



REAR AXLE APPLICATION AND LUBRICATION CAPACITIES (R-LINE TRUCKS)

CODE	IH MODEL ENGINEERING NUMBER		MANUFACTURER'S NUMBER		DESCRIPTION	TRUCK MODELS	LUB. CAPACITY (PINTS)
	HYD.	AIR	HYD.	AIR			
1401	R-1060		IH		Single Reduction	R-110	4
1402	R-1070		IH		Single Reduction	R-120, RM-120, RA-120	4
1403	R-1170		IH		Single Reduction	RA-140, R-150, 153, RM-150	5
1404	R-1440		IH		Single Reduction	R-160, 163, 165, RC-160	8
1405	R-1470		IH		Single Reduction	R-164, 170, 173, 175	8
1406	R-1530	R-1531	IH		Single Reduction	R-174 Hydraulic, R-180, R-183, 185, 1853, RC-180	11
1409	R-1740	R-1741	T-R-100	T-R-100	Single Reduction	R-194, 200, 201, 202, 205	36
1410	R-2464		E-13600		Eaton Two Speed	R-160, 163, 165, RC-160	13
1411	R-2467		E-13600		Eaton Two Speed	R-164, 170, 173, 175	13
1412	R-2585	R-2586	E-16600	E-16600	Eaton Two Speed	R-174, Hydraulic, R-180, R-183, 185, 1853, RC-180	16
1415	R-1540	R-1541	E-2613	E-2614	Eaton Double Reduction	R-184, 190, 193, 195	19
1416	R-1640	R-1641	E-2695	E-2696	Eaton Double Reduction	R-194, 200, 205	19
1418	R-2780	R-2781	E-20500	E-20501	Eaton Two Speed	R-190, 200	20
1420	R-1810	R-1811	T-U-200P	T-U-200P	Timken Double Reduction	R-210	38
1423	R-2800	R-2801	T-U-300P	T-U-300P	Timken Two Speed	R-210	37

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R-LINE MOTOR TRUCK SERVICE

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CODE	IH MODEL ENGINEERING NUMBER		MANUFACTURER'S NUMBER		DESCRIPTION	TRUCK MODELS	LUB. CAPACITY (PINTS)
	HYD.	AIR	HYD.	AIR			
1425	R-2470				IH Two Speed With Timken E300 Differential	R-160, 163, 165	8
1426	R-2475				IH Two Speed With Timken E300 Differential	R-164, 170, 173, 175	8
1428	RF-1475		E-22M		IH Single Reduction	RF-170	11 ea. axle
1429	RF-1575		E-22M		Eaton Single Reduction	RF-174, 190	14 ea. axle
1430	RF-1685		E-36M		Eaton Single Reduction	RF-194, 210	20 Forward 21 Rear
1433	R-1165		IH		IH Single Reduction	R-130	6
1435	R-2610	R-2611	TQ-301N	TQ-301P	Timken Two Speed	R-194, 200, 205	32
1436	R-1547	R-1548	TL-101	TL-101	Timken Single Reduction	R-190, 193, 195	23
1438	R-2995	R-2996	TL-301	TL-301	Timken Two Speed	R-184, 190, 195	29
1450	R-2795	R-2796	TR-300	TR-300	Timken Two Speed	R-200	34
1451		RF-1690		E-36M	Eaton Single Reduction	RF-194, 210	20 Forward 21 Rear
1452	R-1470		IH		IH Single Reduction	R-164, 170, 173, 175	8
1453	R-2466		E-13600		Eaton Two Speed	R-164, 170, 173, 175	11
1454		RF-1570		E-28M	Eaton Single Reduction	RF-174, 190	14 ea. axle
1455	R-2575	R-2576	E-17500	E-17501	Eaton Two Speed	R-184, 190, 193, 195	17
1456	R-2620	R-2621	E-18500	E-18501	Eaton Two Speed	R-194, 200, 205	16
1457	R-2366		E-1350		Eaton Two Speed	R-150, 153	13
1458	R-1572	R-1573	E-1790	E-1791	Eaton Single Reduction	R-184, 190, 193, 195	22
1459	R-1632	R-1633	E-1890	E-1891	Eaton Single Reduction	R-194, 200, 205	21





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REAR AXLE IDENTIFICATION CHART

PRINTED IN UNITED STATES OF AMERICA

Axle Code Number	Axle Model Number	DESCRIPTION	L-110	L-120	LM-120	L-130	LB-140	L-150	L-153	LM-150	L-160	L-163	L-164	L-165	LC-160	L-170	L-173	L-174	L-175	LF-170	L-180	L-183	L-184	L-185	LC-180	L-190	L-193	L-194	L-195	LC-190	LF-190	L-200	L-204	L-205	LC-200	L-210	LF-210	L-220	L-225	LF-220	L-230	LF-230		
1401	R-1060	Single-Reduction-IH. . . .	X																																									
1402	R-1070	Single-Reduction-IH. . . .		X	X																																							
1403	R-1170	Single-Reduction-IH. . . .					X	X	X	X																																		
1404	R-1440	Single-Reduction-IH. . . .									X	X		X	X																													
1405	R-1470	Single-Reduction-IH. . . .											X			X	X		X																									
1406	R-1530	Single-Reduction-IH. . . .																X			X	X			X	X																		
1407	R-1555	Single-Reduction-Eaton .																									X	X		X	X													
1408	R-1630	Single-Reduction-Eaton .																									X						X											
1409	R-1741	Single-Reduction-Timken																										X						X										
1410	R-2465	Two-Speed-Eaton									X	X		X	X																													
1411	R-2466	Two-Speed-Eaton											X			X	X		X																									
1412	R-2585	Two-Speed-Eaton																X				X	X		X	X																		
1413	R-2580	Two-Speed-Eaton																									X	X		X	X													
1414	R-2600	Two-Speed-Eaton																									X						X											
1415	R-1540	Double-Reduction-Eaton .																								X				X	X													
1416	R-1640	Double-Reduction-Eaton .																										X						X										
1417																																												
1418																																												
1419	R-1731	Double-Reduction-Timken																																										
1420	R-1810	Double-Reduction-Timken																																										
1421	R-1740	Single-Reduction-Timken																																										
1422	R-2741	Two-Speed-Timken																																										
1423	R-2800	Two-Speed-Timken																																										
1424																																												
1425	R-2470	Two-Speed with Timken Diff.																																										
1426	R-2475	Two-Speed with Timken Diff.																																										
1427	R-2590	Two-Speed with Timken Diff.																																										
1428	RF-1475	Single-Reduction-IH. . . .																		X																								
1429	RF-1575	Single-Reduction-IH. . . .																														X												
1430	RF-1685	Single-Reduction-Eaton .																																										
1431																																												
1432																																												
1433	R-1165	Single-Reduction-IH. . . .				X																																						



REAR AXLE SPECIFICATIONS

REAR AXLE MODEL	R-1060	R-1070	R-1165	R-1170	R-1440	R-1470	RF-1475	
							Forward RF-1476	Rear RF-1477
Code	1401	1402	1433	1403	1404	1405	1428	1428
Type (Semi or Full-Floating) . .	Semi	Full	Full	Full	Full	Full	Full	Full
Pinion Mounting	Straddled	Straddled	Straddled	Straddled	Straddled	Straddled	Overhung	Straddled
Axle Shaft:								
Diameter at splines	1-9/32"	1-9/32"	1-33/64"	1-33/64"	1-3/4"	1-3/4"	1-3/4"	1-3/4"
Number of splines	10	10	16	16	16	16	16	16
Pinion Cone Center (amount of variation marked on pinion).	2.609	2.609	2.984	2.984	3.253	3.253	4.156	3.253
Lubricant Capacity (Pints) . . .	4	4	4	3	8	8	8-Axle 3-P.D.	8
Axle Ratios	3.73 4.1	4.1 4.777 5.13	4.88 5.571 6.166	4.88 5.57 6.16	5.285 6.166 6.666 7.166	6.166 6.666 7.166	6.166 7.166	6.166 7.166
Pinion Adjustment: Press pressure (tons)*	10	10	10	10	10	10	10	10
Cage Rotating Torque Scale Reading (Lbs.)	10-25	10-25	10-25	10-25	10-25	10-25	10-25	10-25
Pinion Nut Torque (Ft. Lbs.) . .	200-230	200-230	200-230	200-230	200-230	280-300	350-400	280-300
Differential Bearing Pre-load. (Total). . . . .	.005"-.007"	.005"-.007"	.005"-.007"	.005"-.007"	.005"-.007"	.005"-.007"	.005"-.007"	.005"-.007"

* Pressure against bearing race when checking rotating torque of pinion cage.



REAR AXLE SPECIFICATIONS

REAR AXLE MODEL	R-1530	R-1540	R-1555	RF-1575		RF-1685		R-1630
				Forward RF-1576	Rear RF-1577	Forward RF-1686	Rear RF-1687	
Code	1406	1415	1407	1429	1429	1430	1430	1408
Type (Semi or Full-Floating) . .	Full	Full	Full	Full	Full	Full	Full	Full
Pinion Mounting	Straddled	Overhung	Straddled	Overhung	Straddled	Overhung	Overhung	Straddled
Axle Shaft:								
Diameter at splines	1-7/8"	1-63/64"	1-63/64"	1-3/4"	1-3/4"	2-1/8"	2-1/8"	2-1/8"
Number of splines	16	16	16	16	16	16	16	16
Pinion Cone Center (amount of variation marked on pinion).	3.472	2.500	3.844	4.656	3.473	4.875	4.875	2.937
Lubricant Capacity (Pints) . . .	11	19	20	12-Axle 3-P.D.	12	20-Axle 3-P.D.	21	18
Axle Ratios	5.571 6.5 7.166	7.049 7.754 9.025	5.571 6.5 7.166	6.166 7.166	6.166 7.166	5.756 6.940	5.756 6.940	5.571 6.5 7.166
Pinion Adjustment: Press pressure (tons)*. . . .	10	10	10	10	10	10	10	10
Cage Rotating Torque Scale Reading (Lbs.)	10-25	10-25	10-25	10-25	10-25	10-25	10-25	10-25
Pinion Nut Torque	280-300	280-300	350-400	350-400	280-300	600-900	400-500	350-400
Differential Bearing Pre-load. (Total). . . . .	.005"-.007"	.005"-.007"	.005"-.007"	.005"-.007"	.005"-.007"	.005"-.007"	.005"-.007"	.005"-.007"

* Pressure against bearing race when checking rotating torque of pinion cage.



REAR AXLE SPECIFICATIONS

REAR AXLE MODEL	R-1640	R-1730	R-1731	R-1740	R-1810	R-2465	R-2466	R-2470
Code	1416	. . . . .	1419	1421	1420	1410	1411	1425
Type (Semi or Full-Floating) . .	Full	Full	Full	Full	Full	Full	Full	Full
Pinion Mounting	Overhung	Overhung	Overhung	Straddled	Overhung	Overhung	Overhung	Overhung
Axle Shaft:								
Diameter at splines	2-1/8"	2-3/8"	2-3/8"	2-3/8"	2-3/8"	1-3/4"	1-3/4"	1-3/4"
Number of splines	16	16	16	16	16	16	16	16
Pinion Cone Centers (amount of variation marked on pinion).	2.625	. . . . .	. . . . .	. . . . .	. . . . .	4.281	4.281	. . . . .
Lubricant Capacity (Pints) . . .	19	38	38	36	38	13	13	. . . . .
Axle Ratios	7.049 7.754 9.436	5.91 6.51 7.79 8.69 9.76	5.91 6.51 7.79 8.69 9.76	5.28 6.83 7.41	5.91 6.51 7.21 7.79 9.76	5.14-7.15 5.83-8.11 6.33-8.81	5.14-7.15 5.83-8.11 6.33-8.81	6.13-8.10 6.70-8.86
Pinion Adjustment: Press pressure (tons)*	10	10	10	10	10	10	10	. . . . .
Cage Rotating Torque Scale Reading (Lbs.)	10-25	4-5 &	4-5 &	4-5 &	4-5 &	10-25	10-25	. . . . .
Pinion Nut Torque (Ft. Lbs.) . .	400-500	700-900	700-900	700-900	700-900	280-300	280-300	. . . . .
Differential Bearing Pre-load. (Total) . . . . .	.005"-.007"	See Note	See Note	See Note	See Note	.005"-.007"	.005"-.007"	. . . . .

* Pressure against bearing race when checking rotating torque of pinion cage.
& Timken Axle.

NOTE: Tighten one notch each from .000" end play.

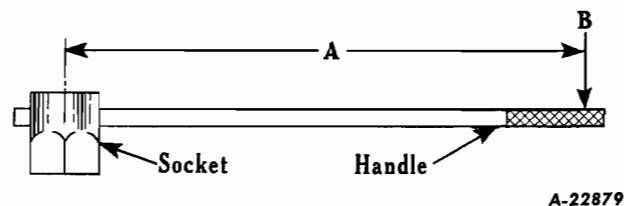


REAR AXLE SPECIFICATIONS

REAR AXLE MODEL	R-2475	R-2580	R-2585	R-2590	R-2600	R-2740	R-2741	R-2800
Code	1426	1413	1412	1427	1414	. . . . .	1422	1423
Type (Semi or Full-Floating). .	Full	Full	Full	Full	Full	Full	Full	Full
Pinion Mounting	Overhung	Overhung	Overhung	Overhung	Overhung	Overhung	Overhung	Overhung
Axle Shaft:								
Diameter at splines	1-3/4"	1-63/64"	1-7/8"	1-7/8"	2-1/8"	2-3/8"	2-3/8"	2-3/8"
Number of splines	16	16	16	16	16	16	16	16
Pinion Cone Centers (amount of variation marked on pinion).		5.281	4.812	. . . . .	5.281	. . . . .	. . . . .	. . . . .
Lubricant Capacity (Pints)		22	20	. . . . .	22	37	37	37
Axle Ratios	6.13-8.10 6.70-8.86	5.571-7.594 6.5-8.866	5.571-7.749 6.166-8.577 6.5-9.041	5.95-7.30 6.13-8.15 6.66-8.85	5.571-7.594 6.500-8.866	4.93-5.91 6.42-8.38 6.99-8.38	4.93-5.91 6.42-8.38 6.99-8.38	4.93-5.91 6.42-8.38 6.99-8.38
Pinion Adjustment: Press pressure (tons)*.		10	10	. . . . .	10	25	25	25
Cage Rotating Torque Scale Reading (Lbs.)		10-25	10-25	. . . . .	10-25	4-5 &	4-5 &	4-5 &
Pinion Nut Torque (Ft. Lbs.)		350-400	280-300	. . . . .	350-400	800-1100	800-1100	800-1100
Differential Bearing Pre-load. (Total). . . . .		.005"-.007"	.005"-.007"	. . . . .	.005"-.007"	See Note	See Note	See Note

* Pressure against bearing race when checking rotating torque of pinion cage.
& Timken Axle.
NOTE: Tighten one notch each from .000" end play.





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FT. LBS. TORQUE	WRENCH A	EFFORT ON WRENCH (APPROX.) B
200	1 foot	200 lbs.
	2 feet	100 lbs.
250	1-1/2 feet	170 lbs.
	2 feet	125 lbs.
300	1-1/2 feet	200 lbs.
	2 feet	150 lbs.
	3 feet	100 lbs.
350	2 feet	175 lbs.
	2-1/2 feet	140 lbs.
	3 feet	118 lbs.
	3-1/2 feet	100 lbs.
450	2-1/2 feet	180 lbs.
	3 feet	150 lbs.
	3-1/2 feet	129 lbs.
	4 feet	113 lbs.
500	3 feet	167 lbs.
	3-1/2 feet	144 lbs.
	4 feet	125 lbs.
	4-1/2 feet	112 lbs.
550	3-1/2 feet	158 lbs.
	4 feet	137 lbs.
	4-1/2 feet	123 lbs.
	5 feet	110 lbs.
600	4 feet	150 lbs.
	4-1/2 feet	134 lbs.
	5 feet	120 lbs.
	5-1/2 feet	110 lbs.

Wrench Torque Chart

The above chart illustrates the length of the wrench handle (A) and the effort that must be applied at (B) when tightening to secure the indicated torque.



AXLES—REAR

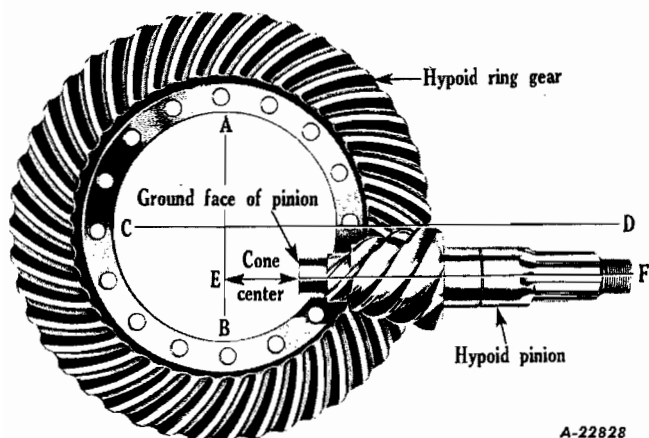
GENERAL INSTRUCTIONS FOR ALL HYPOID AXLES

HYPOID REAR AXLES (ALL MODELS)

All rear axles have a hypoid ring gear and pinion, whether single reduction, double-reduction, double-reduction (single and two-speed final drive) and two-speed differential. Hypoid gears have a greater inherent torque capacity, due largely to the fact that the hypoid pinion is much larger in diameter and the pinion teeth are correspondingly larger than those found in a spiral bevel pinion for the same number of teeth and the same diameter ring gear.

The hypoid pinion has a longer face because of its offset location. It also has larger tooth surface areas and usually has more teeth in instant contact with the gear. It is these design characteristics which contribute to greater strength and quieter final drive operation. Because of this greater tooth contact, it is more difficult to secure correct pinion setting at time of overhaul or when replacing differential bearings and every effort must be made to be sure the final setting results in best possible tooth contact.

Note that the pinion center line (E, F) is offset from the ring gear center line (C, D).



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Fig. 1 - Illustration shows location of pinion in relation to center line of ring gear. Center line of pinion is below center line of ring gear.

NOTE: When adding to or replacing lubricant in a rear axle having hypoid gears, use only hypoid lubricants. (See under "Lubrication" on page 9)

REAR AXLE HYPOID GEAR REPLACEMENT AND ADJUSTMENT

Hypoid Gear Tooth Contact (All Models)

The proper adjustment of hypoid gears in assembly is a vital factor in obtaining quiet and durable gears and the same methods of adjustment applies to both straight, spiral bevel and to hypoid type gears.

There are two distinct considerations in obtaining the proper tooth contact, cone center and backlash.

Hypoid as well as bevel and spur gears are cut with a predetermined amount of backlash. The backlash usually varies from .004" to .005" on small gears and increases on large gears. Generally, the gears are machined to run flush with each other at the outer end (heel or large end) of the tooth, and gears should be set according to their theoretical cone center (Figs. 2, 3, and 4).

Cone Center Specifications

Matched and mated hypoid ring gears and hypoid pinion gears are furnished both for service and for production.

Mated gears are marked with figures showing the amount of variation from their theoretical cone center.

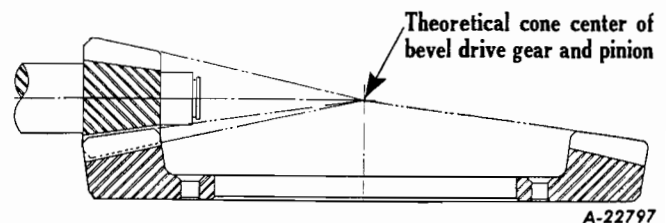


Fig. 2

Fig. 2 illustrates a hypoid ring gear and pinion adjusted to theoretical cone center, wherein the cone centers of both gears coincide. The specifications in this case would be the distance from the line (A, B) (Fig. 1) drawn through the center of the hypoid ring gear to the ground face of the hypoid pinion on center line (E, F). On some axles, the pinion is located above the center line (C, D) (Fig. 1). In these cases the term "hypoid" still applies.

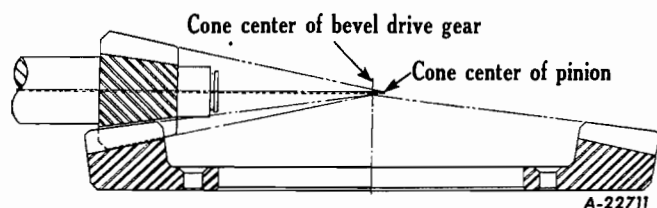


Fig. 3

Fig. 3 illustrates a setting wherein the mating of the gears has necessitated the pinion cone center being farther than the ring gear center. The pinion marking in this case will be minus (-) because the distance from the ring gear center is less.

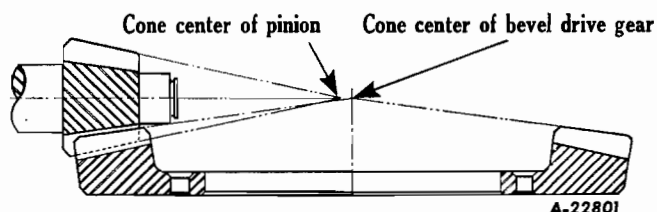


Fig. 4

Fig. 4 illustrates a condition where the mating of the gears required the pinion cone center to be farther OUT. The pinion marking will be plus (+) because the distance is greater.

SE-1065 Pinion Setting Gauge

The SE-1065 pinion setting gauge is a precision gauge designed for use in adjusting differentials to the proper cone setting of the ring gear and pinion. It is used only in adjustment of matched sets of gears. A step plate and bracket have been added to the set so that the gauge may be used on all hypoid differentials with satisfactory results. NOTE: Be sure to allow for thickness of the step plate .400" when making calculations (Fig. 5).

The use of SE-1065 gauge makes possible the exact duplication of the setting etched on the pinion. This results in the best possible setting with a minimum loss of time. It is advisable to check all pinion settings with a paint impression before considering the work complete. By so doing, visible proof of the pinion gauge setting accuracy is obtained, also long and quiet gear performance is assured.

Adjustment of differentials is a simple matter with the SE-1065 gauge. Briefly, it is only necessary to:

1. Install pinion and bearing assembly in differential carrier.

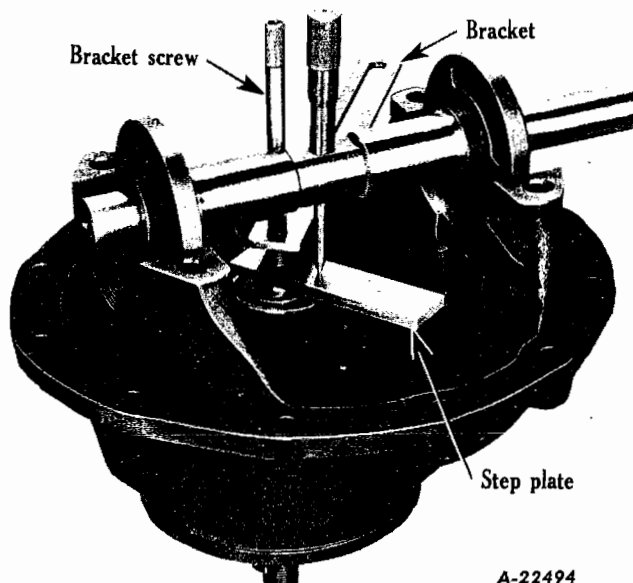


Fig. 5

Fig. 5 shows SE-1065 tool equipment in position on hypoid differential case. Make certain that the bearing bores are clean and free of nicks or burns. The step plate must be placed on the pinion end so that the lugs in the step plate straddle the bearing staking indentations on the smaller axles.

2. Install step plate and bracket as shown in Fig. 5. CAUTION: Be sure lugs on step plate straddle the bearing staking indentations.
3. Mount assembled SE-1065 gauge in bearing bores of carrier.
4. Take micrometer reading to check point of pinion. Add .400" (thickness of step plate) to reading. Write down reading.
5. Locate specified cone center specification for particular model on chart. Write down specified figures.
6. Locate on pinion the etched marking which indicates variation from zero cone center. If a minus figure, subtract from specified cone center, and if a plus figure, add to specified cone center. Results of calculation give corrected cone center.
7. Comparison of corrected cone center (6) with actual measurement (4) indicates amount of change necessary for pinion position.
8. Install ring gear and carrier in position.
9. Adjust backlash according to marking on ring gear.

(See following page)



Example of Mathematics involved;

Truck model to be L-110.

- (a) Micrometer reading (add .400" for step plate) 3.4400"
- (b) Specified cone center on chart 3.400"
- (c) Pinion marked (-5)005"
- (d) Subtraction (b-c) gives corrected cone center 3.395"
- (e) Subtract corrected cone center (d) from actual measurement (a)045"
- (f) It is necessary to move pinion IN.045"
- (g) Remember -- It is essential to arrive at a measurement as nearly equal the corrected cone center as possible.
- (h) DO NOT FAIL TO VERIFY ACCURACY OF THE ADJUSTMENT SECURED WITH THE SE-1065 gauge by checking the gear tooth contact using the paint impression method as set forth under General Rear Axle Hypoid Pinion and Ring Gear Adjustment, which follows.

GENERAL REAR AXLE HYPOID PINION AND RING GEAR ADJUSTMENTS

(PAINT IMPRESSION METHOD)

The following general instructions and suggestions are for the benefit of those service stations not equipped with an SE-1065 pinion setting gauge. Bear in mind that the accuracy of the adjustment obtained with the following procedure is dependent upon the skill of the operator.

