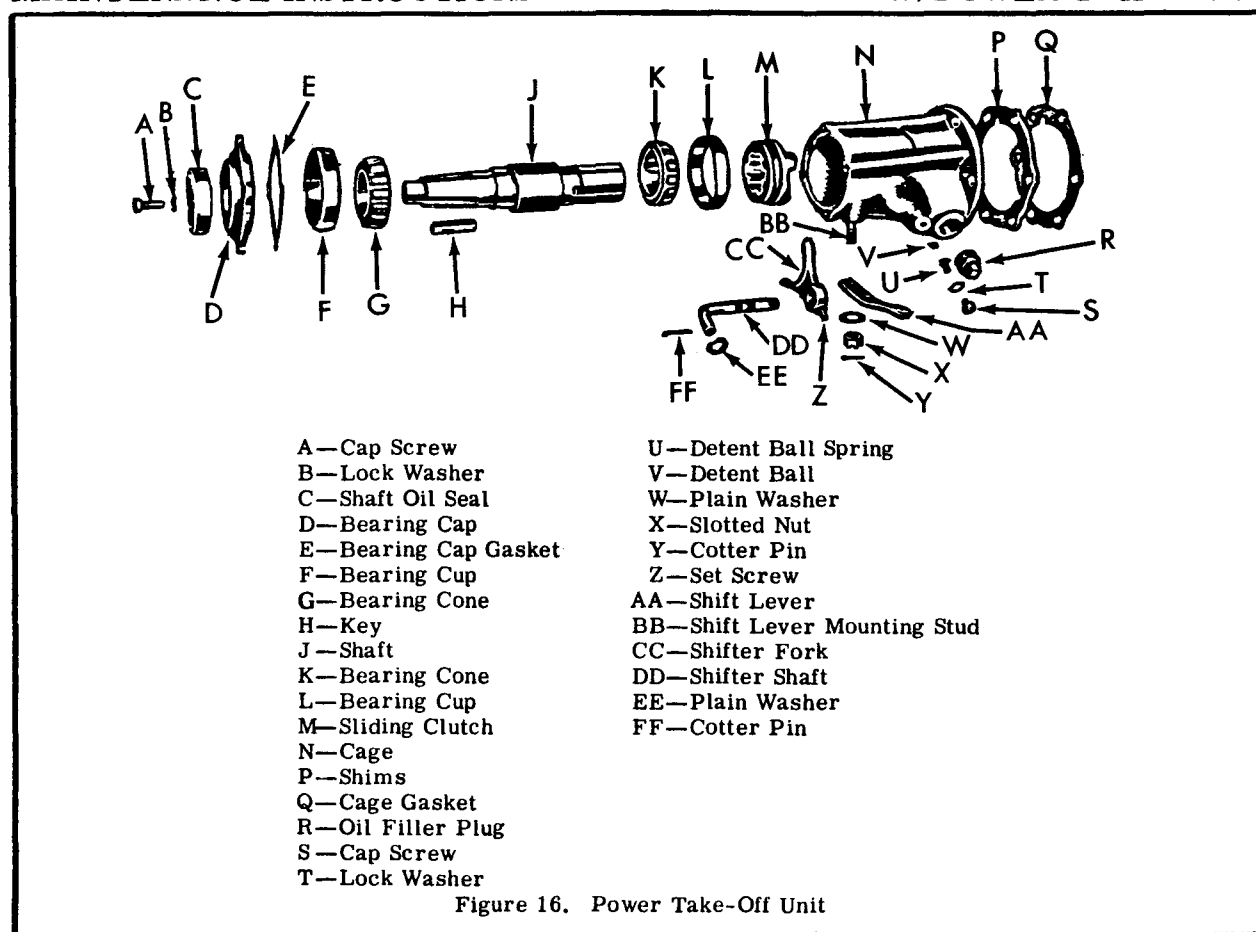


Figure 15.  
Removing Front Axle Drive Shaft Assembly



#### Section IV. ASSEMBLY OF TRANSFER

##### 11. ASSEMBLY AND INSTALLATION OF SUBASSEMBLIES

a. General. Satisfactory performance will depend to a large degree on attention to the following basic rules:

- (1) Keep all parts clean during assembly. Protect subassemblies from wind blown dust, since the slightest particles of dust and dirt are abrasive. Keep hands free of grease and wear no greasy clothing while assembling the transfer.
- (2) Apply engine oil to all gears, shafts and bearings prior to assembly. This will insure lubrication of moving parts for initial operation.
- (3) Secure all nuts and bolts with lock washers or cotter pins when called for.

b. Power-Take-Off Assembly (fig. 16).

- (1) Press the bearing cup (L) into the cage (N). The cup must seat firmly against the shoulder in the cage.
- (2) Turn the cage until the oil plug hole is facing down. Insert the shifter fork (CC) into the cage.
- (3) Slide the shaft (J) with bearing cones and shaft sliding clutch (M) into the cage. Turn the cage upward and make certain that the shifter fork (CC) engages the groove around the side of the sliding clutch (M).



