

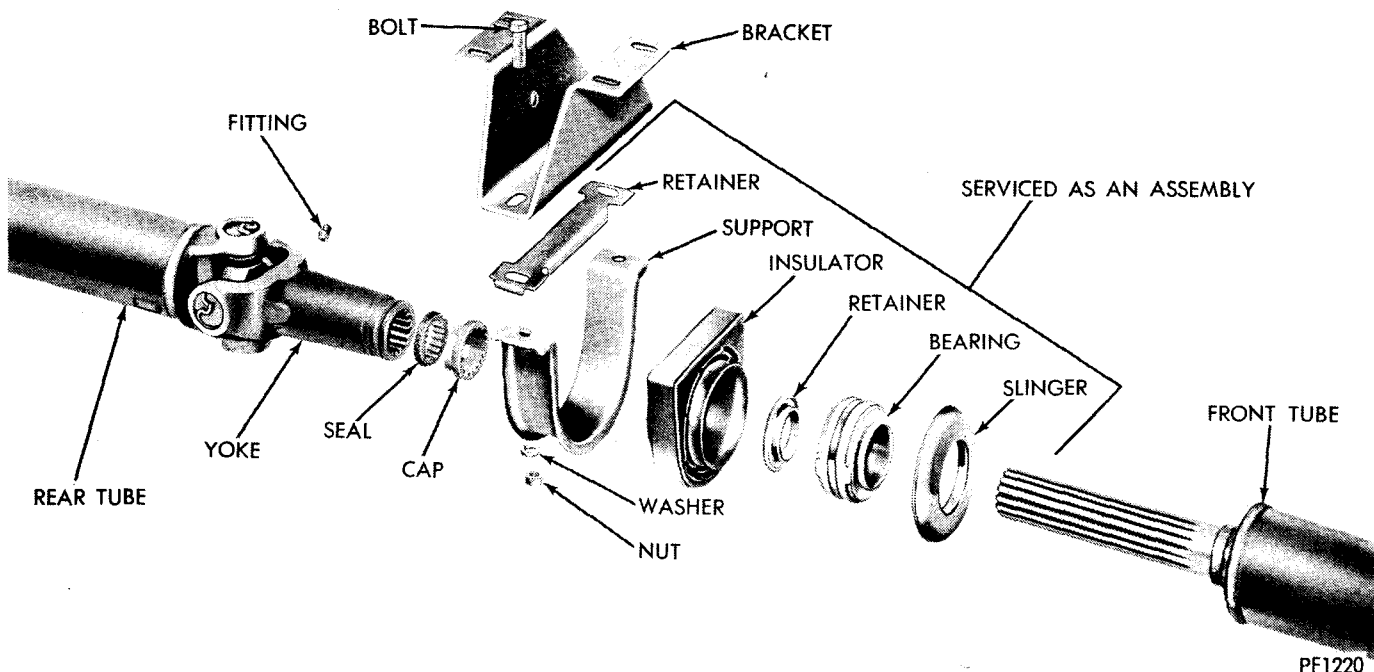


Fig. 5—Slip Yoke Center Bearing

splined couplings are provided with arrows for easy matching (Fig. 6). The arrows are stamped on these parts during initial assembly and balancing.

Make certain arrows are in line. This aligns yokes on parallel planes and maintains original balance of shaft assembly. Check for arrow alignment marks before removing or disassembling propeller shaft. If arrows are not legible, center punch mark the shafts and yokes to insure that propeller shaft will be reassembled for alignment correctly.

Propeller shafts with tube yokes welded in each end, have the centerlines through bearing bores of both yokes aligned to each other during welding.

When propeller shaft has a spline at one end to receive a slip yoke, slip yoke must be installed so that centerline through its bearing bores is in line with centerline through yoke bores at other end of tube. This alignment is checked by eye because one spline equals more than twenty degrees of misalignment.

Single propeller shafts made with a slip yoke at one end, have alignment arrows stamped on yoke and tube. Arrows are stamped on these parts during initial assembly and balancing. Be sure these arrows are lined up. This aligns yokes and maintains original balance of shaft assembly. Check for arrow alignment marks before removing or disassembling propeller shaft. When arrows are not legible, center punch shafts and yokes so they may be reassembled in correct alignment.

Joint Phasing

Propeller shafts are properly phased when the cross and bearings (in the yoke) at each end of shaft are in the same plane.

On multiple shaft installations, proper joint phasing is accomplished by considering each tube separately.

As noted above, the presence of a slip spline and yoke does not affect the condition of same plane.

SLIP JOINT

Disassembly

When propeller shaft has been removed, look for arrow marks on shaft and slip yoke. When marks are not discernable, punch mark both members insuring reassembly in exactly same relative position. When marked, unscrew dust cap and withdraw shaft. Remove washer, steel washer, and dust cap from shaft.

Cleaning and Inspection

Clean all dirt and old grease from slip yoke; slip yoke spline and shaft splines using a suitable cleaning fluid. Inspect slip yoke splines for wear or evidence of twisting. Check clearance between slip yoke splines and shaft splines. Worn parts must be replaced when backlash is excessive.

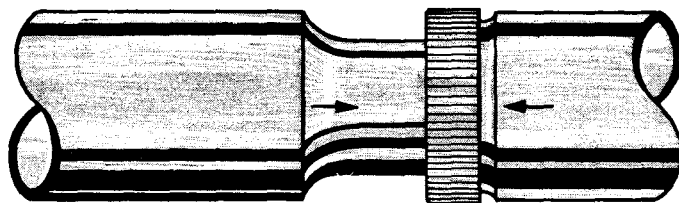


Fig. 6—Matching Prop Shaft Slip Yoke

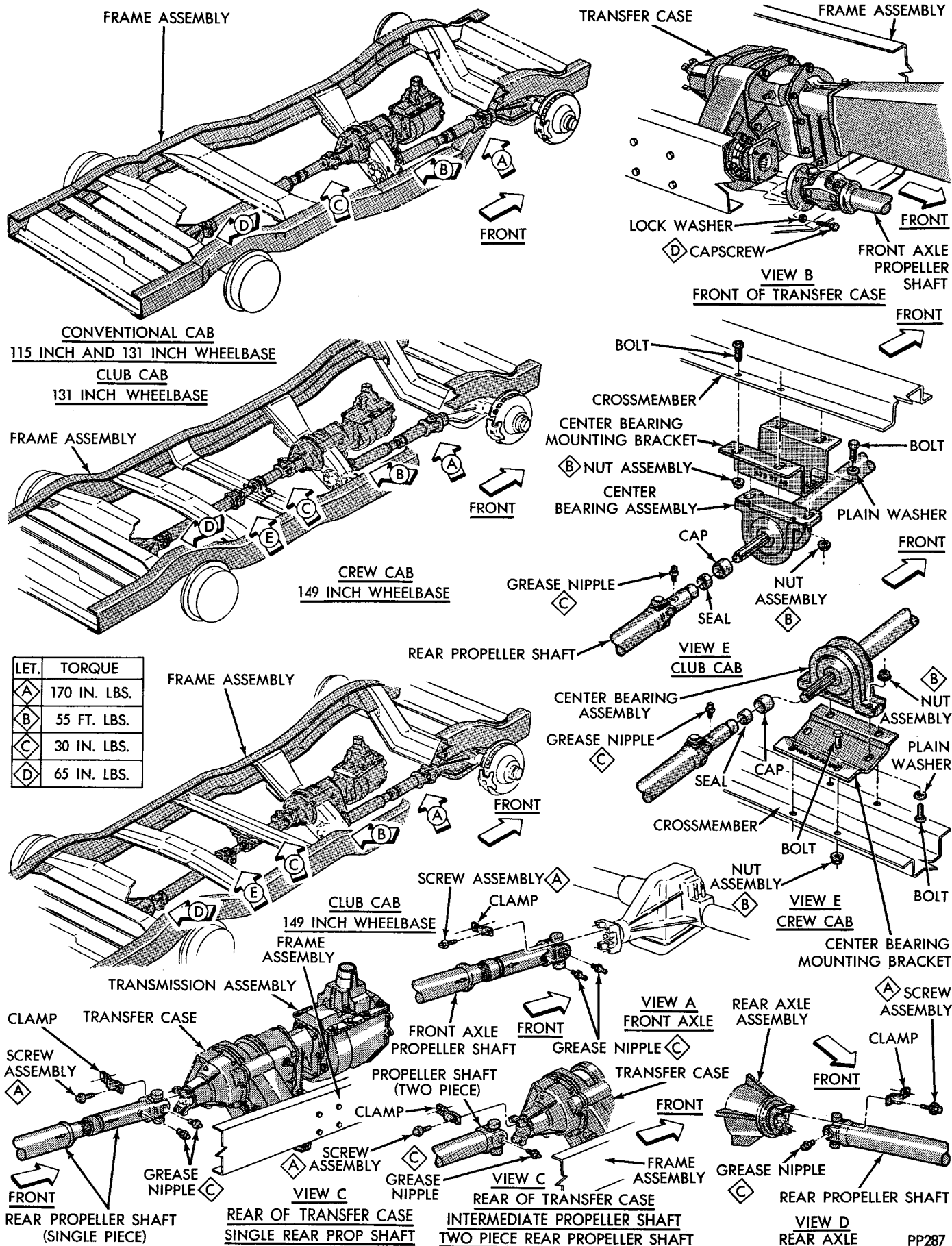


Fig. 7—Driveline Components (W100, W200, W300)

Assembly

(1) With dust cap positioned on shaft, install washers on shaft. Coat shaft splines with lubricant specified in LUBRICATION SECTION.

(2) Align arrows on splined shaft and slip yoke, then insert shaft into slip yoke. Make certain yokes on both joints are aligned. Journal crosses must be in same plane or serious vibration damage could occur.

(3) Install dust cap on slip yoke end. Hand tighten dust cap. Avoid use of wrench which will damage cork or felt washer.

(4) Install lubrication fitting in slip yoke.

FRONT PROPELLER SHAFT (Fig. 7) (Model 7260 For Vehicles W100, W200, W300)

Removal

(1) Remove skid plate if so equipped.

(2) Remove four (4) flange retaining bolts and lockwashers from constant velocity universal joint at transfer case.

(3) To prevent constant velocity universal joint from rotating while removing the four flange retaining bolts, utilize a press bar.

(4) Mark yokes before disassembly to assure retaining balance during reassembly.

(5) Remove four (4) nuts and lockwashers from front differential flange together with two (2) u-bolts.

Be sure to provide support for propeller shaft to prevent damage to universal joint during removal from vehicle and then separate universal joint at front differential flange by forcing propeller joint backward to clear flange.

(6) Under no circumstances should propeller shaft be allowed to drop or hang during removal as this can damage the centering ball arrangement. Tie up or otherwise support propeller shaft to prevent damage to universal joints during removal.

Constant Velocity (CV) Universal Joint

(1) To remove cross assembly support the prop shaft with universal joint (Figure 8) in a horizontal position in line with the base plate of a press. Place "U" joint so that the lower ear of the shaft yoke is supported on a 1-1/8" (30 mm.) socket (Figure 9). Place cross press tool C-4365-1 on the open horizontal bearing cups and press the lower bearing cup out of the yoke. Tool will shear the plastic which retained the bearing cup. Observe cup removal sequence (Figure 10).

(2) In the event the bearing cup is not completely removed, lift the cross and insert spacer tool C-4365-4 between the seal and bearing cup being removed (Figure 11). Complete the removal of the bearing cup by pressing it out of the yoke.

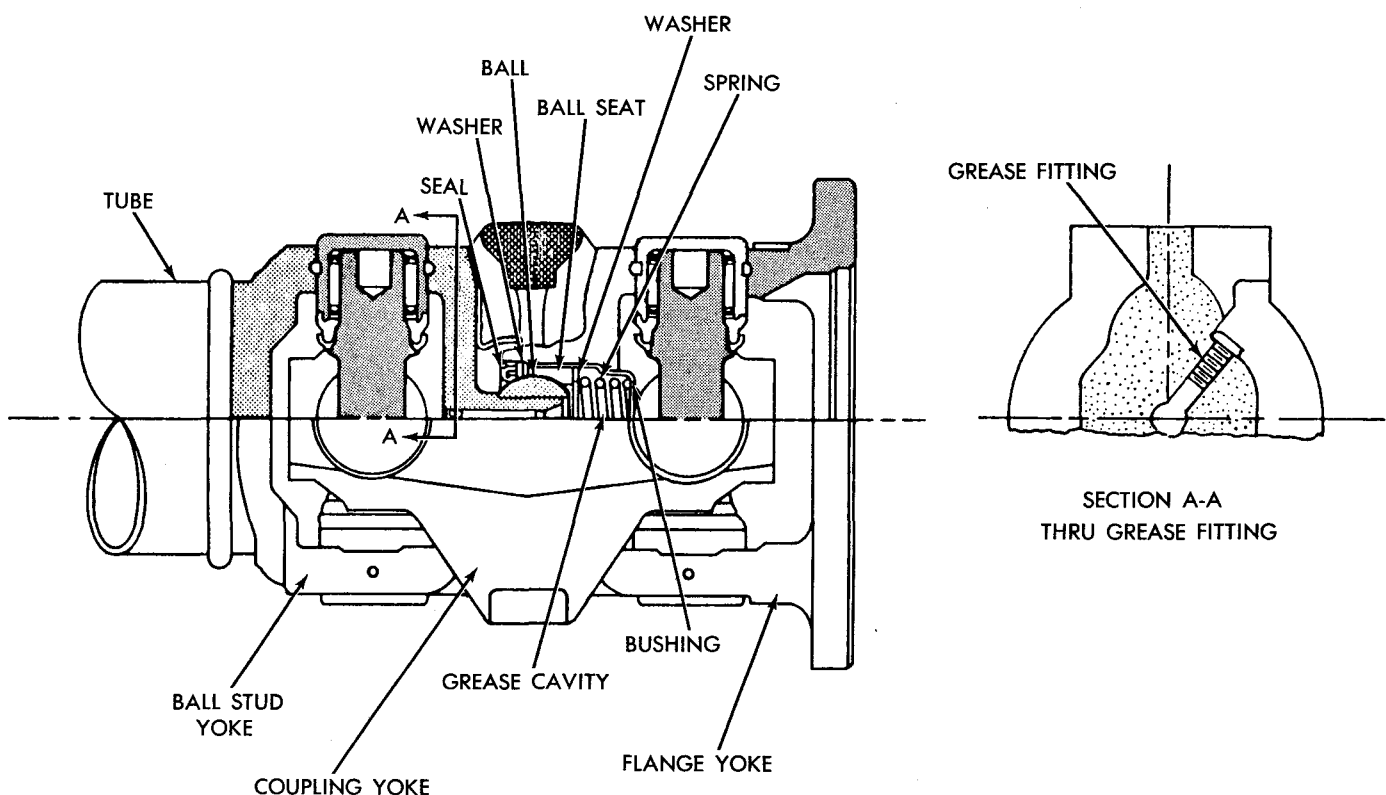


Fig. 8—Constant Velocity (CV) Universal Joint

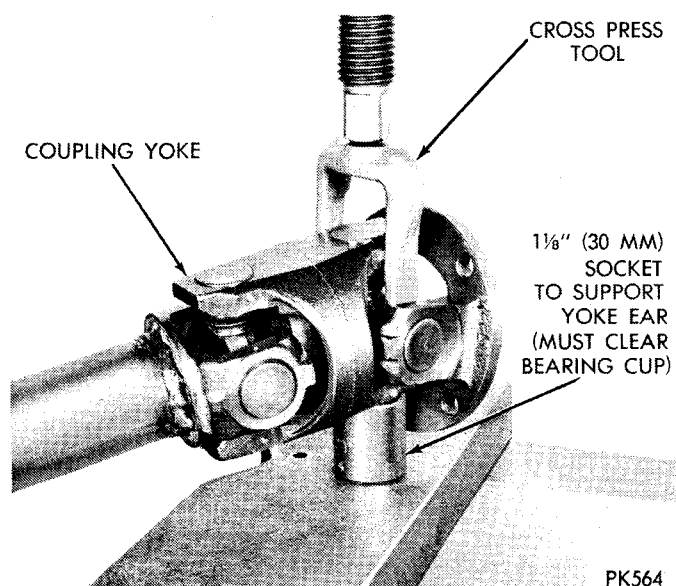


Fig. 9—Bearing Cup Removal (Tool C-4365-1)

(3) Rotate the drive shaft, shear the opposite plastic retainer, and press the bearing cup out of the yoke as before, using spacer if required. Disengage cross from yoke and remove. Install the bearing cups over the trunnions and press the remaining two bearings from the yoke.

(4) Clean all remains of the sheared plastic from the ears of the yokes. Production universal joints bushings and rollers cannot be reassembled. There are no retaining ring grooves in production bearing cups.

(5) To install cross assembly, install one bearing cup part way into one side of the yoke and turn this yoke to the bottom. Insert cross into yoke so that the trunnion seats into the bearing cup. Install the opposite bearing cup part way. Press the bearing cups, working the cross to insure free movement of the trunnions in the bearings.

(6) When one retaining ring groove clears the inside of the yoke, stop pressing and snap the retaining ring in place.

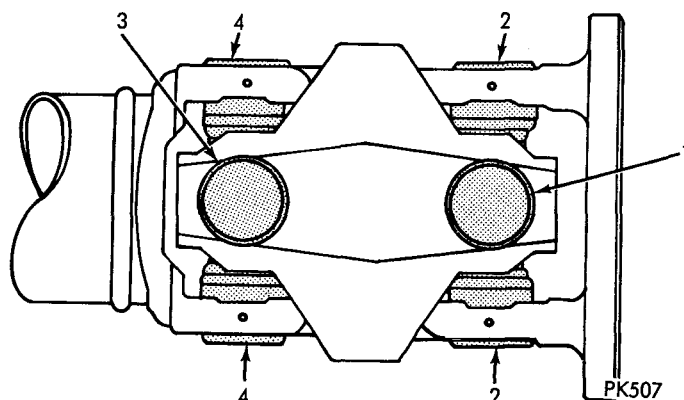


Fig. 10—Bearing Cup Removal Sequence

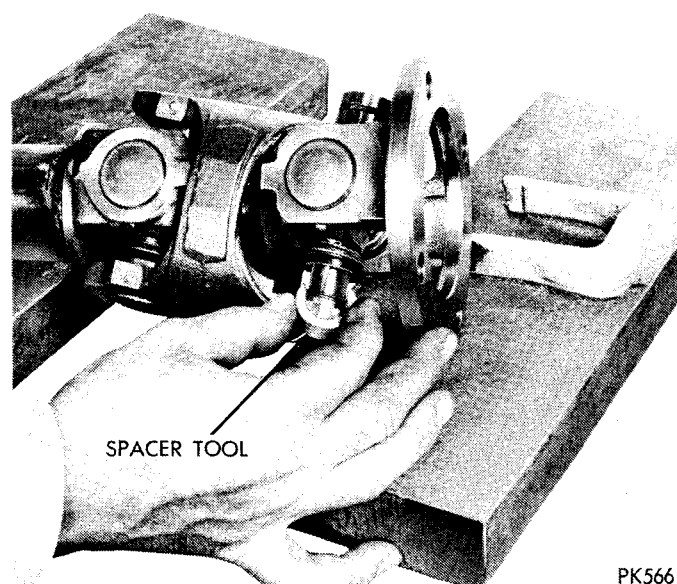


Fig. 11—Spacer Placement (Tool C-4365-4)

(7) Continue to press until the opposite retaining ring can be snapped into place. If difficulty is encountered, strike the yoke ear firmly with a hammer to seat the retaining rings.

(8) Relube the center ball and socket and assemble the other half of the universal joint in the same manner.

Ball Socket Inspection and Replacement

(1) For ball removal, separate the universal joint between the coupling yoke and the flange yoke by pressing out the trunnion bearing in the coupling yoke. Pull the flange yoke and cross with ball socket from the centering ball as a unit.

(2) Clean and inspect the ball seat insert bushing for wear. If bushing is worn, replace the flange yoke and cross assembly.

(3) Pry seal from ball cavity; remove washers, spring and three ball seats.

(4) Clean and inspect the centering ball surface,

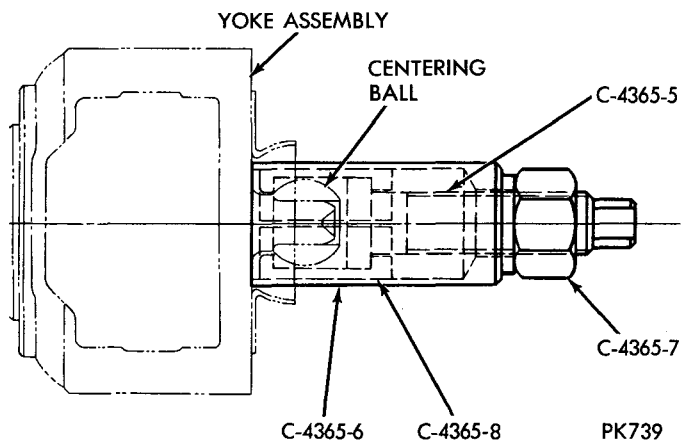


Fig. 12—Centering Ball Removal (Tool C-4365-5, 6, 7, 8)

16-12 PROPELLER SHAFT AND UNIVERSAL JOINTS

seal, ball seats, spring and washer. If parts are worn or broken replacement is recommended.

(5) Remove centering ball using components of Tool C-4365; C-4365-5 screw, C-4365-6 sleeve, C-4365-7 nut and C-4365-8 jaws as shown in (Fig. 12).

(6) Draw the ball off the ball stud.

(7) To install centering ball onto stud, drive until ball can be seen to seat firmly against the shoulder at the base of the stud (Figure 13).

Lubrication

(1) Using the grease provided in the ball seat kit, lubricate all parts and insert them into the clean ball seat in this order: spring, small O.D. washer, three ball seats with large opening outward, and large O.D. washer.

(2) Lubricate seal lip and press in seal flush with suitable tool. Sealing lip should tip inward. Fill cavity with grease provided in service kit.

Installation

Propeller shafts together with their yoke installed cross and bearings at each end of shaft must be in the same plane. The presence of a slip spline and yoke will not affect condition of the same plane.

(1) Before installing propeller shaft, wipe sliding yoke clean, inspect machined surface for scratches, nicks or burrs. Do not burr the splines when engaging yoke splines.

(2) Provide support for propeller shaft during in-

installation as recommended in (4) above, to prevent damage to universal joints.

(3) Position front end of shaft and aligning marks noted during removal.

(4) Install two u-bolts on u-joint and insert in differential flange. Attach four (4) lockwashers and nuts.

(5) Install four (4) lockwashers and bolts through transfer case flange yoke and into constant velocity universal joint. Use press bar to prevent assembly from rotating while attaching bolts.

(6) Tighten all bolts to torques as specified.

PROPELLER SHAFT BALANCE

If a vibration is traced to a propeller shaft, it may be checked and balanced in the following manner:

(1) Raise vehicle on hoist and install jack stands.

(2) Clean all foreign material from shaft (mud undercoating, etc.).

(3) Examine shaft for missing balance weights, broken welds, bends or dents. **If the shaft is bent, it should be replaced.**

(4) Make sure that cross and rollers are not worn and that they are properly centered in the shaft and that their retainers are properly installed.

(5) Check or retighten pinion flange bolts.

(6) Remove wheelcovers. Mark rear wheel and stud to aid in proper indexing at reassembly. Remove wheel and tire assemblies. Reinstall wheel nuts to hold brake drums in position.

(7) Mark the shaft at four 90° intervals, approximately six inches forward of the weld at the rear end, and number them one through four.

(8) Install and tighten a screw type hose clamp on the prop shaft with screw at position number one (Fig. 14).

(9) Connect a tachometer. Start the engine, place vehicle in gear and accelerate engine to R.P.M. where vibration occurred. Compare vibration level to

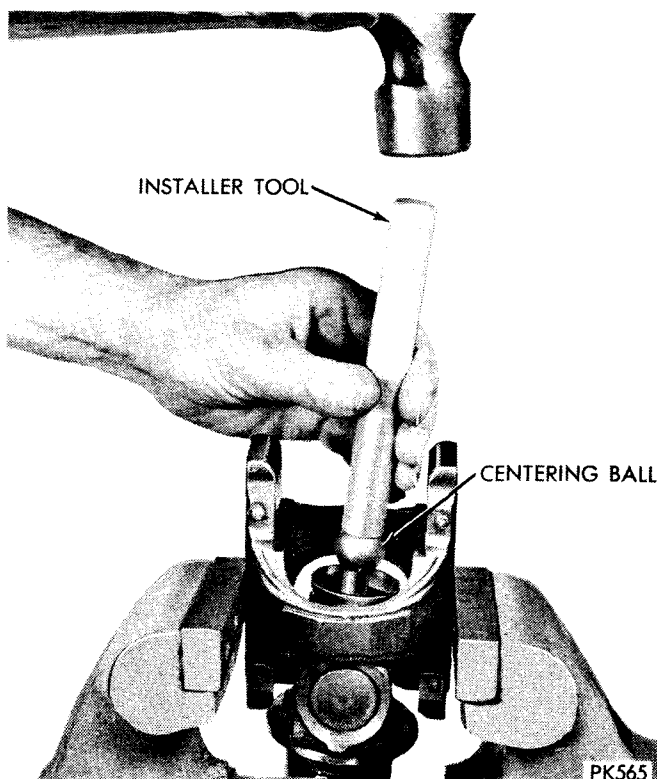


Fig. 13—Centering Ball Installation (Tool C-4365-3)

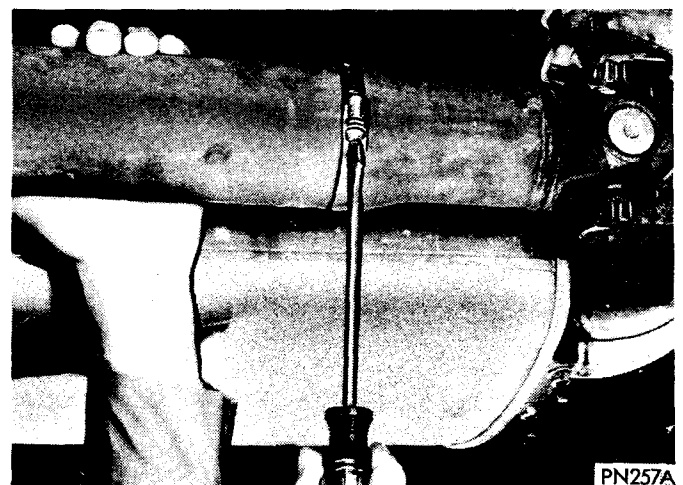


Fig. 14—Clamp Installed at Position Number One

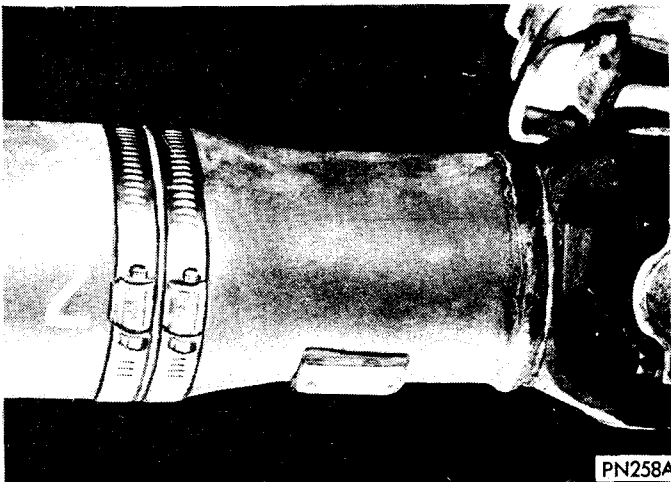


Fig. 15—Two Clamps Installed at Best Position

original complaint. If there is little or no change, move clamp to the other three marked positions and repeat test. If no difference is noted with clamp moved to all four positions, vibration may not be propeller shaft unbalance.

(10) If vibration lessened but was not completely gone, position two clamps at that point and run test again (Fig. 15).

(11) Two clamps combined weight at one point may cause an unbalance condition; if so, rotate clamps about one half inch (one quarter inch each

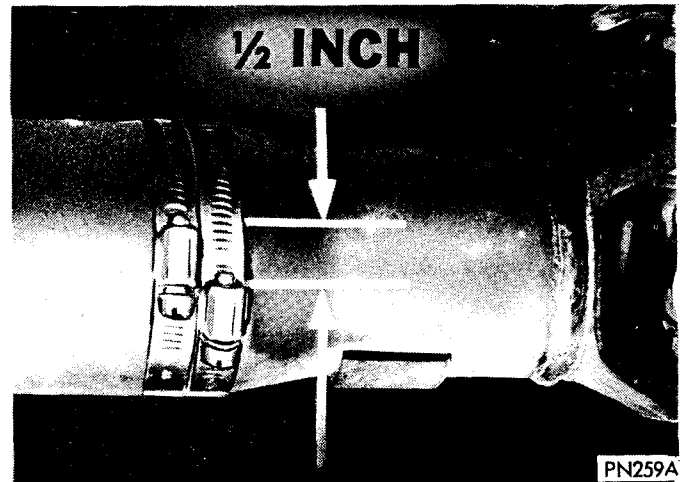


Fig. 16—Rotating Clamps Apart

above and below the best position), and repeat test (Fig. 16).

(12) Continue to rotate clamps apart until vibration is at its lowest level. Bend loose end of clamp so that clamp will not loosen.

(13) Reinstall wheel and tire assemblies and wheel covers. Remove jack stands, lower vehicle and road test.

(14) If vibration level is still unacceptable, repeat this procedure at the front end of propeller shaft.

TIGHTENING REFERENCE

	Thread Size	Foot-Pounds	Inch-Pounds
Center Bearing Bracket to Frame Bolt	7/16-14	50	—
Center Bearing Support to Bracket Bolt	7/16-14	50	—
Hub Yoke (Axle)	7/8-14	300	—
Hub Yoke (Transmission)	3/4-16	175	—
Roller Bushing Clamp Bolt	1/4-28	—	170
Roller Bushing Clamp Bolt	5/16-24	—	300
Parking Brake to Flange Yoke Nut	3/8-24	35	—

SPRINGS AND SHOCK ABSORBERS

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GENERAL INFORMATION

Leaf-type fixed rate front springs are used on W100, W200, W300 and all medium duty trucks. The double-wrapped fixed eye type front spring (Fig. 1) is used on S600, S700 and D500 through D800 vehicles. The springs are mounted approximately parallel to the frame side members and are held in place on the axles by "U" bolts. The D100, D200 and D300 front springs are independent coil type and are covered in the "Independent Front Suspension" section of Group Two in this manual.

The leaf type light and medium duty truck front and rear springs are equipped with Silentbloc rubber bushings.

The most common type of truck spring is the semi-elliptic leaf. It is composed of a number of steel leaves of graduated length, each leaf being in contact with the leaf above, except where the design is intended to give a changing rate of light load, as in a "Progressive Type."

Progressive type rear springs (Fig. 2) are standard on D100, D200 and D300 model trucks.

The progressive spring is comprised of two stages. The first stage, comprised of the upper leaves, provides a low rate at light loads. The lower leaves, second stage, gradually come in contact with the upper leaves providing increased rate at heavier loads. This

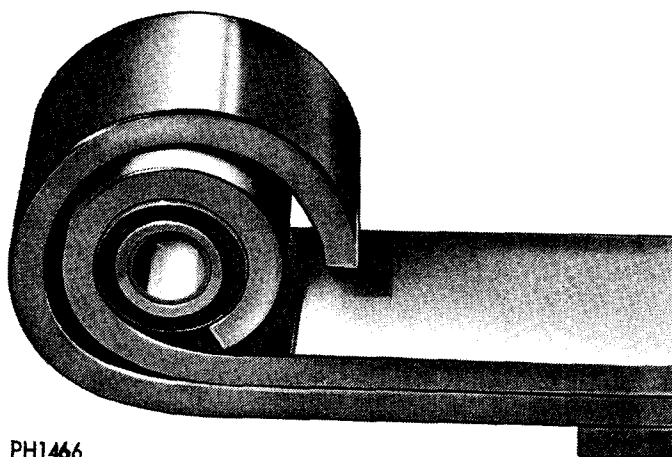
type of spring should not be confused with the main and auxiliary type of two-stage spring where the auxiliary spring is mounted above the main leaves.

The variable rate rear spring now used on medium duty models utilizes cam brackets to control the spring rate. The effective length of the spring is longest at light loads allowing a low rate and improved ride. As load is applied the spring length shortens which in turn increases the spring rate to supply a firm support for the added load.

The radius leaf is used to control rear axle articulation. Depending on the spring used, the ends of the 2nd or 3rd leaf are turned down to form hooks. The hook surrounds a bolt and is a safety against loss of the axle in case of radius leaf failure. The hooks also restrain the rebound travel of the axle.

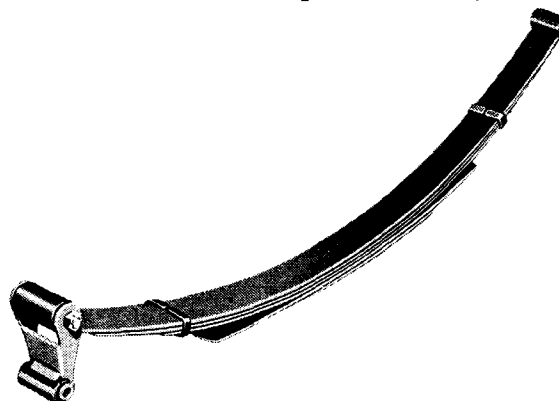
Improvements in construction and application have made it advantageous to use leaf springs containing less leaves. The width and length of spring has increased and leaf thickness has also increased. This has been done without sacrificing load capacity or the life of the spring.

The springs are designed to operate normally without lubrication between the leaves, however, under abnormal conditions, some lubrication may be necessary. Light duty D100, D200 and D300 truck springs are equipped with plastic tip liners. Heavy Duty D200



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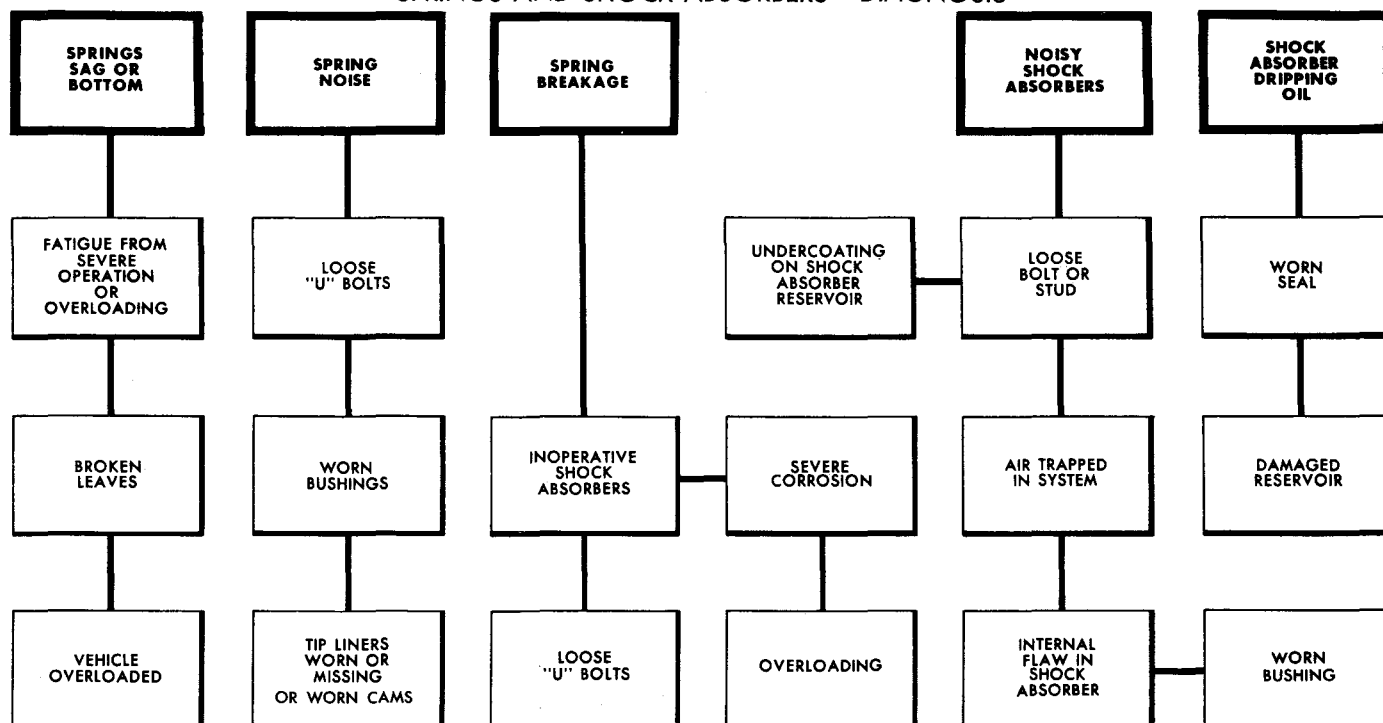
Fig. 1—Double-Wrapped Fixed Eye



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Fig. 2—Progressive Type Spring

SPRINGS AND SHOCK ABSORBERS—DIAGNOSIS



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and D300 trucks do not have plastic tip liners. **These tips should not be lubricated**, but may be replaced if worn or missing.

Spring leaves, if broken, may be replaced with new parts, however, if spring assemblies have taken a set (lost significant height), they should be replaced.

SERVICE PROCEDURES

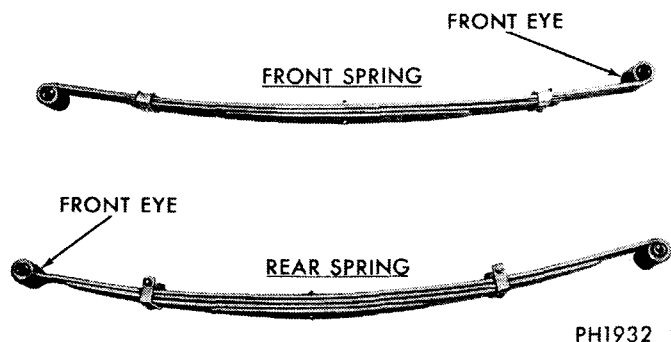
The following procedures apply to all medium duty and "W" model front and rear springs and to D100, D200 and D300 rear springs.

For removal and installation of D100, D200 and D300 Front Springs see "Independent Front Suspension" section, Group Two in this manual.

FRONT SPRINGS (Figs. 3 Thru 9)

Removal

- (1) Using a chain hoist or hydraulic crane hooked



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Fig. 3—Front and Rear Spring Assemblies (W100-W200)

to towing eyes or at frame attachment, raise truck until weight is removed from springs.

- (2) With wheels still touching the floor, install stands under side frame members as a safety precaution.

- (3) Disconnect sway bar at spring plate if applicable.

- (4) Remove nuts, lockwashers and "U" bolts securing spring to axle.

- (5) Remove spring shackle bolts, shackles, and spring front eye bolt, then remove spring.

Installation

- (1) Line up spring fixed eye with bolt hole in bracket and install spring bolt and nut.

- (2) Install shackle bolts, shackles and nuts. Tighten shackle bolt nuts and fixed eye bolt nut until slack is taken up.

- (3) Position spring on axle so spring center bolt enters locating hole in axle pad.

- (4) Install "U" bolts, new lockwashers and nuts. Tighten until nuts push lockwashers against axle.

- (5) Connect sway bar to spring plate if applicable.

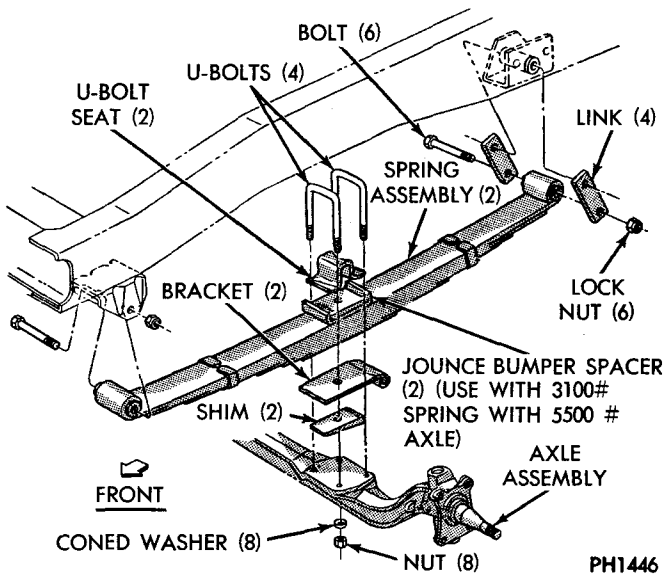


Fig. 4—Front Suspension—5000#, 5500# and 7000# Axle (S600, S700 and D500 thru D800)

(6) Remove stands from under frame, lower truck so weight is resting on wheels. Tighten "U" bolt nuts, spring eye bolt nuts and shackle bolt nuts to specifications given in spring tightening references. Do not lubricate rubber bushings.

REAR SPRINGS (100 THROUGH 300 MODELS ONLY) (Figs. 10 through 14)

Removal

(1) Raise rear of truck with chain hoist or hydraulic crane until weight is removed from springs, wheels just touching the floor.

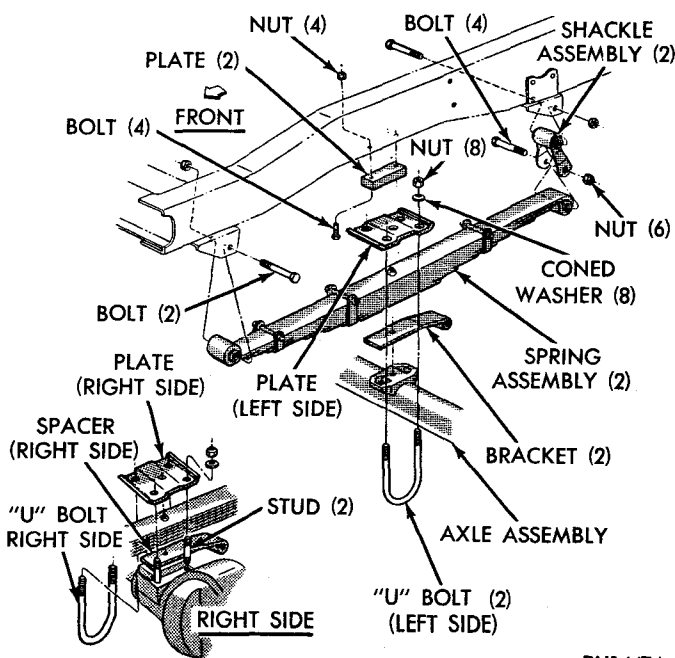


Fig. 5—Front Suspension (Spicer 70 Axle)—W600

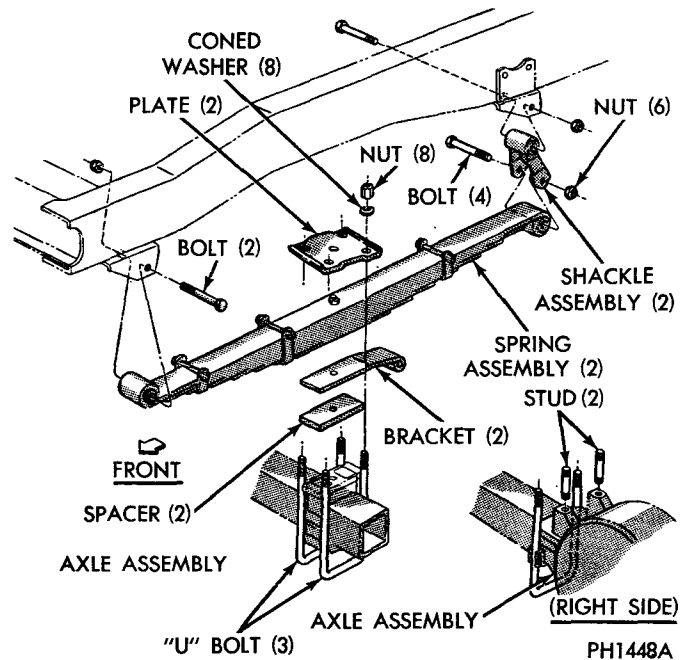


Fig. 6—Front Suspension (F75 Axle)—W600

Truck must be lifted by jack or hoist under frame side rail at crossmember behind the axle, being careful not to bend flange of side rail.

(2) Place stands under side frame members as a safety precaution.

(3) Remove nuts, lockwashers and "U" bolts securing spring to axle.

(4) Remove spring shackle bolts, shackle, and spring front bolt, then remove spring.

Installation

(1) Position spring on axle so spring center bolt enters locating hole in axle housing pad.

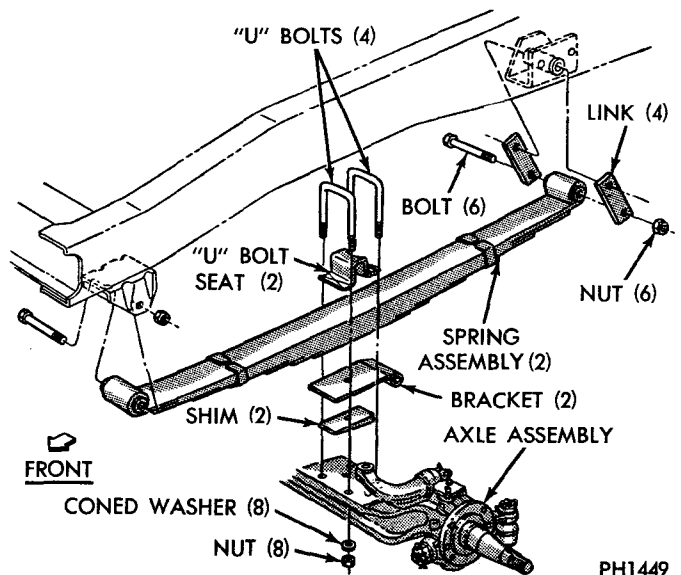


Fig. 7—Front Suspension (9000# Axle)—D800

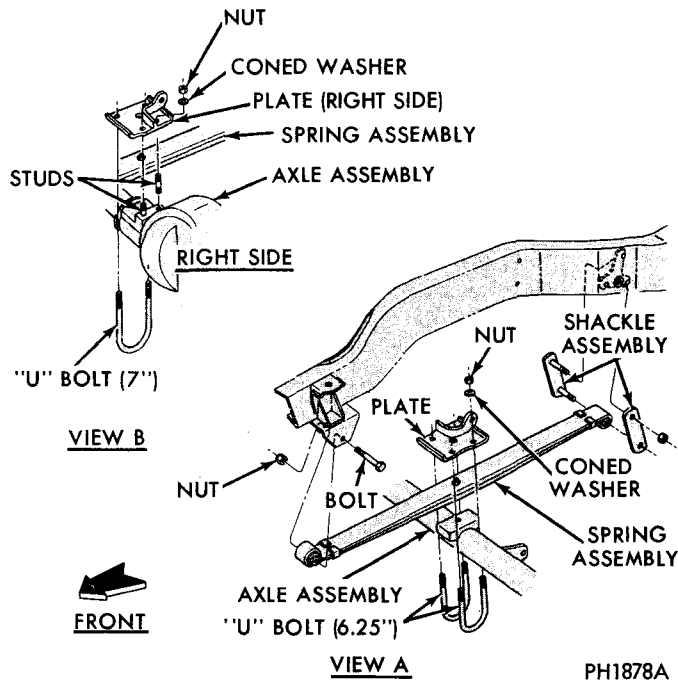


Fig. 8—Front Suspension (Spicer 44 Axle)—W100 and W200

(2) Line up spring front eye with bolt hole in bracket and install spring bolt and nut.