Hypoid gears when mounted should show a bearing toward the toe or small end of the tooth, never at the heel or large end, the reason being that it is practically impossible to make gears and gear mounting rigid enough so that there will not be some slight deflection when full load is applied. This always has a tendency to cause the bearing to come on the heel of the tooth and when gears are adjusted so that the bearing is toward the heel of the tooth it results in a concentration of load on the top corner of the heel and breakage will follow.

Checking tooth contact is accomplished by means of oiled red lead applied lightly to the bevel gear teeth (Fig. 6). When the pinion is rotated, the red lead is squeezed away by the contact of the teeth, leaving bare areas the exact size, shape, and location of the contacts.

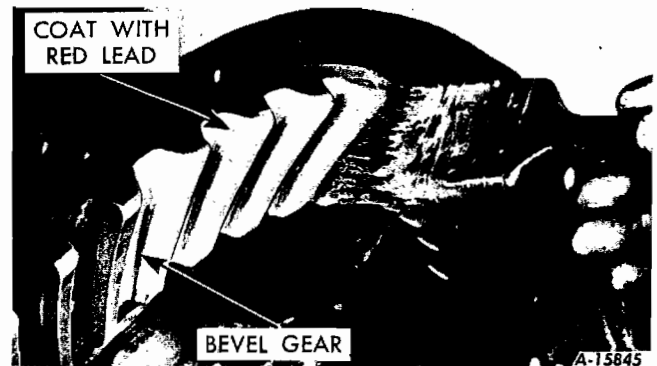


Fig. 6

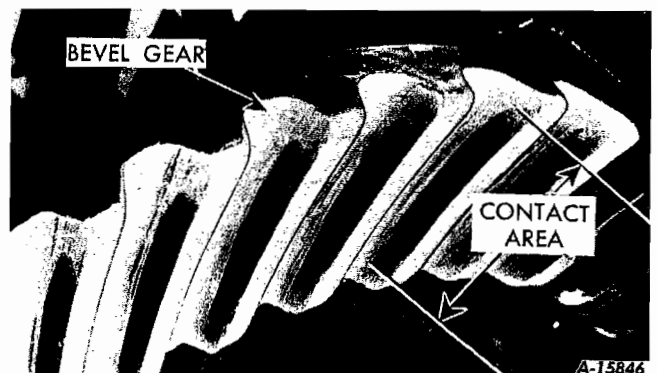


Fig. 7

Sharper impressions may be obtained by applying a small amount of resistance to the gear with a flat steel bar and using a wrench to rotate the pinion. When making adjustments, check the drive side of the bevel gear teeth. Coast side contact should be automatically corrected when drive side contact is correct. As a rule, coating about twelve teeth is sufficient for checking purposes.

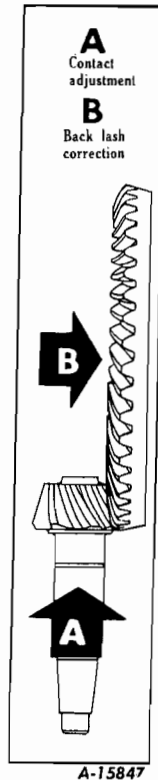
With adjustments properly made, the correct tooth contact shown in Fig. 7 will be secured. The area of contact starts near the toe of the gear and extends about 80 per cent of the tooth length. This adjustment results in a quiet running gear and pinion set which, because the load is distributed over the teeth within the proper area, will deliver all the long service built into it.

Figs. 8 to 11 illustrate method of adjustment in securing the proper gear tooth contact.



A HIGH NARROW CONTACT IS NOT DESIRABLE. If gears are allowed to operate with an adjustment of this kind, noise, galling and rolling over of the top edges of the teeth will result. To obtain correct contact, move pinion toward bevel gear to lower contact area to proper location. This adjustment will decrease backlash between pinion and bevel gear teeth, which may be corrected by moving bevel gear away from pinion. Backlash of .006" to .012" is correct.

Fig. 8

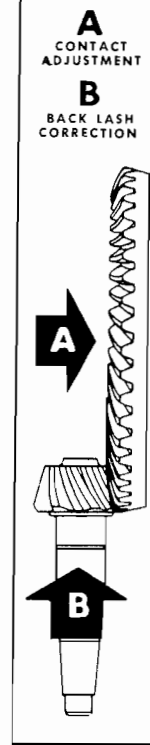


A-15847



A SHORT TOE CONTACT IS NOT DESIRABLE. If gears are allowed to operate with an adjustment of this kind, chipping at tooth edges and excessive wear due to small contact area will result. To obtain correct contact, move bevel gear away from pinion. This will increase the lengthwise contact and move contact toward heel of tooth. Correct backlash of .006" to .012" can be obtained by moving pinion toward bevel gear.

Fig. 10

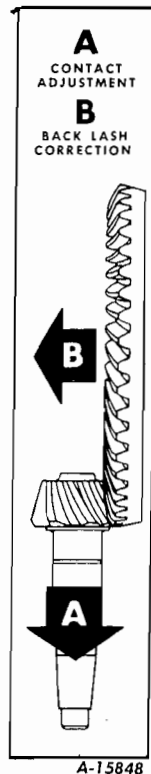


A-15849



A LOW NARROW CONTACT IS NOT DESIRABLE. If gears are allowed to operate with an adjustment of this kind, galling, noise and grooving of teeth will result. To obtain correct contact, move pinion away from bevel gear to raise contact area to proper location. Correct backlash of .006" to .012" may be obtained by moving bevel gear toward pinion.

Fig. 9



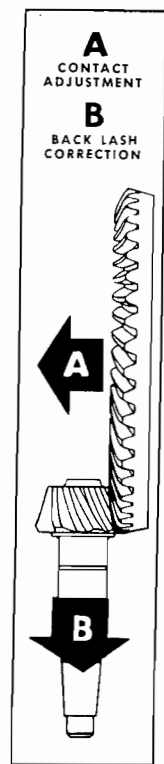
A-15848



A SHORT HEEL CONTACT IS NOT DESIRABLE. If gears are allowed to operate with an adjustment of this kind, chipping, excessive wear and noise will result. To obtain correct contact, move bevel gear toward pinion to increase the lengthwise contact and move contact toward toe. Correct backlash of .006" to .012" can be obtained by moving pinion away from bevel gear.

Several adjustments of both pinion and gear may be necessary before correct contact and backlash are secured.

Fig. 11



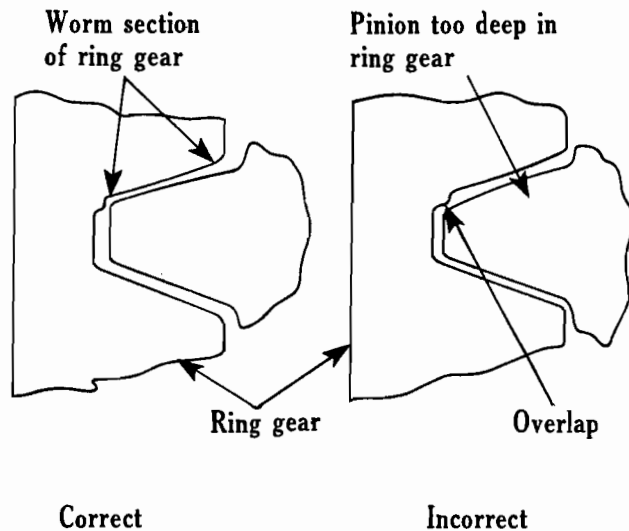
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Gear Adjustment for Lash

Generally if original gears are being reinstalled, red leading of teeth will not indicate the same contact as new gears and can be misleading. Gears that have been in service for long periods form running contacts due to wear of teeth; therefore, the original shim pack should be maintained to check gear lash. Gear lash, when using original gears, can be reduced only to a point of smooth rotation of gears.

If the gear lash is in excess of maximum tolerance as stated under Gear Adjustment, the lash may be reduced only in the amount that will avoid overlap of the worn tooth section (Fig. 12). Rotate the gears and check for smooth or rough operation. If a slight overlap, as illustrated (Fig. 12), takes place at the worn tooth section, rotation will be rough.



A-19693

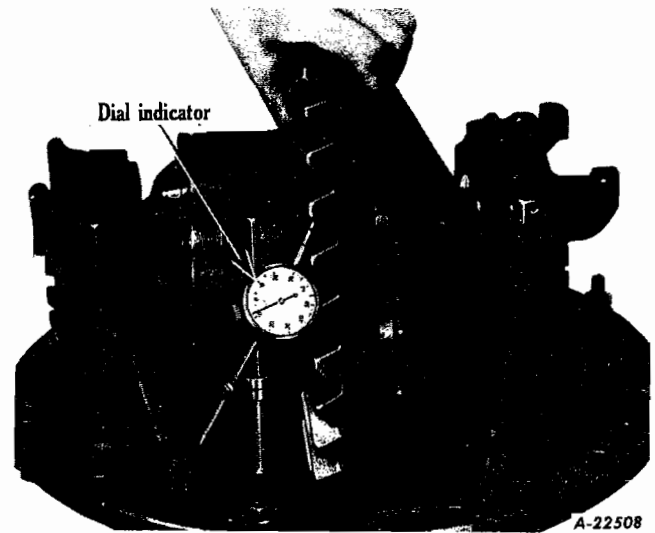
Fig. 12

Fig. 12 illustrates worn condition of gear teeth and overlapping condition.

When installing new gears, check gear lash with dial indicator (Fig. 13) and adjust to obtain amount of backlash marked on ring gear as follows:

1. Set pinion according to procedure outlined under SE-1065 Pinion Setting Gauge.
2. To move ring gear, tighten or loosen differential bearing adjusting nuts as required.
3. After correct gear lash is secured, check and adjust as necessary to obtain the correct tooth contact. (See Gear Adjustment for correct tooth contact.)

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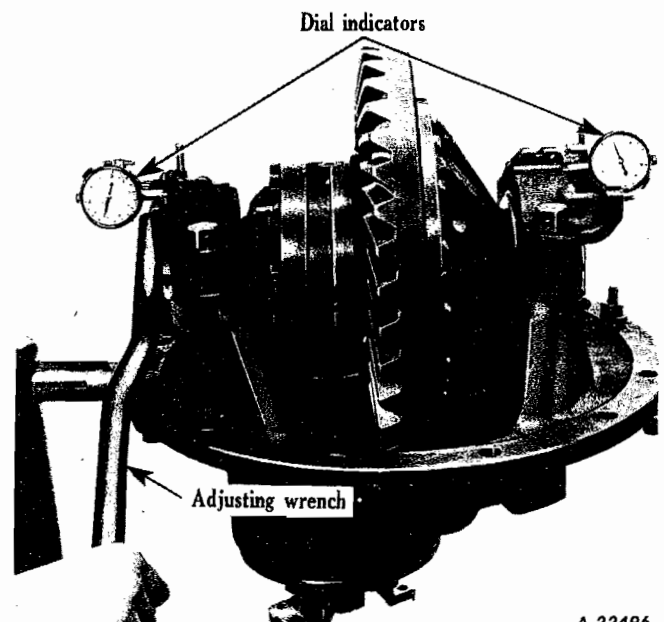
Fig. 13 - Checking gear lash.

Adjust Differential Bearing Pre-Load

Using dial indicators at side of each bearing cap (Fig. 14), adjust to obtain bearing pre-load as follows:

1. Loosen adjusting nuts only enough to notice end play on indicators.
2. Tighten adjusting nuts only enough to obtain .000" end play reading on indicators.

Note: While gear is held in .000" end play and before loading bearings, check gear for runout. If runout exceeds .008", remove differential and check for cause.



A-22496

Fig. 14 - Adjusting differential bearing pre-load.



3. Tighten BOTH adjusting nuts from .000" end play to pre-load differential bearings. Adjust pre-load to secure equal pre-load reading at indicators. (See specifications for pre-load data on the various axles.)
4. Tighten bearing cap stud nuts to specified torque.
5. Install adjusting nut locks.

Pinion Bearing Adjustment for Correct Pre-Load (Torque Method)

After the pinion, the pinion bearings and spacers have been assembled in the pinion bearing cage, place the assembly in a press being sure to use a sleeve adapter as shown in Fig. 15. Press the bearing down firmly and rotate the pinion cage to align the bearings and assure normal bearing contact. Set press at correct pressure and attach a spring scale to pinion cage as indicated in Fig. 15. Read scale only while pinion cage is turning. If preload reading is incorrect, the bearing load may be increased by installing a thinner spacer or decreased by using a thicker spacer.

The correct press ram pressure and scale reading for the various axles may be found in the Rear Axle Specifications.

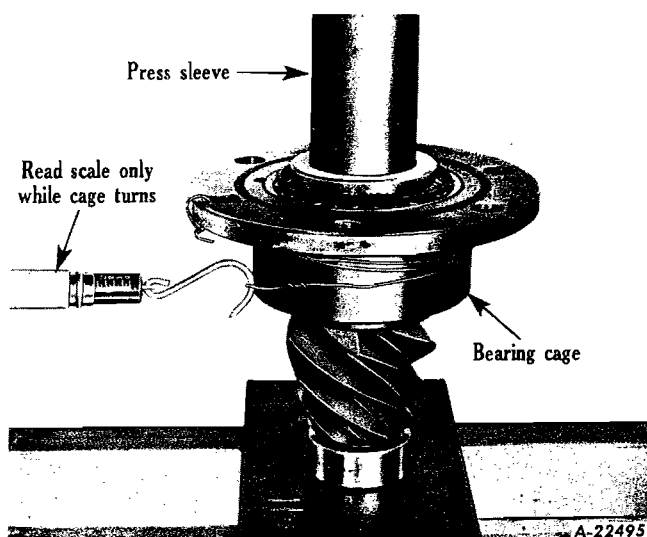


Fig. 15

Fig. 15 shows method of checking pinion bearing preload using scales to measure torque.

Pinion Bearing Adjustment for Pre-Load Using Dial Indicator (This method should only be used on the smaller axles).

An outside or bench assembly should be made of bevel pinion, bearings and cage. With cups assembled in cage, assemble the pinion and inner bearing cone and roller assembly in place, using the proper spacer to space the pinion bearings. Next assemble the outer pinion bearing cone and rollers, spacer, companion flange, washer and nut.

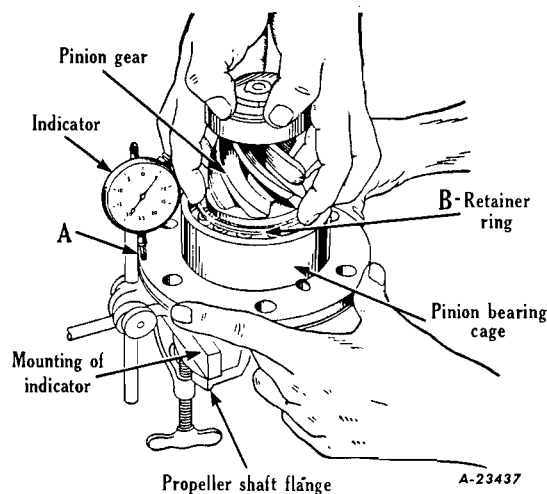


Fig. 16

Fig. 16 shows method of attaching dial indicator when adjusting bearing pre-load. This method can be used when press equipment is not available.

NOTE: Do not install pinion bearing oil seal until all adjustments have been completed. Then check bearing fit to see that bearings have no end movement with flange nut drawn up tight. To secure this fit, proper spacer must be found by trial as follows:

- (1) Place assembly in vise in position shown.
- (2) Mount indicator on propeller shaft flange with indicator finger resting on upper face of cage. (See A, Fig. 16.)
- (3) With the tips of the fingers grasp the bearing retainer and work bearings up against the back face of pinion. (See B, Fig. 16.)
- (4) With the bearings held firmly against the pinion, move the cage up and down, observing the indicator reading. It is impossible to accurately determine the end play unless the bearing is worked loose and up against the pinion. Assemblies having as much as .005" end play cannot be moved enough to show on the indicator until the bearing has been worked up and away from the cup.

CAUTION

Bearings must be absolutely clean!

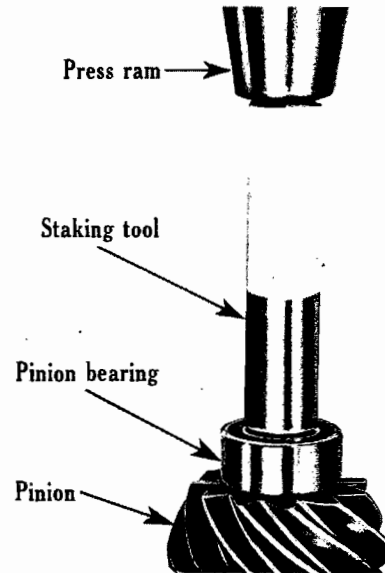
Preload the pinion bearings by replacing the spacer between the pinion bearings with one smaller to the extent of the amount of the end play plus .002" for the loading. For example, should there be .005" end play as indicated in the sketch in the assembly, replace the spacer with one .007" smaller. Do not depend upon the spacers to be right according to number but check each and every one with an accurate micrometer. Before reassembling the bearings to the pinion shaft they should be dipped in rear axle lubricant. Propeller shaft flange nut must be pulled down securely to assure tight bearings. A wrench with 30" of leverage should be used.

In order to determine if insufficient or excessive preload has been applied, make the following test:

- (1) Place assembly in vise with jaws clamping together on the flange of the pinion bearing cage and with assembly in a horizontal position.
- (2) Grasp the propeller shaft flange with one hand and attempt to turn.
- (3) If the pinion turns freely, assembly is too loose. If pinion cannot be turned, assembly is too tight.
- (4) The ideal condition is to secure a firm drag when turning the pinion cage by hand.

After proper bearing fit has been obtained, place pinion bearing cage shims approximately .020 in thickness over end of cage and place cage and pinion assembly in carrier, it being necessary to match flange holes in cage, since one hole is out of equal spacing to assure proper position of cage. Next assemble two cage bolts only until gear setting is completed. Assemble differential and bevel gear assembly and place bearing cap and adjuster in position. Tighten bearing cap bolts and back off slightly to provide sufficient looseness to allow turning the adjuster for a temporary backlash adjustment of approximately .010". After this adjustment has been made, tighten each bearing adjuster snug then give them a final tightening operation, drawing them up to secure the .005" to .007" total bearing pre-load. This is important in order to make certain that the bearings are seating properly.

IMPORTANT: Hypoid drive pinion oil seals must be soft and pliable before being installed if the seals have become dried out and hard while in stock, use kerosene and work it in thoroughly. When seal has become soft and pliable, dip it in hot oil and work this oil in thoroughly.



A-22727

Fig. 17 - Using the pinion staking tool.

Pinion Bearing (Straddle bearing)

The straddle pinion bearing is held in place on the pinion by a staking operation.

The staking operation is accomplished through the use of a hydraulic or screw press applying 18 to 20 tons pressure on the special staking tool as illustrated in Fig. 17. The result will be uniformly spaced ball indentations that securely lock the pinion bearing to the shaft.

Differential Ring Gear Rivet Removal

If necessary to remove hypoid ring gear or herringbone gear rivets, drill the rivet heads from the gear side, using a drill slightly larger than the rivet itself. Use a punch for the removal of the remaining portion of the rivet. (See Fig. 18).

Knocking off or "busting" rivets is a dangerous practice both from the standpoint of personal safety and because such practice may cause distortion to the gear carriers or gears and will elongate the rivet holes.

Rivet Pressures

Proper installation of differential ring gear rivets demands that sufficient pressure be applied to the rivets to expand them and cause them to completely fill the holes in which they are installed. Riveting should be done with COLD rivets. Hot rivets will shrink when cool, leaving a space and inviting shearing upon the application of torque.

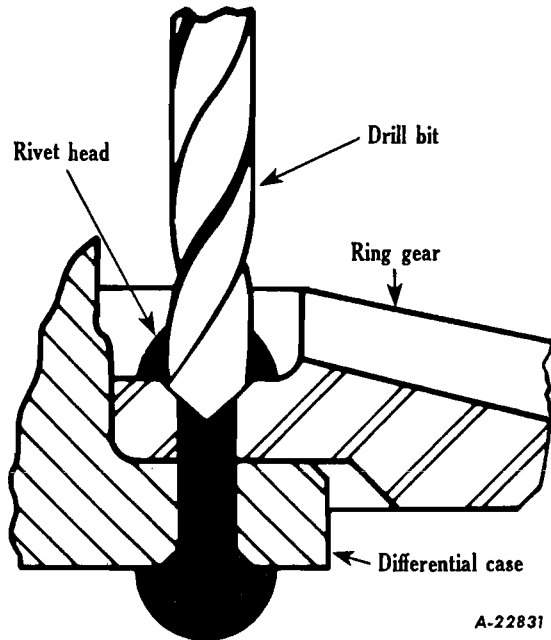


Fig. 18 - Drill rivet head and punch-out rivet as shown.

Riveting Jig SE-1575 is available and is designed for use with hydraulic or mechanical press equipment.

The following pressures are recommended for differential ring gear rivet installation:

RIVET SIZE (INCH)	PRESSURE PER RIVET (TONS)
5/16	12 to 15
3/8	17 to 20
7/16	30 to 35
1/2	45 to 50
9/16	60 to 70
5/8	60 to 70

Axle Shaft Removal (Timken Axles)

Axle shafts are attached to the wheel hubs by studs and nuts at the flanged end. Stud holes in each axle shaft flange are taper-reamed to receive split tapered dowels.

When disassembling the axle, some of the bearing cage studs or axle shaft studs may turn loose from the housing rather than at the nuts. When the axle is reassembled, the nuts should be removed from the studs and the studs replaced in their tapped holes before installing the cage or carrier.

When removing the axle shafts from the Timken axle, remove the stud nuts and lockwashers and proceed as indicated in Figs. 19, 20, 21.

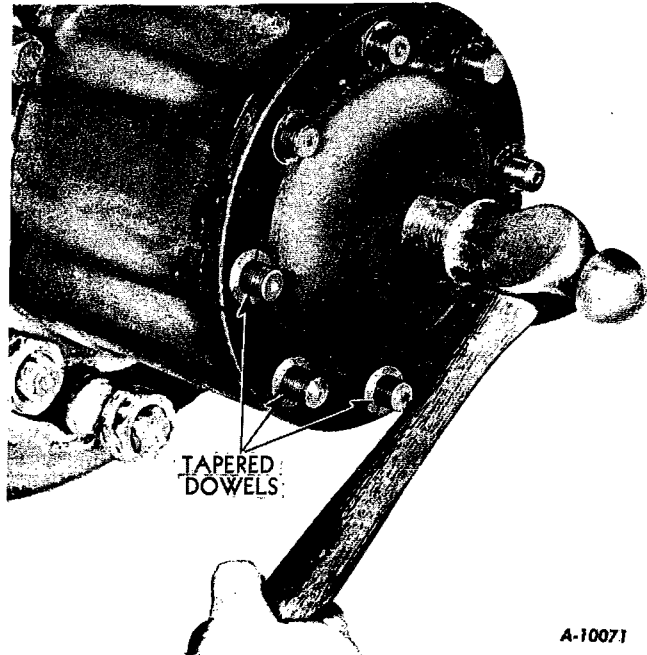


Fig. 19 - Using a heavy hammer, strike sharply on the center of the flange of the axle shaft. This will unseat and loosen the tapered dowels in each stud hole.

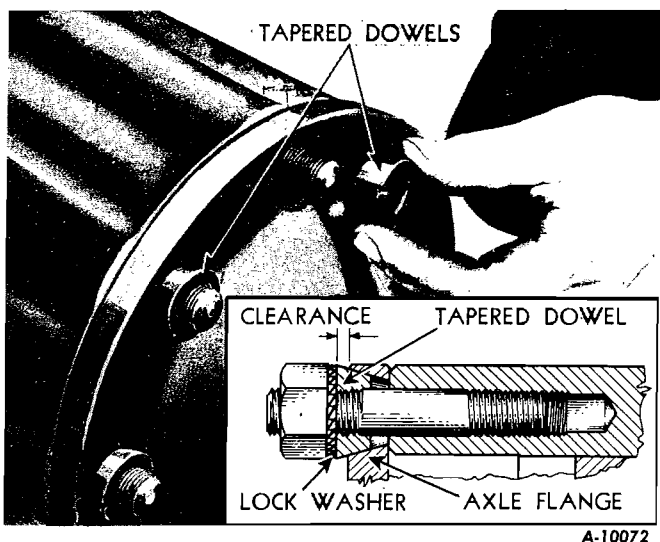


Fig. 20 - Remove the tapered dowels.

Note: When reassembling there must be a slight clearance between the lockwasher and axle shaft driving flange. Excessive wear on studs, dowels, or holes in the flange will indicate a lack of clearance at this point.