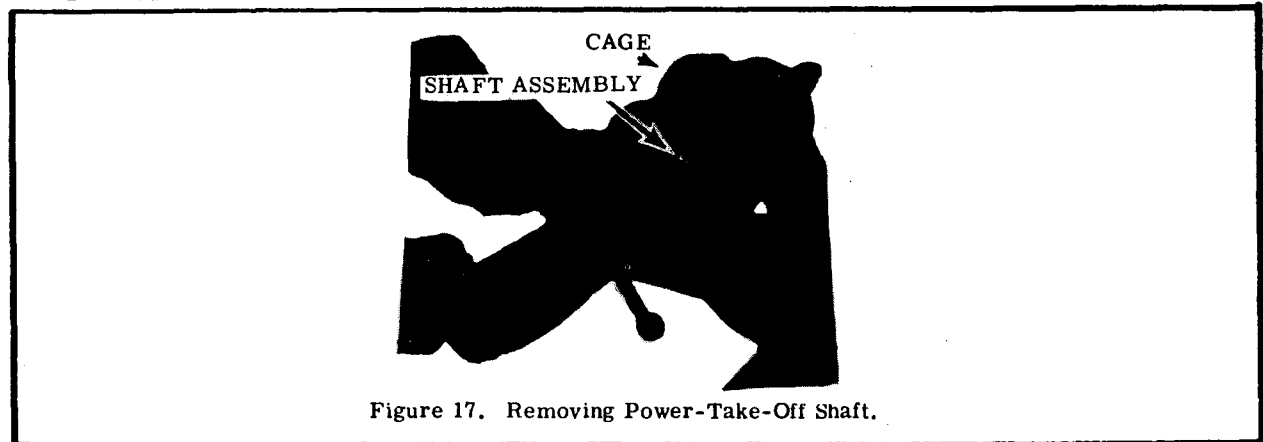
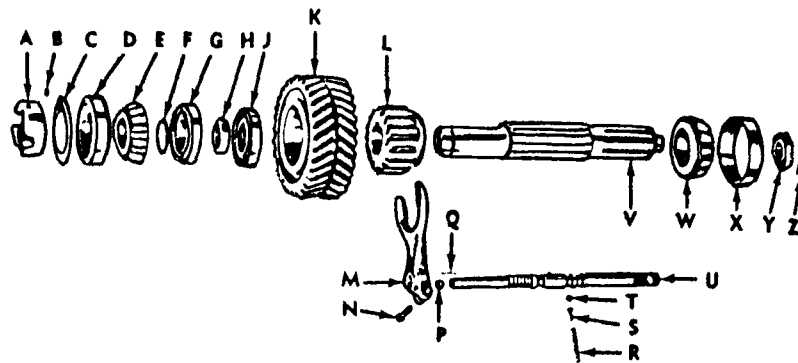


Figure 17. Removing Power-Take-Off Shaft.

- (4) Slide the shifter shaft (DD) into the cage (N) and through the shifter fork (CC). Aline the shaft so the depression in the shaft is directly under the set screw hole in the fork.
  - (5) Working through the oil plug opening in the cage with a screw driver, install and tighten the set screw (Z) to secure the shifter fork to the shifter shaft.
  - (6) Mount the bearing cap gasket (E) and bearing cap (D) on the cage (N). Secure with cap screws (A) and lock washers (B), tightening evenly and alternately to prevent distortion of the cap.
  - (7) Drop the detent ball (V) and detent ball spring (U) into place in the cage (N). Place the lock washer (T) on the cap screw (S), and install and tighten the screw in the cage.
  - (8) Install the oil filler plug (R).
  - (9) Tap the key (H) into position in the shaft (J).
  - (10) Install the universal joint yoke and slotted nut on the shaft. Secure the slotted nut with a cotter pin.
- c. Front Axle Declutch Assembly. See paragraph 15 for assembly of a similar front axle declutch.
- d. Main Shaft and Front Axle Driven Shaft Temporary Installation (fig. 7).
- (1) Position the front axle driven shaft assembly in the transfer case. Position the main shaft assembly in the transfer case.

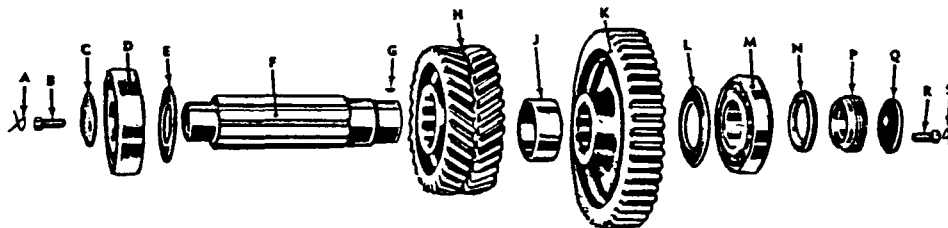
Note. Do not install the idler shaft assembly at this time.

- (2) Place a new transfer case cover gasket (K) on the transfer case (M); then position the transfer case cover (J) on the transfer case. Secure the cover to the case with cap screws (VV), lock washers (UU), and nuts (PP).
- (3) Position a new gasket and the front axle declutch unit on the transfer case. Secure with nuts and lock washers.
- (4) Position a new gasket (EE) and the main shaft front bearing cap (Z) on the transfer case. Secure with nuts and lock washers.
- (5) Position the original bearing adjusting shims (E) and the front axle driven shaft rear bearing cage (D) on the transfer case cover (J). Secure with lock washers (A) and nuts (B).