(3) Install the rear shackle, bolts and nuts. Tighten shackle bolt nuts and front bolt nut until slack is taken up.

(4) Install "U" bolts, new lockwashers and nuts. Tighten until nuts push lockwashers against axle. Align auxiliary spring parallel with main spring.

(5) Remove stands from under frame, lower truck

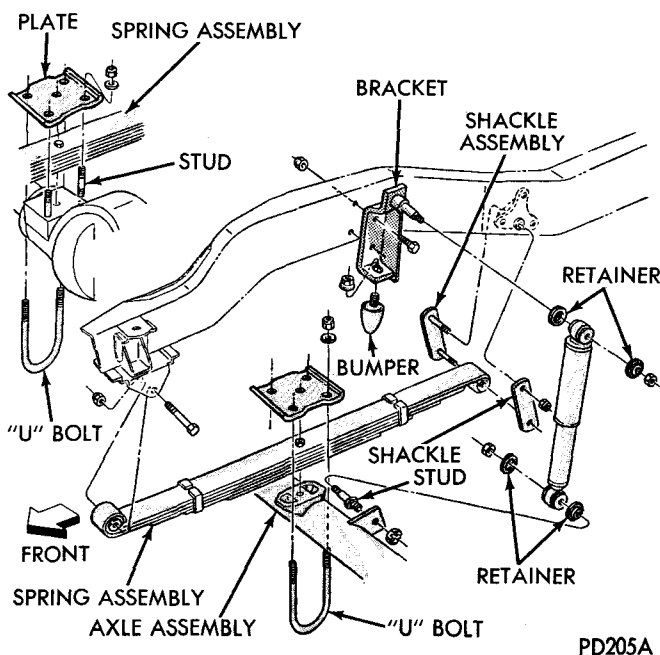


Fig. 9—Front Suspension (Spicer 60 Axle)—W200 and W300

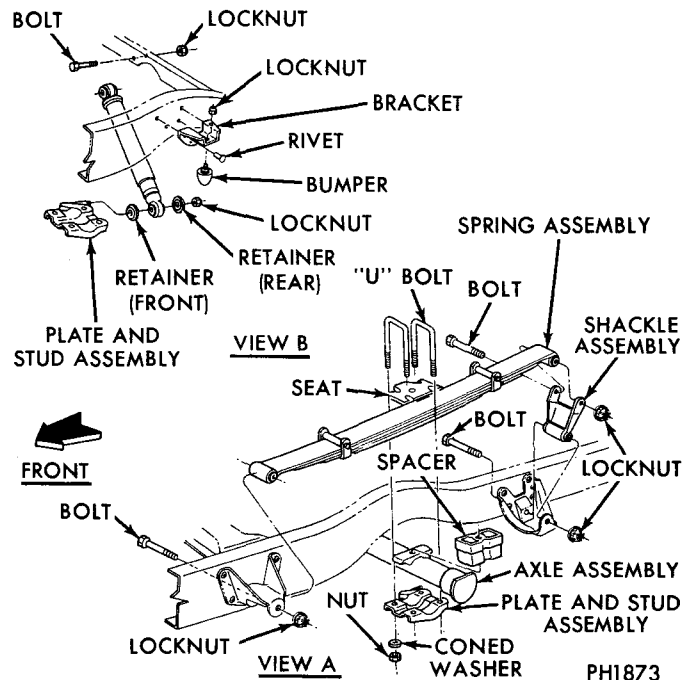


Fig. 10—Rear Suspension—W100

so weight is resting on wheels. Tighten the "U" bolt nuts, spring eye bolt nuts and shackle bolt nuts to specifications given in spring tightening reference.

Installing New Leaf

(1) Clamp spring in a vise as shown in Fig. 13. Loosen or remove spring leaf alignment clips and remove center bolt.

(2) Insert long drift in center bolt hole and release vise slowly.

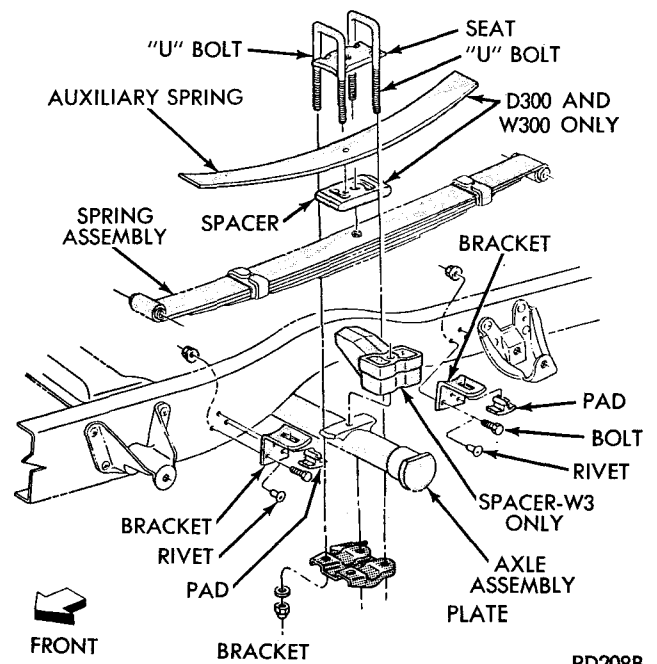


Fig. 11—Rear Suspension—W200, W300 and D300

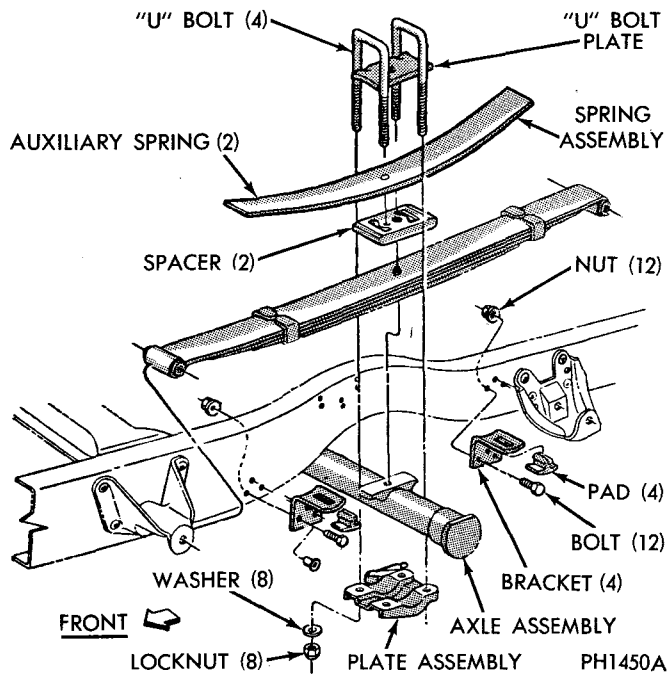


Fig. 12—Rear Suspension with Auxiliary Spring—D100 and D200

(3) Remove assembly from vise and replace broken leaf.

(4) Place spring assembly in vise, slowly tighten vise while holding spring leaves in alignment with drift.

(5) Remove drift and install new center bolt (Fig. 13).

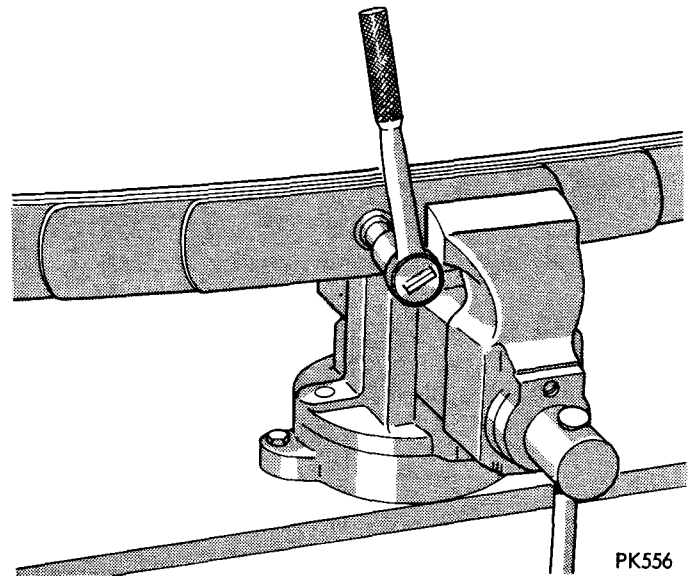


Fig. 13—Disassembling Spring Assembly

(6) Install nut, tighten to 15 foot-pounds or until center of spring has no gap between leaves (maximum 40 foot-pounds). Reinstall alignment clips.

REAR SPRINGS (D500, D600, D700, D800, W600, S600 and S700) (Fig. 14)

Removal

(1) Raise truck frame until weight is off rear springs with wheels still touching floor.

(2) Remove nuts from spring "U" bolts and re-

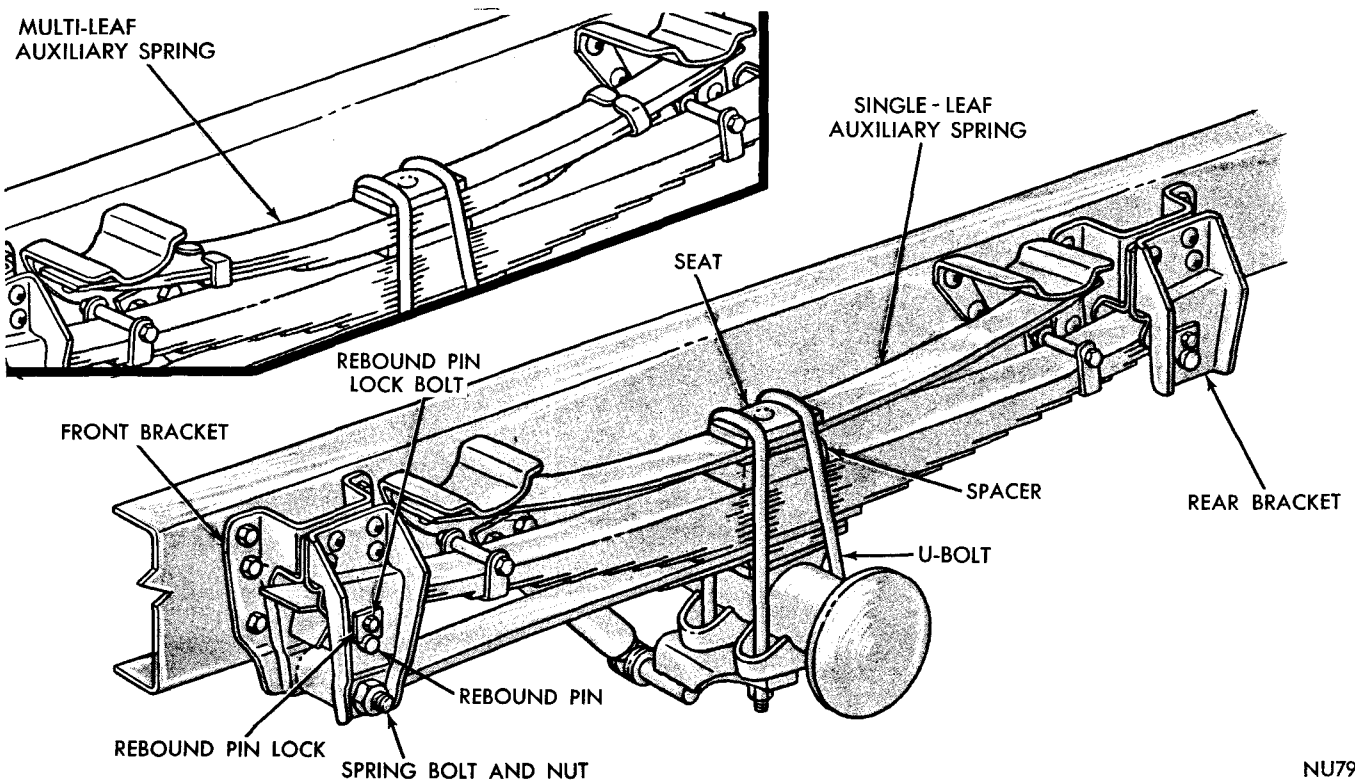


Fig. 14—Variable Rate Spring

17-6 SPRINGS AND SHOCK ABSORBERS

move spring plate. Remove spring "U" bolts.

(3) If truck is so equipped, remove the auxiliary spring and spacer (Fig. 14).

(4) Install a "C" clamp on radius leaf to relieve load on spring eye bolt. Remove front eye bolt retaining nut.

(5) Remove spring eye bolt, and slowly release tension on radius leaf.

(6) Remove rebound pin retaining lock from bracket. Remove spring rebound pin.

(7) Remove rebound pin retaining lock from rear bracket. Remove rebound pin.

(8) Remove rear spring.

(9) If necessary replace radius leaf eye rubber bushing.

Installation

(1) Position spring in front bracket and install rebound pin. Install retaining lock.

(2) Position spring in rear bracket, and install rebound pin, install retaining lock.

(3) Align spring eye and install spring eye bolt and nut. It may be necessary to draw the radius leaf eye into position with a "C" clamp.

(4) Install auxiliary spring assembly if so equipped.

(5) Install spring "U" bolt plate and "U" bolt seat. Install "U" bolts, washers and nuts. Tighten nuts until they are snug.

(6) Lower truck to the floor and tighten spring "U" bolt nuts as specified.

WEIGHT DISTRIBUTION AND LOADING

Payload distribution is an important phase of vehicle operation. The load should be distributed as evenly as possible over the floor of the vehicle. In other words, the weight centerline should fall slightly ahead of the rear axle.

Improper loading often results in excessive tire wear, spring failure, or a sufficient change in caster angle to cause erratic steering under extreme conditions.

Proper front tire contact on the road is necessary for stability and safety. However, this tire contact cannot be maintained when the load is shifted too far toward the rear of the vehicle.

Proper weight distribution should be taken into consideration when making inspections and adjustments to correct erratic steering, spring failure or excessive tire wear.

SWAY BAR

Removal

- (1) Remove link rod nut from each end of sway bar.
- (2) Remove retainers and rubber bushings from sway bar link rods.

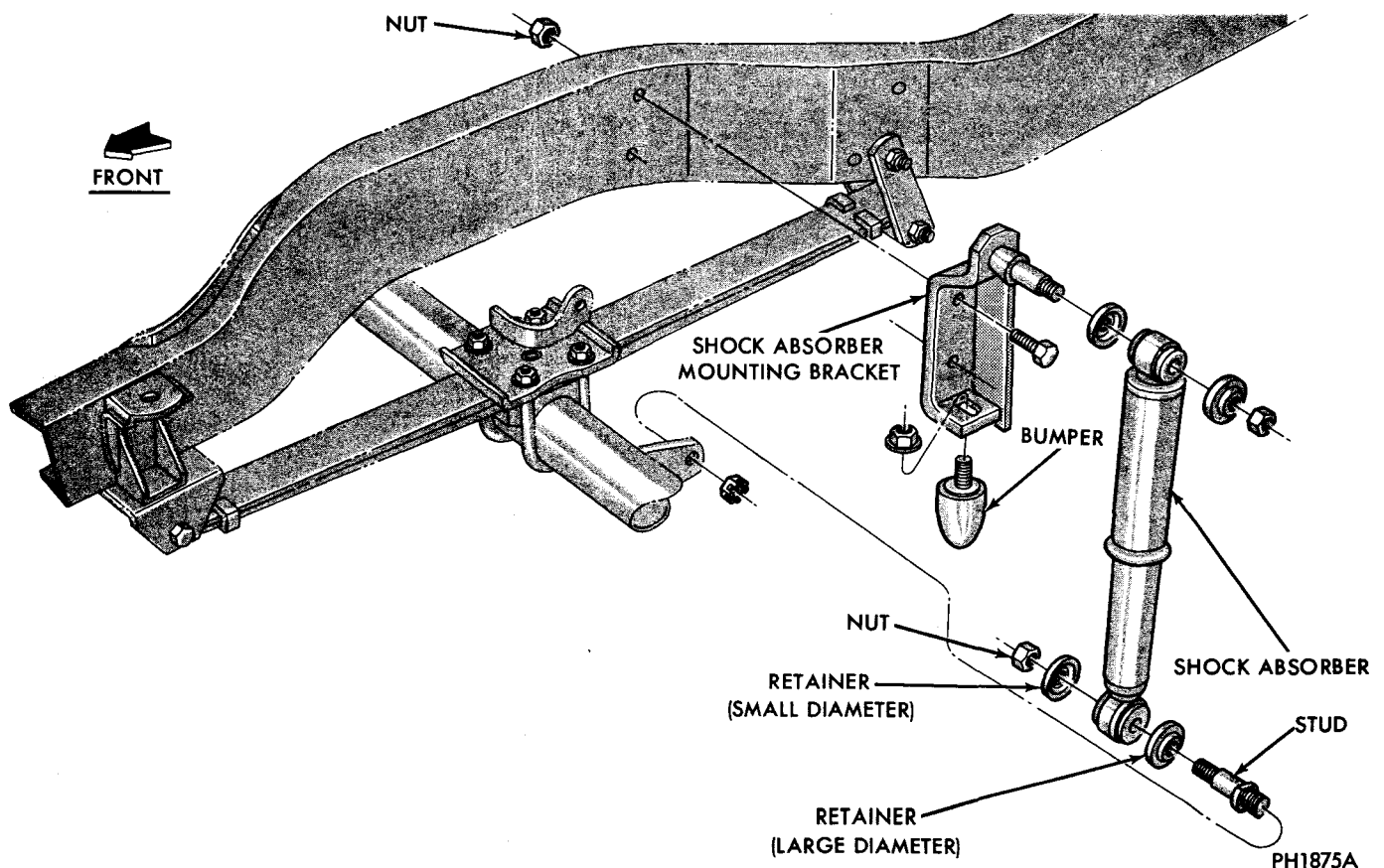


Fig. 15—Front Shock Absorber and Bumper

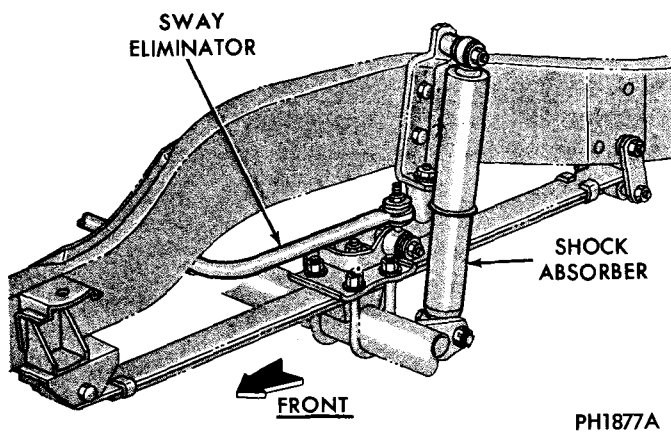


Fig. 16—Front Shock Absorber and Swaybar Installed

(3) Remove bolts from "U" shaped sway bar support brackets and remove sway bar.

Installation

- (1) Place sway bar into position and install "U" shaped sway bar support brackets. Tighten as specified.
- (2) Install sway bar link retainers and bushings.
- (3) Install link rod nuts. Tighten as specified.

SHOCK ABSORBERS (Figs. 15 and 16)

Shock Absorber Removal and Installation

(1) Remove the two bolts securing the shock absorber bracket to the frame. **On all 4 x 4 Models, remove**

lower bracket bolt, loosen upper bolt, rotate bracket until shock absorber clears upper bolt and remove.

(2) Remove shock absorber lower bracket nut, rubber bushings and washers.

(3) After removing shock absorber and bracket assembly from vehicle, remove bracket from shock absorber.

(4) Before installing the shock absorbers on the vehicle, install upper brackets.

(5) When installing the shock absorbers, be sure the bushings are replaced in the shock absorber and the shock absorber assembled to the stud with proper retainers on either side of the bushings. Install the nut and tighten as specified in tightening reference.

Shock Absorber Tests

- (1) Remove from vehicle.
- (2) To remove entrapped air use the following procedure:
 - a. Hold shock upright (simulate position as on vehicle) and run to full extension.
 - b. Invert shock absorber and slowly collapse until the piston bottoms.
 - c. Repeat the above procedure several times.
- (3) Clamp lower end in vise having shock absorber in upright position.
- (4) Extend and collapse shock absorber.
- (5) A good shock absorber will have an even, steady resistance in both directions.
- (6) If little or no resistance is felt, the shock absorber should be replaced.

SPECIFICATIONS

FRONT SPRINGS

Truck Model Designation	Width/Length (Inches)	No. of Leaves	Capacity Axle (Lbs.)	Capacity, Spring
Standard Equipment				
W100, W100 Club Cab, W200 (44 Axle)	48/2.5	3	3500	1400/1640
W200 (Club Cab)	48/2.5	3	3500	1550/1800
W100 Sno-Fiter, W200 Sno-Fiter	48/2.5	3	4500	1750/2100
W200 (60 Axle)	48/2.5	5	4500	1600/1840
W300	48/2.5	5	4500	1600/1940
W200 Sno-Fiter (H.D.)	48/2.5	6	4500	1900/2250
D500, D600	52/3.0	6	5000	2150/2500
W600 (Export only)	52/2.5	6	7500	2550/3000
W600	52/2.5	8	7500	3200/3750
S600, D600, S700, D700	52/3.0	7	5500	2500/2900
D600, S600, D700, S700, D800	52/3.0	8	7000	3100/3500
D700, D800, S700	52/3.0	8	9000	4000/4600
Extra Equipment				
W100	48/2.5	3	3500	1550/1800
W300	48/2.5	6	4500	1900/2250
D500, D600	52/3.0	7	5000	2500/2900
D600, S600	52/3.0	8	5500	3100/3500
S600, D600, D700, S700, D800	52/3.0	8	7000	4000/4600
D800	52/3.0	8	9000	5000/5700

Note: Light and Medium Duty Trucks use rubber type bushings on all spring applications.

REAR SPRINGS

Truck Model Designation	D100	D200	D300
Standard Equipment			
Spring (type)	Progressive	Progressive	Progressive
Width (inches)	2.5	2.5	2.5
Length (inches)	52	52	52
Number of Leaves	4	5	6
Type of Bushings	Rubber	Rubber	Rubber
Capacity (lbs.) 6-8 Cyl.—*Pad Rating	1350	1950	2500
**Ground Rating	1520	2175	2820
Extra Equipment			
Capacity (lbs.) 6-8 Cyl.—*Pad Rating	1650	2500	3250
**Ground Rating	1820	2725	3650
Number of Leaves	5	6	7
Auxiliary Leaf (Extra with Extra Equipment)			
Thickness	.262	.423	.423
Added Capacity (lbs.)	365	585	***585
Truck Model Designation	W100	W200	W300
Standard Equipment			
Spring (type)	Progressive	Progressive	Progressive
Width (inches)	2.5	2.5	2.5
Length (inches)	52	52	52
Number of Leaves	4	5	7
Type of Bushings	Rubber	Rubber	Rubber
Capacity (lbs.) 6-8 Cyl.—*Pad Rating	1350	1950	3250
**Ground Rating	1520	2175	3650
Extra Equipment			
Capacity (lbs.) 6-8 Cyl.—*Pad Rating	1650	2500	—
**Ground Rating	1820	2725	—
Number of Leaves	5	6	—
Auxiliary Leaf (Extra with Extra Equipment)			
Thickness	—	.423	.423
Capacity (lbs.)	—	585	***585

*Pad Rating = Weight actually supported by spring on the axle spring pad (sprung weight).

**Ground Rating = Total of "sprung weight" and wheel and axle assemblies on the ground, per wheel.

***900 lb. 4 leaf auxiliary spring available on 10,000 lb. G.V.W. D300 and W300 models only.

REAR SPRINGS (VARIABLE RATE)

Truck Model Designation	Capacity Pad/Ground	Rate of Defl. (Lbs. Per In.)	No. of Leaves
D500	6100/6750	380/2150	13
D500, D600, S600, W600	6850/7500	380/2150	13
D600, S600, W600	7750/8500	652/2700	12
D600, D700, D800, S600, S700, W600	8400/9250	652/2700	12
D600, D700, D800, S600, S700, W600	9300/10400	635/2900	13
D700, D800, S600, S700	10400/11500	780/3300	14
D500, D600, D700, D800, W600		2300 (Aux.—Single Leaf)	
		3000 (Aux.—Multi Leaf)	

Note: Following information pertains to all medium duty rear spring applications.

1. Bushing type	Rubber	5. Length—Max.	59.25
2. Radius Leaf Eye Pin Dia.	.875	Light	55.25
3. Mounting (Front and Rear Ends)	Cam	Loaded	46.0
4. Width	3.0 In.	Aux.	34.5

TIGHTENING REFERENCE

SPRINGS AND SHOCK ABSORBERS

SPRINGS (FRONT)

W100, W200, W300	
Shackle Nut	80 Ft./Lbs.
Front Eye Bolt Nut	80 Ft./Lbs.
Spring Plate Stud	105 Ft./Lbs.
Spring Plate Stud Nut	110 Ft./Lbs.
"U" Bolt Nut	110 Ft./Lbs.
D500, D600, D700, D800, W600, S600, S700	
Shackle Nut	170 Ft./Lbs.
Front Eye Bolt	170 Ft./Lbs.
"U" Bolt Nut (9/16-18)	115 Ft./Lbs.
"U" Bolt Nut (5/8-18)	160 Ft./Lbs.

SPRINGS (REAR)

D100, D200, D300, W100, W200, W300	
Shackle Bolt Nut and Front Eye Bolt (1/2-20)	93 Ft./Lbs.
Shackle Bolt Nut and Front Eye Bolt (5/8-18)	160 Ft./Lbs.
Shackle Bolt Nut and Front Eye Bolt (3/4-16)	200 Ft./Lbs.
"U" Bolt Nut	65 Ft./Lbs.
"U" Bolt Nut	110 Ft./Lbs.
Aux. Spring Pad Bracket to Frame Bolt Nut	30 Ft./Lbs.
D500, D600, D700, D800, S600, S700, W600	
Front Eye Bolt Nut	200 Ft./Lbs.
Rebound Pin Lockscrew	200 Inch/Lbs.
"U" Bolt Nut (3/4-16 and 7/8-14)	335 Ft./Lbs.
Auxiliary Spring Bumper Bracket to Frame Bolt Nut ...	55 Ft./Lbs.

SHOCK ABSORBERS (FRONT)

D100, D200, D300	
Upper Bushing Retainer Nut	25 Ft./Lbs.
Lower Mounting Bolt	200 Inch/Lbs.
W100, W200, W300	
Lower Shock Absorber Mounting Stud to Axle Nut	115 Ft./Lbs.
Lower Shock Absorber Mounting Nut	55 Ft./Lbs.
Upper Shock Absorber Mounting Stud Nut	55 Ft./Lbs.
D500, D600, D700, D800, S600, S700, W600	
Lower Shock Absorber Mounting Stud to Axle Nut	170 Ft./Lbs.
Lower Shock Absorber Mounting Stud Nut	50 Ft./Lbs.
Upper Shock Absorber Mounting Nut	50 Ft./Lbs.
Upper Shock Absorber Bracket to Frame Bolt Nut	75 Ft./Lbs.

SHOCK ABSORBERS (REAR)

D100, D200, D300, W100, W200, W300	
Lower Mounting Nut	85 Ft./Lbs.
Upper Mounting Nut	85 Ft./Lbs.
D500, D600, D700, D800, S600, S700, W600	
Lower Mounting Nut	90 Ft./Lbs.
Upper Mounting Bracket to Frame Bolt Nut	90 Ft./Lbs.
Upper Mounting Stud to Bracket Nut	105 Ft./Lbs.
Upper Mounting Shock Absorber Retaining Nut	90 Ft./Lbs.

JOUNCE BUMPERS

Front Jounce Bumper Retaining Nut (W100, W200, W300, W600)	30 Ft./Lbs.
Front Jounce Bumper Mounting Bracket to Frame Bolt Nut (W600)	200 Inch/Lbs.
Rear Jounce Bumper Retaining Nut (D100)	180 Inch/Lbs.
Rear Jounce Bumper Retaining Bolt Nut (D200, D300, W100, W200, W300)	200 Inch/Lbs.
Rear Jounce Bumper Bracket to Frame Bolt Nut (D100, D200, W100, W200)	200 Inch/Lbs.

SWAY BAR

"U" Shaped Bracket Retaining Bolt Nut	270 Inch/Lbs.
Front Mounting Bracket Bolt Nut (W100, W200)	50 Ft./Lbs.
Link Rod Bushing Retaining Nut	100 Inch/Lbs.
Link Bracket Retaining Bolt Nut (D100, D200, D300) ...	200 Inch/Lbs.
Link Bushing to Spring Plate Bolt Nut (W100, W200)	75 Ft./Lbs.

STEERING

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MANUAL STEERING GEARS

MODEL 525

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GENERAL INFORMATION

The manual steering gear Model 525 (Fig. 1) is designed to provide easy steering with minimum friction in the steering gear. A ball nut travels up or down on the wormshaft, riding on recirculating balls which act as a screw thread.

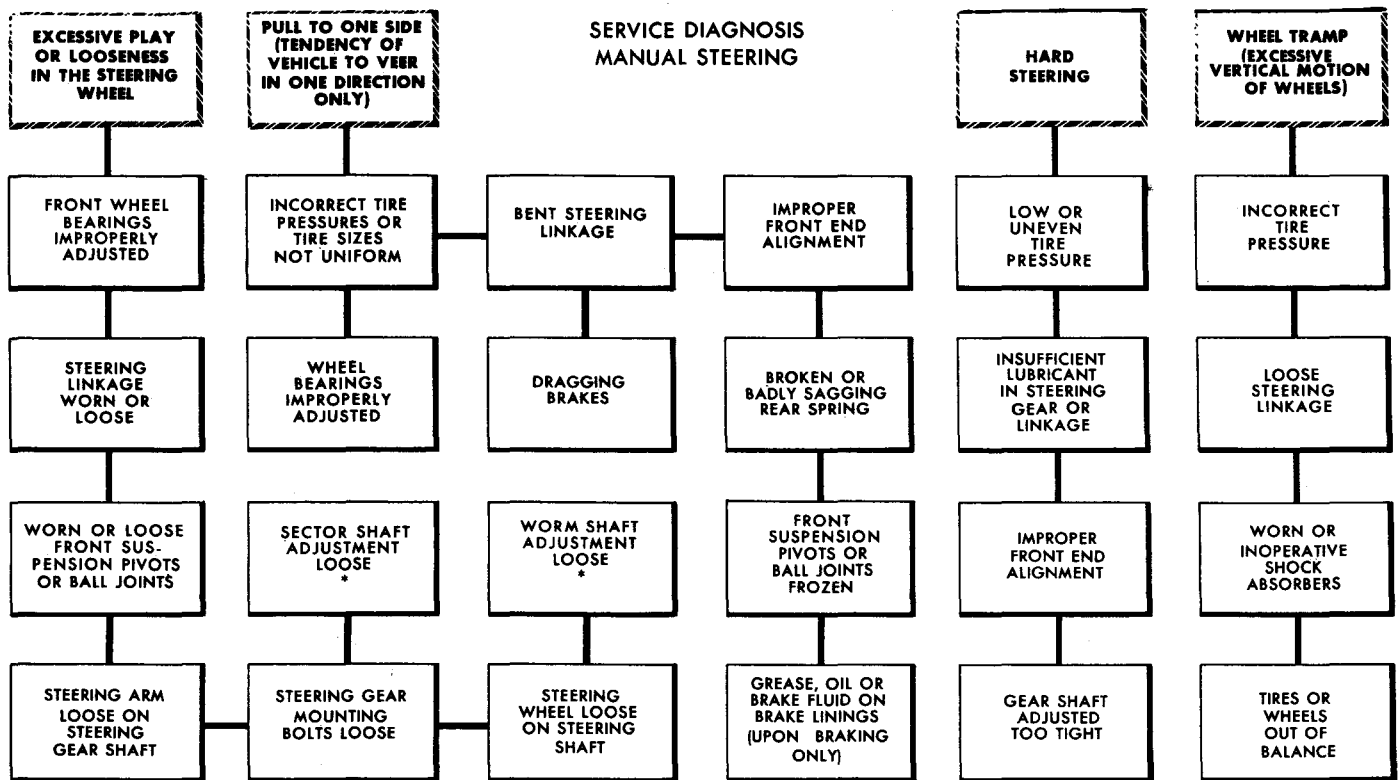
The wormshaft and ball nut assembly is supported in the gear housing by an adjustable ball thrust type upper and lower bearing.

The sector shaft is integral with the sector gear. The sector gear meshes with the rack teeth on the re-circulating ball nut. Adjustment at this point is controlled by the sector shaft adjusting screw which extends through the housing cover.

The teeth on the sector, and the ball nut are so designed that a tighter fit exists between the two when

the front wheels are straight ahead. Proper engagement between the sector and the ball nut is obtained by an adjusting screw which moves the sector shaft endwise, permitting desired engagement of the tapered teeth of the ball nut and sector gear. The worm bearing adjuster can be turned to provide proper preloading of the upper and lower worm thrust bearings.

To use Steering Service Diagnosis chart, look for the squares with broken lines which describe the condition requiring correction, then follow connecting lines into squares indicating possible causes. In most cases corrective procedures are self evident, however, an asterisk (*) indicates a procedure described in appropriate section of this manual.



*TESTS, ADJUSTMENTS AND SERVICE PROCEDURES ARE DESCRIBED IN THIS MANUAL

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SERVICE PROCEDURES

ADJUSTMENTS

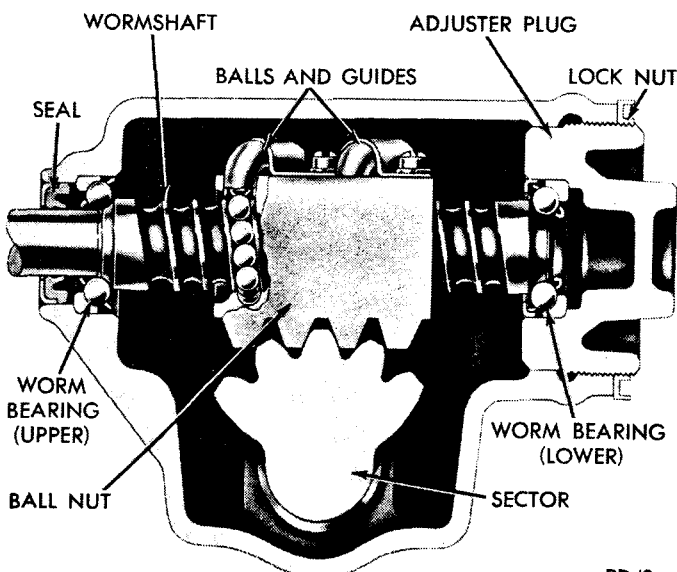
Two adjustments are provided in the steering gear (Fig. 1 & 2). The worm bearing preload adjustment, and the ball nut rack sector gear mesh adjustment.

Before the correct adjustment can be made at the ball nut rack and the sector gear, it must be determined that the worm bearing preload is properly adjusted.

The worm bearing preload adjustment is controlled by the worm thrust bearing adjuster which threads into the housing at the lower end of the wormshaft.

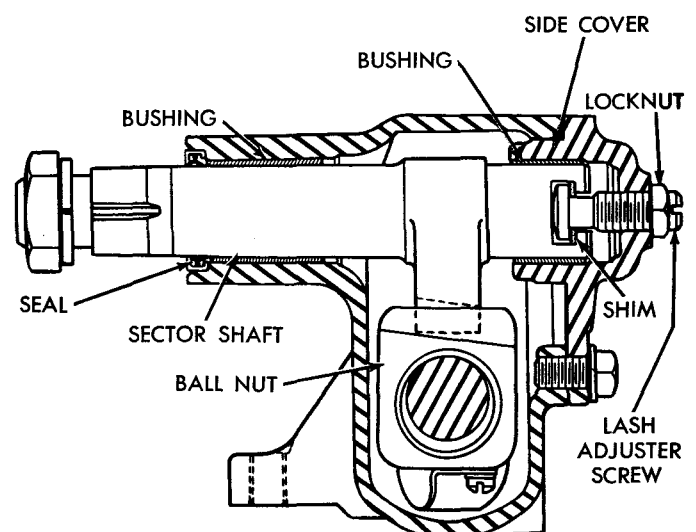
Worm Bearing Preload

- (1) Disconnect and remove steering gear arm from sector shaft using Tool C-4150 (Fig. 3).
- (2) Remove horn pad.



PD40

Fig. 1—Manual Steering Gear Model 525



PD41A

Fig. 2—Manual Steering Gear (Sectional View)

(3) Loosen sector shaft adjusting screw lock nut, and back out adjusting screw one half to two turns. This will relieve any friction load which may be present at the closely meshed ball nut rack and sector gear teeth.

(4) Turn steering wheel to right stop then back it off one half turn and place Tool C-3380 or other suitable torque wrench on steering shaft nut.

(5) Rotate steering shaft from right stop toward straight ahead position, while testing rotating torque with torque wrench.

The torque required to keep wheel moving should be between 4 and 6 inch-pounds. If reading is not within these limits, adjustment can be made, in or out of the vehicle as follows:

(a) Loosen adjuster locknut.

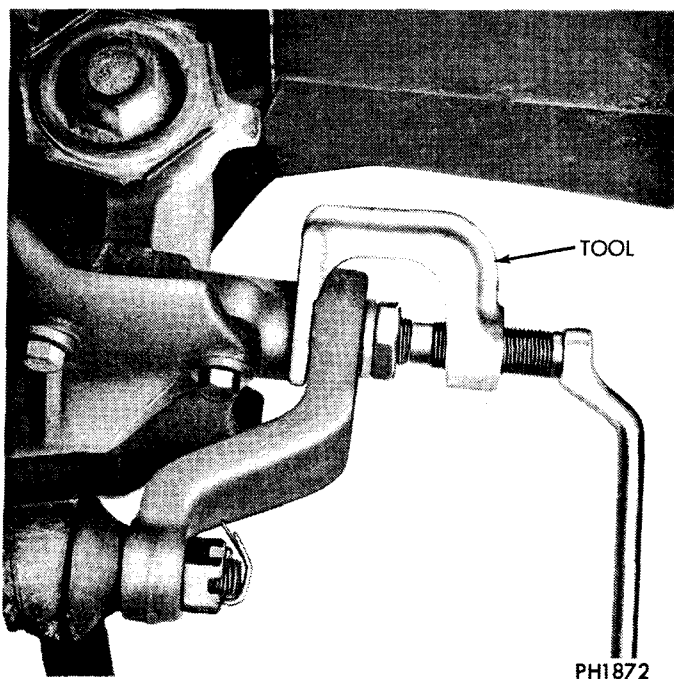
(b) Turn adjuster plug clockwise to increase preload or counterclockwise to decrease preload.

(c) While holding adjuster plug from turning, tighten locknut securely, then retest worm bearing preload.

Ball Nut Rack and Sector Mesh

The sector shaft adjusting screw, located in housing cover, raises or lowers shaft to provide proper mesh load between tapered teeth of sector gear and tapered teeth of ball nut. **This adjustment can be accurately made only after proper worm bearing preload has been established.**

(1) Turn steering wheel gently from one stop to the other, carefully counting number of turns. Turn steering wheel back exactly half way, to center position.



PH1872

Fig. 3—Removing Steering Gear Arm

(2) Turn sector shaft adjusting screw clockwise to take out all lash between ball nut rack and sector gear teeth, then tighten adjusting screw locknut as specified.

(3) Turn steering wheel about 1/4 turn away from center of "high spot" position. Then, using torque wrench at steering wheel nut, measure torque required to rotate steering wheel through high spot at center position. The reading should be 14 inch-pounds. This represents the total of worm shaft bearing preload and ball nut rack and sector gear-mesh load. Readjust sector shaft adjustment screw if necessary, to obtain proper torque reading.

(4) After adjustments have been completed, place front wheels in a straight ahead position, and with steering gear and steering wheel centered, install steering arm lockwasher and nut on sector shaft.

(5) Tighten steering arm retaining nut to 180 foot-pounds.

REMOVAL AND DISASSEMBLY

Removal

(1) Remove two bolts from wormshaft coupling.

(2) Remove steering arm from steering gear.

(3) Remove steering gear to frame bolts and remove gear from vehicle.

Disassembly

Thoroughly clean entire outside surface of steering gear before disassembly to avoid contaminating wormshaft and ball nut assembly with dirt or grit.

(1) Attach steering gear to holding fixture, Tool C-3323 and install holding fixture in a vise. If fixture is unavailable, clamp vise jaw on mounting lug.

(2) Rotate wormshaft from stop to stop, counting the turns, then turn back exactly half way, placing it on center.

(3) Loosen sector shaft adjuster screw locknut and remove cover to housing bolts.

(4) Lift the side cover and sector shaft assembly from the gear housing. Using a plastic hammer, tap lightly on the end of the sector shaft to aid in removal (Fig. 4).

(5) Loosen wormshaft bearing adjuster locknut and remove wormshaft bearing adjuster assembly including one bearing and one race.

(6) Remove the wormshaft and ball nut assembly from the housing (Fig. 5).

CAUTION: Be careful that the ball nut does not run down to either end of the wormshaft as the ball guide ends can be damaged if the ball nut is allowed to rotate until stopped at the end of the worm.

(7) Remove the remaining wormshaft bearing from inside the gear housing.



Fig. 4—Removing Sector Shaft Assembly

(8) Using a screwdriver, pry the lower bearing retainer from the adjuster plug, and remove the bearing (Fig. 6).

(9) Remove lock nut from sector shaft adjusting screw and remove screw from cover by turning screw clockwise. Slide the adjuster screw and shim out of the slot in the end of the sector shaft.

(10) Remove wormshaft and sector shaft seals.

Cleaning and Inspection

Having disassembled the steering gear completely, make sure all parts are clean. Wash parts in cleaning solvent and dry thoroughly with compressed air. Check bearings and bearing races for signs of defects, such as cracks, surface imperfections and distorted cage. Replace parts having defects.

RECONDITION GEAR

Sector Shaft Bushing Replacement—Side Cover

Check sector shaft and bushing for wear. If clear-

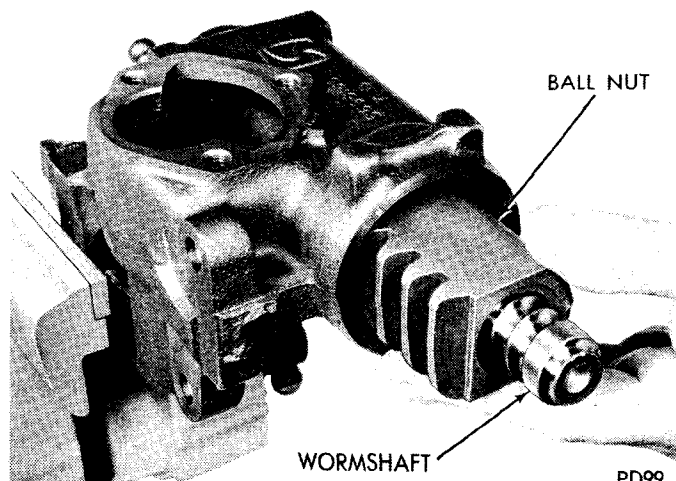


Fig. 5—Removing Ball Nut and Wormshaft

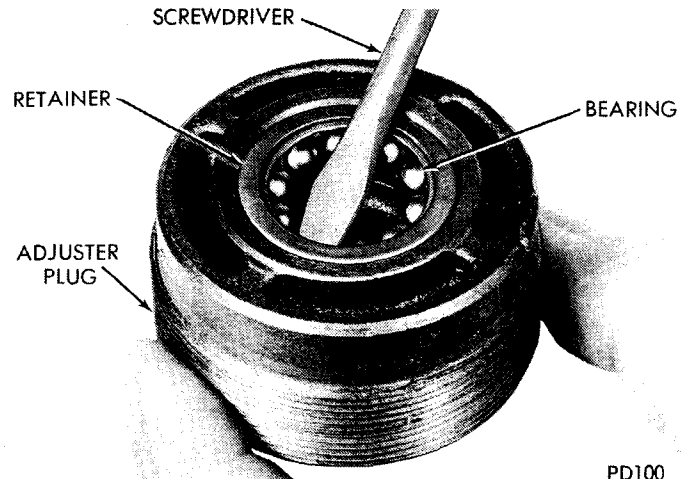


Fig. 6—Removing Lower Bearing Retainer

ance resulting from bushing wear is excessive, replace the entire side cover and bushing assembly.

Sector Shaft Bushing Replacement—Housing

(1) Support the steering gear housing in an arbor press: press the sector shaft bushing and seal from the housing using Tool C-4171 and adapter C-4173 inserted from the lower end of the housing.

(2) Press the new bushing into position using Tool C-4171 and adapter C-4174. No reaming is necessary after installation as service bushings are machined to size. Install seal using suitable tool.

Install a new seal whenever a seal has been removed, or if signs of wear are evident.

Wormshaft Bearing—Adjuster Race Replacement

(1) Hold wormshaft adjuster in vise. Using slide hammer C-637 or other suitable tool, remove bearing race.

(2) Press the new bearing race into position using Tool C-4171 and adapter C-4176.

Wormshaft Bearing Race Replacement—Housing

(1) Drive the bearing race out of the housing with the aid of a drift or punch.

(2) Press the new bearing race into position using Tool C-4171 and adapter C-4176.

BALL NUT

Side Loading Guides

If there is no indication of binding or tightness in the ball bearing nut assembly when the wormshaft is rotated, disassembling the unit is unnecessary. If, however, tightness or binding is noticed; disassemble, clean and inspect the unit to determine the cause. Disassemble the ball nut, clean and inspect as follows:

(1) Remove screws and ball retaining clamp. Remove guides from nut.

(2) Invert the nut, rotate wormshaft in both directions to permit the balls to drop out. (Make sure work area is clean.) Having removed all of the balls, remove the nut from the wormshaft.

(3) Wash parts, using cleaning solvent and dry with compressed air. Using a magnifying glass, inspect parts for defects. Check the ball guide ends for damage. Replace defective parts.