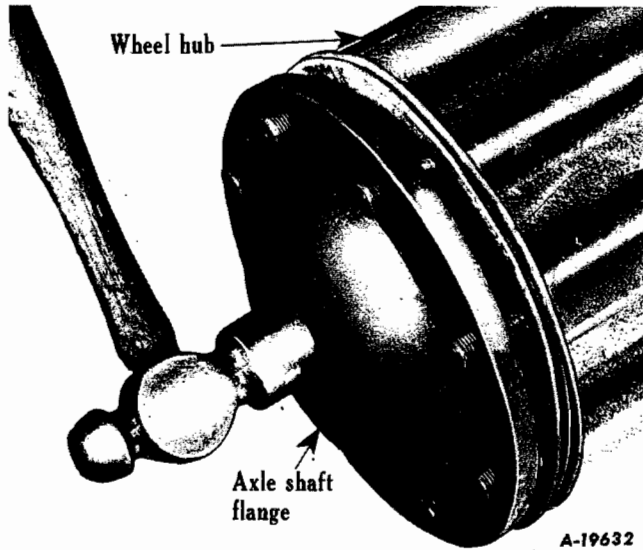


Fig. 21 - Push the axle shaft flange back into position against the wheel hub, and again, strike a sharp blow in the center of the axle shaft flange. This will cause the axle shaft to spring away from the wheel hub and allow removal of the axle shaft without resorting to the use of a pry bar or screwdriver. Do not pry between the axle shaft flange and wheel hub. To do so is apt to damage the seal assembly or machined surfaces of the wheel hub or axle shaft flange.

When reinstalling the axle shafts there must be a slight clearance between the lockwashers and driving flange, see Fig. 20. Excessive wear on studs, dowels or holes in the axle flange will take place when no clearance exists.

Axle Housing Breather Valve

When the rear axle becomes warm, after a short period of operation, a pressure is built inside the axle housing. To prevent this pressure from forcing lubricant past the rear wheel oil seals and damaging the brake linings, a breather valve has been provided. The valve is so constructed that warm air may pass out of the axle to relieve built up pressure, yet dirt and moisture are prevented from entering. The location of the breather valve is shown in Fig. 18, inset shows detail of valve.

The breather valve should be kept open and clean. When the vehicle is operated or unimproved highways or in ice and snow it is possible that dirt will be forced under the valve cap, thus rendering the valve ineffective. Remove valve occasionally and clean thoroughly in a cleaning solution.

NOTE: Where power divider is mounted on rear axle, the breather is mounted on upper side of the power divider.

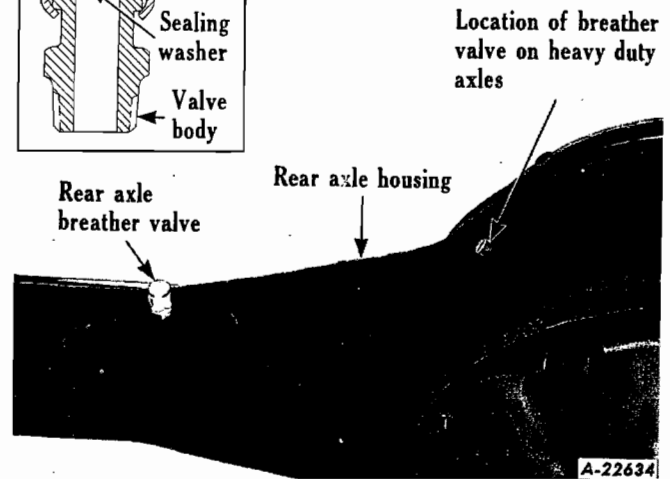
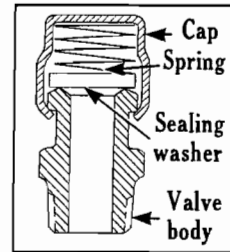


Fig. 22 - Keep breather valves clean and free of obstruction. Breathers are usually located in housing as illustrated.

IMPORTANT

Lubrication Of Hypoid Axles

The lubricant used in hypoid axles is an important factor in obtaining long gear life and satisfactory drive unit service. Past experience proves that a large portion of service problems can be traced to using incorrect, or lubricant of poor quality.

In the selection of Hypoid Lubricants, it is advisable to consider using products of unquestionable quality.

Because of the higher unit pressures and sliding tooth characteristics of hypoid gearing, the lubricant must have properties which enable it to withstand these actions.

It is important that the axle hypoid gearing receive initial lubrication after overhaul, or when a vehicle has been standing in storage, and BEFORE THE AXLE IS SUBJECTED TO HEAVY LOADS; Good practice is to check the lubricant level in the axle housing then, JACK UP BOTH rear wheels and operate the vehicle in high transmission gear at approximately 25 miles per hour for five minutes. This will assure thorough lubrication of the gearing before the unit is placed into service. (Do not allow one wheel to race faster than the opposite wheel.)

Where the axle pinion cage is provided with a plug at the pinion cage, insert one pint of lubricant to provide initial lubrication for the pinion bearing.



Specified Lubricant For Hypoid Axles

For hypoid axles (not Eaton) use SCL, EP gear oil or a multi-purpose gear lubricant suitable for hypoid axles and supplied by a reputable refinery. SAE-90 for cold climate and SAE-140 for warm climate. For Eaton hypoid axle, use a hypoid gear lubricant available as Elco Gear Safety "28" or its equivalent. A number of hypoid lubricants are prepared by reputable companies which contain Elco additive concentrates. (See "Lubrication", section A).

NOTE: When reassembling the differential gears, thrust washers, cross shaft spur gears and bearings, lubricate the wearing surfaces with a light coat of the specified axle lubricant.

Differential Assembly -- L-110 and L-120

The L-110 and L-120 Series Trucks use differential assemblies that are identical in construction except that a spacer or thrust block is used when the unit is installed in a L-110 axle.

Since the L-110 axle is of semi-floating construction, a means of taking up the end thrust of the axles and wheels must be provided. The block serves this purpose. The wheel bearings pick up the end play or thrust on the L-120 (full-floating) axles and no thrust block is needed. Also the axle shafts in the full-floating design are slightly longer than those used in the semi-floating design and for this reason the thrust block must be removed when the differential unit is used in the L-120 series vehicle.

Removal of the thrust block is as follows:

1. Drive cross pin retainer pin from differential case so as to clear the cross pin (Fig. 23).

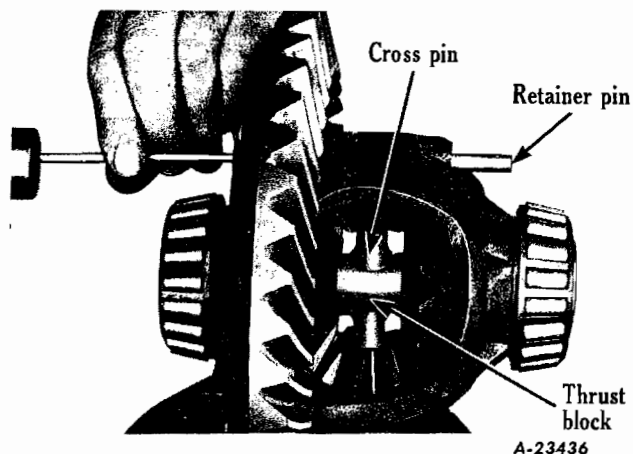


Fig. 23 - Driving retainer pin from differential case using a hammer and punch.

2. Using punch, drive the cross pin out of differential case far enough to remove the thrust blocks (Fig. 24).

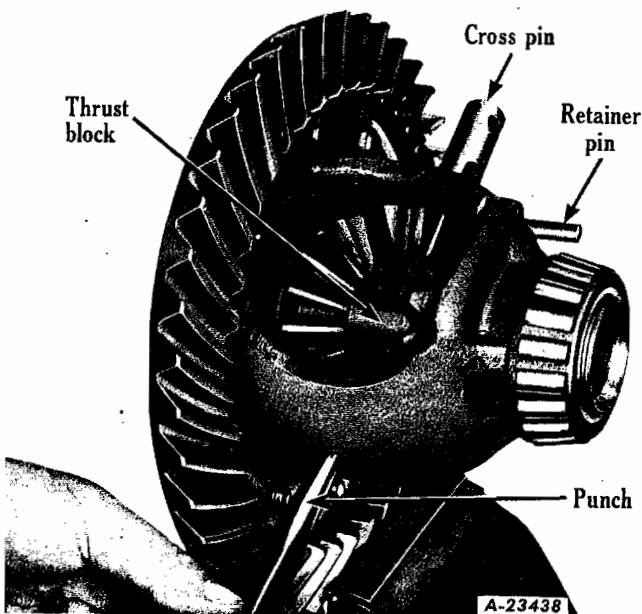


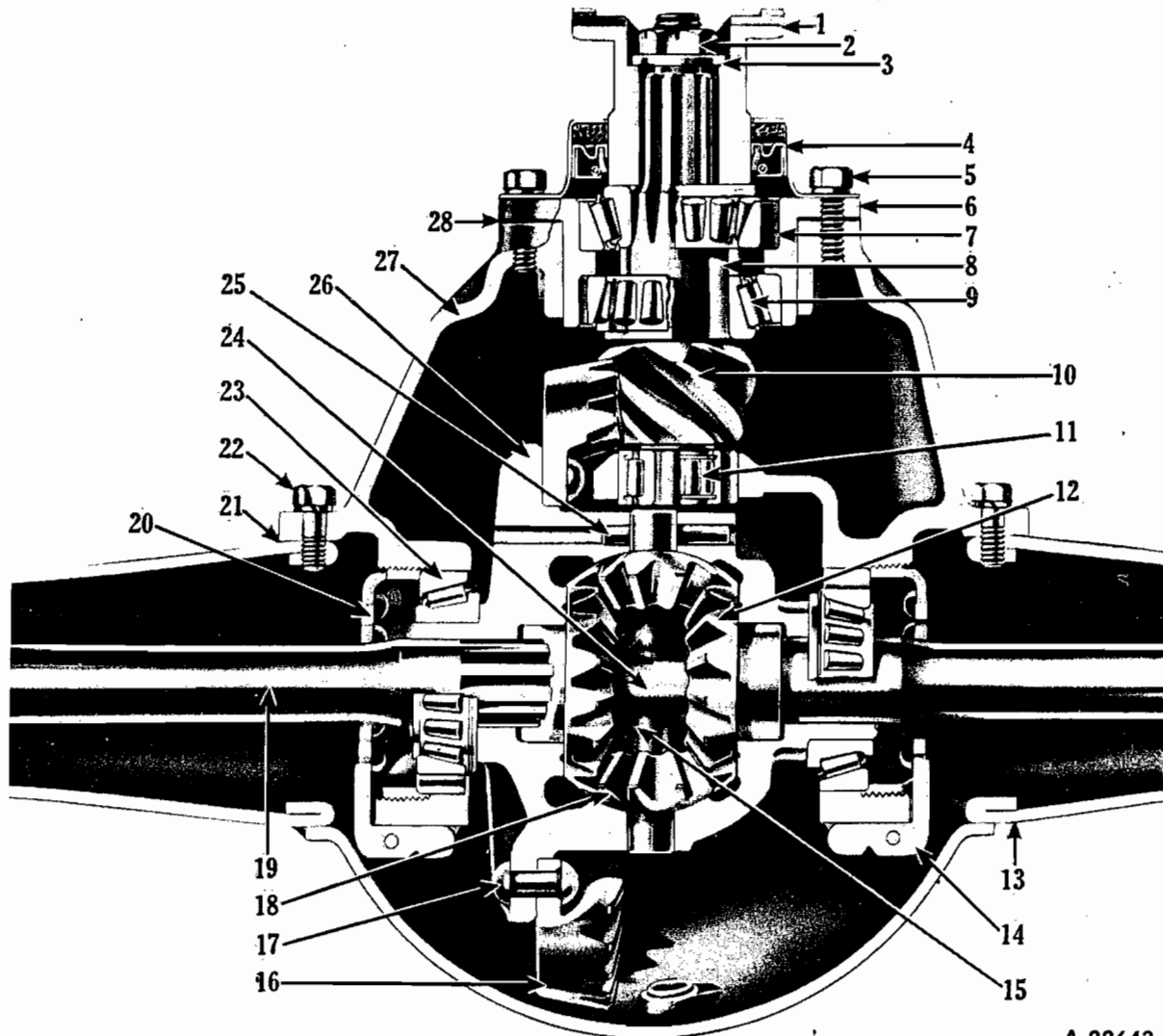
Fig. 24

3. Push cross pin back into position in the differential case. Drive retainer pin into position and stake case to secure retainer pins (Fig. 25).



Fig. 25

SINGLE-REDUCTION HYPOID AXLE (UNIT SHOWN IS MODEL R-1060 OR R-1070)



A-22643

Fig. 26 - Sectional View of Hypoid Rear Axle.

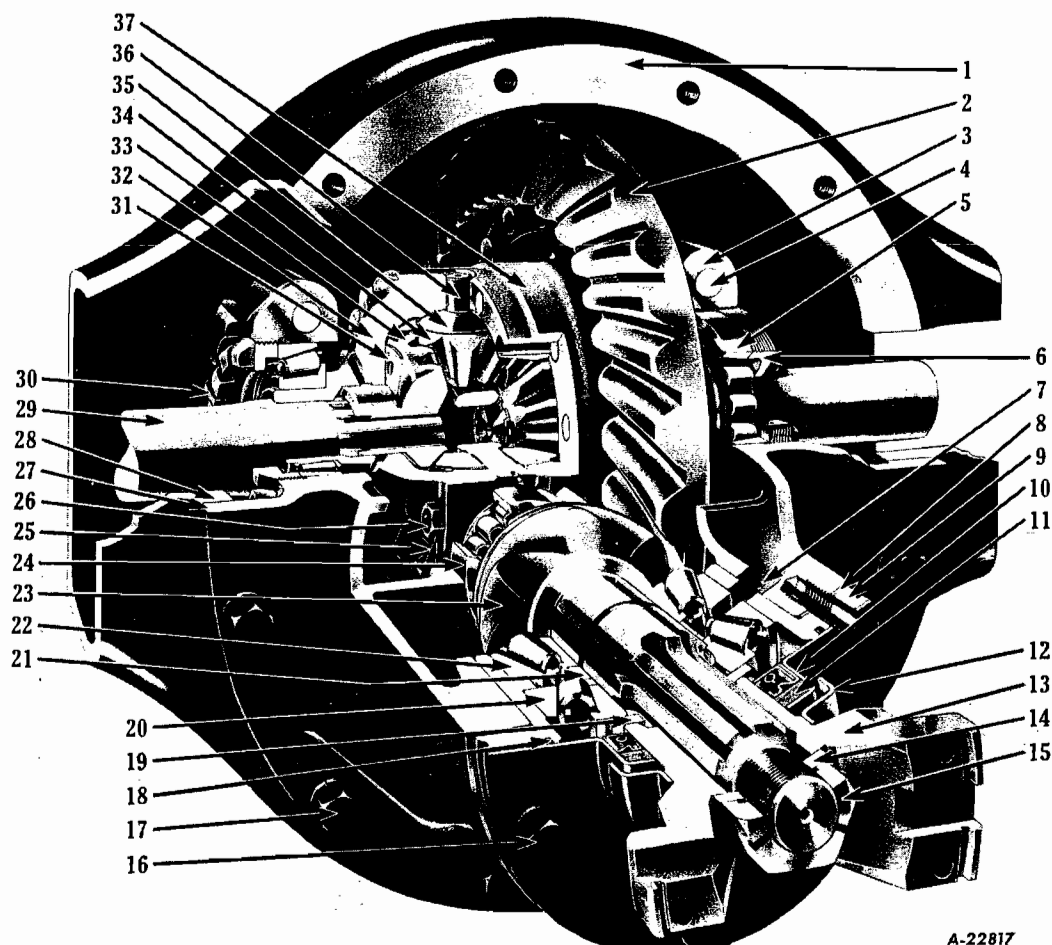
- | | |
|---|---|
| 1. Companion flange. | 15. Differential cross pin. |
| 2. Propeller shaft mounting nut. | 16. Hypoid ring gear. |
| 3. Propeller shaft mounting nut washer. | 17. Hypoid ring gear rivet. |
| 4. Pinion shaft bearing oil seal. | 18. Differential pinion. |
| 5. Pinion bearing cage to carrier capscrew. | 19. Axle shaft. |
| 6. Pinion bearing cage. | 20. Differential bearing adjuster. |
| 7. Pinion bearing, outer. | 21. Differential carrier to housing gasket. |
| 8. Pinion bearing spacer. | 22. Differential carrier to housing capscrew. |
| 9. Pinion bearing, inner. | 23. Differential roller bearing. |
| 10. Hypoid pinion gear (straddle mounting). | 24. Differential center block. |
| 11. Pinion bearing. | 25. Differential cross pin retaining pin. |
| 12. Differential side gear. | 26. Differential case. |
| 13. Axle housing. | 27. Differential carrier housing. |
| 14. Differential bearing adjuster lock. | 28. Pinion bearing cage shim. |

NOTE: Rear Axle R-1070 is identical with above description except differential center block (24) is not used.



SINGLE-REDUCTION HYPOID AXLE

(MODELS R-1165, R-1170, R-1440, R-1470, R-1530, R-1555, R-1630)



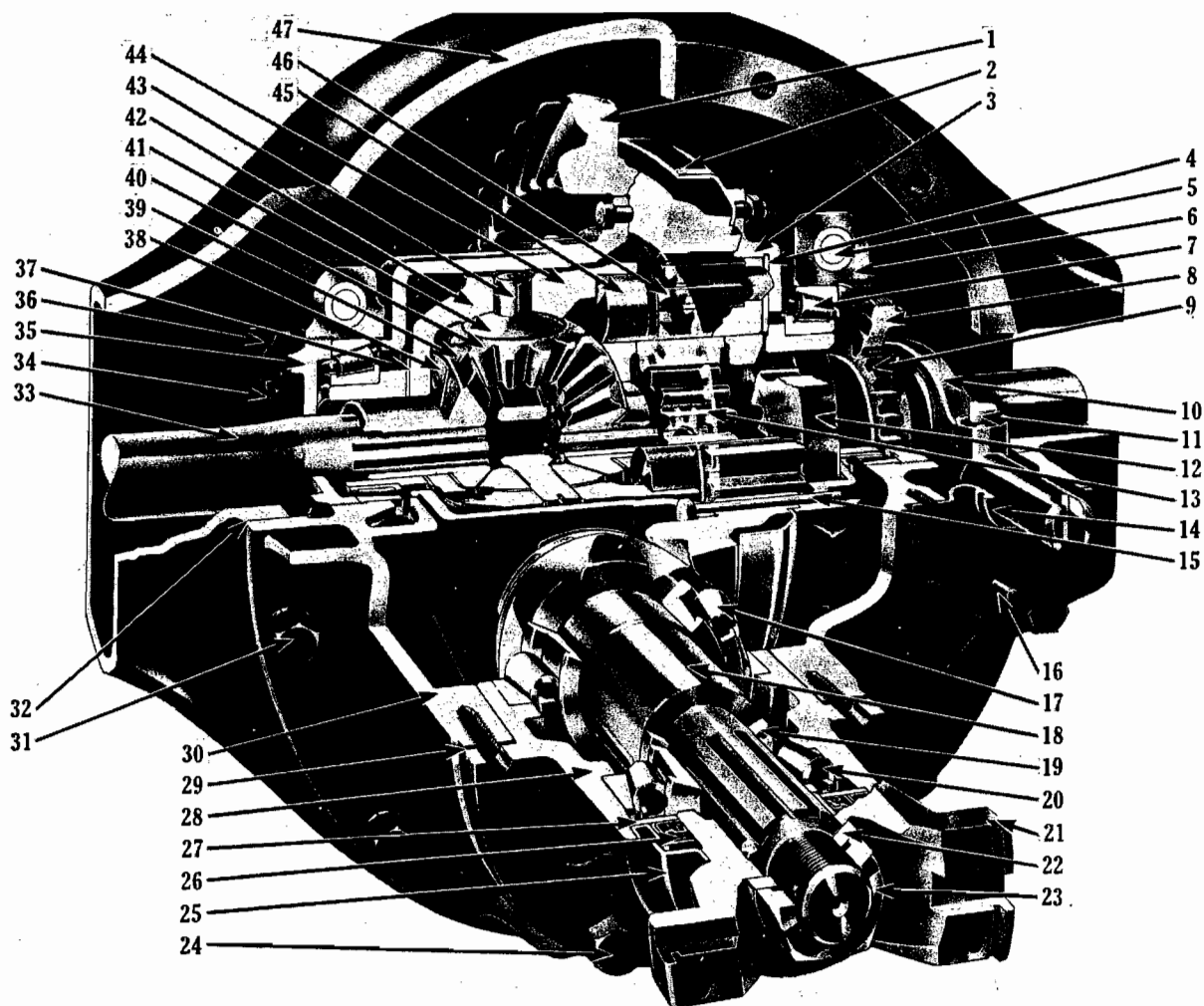
A-22817

Fig. 27 - Sectional View of Hypoid Rear Axle

- | | |
|---|---|
| 1. Axle housing. | 20. Pinion bearing, outer. |
| 2. Hypoid ring gear. | 21. Pinion bearing spacer. |
| 3. Differential bearing cap. | 22. Pinion bearing, inner. |
| 4. Differential bearing cap mounting stud. | 23. Hypoid pinion (straddle mounting). |
| 5. Differential bearing. | 24. Pinion bearing. |
| 6. Differential bearing adjuster. | 25. Differential case bolt lockwire. |
| 7. Oil passage to pinion bearings. | 26. Differential case bolt. |
| 8. Pinion bearing cage shims. | 27. Differential carrier. |
| 9. Pinion bearing cage. | 28. Differential carrier mounting gasket. |
| 10. Pinion oil seal retainer. | 29. Axle shaft. |
| 11. Pinion oil seal. | 30. Differential bearing adjuster lock. |
| 12. Slinger. | 31. Differential side gear thrust washer. |
| 13. Companion flange. | 32. Differential case, plain half. |
| 14. Thrust washer. | 33. Differential side gear. |
| 15. Propeller shaft companion flange nut. | 34. Differential spider pinion. |
| 16. Pinion cage mounting capscrew. | 35. Differential spider pinion thrust washer. |
| 17. Differential carrier mounting capscrew. | 36. Differential spider. |
| 18. Pinion bearing cage cork seal. | 37. Differential case, flanged half. |
| 19. Thrust washers. | |

TWO-SPEED AXLES

SEE SECTION "H" FOR ELECTRIC SHIFT



A-22814

Fig. 1 - Two-Speed Axle (Eaton)

- | | | |
|-------------------------|-----------------------|------------------------------|
| 1. Hypoid ring gear. | 17. Bearing, inner. | 33. Axle shaft. |
| 2. Oil collector drum. | 18. Hypoid pinion. | 34. Bearing adjuster lock. |
| 3. Ring gear case. | 19. Bearing spacer. | 35. Bearing adjuster. |
| 4. Thrust washer. | 20. Bearing, outer. | 36. Bearing cap. |
| 5. Bearing cap stud. | 21. Companion flange. | 37. Thrust washer. |
| 6. Bearing cap. | 22. Washer. | 38. Side gear thrust washer. |
| 7. Carrier bearing. | 23. Nut | 39. Side gear. |
| 8. Clutch plate. | 24. Cage capscrew. | 40. Differential pinion. |
| 9. Sliding clutch | 25. Slinger. | 41. Pinion thrust washer. |
| 10. Shift fork. | 26. Seal. | 42. Differential case. |
| 11. Shift fork shaft. | 27. Washer. | 43. Pinion gear spider. |
| 12. Clutch plate. | 28. Pinion cage. | 44. Ring gear case. |
| 13. Sliding clutch. | 29. Shims. | 45. Idler pinion pin. |
| 14. Diaphragm seal. | 30. Carrier. | 46. Idler pinion gear. |
| 15. Gear case bolt. | 31. Carrier capscrew. | 47. Axle housing. |
| 16. Shifter motor stud. | 32. Gasket. | |



EATON TWO-SPEED REAR AXLE

The two-speed rear axles are full-floating hypoid drive type, having four planetary gears which mesh with an internal gear on the hypoid ring gear.

The primary reduction is accomplished through the hypoid ring gear and a straddle-mounted hypoid pinion. The secondary reduction is accomplished with a sliding clutch serving to lock or unlock the planetary gears.

Servicing

The correct servicing of this unit, as is true with any mechanical equipment, is important to satisfactory operation and life. Servicing the two-speed unit does not require special tools. The ordinary equipment found in most shops is sufficient for this work. Use the following step-by-step procedure for disassembling. Direct reversal of the action will be the proper reassembly procedure. (See Shop Talk No. 1 for step-by-step illustrations on disassembly.)