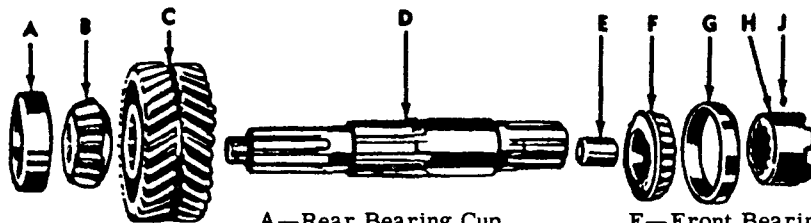
- |                              |                         |
|------------------------------|-------------------------|
| A—Main Shaft Driving Clutch  | N—Bolt                  |
| B—Set Screw                  | P—Slotted Nut           |
| C—Oil Slinger                | Q—Cotter Pin            |
| D—Rear Bearing Cup           | R—Detent Plunger Spring |
| E—Rear Bearing Cone          | S—Detent Plunger        |
| F—Rear Bearing Spacer        | T—Detent Ball           |
| G—Driven Gear Front Bearing  | U—Shifter Shaft         |
| H—Driven Gear Bearing Spacer | V—Main Shaft            |
| J—Driven Gear Rear Bearing   | W—Front Bearing Cone    |
| K—Driven Gear                | X—Front Bearing Cup     |
| L—Sliding Gear               | Y—Slotted Nut           |
| M—Shifter Fork               | Z—Cotter Pin            |

Figure 18. Main Shaft



- |                                 |                                  |
|---------------------------------|----------------------------------|
| A—Locking Wire                  | K—Low Speed Gear                 |
| B—Cap Screw                     | L—Front Bearing Spacing Washer   |
| C—Rear Bearing Retaining Washer | M—Front Bearing                  |
| D—Rear Bearing                  | N—Speedometer Drive Gear Spacer  |
| E—Rear Bearing Spacing Washer   | P—Speedometer Drive Gear         |
| F—Idler Shaft                   | Q—Front Bearing Retaining Washer |
| G—Woodruff Key                  | R—Cap Screw                      |
| H—Idler Gear                    | S—Locking Wire                   |
| J—Gear Spacer                   |                                  |

Figure 19. Idler Shaft



- |                           |                      |
|---------------------------|----------------------|
| A—Rear Bearing Cup        | F—Front Bearing Cone |
| B—Rear Bearing Cone       | G—Front Bearing Cup  |
| C—Driven Gear             | H—Driving Clutch     |
| D—Front Axle Driven Shaft | J—Set Screw          |
| E—Pilot Bearing           |                      |

Figure 20. Front Axle Driven Shaft

- (6) Position the power-take-off oil slinger on the rear of the main shaft. Carefully tap the power-take-off driving clutch on the main shaft and secure with set screw.
- (7) Position a new gasket, original shim pack, and the power-take-off unit on the transfer case cover. Secure with cap screws and lock washers.
- (8) Turn each shaft by hand. If bearings are properly adjusted, a slight drag will be evident. Remove shims if it is necessary to establish a slight drag. Add shims if it is necessary to reduce excessive drag or binding.
- (9) Carefully remove the power-take-off unit.  
Caution: The same power-take-off gasket and shims must be reused in final installation.
- (10) Remove the power-take-off shaft sliding clutch and oil slinger from the main shaft.
- (11) Carefully remove the transfer case cover from the transfer case.  
Caution: The same transfer case cover gasket must be reused in final installation.

e. Installation of Idler Shaft, Main Shaft, and Front Axle Driven Shaft Assemblies.

- (1) Remove the main shaft assembly from the transfer case.
- (2) Slide the front axle driven shaft assembly from the transfer case just enough to tilt it to one side. Carefully place the idler shaft assembly alongside of front axle driven shaft assembly. Carefully mesh the gear teeth of the two assemblies to avoid injury to any gear tooth.
- (3) Alternately tap the shafts until both are seated in the transfer case.
- (4) Carefully work the main shaft into place.
- (5) Replace the transfer case cover and the transfer case cover gasket used during temporary shaft installation (d-Chapter 11).
- (6) Install the power-take-off oil slinger and power-take-off driving clutch on the main shaft and secure with set screw.
- (7) Install the power-take-off, and same gasket and shims used during temporary shaft installation (d-Chapter 11).
- (8) Using new idler shaft front and rear bearing cap gaskets (H and P, fig. 7), position both the front and rear idler shaft bearing caps (H and Q) in place on transfer case and transfer case cover. Secure with cap screws and lock washers.

f. Installation of Shifter Shaft and Fork (fig. 7).

- (1) Position the shifter fork (MM) in the transfer case so that it engages the main shaft sliding gear.
- (2) Slide the shifter shaft (X) into the case and then screw it into the shifter fork (MM).
- (3) Tighten the bolt (GG) in the shifter fork and secure with lock washer (LL) and slotted nut (KK).

- (4) Position the detent ball in the transfer case. Place the detent plunger (HH) into the detent plunger spring (JJ) and insert them into the transfer case.
- (5) Position the shifter fork cover gasket (FF), breather plate (DD), and the shifter fork cover (AA) on the case. Press the cover down to compress the detent plunger spring. Secure the cover with lock washers (BB) and cap screws (CC), using care to hold the detent plunger spring down until the cover is secured.
- g. Install Companion Flanges on Drive Shafts.
  - (1) Press the flanges on the shafts and secure with slotted nut and cotter pin.