(4) Hold the ball nut with the helical grooved bore in a horizontal position and the ball guide holes up. Have the shallow side of the rack teeth toward the left as viewed from the steering wheel related end. Insert the wormshaft, aligning the wormshaft grooves with the grooves in the nut.

(5) Count 27 balls, number of balls for one circuit, into a clean container. Place 20 of these balls into one of the guide holes. It may be necessary to push them in with the aid of a pin punch (Fig. 7).

CAUTION: Do not rotate wormshaft while installing the balls, or until both circuits complete with balls are assembled.

(6) Place one set of ball guides on the bench, each guide-half having the ball-groove up. Position the remaining seven balls into the groove of one ball guide-half and cover them with the second guide-half. Holding the two halves together, plug the opening on each end with a dab of grease to keep the balls in place while installing the guide assembly (Fig. 8).

(7) Push the guide assembly into the guide holes of the nut. If a slight bind is encountered, tap lightly into place with a screwdriver handle. After the guide assembly is in position, one ball circuit is completed.

(8) Use the same procedure to assemble the second ball circuit. Install the ball guide clamp and tighten the screws as specified. Rotate the nut on the worm to check for binding and free movement.

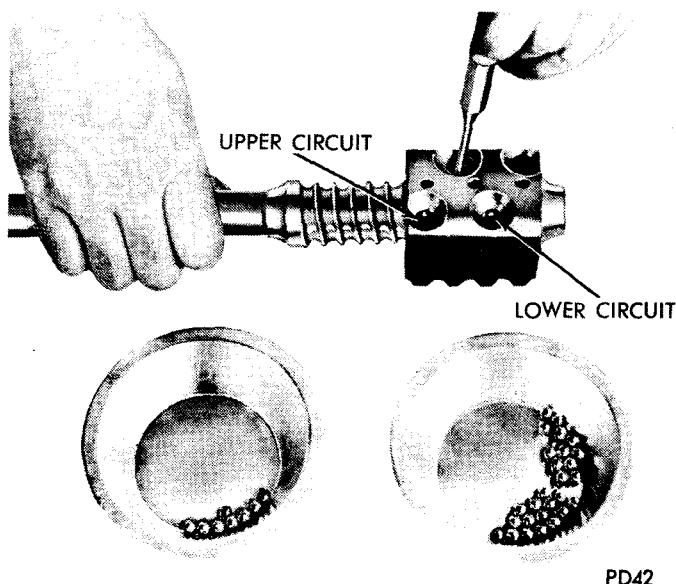


Fig. 7—Filling Ball Circuit (Closed Type)

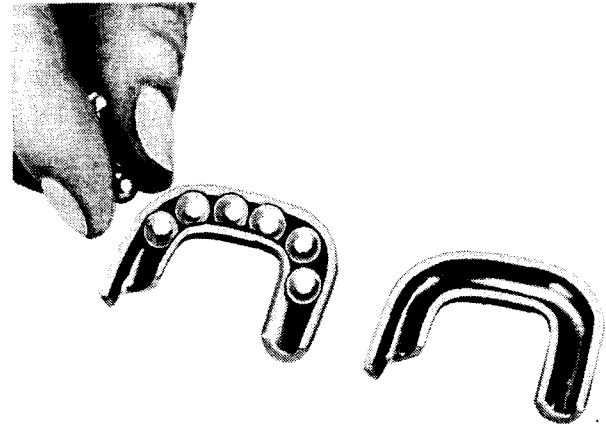


Fig. 8—Filling Ball Guides

CAUTION: Do not rotate the nut to the end of the worm threads as damage will result to the ball guides.

Top Loading Style Ball Guide (Fig. 9)

(1) Slip the ball nut over the wormshaft with the ball guide holes up, and the shallow end of the ball nut teeth to the left as viewed from the steering wheel position. Align the grooves in the worm and nut by sighting through the ball guide holes.

(2) Place two ball guide halves together and insert them into the upper circuit in the ball nut. Place the remaining two guides together and insert them in the lower circuit.

(3) Count 25 balls into a suitable container. This is the correct number of balls for one circuit.

(4) Load the balls into one of the guide holes while turning the wormshaft gradually away from that hole. When all 25 of the balls have been installed, the circuit is complete.

(5) Fill the remaining ball circuit in the same manner as described for the first circuit.

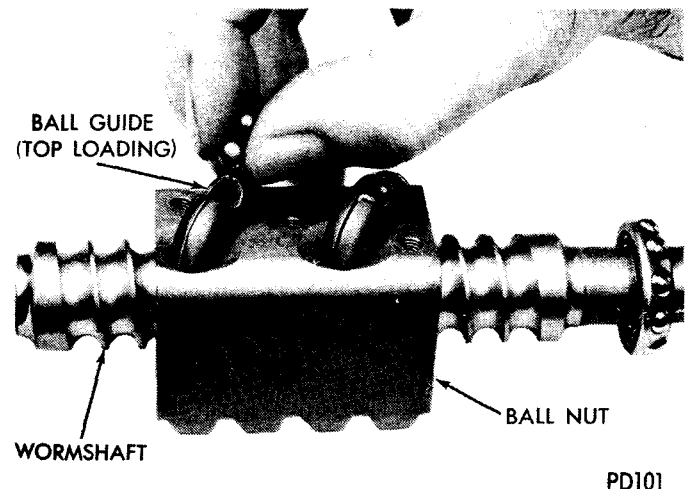


Fig. 9—Filling Ball Guide and Circuit (Top Loading Type)

REASSEMBLY AND INSTALLATION

Reassembly (Fig. 10)

Upon completion of a major overhaul, coat the threads of the wormshaft adjuster, side cover bolts and the sector shaft lash adjuster bolt sparingly with a non-hardening oil resistant sealing compound. This practice will aid in the prevention of lubricant leaking from the steering gear assembly.

After installing new sector shaft and wormshaft seals, and noting that the sector shaft bushings and wormshaft bearing races in the gear housing are satisfactory, continue with assembly procedures.

(1) Attach the steering gear to holding fixture Tool C-3323. Place the holding fixture in a vise having the wormshaft bore in a horizontal position with the side cover opening up. If fixture is not available, hold the gear housing in vise by clamping mounting lug in vise.

(2) With the upper ball bearing on the wormshaft, install the wormshaft and nut assembly into the hous-

ing, positioning the wormshaft thru the upper ball bearing race and seal.

(3) Assemble the ball bearing and seal into the wormshaft adjuster plug. Press retainer into position.

(4) Place the adjuster and lock nut into position guiding the wormshaft into the bearing. Tighten adjuster until very little wormshaft end play remains.

(5) Place the sector shaft lash adjuster screw, with shim, in the slotted end of the sector shaft. With adjuster screw positioned in the slot at the end of the sector shaft, check the end clearance of the screw (Fig. 11). Hold clearance to .002 inch or less. A selection of four shims having thicknesses of .063, .065, .067 and .069 inch is available.

(6) Lubricate the steering gear with steering gear grease. If steering gear grease is not available, use N.L.G.I. Grade 2 E.P. or equivalent.

Turn wormshaft until the ball nut is at the end of its travel. Pack as much lubricant into the housing as possible, without losing it out of the sector shaft opening. Turn the wormshaft until the ball nut is at

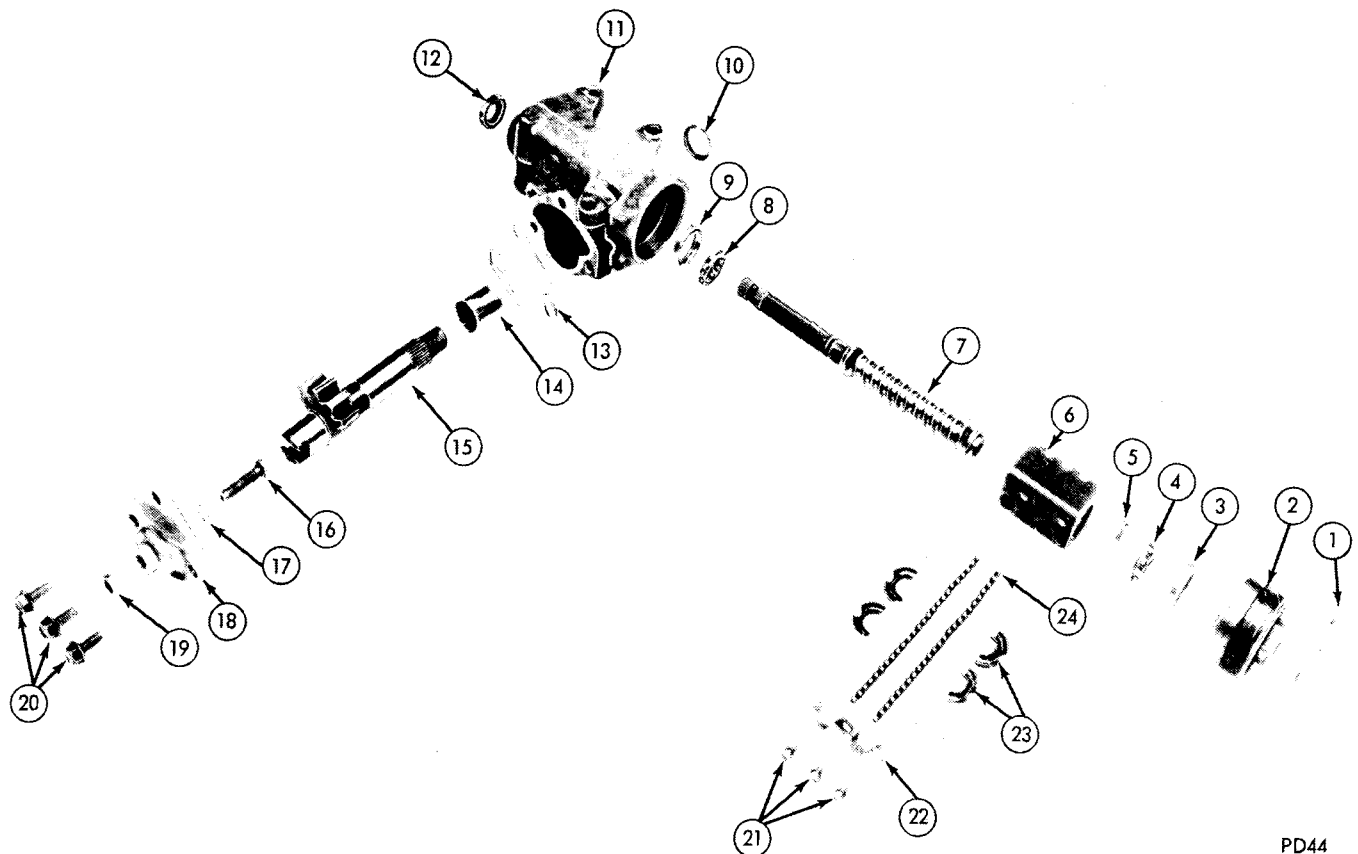
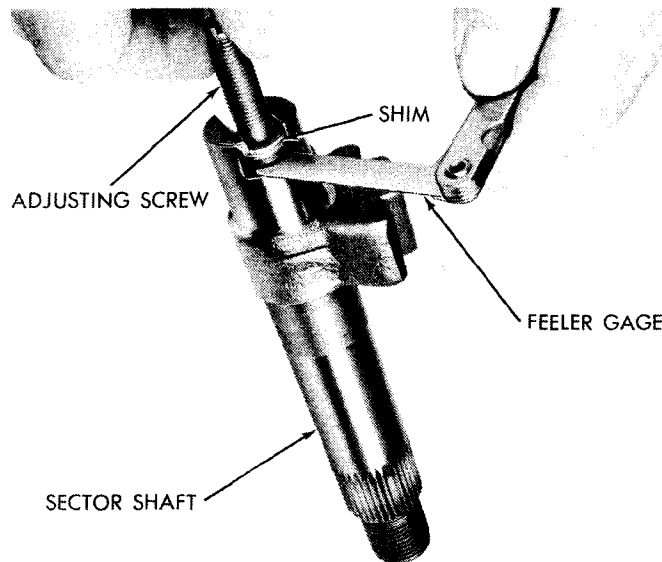


Fig. 10—Manual Steering Gear—525 (Disassembled)

LEGEND FIG. 10

- | | | | |
|---------------------------------|--------------------------|--|----------------------------|
| 1—Worm Bearing Adjuster Locknut | 7—Wormshaft | 13—Side Cover Gasket | 19—Lash Adjuster Locknut |
| 2—Worm Bearing Adjuster | 8—Upper Ball Bearing | 14—Sector Shaft Bushing | 20—Side Cover Bolts |
| 3—Lower Worm Bearing Cup | 9—Upper Worm Bearing Cup | 15—Sector Shaft | 21—Ball Guide Clamp Screws |
| 4—Lower Ball Bearing | 10—Sector Shaft Seal | 16—Lash Adjuster | 22—Ball Guide Clamp |
| 5—Lower Bearing Retainer | 11—Housing | 17—Lash Adjuster Shim | 23—Ball Guides |
| 6—Ball Nut | 12—Wormshaft Seal | 18—Housing Side Cover and Bushing Assembly | 24—Recirculating Balls |



PD102

Fig. 11—Checking Lash Adjuster End Clearance

its other extreme. Pack as much lubricant into the housing as possible.

(7) Rotate the wormshaft to bring ball nut to the center of its travel.

(8) Install the sector shaft assembly, including the

adjuster screw and shim, into the housing. Engage the center tooth of the sector with the tooth space in the center of the ball nut.

(9) Pack more lubricant into the housing and make sure that the side cover bushing bore is lubricated.

(10) Position side cover gasket.

(11) Install side cover; reach through side cover adjusting screw hole with a screwdriver and turn lash adjuster screw counter-clockwise until screw bottoms, then turn opposite direction one half turn. Start locknut and tighten finger tight.

(12) Install side cover bolts and tighten as specified.

(13) Adjust steering gear as specified.

(14) Tighten wormshaft adjuster locknut and sector shaft adjuster locknut as specified.

Installation

(1) Position steering gear to frame and install mounting bolts.

(2) Install steering arm, and place wheels in straight ahead position.

(3) Place steering wheel in straight ahead position.

(4) Install wormshaft to column coupling bolts.

(5) **Tighten all bolts as specified.**

MODEL 553

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GENERAL INFORMATION

The Model 553 Saginaw manual steering gear is a worm and recirculating ball type gear (Figs. 1, 2, and 3). Usage of the 553 steering gear is listed in "Specifications and Steering Gear Application".

The steering gear worm shaft is a "stub" type and is connected to the steering column shaft with a universal joint type coupling.

The steering gear worm shaft is supported at each end by barrel type bearings. The ball nut is connect-

ed to the worm shaft through steel balls. The steel balls form a thread between grooves in the ball nut and the worm shaft. As the worm is turned, the ball nut moves along on the balls as it would on an ordinary screw thread.

The sector shaft incorporates an integral sector gear which meshes with grooves on the ball nut. The sector shaft rotates in steel backed bronze bushings in the steering housing and in the housing cover.

SERVICE PROCEDURES

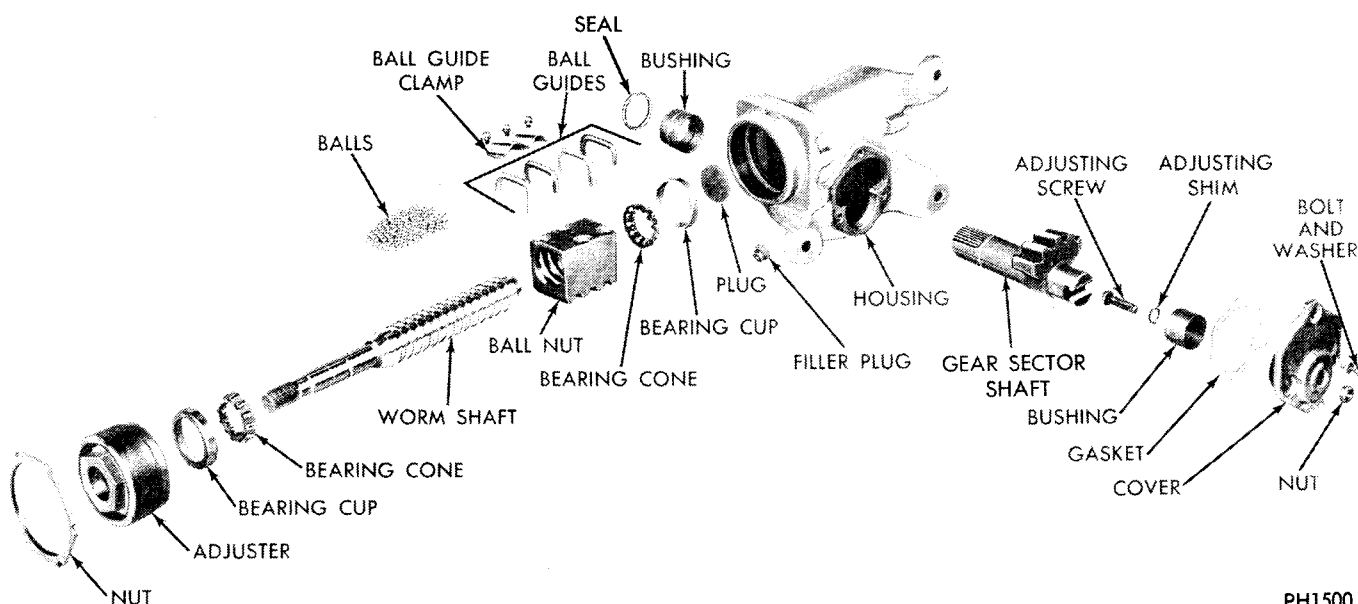
STEERING GEAR MAINTENANCE

The following maintenance operations may be accomplished with the steering gear assembly installed in the vehicle.

(1) At regular intervals check and, if necessary,

tighten all steering gear mounting bolts, steering arm nut, and gear housing side cover attaching bolts. For correct tightening specifications see Tightening Reference at rear of section.

(2) Check steering gear lubricant level and add lubricant if necessary (Lubrication Section Group O).



PH1500

Fig. 1—Manual Steering Gear—553 (Disassembled)

(3) Adjust linkage and steering gear assembly whenever looseness in steering gear indicates an adjustment is required.

ADJUSTMENTS

The steering gear assembly is designed to provide adjustment to compensate for normal wear at worm bearings and steering gear sector shaft.

Before making any steering gear adjustments, check lubricant level in gear housing and fill to proper level, if necessary, as directed in Lubrication Section Group O of this manual. Tighten steering gear to frame mounting bolts.

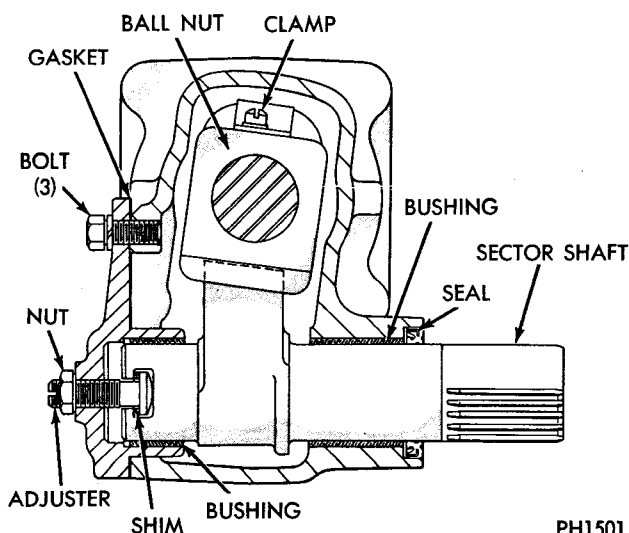
Two adjustments can now be made on the Model 553 steering gear; worm bearing preload and ball nut

and sector gear mesh. These adjustments must be made carefully and in the order given to insure satisfactory results.

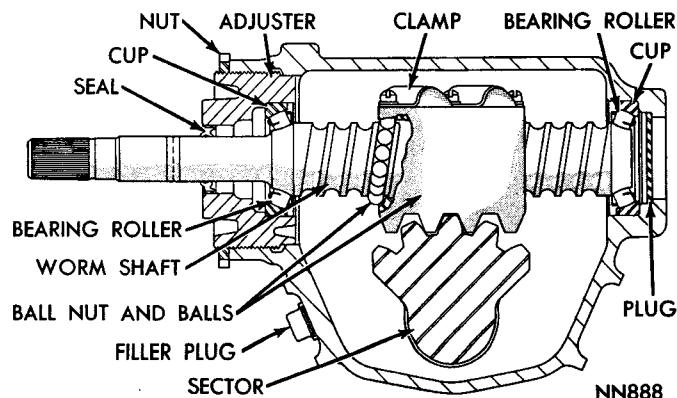
The steering gear should be readjusted only after looseness in the steering gear indicates that readjustment is required.

Steering gear adjustment can be checked without removing gear from truck. The procedure is the same as that outlined for use with gear removed from truck, with the following exceptions:

- Remove steering gear arm from sector shaft, and remove horn button and spring.
- Check for misalignment of steering column which might result in column bind and erroneous torque readings. Correct as required.
- Use Torque Wrench and socket on steering wheel nut to check steering gear worm shaft torque. Column drag is negligible as long as the column is properly aligned.
- Turn steering wheel two turns off-center, either right or left, and check torque required to pull steer-

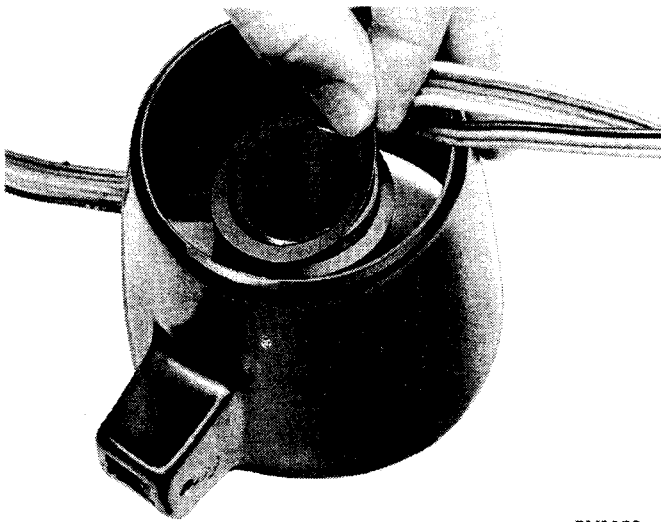


PH1501

Fig. 2—Sector Shaft—Sectional View

NN888

Fig. 3—Worm Shaft—Sectional View



PY1183

Fig. 16—Shift Housing and Spring Washer

ers. Tighten 3 screws to 30 inch-pounds (Fig. 22).

(f) Place spring washer on shift housing using grease to hold it in place (Fig. 16).

(g) Install shift housing over jacket while guiding shift tube key into slot in housing (Fig. 17).

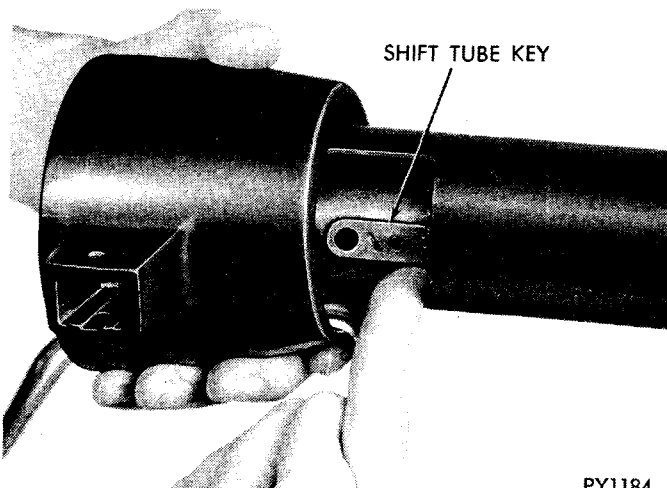
(h) Insert shift lever into shift housing and drive in the retaining roll pin. Support housing with socket to protect paint.

(i) At lower end, adjust shift lever end play by rotating bushing screws in jacket slots so that end play is eliminated but levers move easily (Fig. 23). Tighten screws to 30 inch-pounds.

(5) Install the lock housing.

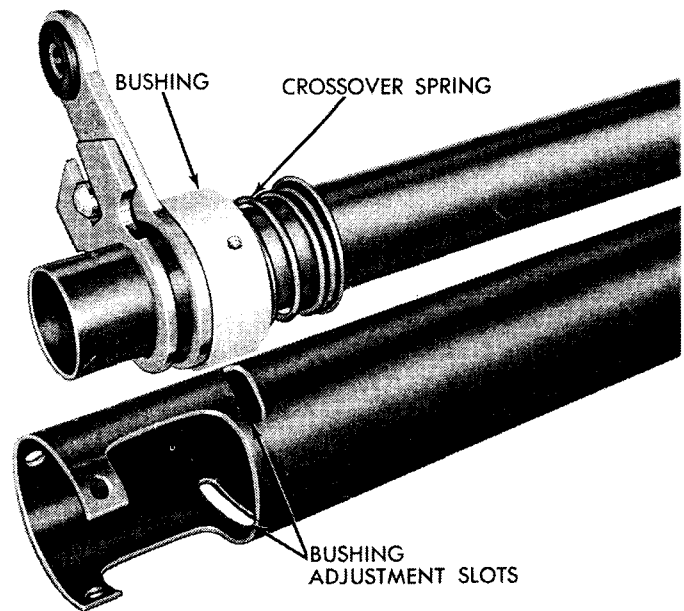
(6) Position ignition switch to center detent (OFF) position. Feed wires down through the space between housing and jacket. Position switch in housing and tighten three mounting screws (Fig. 9).

(7) **With the ignition key cylinder in the LOCK position, and with the key removed,** insert the key cylinder into the lock housing. Press the cylinder into place until contact is made with the pin on the igni-



PY1184

Fig. 17—Installing Shift Tube in Shift Housing



PY1178

Fig. 18—Shift Tube Assembly

tion switch cam. Insert the key into the lock and rotate the lock until the slot in the cylinder plate lines up with the pin. Press the key cylinder the remaining way into the lock housing, making sure the retainer bar snaps into its slot in the lock housing.

Steering Shaft Installation

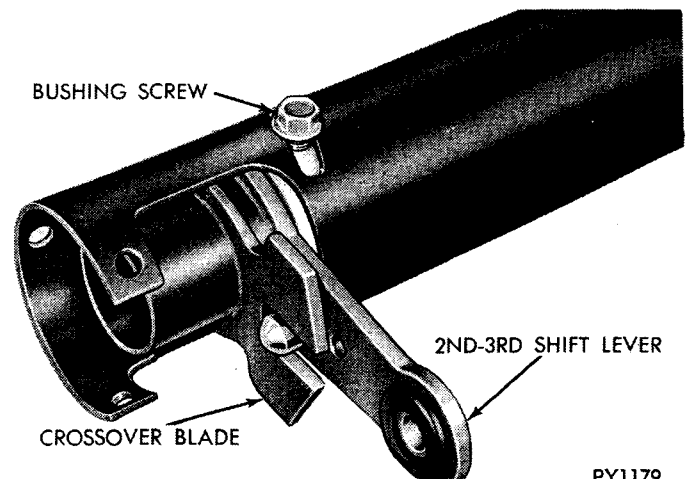
(1) Insert the steering shaft assembly into the column and shift tube assembly.

(2) Install the bearing lower snap ring on the steering shaft.

Bearing Housing Assembly

(1) Place rubber insulator with ground staple, over column upper bearing and install assembly into bearing housing bore. Use a soap solution or rubber lubricant to ease installation.

(2) Install the turn signal switch in the bearing



PY1179

Fig. 19—Shift Tube Assembly in Jacket

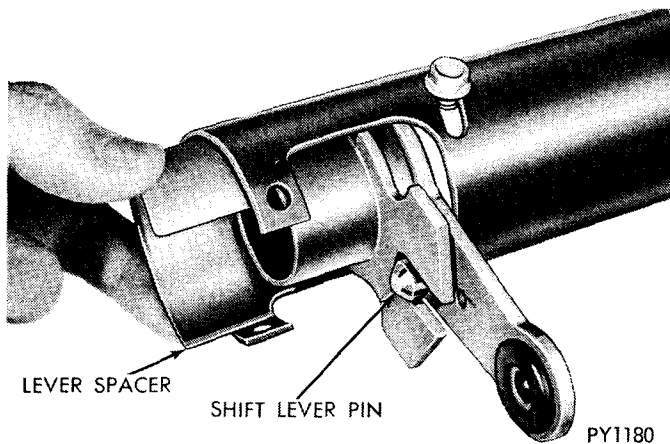


Fig. 20—Shift Lever Spacer

housing, feeding the wires through the opening in the housing.

(3) Install the retaining plate over the switch and tighten 3 screws to 27 inch-pounds.

(4) Install the turn signal lever or turn signal speed control lever on the turn signal switch.

(5) Position the bearing housing assembly on the column jacket assembly, feeding the wires through the space between the lower housings and the jacket.

(6) When installing this housing, the steering shaft must be drawn, not pushed, through the bearing, using the bearing inner race as a reaction member, or damage to the lock housing components, or bearing could result. **DO NOT DRIVE THE SHAFT INTO THE BEARING.**

(7) Install on steering shaft, Tool C-3879, with washer and steering wheel nut (Fig. 24). Turn nut to pull shaft through bearing. Remove tool and install upper snap ring on shaft.

(8) Install and tighten to 35 inch-pounds the 3 bearing housing to lock housing screws.

(9) Carefully install the lamp assembly in the bearing housing (Automatic transmission).

(10) Install the wiring trough in place over the

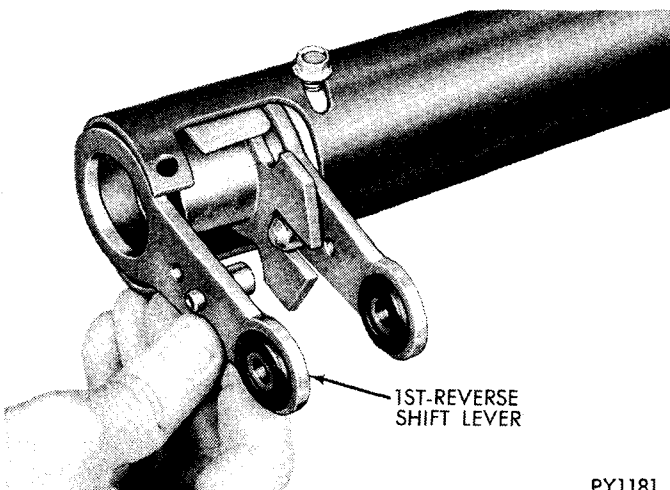


Fig. 21—First-Reverse Shift Lever

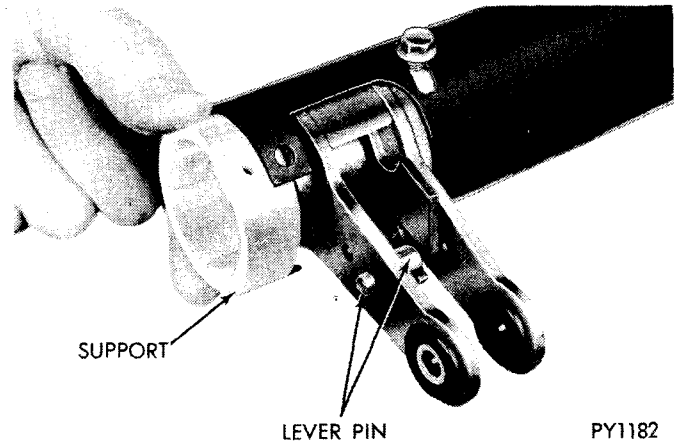


Fig. 22—Shift Tube and Lever Support

wires, being careful to not pinch wires between trough and jacket.

COLUMN REASSEMBLY (Models D500 and Up)

(1) Before reassembling pot coupling, half fill pot housing with Multi-Purpose grease. (Make sure spherical surface of plug is toward open end of pot housing).

(2) Install spring and bearings on shaft pin.

(3) Line up scribe marks and slide pot housing over bearings and onto shaft.

(4) Slide boot into housing and install retaining ring. (Make sure lobes of ring are fully seated in slots of housing.)

(5) Insert splined end of shaft assembly into seal bushing at bulkhead.

(6) Align flat on wormshaft with flat in coupling and tap into position using a drift pin to line up the bolthole in the clamp with notch in wormshaft.

Upper Shaft and Column Reassembly

(1) Pack bearings with Multi-Purpose grease if removed from assembly.

(2) Slide lower bearing onto shaft (sealed side toward coupling).

(3) Install snap ring into lower groove (nearest to coupling).

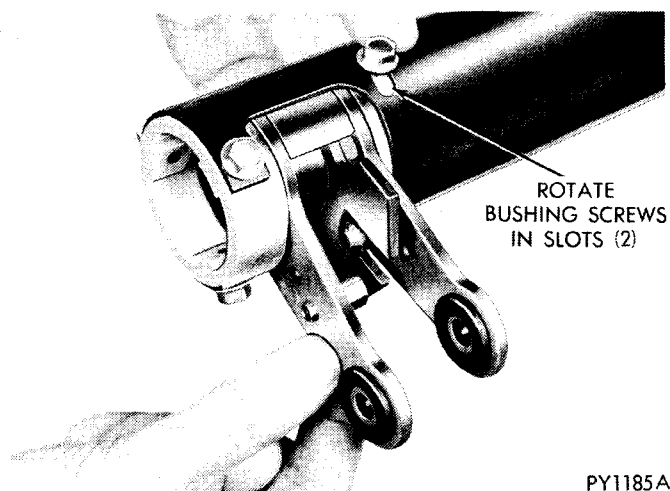
(4) Press shaft and bearing into lower end of column tube until bearing seats against tabs in I.D. of tube. Bend outer tabs (no more than 45°) to lock bearing in tube.

(5) With column in upright position (coupling end down) place spring, spacer (small diameter up) and bearing over splined end of shaft.

(6) Press bearing into tube until it seats against tabs in I.D. of tube and bend outer tabs (no more than 45°) to lock bearing in tube. Insert washer on bearing.

(7) Force shaft upward until upper snap ring groove is exposed. Install snap ring.

(8) Place turn signal switch mounting plate into housing and secure with three screws from underside



PY1185A

Fig. 23—Adjusting Shift Lever End Play

of upper end of column jacket.

(9) Place turn signal switch into housing. (If wires have been pulled out of column, feed them through the opening at the support bracket.)

(10) Align turn signal switch retainer plate holes with those in switch assembly and secure with three screws.

(11) Insert turn signal lever into column and secure into position with retaining screw.

(12) Align scribe mark on steering wheel with mark on column and place steering wheel over splines of steering shaft.

(13) Insert horn button retainer and nut on steering shaft and tighten to 27 foot-pounds.

(14) Connect horn button assembly wire to terminal in steering wheel and insert horn spring over end of shaft, then depress horn button assembly into slots of retainer and turn counterclockwise to lock.

The turn signal and steering wheel assembly may be installed on column, on or off vehicle.

COLUMN INSTALLATION (Models Up To D500)

(1) Insert the steering column assembly through the firewall opening.

(2) Connect the steering column coupling flange with the "Rubber and Fabric" Type Coupling on the steering gear wormshaft.

NOTE: Position steering column so flange face is parallel to fabric coupling face, to prevent undue stress on fabric coupling. W models, position the column to center the steering shaft bearing blocks in the pot coupling.

(3) Install the two steering column upper bracket bolts; tighten finger tight.

(4) With front wheels in straight position using centering tool C-4134, center the shaft in the shift tube.

(5) Position the support plate to the firewall; tighten the screws. Slide "O" ring into position on the

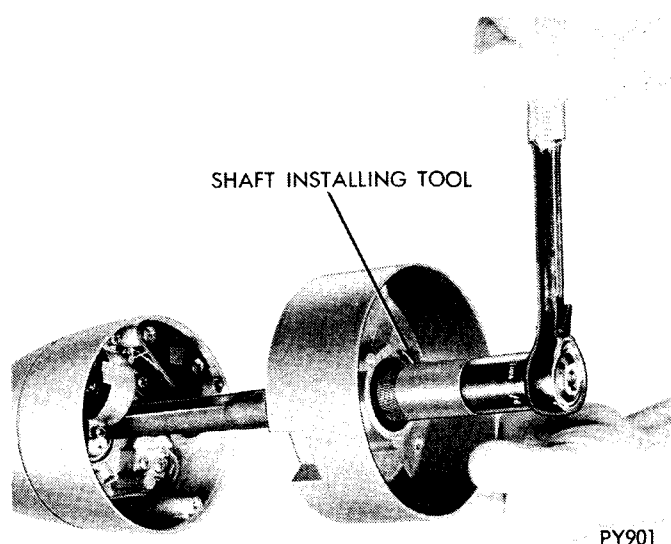


Fig. 24—Pulling Shaft into Bearing

support plate and secure with the two screws.

(6) Tighten the steering column bracket bolts to 110 inch-pounds; tighten the steering column coupling to steering gear flange nuts 15 to 25 foot-pounds.

(7) Remove centering tool.

(8) Connect gearshift indicator pointer to operating bracket on shift housing in its approximate original location. Slowly move gearshift lever from "L" (low) to "P" (park) pausing briefly at each selector position. The indicator pointer must align with each selector position. If necessary, loosen the bolt and readjust to align pointer correctly.

(9) Place steering wheel on steering shaft with master splines aligned. Install retaining nut and washer, tighten nut to 27 foot-pounds. **Do not drive wheel on shaft, draw wheel down with retaining nut.**

(10) Install horn switch parts previously removed from steering wheel. Connect horn switch wire.

(11) Connect wiring connectors at steering column jacket. Connect battery ground cable, test operation of lights and horns.

(12) Connect and adjust gearshift linkage. Refer to "Transmission Group 21."

COLUMN INSTALLATION (Models D500 and Up)

(1) Align "U" joint bolt hole with notch in lower steering shaft and slide into position. Install clamping bolt and nut and tighten to 65 foot-pounds.

(2) Slide "U" nuts into position on hanger bracket (under instrument panel) and attach column assembly in place with "U-nut" bolts.

(3) Install nuts and bolts on column support bracket at bulkhead.

(4) Connect wiring at instrument panel and install plastic trim plate under column.

(5) Connect battery cable.

SPECIFICATIONS AND STEERING GEAR APPLICATION

Gear Model	MANUAL STEERING		POWER STEERING	
	525	553	708	710
Truck Application and Front Axle Capacity (Pounds)	D100 (3000)	W600 (6000, 7500)	D100 (3000)	D500 (5000)
	D200 (3300, 3800)	D800 (9000)	D200 (3300, 3800)	D600 (5000, 7000)
	D300 (3800)	D500 (5000)	D300 (3800)	D800 (7000, 9000)
	W100 (3500, 3850)	D600 (5000, 5500, 7000)	W100 (3500, 3850)	D700 (5500, 7000)
	W200 (3500, 3850, 4500)	D700 (5500, 7000)	W200 (3500, 3850, 4500)	S600, S700 (5500, 7000)
		D800 (7000)	W300 (4500)	W600 (7500)
		W300 (4500)		
		S600, S700 (5500, 7000)		
Type	Recirculating Ball and Nut	Recirculating Ball and Nut	Recirculating Ball and Nut	Recirculating Ball and Nut
Gear Ratio	24 to 1	28.1 to 1	17.5 to 1	24 to 1
Arm Length (inches)	5.5 (D100, D200, D300) 6.0 (W100, W200)	11.0	(Constant) Ratio*	9.50
Worm Bearing Preload to keep Wormshaft moving—Inch Pounds	5-8	14-18	4-5 (Old Gear) 4-8 (New Gear)	4-5 (Old Gear) 4-8 (New Gear)
Gear Lash—Inch Pounds (Includes Worm Bearing Preload and Sector Gear Mesh	16 Max.	30 Max.	14 Max. (Old Gear) 18 Max. (New Gear)	14 Max. (Old Gear) 18 Max. (New Gear)

*20 to 1 on center, 16.2 to 1 at corners (Variable Ratio)

POWER STEERING PUMP

Truck Model Designation	D100, D200, D300 W100, W200, W300	D500, D600, W600 S600, S700, D700, D800
	Saginaw Constant Displacement—.94 Cu. In. per revolution vane	Saginaw Constant Displacement—1.14 Cu. In. per revolution vane
Model		
Pump Type		
Pump Pressure	1350 1450	1450 1500

TIGHTENING REFERENCE—Foot Pounds

STEERING GEARS

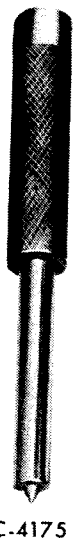
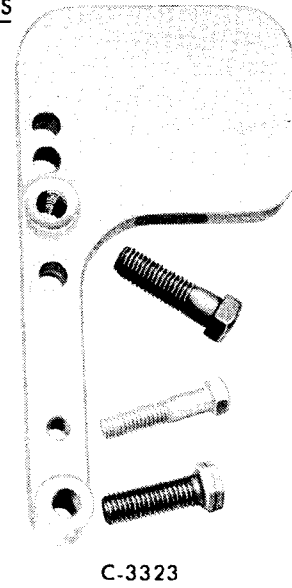
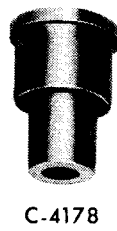
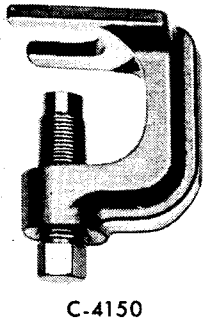
	525	553	708	710
Worm Bearing Preload				
Adjuster Locknut	85	85	80	80
Side Cover Bolts	30	35	45	45
Sector Shaft Adjusting Screw Locknut	25	30	35	
End Cover Bolts		38		
Coupling Flange Bolts	30			
Coupling Flange Nuts	25			
Wormshaft Clamp Bolt	30	30		
Steering Gear Arm Nut	180	175	180	
Rack Piston Plug			75	75
Oil Line Fittings (At Gear)			30	30
Gear to Frame Bolts—All			7/16×20 bolt=55 ft. lbs.	

POWER STEERING PUMPS

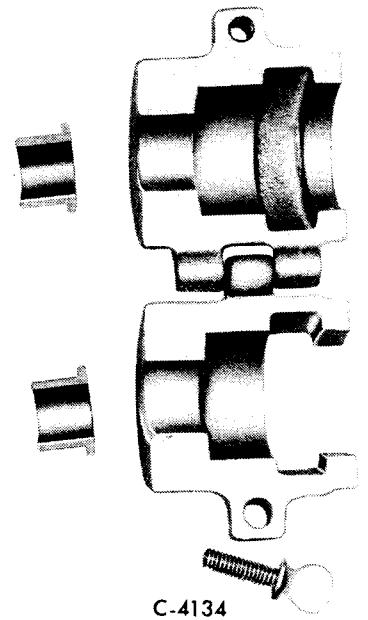
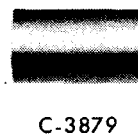
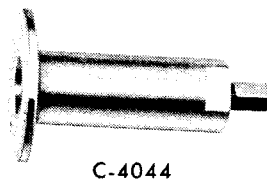
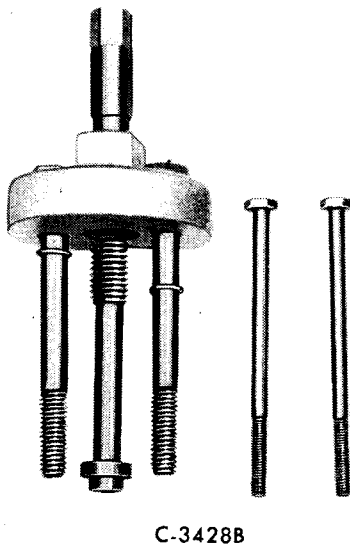
	.94	1.14
Pulley Nut	55	55
Discharge Fitting	35	35
Bracket Bolts	30	30
Bracket to Engine Bolts	30	30
Reservoir to Pump Body Bolt	35	
Flow Control Plug	6 in./lbs.	6 in./lbs.

1/2×20 bolt=85 ft. lbs. 9/16×18 bolt=115 ft. lbs.

SPECIAL TOOLS—STEERING GEARS

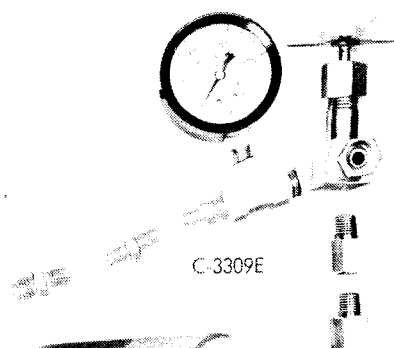


SPECIAL TOOLS—STEERING COLUMN

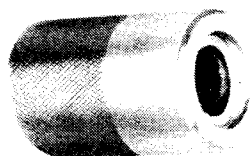


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POWER STEERING PUMPS SPECIAL TOOLS



C-3309E



C-4061



C-4063



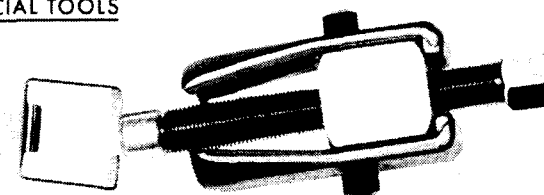
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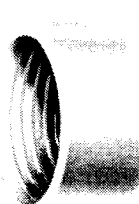
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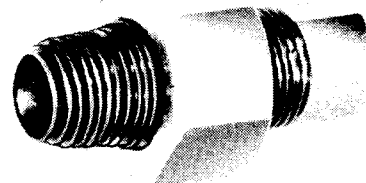
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C-4068A OR C-4333



C-4062



C-4324

PK296A

TRANSMISSION

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MANUAL TRANSMISSION—(A-230) THREE SPEED

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GENERAL INFORMATION

The vehicle identification number on the "B" post starts with a capital letter which indicates the line or sales name of vehicle (see Introduction of this manual). These codes letters are also used to indicate the vehicle to which the service information applies.

The A-230 three speed transmission (Fig. 1) has two synchronizer units, providing clash free shifting in all forward gears.

Synchronizers will be serviced as an assembly. Ex-

cept for stop rings, synchronizer parts should not be interchanged.

A pad has been provided on the right side of the transmission (Fig. 2) for transmission and vehicle identification numbers.