Disassembly

Remove differential carrier assembly complete from the truck, following the same procedure as you would to take out a single or double reduction unit, except in this case, the two wires on the shift unit must be disconnected. For convenience in handling, the head may be placed in the end of a clean small drum. The opening should be large enough to accept the bevel drive gear and bearing caps. Then proceed as follows:

1. Remove the two shift housing to carrier stud nuts and lockwashers and pull off shift unit assembly. (See section "H" for electric shift instructions.)
2. Remove plug, washer, spring, capscrew, lockwasher and oil distributor.
3. Pull out shift fork shaft after removing shift fork shaft retainer (Fig. 2). The shift fork may then be slipped from the sliding clutch gear and removed through the back of the differential carrier.
4. Slip out sliding clutch gear.
5. Mark right hand differential bearing adjuster with punch. (This is for relocating when reassembling.)
6. Remove bearing cap bolt lockwires on both right and left hand sides. Loosen cap bolts only. Take off right hand bearing adjuster, lock and cotter pin.
7. Remove left hand differential bearing cap adjuster and lock as an assembly to assure correct positioning of gear on reassembly. (When reassembling hold adjuster and bearing cap up away from threads in bore of carrier unit; cap bolts are started. Drop cap; the threads of the adjuster and those in carrier will mesh freely.)
8. After removing bearing caps, tip up left hand end of planetary unit and lift out.
9. Remove pinion bearing cage capscrews.
10. Using a suitable puller, remove pinion assembly from carrier. May also be removed by using a brass drift and tapping lightly from the inside. (Note shims under pinion bearing cage.)
11. Remove pinion shaft nut and slide off companion flange.
12. Lift off pinion bearing cage, bearing, washer and spacer.
13. Drive off pinion bearing cage by tapping lightly between teeth of pinion alternately on opposite sides of inner race. CAUTION: Exercise care so as not to damage bearing during this operation.
12. Remove pinion bearing cone and washer cage assembly. Take out pinion bearing cage cork. (Replace this cork with every repair.)
15. Remove lockwires, nuts and bolts from planetary unit (support case).
16. Tap alternately on opposite sides of ring gear with head of rawhide hammer until gear is free of flange on support case. (When reassembling, use two bolts to assure proper alignment of bolt holes.)
17. Lift off left hand support case and bevel drive gear.
18. Pry off high speed clutch plate and take out idler pinions and pins.
19. Lift out entire differential assembly and remove support case thrust washer.
20. Take out differential case bolt lockwire and remove bolts. (Note short bolts between spider arms.)
21. Lift off right hand differential case. Pick up long hub side gear, right hand, and slip off thrust washer. (Note-chamfered side of washer against back face of gear.)
22. Pull out spider and differential side pinions noting thrust washers behind pinions. Slip washers and pinions off spider arms. Take out short hub side gear, left hand



and remove thrust washer. (Note chamfered side of washer against back face of gear.)

23. Remove differential bearing cones by striking inner race on alternate sides through holes provided in the support case.
24. In reassembling the pinion, use SE-1065 pinion setting gauge in adjusting matched sets of pinions and ring gears to proper cone settings. (Theoretical cone centers for various axles are found under Specifications, Rear Axle Section.)

REASSEMBLY -- IMPORTANT

Assembling Differential Unit

Lubricate both sides of all thrust washers well. Chamfered sides of washers must be against back face of side gears. Lubricate spider arms, side-pinion bores and side-gear hubs. Draw bolts tight with long-handled wrench and securely fasten with lockwire.

Assembling Planetary Unit

Before placing thrust washer, lubricate both sides well. Cover idler-pinion pins with lubricant. Chamfered teeth on high-speed clutch plate must face pinions. Place notches in oil-collector drum between bolt holes in bevel gear. Draw bolts tight with long-handled wrench and secure wire.

Pinion Shaft Bearing Adjustment

Desired bearing tension is obtained by using a spacer of the correct thickness between the bearing inner races. There are 12 spacers, each of different thickness, available for this purpose. To make the assembly, proceed as follows:

1. Place the pinion and bearings in position in the cage using original spacer, providing the pinion did not have any perceptible end movement before disassembly.
2. Then assemble flange washer and flange. Tighten retaining nut securely. There should be no perceptible end play and bearing should roll freely. If correction is to be made select proper size spacer to obtain desired fit.

Assembling Differential Carrier Unit

Lubricate all bearings as they are assembled in carrier. After adjusting gear, be sure cap bolts are tight. Wire bolts securely, including capscrews, in adjuster lock.

Pinion Bearing Pre-Load

Follow instructions given in Hypoid Rear Axle Section "A", page 6.

Differential Carrier Bearing Pre-Load

The correct procedure for securing the specified carrier bearing pre-load, as listed in the Rear Axle Specification for these axles, will be found in Section "A", Hypoid Rear Axles.

Gear Tooth Contact

To secure best possible tooth contact, use SE-1065 pinion setting gauge and follow instructions under this heading, Section "A", page 2. Check results obtained by making a paint impression test of tooth contact. See Gear Adjustment for correct tooth contact - Paint Impression Method, Section "A", page 3.

Lubrication

An oiling system is provided to supply lubricant within a half a turn of the truck wheels to the essential places during conditions when splash and dip alone would be insufficient. A heavy coating of oil is picked up by the oil collector drum and transmitted to the oil scoop. The oil scoop scrapes the oil from the drum and splits it into two courses. One half of this lubricant goes to the pinion bearings; the other half, to the right hand differential and planetary unit to the left differential bearing and then returning to the reservoir.

Whenever a two-speed differential (new or rebuilt) has been installed in the axle housing, fill the oil reservoir to bottom of filler plug opening and replace plug. Then add one additional pint of lubricant using filler hole provided at top of carrier housing just above pinion cage.

Use a hypoid gear lubricant available as ElcoGear Safety "28" or its equivalent. A number of hypoid lubricants are prepared by reputable companies which contain Elco additive concentrates. Viscosity of the hypoid lubricant should be SAE-90. When high atmospheric temperatures (above 100° F.) prevail, SAE-140 may be used. See "Lubrication" section A.

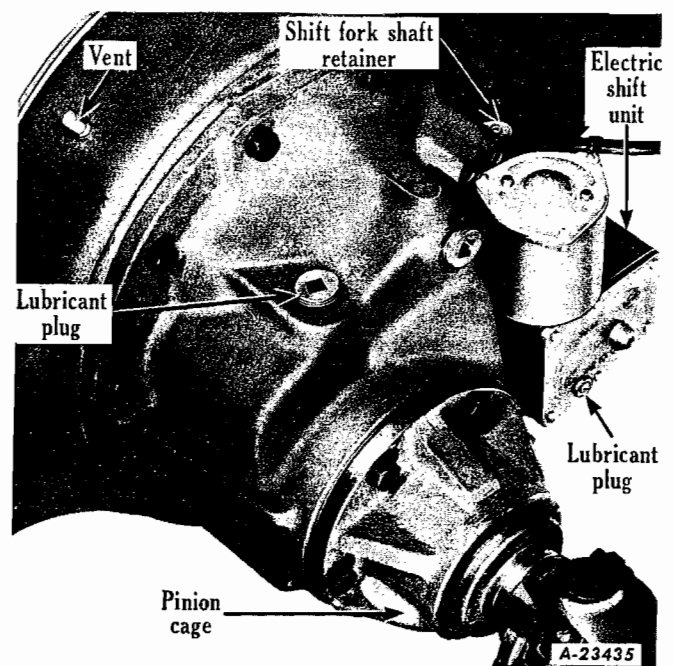
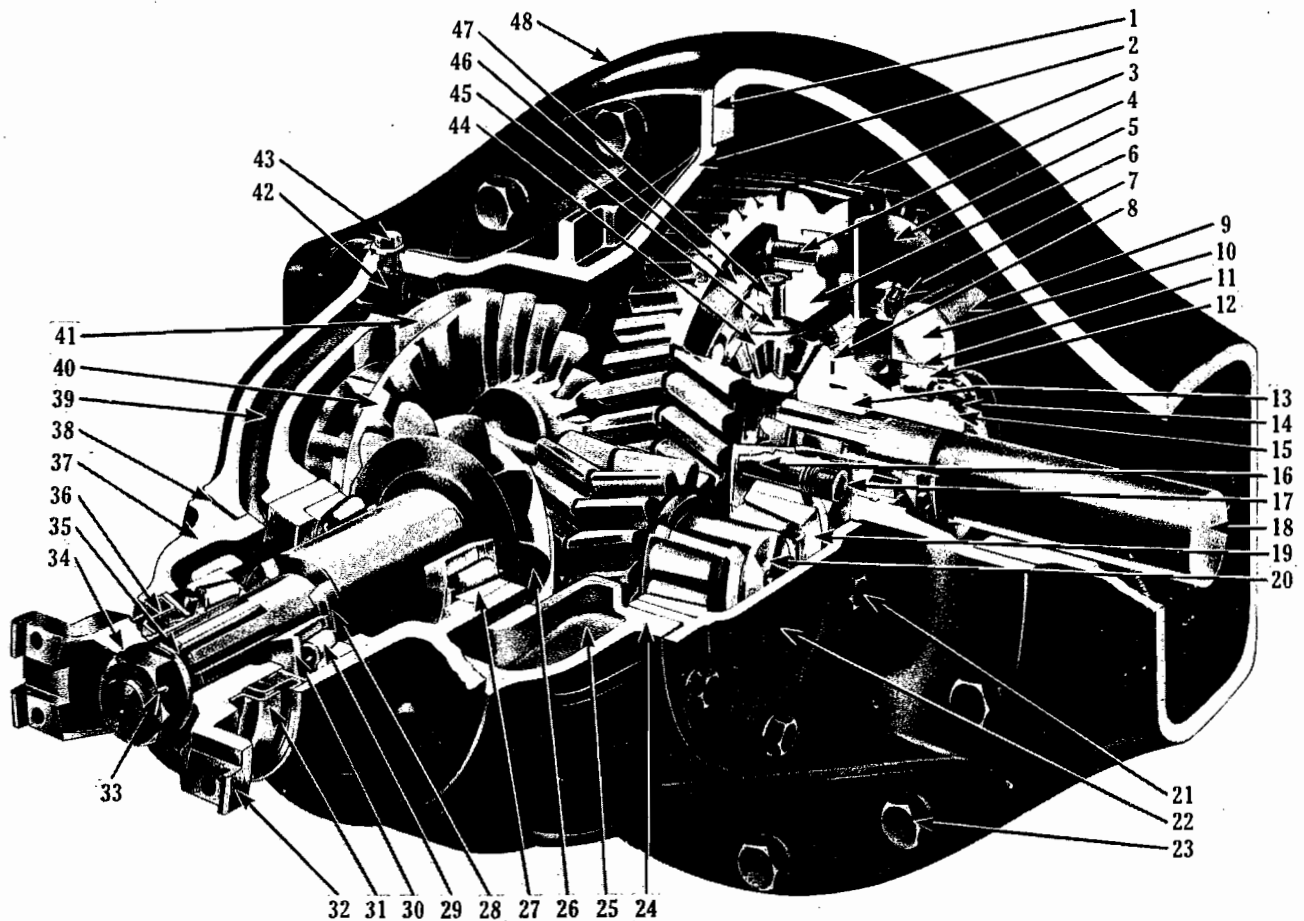


Fig. 2

DOUBLE-REDUCTION AXLE
(EATON)

A-22813

Fig. 1 - Double-Reduction Axle (Eaton)

- | | | |
|--------------------------|---------------------------|---------------------------|
| 1. Carrier gasket. | 17. Spring and plug. | 33. Cotter pin. |
| 2. Carrier. | 18. Axle shaft. | 34. Nut. |
| 3. Herringbone gear. | 19. Countershaft bearing. | 35. Washer. |
| 4. Gear rivet. | 20. Pinion countershaft. | 36. Oil seal. |
| 5. Oil distributor disc. | 21. Cage capscrew. | 37. Bearing cage. |
| 6. Case, flanged half. | 22. Bearing cage. | 38. Cage shims. |
| 7. Case bolt and nut. | 23. Carrier capscrew. | 39. Oil passage. |
| 8. Thrust washer. | 24. Cage shims. | 40. Hypoid ring gear. |
| 9. Bearing cap. | 25. Oil reservoir. | 41. Oil distributor disc. |
| 10. Cap stud. | 26. Hypoid pinion. | 42. Oil scoop. |
| 11. Lock ring. | 27. Bearing, inner. | 43. Oil scoop capscrew. |
| 12. Bearing. | 28. Bearing spacer. | 44. Spider pinion. |
| 13. Side gear. | 29. Bearing, outer. | 45. Pinion thrust washer. |
| 14. Thrust washer. | 30. Washer. | 46. Case, plain half. |
| 15. Lock ring. | 31. Slinger. | 47. Spider. |
| 16. Oil scoop. | 32. Companion flange. | 48. Axle housing. |



EATON DOUBLE-REDUCTION REAR AXLE

The Eaton double-reduction rear axles, shown in Fig. 1, are heavy-duty, double reduction type. The primary reduction is through a hypoid ring and pinion gear while the secondary reduction is through a set of herringbone gears.

Primary Reduction

The primary reduction gears are the hypoid type, consisting of a hypoid pinion mounted on the forward end of the carrier housing, and meshed with a hypoid ring gear which is riveted to an integral flange on the ring gear shaft. This shaft also carries, as an integral part, the herringbone drive pinion for the secondary reduction.

Secondary Reduction

The secondary herringbone reduction gears consist of a drive pinion and a mating gear. The teeth on the secondary reduction gears are right and left-hand spiral cut in line with each other, forming a "V", the apex of which is at the center of the gear face. A center cut through the apex breaks the tooth line into two separate and opposed spiral gears, each exerting equal and opposed pressure thus balancing the end thrust.

Installing New Herringbone Drive Gear (Differential Case)

If new gears are being installed, the pilot diameter on differential case drive gear flange should be checked to see that it runs true. If inspections indicate a run out of .004", a new differential case should be installed. When assembling drive gear on face of flange, make sure each rivet is tight. The best results are obtained if a press is used to install rivets. Follow the instructions outlined under Rivet Pressures on page 8, Section "A".

Hypoid Pinion Shaft and Adjustment

Adjustable hypoid pinion bearings are assembled to pinion shaft and retained by universal joint flange and nut on forward end of pinion shaft.

A spacer (available in several thicknesses) is used to maintain correct distance between front and rear bearings and to secure the pinion bearings pre-load as indicated in Rear Axle Specifications. The pinion cage is mounted in the conventional manner and the correct cone center adjustment is secured by means of a shim pack under pinion cage flange. See SE-1065 Pinion Setting Gauge, Section "A", page 2).

IMPORTANT: Hypoid drive pinion oil seals must be soft and pliable before being installed if the seals have become dried out and hard while in stock, use kerosene and work it in thoroughly. When seal has become soft and pliable, dip it in hot oil and work this oil in thoroughly.

Pinion Bearing Lubrication

NOTE: When reassembling differential to axle housing, or new and dry differential is used from stock, be sure to inject about one pint of differential lubricant into the pinion bearing housing through the filler plug opening at the side of the carrier. This will provide immediate lubrication for the pinion bearings upon placing the unit in operation.

Herringbone Gear Shaft (Cross Shaft)

The herringbone drive pinion gear shaft is mounted at right angles to the hypoid pinion shaft in the carrier housing. This shaft is a one-piece steel forging consisting of an integral herringbone gear in the center and an integral flange on one end to which is bolted a hypoid ring gear.

To remove this shaft, it is necessary to remove the differential and herringbone ring gear assembly. Then withdraw the hypoid pinion and cage assembly far enough to clear the hypoid ring gear, when being removed. (Removal of universal joint flange is unnecessary.) Remove both bearing covers and using a soft hammer, tap ring gear end of shaft until the bearing cup at opposite end of shaft is removed from carrier housing. This will permit sufficient opening to partly pass shaft through until bearing is clear of carrier housing at ring gear end of shaft. Tilt ring gear end of shaft to rear and withdraw from carrier.

The cross shaft bearing covers control the hypoid pinion and ring gear backlash and tooth contact as well as the bearing pre-load. This is accomplished by means of a shim pack under each bearing cover.

Herringbone Gear Adjustment

Herringbone gears are not adjustable for backlash. This clearance is taken into account in the construction and remains constant as long as the gears remain undamaged or the differential carrier bearings are not worn excessively.

The self-aligning differential carrier bearings eliminate the need for adjustment to align the herringbone pinion and herringbone ring gear. The heavy duty roller bearings permit



the differential carrier to move sidewise within the bearing race sufficiently to keep both gears in perfect alignment at all times.

Differential

Differential is conventional four-pinion type with thrust washers back of side gears and pinions. Cases are supported on heavy duty roller bearings.

Differential Lubricators

The double reduction axles have special provision incorporated to supply oil to the herringbone pinion shaft bearings as well as the hypoid pinion shaft bearings. This is accomplished by scooping lubricant from oil collector discs mounted on the herringbone gear and the hypoid ring gear. The lubricant is picked up from these discs by oil scoops and circulated through special passages to the differential carrier bearings and the herringbone pinion shaft bearings. Fig. 2 illustrates the flow of oil and the principal of this means of bearing lubrication.

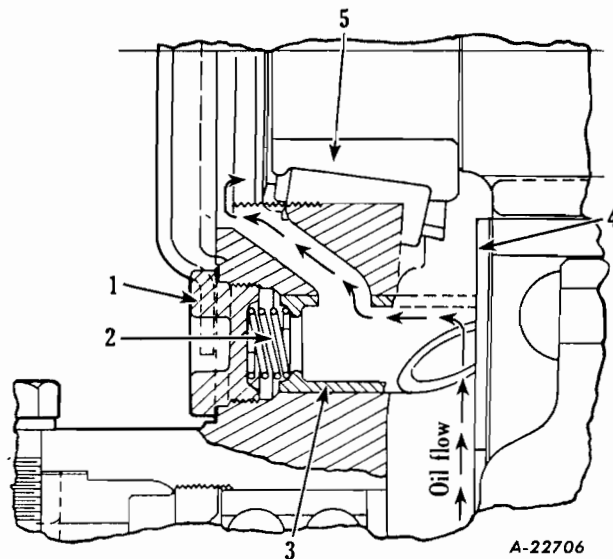


Fig. 2

Lubrication of Hypoid Axles

The lubricant used in hypoid axles is an important factor in obtaining long gear life and satisfactory drive unit service. Past experience proves that a large portion of service problems can be traced to using incorrect, or lubricant of poor quality.

In the selection of Hypoid Lubricants, it is advisable to consider using products of unquestionable quality.

Because of the higher unit pressures and sliding tooth characteristics of hypoid gearing, the lubricant must have properties which enable it to withstand these actions.

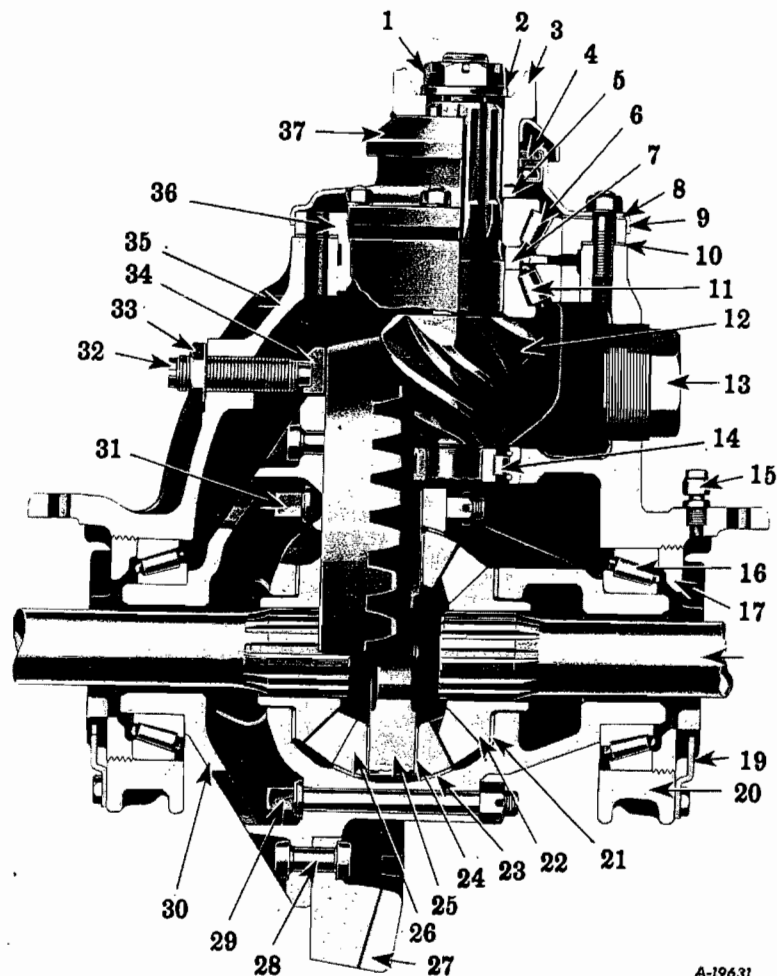
It is important that the axle hypoid gearing receive initial lubrication after overhaul, or when a vehicle has been standing in storage, and **BEFORE THE AXLE IS SUBJECTED TO HEAVY LOADS**. Good practice is to check the lubricant level in the axle housing then, jack UP BOTH rear wheels and operate the vehicle in high transmission gear at approximately 25 miles per hour for five minutes. This will assure thorough lubrication of the gearing before the unit is placed into service. (Do not allow one wheel to race faster than the opposite wheel.)

Where the axle pinion cage is provided with a plug at the pinion cage, insert one pint of lubricant to provide initial lubrication for the pinion bearings.

NOTE: When reassembling the differential gears, thrust washers, cross shaft spur gears and bearings, lubricate the wearing surfaces with a light coat of the specified axle lubricant. This will help provide initial lubrication.

Use a hypoid gear lubricant available as ElcoGear Safety "28" or its equivalent. A number of hypoid lubricants are prepared by reputable companies which contain Elco additive concentrates. Viscosity of the hypoid lubricant should be SAE-90. When high atmospheric temperatures (above 100 F.) prevail, SAE-140 may be used.

SINGLE-REDUCTION AXLE (TIMKEN 100 SERIES AXLES)



A-19631

Fig. 1 - Single-Reduction Timken 100 Series Axle

- | | |
|-----------------------------------|------------------------------------|
| 1. Pinion shaft nut. | 19. Adjusting nut lock. |
| 2. Pinion shaft nut washer. | 20. Differential bearing cap. |
| 3. Companion flange or yoke. | 21. Side gear thrust washer. |
| 4. Oil seal. | 22. Side gear. |
| 5. Thrust washer. | 23. Pinion thrust washer. |
| 6. Pinion bearing, outer. | 24. Pinion bushing. |
| 7. Pinion bearing spacers. | 25. Differential spider. |
| 8. Cover gasket. | 26. Pinion gear. |
| 9. Bearing cover. | 27. Bevel drive gear. |
| 10. Pinion bearing cage shims. | 28. Rivet. |
| 11. Pinion bearing, inner. | 29. Differential pan bolt, long. |
| 12. Pinion. | 30. Differential case. |
| 13. Lubricant filler plug. | 31. Differential case bolt, short. |
| 14. Pinion radial bearing. | 32. Thrust block adjusting screw. |
| 15. Breather. | 33. Lock nut. |
| 16. Differential side bearing. | 34. Thrust block. |
| 17. Adjusting nut (differential). | 35. Differential carrier. |
| 18. Axle shaft. | 36. Pinion bearing cage. |
| | 37. Slinger. |



TIMKEN SINGLE-REDUCTION AXLES

Description

The Timken Single-Reduction Rear Axle (R-100) is a full-floating, hypoid-type final drive, assembled in a one-piece axle housing.

The differential used in the R-100 Timken Single-Reduction Axle is of four-pinion-type with thrust washers used between the pinions and case. The pinions contain bushings which can be renewed when necessary. Thrust washers are also used between the side gears and case. The two halves of the differential case are machined as a complete assembly and must be replaced as such.

Removal of Differential Carrier - Hypoid

To remove the differential carrier assembly, remove plug from bottom of axle housing and drain out the lubricant. Disconnect the propeller shaft at front end of pinion shaft. (Be sure to replace the universal joint trunnions on their respective journals and hold them in place with a short loop of wire until ready to reassemble.) Remove axle shafts and differential carrier to housing capscrews (or stud nuts on heavy-duty axles), and take out carrier.

When removing the differential from the axle housing, it will be necessary to utilize the two puller screws to loosen the differential carrier as shown in Fig. 2.

The differential thrust block screw shown in Figs. 3 & 4 must be removed before the differential can be removed from the carrier.

Differential

The differential assembly of this axle consists of four nine-tooth pinions mounted on a spider and two 16 tooth side gears all assembled into the differential case -- one half being flanged to mount the hypoid ring gear.

Hardened steel thrust washers are installed between the side gears and the case and between the pinions and the case. The differential case is held together by twelve bolts, eight of which are longer than the remaining four.

Differential Disassembly

Mark each half of the differential case before teardown so that they can be reassembled in the original position. Wash and inspect all parts and replace any which are at all questionable. Oil all parts with gear oil before reassembly. Use new lockwashers when reassembling.

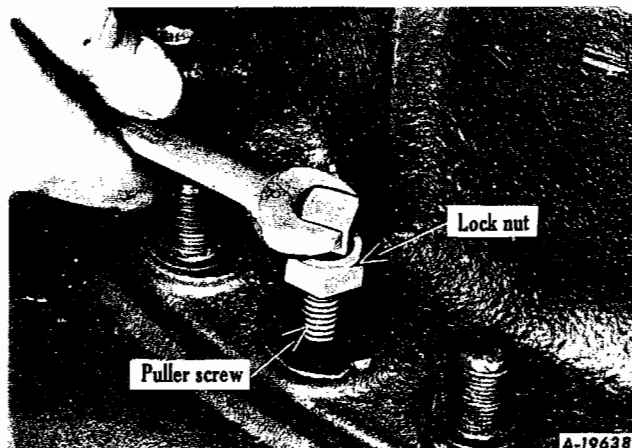


Fig. 2 - Loosen lock nuts on two puller screws provided, and turn puller screws down into carrier. It may be necessary to break carrier loose from housing by striking the carrier with a heavy soft hammer (lead or leather).