## 12. LUBRICATION AND OPERATION TEST

a. Lubricate. Install drain plug and tighten securely. Turn the transfer upright and pour in 1/2 pint of universal gear lubricant through filler plug opening. Add lubricant to the front axle declutch carrier and the power-take-off cage. Indicate this incomplete lubrication on a suitable tag and fasten tag to case. Complete lubrication of the transfer will be accomplished after its installation in the vehicle.

b. Transfer Shift Test (Power-Take-Off and Front Axle Declutch Disengaged).

- (1) High Range. Move the shifter shaft to the innermost position. Turn the main shaft and note that the axle drive shaft turns.
- (2) Low Range. Move the shifter shaft to the outermost position. Turn the main shaft and note that the axle drive shaft turns.
- (3) Neutral. Move the shifter shaft to the intermediate position between low (shifter shaft out) and high (shifter shaft in). Turn the main shaft and note that the axle drive shaft does not turn.

c. Power-Take-Off Shift Test.

- (1) Engaged. Move the shifter shaft to the inner position. The power-take-off shaft should revolve with the main shaft.
- (2) Disengaged. Move the shifter shaft to the outer position. The power-take-off shaft should not revolve with the main shaft.

d. Front Axle Declutch Test.

- (1) Engaged. Move the shifter shaft to the inner position. The declutch shaft should revolve with the axle drive shaft.
- (2) Disengaged. Move the shifter shaft to the outer position. The declutch shaft should not revolve with the axle drive shaft.

## 13. DISASSEMBLING FRONT AXLE DECLUTCH UNIT

a. Remove Universal Joint Yoke (fig. 21). Remove cotter pin (EE) from slotted nut (A). Remove slotted nut from front axle declutch shaft (K). Pull universal joint yoke (B) from front axle declutch shaft (K) with a suitable puller.

b. Remove Front Axle Declutch Bearing Cage Assembly (fig. 21). Re-

move nuts (DD) and lock washers (CC) that attach front axle declutch shaft bearing cage (F) to front axle declutch shaft bearing carrier (Z). Tap bearing cage (F) lightly with a soft hammer to loosen it from bearing carrier. Then carefully pry bearing cage from bearing carrier.

c. Remove Shifter Fork (fig. 21). Remove cotter pin (FF) and declutch lever pin (M). Remove locking wire from cap screw (T) and remove cap screw. Lift shifter shaft lever (L) from shifter shaft (N). Remove lock screw (X), lock washer (W), detent ball spring (V), and detent ball (U) from bearing carrier. Remove plug (Y) from bearing carrier. Remove set screw (P) that secures declutch shifter fork (Q) to declutch shifter shaft (N). Slip shifter shaft (N) from bearing carrier. Working through plug hole, lift shifter fork (Q) up then remove front axle declutch shaft sliding clutch (BB) and shaft from carrier. Remove shifter fork (Q) from carrier. Bearing cones and cups will be removed if necessary after inspection.

#### 14. INSPECTION

a. Front Axle Declutch Shaft Bearing Carrier Assembly. Replace a front axle declutch shaft bearing carrier if broken or cracked or if any of the tapped holes are damaged beyond repair. Replace a shifter fork if bent out of shape, worn, or damaged. Replace a shifter shaft if worn or damaged. Replace a front axle declutch shaft sliding clutch if worn, broken, or damaged. Replace a declutch shifter shaft oil seal if worn or damaged. Replace a front axle declutch shaft if worn or if the splines are broken or twisted. Replace a front axle declutch shaft bearing cone if worn, pitted, damaged, or if discolored due to overheating. Replace a front axle declutch shaft bearing cup that is cracked, worn, pitted, or discolored due to overheating. Replace a front axle declutch shaft bearing cage if cracked or damaged. Replace a universal joint yoke if splines are worn or if the yoke is bent or twisted.

#### 15. ASSEMBLE FRONT AXLE DECLUTCH UNIT ASSEMBLY

a. Install Declutch Shifter Fork (fig. 21). Hold shifter fork (Q) in position in front axle declutch shaft bearing carrier (Z). Insert the front axle declutch shaft sliding clutch (BB) in bearing carrier making sure the notched end of clutch is facing towards transfer mounting surface and that shifter fork engages groove in clutch. Slip shifter shaft (N) into bearing carrier and shifter fork (Q) making sure detent in shaft is aligned with set screw hole of shifter fork. Install and tighten set screw (P) in shifter fork (Q). Install plug (Y) in bearing carrier. Install detent ball (U), detent ball spring (V), lock washer (W) and lock screw (X) in bearing carrier. Position shifter shaft lever (L) in position in shifter shaft (N) and secure with declutch lever pin (M) and new cotter pin (FF). Secure shifter shaft lever (L) to bearing carrier with cap screw (T). Secure cap screw (T) and plug (Y) with locking wire.

b. Install Declutch Bearing Cage Assembly (fig. 21). Position a new gasket (S) on studs (AA) of front axle declutch shaft bearing carrier (Z). Aline splines of front axle declutch shaft (K) with those of front axle de-