The drive pinion (input shaft) is supported by a ball

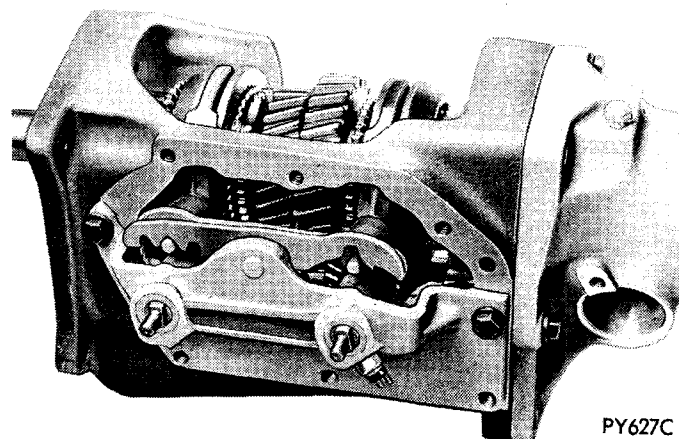


Fig. 1—A-230 Transmission Cutaway

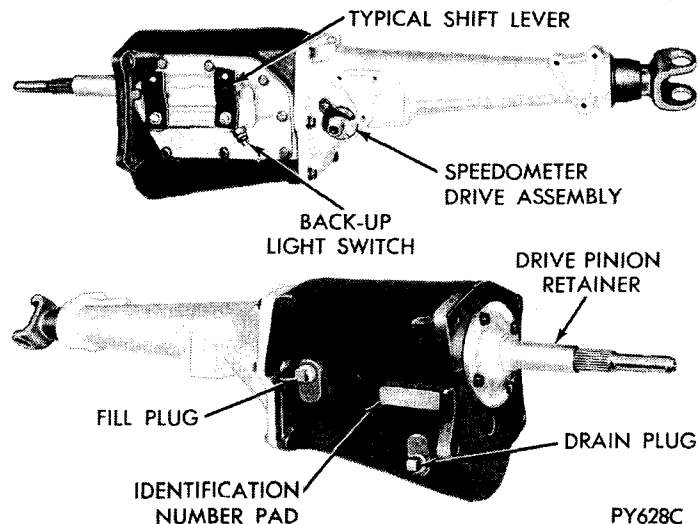


Fig. 2—A-230 Transmission—Right and Left Sides

bearing in the transmission case and an olive bushing pressed in the end of the crankshaft.

The mainshaft (output shaft) front end is supported by roller bearings in the end of the main drive pinion and a ball bearing retainer in the front of the extension housing. The output end of the mainshaft is splined to the sliding universal joint yoke, which is supported by a bushing in the extension housing.

The countershaft gear is supported by a double row of needle type roller bearings at each end and the thrust is taken on thrust washers between the ends of the gear and the transmission case. The alignment of the needle type roller bearings within the gear is maintained by six thrust washers (one being used between the rows of roller bearings and one at

each end).

The reverse idler gear is also supported on needle type roller bearings.

A magnetic disc is attached to bottom, near front of case under largest gear on countershaft. This magnet collects and prevents circulation of chips in transmission oil.

The gearshifting is manually operated through shift control rods to the transmission. Any forward gear may be engaged while the vehicle is in motion through the use of synchronizing clutches.

The transmission may be used as an aid to deceleration by downshifting in sequence without double clutching or gear clashing, due to the fact that all forward speeds are synchronized.

SERVICE PROCEDURES

TRANSMISSION REMOVAL

- (1) Remove shift rods from transmission levers.
- (2) Drain fluid from transmission.
- (3) Disconnect propeller shaft at rear universal joint. Mark both parts to reassemble in same position. Carefully pull shaft yoke out of transmission extension housing.

Be careful not to scratch or nick ground surface on sliding spline yoke during removal and installation of the shaft assembly.

- (4) Disconnect speedometer cable and back-up light switch leads.

- (5) Install engine support fixture C-3487A, with adapters Tool DD-1279 firmly over frame rails. Be sure support ends are up against underside of oil pan flange.

- (6) On the 100, 200 and 300 models, remove the long bolt securing insulator assembly to crossmember (Fig. 3).

- (7) Support transmission with a suitable jack.

- (8) Remove transmission to clutch housing bolts. Slide transmission toward rear until drive pinion shaft clears clutch disc, before lowering transmission.

- (9) Lower transmission and remove from under vehicle. Thoroughly clean exterior of unit.

DISASSEMBLING TRANSMISSION (Fig. 4)

Gearshift Housing and Mechanism

- (1) Shift transmission to second gear for shift fork clearance.

- (2) Remove housing retaining bolts and lift shift mechanism from case (Fig. 5).

- (3) If shaft "O" ring seals need replacement, or interlock levers are cracked, proceed as follows: Pull shift forks out of shaft.

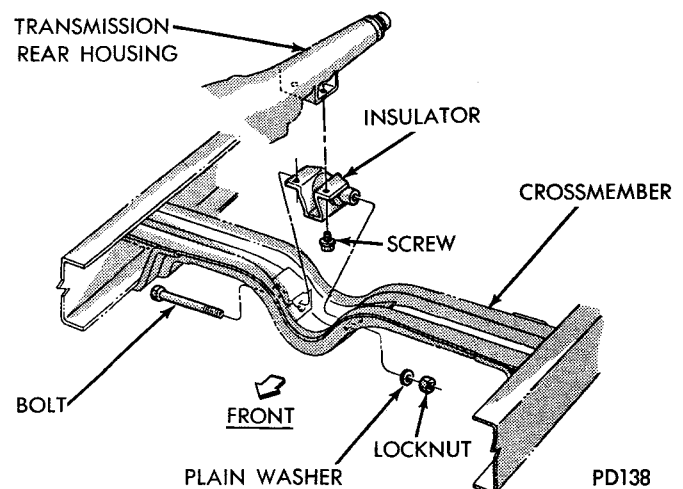


Fig. 3—Rear Transmission Mount

LEGEND FIG. 4

- | | | | | | |
|------------------|------------------|-------------------|-------------------|------------------------|----------------------------|
| 1. Gear First | 14. Gasket | 27. Shaft, Output | 40. Gasket | 53. Lever | 66. Washer |
| 2. Ring | 15. Extension | 28. Spacer Ring | 41. Seal | 54. Nut, Locking | 67. Roller |
| 3. Spring | 16. Bushing | 29. Roller | 42. Snap Ring | 55. Switch | 68. Gear, Idler |
| 4. Sleeve | 17. Seal | 30. Spacer Ring | 43. Snap Ring | 56. Lever | 69. Washer |
| 5. Struts (3) | 18. Yoke | 31. Roller | 44. Bearing | 57. Bolt | 70. Shaft |
| 6. Spring | 19. Snap Ring | 32. Spacer Ring | 45. Pinion, Drive | 58. Gasket | 71. Key |
| 7. Snap Ring | 20. Ring | 33. Countershaft | 46. Roller | 59. Lever, Interlock | 72. Washer |
| 8. Bushing | 21. Spring | 34. Spacer Ring | 47. Snap Ring | 60. Lever | 73. Plug, Filler |
| 9. Gear, Reverse | 22. Sleeve | 35. Roller | 48. Case | 61. Fork | 74. Gear, Clutch |
| 10. Bearing | 23. Struts (3) | 36. Spacer Ring | 49. Plug, Drain | 62. Spring | 75. Gear, Clutch |
| 11. Snap Ring | 24. Spring | 37. Roller | 50. Fork | 63. Snap Ring | 76. Key |
| 12. Snap Ring | 25. Ring | 38. Spacer Ring | 51. Lever | 64. Washer | 77. "O" Rings (2) |
| 13. Retainer | 26. Gear, Second | 39. Retainer | 52. Housing | 65. Gear, Countershaft | 78. "O" Ring Retainers (2) |

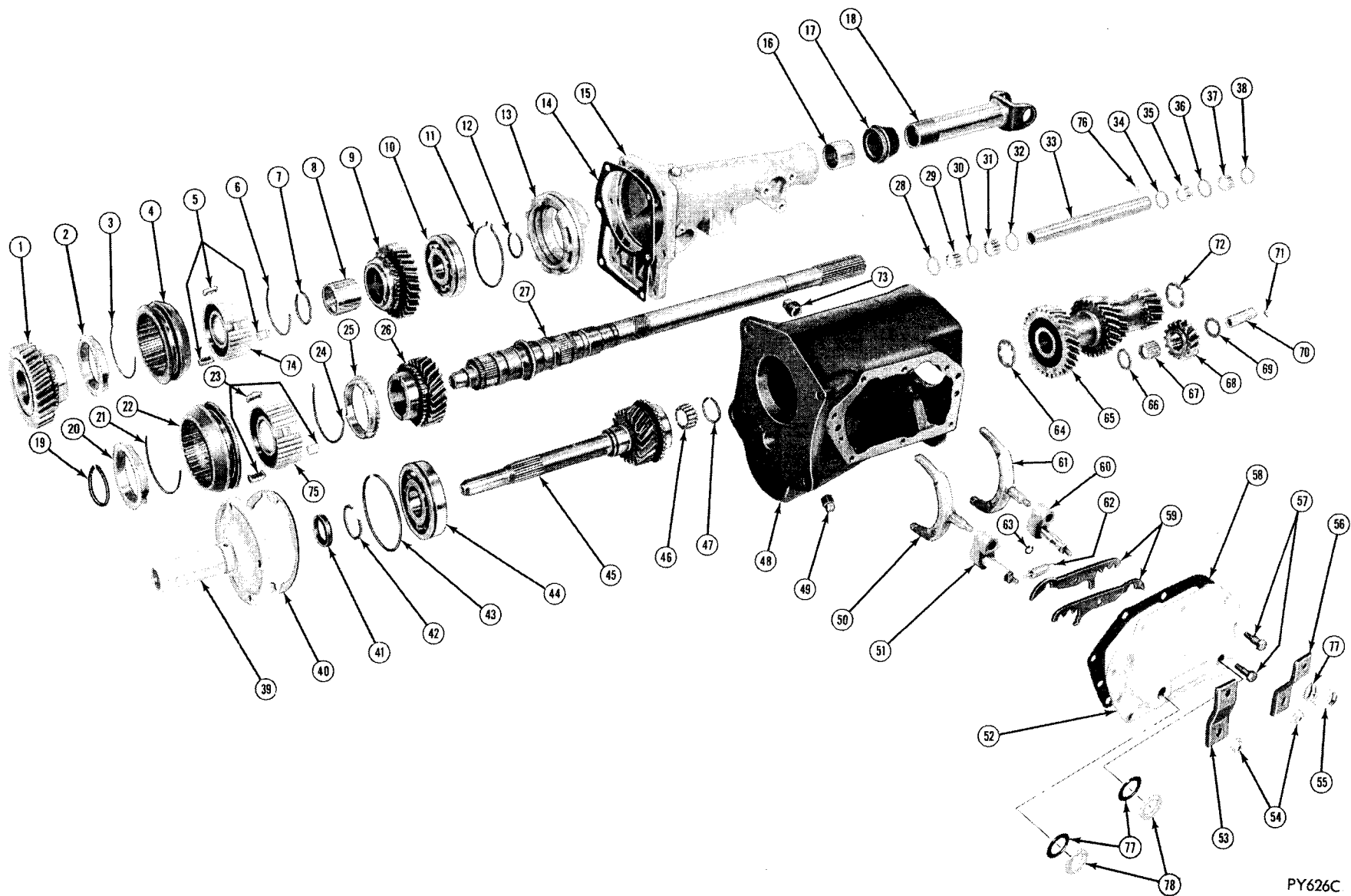


Fig. 4—A-230 Transmission—Disassembled

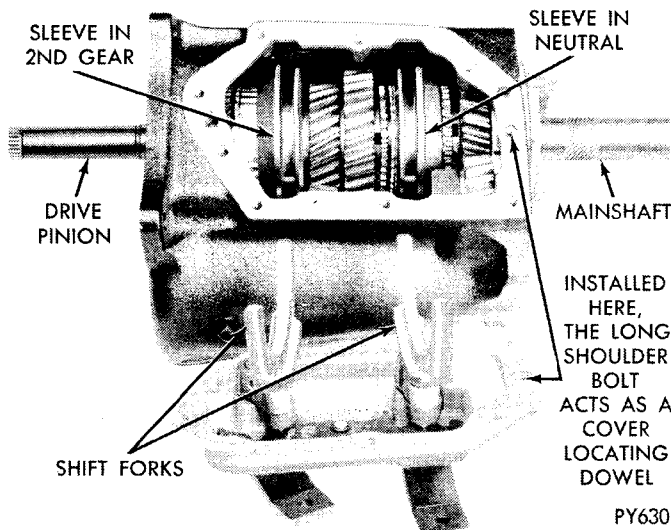


Fig. 5—A-230 Transmission with Shift Mechanism, Pinion Bearing Retainer and Extension Housing Removed

- (4) Remove nuts attaching operating levers to the shafts. Disengage levers from flats on shafts and remove.
- (5) Remove burrs from shafts before removal from housing to avoid scoring the bores.
- (6) Push gearshift lever shafts through housing bores and remove.
- (7) Remove "O" ring retainers and "O" rings from housing.

Drive Pinion Retainer and Extension Housing

- (1) Remove bolts holding drive pinion bearing retainer to front of transmission case.
- (2) Slide retainer and gasket forward off the drive pinion. Pry pinion oil seal from bearing retainer. To avoid leakage around the new seal, do not nick or scratch the bore in which the seal is pressed, or the surface on which seal bottoms.
- (3) Tap drive pinion forward carefully with a brass drift, as far as possible to provide maximum disassembly clearance for mainshaft removal (Fig. 6).
- (4) Rotate cut away part of second gear next to countershaft gear for mainshaft removal clearance (Fig. 7).
- (5) Also shift 2nd-3rd synchronizer sleeve forward for the same reason.
- (6) Remove bolt and retainer securing speedometer pinion adapter in extension housing (Fig. 2). Carefully work adapter and pinion out of extension housing.
- (7) Remove bolts that attach extension housing to rear of transmission case.
- (8) Tap with plastic hammer to break gasket seal and carefully guide housing off rear of mainshaft.

Idler Gear and Mainshaft (Fig. 8)

- (1) Insert arbor Tool C-464 in case to push reverse

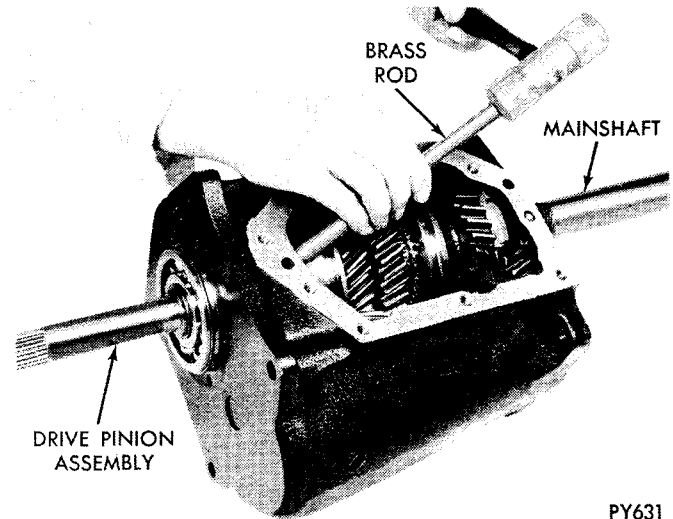


Fig. 6—Obtaining Mainshaft Pilot Clearance

idler shaft and key out of case (Fig. 8).

- (2) Remove idler gear with arbor in place to retain rollers.
- (3) Remove both thrust washers (Fig. 9).
- (4) Grasp mainshaft assembly and remove through rear of case (Fig. 9).

Countershaft Gear and Drive Pinion

Remove the magnetic disc from the bottom of the case by prying off the retaining clip with a screwdriver. Removal of the disc is necessary to allow clearance for dropping the countershaft gear.

This cup and disc should be discarded for chip collection. The drain plug should be replaced with magnetic plug assembly.

- (1) Using a mallet and arbor Tool C-4112 tap countershaft rearward and remove key. Continue to drive countershaft out of case, maintaining contact between

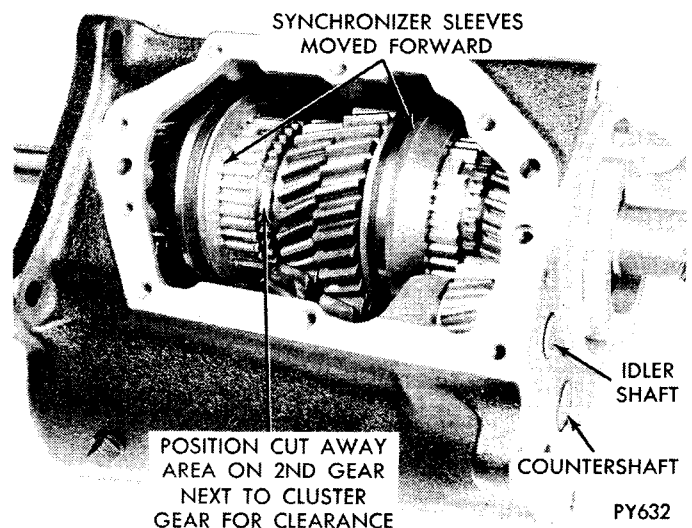


Fig. 7—Securing Clearance for Mainshaft Removal

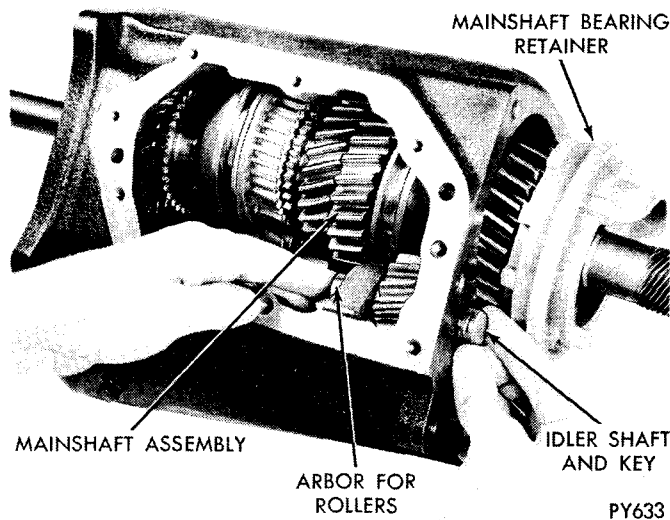


Fig. 8—Removal or Installation—Reverse Idler Gear

shaft and arbor so that washers will not drop between them (Fig. 10).

(2) Lower countershaft gear to bottom of case to permit removal of main drive pinion.

(3) Remove snap ring from pinion bearing outer race (Fig. 11).

(4) Using a plastic hammer, drive the pinion into case and remove through rear (Fig. 12).

(5) If bearing is to be replaced, remove snap ring and press bearing off the pinion gear shaft (Fig. 13).

(6) Lift countershaft gear and arbor assembly out through rear of case (Fig. 14).

Mainshaft Disassembly

(1) Remove the snap ring from front end of mainshaft which retains the 2nd-3rd synchronizer clutch gear (Fig. 15).

If synchronizer is to be disassembled, mark all parts so that they will be reassembled in the same position. Do not interchange the first-reverse assembly with the second-third assembly.

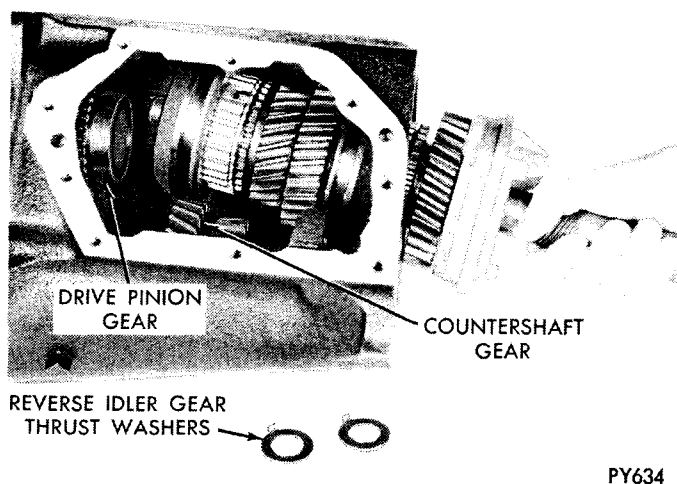


Fig. 9—Mainshaft Assembly—Removal or Installation

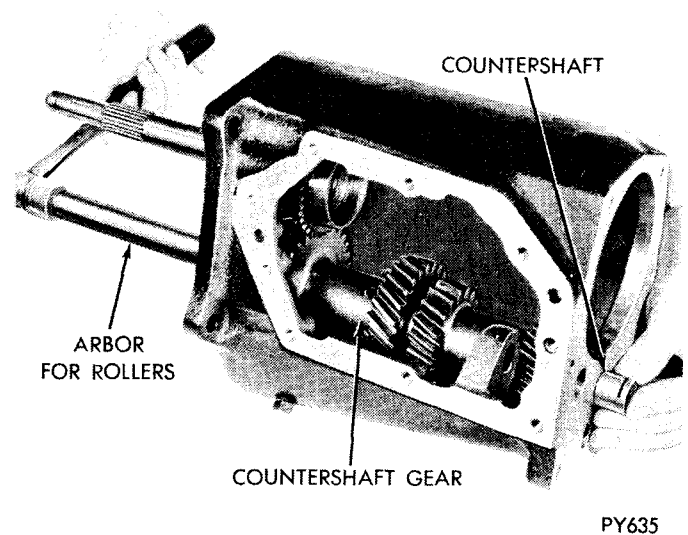


Fig. 10—Countershaft Removal

(2) Slide the 2nd-3rd synchronizer assembly off end of mainshaft along with the 2nd gear stop ring (Fig. 16).

(3) Remove 2nd gear from mainshaft (Fig. 17).

(4) Spread snap ring in mainshaft bearing retainer to disengage bearing groove and slide retainer off the bearing race (Fig. 18).

(5) Remove snap ring securing bearing to mainshaft (Fig. 19).

(6) Set up parts in arbor press to force bearing off mainshaft. By supporting front side of reverse gear it can push the bearing off shaft as pressure is applied to shaft (Fig. 20). When bearing clears shaft, don't let parts drop through.

(7) Remove from press and slip off the end of shaft, the mainshaft bearing and reverse gear (Fig. 21).

(8) Remove from mainshaft the snap ring which

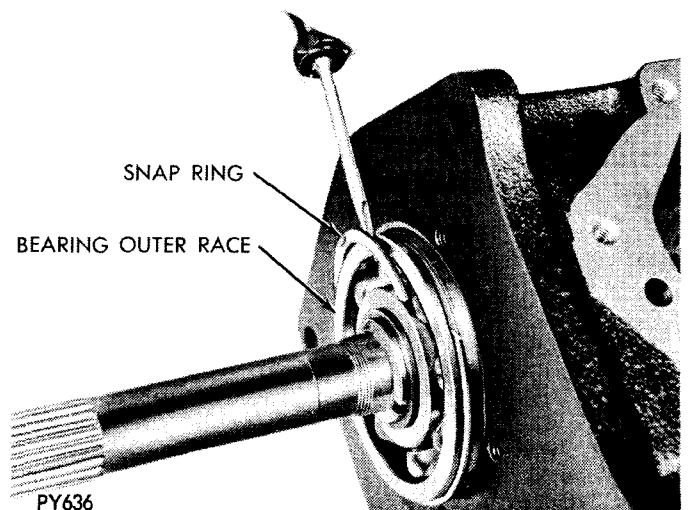


Fig. 11—Removing Pinion Gear Bearing Snap Ring

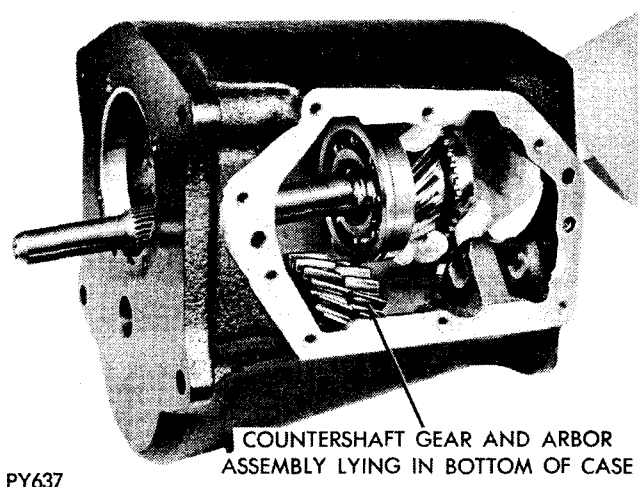


Fig. 12—Drive Pinion and Bearing Assembly—Removal or Installation

retains the 1st-Reverse synchronizer clutch gear (Fig. 22).

(9) Slide 1st-Reverse synchronizer assembly off splines and remove from mainshaft (Fig. 23).

(10) Remove 1st gear and its stop ring from mainshaft (Fig. 24).

CLEANING AND INSPECTION

Clean transmission case thoroughly, using a suitable solvent, dry with compressed air. Inspect case for cracks, stripped threads in various bolt holes and machined mating surfaces for burrs, nicks or any condition that would render the case unfit for further service. The front mating surface should be smooth; if any burrs are present, dress them off with a fine mill file. If threads are stripped, install Helicoil or equivalent inserts.

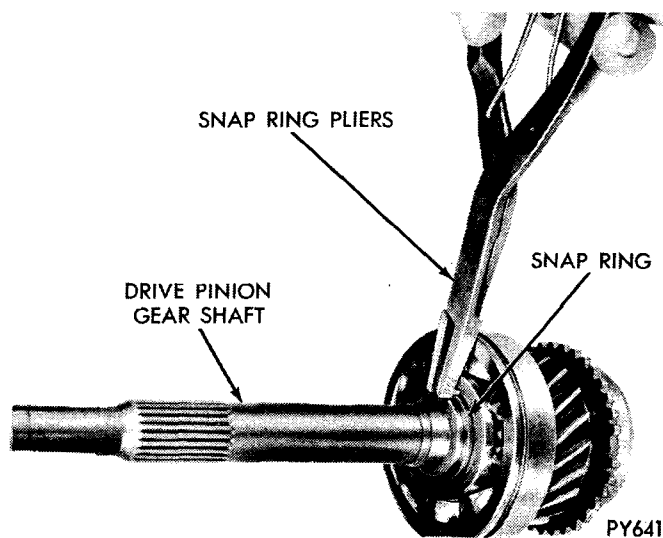


Fig. 13—Removal or Installation—Pinion Shaft-to-Bearing Snap Ring

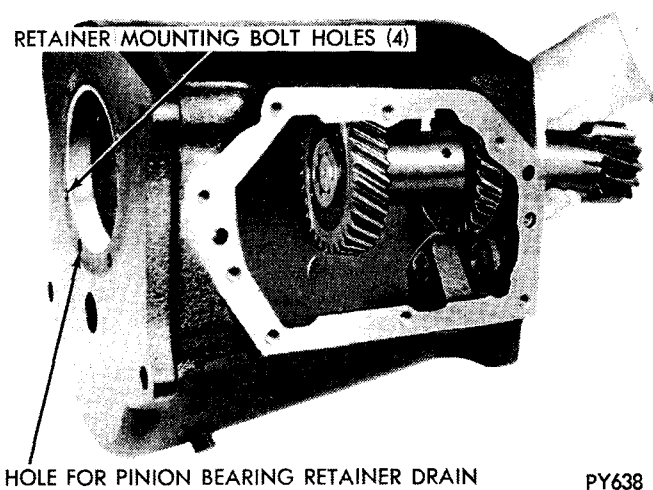


Fig. 14—Removal or Installation—Countershaft Gear and Arbor Assembly

Ball Bearings

Wash ball bearings, using a clean solvent and blow dry with compressed air.

CAUTION: Do not spin bearings with air pressure; turn slowly by hand. Spinning unlubricated bearings may cause damage to races and balls.

Be sure ball bearings are clean, then lubricate them with light grade engine oil. Inspect bearings for pitting. This can best be determined by slowly turning outer race by hand. Measure fit of bearings on their respective shafts.

Needle Type Bearing Rollers and Spacers

Inspect all bearing rollers for flat spots or brinelling. Inspect all bearing roller spacers for signs of wear or galling. Install new parts as required.

Gears

Inspect gear splines on synchronizer clutch gears and stop rings. If there is evidence of chipping or excessively worn teeth, install new parts at reassembly.

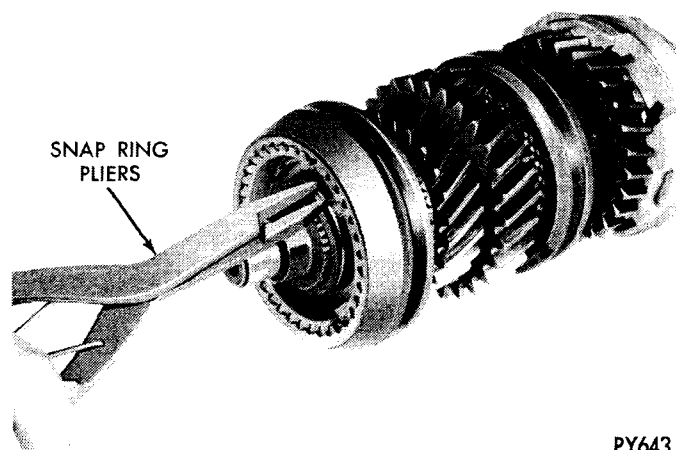


Fig. 15—Removal or Installation—2nd-3rd Synchronizer Clutch Gear-to-Mainshaft Snap Ring

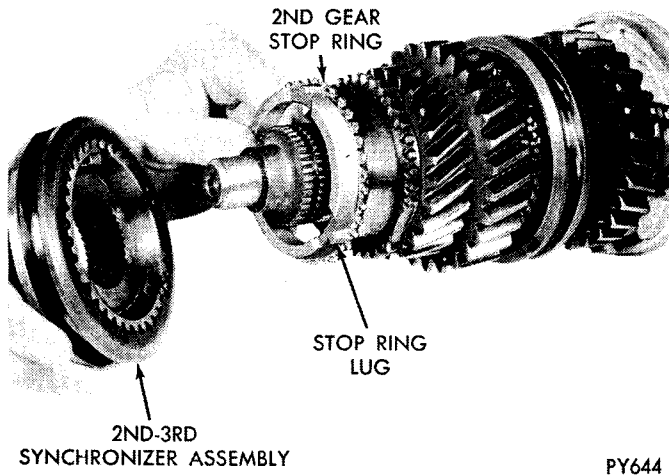


Fig. 16—Removal or Installation—2nd-3rd Synchronizer Assembly and Stop Ring

Be sure clutch sleeve slides easily on the clutch gear. Inspect countershaft gear and all gear teeth for chipped or broken teeth, or showing signs of excessive wear. Small nicks or burrs must be stoned off.

Inspect teeth on main drive pinion. If excessively worn, broken or chipped, a new pinion should be installed. If the oil seal contact area on drive pinion shaft is pitted, rusted or scratched, a new pinion is recommended for best seal life.

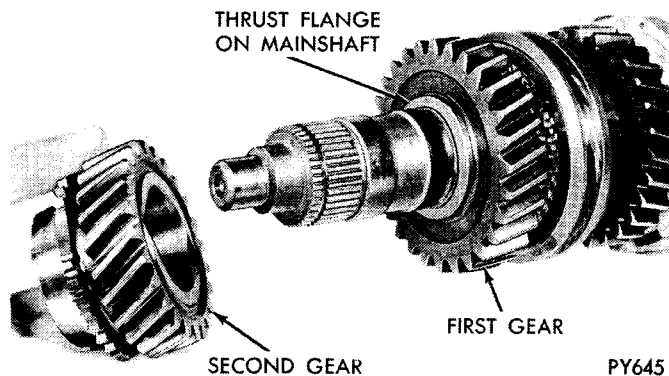


Fig. 17—Second Gear—Removal or Installation

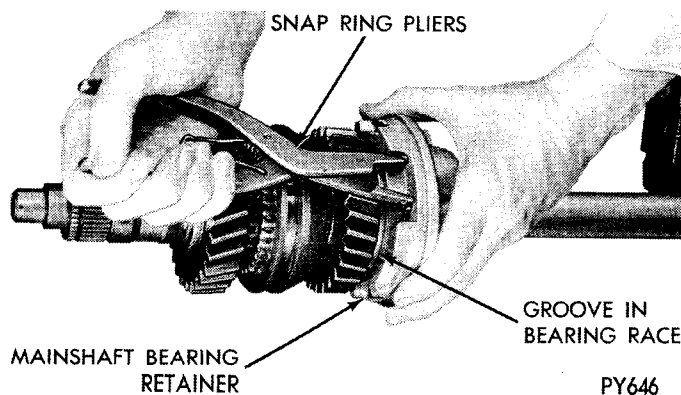


Fig. 18—Snap Ring Spread to Remove or Install Mainshaft Bearing Retainer

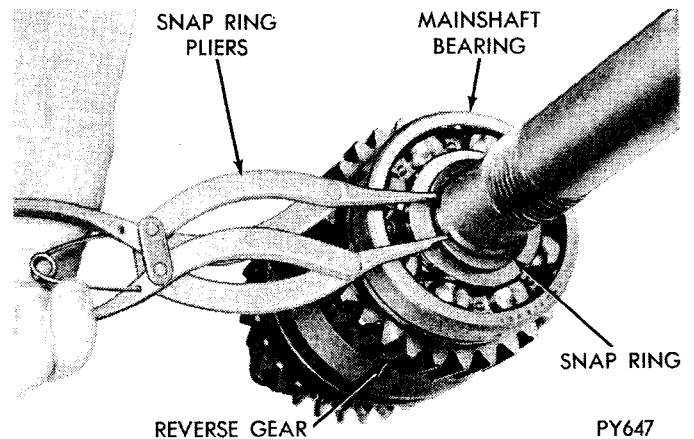


Fig. 19—Removal or Installation—Mainshaft Bearing-to-Snap Ring

Synchronizer Stop Rings

Inspect stop rings for cracks and wear. If rings are cracked or show signs of extreme wear on threaded bore, install new rings at reassembly. Test new rings for good fit on gear cones with minimum wobble.

Mainshaft

Inspect mainshaft gear and bearing mating surfaces. If gear contact surfaces show signs of galling or are excessively worn, a new mainshaft should be installed.

Inspect snap ring grooves for burred edges. If rough or burred, remove condition using a fine file or

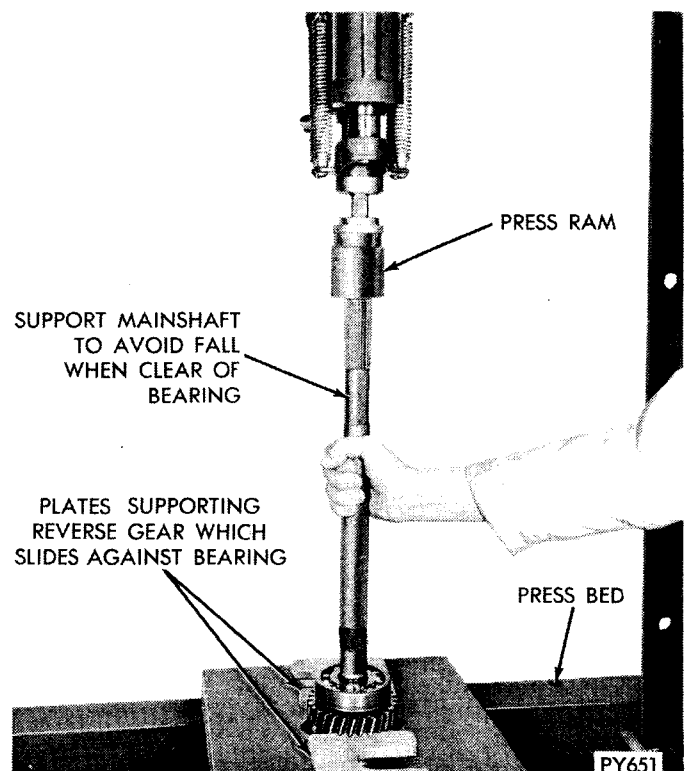


Fig. 20—Pressing Off Mainshaft Bearing

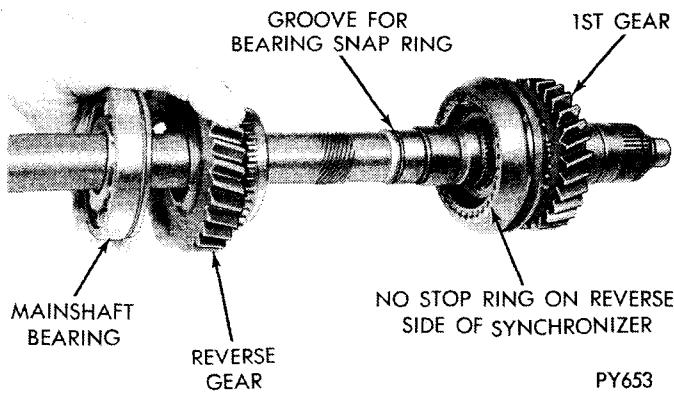


Fig. 21—Removal or Installation—Reverse Gear and Mainshaft Bearing

crocus cloth. Inspect synchronizer clutch gear splines on shaft for burrs.

ASSEMBLING TRANSMISSION

Countershaft Gear

- (1) Slide assembly arbor, Tool C-4112, into countershaft gear.
- (2) Slide one roller thrust washer over arbor and into gear, followed by 22 Greased Rollers (Fig. 25).
- (3) Repeat Step 2, adding one roller thrust washer on end.
- (4) Repeat Steps 2 and 3 at other end of counter-

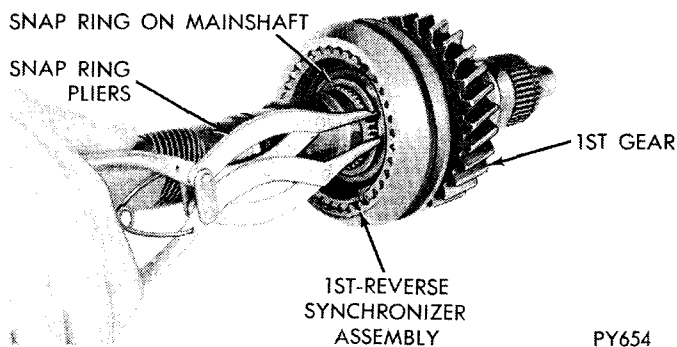


Fig. 22—Removal or Installation—1st-Reverse Synchronizer Clutch Gear Snap Ring

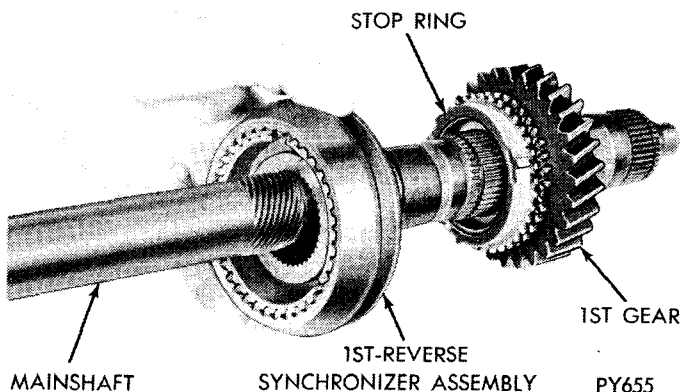


Fig. 23—Removal or Installation—1st-Reverse Synchronizer Assembly

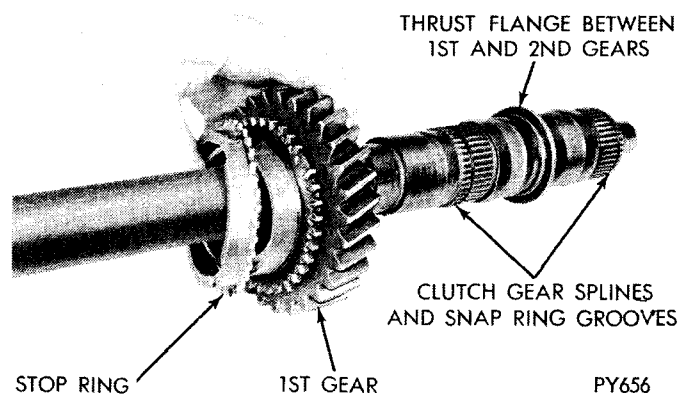


Fig. 24—Removal or Installation—1st Gear and Stop Ring

shaft gear. (Total of 88 Rollers and 6 thrust washers).

(5) Place greased front thrust washer on arbor against gear with tangs forward.

(6) Coat rear thrust washer with grease and stick it in place in the transmission case, with tangs rearward.

Magnetic chip collector and spring clip must be removed and discarded if present in case.

(7) Carefully place countershaft gear assembly in position in bottom of transmission case (Fig. 14). **Do not finish installation with countershaft and key until drive pinion is installed.**

Pinion Gear

(8) Press new bearing on pinion with snap ring groove forward. Install snap ring on shaft (Fig. 13).

(9) Install 15 rollers and retaining ring in gear (Fig. 26).

(10) Install drive pinion and bearing assembly into case (Fig. 12).

(11) Now finish installation of countershaft gear assembly by positioning it and the thrust washers so that the countershaft can be tapped into position (Fig. 27). **Be careful to keep the arbor in contact with the countershaft to avoid parts dropping out of position and blocking the installation.** Install key in countershaft as installation is finished.

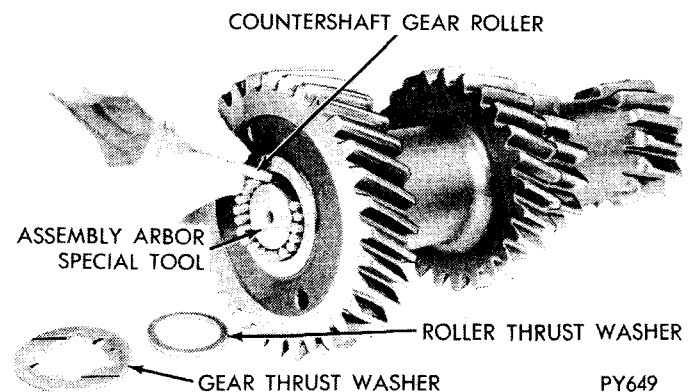
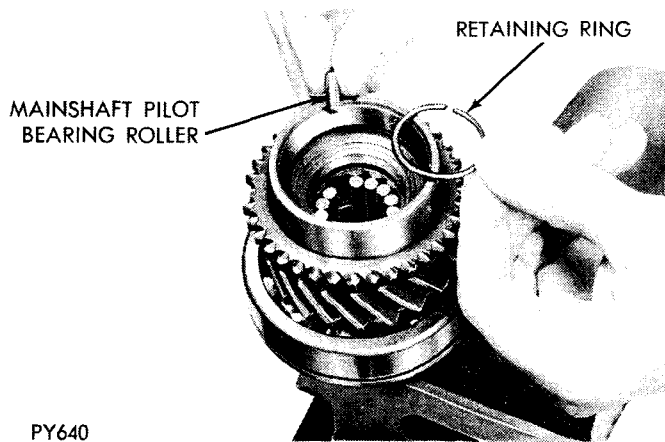


Fig. 25—Countershaft Gear—Roller Bearing Assembly



PY640

Fig. 26—Installing Rollers in Drive Pinion Gear

(12) Carefully tap drive pinion forward to provide maximum clearance for mainshaft installation (Fig. 6).

Mainshaft (Fig. 28)

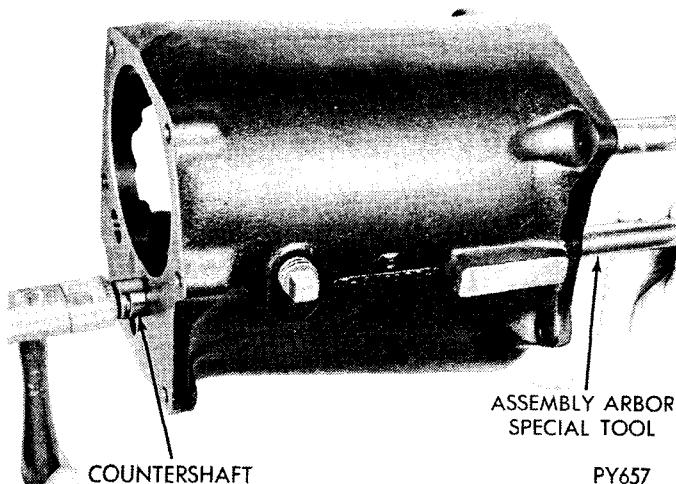
(13) Sub-assemble the synchronizer parts in the order shown in (Figs. 29, 30 and 31) as follows: Place a stop ring flat on the bench followed by the clutch gear and sleeve. Drop the struts in their slots and snap in a strut spring placing the tang inside one strut. Turn the assembly over on the stop ring and install second strut spring with tang in a different strut.

(14) Slide 1st gear and stop ring over rear end of mainshaft and against flange which separates 1st and 2nd gears (Fig. 24).

(15) Slide 1st-Reverse synchronizer assembly over mainshaft, indexing the hub slots to 1st gear stop ring lugs (Fig. 23).

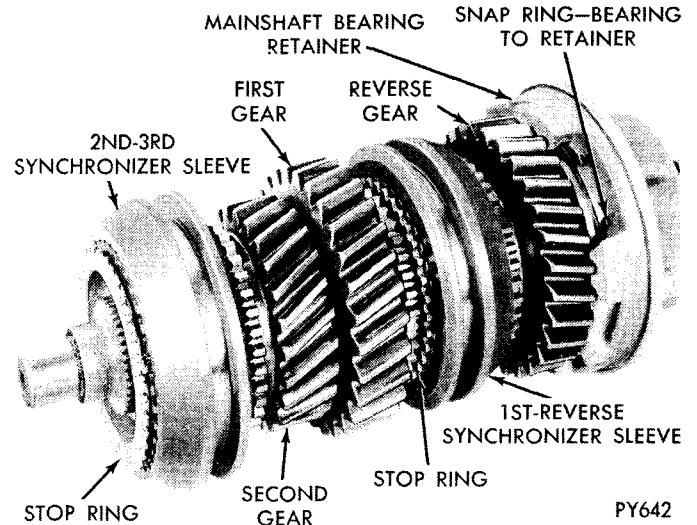
(16) Install clutch gear snap ring on mainshaft (Fig. 22).

(17) Slide reverse gear and mainshaft bearing in place and take to press, to force bearing on shaft (Fig. 21).



PY657

Fig. 27—Countershaft Installation



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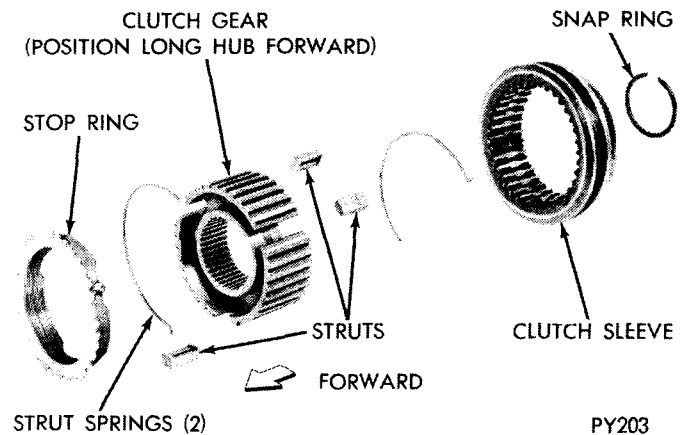
Fig. 28—Mainshaft Assembled

(18) Support inner race of bearing and press shaft through to shoulder (Fig. 32).