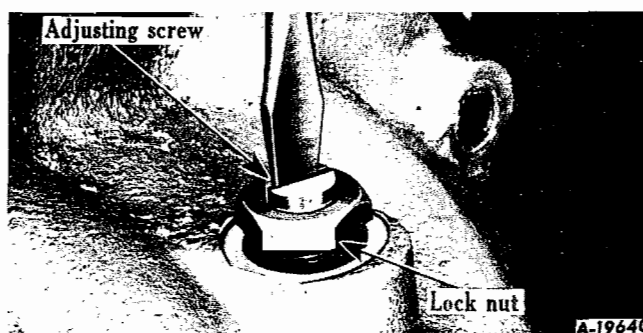


Fig. 3 - Place differential carrier in suitable holding fixture or overhaul stand, and loosen the lock nut on the drive gear thrust block adjusting screw. Remove thrust block adjusting screw from carrier. This will permit the thrust block to fall into the carrier.

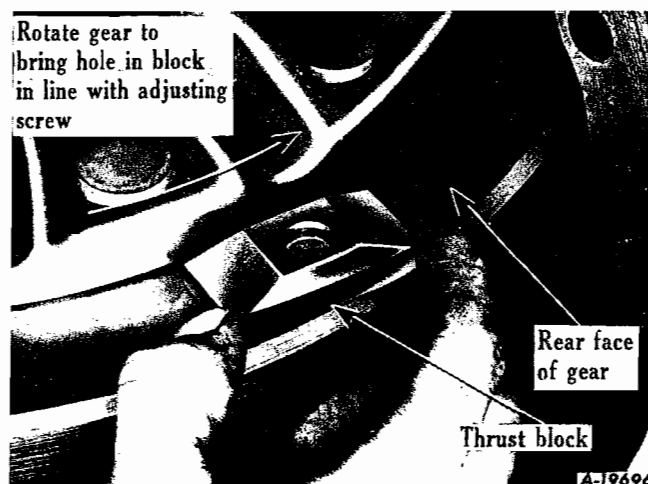


Fig. 4 - When replacing thrust block, place block on gear and rotate gear to bring block in line with adjusting screw.

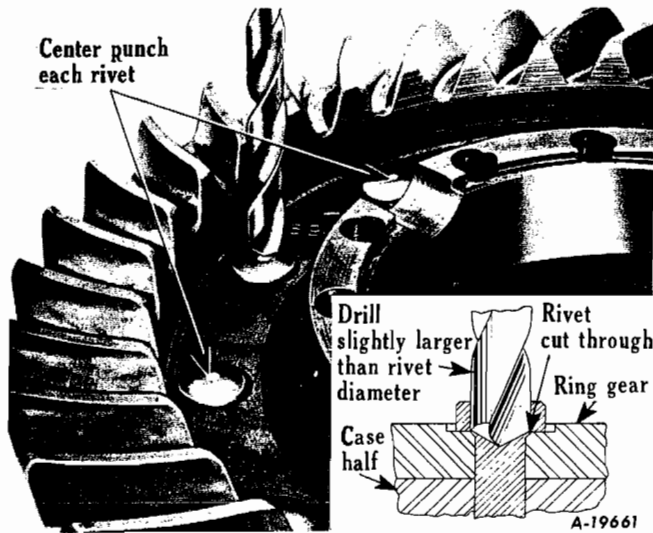


Fig. 5 - If it is necessary to remove the ring gear from the differential case half, carefully center punch each rivet in the center of the rivet-formed head as shown. Drill through the center of each rivet-formed head, using a drill slightly larger than the body of the rivet. Punch or press rivet out of gear and case half.

If inspection reveals that the ring gear should be replaced, exercise care when removing the ring gear rivets. Fig. 5 shows the correct way to remove the ring gear rivets to avoid damage to the differential case.

The four differential spider pinion gears run on bronze bushings and where they are found to be worn excessively, the bushings can be replaced. Cut the old bushings out of the pinions and using the special tool shown in Fig. 6, install and burnish the new bushings in the pinions.

Bronze bushings are burnished by means of a stud ball which, when being pressed through the pinion bushings, compresses the bushing metal, giving a denser surface and tighter fit in the pinion. The burnishing operation also locks the bushings in place in the pinion, since some of the bushing metal is compressed into the locking groove located on the inside bore of the pinion. The correct size ball should be approximately .005" larger than the spider pinion bushings. Do not attempt to ream the spider pinion bushings.

Pinion

The pinion cage can easily be withdrawn, from the differential carrier with the use of puller screws provided.

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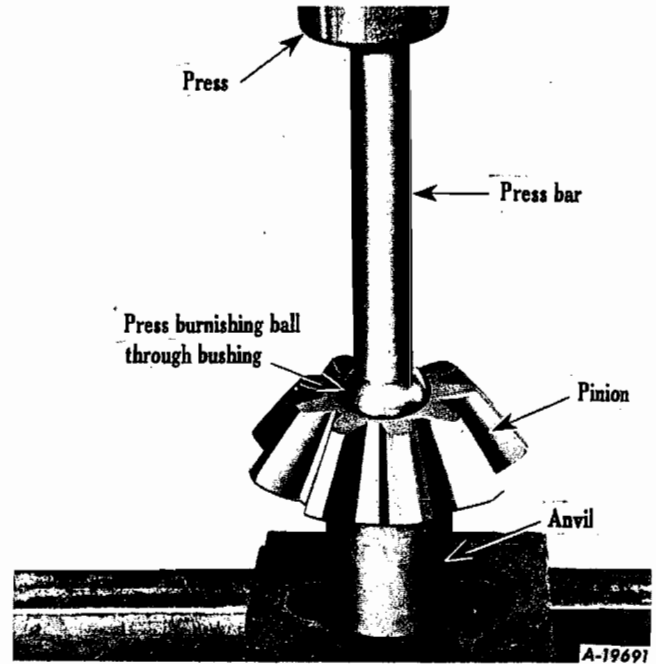


Fig. 6 - Use bar to press burnishing ball through bushing. The correct size ball should be approximately .005" larger than the differential spider trunnion.

Remove the pinion shaft from the pinion cage on a press. Remove the inner pinion bearing with a suitable puller. The inner radial bearing retainer is removed after removal of the retainer screw.

Pinion Bearing Pre-Load

When the pinion shaft, bearings, bearing spacers and pinion cage have been reassembled,

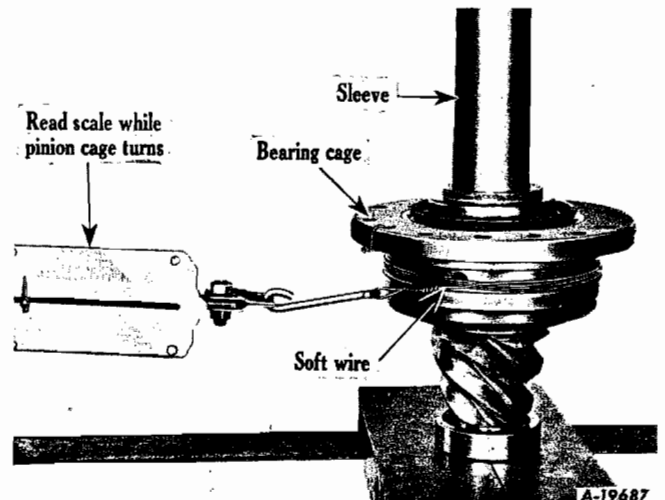


Fig. 7 - Checking pinion bearing pre-load using torque method.



be sure to check the bearing pre-load. Attach a scale to the end of a soft wire wrapped around the pinion cage as in Fig. 7. Read the scale only when pinion cage is moving (rotating torque). If first adjustment does not result in correct pre-load, select a thicker combination of spacers to decrease, or use thinner combinations of spacers to increase the bearing pre-load. The rear axle specifications list the correct bearing pre-load for these axles.

Gear Adjustment for Correct Tooth Contact

Checking tooth contact is accomplished by means of oiled red lead applied lightly to the bevel gear teeth. When the pinion is rotated, the red lead is squeezed away by the contact of the teeth, leaving bare areas the exact size, shape and location of the contacts.

Gear Adjustment for Lash

Generally, if original gears are being re-installed, red leading of teeth will not indicate the same contact as new gears and can be misleading. Gears that have been in service for long periods form running contacts due to wear of teeth; therefore, the original shimpack should be maintained to check gear lash. Gear lash, when using original gears, can be reduced only to a point of smooth rotation of gears.

If the gear lash is in excess of maximum tolerance as stated under gear adjustment, the lash may be reduced only in the amount that will avoid overlap of the worn tooth section. Rotate the gears and check for smooth or rough operation. If a slight overlap, takes place at the worn tooth section, rotation will be rough.

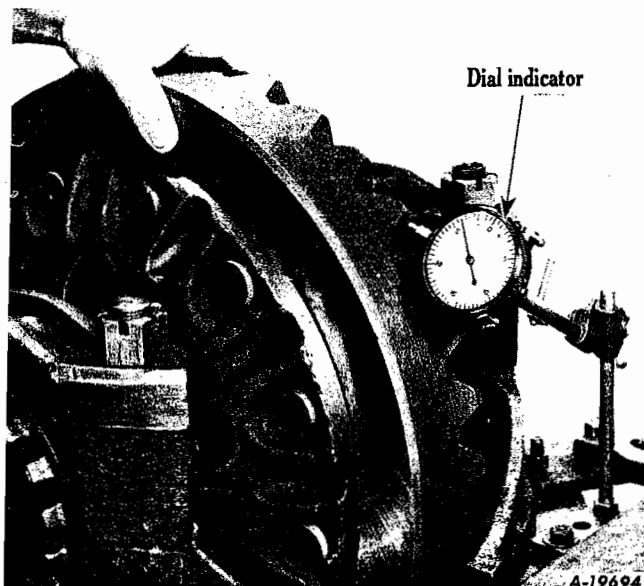


Fig. 8 - Checking gear lash.

When installing new gears, check gear lash with dial indicator (Fig. 8) and adjust to obtain .006" to .012" lash as follows:

1. To move pinion toward gear, remove shims from pack under pinion cage.
2. To move pinion away from gear, add shims under pinion cage.
3. To move gear, tighten or loosen differential bearing adjusting nuts as required.

After correct gear lash is secured, check and adjust as necessary to obtain the correct tooth contact. (See gear Adjustment for correct tooth contact.)

Adjust Differential Bearing Pre-Load

Using dial indicator at back face of ring gear (Fig. 9), adjust to obtain bearing pre-load as follows:

1. Loosen adjusting nut on side opposite gear teeth only enough to notice end play on indicator.
2. Tighten same adjusting nut only enough to obtain .000" end play reading on indicator.

NOTE: While gear is held in .000" end play and before loading bearings, check gear for runout. If runout exceeds .008", remove differential and check for cause.

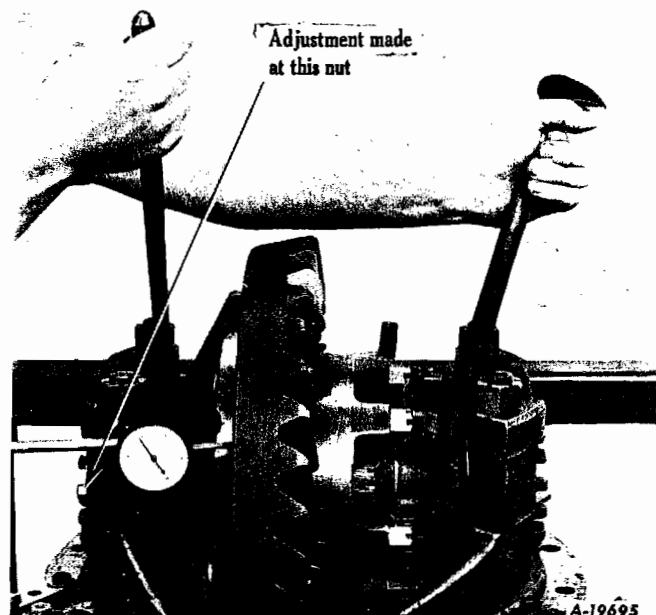


Fig. 9 - Adjusting differential bearing pre-load.



3. Tighten BOTH adjusting nuts one notch each from .000" and play to pre-load differential bearings.
4. Tighten bearing cap stud nuts to specified torque (L-100 and R-100 Axle). (Rear Axle Specifications).
5. Install adjusting nut locks, capscrews and lock wires.

Thrust Block Installation

Turn carrier assembly to bring back face of ring gear facing upward and install the thrust block as follows:

1. Place thrust block on rear face of gear and rotate gear until hole in thrust block is aligned with the adjusting screw hole. NOTE: A light coating of grease placed on the thrust block face will serve to hold the block in position on the rear face of the gear.

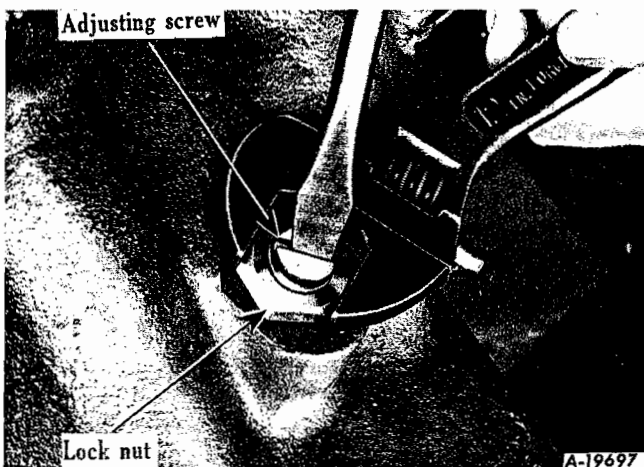


Fig. 10 - Adjusting clearance of thrust block. Turn adjusting screw out of carrier 1/4 turn to obtain .010 to .015 inch clearance.

2. Install adjusting screw and lock nut. Tighten adjusting screw to force thrust block against gear, then back off one quarter (1/4) turn and lock securely with lock nut (Fig. 10). Clearance between back face of gear and thrust block is .010 to .015". CAUTION: Be sure that the adjusting screw end is seated properly in the thrust block hole.

Lubrication

1. Remove inspection and oil filler plug (Fig. 1) and fill to level of plug hole with specified lubricant. Capacity for the R-100 axle is 30 pints (30 lbs.). Capacity of the L-100 axle is 23 pints (23 lbs.).
2. Jack up BOTH rear wheels and operate vehicle in high transmission gear at approximately 25 miles per hour for five minutes to assure proper lubrication of all parts before the unit is put into service.

Both wheels should rotate at approximately the same speed while the vehicle is jacked up. Do not allow one wheel to race faster than the opposite wheel. To do so might cause serious damage to the differential spider and gears.

Use SCL, EP gear oil or a multi-purpose gear lubricant suitable for hypoid axles and supplied by a reputable refinery. SAE-90 for cold climate and SAE-140 for warm climate.

DOUBLE-REDUCTION TWO-SPEED AXLE (TIMKEN 300 SERIES AXLES)

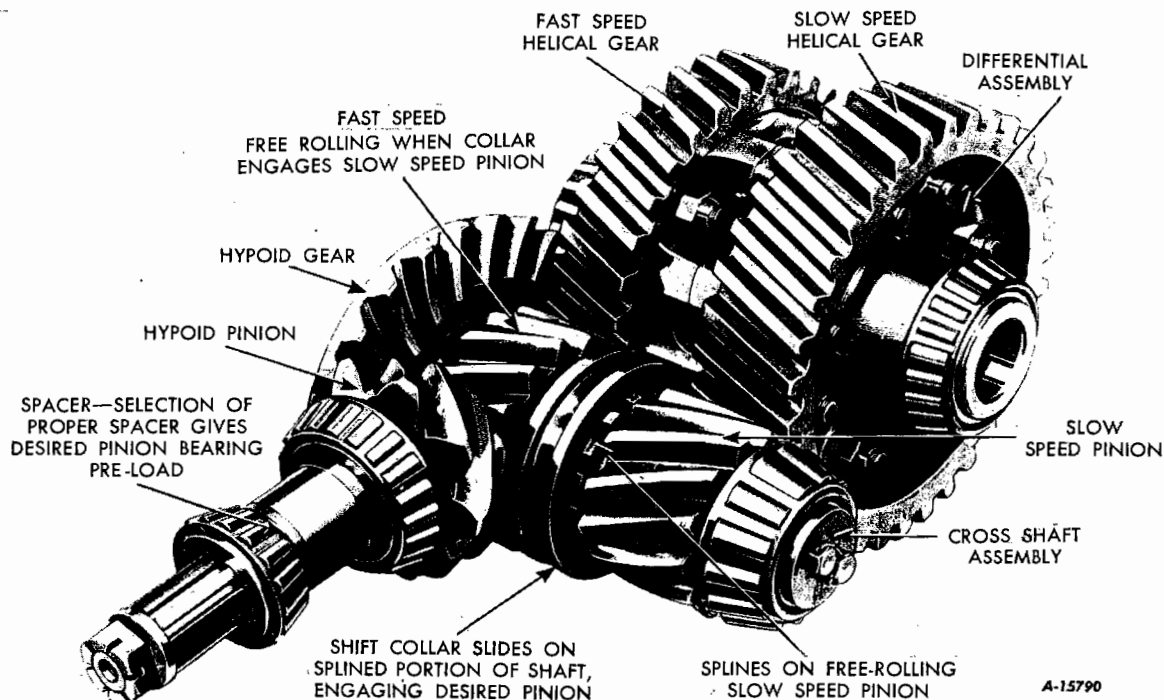


Fig. 1 - Two-speed Double-Reduction Drive Unit

Description

The Timken Two-Speed Double-Reduction Final Drive Differential (Fig. 7) provides two gear ratios--actually two full size final drives in one unit; a "fast" ratio for maximum speed and a "slow" ratio for maximum pulling power. This feature enables the truck driver to use the proper axle gear combination required for speed, load and road conditions.

Operation

The first reduction in the Timken Two-Speed Double Reduction Drive Axle is through a heavy duty hypoid bevel pinion and gear. The hypoid bevel pinion and gear set operates in conjunction with either of two sets of wide-face helical spur gears and pinions of different ratios. This second reduction is selective between a fast or slow ratio.

The bevel pinion is mounted on two tapered roller bearings in a pinion cage. The bevel gear is locked on the cross shaft by a key. The cross shaft is mounted on tapered roller bearings and carries two free-rolling helical spur pinions. Both spur pinions engage helical spur

gears attached to the tapered roller bearing mounted differential.

On the inner side of each of the spur pinions are integral splines. On the cross shaft are two rows of splined teeth. A shift fork, actuated by an electric power shift unit, moves the shift collar on the splined portion of the cross shaft to engage the splines on the fast or slow speed spur pinion. See Fig. 4.

When the fast axle speed is selected and torque released, the shift collar is moved toward the fast speed spur pinion, and at the same time disengages the splines on the slow speed spur pinion. The fast speed spur pinion then revolves as part of the cross shaft to drive the fast speed spur gear. During this operation the slow speed spur pinion is disengaged so as to rotate freely on the cross shaft. Power is transmitted through the hypoid pinion and gear, cross shaft, clutch collar, fast speed spur pinion and gear, differential and axle shafts.

When the slow speed is selected and torque released the shift collar moves in the opposite direction disengaging the fast speed spur pinion and locking the slow speed spur pinion as part of the cross shaft. Power is then transmitted through the slow speed spur pinion and gear, differential and axle shafts.



The design of the shift collar prevents disengagement until the opposite gear ratio is selected and torque released.

Adjustments and Clearances

Various clearance adjustments are provided for both in the axle gearing and shifting mechanism. These adjustments once made, seldom need attention. Where a disassembly job is to be performed, the detailed information found in Shop Talk No. 34 will be most helpful.

Hypoid Pinion and Cage

The pinion and bearings are installed in the pinion cage with a pre-load secured by following the instructions under Pinion Bearing Pre-Load, Sec. A. The pre-load is controlled by proper selection of spacers, or combination of spacers, located between the outer pinion bearing and bearing seat on the pinion shaft (Fig. 1). These spacers are ground to close tolerances and are available in graduated thicknesses. Thicker spacers decrease bearing pre-load and thinner spacer increase bearing pre-load. For correct procedure see pinion bearing adjustment for correct pre-load, Sec. A.

When installing the pinion cage assembly in the differential carrier, be sure that the oil passage holes in the carrier housing, gasket, shim pack and pinion bearing cage are aligned. When the original gears are being reinstalled use the original shim pack plus a new gasket under the pinion cage.

Hypoid Ring Gear and Cross Shaft

The hypoid ring gear is assembled on the cross shaft by pressing the gear firmly against the cross shaft shoulder (Fig. 2). To facilitate

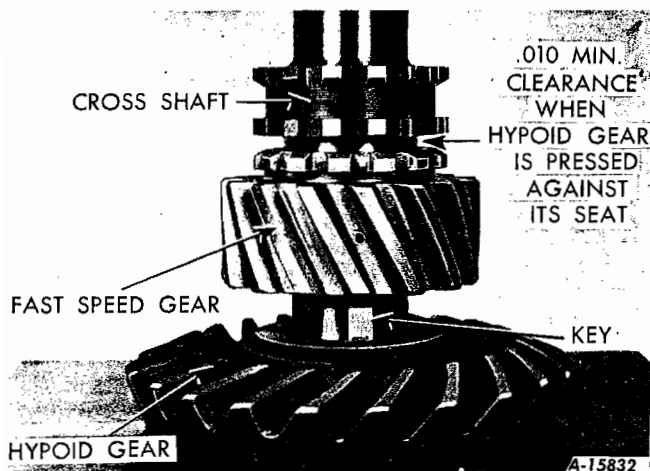


Fig. 2 - Pressing hypoid gear on cross shaft.

installation the gear may be heated to 200 to 250° F. Be sure the key is in line with the key slot in the gear before pressing the gear into place.

The fast speed pinion located between the hypoid ring gear and splined teeth on the cross shaft should have an end play of at least .010". Normal end play will be from .015" minimum to .030" maximum. The slow speed pinion end play must also check to a minimum of .010". The shift collar is installed over the springs and poppets with the longer splines on the inside diameter of the collar toward the hypoid ring gear.

The cross shaft bearing pre-load is measured by wrapping wire around the slow speed pinion and pulling with a scale to a reading of approximately 8 pounds rotating torque (not starting torque), (Fig. 3).

To obtain correct pre-load add or remove shims at shim pack under bearing cage on cross shaft end opposite ring gear. Use original shim packs plus a new gasket when re-installing original gears.

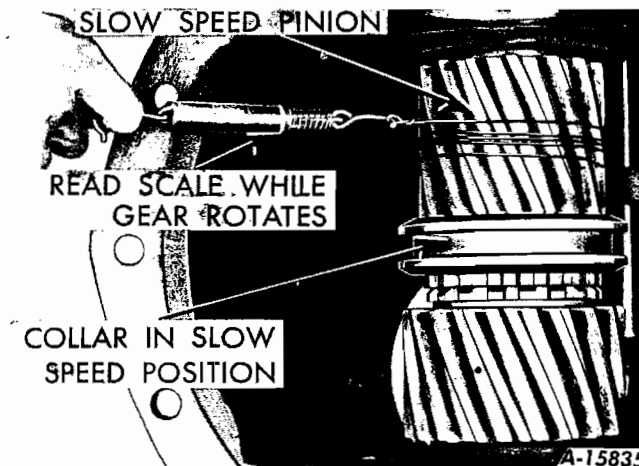


Fig. 3 - Checking cross shaft pre-load.

Gear Tooth Impression and Lash

When the hypoid gear set has been renewed, adjust gear back lash with dial indicator, and adjust to obtain .006" to .012" lash. Movement of the gears is controlled as follows:

1. To move pinion toward ring gear, remove shims from pack under pinion cage.
2. To move pinion away from ring gear, add shims to pack under pinion cage.
3. To move ring gear away from pinion, remove shims from pack under cross shaft bearing cage (side opposite ring gear) and add shims of equal thickness to pack under



cross shaft bearing cage (ring gear side). Shims should be transposed in this manner to maintain the established pre-load.

4. To move ring gear toward pinion, remove shims from pack under cross shaft bearing cage (ring gear side) and add shims of equal thickness to pack under cross shaft bearing cage (side opposite ring gear). Shims should be transposed in this manner to maintain the established bearing pre-load.

When correct gear lash is obtained, check and adjust as necessary to obtain correct tooth contact using oiled red lead applied lightly to the ring gear teeth. Gear tooth impression illustrations are shown in Section "A," pages 3 and 4.

Shift Collar Adjustment

The shifting collar serves as the lock between the cross shaft and either the high or the low speed spur pinions. When engaged with either speed spur pinion the collar must be flush against the spur pinion face (Fig. 4). The collar is held flush against the pinions by three spring loaded poppets located in the cross shaft, and unless there is misadjustment in the location or travel of the shifting fork the collar will seat itself against whichever gear is selected.

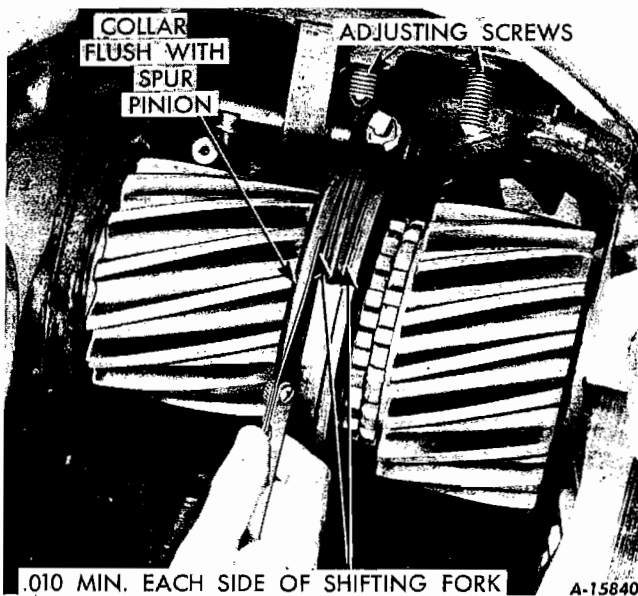


Fig. 4 - Checking clearance between shift collar and spur pinion. Clearance should not be less than .010".