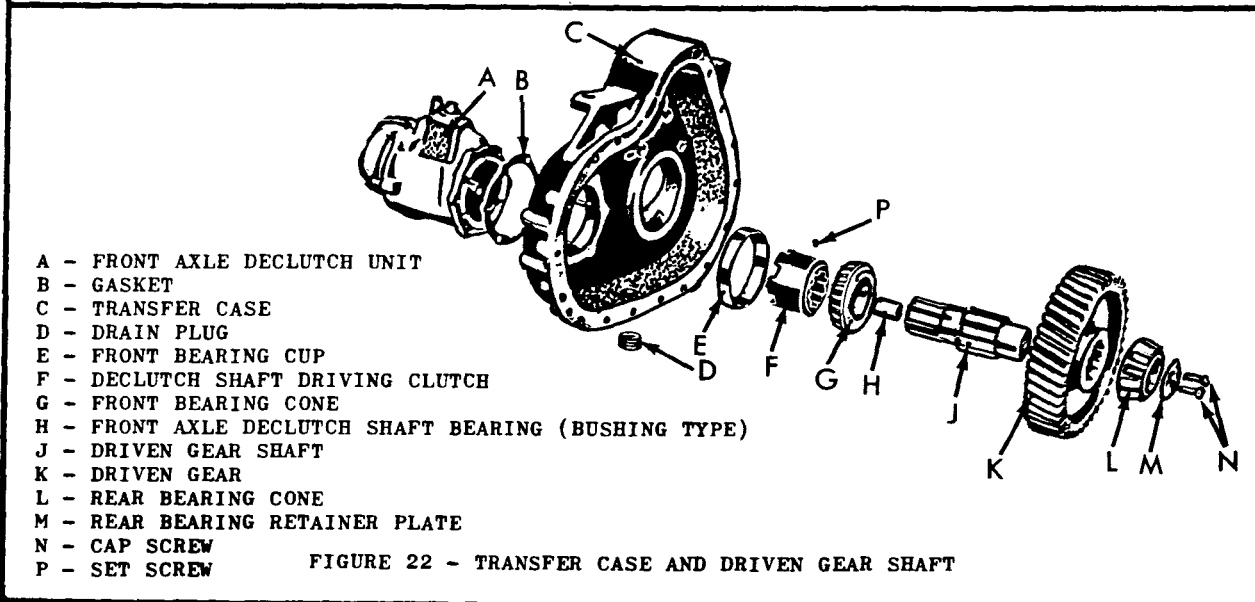
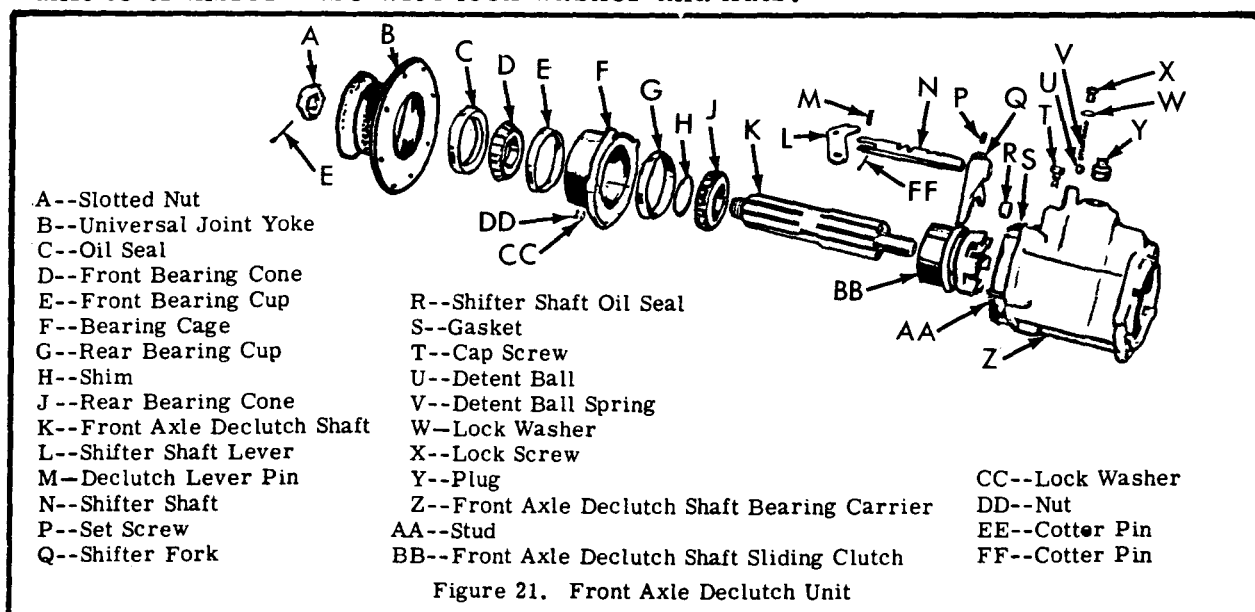
clutch shaft sliding clutch (BB), and install shaft. Then slip front axle declutch shaft bearing cage (F) onto studs (AA). Install and tighten lock washers (CC) and nuts (DD).

c. Install companion flange (Fig. 21). Slide companion flange (B) over splines of front axle declutch shaft (K). Secure with slotted nut (A) and new cotter pin (EE).