Be sure snap ring groove on outer race is forward.

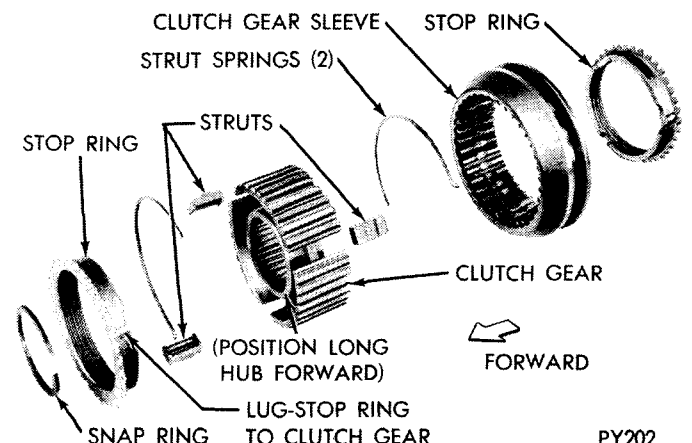
(19) Install bearing retaining snap ring on mainshaft (Fig. 19).

(20) Spread snap ring in mainshaft bearing re-



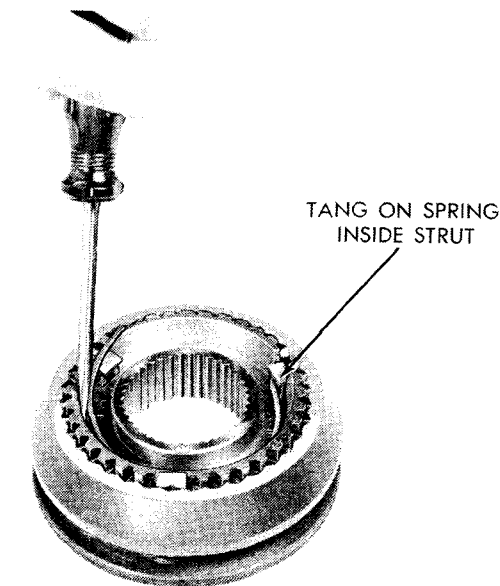
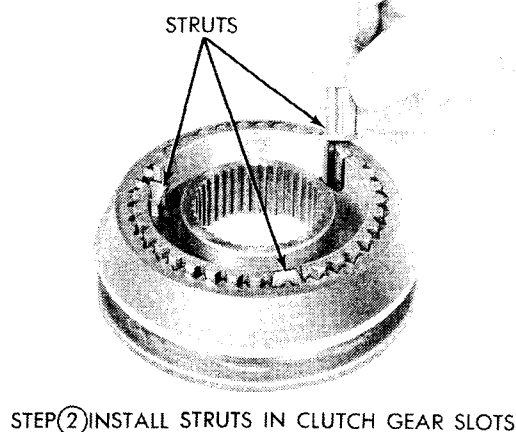
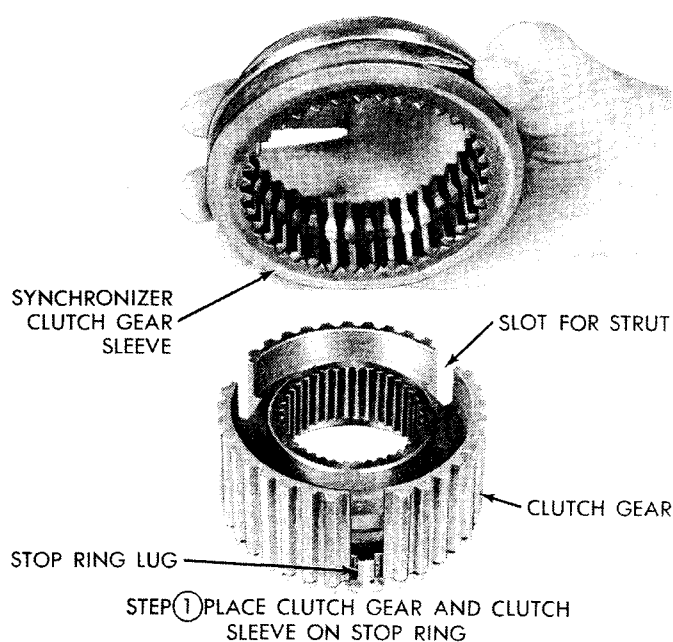
PY203

Fig. 29—1st-Reverse Synchronizer—Disassembled

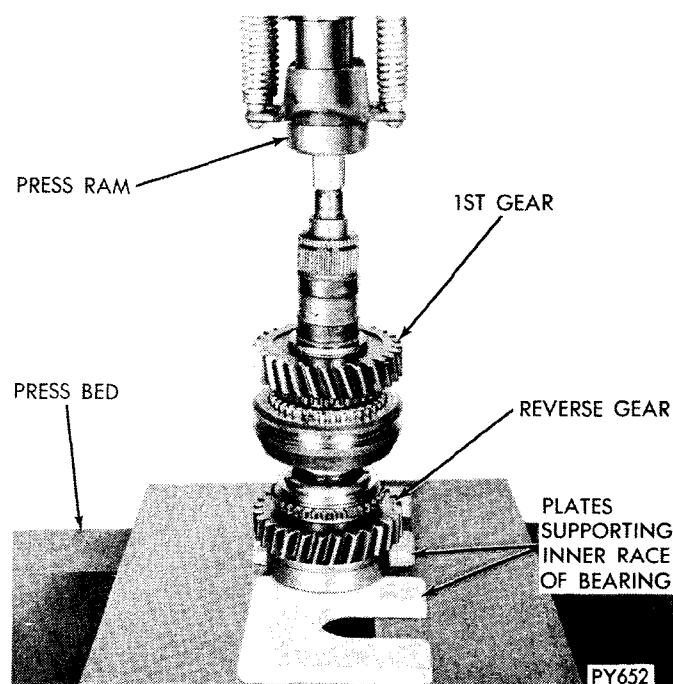


PY202

Fig. 30—2nd-3rd Synchronizer—Disassembled



PY650

Fig. 31—Assembling Synchronizer Parts**Fig. 32—Pressing on Mainshaft Bearing**

tainer groove and slide it over the bearing. Be sure snap ring seats in bearing groove (Fig. 18).

(21) Place second gear over front of mainshaft with thrust surface against flange (Fig. 17).

(22) Install properly indexed stop ring and 2nd-3rd synchronizer assembly against second gear (Fig. 16).

(23) Install 2nd-3rd clutch gear snap ring on shaft (Fig. 15).

(24) Move 2nd-3rd synchronizer sleeve forward as far as practical (limited by need to retain struts in place) and install front stop ring (coated with grease to hold it in position) inside sleeve with lugs indexed to struts.

(25) Rotate cut out on second gear so it is toward countershaft gear for clearance (Fig. 7).

(26) Now slowly insert mainshaft assembly into case (Fig. 9) tilting it as required to clear countershaft gears and finally entering the pilot rollers in the drive pinion gear.

If everything is in proper position the bearing retainer will bottom to the case without force. If not, check to see if a strut, pinion roller, or stop ring is out of position.

Reverse Idler Gear

(27) Place assembly arbor, Tool C-464 into idler gear along with 22 greased rollers (Fig. 33).

(28) Position reverse idler thrust washers in case with grease to retain them.

(29) Now position reverse idler gear with arbor and rollers in the case (Fig. 8) while installing idler shaft and key.

(30) Install extension housing and gasket to hold

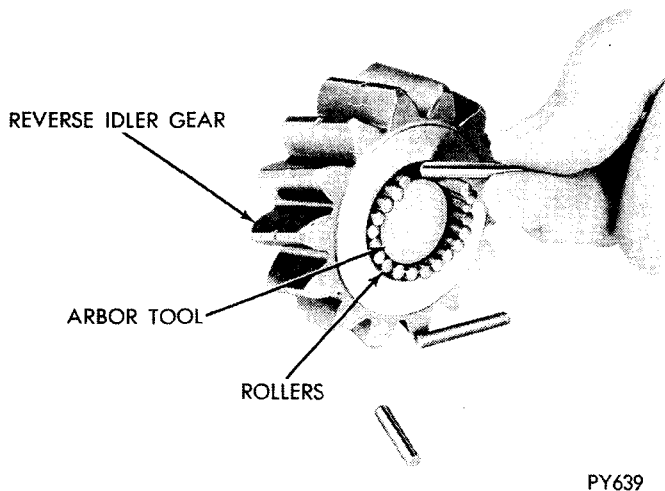


Fig. 33—Reverse Idler Gear—Roller and Arbor Assembly

mainshaft and bearing retainer in place (Fig. 34). First, replace bushing and seal, if necessary.

Extension Housing Bushing Replacement

(a) Remove extension housing yoke seal (Fig. 35) with Tool C-3985 or C-748.

(b) Drive the bushing out of housing (Fig. 36) with Tool C-3974.

(c) Slide a new bushing on installing end of Tool C-3974. Align oil hole in bushing with oil slot in housing, and drive bushing into place (Fig. 36).

(d) To install a new seal, position seal in opening of extension housing and drive it into housing with Tool C-3972 (Fig. 37).

Drive Pinion Bearing Retainer

(31) Install the outer snap ring on the drive pinion bearing and tap the assembly back until the snap ring contacts case.

(32) Using Tool C-3789 (Fig. 38), install a new oil seal in retainer bore. Position main drive pinion

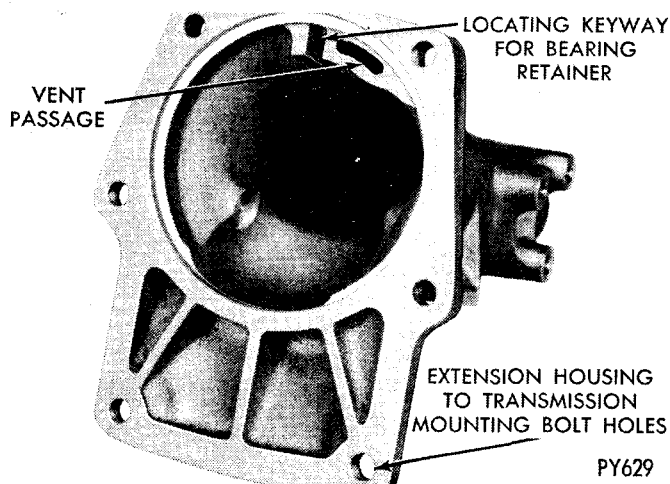


Fig. 34—Extension Housing—Front View

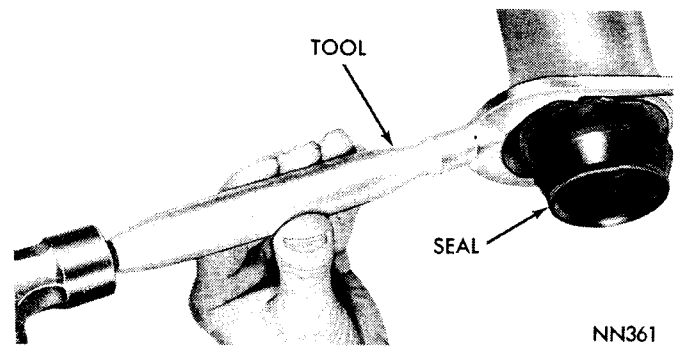


Fig. 35—Removing Extension Housing Yoke Seal

bearing retainer and gasket on front of case. Coat threads with sealing compound, then install attaching bolts and tighten to 30 foot-pounds (Fig. 2).

Gearshift Mechanism and Housing (Fig. 39)

(33) If removed, place the two interlock levers on the pivot pin and secure with "E" clip on Pivot pin.

(34) With pliers install the spring on interlock lever hangers.

(35) The 1st-reverse shift shaft has a "flat" machined on it to actuate the back-up light switch.

(36) Install shift shafts in proper bores in housing followed by greased "O" rings, "O" ring retainers and external shift levers. Tighten shift lever nuts to 18 foot-pounds. Tighten back up light switch to 15 foot-pounds.

(37) Rotate each shift lever to neutral position (straight up) and install shift forks through bores and under both interlock levers.

Install Gearshift Mechanism

(38) Position the 2nd-3rd Synchronizer sleeve in transmission to rear (in 2nd gear). Position the 1st-reverse synchronizer sleeve to middle of travel (in neu-

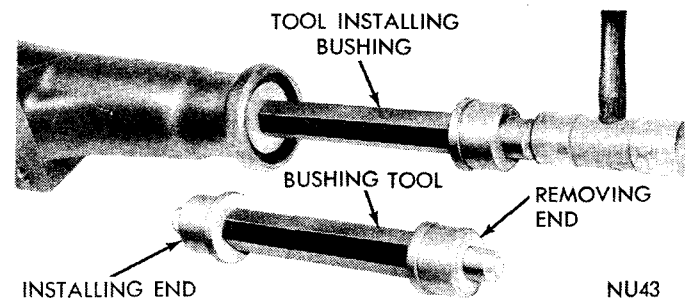


Fig. 36—Replacing Bushing in Extension Housing

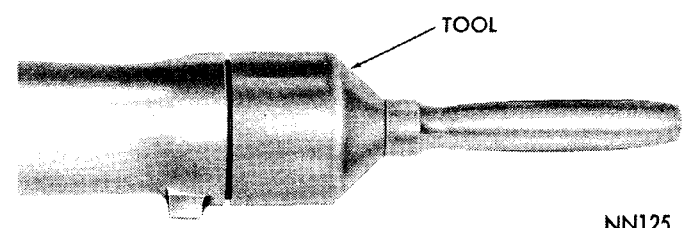


Fig. 37—Installing Extension Housing Seal

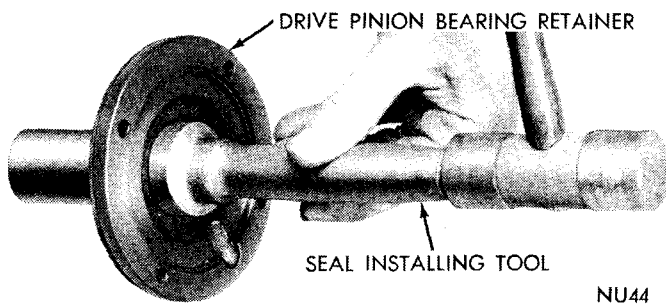


Fig. 38—Installing Seal—Drive Pinion Bearing Retainer

tral) (Fig. 5). Place the shift forks in the gearshift mechanism in the same positions.

(39) Install gasket and gearshift mechanism on transmission using special shoulder bolts. One bolt has an extra long shoulder which enters the transmission case acting as a locating dowel pin. This hole is at center rear of case (Fig. 5). Tighten bolts evenly to 15 foot-pounds.

(40) Install speedometer drive pinion gear and adapter being sure range number, stamped on outside of adapter, representing number of teeth on gear, is in 6 o'clock position (Fig. 40).

TRANSMISSION INSTALLATION

The transmission pilot bushing in end of crankshaft requires a grease which will stay in place during high temperature operation. Use Multi-Purpose Grease, Part Number 2932524, or equivalent, which is a grease of this type.

Place a small amount of Multi-Purpose lubricant around inner end of pinion shaft pilot bushing in fly-wheel and on pinion bearing retainer pilot, for clutch release sleeve. **Do not lubricate end of pinion shaft, clutch disc splines or clutch release levers.**

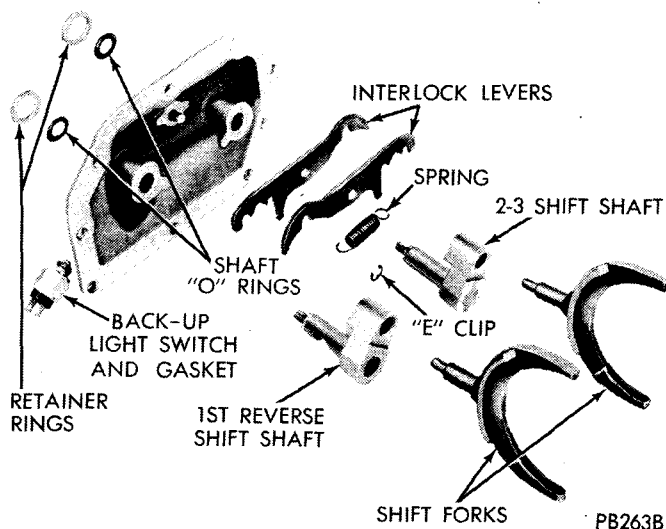


Fig. 39—Gearshift Mechanism and Housing—Disassembled

(1) With transmission on a suitable jack, slide assembly under vehicle.

(2) Raise transmission until drive pinion is centered in clutch housing bore.

(3) Roll transmission slowly forward until pinion shaft enters clutch disc. Turn pinion shaft until splines are aligned, then work transmission forward until seated against clutch housing. **Do not allow transmission to "hang" after pinion shaft has entered the clutch disc.**

(4) Install transmission to clutch housing bolts and tighten to 50 foot-pounds.

(5) Install transmission rear mount assembly to crossmember. Install transmission extension housing bolts (Fig. 3).

(6) Remove engine support fixture and disengage hooks from the frame side rails.

(7) Referring to "Gearshift Linkage Adjustment", connect shift control rods to transmission levers and connect speedometer cable.

(8) Carefully guide front universal joint yoke into extension housing and onto mainshaft splines. Connect propeller shaft to rear axle pinion yoke aligning the marks made at removal.

(9) Fill transmission. See Lubrication Section for detailed recommendations.

(10) Road test vehicle to make sure transmission shifts smoothly and operates quietly.

SPEEDOMETER PINION GEAR

Removal and Installation

Rear axle gear ratio and tire size determines pinion gear size requirements. Refer to "Speedometer Pinion Gear Chart in Specifications."

(1) Place drain pan under adapter or drain transmission.

(2) Remove bolt and retainer securing speedometer pinion adapter to extension housing (Fig. 40).

(3) With cable housing connected, carefully work adapter and pinion out of extension housing.

(4) If transmission fluid is found in cable housing, replace seal in the adapter (Fig. 41). Start seal and re-

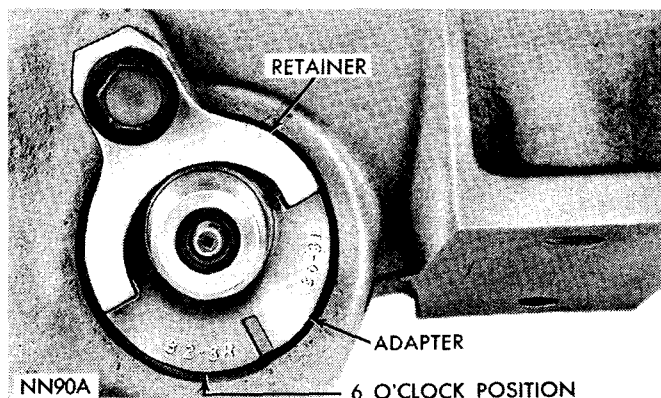


Fig. 40—Speedometer Pinion and Adapter—Installed

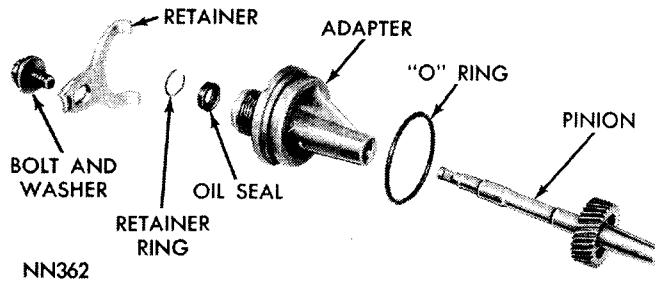


Fig. 41—Speedometer Pinion and Adapter—Disassembled

tainer ring in adapter, then push them into adapter with Tool C-4004 until tool bottoms (Fig. 42).

(5) Note number of gear teeth and install speedometer pinion gear into adapter (Fig. 41).

Before installing pinion and adapter assembly, make sure adapter flange and its mating area on extension are perfectly clean and lubricated. Dirt or sand will cause mis-alignment resulting in speedometer pinion gear damage.

(6) Rotate the speedometer pinion gear and adapter assembly so that the number on the adapter, corresponding to the number of teeth on the gear, is in the 6 o'clock position as the assembly is installed (Fig. 40).

(7) Install retainer and bolt, with retainer tangs in

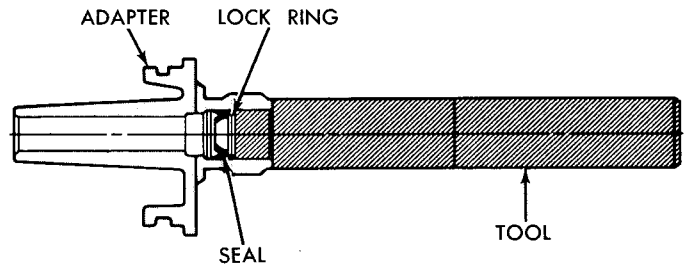


Fig. 42—Installing Speedometer Pinion Seal

adapter positioning slots. Tap adapter firmly into extension housing and tighten retainer bolt to 100 inch-pounds.

(8) Fill transmission to level of fill plug (Refer to Lubrication Section).

EXTENSION HOUSING YOKE SEAL

Replacement

(1) Place drain pan under yoke seal.

(2) Disconnect propeller shaft at rear universal joint. Mark both parts to reassemble in same position. Carefully pull shaft yoke out of transmission extension housing.

Be careful not to scratch or nick ground surface on sliding spline yoke during removal and installation of the shaft assembly.

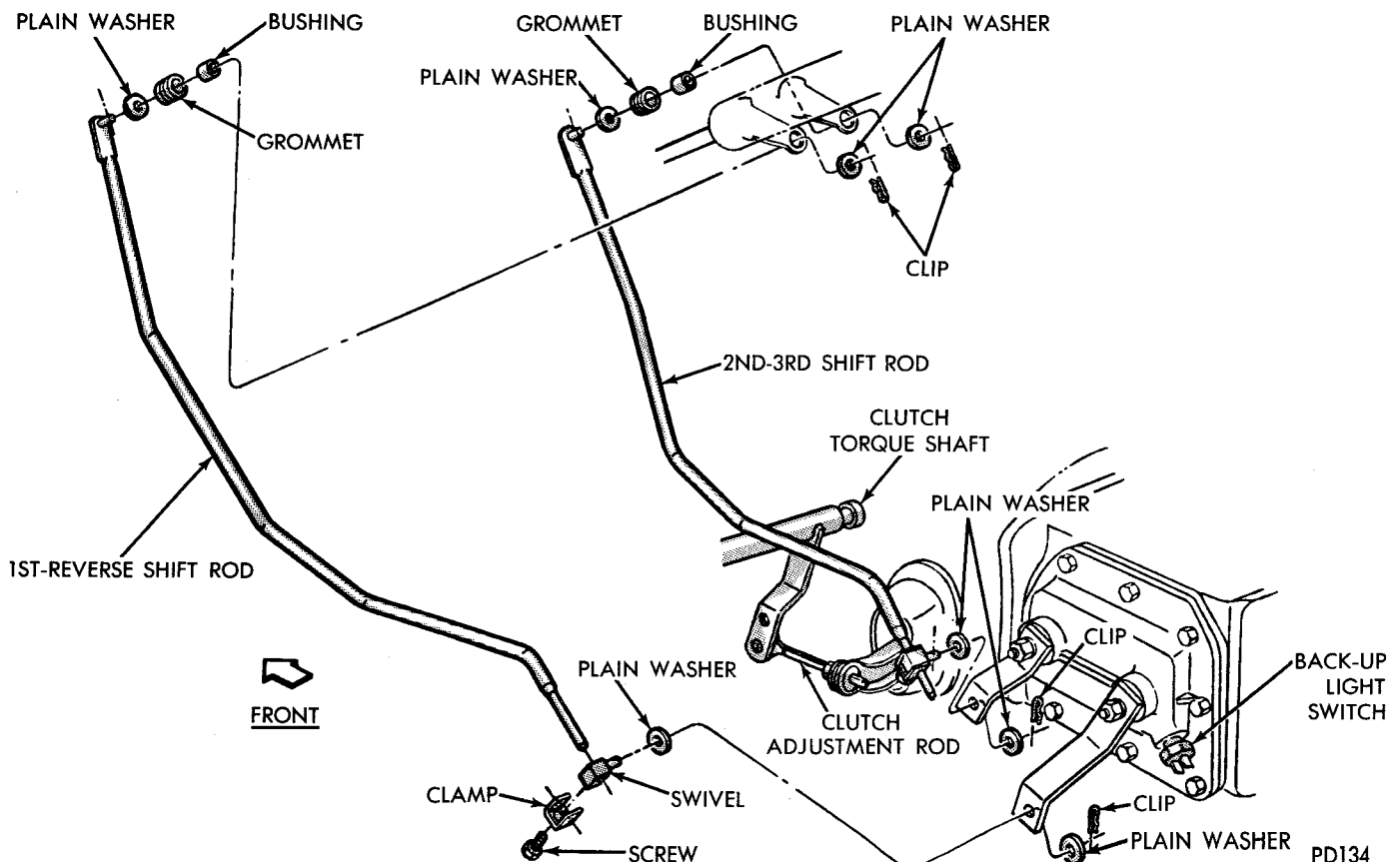


Fig. 43—Gearshift Linkage

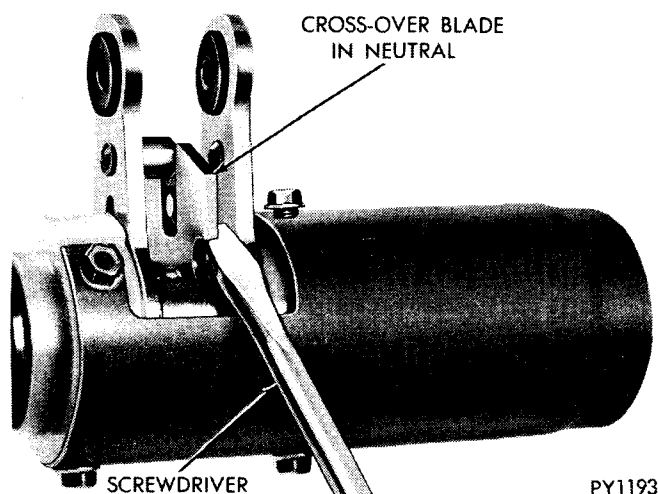


Fig. 44—Holding Cross-Over Blade in Neutral Position

(3) Remove extension housing yoke seal (Fig. 32) with Tool C-3985 or C-748.

(4) To install a new seal, position seal in opening of extension housing and drive it into housing with Tool C-3972 (Fig. 37).

(5) Carefully guide front universal joint yoke into extension housing and on mainshaft splines. Connect propeller shaft to rear axle pinion shaft yoke aligning the marks made at removal.

(6) Fill transmission to level of fill plug (Refer to Lubrication Section).

GEARSHIFT LINKAGE ADJUSTMENT

A-230 Column Shift

(1) Remove both shift rod swivels from transmission shift levers (Fig. 43).

(2) Make sure transmission shift levers are in neutral (middle detent) position.

(3) Move shift lever to line up locating slots in bottom of steering column shift housing and bearing housing.

(4) Place screwdriver or suitable tool between cross-over blade and 2nd-3rd lever at steering column so that both lever pins are engaged by cross-over blade (Fig. 44).

(5) Set 1st-Reverse lever on transmission to reverse position (rotate clockwise).

(6) Adjust 1st-reverse rod swivel by loosening clamp bolt and sliding swivel along rod so it will enter 1st-reverse lever at transmission. Install washers and clip. Tighten swivel bolt to 100 inch-pounds.

(7) Remove gearshift housing locating tool, and shift into neutral position.

(8) Adjust 2nd-3rd rod swivel by loosening clamp bolt and sliding swivel along rod so it will enter 2nd-3rd lever at transmission. Install washers and clip. Tighten swivel bolt to 100 inch-pounds.

(9) Remove tool from cross-over blade at steering column and shift through all gears to check adjustment and cross-over smoothness.

MANUAL TRANSMISSION—THREE SPEED (A-390)

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GENERAL INFORMATION

The vehicle identification number on the "B" post starts with a capital letter which indicates the line or sales name of vehicle (see Introduction of manual). These code letters are also used to indicate the vehicle to which the service information applies.

The A-390 three speed transmission (Fig. 1) has two synchronizer units, providing clash free shifting in all forward gears.

Synchronizers will be serviced as an assembly. Except for stop rings, synchronizer parts should not be interchanged.

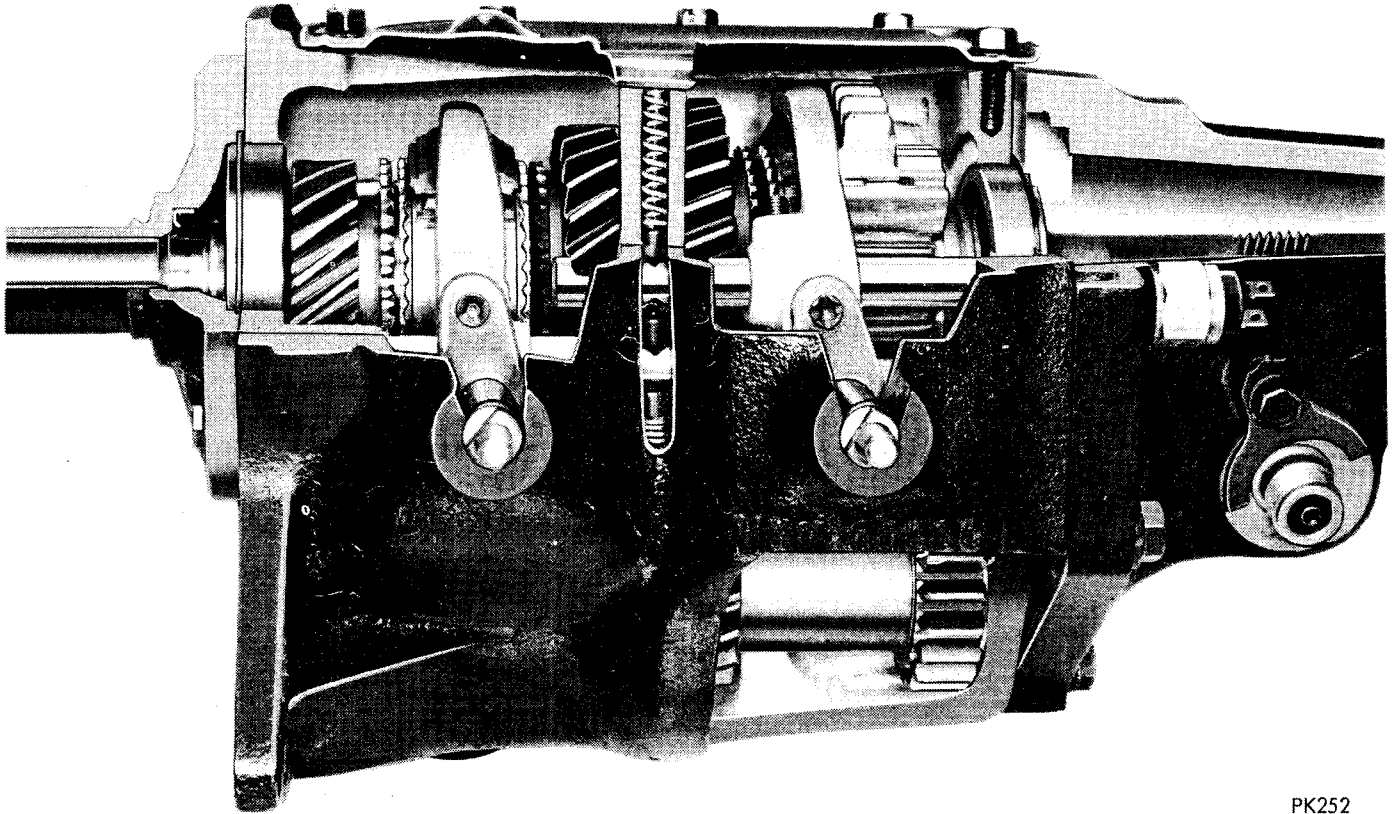
A pad has been provided on the right side of the transmission (Fig. 2) for Transmission and Vehicle identification numbers.

This transmission has the following gear ratios: First—2.99 to 1; Second—1.75 to 1; Third—1 to 1; Reverse—3.17 to 1.

The input shaft is supported by a ball bearing in the transmission case and an olive bushing pressed in the end of the crankshaft.

The output shaft front end is supported by roller bearings in the end of the input shaft and a ball bearing retainer in the front of the extension housing. The rear end of the output shaft is supported by the sliding yoke and bushing in the extension housing. The speedometer drive gear is integral with the output shaft.

The countershaft is a loose fit in the transmission



PK252

Fig. 1—A-390 Transmission Cutaway

case to allow the countershaft to float. An expansion plug is pressed into a counterbore at the front of the shaft to prevent oil leakage.

A magnetic disc is attached to bottom of case below the countershaft gear. This magnet collects and prevents circulation of chips in the transmission oil.

The gearshifting is manually operated through shift

control rods to the transmission. Any forward gear may be engaged while the vehicle is in motion through the use of synchronizing clutches.

The transmission may be used as an aid to deceleration by downshifting in sequence without double clutching or gear clashing, due to the fact that all forward speeds are synchronized.

SERVICE DIAGNOSIS

Condition	Possible Cause	Correction
HARD SHIFTING	(a) Incorrect clutch adjustment.	(a) Refer to Clutch Group for corrections.
	(b) Improper linkage adjustment.	(b) Perform linkage adjustment as outlined in "Gearshift Linkage Adjustments."
	(c) Inadequate linkage lubrication.	(c) Apply small amount of multi-purpose grease between shift levers and cross-over blade at lower end of steering column.
	(d) Synchronizer clutch sleeve damaged.	(d-e-f) Causes noted can only be corrected by disassembling transmission and replacing damaged or worn parts.
	(e) Synchronizer spring improperly installed.	
	(f) Broken or worn synchronizer stop rings.	
	(g) Grommets in gearshift linkage misassembled or damaged.	(g) Replace grommets.
TRANSMISSION SLIPS OUT OF GEAR	(a) Linkage interference.	(a) Inspect and remove all linkage interferences.
	(b) Gearshift rods out of adjustment.	(b) Adjust gearshift rods as outlined in "Gearshift Linkage Adjustments."
	(c) Synchronizer clutch teeth worn.	(c) Disassemble transmission and replace parts as necessary.

Condition	Possible Cause	Correction
TRANSMISSION NOISES	(d) Clutch housing bore or face out of alignment.	(d) Refer to Clutch Group for correction procedures.
	(e) Engine mounts loose or broken.	(e) Inspect and correct.
	(a) Excessive end play in countershaft gear.	(a) Replace thrust washers.
	(b) Damaged broken or excessively worn gear teeth.	(b) Replace worn gears.
	(c) Rough or pitted bearing race or balls.	(c) Replace worn bearing.

SERVICE PROCEDURES

SERVICE IN VEHICLE

GEARSHIFT LINKAGE ADJUSTMENT

Column Shift (Fig. 4)

- (1) Loosen both shift rod swivels.
- (2) Make sure transmission shift levers are in neutral (middle detent) position.
- (3) Move shift lever to line up locating slots in bottom of steering column shift housing and bearing housing. Install suitable tool in slot.
- (4) Place screwdriver or suitable tool between cross-over blade and 2nd-3rd lever at steering column so that both lever pins are engaged by cross-over blade (Fig. 5).
- (5) Tighten both shift rod swivel bolts to 125 inch-pounds.
- (6) Remove gearshift housing locating tool.
- (7) Remove tool from cross-over blade at steering column and shift through all gears to check adjustment and cross-over smoothness.
- (8) Check for proper operation of steering column lock in reverse. With proper linkage adjustment, ignition should lock in reverse position only, with hand off gearshift lever.

SPEEDOMETER PINION GEAR

Removal and Installation

Rear axle gear ratio and tire size determines pinion gear size requirements. Refer to "Speedometer Pinion Chart" in Specifications for pinion usage.

- (1) Place drain pan under speedometer adapter to drain transmission.

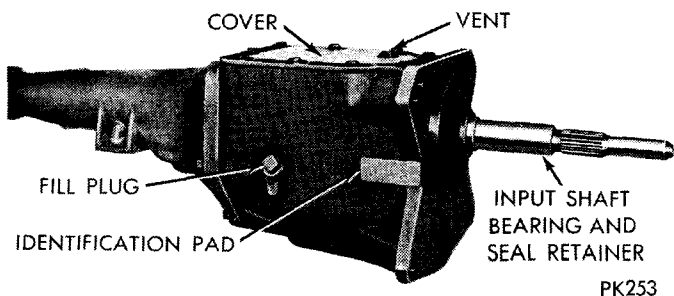


Fig. 2—A-390 Transmission—Right Side

- (2) Remove bolt and retainer securing speedometer pinion adapter in extension housing (Fig. 6).

(3) With cable housing connected, carefully work adapter and pinion out of extension housing.

- (4) If transmission fluid is found in cable housing, replace seal in the adapter (Fig. 7).

(5) Start seal and retainer ring in adapter, then push them into adapter with Tool C-4004 until tool bottoms (Fig. 8).

- (6) Note number of gear teeth and install speedometer pinion gear into adapter (Fig. 7).

Before installing pinion and adapter assembly, make sure adapter flange and its mating area on extension housing are perfectly clean and lubricated. Dirt or sand will cause mis-alignment resulting in speedometer pinion gear damage.

- (7) Rotate the speedometer pinion gear and adapter assembly so that the number on the adapter, corresponding to the number of teeth on the gear is in the 6 o'clock position as the assembly is installed (Fig. 6).

(8) Install retainer and bolt, with retainer tangs in adapter positioning slots. Tap adapter firmly into extension housing and tighten retainer bolt to 100 inch-pounds.

- (9) Fill transmission to level of fill plug (Fig. 2).

EXTENSION HOUSING BUSHING

Removal

- (1) Drain transmission fluid by removing speedometer adapter.

(2) Disconnect propeller shaft at rear universal joint. Mark both parts to reassemble in same position. Carefully pull shaft yoke out of transmission extension housing.

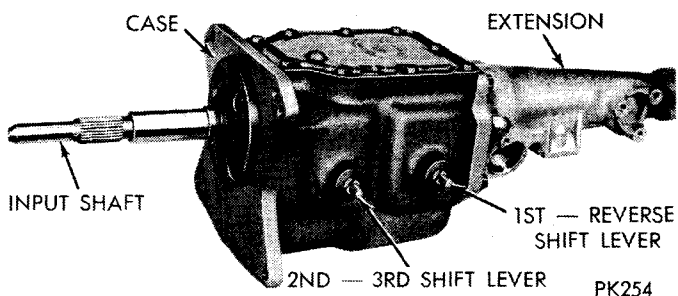


Fig. 3—A-390 Transmission—Left Side

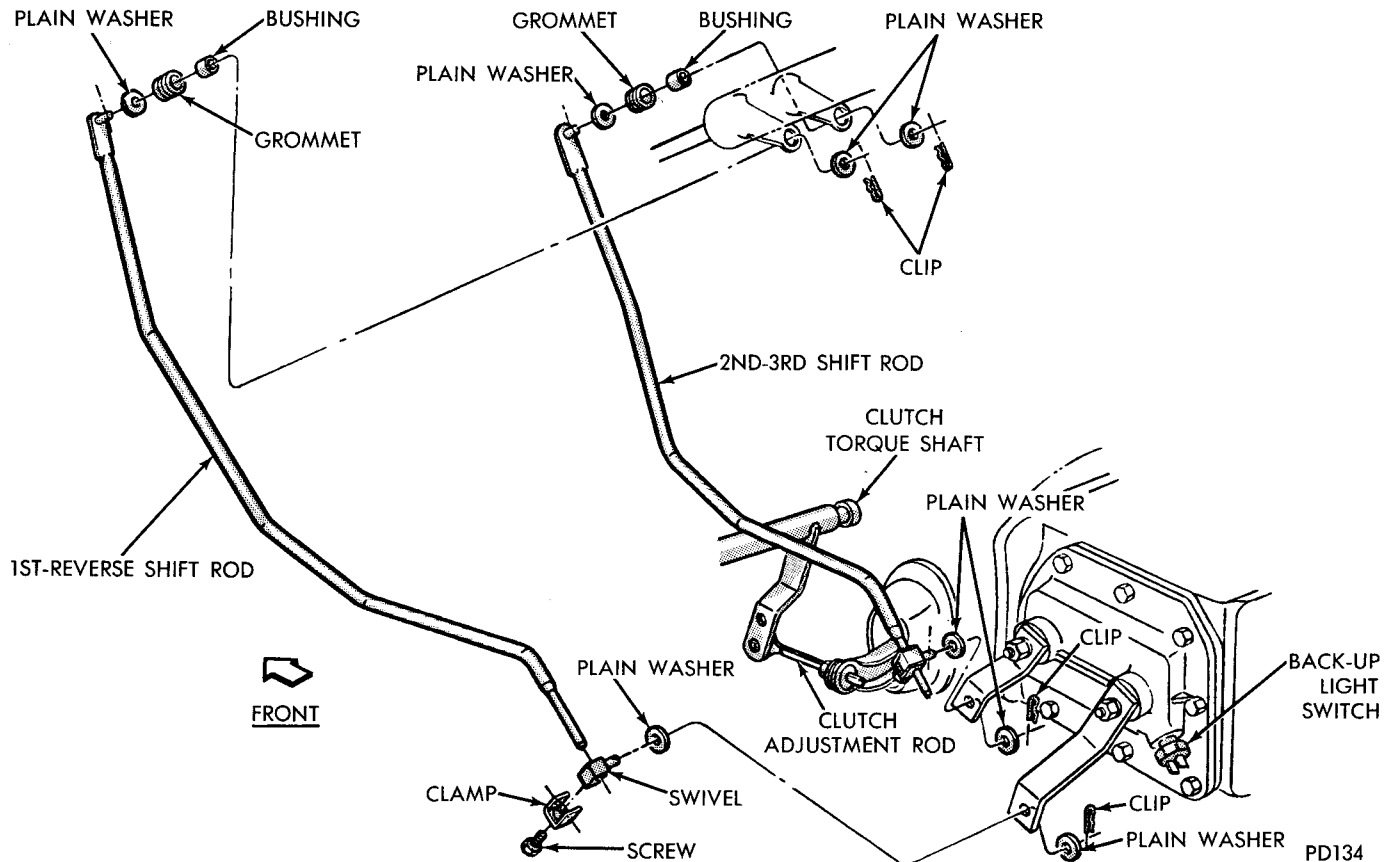


Fig. 4—A-390 Column Gearshift Linkage

Be careful not to scratch or nick ground surface on sliding spline yoke during removal and installation of the shaft assembly.

(3) Cut boot end of extension housing yoke seal, then screw the tapered thread of Tool C-748 into the seal. Turn the screw of the tool to remove the seal (Fig. 9).

(4) Remove bolts securing extension housing to crossmember. Raise transmission slightly with service jack and remove center crossmember.

(5) Remove extension housing to transmission bolts and slide extension housing off the mainshaft.

Bushing Replacement

(1) Drive the bushing out of housing (Fig. 10) with Tool C-3996.

(2) Slide a new bushing on installing end of Tool C-3996. Align oil hole in bushing with oil slot in housing, then drive bushing into place (Fig. 10).

(3) Drive a new oil seal into housing with Tool C-3995 (Fig. 11).

Installation

(1) Slide extension housing, with a new gasket, over

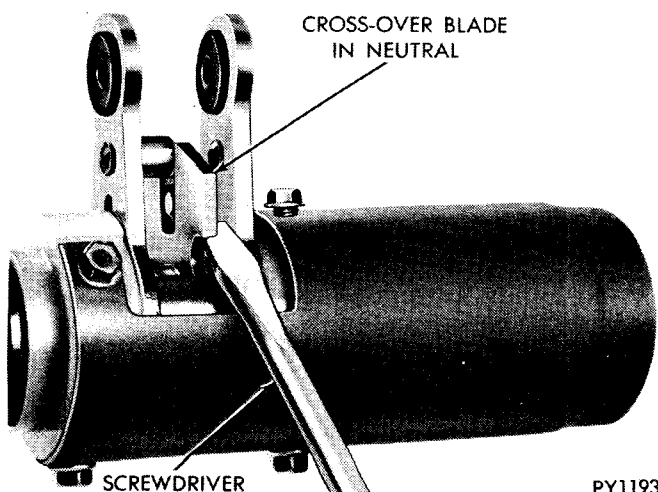


Fig. 5—Holding Crossover Blade in Neutral Position

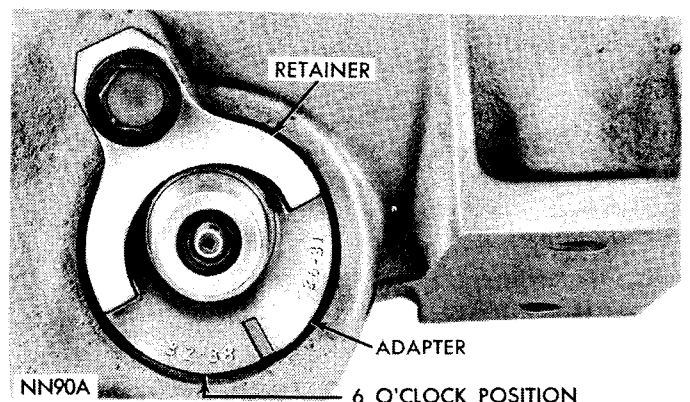


Fig. 6—Speedometer Pinion and Adapter—Installed

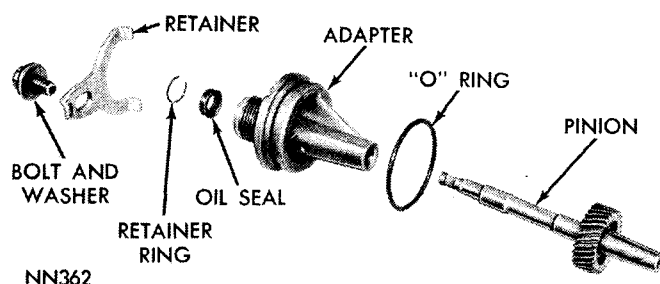


Fig. 7—Speedometer Pinion and Adapter—Disassembled

mainshaft and down against the case. Install and tighten attaching bolts to 50 foot-pounds.

(2) Install center crossmember and tighten retaining bolts to specifications. Lower transmission, install extension housing to rear engine mount bolts and tighten to specifications.

(3) Install the speedometer pinion and adapter.

(4) Carefully guide front universal joint yoke into extension housing and onto mainshaft splines. Align marks made at removal and connect propeller shaft to rear axle pinion yoke.