To check the travel of the collar when the differential is mounted on the axle housing it is necessary to remove the pinion cage assembly. Illustrations show details of the checking procedure with the carrier removed from the axle housing and the differential gear assembly removed.

Check clearance of shift fork collar (flat) faces in shift collar with feeler gauge (Fig. 4). The clearance should not be less than .010" minimum on each side of the fork in both the fast and slow speed positions. When checking this clearance the shift collar must be flush with the end face of the spur pinion in both fast and slow positions.

Shims located at the shifting chamber bracket regulate the travel range of the shift rail and fork. Add or remove shims to allow the shift collar to seat flush against the spur pinions in both high and low positions (Fig. 5 & 6). The electric shift chamber and bracket assembly must be removed from the carrier in order to remove shims.

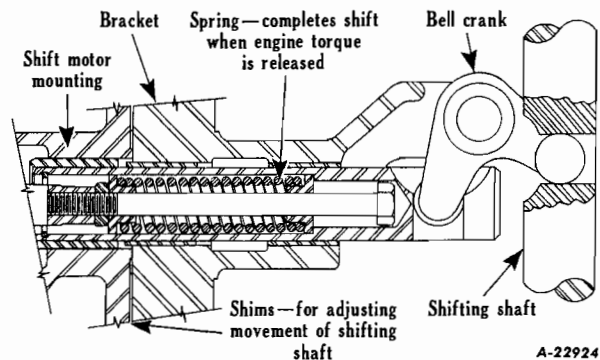


Fig. 5 - Details of front mounted electric shifting mechanism. Note location of shims for travel adjustment.

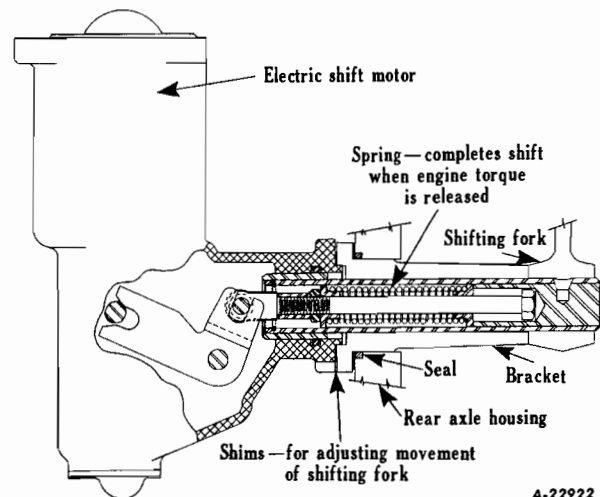


Fig. 6 - Showing details of side mounted electric shift mechanism. Shims are provided to adjust travel of shift fork. Overhaul procedure for the electric shifting unit is given in the Electric Shift Section "H".

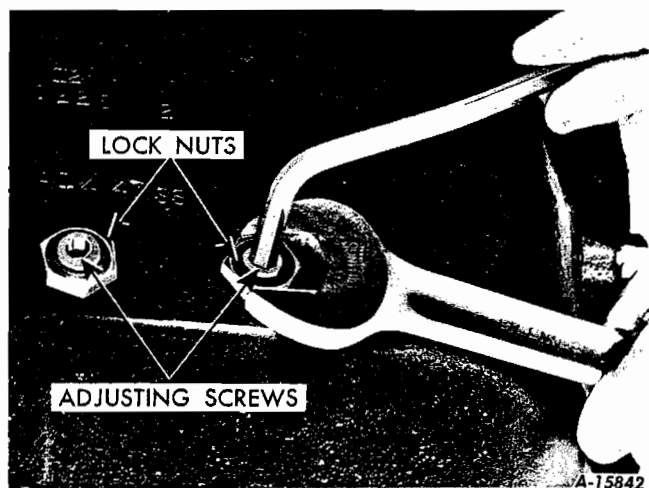


Fig. 7 - Adjusting stop screws to limit travel of shifting fork. Fig. 4 shows point of contact of the screws with the shifting collar.

Adjusting screws located on top of the carrier housing (Fig. 7) provide means of limiting the travel of the shifting fork and rail. Turn in or out on each adjusting screw to stop the travel of the shifting fork so that the fork does not bear against the sides of the shifting collar after the collar is seated flush with the spur pinion face in both high and low positions. There must be a minimum of .010" clearance between the fork and shift collar. This clearance is to assure that the collar is free of shifting fork interference and allows the poppets to hold the collar against either of the spur pinions. Also the .010" minimum clearance is running clearance between the forks and collar sides to prevent unnecessary wear to the two parts.

Differential Adjustment

The differential assembly is installed in the carrier with the helical gears located to provide approximately 1/16" clearance between the helical gear sides and shift collar faces in both the fast and slow speed positions. Move the differential assembly from side to side to obtain this adjustment by turning on the adjusting nuts.

Using dial indicator at the side face of one of the helical gears adjust to no end play (.000" end play), in the differential bearings. Rotate assembly several times to assure normal bearing contact. Tighten adjusting nuts one notch each from .000" end play to secure the correct differential bearing pre-load.

With the dial indicator contacting the side face of the helical gear check for runout. If runout exceeds .008" remove differential and check for cause.

Lubrication

1. Before starting new truck and after overhaul, remove pipe plug at pinion cage and insert one pint of specified lubricant.
2. Fill axle housing to correct level with specified lubricant. Capacity is 18-1/2 quarts (37 lbs.).
3. Jack up BOTH rear wheels and operate vehicle in high transmission gear at approximately 25 miles per hour for five minutes to assure proper lubrication of all parts before the unit is put into service.

Both wheels should rotate at approximately the same speed while the vehicle is jacked up. Do not allow one wheel to race faster than the opposite wheel. To do so might cause serious damage to the differential spider and gears.

Use SCL, EP gear oil or a multi-purpose gear lubricant suitable for hypoid axles and supplied by a reputable refinery. SAE-90 for cold climate and SAE-140 for warm climate.

When reassembling the differential gears, thrust washers, cross shaft spur gears and bearings lubricate the wearing surfaces with a light coat of specified axle lubricant. This will help provide initial lubrication.



Fig. 8 - Insert one pint of lubricant in pinion cage before starting new truck or after overhaul.

Electric Shift

The electric shift mechanism used on all Timken double-reduction two speed axles is identical with the electric shift used on Eaton two speed axles. For detailed information see Electric Shift Section "H".

DOUBLE-REDUCTION AXLE (TIMKEN 200 SERIES AXLES)

(See Shop Talk No. 25 for complete illustrated disassembly)

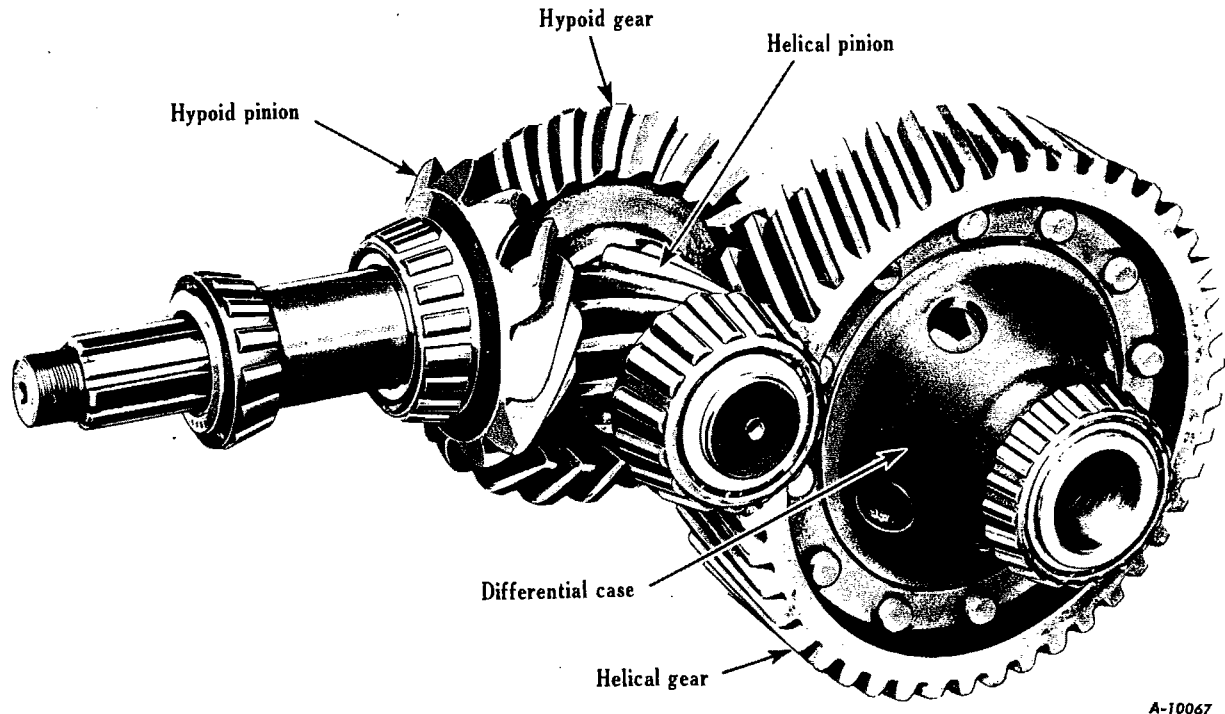


Fig. 1 - Double-Reduction Drive Unit (Timken).

The Timken S-200-P and U-200-P series double-reduction rear axles (Fig. 1) introduce improvements in design and construction over conventional rear axles for on-highway and off-highway service in heavy-duty motor trucks.

These axles provide increased torque capacity and eliminate the former need, because of specific chassis requirements, for both top-mounted and front-mounted double-reduction final drive units. The differential carrier on the S-200-P and U-200-P axles is mounted at an elevation which is a satisfactory compromise between the two extremes.

The S-200-P and U-200-P rear axles employ the same differential and carrier assemblies. They differ only in that the rear axle housing of the S-200-P is of lighter construction for the S-200-P axle is not intended for off-highway service.

Drive Unit

The drive unit, or differential carrier assembly, is mounted on the sloping front face of the axle housing and is readily removable for periodic inspection. The differential bearing

legs are dowelled in the axle housing to eliminate deflection under torque load.

Pinion Shaft Location

The pinion shaft is located at an elevation midway between that used on the front-mounted type axles, where the pinion shaft is on the axle center line, and that used on the top-mounted type axles, where the pinion shaft is considerably above the axle center line (Fig. 1).

Final Drive

The final gear-drive consists of a large diameter hypoid bevel gear and bevel pinion for the first reduction, and a wide-faced helical gear and helical pinion for the second reduction.

A range of gear ratios is available to meet all operating requirements. (See Specifications.)

Axle Housing

The axle housings in both axles are similar in design, although the U-200-P axle housing has larger sections to produce its greater load carrying capacity.



Differential

The differential assembly of this axle consists of four 9-tooth pinions mounted on a spider and two 16-tooth side gears all assembled into the differential case, both halves of which are identical.

Hardened-steel thrust washers are installed between the side gears and the case and between the pinions and the case. The large helical gear is mounted between the differential case halves and the assembly is held together by twelve rivets. The differential assembly is mounted in tapered roller bearings.

Oil Seals

The rear wheel outer oil seal is illustrated in Fig. 2. This is the latest type oil seal assembly and when installing this seal, be sure to cement the new cork gasket to the inner flange of the new wiper ring.

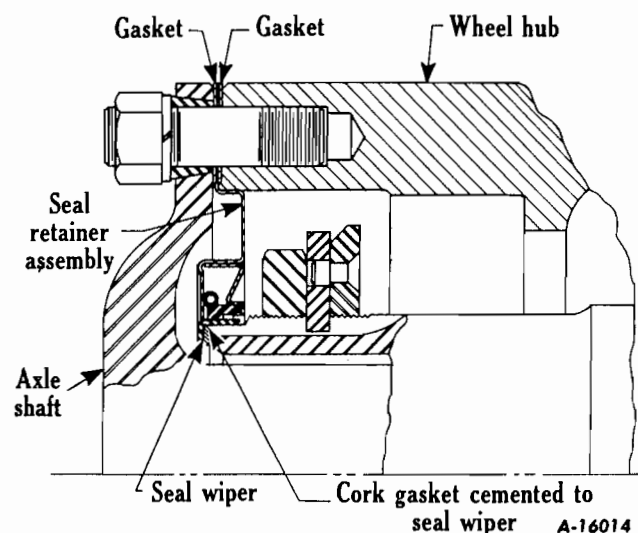


Fig. 2 - Illustrates sectional view of seal installed.

The seal wiper and cork gasket are pressed over the end of the axle tube. Be careful not to bend or damage the seal wiper when installing. (Fig. 3).

The seal retainer assembly is placed over the axle flange studs, as shown in Fig. 4, using a gasket on both sides of the seal retainer assembly.

The rear wheel inner seal construction is illustrated in Fig. 5. Before installing the inner seal, check the location of the bearing and oil seal spacer to be certain that the seal lip on the oil seal assembly faces toward the oil seal wiper ring in the wheel hub, as shown.

Special adapters should be used in seal installation as described in Service Bulletin B-97-1946 and Addendum No. 1.

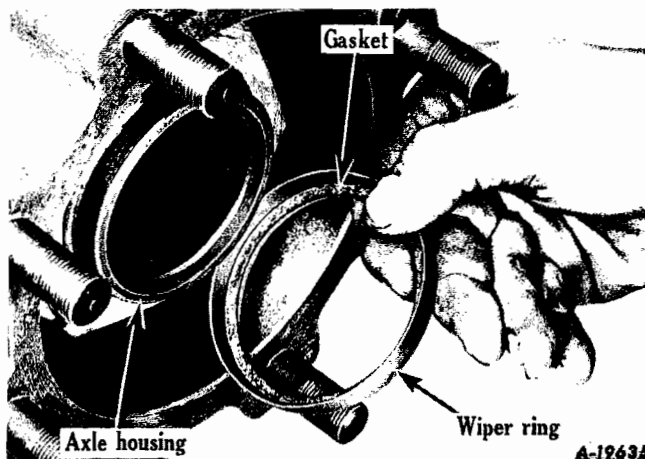


Fig. 3 - Illustrates wiper ring and gasket.

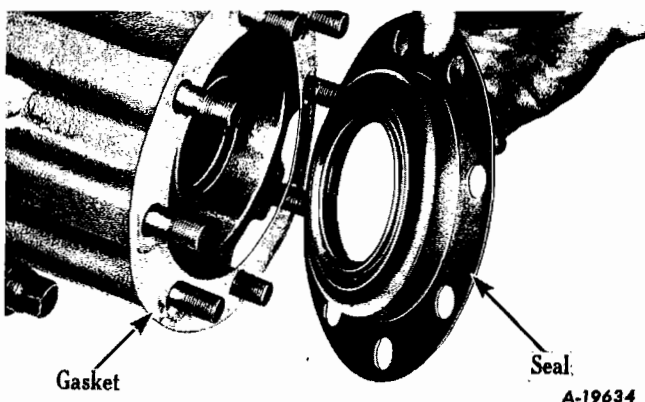


Fig. 4

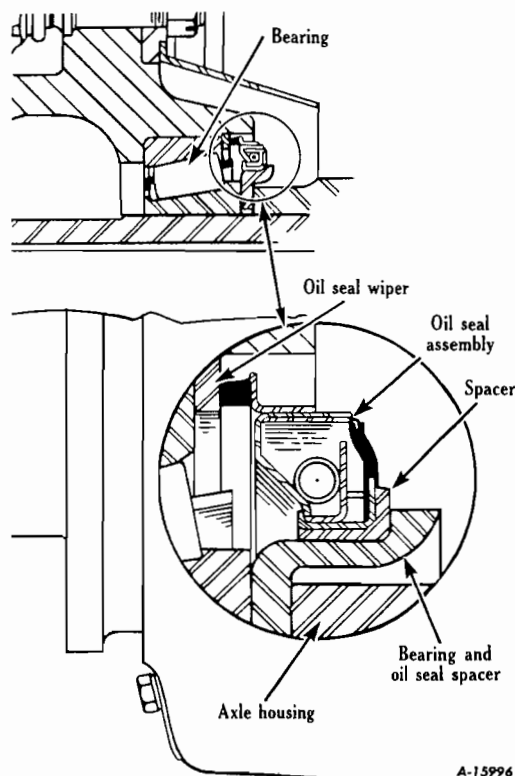


Fig. 5 - Rear wheel inner seal.



Lubrication

1. Before starting new truck and after overhaul, remove pipe plug at pinion cage and insert one pint of specified lubricant.
2. Fill axle housing to correct level with specified lubricant. The various axle capacities are found in Lubrication Section.
3. Jack up BOTH rear wheel and operate vehicle in high transmission gear at approximately 25 miles per hour for five minutes to assure proper lubrication of all parts before the unit is put into service.

Both wheels should rotate at approximately the same speed while the vehicle is jacked up. Do not allow one wheel to race faster than the opposite wheel. To do so might cause serious damage to the differential spider and gears.

Use SCL, EP gear oil or a multi-purpose gear lubricant suitable for hypoid axles and supplied by a reputable refinery. SAE-90 for cold climate and SAE-140 for warm climate.

Hypoid Pinion and Cage

The pinion and bearings are installed in the pinion cage with a pre-load as indicated in Rear Axle Specifications for these axles. The pre-load is controlled by proper selection of spacers, or combination of spacers, located between the outer pinion bearing and bearing seat on the pinion shaft. These spacers are ground to close tolerances and are available in graduated thicknesses. Thicker spacers decrease bearing pre-load and thinner spacers increase bearing pre-load. For correct procedure, see Pinion Bearing Adjustment for correct pre-load, Section "A", page 6.

When installing the pinion cage assembly in the differential carrier, be sure that the oil passage holes in the carrier housing, gasket shim pack and pinion bearing cage are aligned. When the original gears are being reinstalled use the original shim pack plus a new gasket under the pinion cage.

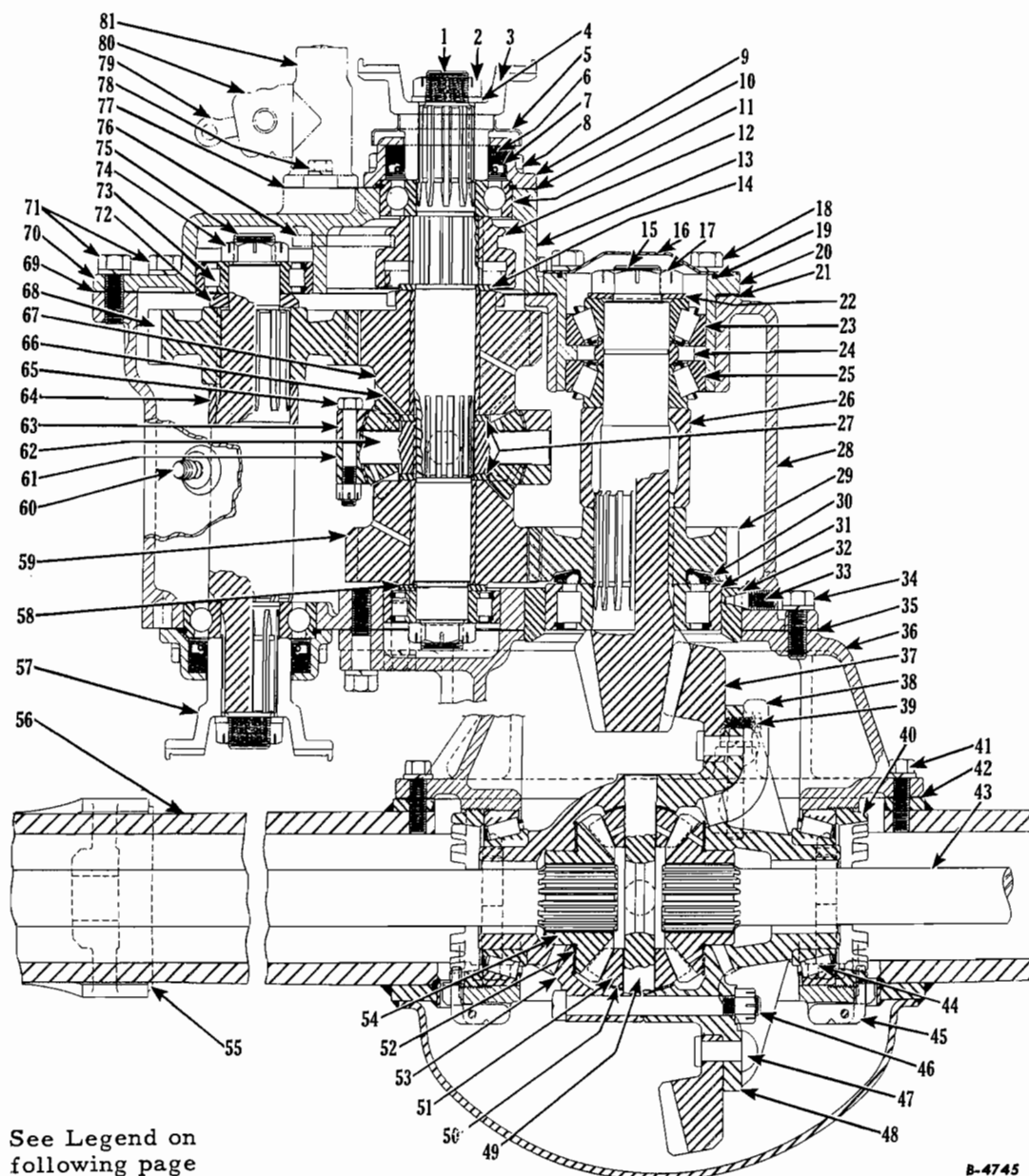
Helical Gear Shaft (Cross Shaft)

The helical gear or cross shaft is mounted at right angles to the hypoid pinion shaft in the carrier housing. This shaft is a one-piece steel forging consisting of an integral helical drive pinion gear in the center. The hypoid ring gear is aligned with key in shaft before pressing gear onto shaft.

To remove the cross shaft, it is necessary to first remove the differential and helical ring gear assembly; second, withdraw the hypoid ring gear when being removed. (Do not remove universal joint flange.) Then remove both bearing cages, move shaft enough to allow bearing at ring gear end of shaft to clear the carrier housing and tilt shaft to rear for removal from carrier.

The correct bearing pre-load is obtained by adding or removing shims at shim pack under the cross shaft bearing cage at end opposite hypoid ring gear. Use original shim pack plus a new gasket when reinstalling original gears. To measure correct bearing pre-load, follow method outlined for Timken Double-Reduction Two-Speed Axles, Section E, Fig. 3.

TANDEM AXLES



See Legend on
following page

B-4745

Fig. 1 - Details of axle mounted power divider mounted on forward rear axle.

**AXLES--RF-1475, RF-1575, RF-1685.
FOUR-WHEEL, AXLE-MOUNTED POWER
DIVIDER**

The above axles have a power divider built as an integral part of the differential assembly. This results in a more simplified tandem axle design, with less moving parts. The compactness of the combined power divider and differential makes possible the use of fewer propeller shafts and eliminates the need for a propeller shaft hanger at the rear of the vehicle. The

power from the engine is delivered through the transmission (and auxiliary transmission where the truck is so equipped) to the power divider which, as the name implies, divides the power between the two axles. A differential unit is included in the power divider to compensate for the difference in speeds between the two axles. This difference in axle speeds is brought about by wheels slipping on either of the axles or slightly different tire diameter due to tire wear. (Both rear axles on six-wheel (6x4) trucks have the same axle differential ratio.)