## 16. ASSEMBLE SUBASSEMBLIES

a. Install Front Axle Declutch Unit. Position a new gasket (B, fig. 22 on studs of transfer case. Aline front axle declutch unit with studs on case and tap into place with soft hammer.

Caution: Make certain that declutch shifter shaft lever is in the dis-engaged position when tapping unit into place. Secure front axle declutch unit to transfer case with lock washer and nuts.



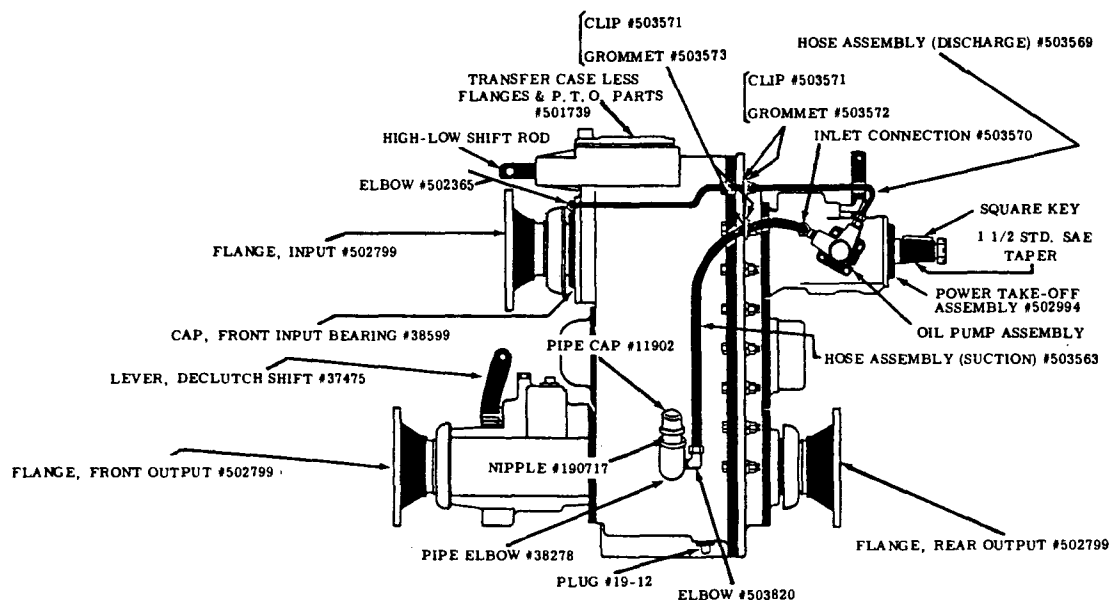


Figure 23. T-77 Transfer Case Power Take-Off Assembly  
Oil Pump Installation Diagram.

1. BEFORE CONNECTING HOSE ASSEMBLIES TO OIL PUMP, TEST CHECK VALVE AND OIL PUMP FOR AIR TIGHTNESS.
2. BEFORE PUTTING OIL PUMP IN OPERATING CONDITION, HOSE ASSEMBLY (SUCTION) #503563, CHECK VALVES, OIL PUMP MUST BE PRIMED WITH OIL.
3. AFTER CONNECTING SUCTION LINE AND PUMP, DISENGAGE CLUTCH AND TURN P. T. O. WITH POWER WRENCH TO BE CERTAIN THAT PUMP IS DELIVERING OIL AT OUTLET.
4. AFTER SECURING POINTS 1-3 OF THESE INSTRUCTIONS, CONNECT OUTLET HOSE TO FRONT BEARING CAP.
5. TIGHTEN ALL FITTINGS AND CONNECTORS.