(5) Fill transmission to level of fill plug. (Fig. 2).

EXTENSION HOUSING YOKE SEAL

Replacement

(1) Place drain pan under seal.

(2) Disconnect propeller shaft at rear universal joint. Mark both parts to reassemble in same position. Carefully pull shaft yoke out of transmission extension housing.

Be careful not to scratch or nick ground surface on sliding spline yoke during removal and installation of the shaft assembly.

(3) Cut boot end of extension housing yoke seal, then screw the tapered thread of Tool C-748 into the seal. Turn the screw of the tool to remove the seal (Fig. 9).

(4) To install a new seal, position seal in opening of extension housing and drive it into housing with Tool C-3995 (Fig. 11).

(5) Carefully guide front universal joint yoke into extension housing and on the mainshaft splines. Align

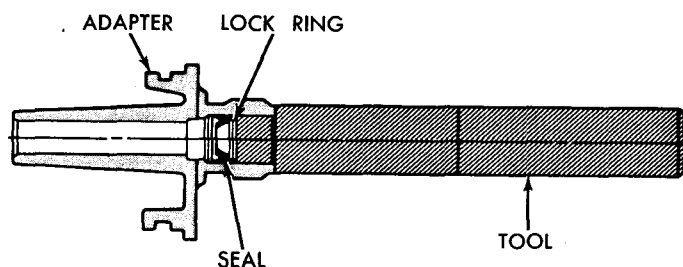


Fig. 8—Installing Speedometer Pinion Seal

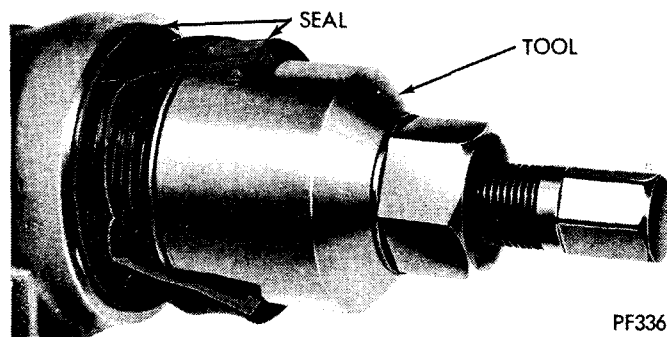


Fig. 9—Removing Extension Housing Yoke Seal

marks made at removal and connect propeller shaft to rear axle pinion shaft yoke.

(6) Fill Transmission to level of fill plug (Fig. 2).

SERVICE OUT OF VEHICLE

TRANSMISSION REMOVAL

(1) Drain lubricant from transmission.

(2) Disconnect propeller shaft at rear universal joint. Mark both parts to reassemble in same position. Carefully pull shaft yoke out of transmission extension housing.

Be careful not to scratch or nick ground surface on sliding spline yoke during removal and installation of the shaft assembly.

(3) Disconnect speedometer cable, back-up light switch leads, and gearshift operating levers.

(4) Install engine support fixture C-3487-A, mounting hooks firmly into holes in the side frame members with support ends up against underside of oil pan flange. Use Adapter Leg C-3806.

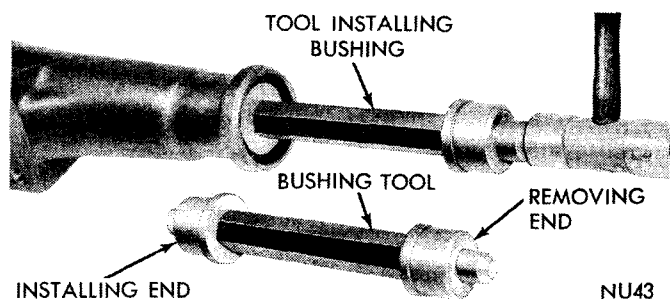


Fig. 10—Replacing Bushing in Extension Housing

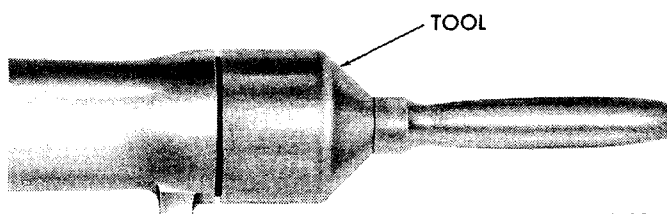


Fig. 11—Installing Extension Housing Yoke Seal

(5) Raise engine slightly with support fixture. Disconnect transmission extension housing from removable center crossmember.

(6) Support transmission with a suitable jack and remove center crossmember. Remove bolts that attach transmission to clutch housing.

(7) Slide transmission rearward until input shaft clears clutch disc before lowering transmission. (This precaution will avoid damaging the clutch disc.)

(8) Lower transmission and remove from under vehicle. Clean outside of transmission.

DISASSEMBLING TRANSMISSION (Fig. 1)

(1) Remove bolts that attach cover to case. Remove cover and gasket.

(2) Remove long spring that retains detent plug in case (Fig. 2). Remove detent plug with a small magnet.

Extension Housing

(1) Remove bolt and retainer securing speedometer pinion adapter in extension housing. Carefully work adapter and pinion out of extension housing.

(2) Remove bolts that attach extension housing to transmission case. Slide extension housing off output shaft.

Input Shaft Bearing Retainer

(1) Remove bolts that attach input shaft bearing retainer to case, then slide retainer off shaft. Using a suitable tool, pry seal out of retainer. To avoid leakage around new seal, do not nick or scratch bore in which seal is pressed or surface on which seal bottoms.

Output Shaft Assembly, Input Shaft, and Shift Forks

(1) Remove lubricant fill plug from right side of case. Working through fill plug opening, drive roll pin out of countershaft with a 1/4 inch punch (Fig. 3).

(2) Using countershaft bearing arbor, Tool C-4337, and a soft faced hammer, tap countershaft toward front of case with arbor tool to remove expansion plug from countershaft bore at front of case. The countershaft is a loose fit in the case and will slide easily.

(3) Insert arbor tool through front of case and push countershaft out rear of case so roll pin hole in countershaft does not travel through roller bearings (Fig. 4). The countershaft gear will drop to bottom of case. Remove countershaft from rear of case.

(4) Place both shift levers in neutral (center) position.

(5) Remove input shaft assembly and stop ring from front of case.

(6) Remove set screw that secures the 1st-reverse

shift fork to shift rail. Slide 1st-reverse shift rail out through rear of case.

(7) Move 2nd-3rd shift fork rearward for access to set screw. Remove set screw from fork. Using suitable tool, rotate shift rail one quarter (1/4) turn (Fig. 5).

(8) Lift interlock plug (Fig. 2) from case with a magnet.

(9) Tap on inner end of 2nd-3rd shift rail to remove expansion plug from front of case. Remove shift rail out through front of case.

(10) Remove 2nd-3rd detent plug and spring from detent bore with a magnet.

(11) Tap output shaft assembly rearward until output shaft bearing clears case. Remove both shift forks. Remove snap ring that retains output shaft bearing to output shaft.

(12) Assemble remover tool C-4335 over output shaft and output shaft bearing. Remove output shaft bearing (Fig. 6).

(13) Remove output shaft assembly out through top of case (Fig. 7).

Reverse Idler Gear

(1) Using a suitable drift, drive reverse idler gear shaft towards rear and out of case.

(2) Lift reverse idler gear and thrust washers out of case (Fig. 8).

Countershaft Gear

(1) Remove countershaft gear and arbor assembly and thrust washers from bottom of case.

(2) Remove countershaft roll pin from bottom of case.

Output Shaft

(1) Remove snap ring that retains 2nd-3rd synchronizer clutch gear and sleeve assembly to output shaft. Slide 2nd-3rd synchronizer assembly off end of output shaft. **Do not separate 2nd-3rd synchronizer clutch gear, sleeve, struts, or springs unless inspection reveals that a replacement is required.**

(2) Slide 2nd speed gear and stop ring off output shaft.

(3) Remove snap ring and thrust washer retaining 1st speed gear. Slide 1st speed gear and stop ring off output shaft.

(4) Remove snap ring that retains 1st-reverse synchronizer hub to output shaft. The 1st-reverse synchronizer hub is a press fit on output shaft. To avoid damage to synchronizer, remove synchronizer hub using an arbor press (Fig. 9). **Do not attempt to remove or install hub by hammering or prying.**

PARTS REPAIR OR REPLACEMENT

Shift Levers and Seals

(1) Remove operating levers from their respective

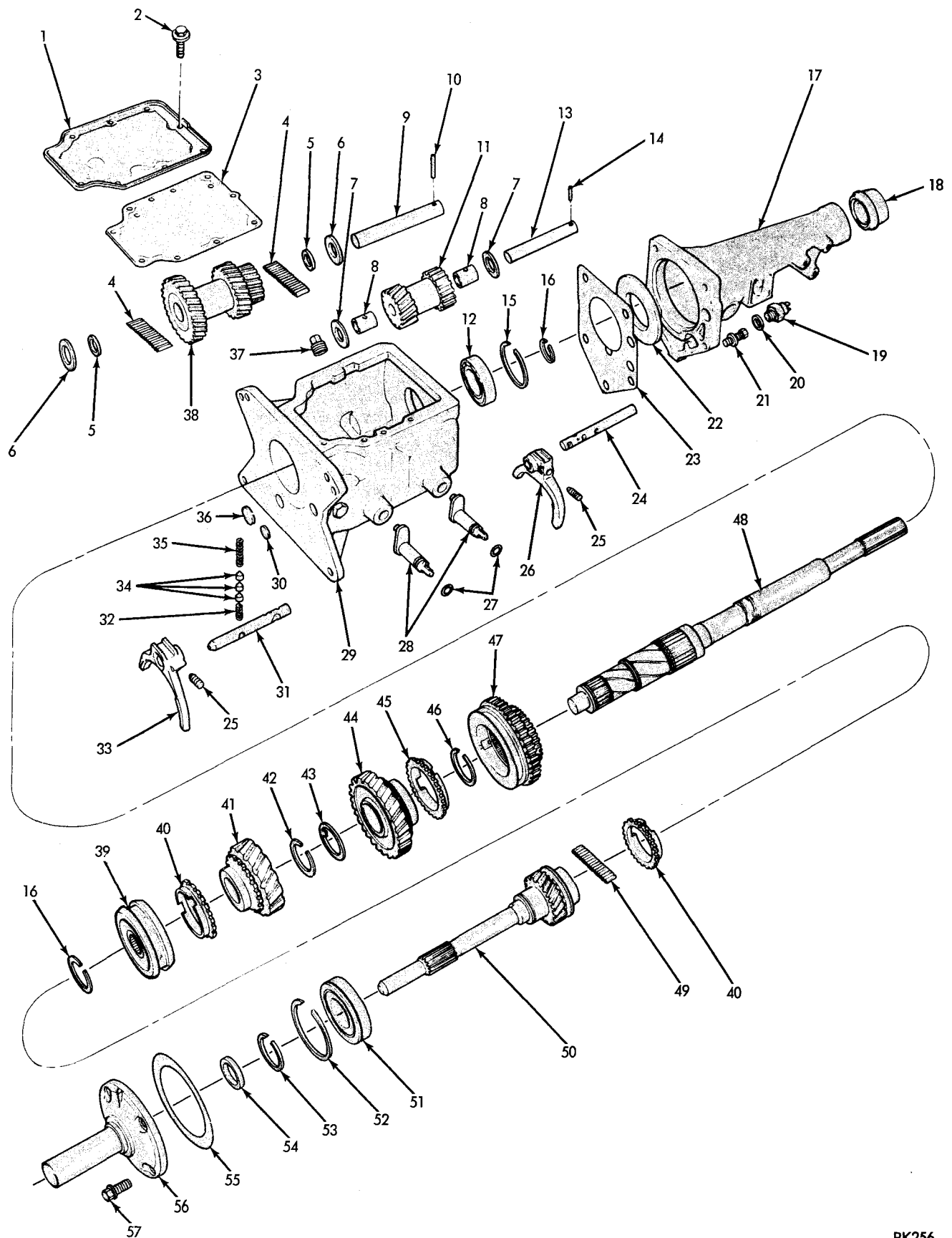


Fig. 1—A-390 Transmission—Disassembled

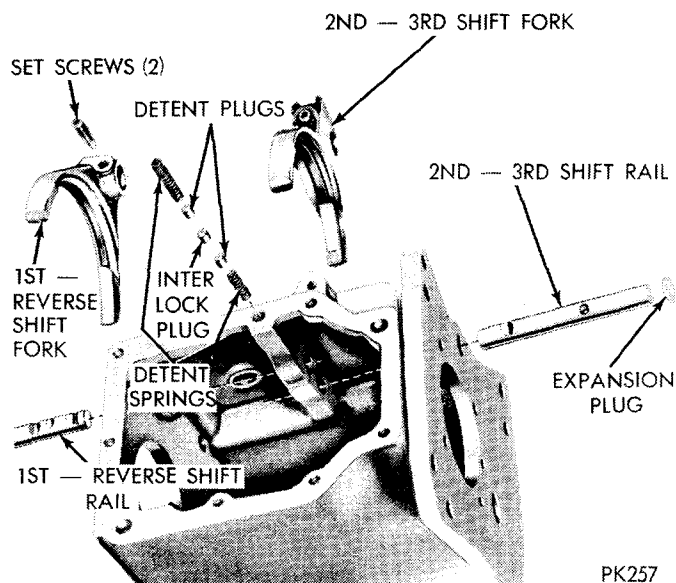


Fig. 2—Shift Rails and Forks—Disassembled

shafts. Remove burrs from shafts to avoid damage to case.

(2) Push shift levers out of transmission case. Remove and discard "O" ring seal from each shaft.

(3) Lubricate new seals with transmission fluid and install them on shafts.

(4) Install shift levers in case.

(5) Install operating levers and tighten retaining nuts to 18 foot-pounds.

Input Shaft Bearing and Rollers

(1) Remove snap ring securing bearing on input shaft. Carefully press input shaft out of bearing using special tool C-4335 (Fig. 10) or an arbor press.

(2) Remove fifteen (15) bearing rollers from cavity in end of input shaft.

(3) Install 15 bearing rollers in cavity of input shaft. Coat bearing rollers with a thin film of grease to retain them during installation.

(4) Slide input shaft bearing over shaft (snap ring

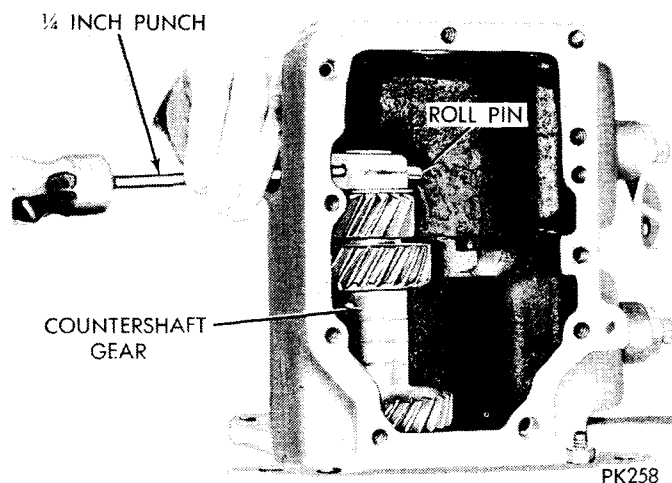


Fig. 3—Removing Roll Pin from Countershaft

groove away from gear end), then seat on input shaft using special tool C-4338-A (Fig. 11) or an arbor press.

(5) Secure bearing with snap ring. Be sure snap ring is properly seated. If large snap ring around bearing was removed, install it at this time.

Synchronizers

If either synchronizer is to be disassembled, mark all parts so that they will be reassembled in same position. Do not mix parts from 2nd-3rd synchronizer with 1st-reverse synchronizer.

(1) Push synchronizer hub from each synchronizer sleeve.

(2) Separate struts and springs from hubs.

(3) Install spring on front side of 1st-reverse synchronizer hub, making sure that all three strut slots are fully covered. Hang three struts on spring and in slots with wide end of strut inside hub (Fig. 12).

(4) With alignment marks on hub and sleeve aligned, push sleeve down on hub until struts are in neutral detent. Place stop ring on top of synchronizer assembly.

(5) With alignment marks on 2nd-3rd synchronizer

LEGEND FOR FIG. 1. (A-390)

1. Cover, Case
2. Screw, Case Cover
3. Gasket, Case Cover
4. Roller, Countershaft Brg.
5. Washer, Countershaft Brg.
6. Washer, Countershaft Thrust
7. Washer, Reverse Idler Thrust
8. Bushing, Reverse Idler
9. Countershaft
10. Pin, Countershaft Roll
11. Gear, Reverse Idler
12. Bearing, Output Shaft
13. Shaft, Reverse Idler
14. Pin, Reverse Idler Stop
15. Snap Ring, Output Shaft Brg., Outer
16. Snap Ring, Output Shaft, Inner
17. Extension
18. Seal, Extension
19. Switch, Back-Up Lamp
20. Gasket, Back-Up Lamp Switch
21. Screw, Extension
- Lockwasher, Extension Screw

22. Retainer, Output Shaft Brg.
23. Gasket, Extension
24. Rail, Gearshift First and Reverse
25. Screw, Fork Set
26. Fork, Gearshift First and Reverse
27. Seal, Gearshift Lever Shaft Oil
28. Lever, Gearshift
29. Case
30. Plug
31. Rail, Gearshift Second and Third
32. Spring, Gearshift Detent Pin
33. Fork, Gearshift Second and Third
34. Pin, Gearshift Detent
35. Spring, Gearshift Detent Pin
36. Plug
37. Plug, Case Filler
38. Gear, Countershaft
39. Synchronizer Assy., Second and Third
40. Ring, Synchronizer Second and Third Stop

41. Gear, Second Speed
42. Snap Ring, Low Speed Gear
- Thrust Washer
43. Washer, Low Speed Gear Thrust
44. Gear, Low Speed
45. Ring, Synchronizer Low Stop
46. Snap Ring, Synchronizer Low and Reverse Clutch Gear
47. Synchronizer Assy., Low and Reverse
48. Shaft, Output
49. Roller, Output Shaft Pilot
50. Shaft, Input
51. Bearing, Input Shaft
52. Snap Ring, Bearing, Outer
53. Snap Ring, Bearing Inner
54. Seal, Bearing Retainer Oil
55. Gasket, Bearing Retainer
56. Retainer, Bearing
57. Screw, Bearing Retainer

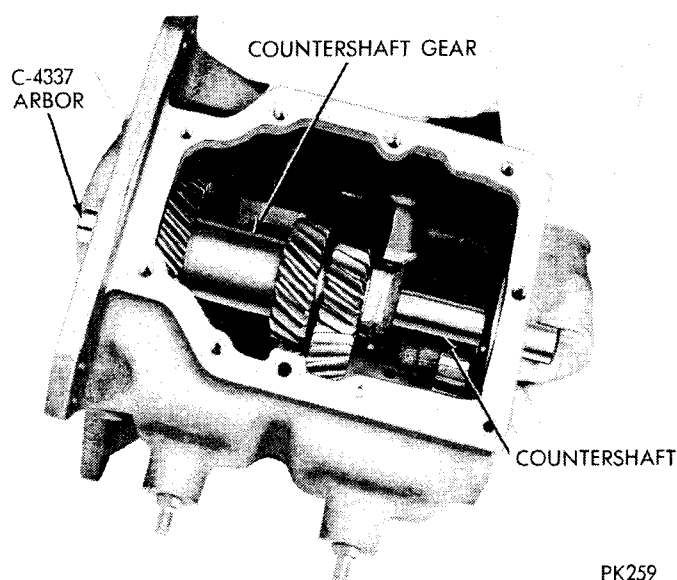


Fig. 4—Removing Countershaft

hub and sleeve aligned, slide sleeve on hub. Drop in three struts in strut slots. Install a spring with hump in center of spring, into hollow of strut. Turn assembly over and install the other spring so that hump in center of spring is inserted in the same strut. Place a stop ring on each end of synchronizer assembly (Fig. 13).

Countershaft Gear and Bearings

(1) Remove countershaft bearing arbor, tool C-4337, 50 roller bearings and 2 bearing retainer washer from countershaft gear (Fig. 14).

(2) Coat bore in each end of countershaft gear with grease.

(3) Insert countershaft bearing arbor and install 25 roller bearings and retainer washer in each end of gear.

(4) Position countershaft gear and arbor assembly in case. Align gear bore and thrust washers with bores in case and install countershaft.

(5) Using a feeler gauge, check countershaft gear end play. The end play should be within .004 to .018

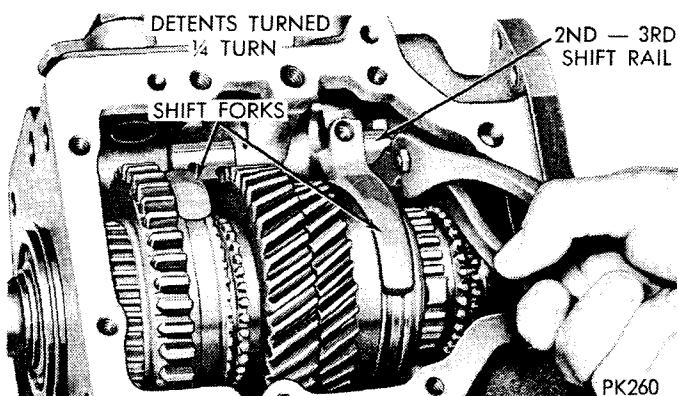


Fig. 5—Rotating 2nd-3rd Shift Rail 1/4 Turn

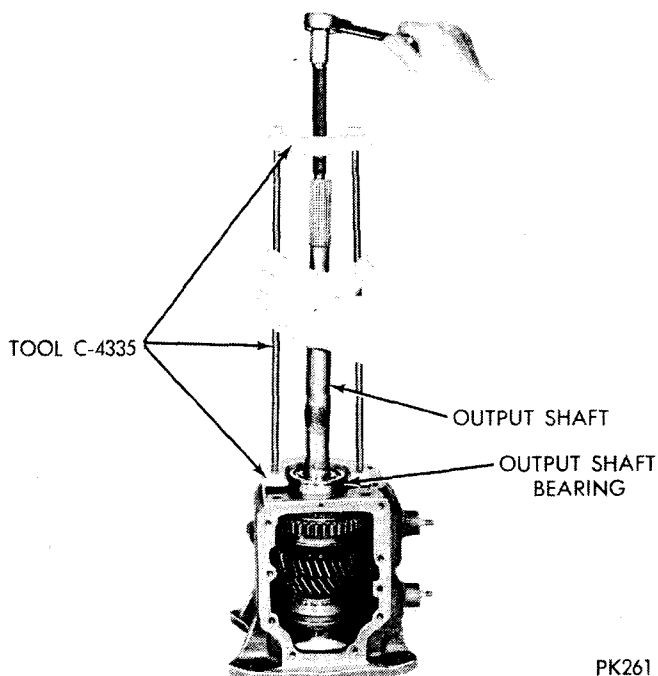


Fig. 6—Removing Output Shaft Bearing

inch. If not within these limits, replace thrust washers.

(6) After establishing correct end play, install arbor tool in countershaft gear and lower gear and arbor assembly to bottom of case.

ASSEMBLING TRANSMISSION

(1) Coat countershaft gear thrust surfaces in case with a thin film of grease and position two (2) thrust washers in place. Place countershaft gear and arbor assembly in proper position at bottom of case. The countershaft gear will remain in bottom of case until output and input shafts have been installed.

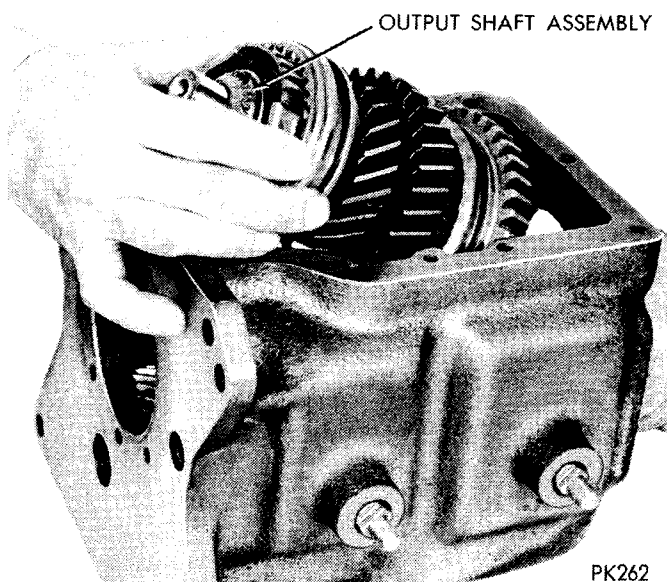


Fig. 7—Removing or Installing Output Shaft Assembly

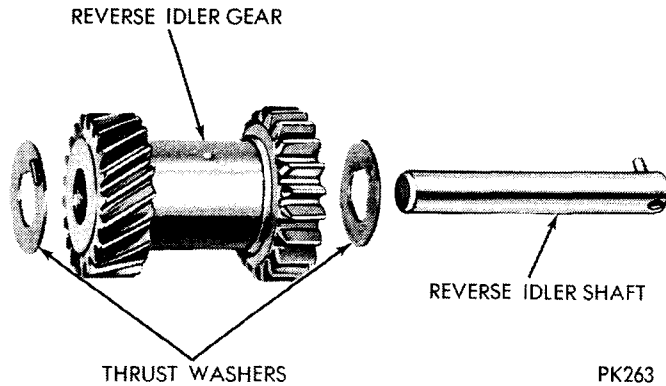


Fig. 8—Reverse Idler Gear—Disassembled

(2) Coat reverse idler gear thrust surfaces in case with a thin film of grease and position two (2) thrust washers in place. Install reverse idler gear in proper position (Fig. 1) and align gear bore and thrust washers in case bores. Install reverse idler shaft.

(3) Measure reverse idler gear end play with a feeler gauge. End play should be within .004 to .018 inch. If end play is not within limits, replace thrust washers. If end play is within limits, leave reverse idler gear installed.

Output Shaft Assembly

(1) Lubricate output shaft splines and machined surfaces with transmission lubricant.

(2) Slide 1st-reverse synchronizer onto output shaft with fork groove toward front. The 1st-reverse synchronizer hub is a press fit on output shaft. To eliminate possibility of damaging hub, install hub using an arbor press (Fig. 9). **Do not attempt to install hub by hammering or prying.** Secure hub to output shaft with snap ring.

(3) Slide 1st speed gear and stop ring onto output shaft, aligning slots in stop ring with struts. Install thrust washer and snap ring (Fig. 15).

(4) Slide 2nd speed gear and stop ring onto output shaft.

(5) Install 2nd-3rd synchronizer assembly on output

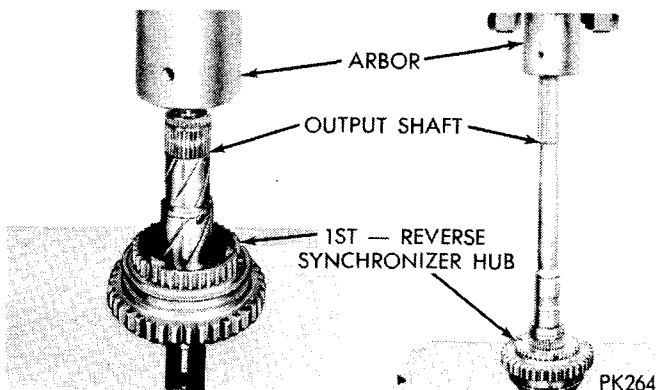


Fig. 9—Removing and Installing 1st-Reverse Synchronizer Hub

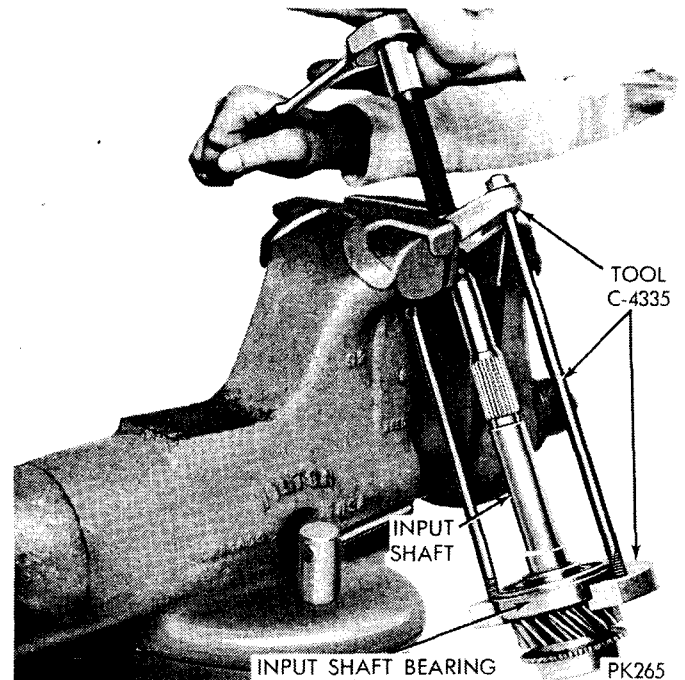


Fig. 10—Removing Input Shaft Bearing

shaft. Rotate 2nd speed gear to index struts with slots in stop ring. Secure synchronizer with a snap ring.

(6) Position output shaft assembly in case (Fig. 7). Place transmission in vertical position with front of case flat on workbench. Place a 1-1/4 inch block of wood under front end of output shaft. The block of wood will hold output shaft assembly up during installation of output shaft bearing (Fig. 16).

(7) Install large snap ring on output shaft bearing. Place bearing on output shaft with large snap ring up.

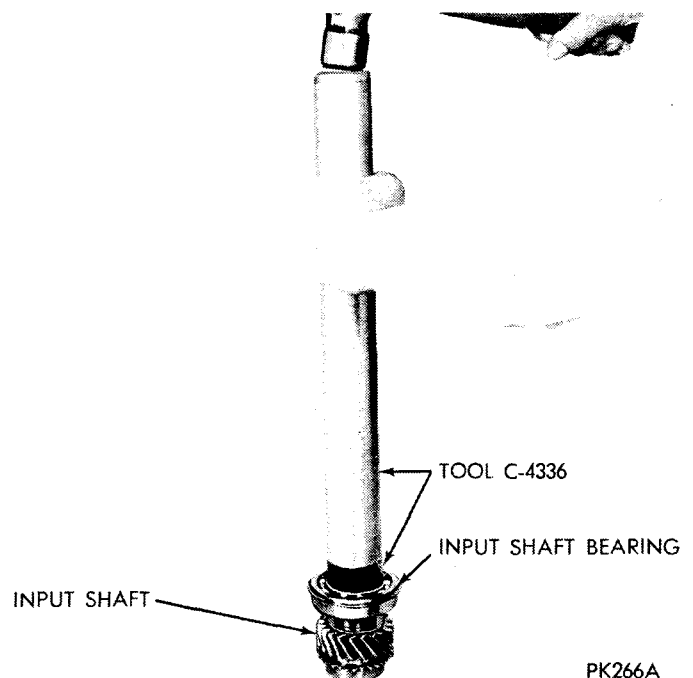


Fig. 11—Installing Input Shaft Bearing

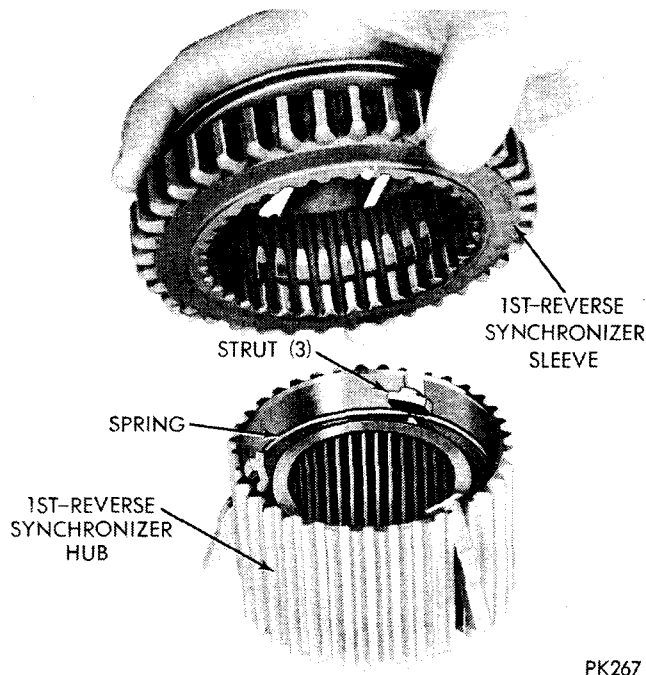


Fig. 12—Assembling 1st-Reverse Synchronizer

Using special tool C-4336, drive bearing until seated on output shaft (Fig. 16). Secure bearing to output shaft with a snap ring. Return transmission to horizontal position.

(8) Insert both shift forks into case and into proper sleeves. Push output shaft assembly into position and tap it forward until output shaft bearing seats in case.

(9) Install **shortest** detent spring followed by a detent plug into case (Fig. 2). Place 2nd-3rd synchronizer assembly in 2nd speed position.

(10) Align 2nd-3rd fork and install 2nd-3rd shift rail (Fig. 2). The 2nd-3rd shift rail is the shortest of the two (2) shift rails. It will be necessary to depress the detent plug to enter shift rail in bore. Move rail inward until detent plug engages forward notch (2nd speed position).

(11) Secure fork to rail with a set screw. Move synchronizer to neutral position.

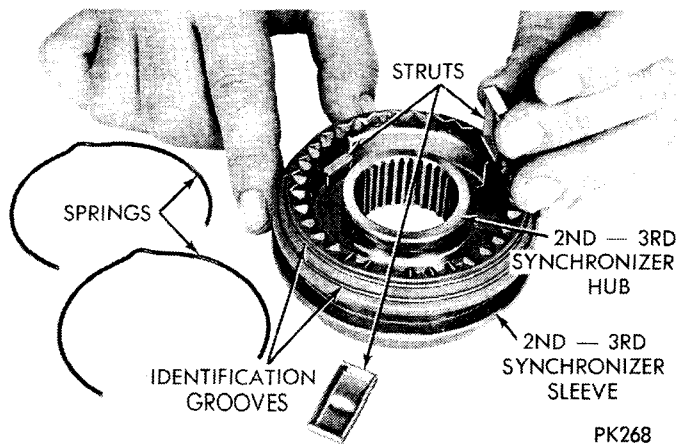


Fig. 13—Assembling 2nd-3rd Synchronizer

(12) Install a new expansion plug in case.

(13) Install interlock plug in case (Fig. 2) with a magnet. If 2nd-3rd shift rail is in neutral position, top of interlock plug will be slightly lower than surface of 1st-reverse shift rail bore.

(14) Align 1st-reverse fork and install 1st-reverse shift rail. Move rail inward until center notch (neutral) is aligned with detent bore. Secure fork to rail with a set screw.

Input Shaft and Retainer Seal

(1) Using Tool C-4338-A (Fig. 17), install a new oil seal in the input shaft bearing retainer bore.

(2) Coat bore of input shaft gear with a thin film of grease. **A thick, heavy grease will plug lubricant holes and prevent lubrication to roller bearings.** Install (15) roller bearings in bore.

(3) Place stop ring, slots aligned with struts, into 2nd-3rd synchronizer. Tap input shaft assembly into place in case while holding output shaft to prevent roller bearings from dropping.

Countershaft Gear

(1) Roll transmission over so that it rests on both top edge and shift levers (Fig. 18). Countershaft gear will drop into place. Using a screw driver, align bore of countershaft gear and thrust washers with bore of case.

(2) Working from rear of case, slide countershaft into position being careful to keep countershaft in contact with arbor to avoid parts dropping out of position and blocking installation. Be sure roll pin hole in countershaft aligns with roll pin hole in case.

(3) Install roll pin. Install new expansion plug in countershaft bore at front of case. Install plug flush or below face of case to prevent interference with clutch housing.

Extension Housing and Input Shaft Bearing Retainer

(1) Slide extension housing, with a new gasket, over output shaft and against case. Coat attaching bolt threads with sealing compound. Install and tighten attaching bolts to 50 foot-pounds.

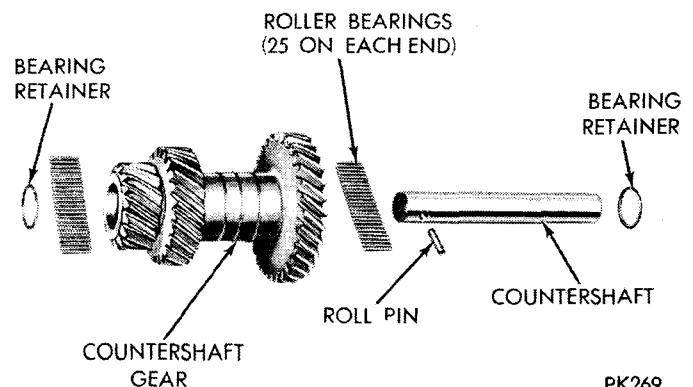
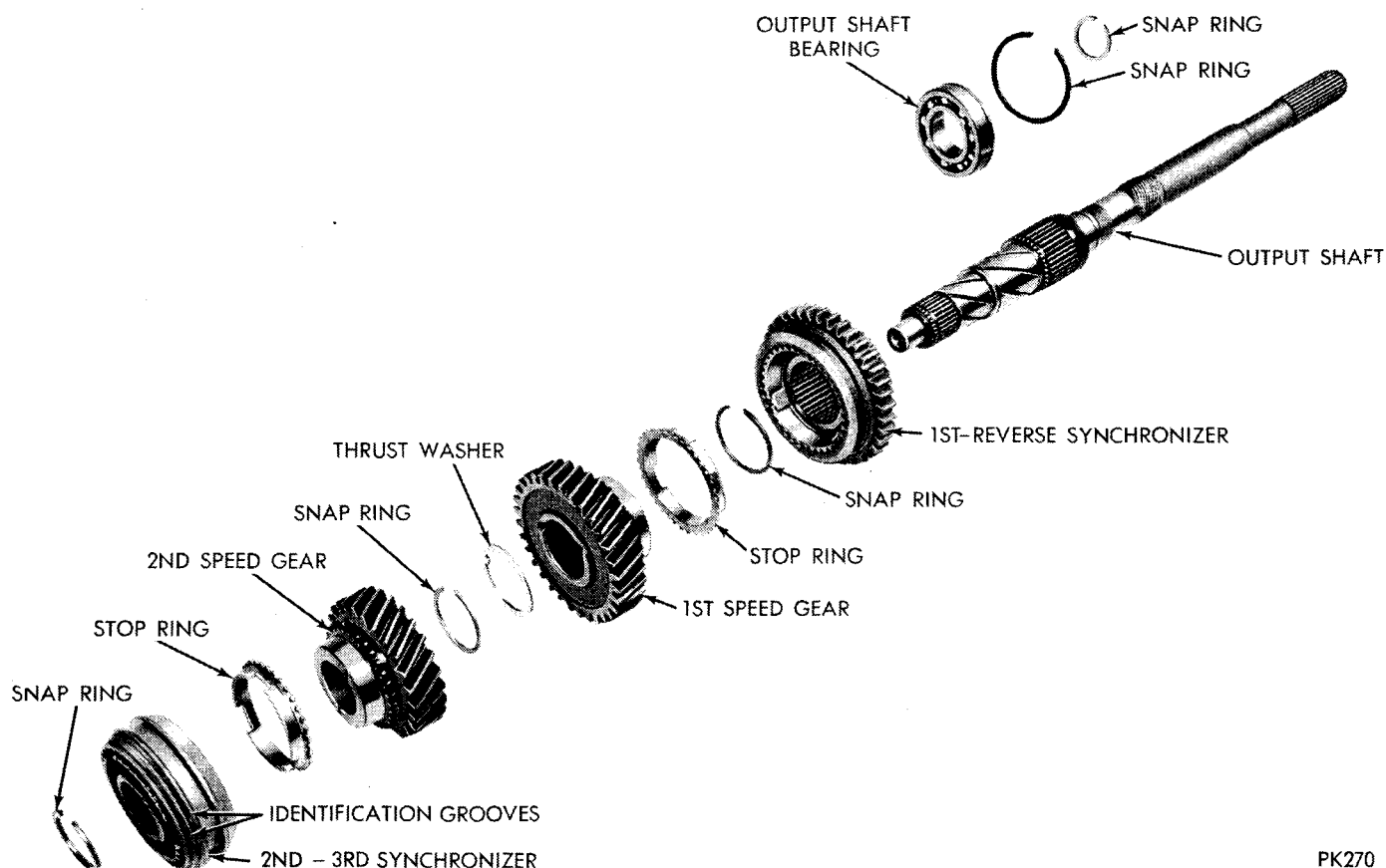


Fig. 14—Countershaft and Gear—Disassembled



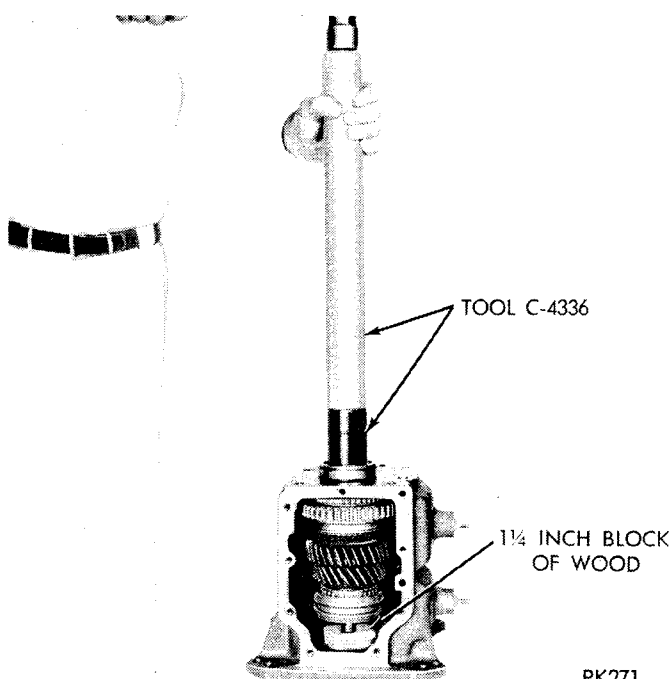
PK270

Fig. 15—Output Shaft Assembly—Disassembled

(2) Install input shaft bearing retainer and a new gasket, making sure that oil return slot is at bottom. Coat threads with sealing compound, then install attaching bolts and tighten to 30 foot-pounds.

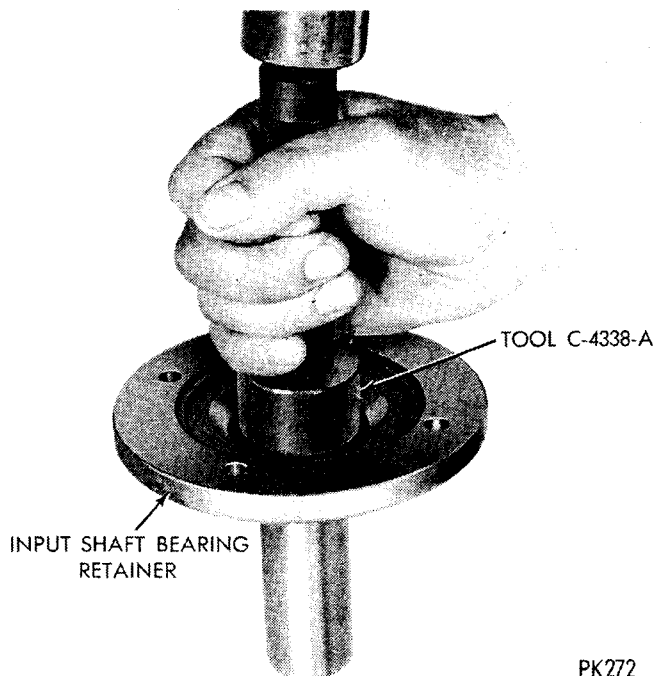
Cover

(1) Install remaining detent plug into case, followed by detent spring (Fig. 2).



PK271

Fig. 16—Installing Output Shaft Bearing



PK272

Fig. 17—Replacing Seal in Input Shaft Bearing Retainer

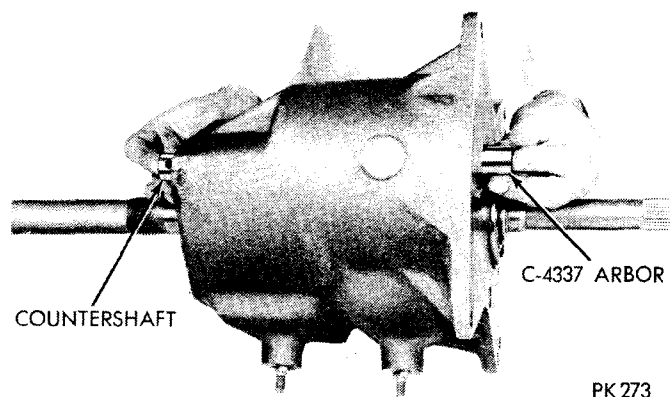


Fig. 18—Installing Countershaft

(2) Install filler plug and back-up lamp switch. Pour lubricant over entire gear train while rotating input and output shafts.

(3) Place cover, with a new gasket, on transmission. Coat attaching screw threads with sealing compound. Install and tighten attaching screws to 22 foot-pounds.

TRANSMISSION INSTALLATION

The transmission pilot bushing in end of crankshaft requires a grease which will stay in place during high temperature operation. Use MOPAR Multi-Purpose Grease, Part Number 2932524, or equivalent, which is a grease of this type.

Place a small amount of Multi-Purpose Grease around inner end of pinion shaft pilot bushing in crankshaft and on pinion bearing retainer release bearing sleeve area. Do not lubricate end of the pinion shaft, clutch disc splines or clutch release levers.

(1) Place transmission on a suitable jack and slide assembly under vehicle.

(2) Raise transmission until drive pinion shaft is centered in clutch housing bore.

(3) Roll transmission slowly forward until pinion shaft enters clutch disc. With transmission in gear, turn output shaft until splines are aligned, then push transmission forward until seated against clutch housing. Do not allow transmission to "hang" after pinion has entered the clutch disc.

(4) Install transmission attaching bolts and tighten to 50 foot-pounds. Remove the jack.

(5) Using a pointed drift, align crossmember bolt holes, then install attaching bolts. Tighten to specifications (Fig. 9).

(6) Remove engine support fixture and disengage hooks from holes in frame side rails. Install extension housing to rear engine mount bolts and tighten to specifications. The engine mount to center crossmember bolt and nut, loose assembled to this point, should now be torqued to 50 foot-pounds.

(7) Reconnect speedometer cable, gearshift operating levers and back-up light switch wires. Refer to "Gearshift Linkage Adjustment" in this section.

(8) Carefully guide front universal joint yoke into extension housing and onto output shaft splines. Connect propeller shaft to rear axle pinion yoke aligning the marks made during removal. Tighten clamp screws to 15 foot-pounds.