Legend For Fig. 1

- | | |
|--|---|
| 1. Mainshaft. | 42. Differential carrier to axle housing mounting gasket. |
| *2. Companion flange retaining nut. | 43. Axle shaft. |
| 3. Companion flange. | 44. Differential carrier bearing. |
| *4. Thrust washer. | 45. Adjuster lock. |
| 5. Slinger. | 46. Differential case bolt and nut. |
| 6. Felt. | 47. Bevel ring gear rivet. |
| 7. Oil seal. | 48. Differential case, flange half. |
| 8. Bearing cover retaining nut. | 49. Differential spider. |
| 9. Bearing cover. | 50. Differential spider pinion gear thrust washer. |
| 10. Bearing cover gasket. | 51. Differential spider pinion gear. |
| 11. Mainshaft bearing, front. | 52. Differential case, plain half. |
| 12. Differential lock. | 53. Differential side gear thrust washer. |
| 13. Transfer case cover. | 54. Differential side gear. |
| 14. Thrust washer. | 55. Axle torque arm. |
| 15. Forward axle bevel pinion shaft. | 56. Axle housing. |
| 16. Pinion bearing cage cover. | 57. Rear-rear axle drive shaft companion flange. |
| 17. Outer pinion bearing nut. | 58. Rear helical and side gear thrust washer. |
| 18. Pinion bearing cage capscrew. | 59. Rear helical and side gear. |
| 19. Pinion bearing cage cover seal. | 60. Breather. |
| 20. Pinion bearing cage. | 61. Differential case (male). |
| 21. Shims. | 62. Differential spider. |
| 22. Thrust washer. | 63. Differential case (female). |
| 23. Pinion bearing, outer. | 64. Rear-rear axle helical drive gear. |
| 24. Pinion bearing spacer. | 65. Differential case bolts. |
| 25. Pinion bearing, inner. | 66. Differential spider pinion gear. |
| 26. Spacer. | 67. Front helical and side gear. |
| 27. Differential spider thrust washers, power divider. | 68. Rear-rear axle helical drive gear. |
| 28. Transfer case. | 69. Transfer case cover mounting gasket. |
| 29. Forward axle helical drive gear. | 70. Transfer case cover. |
| 30. Oil seal assembly. | 71. Transfer case cover mounting capscrews. |
| 31. Pinion bearing. | 72. Thrust washer. |
| 32. Pinion bearing sleeve. | 73. Drive shaft bearing, inner. |
| 33. Pinion bearing sleeve set screw. | 74. Drive shaft nut, inner end. |
| 34. Power divider to differential carrier mounting capscrew. | 75. Rear-rear axle drive shaft. |
| 35. Power divider to differential carrier mounting gasket. | 76. Shifter fork. |
| 36. Differential carrier. | 77. Shift fork bracket mounting gasket. |
| 37. Bevel ring gear. | 78. Shift fork bracket retaining capscrew. |
| 38. Differential lubricator. | 79. Shift fork lever. |
| 39. Differential lubricator retaining capscrew. | 80. Shift fork lever boot. |
| 40. Differential carrier bearing adjuster. | 81. Shift fork bracket. |
| 41. Differential carrier mounting capscrew. | |

* Rear-rear axle drive shaft outer bearing cover assembly, flange nut and thrust washer are identical with the units on outer end of mainshaft.

NOTE: Rear-rear axle drive shaft inner bearing (73) and nut (74) are identical with mainshaft inner bearing and nut.

A differential lock is available for the power divider. This locking arrangement is used to lock both the front rear and rear rear axles together and is generally used when the vehicle is operating in mud, snow or off the highway.

CAUTION: The differential must not be held in the locked position longer than necessary. Driving the vehicle on improved or paved roads with the differential lock engaged will subject the axles and gears to unnecessary strain. The differential lock shift fork is spring loaded and automatically releases the lock when shift lever is released by operator.



L-LINE MOTOR TRUCK SERVICE MANUAL

 AXLE-REAR
 Section G
 Page 3

**DISASSEMBLY OF POWER DIVIDER
 (AXLE MOUNTED)**

To disassemble the power divider, proceed as outlined in the following steps:

1. Remove nine power divider to differential carrier mounting capscrews and lift off the power divider. Be sure mounting gasket is also removed.
2. Place power divider in a transmission stand or other suitable fixture and remove the four pinion bearing cage mounting capscrews and remove pinion shaft cover.
3. Remove self-locking setscrew in the transfer case to release pinion bearing sleeve.
4. Remove pinion shaft outer bearing nut and using a soft hammer, tap end of shaft to release pinion bearing sleeve and bearing from housing. Withdraw pinion shaft assembly from transfer case. Complete disassembly of shaft by removing inner pinion bearing, spacer, front axle helical drive gear and pinion bearing.
5. Remove pinion bearing cage from transfer case.
6. Remove mainshaft bearing retainer nut inner end.
7. Remove companion flange mounting nut, and using a suitable puller, remove companion flange and slinger assembly.
8. Remove four bearing cover capscrews and lift off bearing cover.
9. Using a bronze bar, drive inner end of mainshaft until shaft passes through rear helical and side gear and thrust washer. This gear and washer can now be removed through pinion bearing sleeve opening in transfer case.
10. Continue pushing mainshaft toward front of transfer case until differential case assembly and thrust washers are free of shaft. Differential case will also pass through pinion bearing sleeve opening in case. Mark differential case halves so original assembly can be duplicated. Keep differential spider thrust washers with differential case to assure correct reassembly.
11. Withdraw mainshaft all the way. Front helical and side gear, thrust washer and differential lock (where power divider is so equipped) can now be removed through pinion bearing sleeve opening.
12. Using a suitable puller, remove both front and rear mainshaft bearings. This completes disassembly of mainshaft.
13. Remove the nine transfer case cover retainer screws. Carefully remove cover so as not to damage cover or gasket face of transfer case, as cover must be removed from front bearing of rear rear axle drive shaft.
14. Remove nut at front end of rear rear axle drive shaft. The companion flange at rear of shaft should be used to hold shaft while removing nut.
15. Remove companion flange retaining nut and flange at rear of rear rear axle drive shaft. Remove companion flange with suitable puller.
16. Remove the four bearing cover retaining capscrews and remove bearing cover.
17. Remove bearing at front end of rear rear axle drive shaft using a suitable puller. Also remove helical gear retaining washers.
18. Tap front end of rear rear axle drive shaft with a soft hammer to remove helical drive gear and spacer. This action will also drive the rear bearing out of case so that the shaft may now be lifted out.
19. Place rear rear axle drive shaft in vice having soft jaws and pull the rear bearing off the shaft.

The power divider is now completely disassembled. Place all parts in a cleaning solution to remove all dirt and sludge deposits. Be sure transfer case is free of any loose metal particles. Carefully inspect all parts and replace any that are doubtful as to further satisfactory serviceability.

To reassemble the power divider, the exact reverse procedure as outlined for disassembly should be used. However, it is advisable to observe the following precautions:

Be sure all sealing surfaces are free of nicks and that the old gasket material has been completely removed. NOTE: The transfer case to differential carrier mounting gasket is .008" thick.

The differential case was marked as to forward side and also for correct reassembly of the two case halves. It is of utmost importance that the eight differential case mounting bolts be so installed that the bolt heads are also on forward side of differential assembly after installation in power divider. NOTE: Female half of differential case should be forward.



To secure the pinion bearing pre-load reading specified in the Rear Axle Specifications for this model axle, see Pinion Bearing Adjustment for Correct pre-load. Make a bench assembly of bevel pinion shaft, bearings, spacers and pinion bearing cage. Place all parts in the same position as in the final assembly. The pinion shaft assembly may now be placed in the press shown in Fig. 2. After the correct pinion bearing pre-load reading has been secured remove outer pinion bearing and pinion bearing cage only. The pinion shaft is now ready for installation. Complete assembly of pinion shaft to transfer case by inserting pinion shaft through pinion bearing sleeve opening until sleeve is in correct position. Install pinion bearing cage, outer pinion bearing, thrust washer and nut. Do not fail to install pinion bearing sleeve set screw after the cone center and back lash adjustments have been made. Use a new bearing cage cover oil seal when completing assembly.

After the correct pinion bearing pre-load has been obtained, mount power divider on differential carrier. The pinion cone center adjustment may now be made. Follow procedure set forth under SE-1065 Pinion Setting Gauge. Bear in mind the adjustment of the bevel pinion is controlled by means of a shim pack under the pinion bearing cage at forward side of power divider. The differential assembly may now be completed and the bevel ring gear adjusted for back lash -- as marked on outer rim of ring gear. Be sure to obtain a tooth contact pattern as outlined under General Rear Axle Hypoid Pinion and Ring Gear Adjustment Point Impression Method.

The differential carrier and power divider assembly is now complete and ready for installation in forward rear axle housing. Use a new differential carrier mounting gasket.

Center Cross Bar

The assembly of the center cross bar and saddle is shown in Fig. 2. The sleeve is located in the saddle and is locked in place by two thru-bolts. Inside the steel sleeve there is a center cross bar, which must rotate freely in the sleeve. In the LF-170 the center cross bar is solid steel and on the LF-190 and LF-210 it is a steel tube. In removing the tube or cross bar, it is first necessary to jack up the rear end of the truck, remove the spring shackle pins, remove the two equalizer beam end bolts, then remove the saddle, equalizer beam and the springs. The tube or cross bar is then removed from the supporting sleeve.

Equalizing Beam Ends

Equalizing beam end construction is shown in Fig. 3. The beam end ball is supported in a two-piece bronze socket which is pressed into the beam end. Lock bolts prevent the sockets

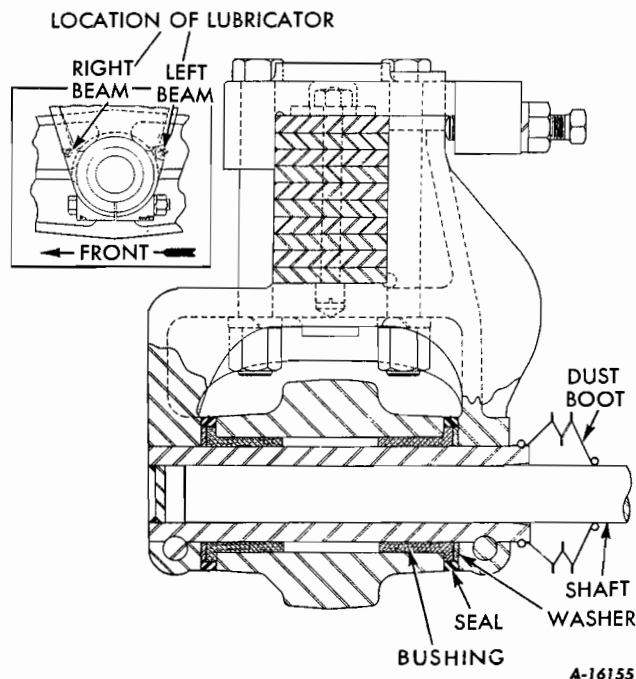


Fig. 2

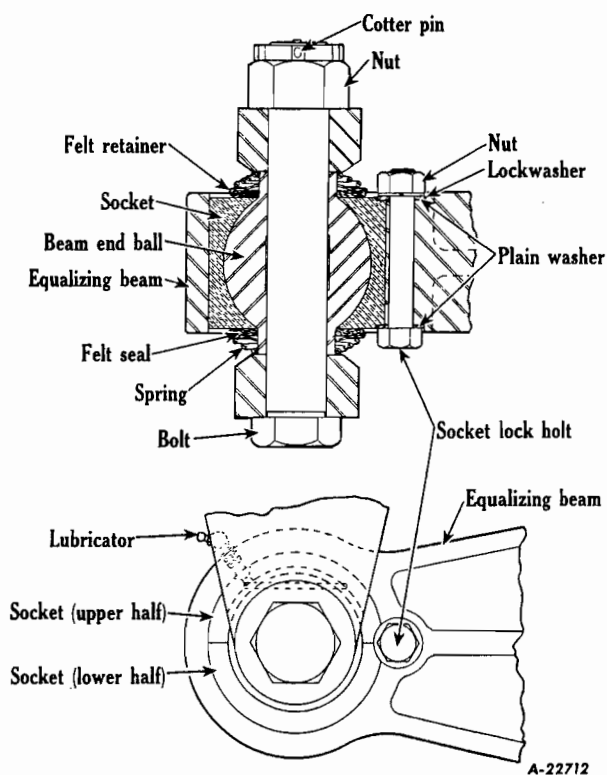


Fig. 3



from moving and felt seals with spring retainers are used to guard against leakage of lubricant and entrance of dirt.

When replacing a socket or ball, assemble both halves of the socket to the ball and press the assembly into the beam end. Make sure that the grease hole in the socket indexes with the lubricator hole in the beam end - **THIS IS VERY IMPORTANT**. Both sides of the socket must be counterbored flush with counterbore in beam so that the socket lock bolt and plain washers will prevent the socket from shifting.

Install felt seals and spring retainers before assembling the beam end to the bracket. The beam end bolt nut should be drawn up as tight as possible and securely locked with a cotter pin.

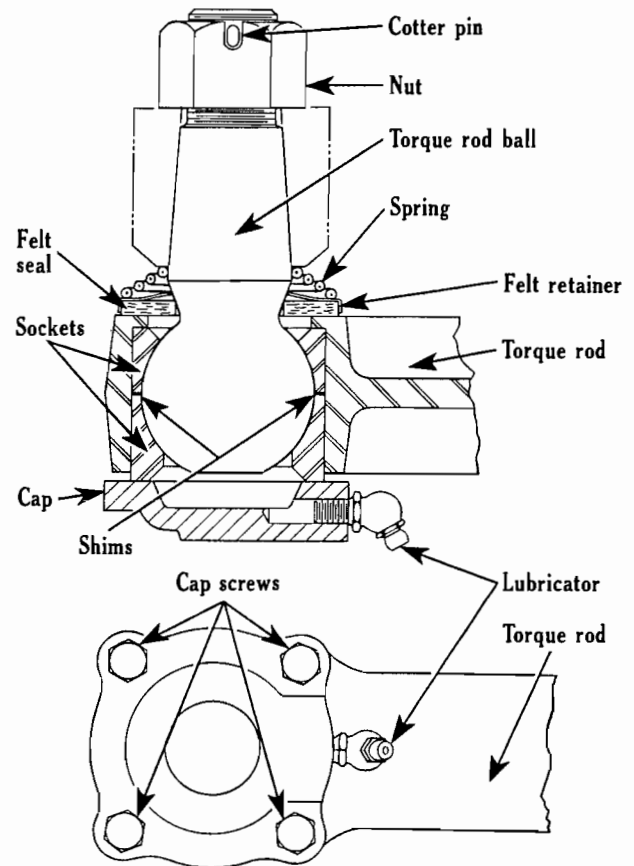
Torque Rods

Figure 4 illustrates the torque rod end assembly used on six-wheel L-line models. Shims are used between the ball sockets to provide proper adjustment.

To disassemble, remove the torque rod ball cap, then tap the torque rod near the bronze socket and the lower half of the socket will slip out. The ball stud nut should then be removed and the ball stud driven out of torque rod.

Reassembly is accomplished in the reverse manner. Press upper half of ball socket into torque rod and insert ball stud. Install shims (approximately .035") and insert lower half of socket. Assemble cap and tighten securely. Check movement of ball stud, using a piece of tubing about 16" long as a lever. If ball stud moves too freely, remove a .005" shim, and if too tightly, add another .005" shim. Only a slight drag should be felt.

NOTE: Be sure that the felt seal retainer and spring are replaced to prevent leakage of grease and entrance of dirt.



A-22729

Fig. 4

ELECTRIC SHIFT (EATON) USED ON EATON AND TIMKEN TWO-SPEED AXLES

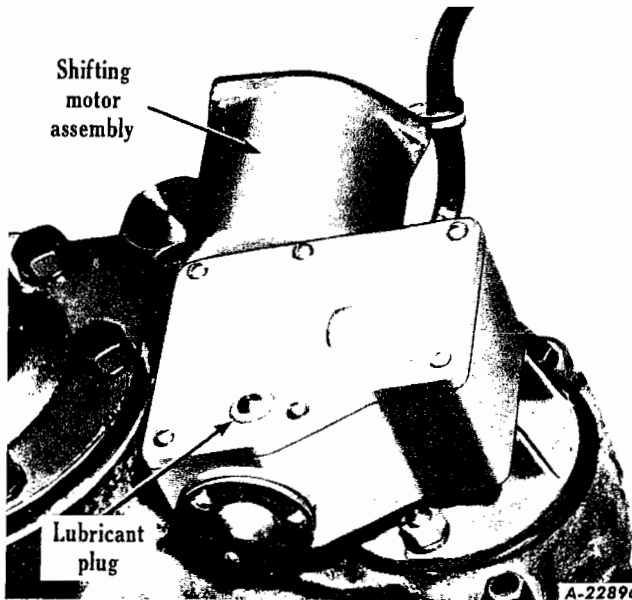


Fig. 1 - Electric Shift Unit. Mounted on two speed axle.

Description

The electric shift device consists, in the main, of an electrically operated shifting fork and shifting unit located on the two-speed axle (Fig. 1). The shift fork is activated by a two-directional coil spring and lever assembly (Figs. 6 and 7). The purpose of this spring and lever assembly is to move the shiftfork quickly into the high or low speed position when gear load is momentarily removed from the differential.

The actual shifting or gear movement is performed by the coil spring located in the housing of the electric shift unit. The coil spring which performs the shift must be placed under tension or in a loaded state before gear shift can be accomplished. This is provided for by a reversible electric motor which drives a power screw which in turn actuates a drive nut in either direction. Trunnions on either side of the drive nut engage slots in the spring lever. Movement of the lever in either direction energizes the spring which performs the shifting movement.

The control of the electric shift unit is by means of a two-way switch located on the transmission gear shift lever (Figs. 2, 3 and 4). Moving control button up or down causes motor at axle shift unit to rotate in either direction. A limit switch located in the electric shift unit

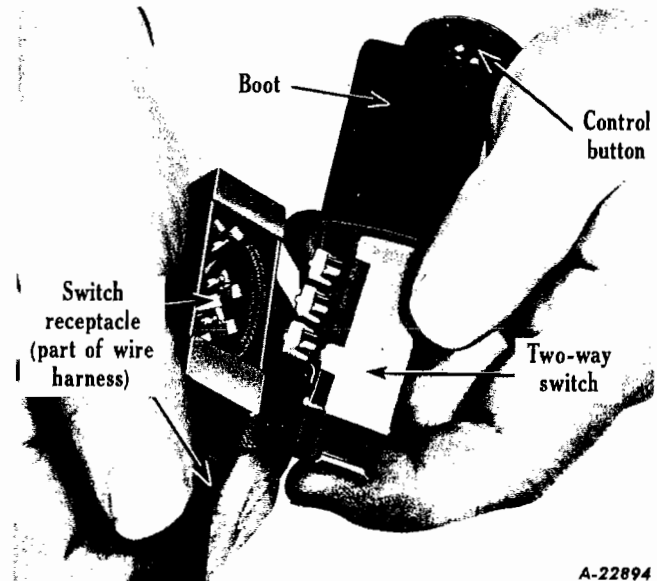


Fig. 2 - Electric Shift Unit Two Way Control Switch

(Figs. 3 and 6) opens the circuit and stops the motor when the shifting spring is fully energized. Any time thereafter, the shift is completed by the energy of the spring when torque is momentarily released from the differential gears either by releasing the clutch or closing the throttle.

A two-speed adapter electrically operated is located at the speedometer and is wired in series with the ignition switch (Figs. 2, 3 and 5). The balance of the electrical circuit is also wired in series with the ignition switch, thereby preventing any closed electrical circuits in the system when the truck is idle and the ignition switch is turned to the "OFF" position.

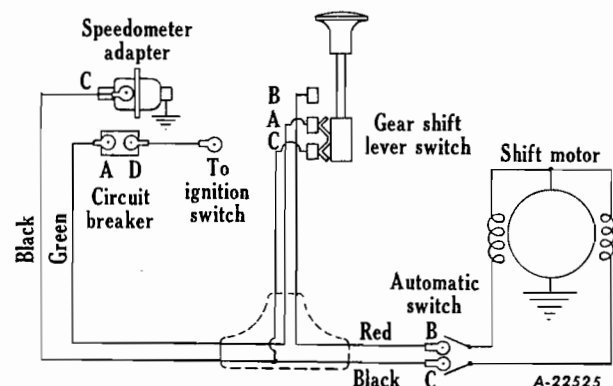


Fig. 3 - Electric Shift Circuit Diagram

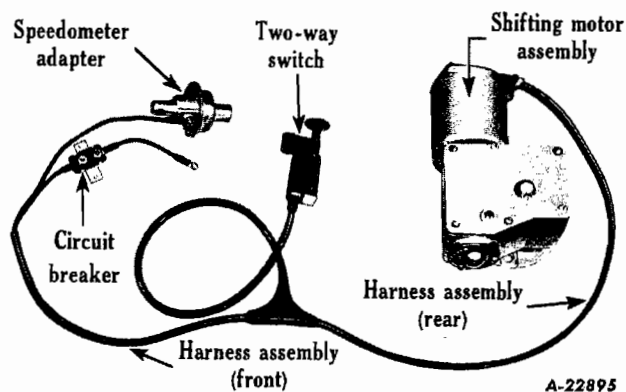


Fig. 4 - Illustration Of Electric Shift Parts

The system is further protected by a self-resetting circuit breaker which becomes operative when normal current flow continues for a period longer than is required to complete a shift, or in case of an overload or direct short.

Details of the various units of the "Electric Shift" their function, and the servicing of each follows:

The switch (Fig. 2) with which the operator controls the axle is located on the transmission gear shift lever.

This control switch has two positions -- up and down. Three wires are connected to the switch. When the selector button of the switch is up, the battery wire (A -- Fig. 3) is connected to wire (B -- Fig. 3) leading to one field of the motor in the axle shift unit proper.

When the button is down, the battery wire is connected to wire (C -- Fig. 3) leading to the other field of the axle shift unit motor and also to the speedometer adapter.

As shown in Fig. 2, the control switch is connected to the harness or wiring system by plugging into the three-pronged connector which is part of the harness. The switch is removable by slipping the rubber boot up to the knob and pulling apart.

Wiring System

The wiring system or harness as shown in Fig. 3 has four terminals. Two of them (b) and (c) in a double line run to the axle shift unit on the axle. Of these the longer red one is connected to the bottom terminal, and the shorter black one is connected to the top terminal. The short single black wire (c) is connected to the speedometer adapter and the green wire (a) is connected to the circuit breaker. Wire (d) connects the copper stud of the circuit breaker to the cold side of the ignition switch. The

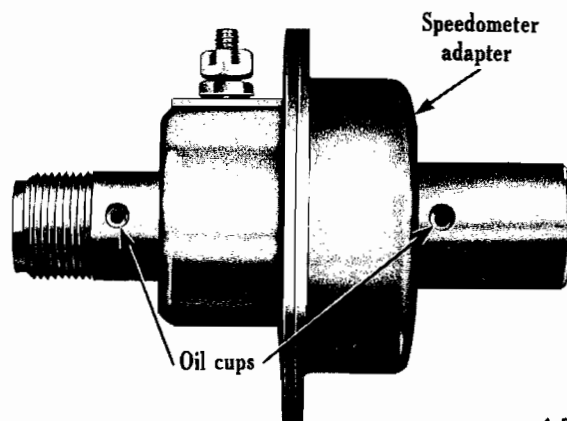


Fig. 5 - Speedometer Two-Speed Adapter

circuitbreaker protects the system in the event of a short circuit. Should a short circuit occur, it will open the circuit until the trouble has been corrected.

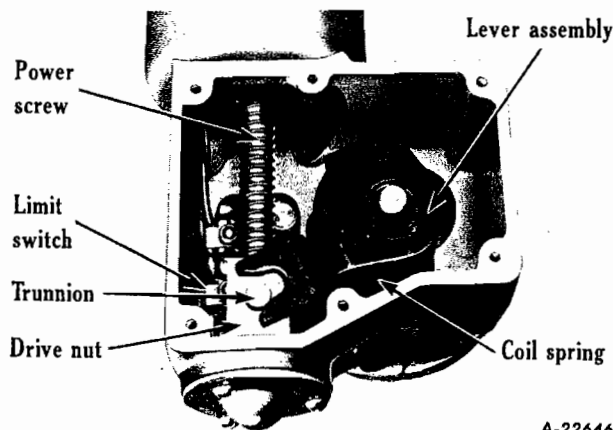
Speedometer Adapter

The speedometer adapter (Fig. 5) compensates for variations in the speed of the drive shaft between high and low-speed range of the axle.

This adapter is held in the high range by a spring and in the low range by an electro magnet. The inner mechanism is lubricated and sealed for life, but the two shaft ends should occasionally receive a small amount of light oil at the oil-wick cups.

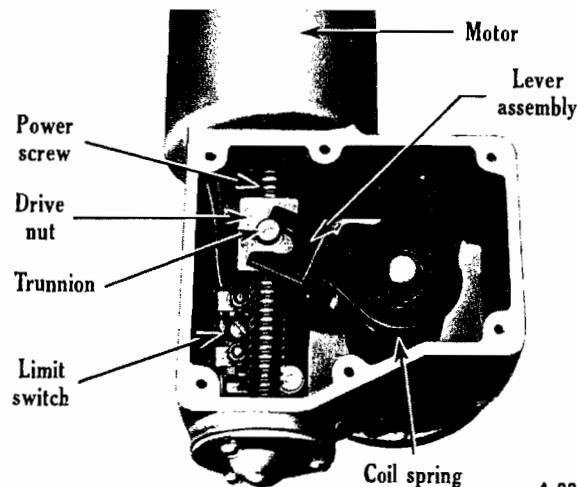
Axle Shift Unit

This unit shifts the axle into high or low-range. Fig. 6 shows the axle shift unit in the high range of the axle. In this position wire (b) (Fig. 3) carries current to one field of the motor (6) (See Fig. 20 for Part Identification) so that the armature and drive screw (20) turn in a clockwise direction and move the nut down. When the nut has traveled a sufficient distance to wind the spring (23), a contact bumper on the nut breaks an electrical connection on the automatic switch (17) so that the motor is no longer energized and the armature stops rotating. To make sure that the nut cannot travel back on the screw due to vibration, a ball screw detent spring (Fig. 12) mounted on the cover (26) holds the nut at the end of its travel on the screw. The nut moves the spring winding lever (24) down which pivoting on the pin (21), winds the torsion spring (23) for high. Thus an increased load is put on the spring, and in this position the axle is ready to snap into the high speed ratio as soon as the load on the axle gears is relieved. The torsion spring is assembled in the unit so that it is under 45 to 65 pounds pressure, depending on the size of the axle. When the spring winding lever is moved so that the spring is wound, the pressure



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Fig. 6 - Axle Shift Unit In High-Range Position



A-22893

Fig. 7 - Axle Shift Unit In Low-Range Position

of the spring is raised to from 90 to 135 pounds again depending on axle size.