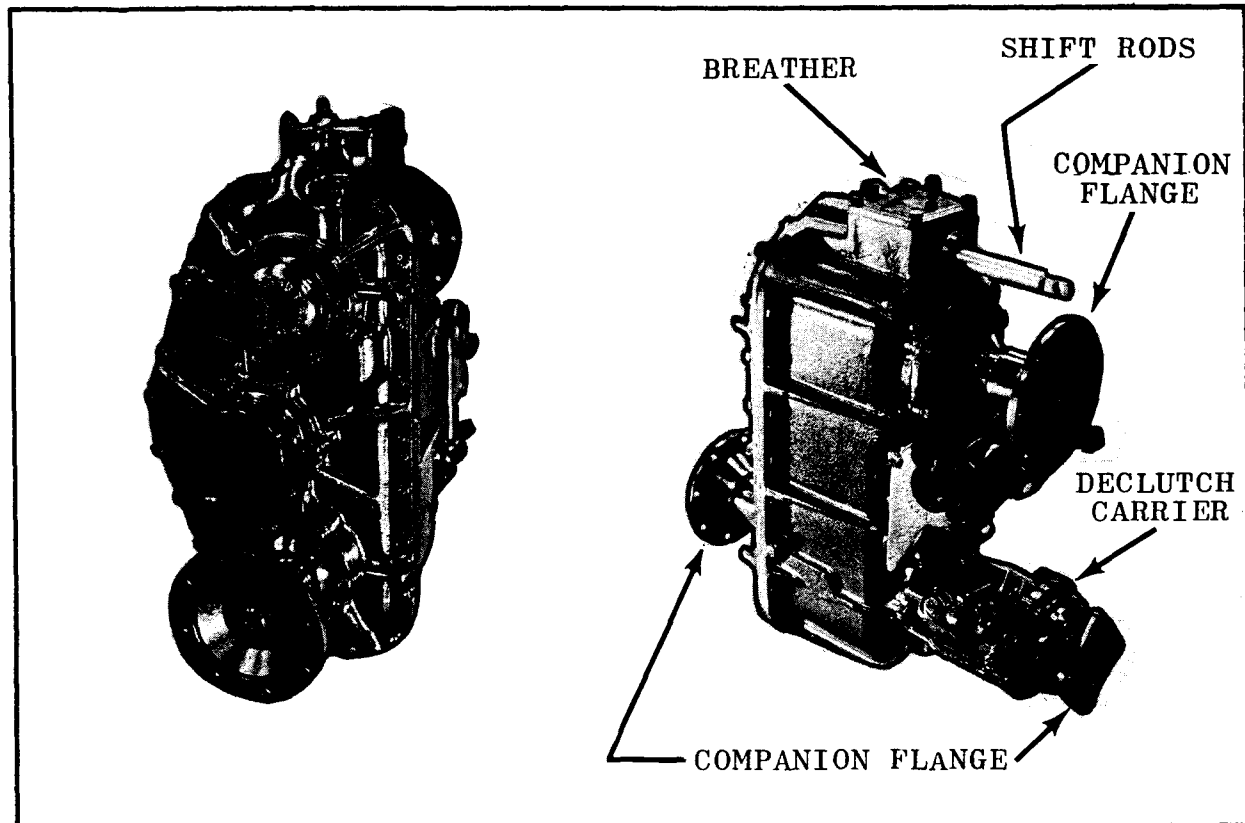


Figure 57- T-76-2 Transfer Case Assembly w/out Power Take-Off

### T-76-2 TRANSFER CASE ASSEMBLY

#### 1. TRANSFER CASE DESCRIPTION.

a. The transfer case is a gear box mounted behind the transmission which delivers power to the front and rear axles. A speed reduction is provided, the selection of which is controlled by a conventional shift lever in the cab. The unit has two speeds—direct (high) and low and a neutral position. A declutch unit is mounted at the lower end of the case facing towards the front axle which consists of a jaw-type clutch supported in a carrier. The engagement of dis-engagement of the front axle is accomplished by means of this mechanism which is controlled through linkage by a shift lever in the cab. As an option the transfer case may be equipped with a power take-off mounted at the rear end of the drive shaft.

#### 2. TRANSFER CASE BREATHER.

a. Description. There is a baffle-type breather mounted on top of the transfer case which permits the unit to breathe, thereby preventing the build-up of pressure from lubricant vapors and heat developed in operation which might cause damage to oil seals. This breather must be kept clean in order to function properly.



b. Cleaning.

(1) Clean the exterior surfaces of the breather cover and the top of the transfer case around the cover with dry-cleaning solvent.

(2) Remove Breather Parts. Remove the cap screws and lock washers holding the breather cover to the transfer case, then lift the breather cover, breather plate, and gaskets from the transfer case. The transfer case shift rail poppet ball and spring are held under the cup on the end of the breather cover, and care must be exercised when removing the cover to prevent the loss of the poppet parts (Fig. 58 ).

(3) Cleaning Breather. Immerse the breather cover and the breather plate in dry-cleaning solvent, and scrub until thoroughly clean. Be sure that all the holes in the cover and the plate are clear. After these parts are clean, dry them thoroughly with compressed air.

(4) Install Breather. Check to see that the poppet parts are in place before installing the breather. Then install a new gasket over the breather opening at the top of the transfer case. Then place the breather plate over the gasket with the breather holes towards the right side of the case. Place another new gasket over the breather plate, then install the breather plate cover. It will be necessary to force the breather cover down against the compression of the poppet spring while the cap screws and lock washers are installed. Be sure that the breather holes in the breather plate are on the opposite side of the breather holes in the breather cover.