(9) Fill transmission to level of fill plug (Refer to Lubrication Group "O").

(10) Road test vehicle, making sure transmission shifts smoothly and operates quietly.

MANUAL TRANSMISSION—OVERDRIVE-4

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GENERAL INFORMATION

The overdrive-4 transmission (Figs. 1, 2, and 3) is available as optional equipment for some models.

Synchronizers will be serviced as an assembly. Except for stop rings, synchronizer parts should not be interchanged.

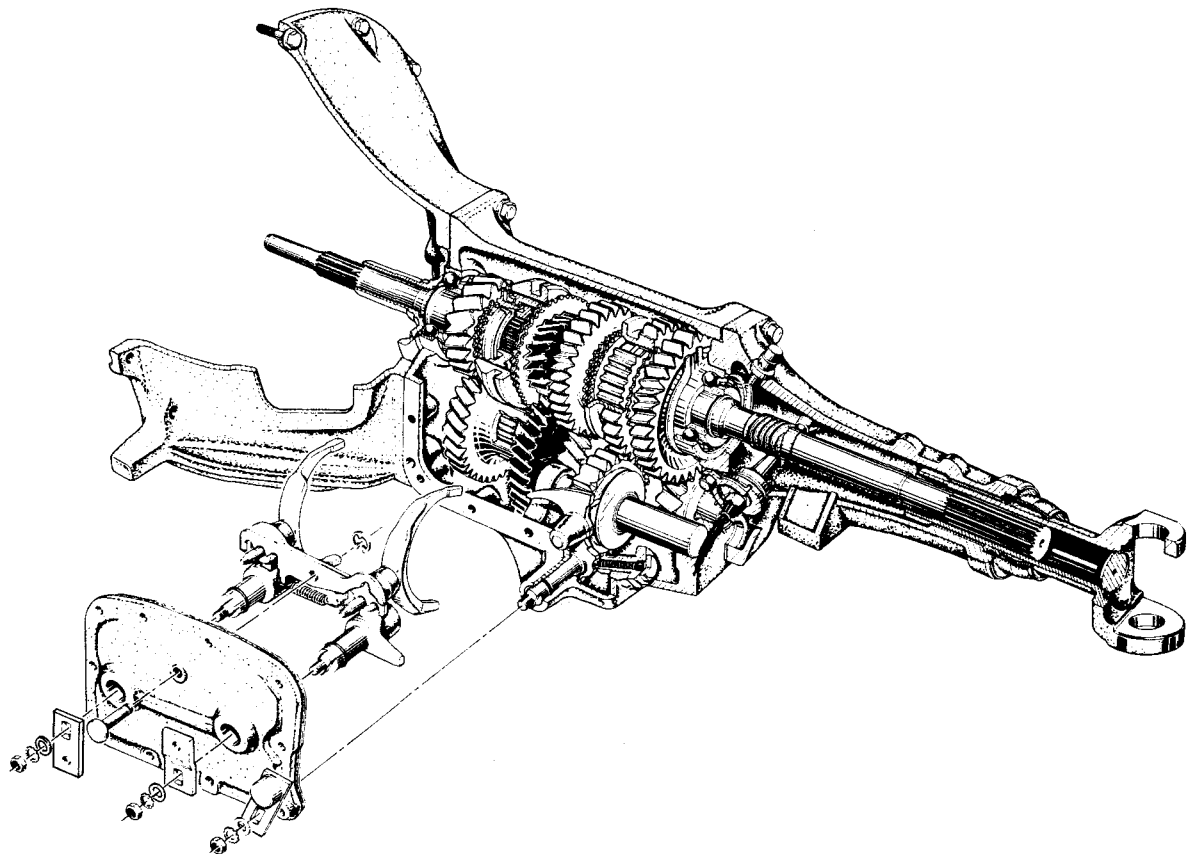
A pad has been provided on right side of transmission for transmission and vehicle identification numbers (Fig. 2).

The drive pinion (input shaft) is supported by a ball

bearing in the transmission case and an oilite bushing pressed in the end of the crankshaft.

The mainshaft front end is supported by roller bearings in the end of the main drive pinion and a ball bearing in the front of the extension housing. The output end of the mainshaft is splined to the sliding universal joint yoke, which is supported by a bushing in the extension housing.

The countershaft gear is supported by a double row



PN69

Fig. 1—Overdrive-4 Transmission Cutaway

of needle type roller bearings at each end and the thrust is taken on thrust washers between the ends of the gear and the transmission case. The alignment of the needle type roller bearings within the gear is maintained by a tubular spacer in the center and four thrust washers (one being used between the rows of roller bearings and one at each end).

Note: The countershaft is not a press fit in the case bores, but has .005 inch diameter clearance. An expansion plug is pressed into a counter bore at the front of the case to prevent oil leakage around the countershaft.

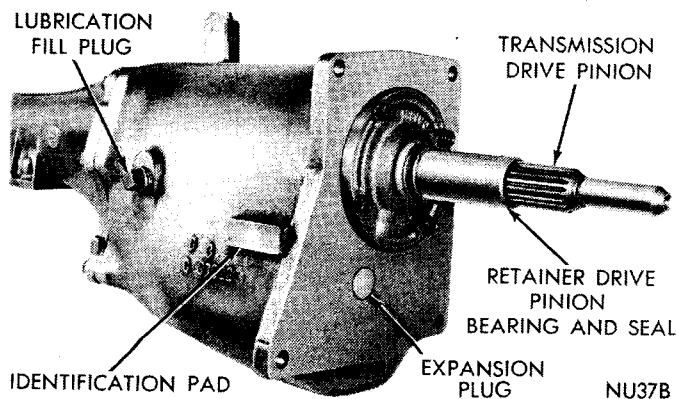
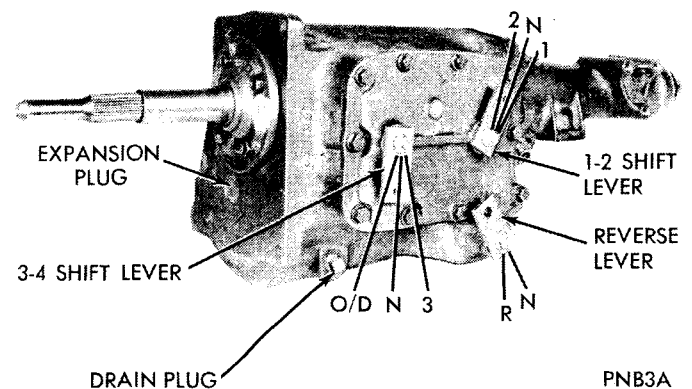
The reverse idler gear is supported on a bronze

bushing, pressed into the gear.

A magnetic disc is attached to bottom, near rear of case under countershaft gear. This magnet collects and prevents circulation of chips in transmission oil.

The gearshifting is manually operated through shift control rods to the transmission. Any forward gear may be engaged while the vehicle is in motion through the use of synchronizing clutches. See "Specifications" for downshift speed limits.

The transmission may be used as an aid to deceleration by downshifting in sequence without double clutching or gear clashing, due to the fact that all forward speeds are synchronized.

**Fig. 2—Overdrive-4 Transmission—Right Side****Fig. 3—Overdrive-4 Transmission—Left Side**

OVERDRIVE-4 DIAGNOSIS

Condition	Possible Cause	Correction
HARD SHIFTING	(a) Incorrect clutch adjustment. (b) Improper linkage adjustment. (c) Inadequate linkage lubrication. (d) Synchronizer clutch sleeve damaged. (e) Synchronizer spring improperly installed. (f) Broken or worn synchronizer stop rings.	(a) Refer to Clutch Group for corrections. (b) Perform linkage adjustment as outlined in "Gearshift Linkage Adjustments." (c) Lubricate linkage with multi-purpose grease. See "Lubrication and Maintenance" Section. (d-e-f) Causes noted can only be corrected by disassembling transmission and replacing damaged or worn parts.
TRANSMISSION SLIPS OUT OF GEAR	(a) Linkage interference. (b) Gearshift rods out of adjustment. (c) Synchronizer clutch teeth worn. (d) Clutch housing bore or face out of alignment.	(a) Inspect and remove all linkage interferences. (b) Adjust gearshift rods as outlined in "Gearshift Linkage Adjustments." (c) Disassemble transmission and replace parts as necessary. (d) Refer to Clutch Group for correction procedures.
TRANSMISSION NOISES	(a) Excessive end play in countershaft gear. (b) Damaged, broken or excessively worn gear teeth. (c) Rough or pitted bearing races or balls. (d) Linkage rattle.	(a) Replace thrust washers. (b) Replace worn gears. (c) Replace worn bearing. (d) Lubricate linkage with multi-purpose grease. See "Lubrication and Maintenance" Section.

SERVICE PROCEDURES**SERVICE IN VEHICLE****OVERDRIVE-4 SHIFT LINKAGE****Removal (Fig. 4)**

- (1) Disconnect negative (ground) cable from battery.
- (2) Remove retaining screws from floor pan boot and slide up and off shift lever.
- (3) Remove shift lever.
- (4) Remove retaining clips, washers, and control rods from shift unit levers.
- (5) Remove bolts and washers which secure shift unit to mounting plate on extension housing and remove unit.

Installation (Fig. 4)

- (1) Fasten unit to extension housing mounting plate with bolts and lock washers and tighten to 30 foot-pounds.
- (2) Install shift rods, washers, and clips.
- (3) Install shift lever.
- (4) Slide boot down over lever and fasten to floor pan.
- (5) Reconnect battery cable.

GEARSHIFT LINKAGE ADJUSTMENT

- (1) Install floor shift lever aligning tool (Fig. 4) to hold the levers in neutral-crossover position.
- (2) With all rods removed from transmission shift levers, place levers in neutral detent positions.
- (3) Rotate threaded shift rods to make length exactly right to enter transmission levers. Start with 1-2 shift rod (it may be necessary to pull clip at shifter end to rotate this rod).
- (4) Replace washers and clips.
- (5) Remove aligning tool and test shifting action.

SPEEDOMETER PINION GEAR**Removal and Installation**

Rear axle gear ratio and tire size determines pinion gear size requirements. Refer to "Speedometer Pinion Gear Chart" in Specifications for pinion usage.

- (1) Place drain pan under speedometer adapter.
- (2) Remove bolt and retainer securing speedometer pinion adapter to extension housing.
- (3) With cable housing connected, carefully work adapter and pinion out of extension housing.
- (4) Remove the pinion retainer from the pinion and remove the pinion from the adapter.

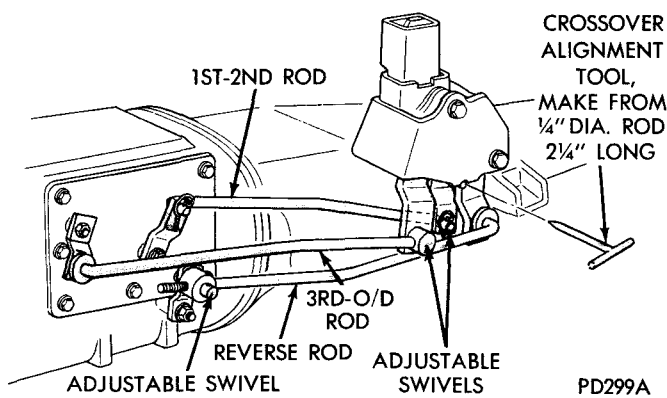


Fig. 4—Gearshift Linkage Adjustment

(5) If transmission fluid is found in cable housing, replace seal in the pinion. Install seal in pinion until it bottoms using Tool C-4472.

(6) If transmission fluid is found leaking between the cable and adapter, replace the small "O" ring on the cable. Remove the speedometer cable retainer from the adapter and remove the adapter from the cable. Replace the "O" ring.

(7) Install the adapter on the cable and install the cable retainer on the adapter. Be sure the retainer is properly seated in the groove.

(8) Install pinion on adapter and install pinion retainer on pinion.

Before installing pinion, adapter, and cable assembly make sure adapter flange and its mating area on extension housing are clean. Dirt or sand will cause misalignment resulting in speedometer pinion gear damage.

(9) Rotate the speedometer pinion gear and adapter assembly so that the number on the adapter, corresponding to the number of teeth on the gear, is in the 6 o'clock position as the assembly is installed.

(10) Install retainer and bolt, with retainer tangs in adapter positioning slots. Tighten retainer bolt to 100 inch-pounds.

(11) Fill transmission to level of fill plug (refer to Lubrication Group "O").

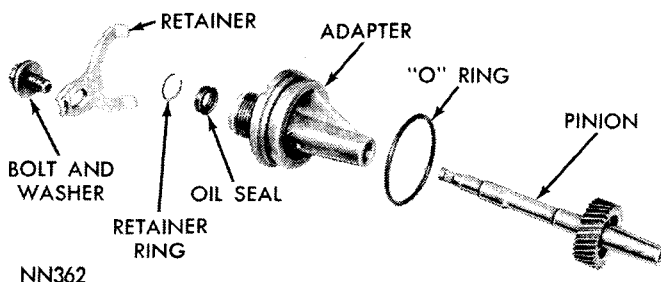


Fig. 5—Speedometer Pinion and Adapter—Disassembled

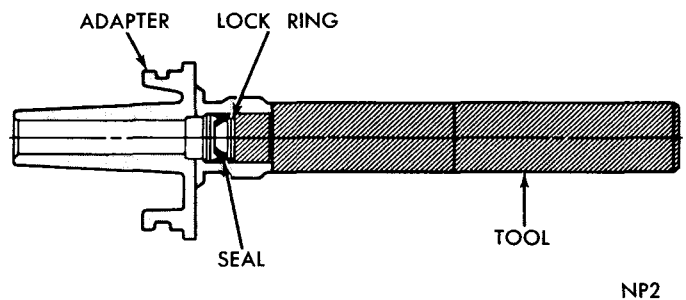


Fig. 6—Installing Speedometer Pinion Seal

EXTENSION HOUSING YOKE SEAL

Replacement

(1) Place drain pan under yoke seal.
(2) Disconnect propeller shaft at rear universal joint. Mark both parts to reassemble in same position. Carefully pull shaft yoke out of transmission extension housing.

Be careful not to scratch or nick ground surface on sliding spline yoke during removal and installation of the shaft assembly.

(3) Remove oil seal with Tool C-3985 or with Tool C-3996 for small yoke extension (Fig. 10).

(4) To install a new seal, position seal in opening of extension housing and drive it into housing with Tool C-3972 or with Tool C-3995 for small yoke extension (Fig. 8).

(5) Carefully guide front universal joint yoke into extension housing and on the mainshaft splines. Align marks made at removal and connect propeller shaft to rear axle pinion shaft yoke.

(6) Fill transmission to level of fill plug. (Refer to Lubrication Group "O").

SERVICE OUT OF VEHICLE

TRANSMISSION REMOVAL

(1) Remove gearshift components, refer to "overdrive-4 shift linkage."

(2) Drain fluid from transmission.

(3) Disconnect propeller shaft at rear universal

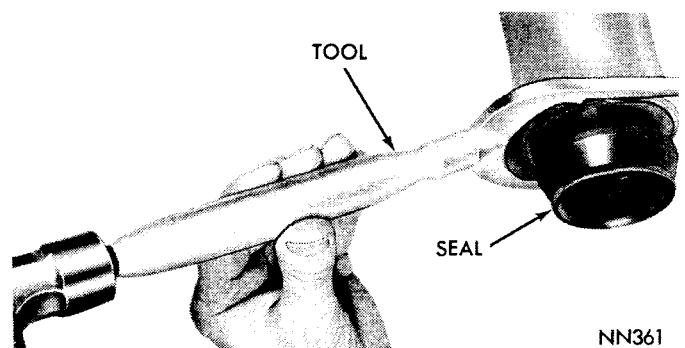


Fig. 7—Removing Extension Housing Yoke Seal

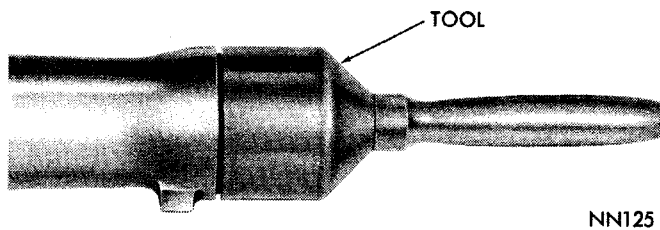


Fig. 8—Installing Extension Housing Yoke Seal

joint, marking parts to reinstall in same position. Carefully pull shaft yoke out of transmission extension housing.

Be careful not to scratch or nick ground surface on sliding spline yoke during removal and installation of the shaft assembly.

(4) Disconnect speedometer cable and back-up light switch leads.

(5) Install engine support fixture C-3487-A. Be sure support ends are up against underside of oil pan flange.

(6) Raise engine slightly with support fixture. Disconnect extension housing from removable center crossmember (Fig. 9).

(7) Support transmission with a suitable jack and remove center crossmember.

(8) Remove transmission to clutch housing bolts. Slide transmission toward rear until drive pinion shaft

clears clutch disc, before lowering transmission.

(9) Lower transmission and remove from under vehicle. Thoroughly clean exterior of unit, preferably by steam. Mount transmission in repair stand (Fig. 10). An adapter mounting plate which enables all four mounting bolts to attach the case to the existing stand will have to be made to enable the transmission to be turned upside down.

DISASSEMBLING TRANSMISSION (Fig. 11)

Gearshift Housing and Mechanism

(1) Remove reverse shift operating lever from shaft. Remove bolts that attach gearshift housing to transmission case (Fig. 13).

(2) With operating levers in neutral detent position, pull housing out and away from the case. (The two shift forks may remain in engagement with synchronizer sleeves). Work forks out of sleeves and remove from the case. The following three steps need only be done if oil leakage is visible around gearshift lever shafts, or the interlock levers are cracked.

(3) Remove nuts that attach shift operating levers to the shafts. Disengage levers from flats on shafts and remove.

Make sure shafts are free of burrs before removal otherwise the bores may be scored resulting in leakage after reassembly.

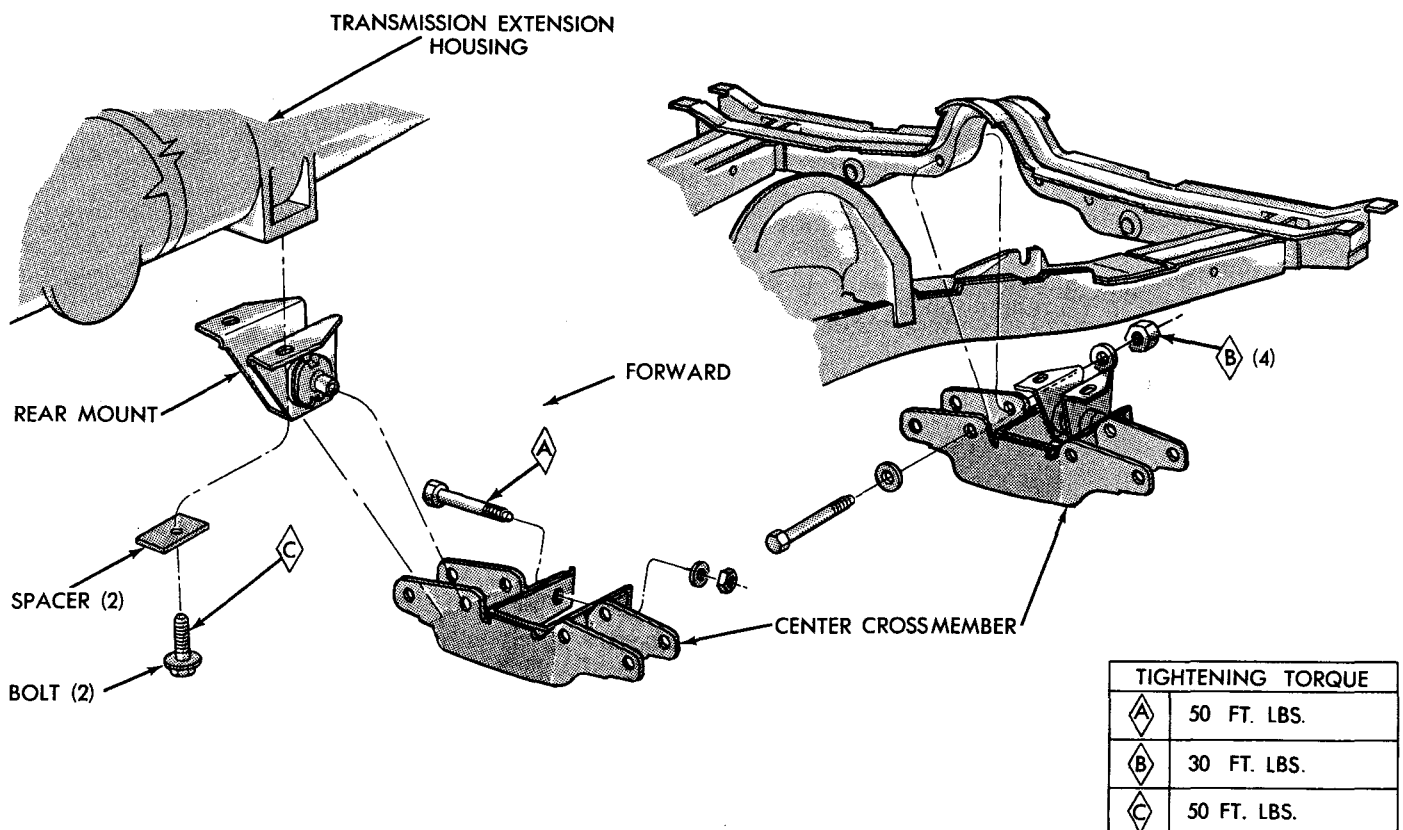
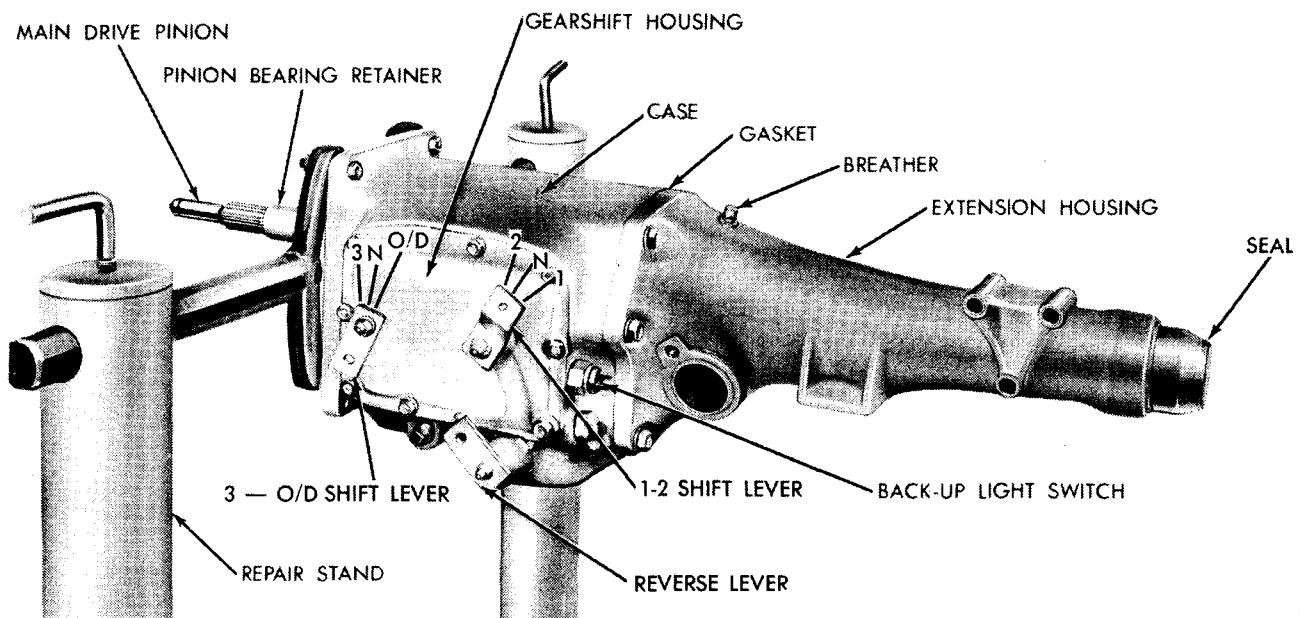


Fig. 9—Center Crossmember and Engine Rear Mount (Typical)



PNB15A

Fig. 10—Overdrive-4 Transmission in Repair Stand

- (4) Pull gearshift lever shafts out of housing.
- (5) Remove "E" ring from interlock lever pivot pin and remove interlock levers and spring from housing.

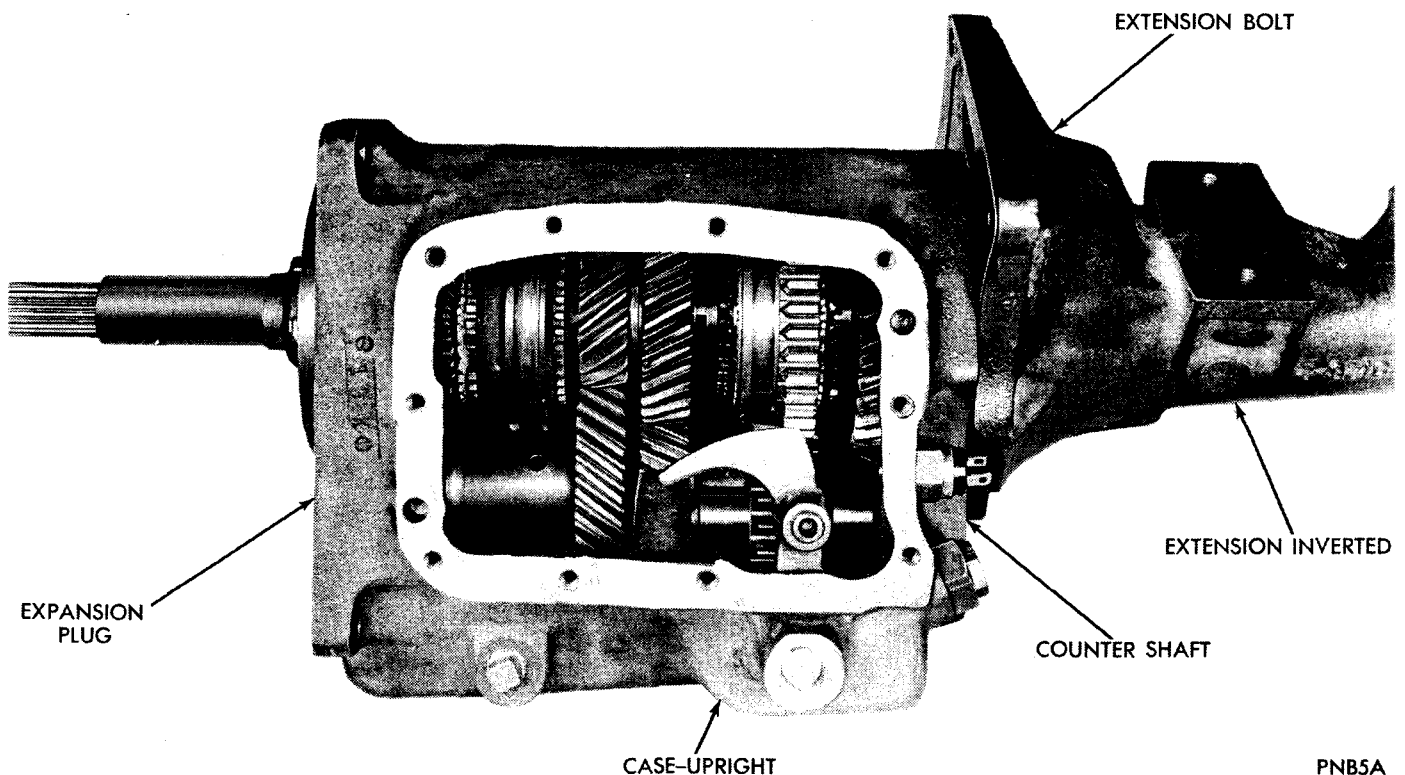
Drive Pinion, Extension Housing, and Mainshaft

- (1) Remove bolt and retainer securing speedometer pinion adapter in extension housing. Carefully work adapter and pinion out of extension housing.

- (2) Remove bolts that attach extension housing to transmission case.

- (3) Rotate the extension on the output shaft to expose the rear of the countershaft. Clearance has been provided on extension flange to enable one bolt to be reinstalled to hold the extension in the inverted position with access to the countershaft. See Figure 11.

- (4) With a centerpunch or drill make a hole in the countershaft expansion plug at the front of the case.



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Fig. 11—Rotating Extension Housing

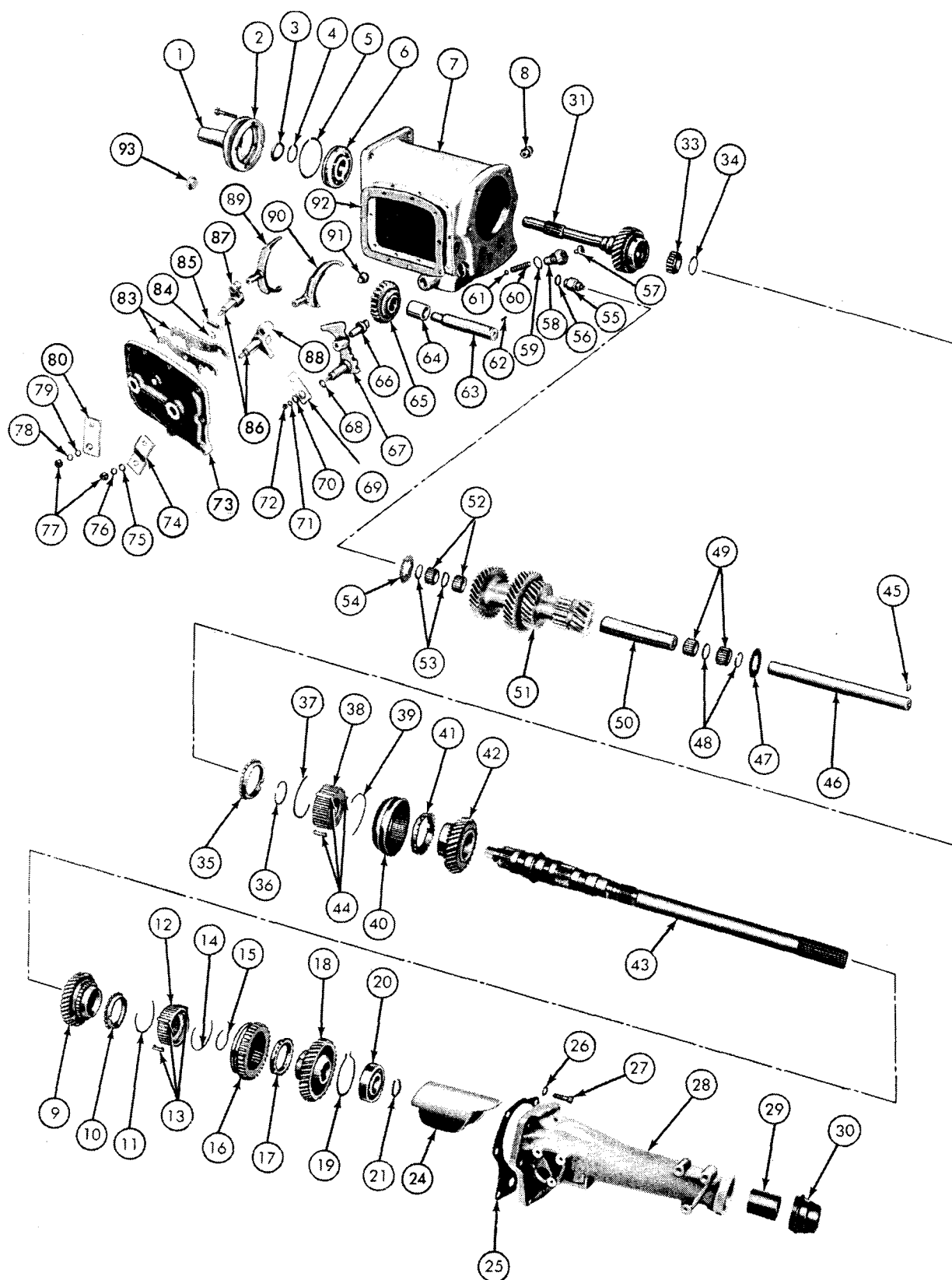


Fig. 12—Overdrive-4 Transmission—Disassembled

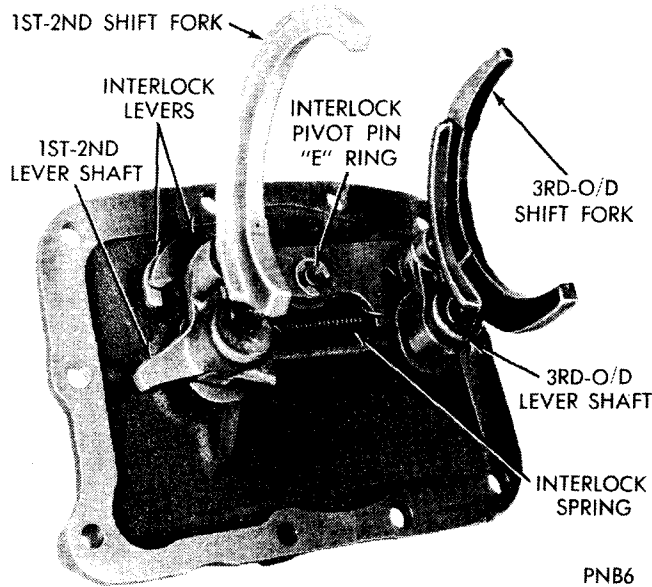


Fig. 13—Shift Housing Assembly

(5) Reaching through this hole push the countershaft rearward until woodruff key is exposed. Remove key. Push countershaft forward against the expansion plug. Using a brass drift, tap the countershaft forward until expansion plug is driven out of case.

(6) Using the countershaft arbor, C-3938, push countershaft out of rear of case, using care to insure that the countershaft washers don't fall out of position. Lower countershaft gear to bottom of case.

(7) Rotate the extension back to normal position.

(8) Remove drive pinion bearing retainer attaching bolts. Slide retainer and gasket from pinion shaft (Fig. 2). Pry pinion or seal from retainer. To avoid leakage around new seal, do not nick or scratch seal bore in the retainer or the surface on which seal bottoms.

(9) Using a brass drift, tap the pinion and bearing

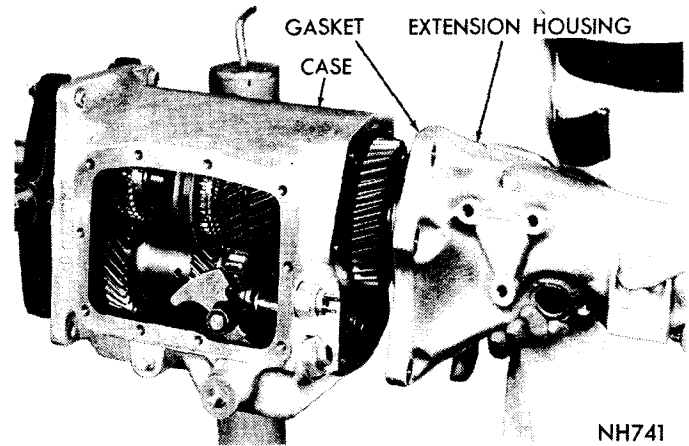


Fig. 14—Removing or Installing Extension Housing and Mainshaft Assembly

assembly forward and remove through front of case. **NOTE:** Replacement of the Drive Pinion Gear or Drive Pinion Bearing requires no further disassembly of the transmission. Replace the failed part and reassemble transmission.

(10) Slide third and overdrive (O/D) synchronizer sleeve slightly forward, slide reverse idler gear to center of its shaft, then using a soft faced hammer, tap on extension housing (in a rearward direction). Slide housing and mainshaft assembly out and away from the case (Fig. 14).

(11) Refer to (Fig. 15) for location of various gears, synchronizer sleeves and clutches before disassembling mainshaft.

(12) Remove snap ring (Fig. 16), that retains 3rd and O/D synchronizer clutch gear and sleeve assembly to the mainshaft then slide 3rd and O/D synchronizer assembly off end of mainshaft.

(13) Slide O/D gear and stop ring off mainshaft. (Do not separate 3rd and O/D speed synchronizer clutch gear, sleeve, shift struts, or springs unless in-

LEGEND FOR FIGURE 12 (Overdrive-4)

- | | | | |
|---------------------------------------|---------------------------------------|--|-----------------------------------|
| 1. Bearing Retainer | 26. Lockwasher | 49. Needle Bearing Rollers | 69. Reverse Operating Lever |
| 2. Bearing Retainer Gasket | 27. Bolt | 50. Bearing Spacer | 70. Flatwasher |
| 3. Bearing Retainer Oil Seal | 28. Extension Housing | 51. Countershaft Gear (Cluster) | 71. Lockwasher |
| 4. Snap Ring, Bearing (Inner) | 29. Mainshaft Yoke Bushing | 52. Needle Bearing Rollers | 72. Nut |
| 5. Snap Ring, Bearing (Outer) | 30. Oil Seal | 53. Spacer Ring Needle Roller Bearing | 73. Gearshift Control Housing |
| 6. Pinion Bearing | 31. Main Drive Pinion | 54. Thrustwasher, Gear (1) | 74. 1st and 2nd Operating Lever |
| 7. Transmission Case | 33. Needle Bearing Rollers | 55. Backup Light Switch | 75. Flatwasher |
| 8. Filler Plug | 34. Snap Ring | 56. Backup Light Switch Gasket | 76. Lockwasher Lever |
| 9. Gear, 2nd Speed | 35. Stop Ring | 57. Plug | 77. Nut, Lever |
| 10. Snap Ring | 36. Snap Ring | 58. Retainer, Reverse Detent Ball Spring | 78. Lockwasher, Lever |
| 11. Shift Strut Springs | 37. Shift Strut Spring | 59. Gasket | 79. Flatwasher, Lever |
| 12. Clutch Gear | 38. Clutch Gear | 60. Spring, Reverse Detent Ball | 80. 3rd and OD Operating Lever |
| 13. Shift Struts (3) | 39. Shift Strut Spring | 61. Ball, Reverse Detent | 83. Interlock Lever (2) |
| 14. Shift Strut Spring | 40. Clutch Sleeve | 62. Woodruff Key | 84. "E" Ring |
| 15. Snap Ring | 41. Stop Ring | 63. Reverse Idler Gear Shaft | 85. Spring |
| 16. 1st and 2nd Clutch Sleeve Gear | 42. OD Gear | 64. Bushing, Reverse Idler Gear | 86. Oil Seal (2) |
| 17. Stop Ring | 43. Mainshaft (Output) | 65. Gear, Reverse Idler | 87. 3rd and OD Lever |
| 18. 1st Speed Gear | 44. Shift Struts (3) | 66. Fork, Reverse Shifter | 88. 1st and 2nd Lever |
| 19. Bearing Retainer Ring | 45. Woodruff Key | 67. Reverse Lever | 89. 3rd and OD Speed Fork |
| 20. Rear Bearing | 46. Countershaft | 68. Oil Seal, Reverse Lever Shaft | 90. 1st and 2nd Speed Fork |
| 21. Snap Ring | 47. Thrustwasher, Gear (1) | | 91. Drain Plug |
| 24. Baffle | 48. Spacer Ring Needle Roller Bearing | | 92. Gasket, Shift Control Housing |
| 25. Gasket, Case to Extension Housing | | | 93. Expansion Plug |

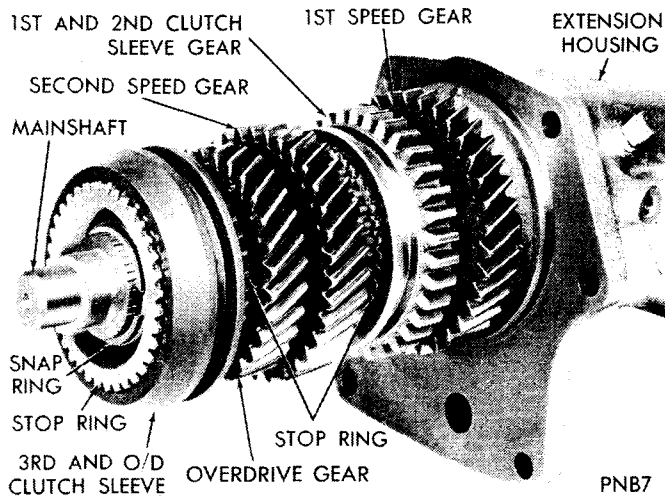


Fig. 15—Mainshaft Gear Identification

spection reveals a replacement part is required).

(14) Using a long nose pliers, compress snap ring that retains mainshaft ball bearing in extension housing (Fig. 17).

(15) Holding snap ring compressed, pull mainshaft assembly and bearing out of extension housing (Fig. 18).

(16) Remove snap ring that retains mainshaft bearing on the shaft (Fig. 19).

Remove bearing from mainshaft by inserting steel plates on front side of 1st speed gear, then press or drive mainshaft through bearing. (Be careful not to damage gear teeth).

(17) Remove bearing, bearing retainer ring, 1st speed gear, and first speed stop ring from the shaft.

(18) Remove snap ring that retains 1st and 2nd clutch gear and sleeve assembly to mainshaft (Fig. 20).

(19) Slide 1st and 2nd clutch gear and sleeve assembly from mainshaft. (Do not separate synchronizer parts unless inspection reveals a replacement part is required.) Remove 2nd speed gear.

(20) Figure 21 shows various mainshaft bearing surfaces for the gears. Inspect these surfaces for signs

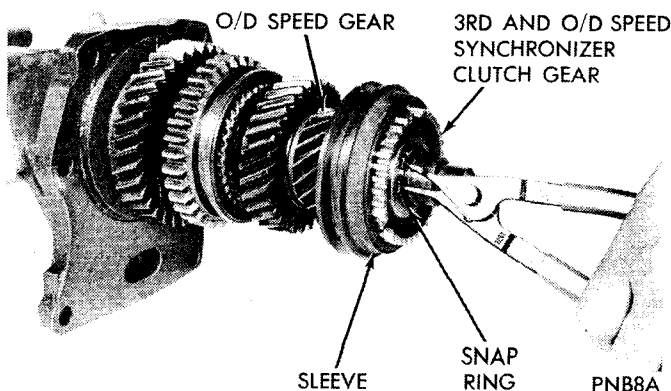


Fig. 16—Disassembling Mainshaft

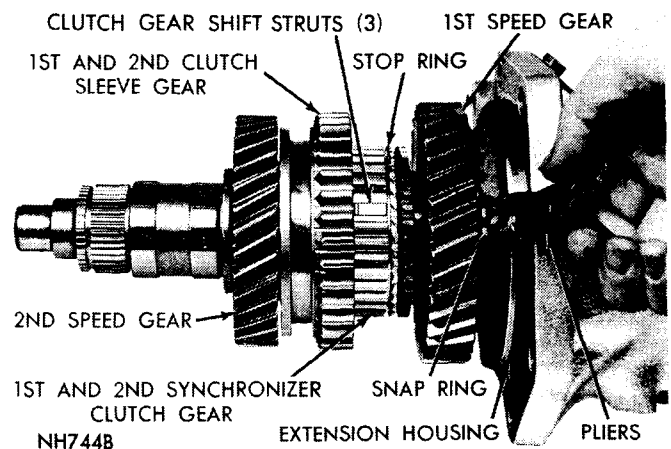


Fig. 17—Removing or Installing Mainshaft Bearing Snap Ring

of wear, scoring, or any condition that would not allow shaft to be used at reassembly.

Drive Pinion and Countershaft Gear

(1) Remove pinion bearing inner snap ring. Using an arbor press, remove bearing from pinion.

(2) Remove snap ring and 16 bearing rollers from cavity in drive pinion.

(3) Remove countershaft gear from bottom of case (Fig. 26).

(4) Remove arbor and 76 needle type bearings, thrust washers, and spacers, from center of countershaft gear.

Reverse Gear, Lever, and Fork

(1) Remove reverse gearshift lever detent spring retainer, gasket, plug, and detent ball spring from rear of the case (Fig. 22).

(2) The reverse idler gear shaft is a very tight fit in the case. To remove, place a 7/16 socket (1/4 or 3/8 inch drive) on end of C-3638 Power Steering "Wormshaft Seal Remover" (Fig. 23).

Place tool in case with socket against end of shaft and other end of tool against the case. Turn screw of tool to press shaft out of the case. Remove woodruff

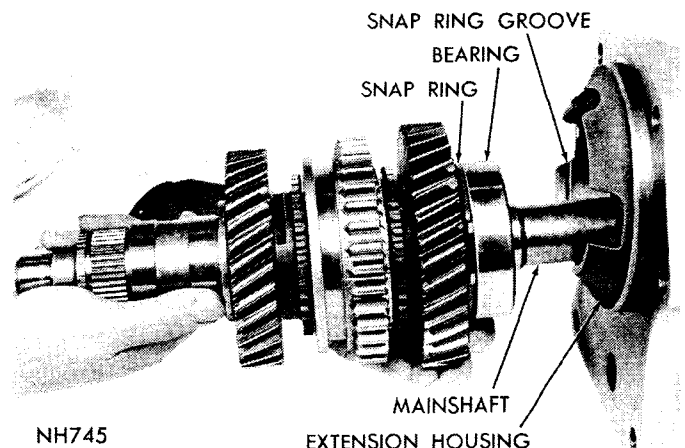


Fig. 18—Removing or Installing Mainshaft

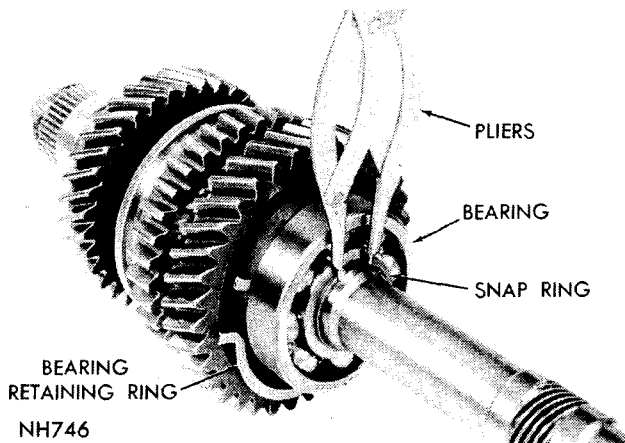


Fig. 19—Removing or Installing Mainshaft Bearing Snap Ring—Rear

key from shaft. In some cases, a 7/16 deep socket and/or a 3 inch extension may be required to press shaft completely out of the case (Fig. 24).

The following step need only be done if oil leakage is visible around reverse gearshift lever shaft.

(3) Remove any burrs from shaft so as not to damage the case bore, then carefully push reverse gearshift lever shaft inward and remove it from case (Fig. 25). Retrieve detent ball from bottom of case. Remove shift fork from shaft and detent plate.