This additional means is used to shift the axle, and when the shift is completed, the ends of the spring come together leaving the original tension of 45 to 65 pounds on the spring. This preload tension holds the axle in either gear.

Shift To Low

When the button is pushed down, the motor is energized so that the screw moves counter clockwise and the nut travels to the top winding the spring for a shift to low in the same manner as before.

SERVICE AND TROUBLE SHOOTING

General Information

If the electric shift should fail to operate properly, the trouble should first be located. A very handy tool for this is a test light consisting of a light bulb, either 6 or 12 volts, depending on the electrical system of the truck, with two wires a few feet long and small battery clips on the ends. Refer now to the wiring diagram Fig. 3 and first connect the test light to Point (d) on the circuit breaker under the dash or hood, depending on the test light to ground. Turn on ignition switch, or accessory switch in the case of a diesel, and the light should show. If it fails to light at this point, there is a poor connection or broken wire between the ignition switch and circuit breaker. Next connect test light to Point (a) on the circuit breaker -- Fig. 3 -- and again the light should show. If it fails to show immediately, watch the light carefully and listen to the circuit breaker for a minute to see if it is flashing off and on. The light should stay on continuously at this point. If it flashes off and on, or you hear the breaker clicking, it indicates that too much current is flowing and the circuit breaker is opening. This is due either to a short circuit, or the motor in the shift unit not being free to run. To determine which of these it is, remove the two wires (b) and (c) from the axle shift unit and recheck. If the light still flashes off and on or you still hear the breaker clicking, it is due to a short in the harness, but if the light now stays on continuously the trouble is in the shaft unit.

If there is no light at all at this point and the circuit breaker cannot be heard clicking, disconnect the green wire from terminal (a) Fig. 3 and again clip the test light to terminal (a) post on the circuit breaker. If the light fails to show here and did show on terminal (d) the circuit breaker is bad and should be replaced.

If the test light glowed normally at point (a), next remove the two wires (b) and (c) from the axle shift unit and connect a test light wire to one of these wires and the other test light wire to ground. The red shift unit wire should light the light only in high gear or up position on the gear shift lever switch and the black wire should light the light only in the low gear or down position of the gear shift lever switch. If the light fails to glow in either of the above tests, it indicates a broken circuit in the harness or gear shift lever switch. If both wires light the test light in one position of the gear shift lever switch, it indicates a short circuit in the harness or gear shift lever switch.

Next connect the test light to the speedometer adapter terminal (c) and ground. Here



the light should glow in the low gear or down position of the gear shift lever switch only. If it fails to glow, it indicates a broken circuit in the harness or gear shift lever switch.

These checks above will quickly locate the trouble. When checking the harness for short or open circuits, watch for broken insulation and do not overlook the gear shift lever switch which can best be tested by substituting a new one in its place.

If the vehicle shifts normally but the speedometer adapter fails to operate properly make the above check with the test light to see if it is getting current in the low range and if it is, replace the adapter. When the trouble has been traced to the shift unit, disassemble as shown under disassembly and inspect the parts carefully. All parts can be washed in cleaning solvent except the motor.

When inspecting the parts, most failures will be readily apparent; however, a few assemblies should be checked as follows:

Automatic Switch

The automatic switch (17) Fig. 20 (serviced only as an assembly) should have clean, free moving points which close firmly under spring tension.

Drive Screw

The drive screw (20) Fig. 20 (serviced only as an assembly) should turn freely by rotating the screw while holding the nut. When the nut gets to the end of the screw, the screw can continue to turn but the nut should not jam or run off the end. By turning the screw in the opposite direction, the nut will go to the other end and stop as before while the screw can continue to be turned.

The fiber bumper in the nut should be a tight press fit. Be sure in assembly that this fiber bumper is in toward the switch.

Motor

The motor (6) Fig. 20 (serviced only as an assembly) is reversible so that with the motor housing connected to one battery terminal and either one of the two motor wires connected to the other battery terminal, the motor will run in one direction. With the other motor wire connected to the battery, the motor will run in the opposite direction. The motor has a stall torque of approximately 6" lbs. The way to check this motor is to put a small crescent wrench on the rectangular drive on the armature shaft. Hold the wrench in one hand, hold the motor itself firmly in the other hand or in a vise and then connect one motor wire to a battery terminal and connect the motor housing

to the other battery terminal. The wrench should then tend to turn with a torque or pull of about 6" lbs. Allow the wrench to turn very slowly, making sure that this pull or torque is present the full 360° turn of the wrench. If one armature winding of the motor is burned out, this torque will disappear for a small part of the 360°. While making this test, care should be taken not to overheat the motor. This motor is lubricated and sealed for life.

Rubber Diaphragm

The rubber diaphragm between the shift unit and the carrier assembly, which can be seen in Fig. 8 under disassembly, should be in good condition and a tight fit over the shift fork. This diaphragm seals off axle lubricant from the shift unit.

NOTE: During reassembly, extreme care should be taken not to allow any dirt to enter the axle shift unit.

For correct positioning of diaphragm refer to lettering printed on its face.

Lubrication

The speedometer adapter requires no more attention than would be required by the speedometer or the speedometer cable. Several drops of light oil should be applied in the provided oil-wick cups.

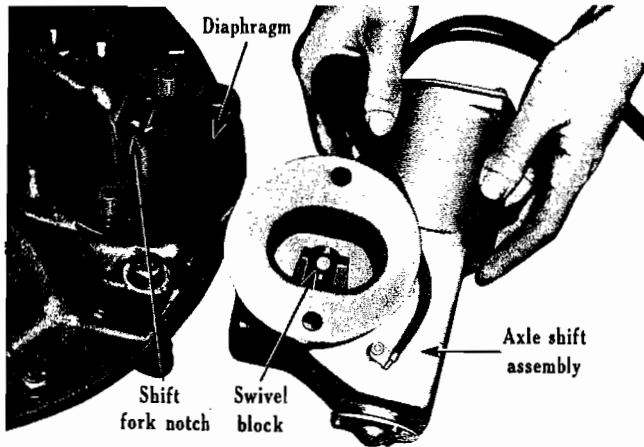
On the axle shift unit, there is an oil filler plug (27), so marked, provided in the front cover (26) near the bottom. Upon installation, the unit should be filled level with lubricant and should be checked every 10,000 miles or 3 months, whichever comes first, to maintain this level.

The lubricant used should be SAE 10 motor oil, except where temperatures below 0° F will be encountered, in which case use 3 parts SAE 10 motor oil to 1 part kerosene. This cold weather mixture can safely be used in temperatures up to 32° F.

To change lubricant, remove front cover (26) and drain. Whenever front cover is removed, care should be taken not to allow any dirt to enter.

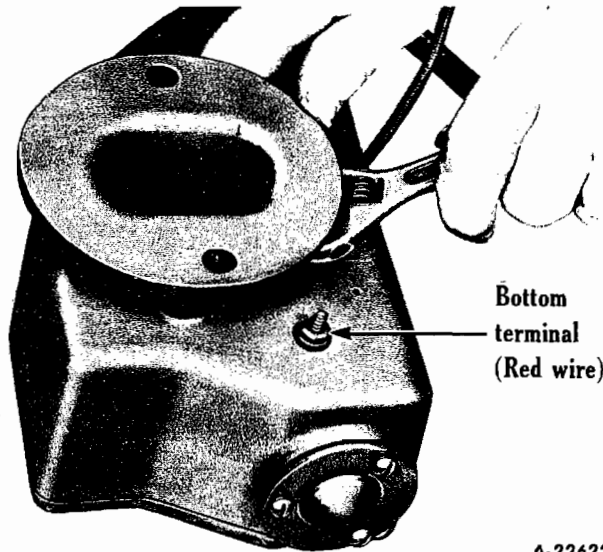
AXLE UNIT DISASSEMBLY

The axle unit (Fig. 1) is removed from the differential carrier for disassembly and servicing as follows:



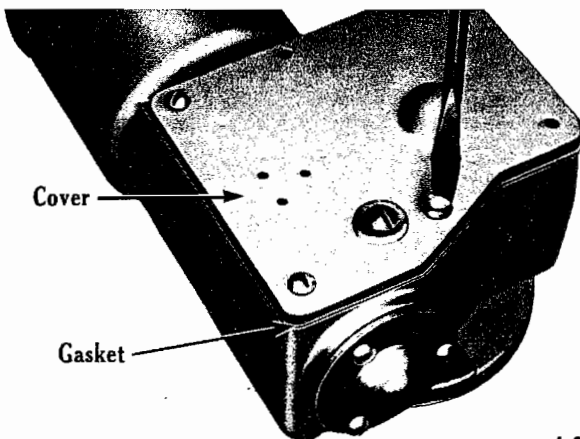
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Fig. 8 - Remove shift housing to carrier stud nuts and lockwashers and lift off shift unit. Upon reassembly, the swivel block must engage the shift fork notch.



A-22622

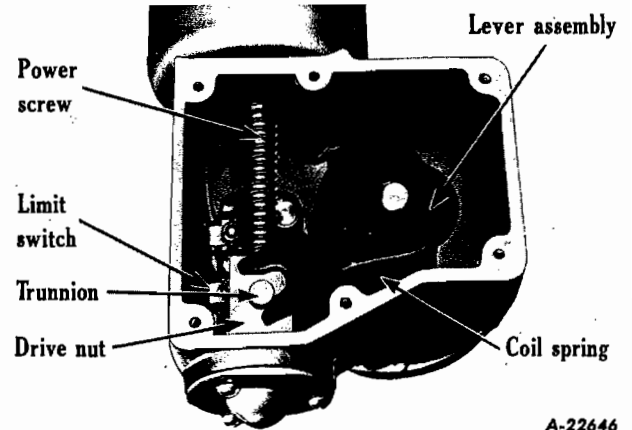
Fig. 9 - Remove lock nuts and two wires from housing. In reassembling, the long or rod wire goes to the bottom terminal.



A-22628

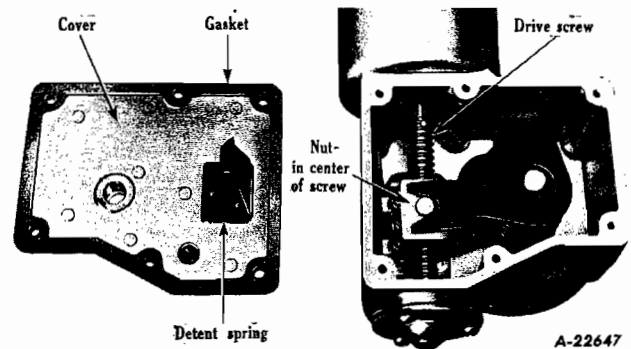
Fig. 10 - Remove cover screws, lockwashers, cover and gasket. Drain lubricant from housing.

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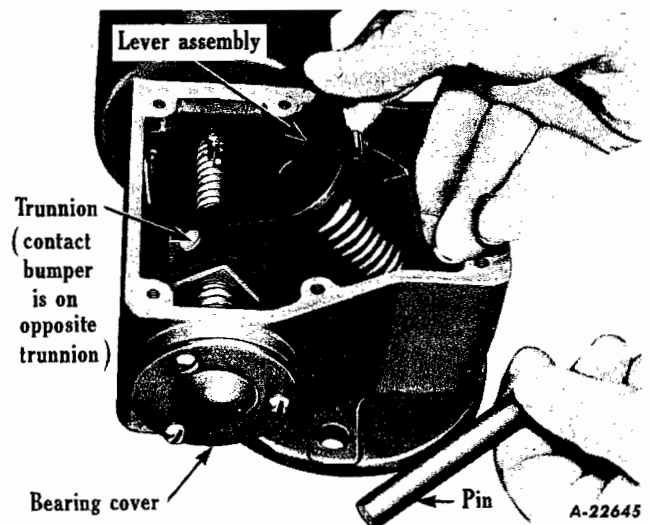
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Fig. 11 - After removal of cover, note that nut and lever assembly will be at either top or bottom of screw, depending upon position in which the shift button was last used.



A-22647

Fig. 12 - By turning drive screw, run nut from either top or bottom position to center of screw. **IMPORTANT:** This step is essential to prevent damage to drive nut contact bumper located in center of lower or inner trunnion. The nut must be in the center position upon assembly also.

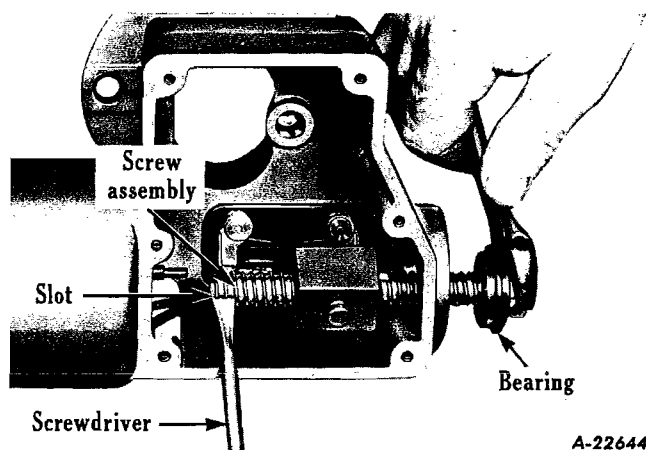


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Fig. 13 - Pull out pivot pin and remove lever assembly.

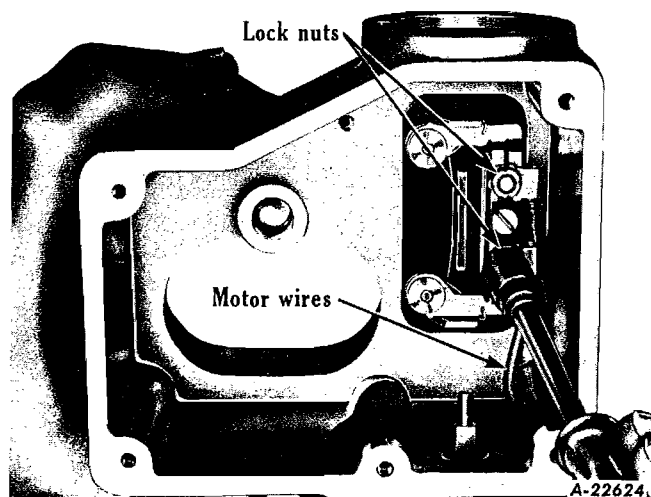


NOTE: When reassembling lever assembly, make certain that the contact bumper on nut is toward the switch.



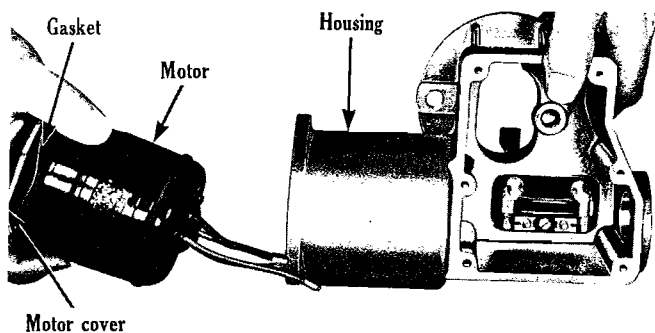
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Fig. 14 - Remove drive screw bearing cover and push down on screw assembly until bearing is free of housing. Insert screwdriver in drive slot of screw and remove bearing retainer nut and bearing.



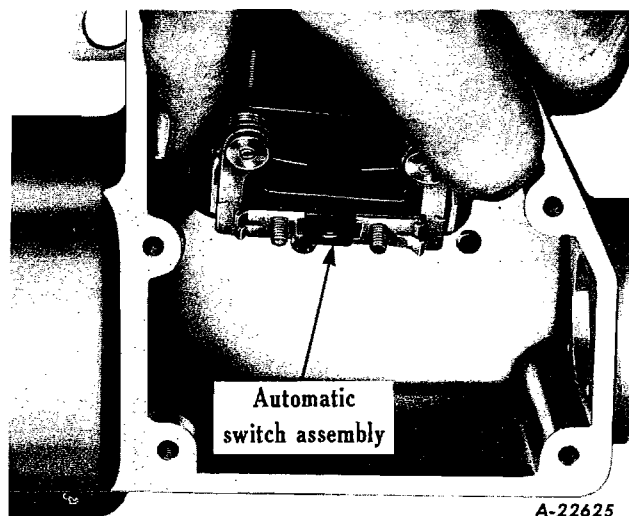
A-22624

Fig. 15 - Remove two lock nuts from switch terminals and remove wires.



A-22649

Fig. 16 - Remove three motor retainer screws, remove cover and gasket, and pull motor assembly out of housing.

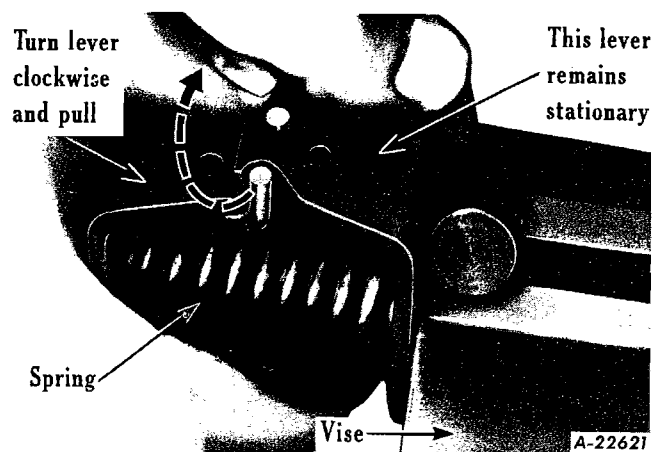


A-22625

Fig. 17 - Remove "jam" nuts (switch retainer nuts) and fiber washers from back side of housing. Remove switch center screw and lift out switch assembly.

Lever and Spring Assembly

Good practice is to perform the disassembly and reassembly of the lever and spring unit only when necessary to replace one of the parts.



A-22621

Fig. 18 - Place lever assembly in vise as shown. Turn lever clockwise and pull; then allow spring to unwind. This operation will permit disassembly of the levers and spring. IMPORTANT: Do not disassemble this unit until necessary to replace one of the parts.

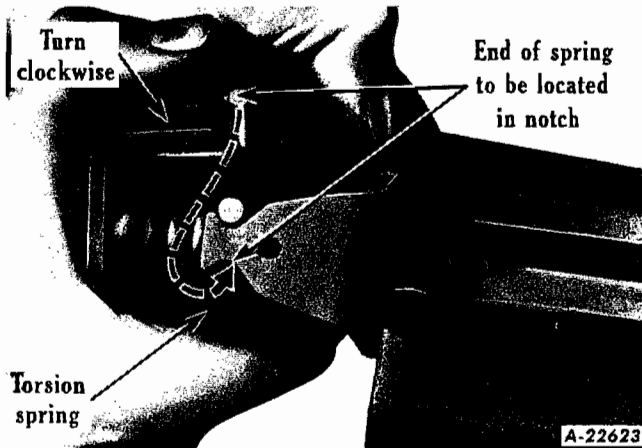


Fig. 19

1. When reassembling the spring and levers, locate parts as shown (Fig. 19). Turn lever and spring clockwise, bringing end of spring around end of lever nearest vise. Push end of spring into notch of actuating lever nearest vise. This will preload spring.

Reassembly of the axle shift unit is the reverse of disassembly.

SHIFTING INSTRUCTIONS FOR EATON TWO-SPEED AXLE ELECTRIC SHIFT

TO SHIFT INTO LOW-SPEED RATIO:

1. Keep accelerator pedal down, push button down.
2. To complete shift, disengage and reengage clutch as quickly as possible, holding accelerator pedal down; or release and reopen accelerator as quickly as possible.

TO SHIFT INTO HIGH-SPEED RATIO:

1. Keep accelerator pedal down, pull button up.
2. To complete shift, release accelerator and pause until shift is completed.

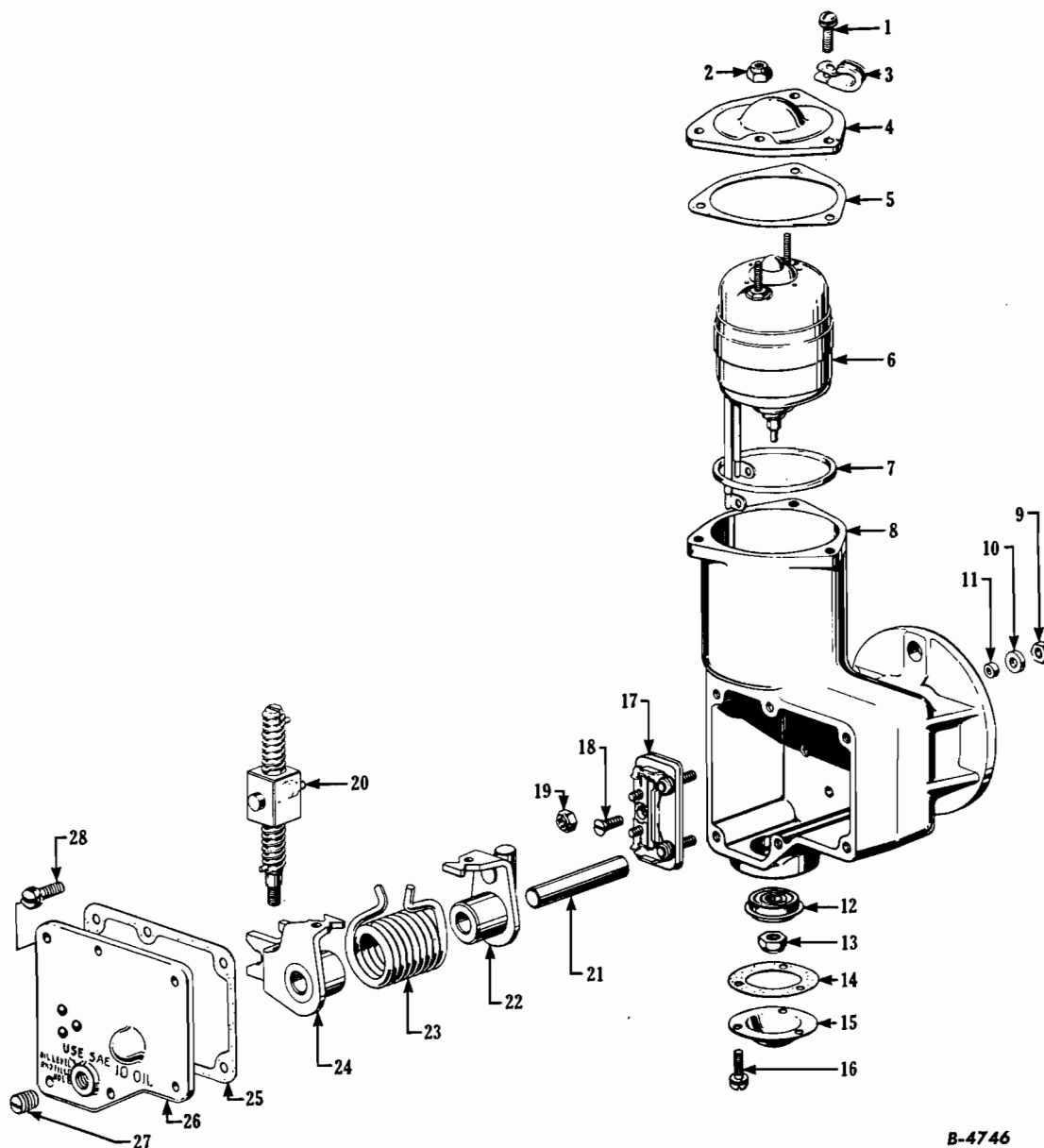
SPLIT-SHIFTING

To shift to next higher gear in the transmission and at the same time from high to low speed axle, make the transmission shift in usual way and just before engaging clutch push the button down.

To shift to next lower gear in the transmission and at the same time from low to high-speed axle, pull the button up, then complete the transmission shift in usual way.

IMPORTANT:

1. Always keep accelerator down when control button is moved, except when split-shifting to low-speed ratio.
2. For best results, start loaded trucks in low-speed ratio.



B-4746

Fig. 20 - Electric Shift Parts Identification List And Illustrations

- | | |
|--|--|
| 1. Screw with lockwasher (motor cover to housing). | 16. Screw with lockwasher (bearing cover to housing). |
| 2. Elastic stop nut (motor to cover). | 17. Automatic switch, terminal screws, and base gasket assembly. |
| 3. Motor cover cable clip. | 18. Flat head screw (automatic switch to housing -- inside). |
| 4. Motor support and cover. | 19. Elastic stop nut (automatic switch terminals -- inside). |
| 5. Motor support and cover gasket. | 20. Drive screw assembly. |
| 6. Electric motor assembly. | 21. Spring winding and shift fork actuating lever shaft. |
| 7. Electric motor grommet. | 22. Shift fork actuating lever assembly. |
| 8. Shift motor housing. | 23. Torsion spring. |
| 9. Jam nut (automatic switch terminal -- outside). | 24. Spring winding lever assembly. |
| 10. Fibre washer (automatic switch terminal -- outside). | 25. Shift housing cover gasket. |
| 11. Bushing (automatic switch terminal hole in housing). | 26. Shift housing cover. |
| 12. Bearing with snap ring. | 27. 1/8" pipe plug. |
| 13. Bearing lock nut. | 28. Screw with lockwasher (shift housing cover to housing). |
| 14. Bearing cover gasket. | |
| 15. Bearing cover. | |



BODY AND CAB GROUP

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