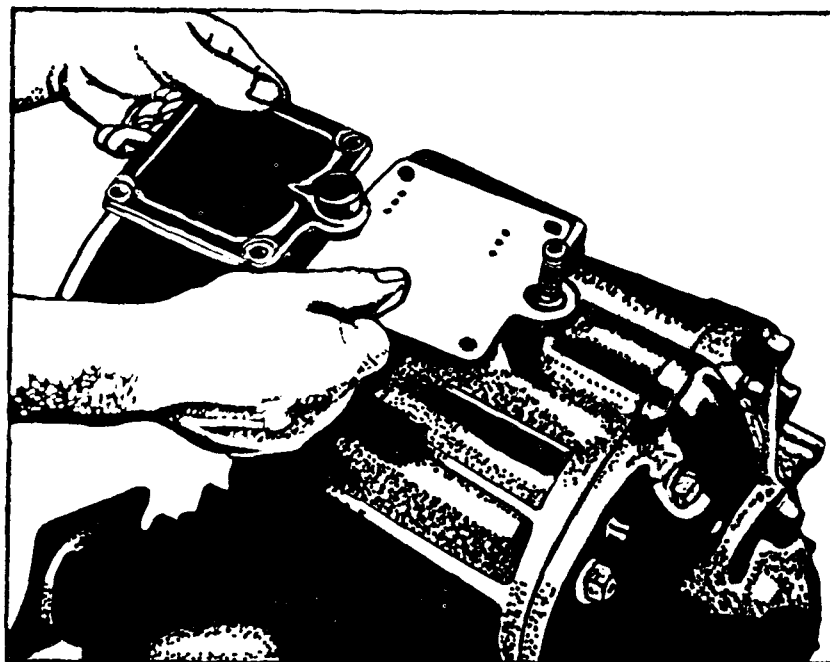


Figure 58 -Removing Transfer Case Breather

### 3. TRANSFER CASE REMOVAL.

- a. Drain Oil. Remove the drain plug, and drain the oil from the transfer.
- b. Disconnect Front and Rear Axle Propeller Shafts. Remove the cap screws and lock washers holding the propeller shafts universal flange yokes to the transfer drive shaft companion flange (front) and adapter (rear) and separate the flange yoke from the companion flange, swinging the propeller shafts assemblies clear.
- c. Remove Propeller Shaft Between Transmission and Transfer Case. Remove the cap screws, nuts and lock washers holding the flange yokes on the propeller shaft between transmission and transfer case to the companion flanges on the transmission main shaft and the transfer case drive shaft. Then remove propeller shaft assembly.
- d. Remove Exhaust Tube, Muffler and Tailpipe. Disconnect exhaust flange, front muffler U-bolt and tailpipe clamp, and remove exhaust assembly if needed for clearance.
- e. Disconnect Speedometer Cable. Thread the speedometer adapter bushing out of the speedometer gear opening in the transfer case idler shaft bearing cap, and swing cable clear.
- f. Disconnect All Transfer Case Controls. If control rods are used, disconnect at transfer case and levers by removing clevis pins and cotterpins. If cables are used disconnect in same way on transfer case. Also disconnect brake control rod from transfer case and emergency brake lever. If transfer case is equipped with power take-off assembly, disconnect power take-off control and drive line from power take-off.
- g. Position Hoisting Chain. Wrap a chain around the idler shaft rear bearing cap and the main shaft front companion flange. Attach this chain to a hook on the hoist, and lift a sufficient amount to cause a slight strain to permit of the removal of the mounting brackets. (Fig. 59).

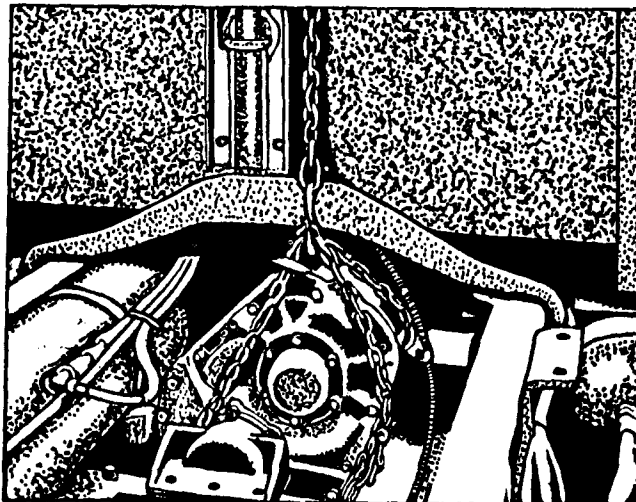


Figure 59-Lifting Transfer Case on Hoist

h. Disconnect Front Transfer Case Support From Frame or Frame Brackets. By removing bolts and nuts holding bracket, keep shims and spacers when used separated for left and right side to secure proper alignment when reinstalling.

i. Disconnect Rear Transfer Case. Support in the same way.

j. Lower Transfer Case to Floor. Lower transfer case assembly until it rests on the floor.

#### 4. TRANSFER INSTALLATION.

a. Lift Transfer Case into Position on Vehicle. Place transfer case into position under chassis, and wrap a chain around it as described for removal. Attach the chain to a hook on the hoist and raise the assembly into position.

b. Fasten Rear Transfer Case Support To Frame or Frame Brackets. Using same spacers, shims and fasteners as were removed.

c. Fasten Front Transfer Case Support In The Same Way.

d. Remove The Chain From The Transfer Assembly.

e. Alignment. If spacers and shims are properly reinstalled in same location where removed from, a check of the alignment should not be necessary. If in any doubt or if noise from the drive line is noticed, check alignment and correct by shimming as described in installation instructions.

f. Reinstall transfer case control rods or cables and emergency brake controls using original clevis pins and new cotterpins.

g. Connect Speedometer Cable. Insert the end of the speedometer cable into the speedometer opening on the transfer case idler shaft bearing cap and thread the adapter bushing into the cap to hold it in place.

h. Install exhaust tube manifold and tail pipe. Install the exhaust assembly into position on the chassis and then attach the exhaust flange, the front muffler U-bolt and the tail pipe clamp if removal of the parts is needed.

i. Install Propeller Shaft Between Transmission and Transfer Case. Lift the propeller shaft assembly into position between the transmission and transfer case and attach the universal joint and flange yokes to the companion flanges on the transmission and transfer case, using the cap screws and lockwashers which were removed.

j. Connect Front and Rear Axle Propeller Shafts. Swing propeller shafts into position so that the universal joint flange yoke is up against the companion flanges on the transfer case, and then attach these parts together with the cap screws, nuts and lockwashers which were removed.

k. Lubricate Transfer Case.