CLEANING AND INSPECTION

Clean transmission case thoroughly, using a suitable solvent, dry with compressed air. The magnetic disc, located on bottom of case, can be removed for cleaning by using a screwdriver to pry off the retaining clip. With aluminum case, the magnetic disc is glued in place; wipe with a clean cloth. After cleaning the magnetic disc with a clean cloth, the disc and retaining clip can be reinstalled by pressing the clip onto the rib in the case. Inspect case for cracks, stripped threads in various bolt holes and machined mating surfaces for burrs, nicks, or any condition that would render the case unfit for further service. The front

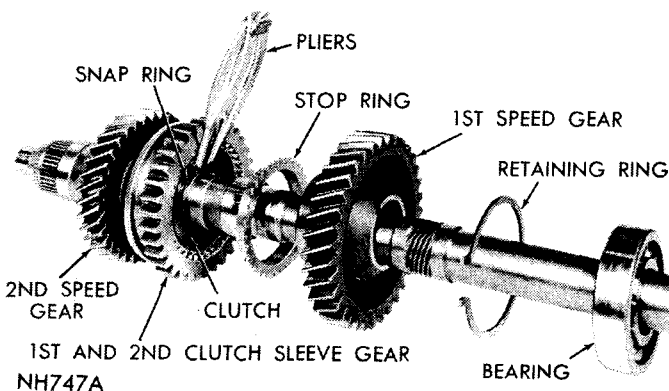


Fig. 20—Removing or Installing Clutch Gear Snap Ring

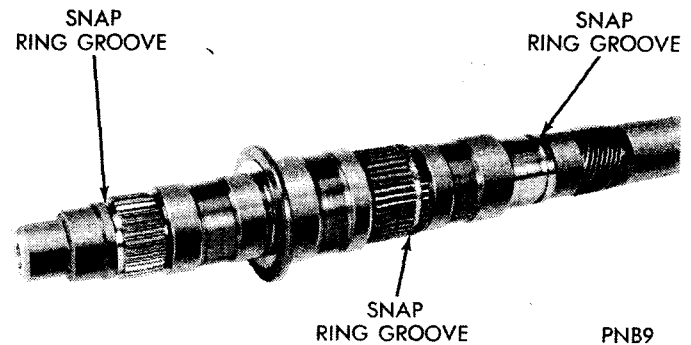


Fig. 21—Mainshaft Bearing Surfaces

mating surface should be smooth; if any burrs are present, dress them off with a fine mill file. If threads are stripped, install Helicoil, or equivalent, inserts.

Ball Bearings

Wash ball bearings, using a clean solvent and blow dry with compressed air.

CAUTION: Do not spin bearings with air pressure; turn slowly by hand. Spinning unlubricated bearings may cause damage to races and balls.

Be sure ball bearings are clean, then lubricate them with light grade engine oil. Inspect bearings for roughness. This can best be determined by slowly turning outer race by hand.

Needle Type Bearing Rollers and Spacers

Inspect all bearing rollers for flat spots or brinelling. Inspect all bearing roller spacers for signs of wear or galling. Inspect roller contact surfaces of gear and shaft. Install new parts as required.

Gears

Inspect countershaft gear and all gear teeth for chipped or broken teeth, or showing signs of excessive wear. Small nicks or burrs must be stoned off.

Inspect teeth on main drive pinion. If excessively

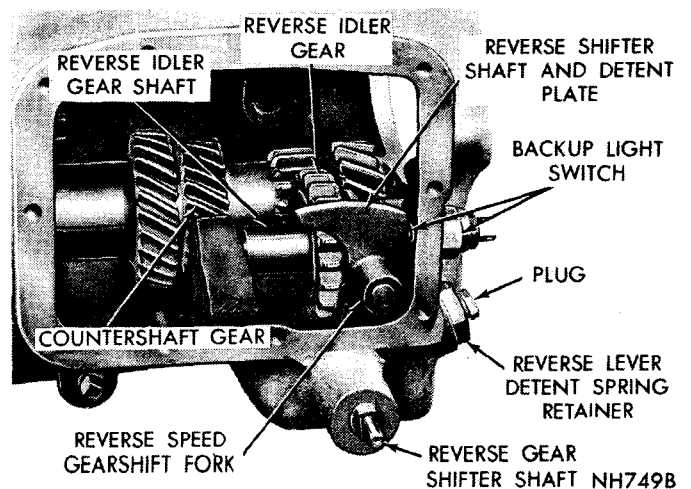


Fig. 22—Gear, Shaft, and Lever Identification

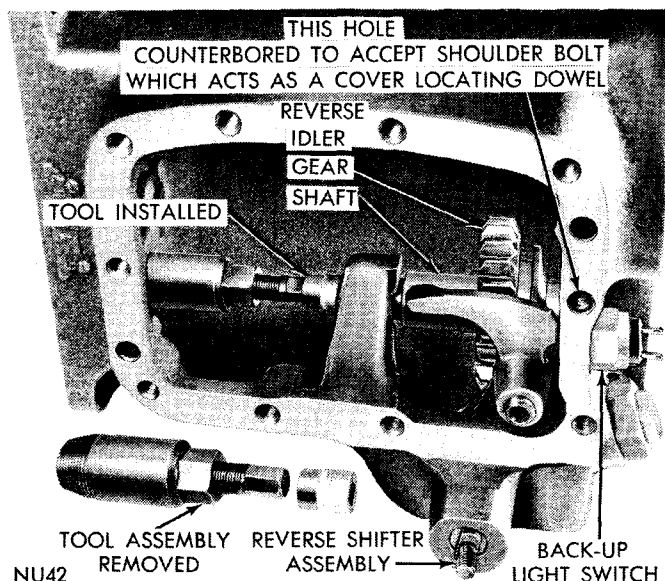


Fig. 23—Removing Reverse Idler Gear Shaft

worn, broken, or chipped, a new pinion should be installed. If the oil seal contact area on drive pinion shaft is pitted, rusted, or scratched, a new pinion is recommended for best seal life.

Inspect interlock levers for cracks at detent and clearance notches at each end of levers. Inspect shift forks for wear on pads and shafts.

Inspect the fork shaft bore in the shift lever for galling.

Synchronizer Assemblies

Inspect spline teeth on synchronizer clutch gears and stop rings. If there is evidence of chipping or excessively worn teeth, install new parts at reassembly. Be sure clutch sleeve slides easily on the clutch gear.

Synchronizer springs should be in place with the tang inside the cavity of one strut and should not show signs of interference with the polished gear cones or inside diameters of the clutch gears.

Inspect stop rings for cracks and wear. If rings are cracked or show signs of extreme wear on threaded

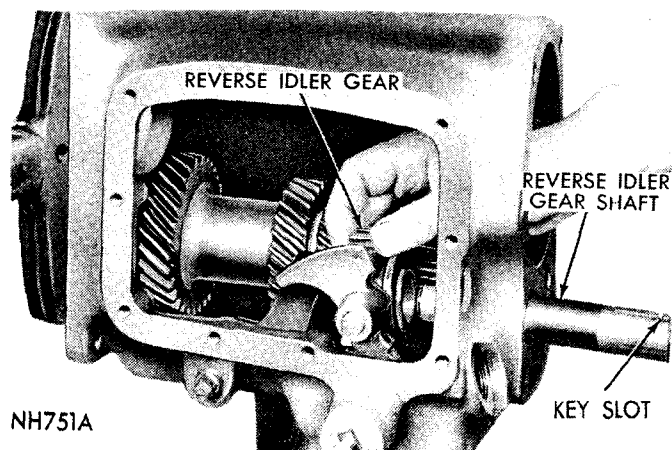


Fig. 24—Removing or Installing Reverse Idler Gear

bore, install new rings at reassembly. Test new rings for good fit on gear cones with minimum wobble. Check synchronizer struts for wear or breakage.

Synchronizers will be serviced as an assembly. Except for stop rings, synchronizer parts should not be interchanged.

Mainshaft

Inspect mainshaft gear and bearing mating surfaces. If gear contact surfaces show signs of galling or are excessively worn, a new mainshaft should be installed.

Inspect snap ring grooves for burred edges. If rough or burred, remove condition using a fine file or crocus cloth. Inspect synchronizer clutch gear splines on shaft for burrs.

ASSEMBLING TRANSMISSION

Reverse Gear, Lever, and Fork

The following steps need only be done if the reverse shaft was removed because of oil leak.

(1) Install a new oil seal "O" ring on reverse gear-shift lever shaft. Coat lever shaft with Multi-purpose grease, then carefully install lever shaft into bore in the case (Fig. 25). Install reverse fork in the lever.

(2) Install reverse detent spring retainer and gasket. Torque to 50 foot-pounds. Insert ball and spring. Install plug and gasket. Torque to 24 foot-pounds.

(3) Place reverse idler gear shaft in position in end of case, and drive it in far enough to position reverse idler gear on protruding end of shaft with fork slot toward rear (Fig. 24). At same time, engage slot with reverse shift fork.

(4) With reverse idler gear correctly positioned, drive reverse gear shaft into case far enough to install woodruff key. Drive shaft in flush with end of case (Fig. 24).

(5) Install back-up light switch and gasket. Torque to 15 foot-pounds.

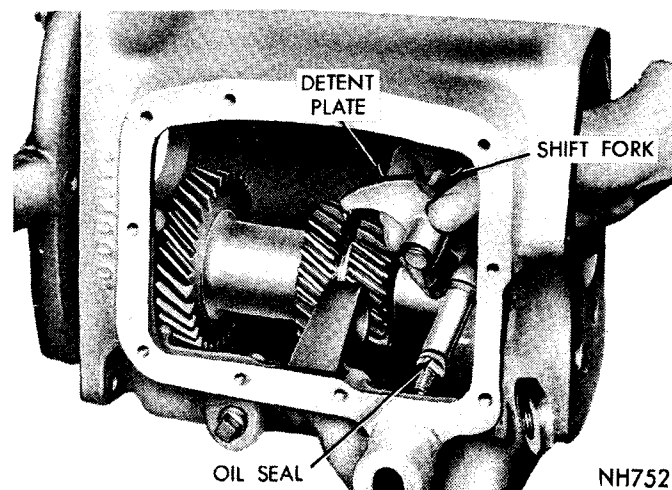


Fig. 25—Removing or Installing Reverse Shift Fork and Lever

Countershaft Gear and Drive Pinion

(1) Coat inside bore of countershaft gear at each end with a thin film of grease and install roller bearing spacer with arbor Tool C-3938 into gear. Center spacer and arbor.

(2) Install 19 rollers, followed by a spacer ring and 19 more roller bearings and 1 spacer ring into each end of gear (Fig. 12).

(3) If countershaft thrust washers are worn or scored, install new thrust washers. Coat thrust washers with grease and install them over arbor with tang side toward the case boss (Fig. 26).

(4) Install countershaft gear assembly into the case (Fig. 26). Allow gear assembly to rest on bottom of case. (Be sure thrust washers stay in position).

(5) Press drive pinion bearing on pinion shaft. Be sure outer snap ring groove is toward front (Fig. 28). Seat bearing fully against shoulder on gear.

(6) Install a new snap ring on shaft to retain bearing. Be sure snap ring is seated. This snap ring is a select fit for minimum end play.

(7) Place pinion shaft in a vise (with soft jaws), then install 16 bearing rollers in cavity of shaft. Coat bearing rollers with grease, then install bearing retaining snap ring in its groove.

(8) Using Tool C-3789 (Fig. 29), install a new oil seal in retainer bore.

EXTENSION HOUSING BUSHING REPLACEMENT

(1) Remove extension housing yoke seal with Tool C-3985 or with Tool C-3996 for small yoke extension.

(2) Drive the bushing out of housing (Fig. 30) with Tool C-3974.

(3) Slide a new bushing on installing end of Tool C-3974. Align oil hole in bushing with oil slot in housing, then drive bushing into place (Fig. 30).

(4) To install a new seal, position seal in opening of

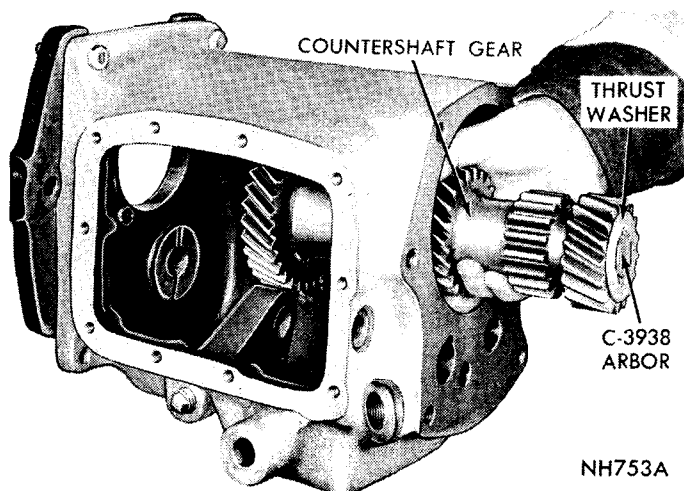


Fig. 26—Removing or Installing Countershaft Gear and Arbor Assembly

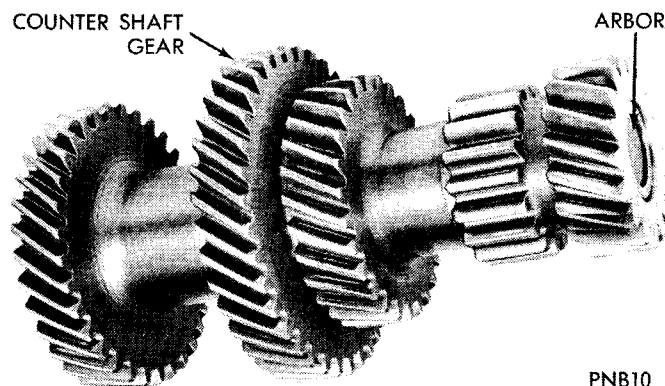


Fig. 27—Countershaft Gear and Arbor Assembly

extension housing and drive it into housing with Tool C-3972 or with Tool C-3995 for small yoke extension (Fig. 8).

Mainshaft

(1) Subassemble the synchronizer parts in the order shown in (Figs. 31 and 32) as follows: Place a stop ring flat on the bench followed by the clutch gear and sleeve. Drop the struts in their slots and snap in a strut spring placing the tang inside one strut. Turn the assembly over on the stop ring and install second strut spring tang in a different strut.

(2) Slide second speed gear over mainshaft (synchronizer cone toward rear) and down against shoulder on shaft (Fig. 20).

(3) Slide 1st-2nd synchronizer assembly (including stop ring with lugs indexed in hub slots, (Fig. 31) over mainshaft, down against second gear cone and secure with a new snap ring (Fig. 20). Slide next stop ring over shaft and index lugs into clutch hub slots.

(4) Slide first speed gear (synchronizer cone toward clutch sleeve gear just installed) over mainshaft into position against clutch sleeve gear.

(5) Install mainshaft bearing retaining ring, followed by mainshaft rear bearing. Using an arbor and a suitable tool, drive or press bearing down into position. Install a new snap ring on shaft to secure bearing

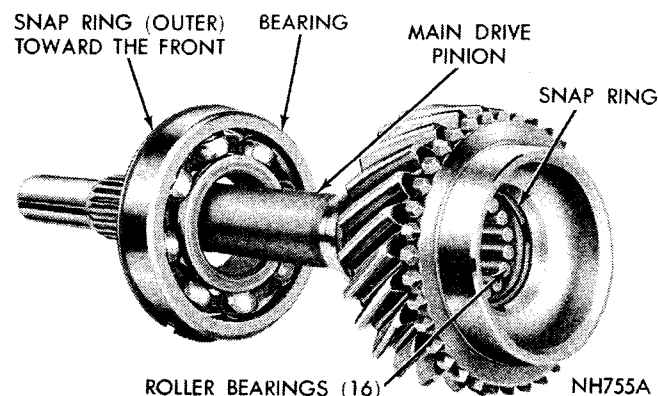


Fig. 28—Drive Pinion and Bearing Assembly

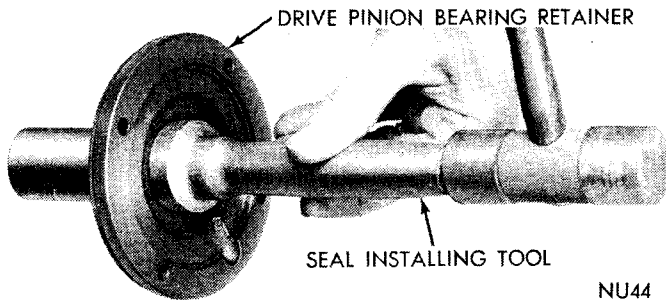


Fig. 29—Replacing Seal in Drive Pinion Bearing Retainer

(Fig. 19). This snap ring is a select fit for minimum end play.

(6) Install partially assembled mainshaft into extension housing far enough to engage bearing retaining ring in slot in extension housing (Fig. 18). Compress ring with pliers so that mainshaft ball bearing can move in and bottom against its thrust shoulder in extension housing. Release ring and seat it all around its groove in extension housing (Fig. 17).

(7) Slide overdrive gear over mainshaft (with synchronizer cone toward front) followed by O/D gear stop ring (Fig. 16).

(8) Install 3rd-O/D synchronizer clutch gear assembly (including sleeve, shift struts and springs) on mainshaft (shift fork slot toward rear) against O/D gear (Fig. 16). Be sure to index rear stop ring with clutch gear struts.

(9) Install retaining snap ring (Fig. 16). Then, using grease, position front stop ring over clutch gear, again indexing ring lugs with struts.

(10) Coat a new extension gasket with grease, then place it in position on the extension.

(11) To provide clearance so that assembly will be possible, slide reverse idler gear to center of its shaft and move the 3rd O/D synchronizer sleeve as far forward as practical (do not lose struts).

(12) Now slowly insert mainshaft assembly into case (Fig. 14) tilting it as required to clear idler and countershaft gears.

(13) Place 3rd-O/D synchronizer sleeve in neutral position.

(14) Rotate the extension on mainshaft to expose rear of countershaft. Install one extension bolt as

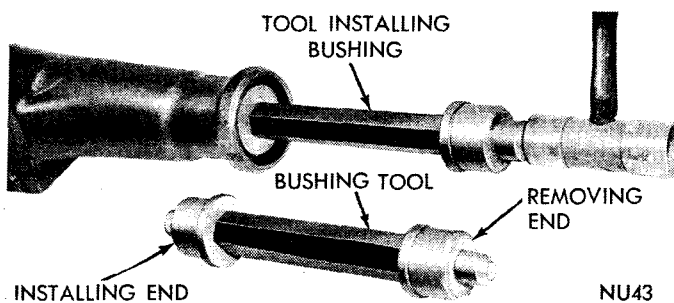


Fig. 30—Replacing Bushing in Extension Housing

shown in Figure 11, to hold extension in inverted position and prevent it from moving rearward.

(15) Install drive pinion and bearing assembly through the front of the case and position in the front bore. Install outer snap ring in bearing groove. Tap lightly into place using a soft faced hammer. If everything is in proper position, the bearing outer snap ring will bottom onto the case face without excessive effort. If not, check to see if a strut, pinion roller, or stop ring is out of position.

(16) Turn transmission assembly upside down holding the countershaft gear assembly to prevent damaging it.

(17) Lower the countershaft gear assembly into position with the teeth meshed with the drive pinion gear. Make sure thrust washers remain in position on ends of the arbor and tangs are aligned with slots in case.

(18) Start the countershaft into bore at rear of case and push forward until the shaft is approximately half way into the case and gear. Install woodruff key. Push shaft forward until end is flush with rear case face. Remove arbor Tool C-3938.

(19) Rotate extension into proper alignment with the case.

(20) Install extension housing bolts and tighten to 50 foot-pounds.

(21) Rotate transmission assembly to normal position.

(22) Install drive pinion bearing retainer and gasket. Coat threads with sealing compound, then install attaching bolts and tighten to 30 foot-pounds (Fig. 2).

(23) Install new expansion plug in countershaft bore in front of case.

Gearshift Housing and Mechanism (Fig. 33)

(1) Install interlock levers on pivot pin and fasten with "E" ring. Use pliers to install spring on interlock lever hangers.

(2) Grease and install new "O" ring oil seals on both

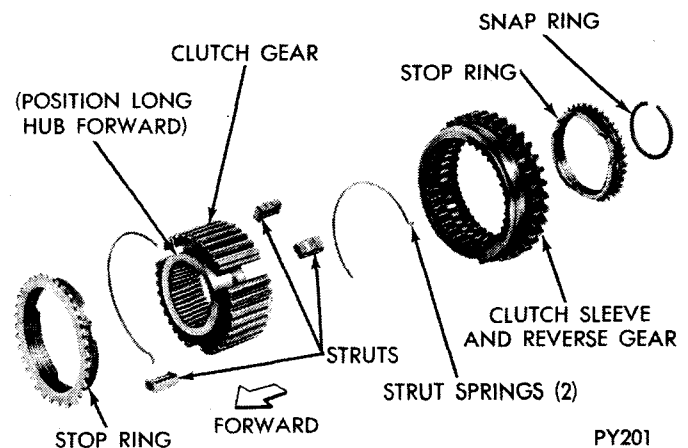


Fig. 31—1st-2nd Synchronizer—Disassembled

shift shafts. Grease housing bores and push each shaft into its proper bore.

(3) Install operating levers and tighten retaining nuts to 18 foot-pounds. Be sure 3rd-O/D operating lever points downward.

(4) Rotate each shift shaft fork bore to neutral position (straight up) and install the 3rd-O/D shift fork in its bore and under both interlock levers.

(5) Position both synchronizer sleeves in neutral. Place the 1-2 shift fork in groove of 1-2 synchronizer sleeve.

(6) Lay transmission on its right side and position gasket using grease to retain it.

(7) As the shift housing is lowered in place, guide the 3rd-O/D shift fork into its synchronizer groove, then lead the shaft of the 1-2 shift fork into its bore in the 1-2 shift lever.

To finish the installation, a screwdriver must be used to raise the interlock lever against its spring tension to allow the 1-2 shift fork shaft to slip under the levers. The shift housing will now seat against the case gasket.

(8) Install housing retaining bolts finger tight and shift through all gears to insure proper operation.

(9) Eight of the shift housing retaining bolts are shoulder bolts for accurately locating the mechanism on the transmission. One bolt shoulder is longer and acts as a dowel, passing through the cover and into the transmission case at center of rear flange (Fig. 23). Two bolts are standard, located at lower rear of cover. Tighten all bolts evenly to 15 foot-pounds.

(10) The reverse shift lever and 1-2 shift lever have cam surfaces which mate in reverse position (Fig. 34) to lock the 1-2 lever, fork and synchronizer in neutral position.

Test for correct action by placing transmission in reverse. Then, while turning input shaft, move 1-2 lever in each direction. If input shaft locks or becomes harder to turn, the synchronizer is partly engaging caused by too much cam clearance. Select new 1-2 shift lever, size "A" or "B" as required (Fig. 34). If

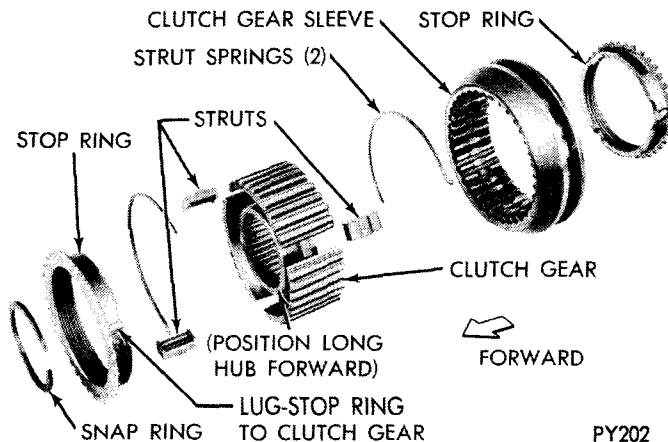


Fig. 32—3rd-O/D Synchronizer—Disassembled

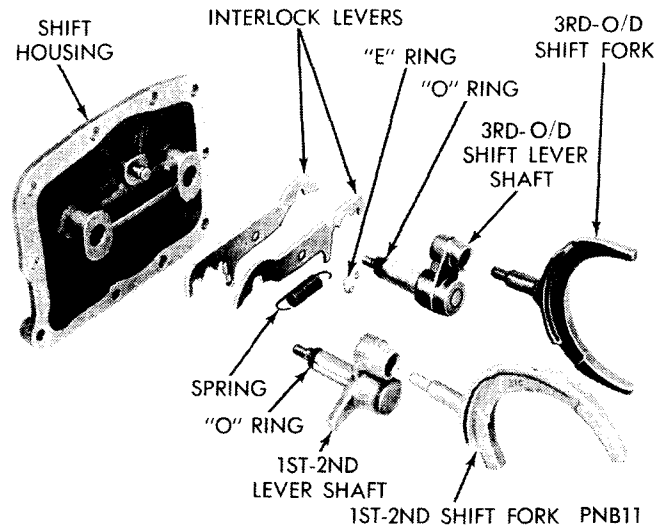


Fig. 33—Shift Housing—Disassembled

too little cam clearance exists it will be difficult or impossible to shift to reverse.

(11) Grease reverse shaft and install operating lever and nut. Tighten to 18 foot-pounds (Fig. 10).

(12) Install speedometer drive pinion gear and adapter being sure range number, representing number of teeth on gear, is in 6 o'clock position.

TRANSMISSION INSTALLATION

The transmission pilot bushing in end of crankshaft requires a grease which will stay in place during high temperature operation. Use MOPAR Multi-Purpose Grease, P/N 2932524, or equivalent, which is a grease of this type.

Place a small amount of Multi-Purpose lubricant around inner end of pinion shaft pilot bushing in fly-wheel and on pinion bearing retainer release bearing

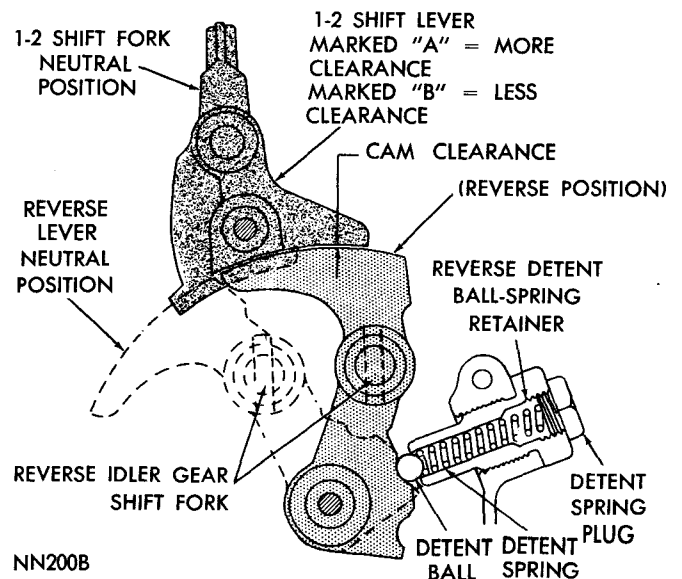


Fig. 34—Reverse Interlock

sleeve area. Do not lubricate end of pinion shaft, clutch disc splines, or clutch release levers.

(1) With transmission on a suitable jack, slide assembly under vehicle.

(2) Raise transmission until drive pinion is centered in clutch housing bore.

(3) Roll transmission slowly forward until pinion shaft enters clutch disc. With transmission in gear, turn output shaft until splines are aligned, then push transmission forward until seated against clutch housing. Do not allow transmission to "hang" after pinion has entered the clutch disc.

(4) Install transmission to clutch housing bolts and tighten to 50 foot-pounds. Remove the jack.

(5) Using a pointed drift, align crossmember bolt holes, then install attaching bolts. Tighten to 30 foot-pounds (Fig. 9).

(6) Remove engine support fixture. Install extension housing to engine rear mount bolts and tighten

to 50 foot-pounds. The engine mount to center cross-member bolt and nut, loose assembled to this point, should now be torqued to 50 foot-pounds.

(7) Fasten shift unit to extension housing mounting plate with two bolts and lock washers and tighten to 24 foot-pounds. Referring to "Gearshift Linkage Adjustment" connect shift control rods to transmission levers and connect speedometer cable.

(8) Carefully guide front universal joint yoke into extension housing and onto mainshaft splines. Connect propeller shaft to rear axle pinion yoke aligning marks made at removal.

(9) Fill transmission with "DEXRON" type automatic transmission fluid. See Lubrication, Group "O" for details.

(10) Lower vehicle, install gearshift lever and console, refer to "overdrive-4 Gearshift".

(11) Road test vehicle to make sure transmission shifts smoothly and operates quietly.

435 FOUR SPEED TRANSMISSION

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GENERAL INFORMATION

The New Process Model 435 four-speed transmission is provided with a direct mounted shift lever and cover. The shift lever retainer is removable by pressing down, rotating the retainer clockwise slightly, then releasing. Second, third, and fourth gears are synchronized, helical type constant mesh. First gears and reverse are spur type. Reverse idler is serviced as an assembly complete with integral bearings. Countershaft with gears is integral one piece design.

A tapered roller bearing supports the main drive pinion with end play controlled by thickness of gaskets between case and retainer. A pilot roller bearing

recessed in the main drive pinion supports the front end of the main shaft with the rear end supported by a ball bearing.

Front synchronizer is a unit consisting of a sliding clutch gear, energizer springs, floating solid pins, with synchronizer cones, serviced as an assembly. This is used with wider flange, outer stop rings, replaceable separately. These stop rings must always be used in sets with the new floating solid pin type synchronizer.

Parking brake drum may or may not be used depending on the overall truck braking system.

SERVICE PROCEDURES

REMOVAL OF SUBASSEMBLIES (Fig. 1 or 2)

Shift Cover and Parking Brake

(1) Mount transmission in holding fixture, remove parking brake assembly (if used).

(2) Shift gears into neutral by replacing gear shift lever temporarily, or using bar or screw driver.

(3) Remove cover screws. (Second screw from

front on each side is shouldered with split washer for installation alignment).

(4) While lifting cover rotate slightly counterclockwise to provide clearance to shift forks and remove cover.

(5) Lock transmission in two gears and remove output flange nut, with yoke and parking brake drum as an assembly (if used). **The drum and yoke are bal-**

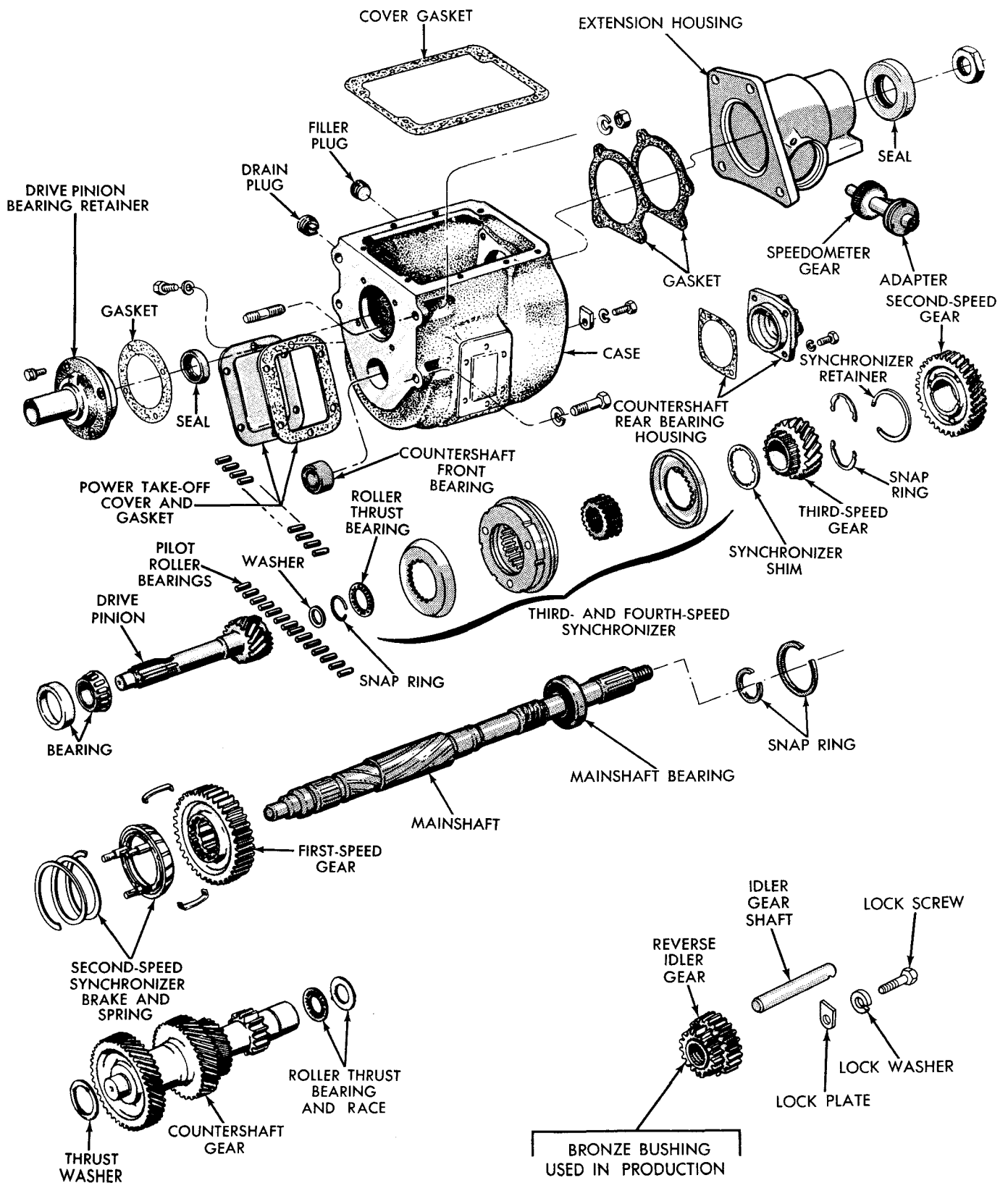


Fig. 1—435 Transmission (Exploded View) (100, 200, and 300 Models)

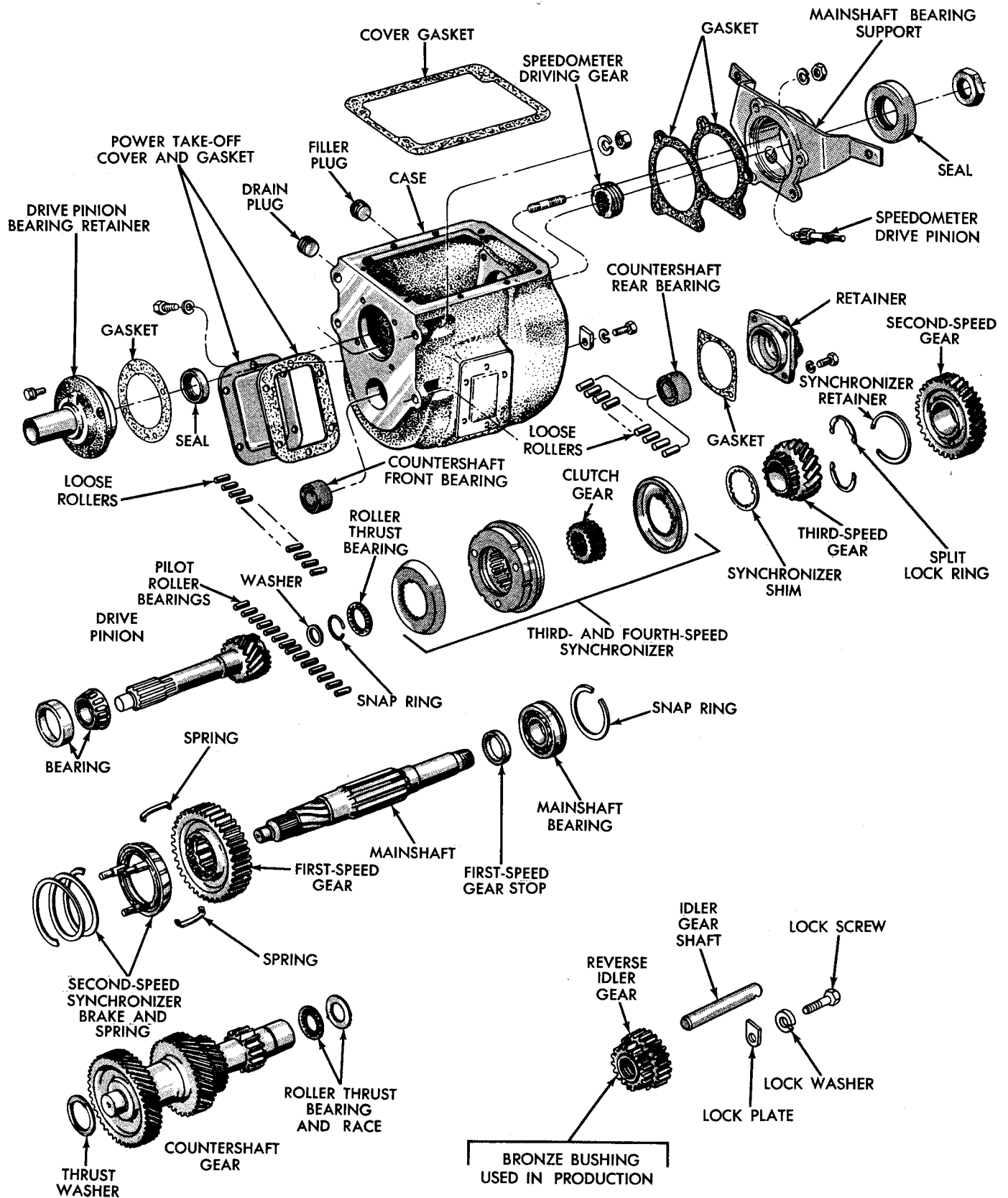


Fig. 2—Transmission (Exploded View) (500, 600, and 700 Models)

anced and unless replacement of parts is required it is recommended that drum and yoke be removed as a unit assembly.

(6) Remove speedometer drive pinion, and mainshaft rear bearing retainer.

Mainshaft End-Play Check

(1) Before removal and disassembly of drive pinion and mainshaft measure end play between synchronizer outer stop ring and third speed gear (Fig. 3). Record reading for reference during build-up. Note deviation from ideal .050 to .070 inch allowable end play so that correction shims can be installed during assembly. Thick or thin shims are available as required.

Drive Pinion

(1) Remove drive pinion bearing retainer.

(2) Rotate the drive pinion gear to align space in pinion gear clutch teeth (Fig. 4) with countershaft drive gear teeth. Remove drive pinion gear and tapered roller bearing from transmission. (Pull on pinion shaft, rap face of case with brass hammer).

(3) Remove snap ring, washer and pilot roller bearings from recess in drive pinion gear.

Mainshaft

(1) Place a brass drift in front center of mainshaft and drive mainshaft to rear.

(2) When mainshaft rear bearing has cleared case remove rear bearing and speedometer gear (with spacer) with a suitable puller.

(3) Move mainshaft assembly to rear and tilt front of mainshaft up.

(4) Remove roller type thrust bearing.

(5) Remove synchronizer and stop rings separately.

(6) Remove mainshaft assembly.

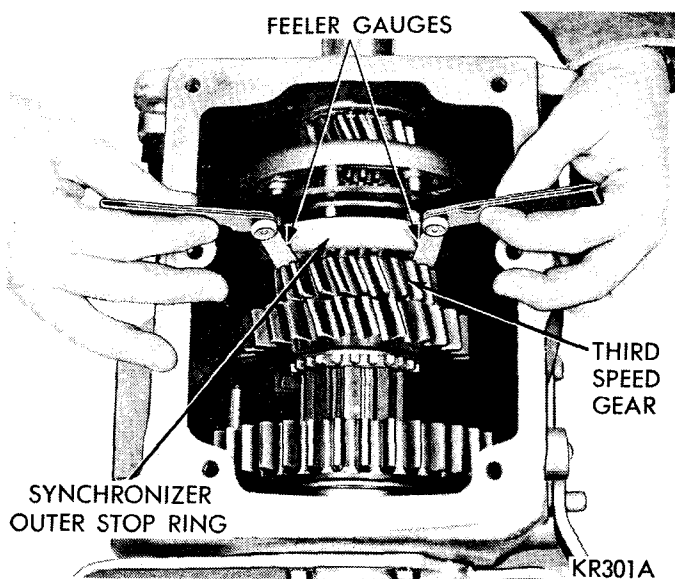


Fig. 3—Measuring Synchronizer End Play

Reverse Idler Gear

(1) Remove reverse idler lock screw and lock plate.

(2) With brass drift held at angle, drive idler shaft to rear and pull shaft.

(3) Lift reverse idler gear from case.

Countershaft Gear

If excessive side play and end play are not found and teeth are not badly worn or chipped countershaft gear may not require replacement. However, if continued use seems impaired, remove as follows:

(1) Remove bearing retainer at rear end of countershaft. The roller bearing assembly at rear end of shaft remains with retainer.

(2) Tilt cluster gear assembly and work out of case.

(3) Using a suitable driver remove front bearings from case.

DISASSEMBLY OF SUBASSEMBLIES (Fig. 1 or 2)

Mainshaft

(1) Remove clutch gear snap ring.

(2) Remove clutch gear, synchronizer outer stop ring to third speed gear shim(s) and third speed gear.

(3) Remove special split lock ring with two screwdrivers and remove second speed gear, and synchronizer.

(4) Remove first and reverse sliding gear.

(5) Drive old seal from rear bearing retainer.

Reverse Idler Gear

(1) Do not disassemble. If no longer serviceable replace as an assembly complete with integral bearings.

Cover and Shift Forks Assembly (Fig. 5 and 8)

Cover and shift forks should be disassembled only if rails, poppets or interlock plungers are worn or springs broken allowing end play or simultaneous movement of rails, and if shift forks or cover itself need replacing. Observe these parts for wear as disassembly takes place.

(1) Remove roll pin from first and second speed shift fork. Remove roll pin from gate in the same manner. A square type or closely wound spiral "easy out" mounted in a tap handle is preferable for this operation.

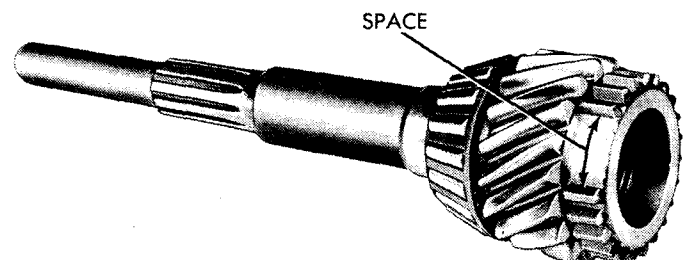


Fig. 4—Drive Pinion Gear—Showing Teeth Removed

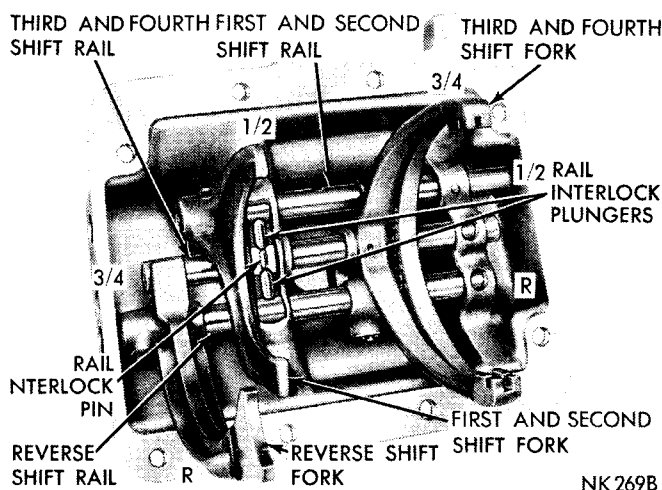


Fig. 5—Cover and Shift Fork Assembly

(2) Push shift rail out through the front to force expansion plug out of cover. Cover detent ball access hole in cover with cloth to prevent ball and spring from flying as rail clears hole. Remove rail, fork and gate.

(3) Remove third and fourth speed rails in the same manner, then remove reverse rail.

(4) Compress reverse gear plunger (Fig. 8) and remove retaining clip. Remove plunger and spring from gate.

Drive Pinion and Bearing Retainer

(1) Remove tapered roller bearing from pinion shaft with suitable tool.

(2) Remove snap ring, washer and pilot rollers from gear bore (if not previously removed).

(3) Pull bearing race from front bearing retainer with suitable puller.

(4) Remove pinion shaft seal, with suitable seal remover.

ASSEMBLY OF SUBASSEMBLIES (Fig. 1 or 2)

In performing assembly operations, use new expansion plugs, gaskets and seals. Lubricate all parts with transmission lubricant before assembly. Where grease is specified as an assembly aid in holding parts together, use an oil soluble grease such as Multi-Purpose Grease NLGI Grade 2, or equivalent. Make certain that oil returns are not plugged with grease.

Mainshaft

(1) Place mainshaft in soft jawed vise with rear end up.

(2) Install first and reverse speed gear. Be sure the two spline springs (if used) are in place inside gear as it is placed on shaft.

(3) Place mainshaft in a soft jaw vise with forward end up.

(4) Assemble second speed synchronizer spring

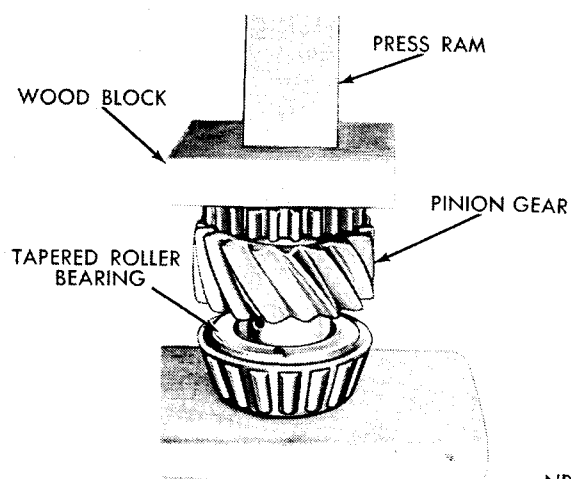


Fig. 6—Installing Pinion Bearing

and synchronizer brake to second speed gear. Secure brake with snap ring making sure that snap ring tangs are away from gear.

(5) Slide second speed gear onto front of output shaft making sure that synchronizer brake is toward rear. Secure gear to shaft with two-piece lock ring. Install third speed gear.

(6) Install shim(s) between third speed gear and third and fourth speed synchronizer stop ring. Refer to end-play measurement recorded at this point during disassembly and determine additional or necessary shims to bring end-play into tolerance (.050 to .070 inch). **Exact determination of end-play must be finally made after complete assembly of mainshaft and main drive pinion is accomplished in the transmission case.**

Reverse Idler Gear

(1) No assembly required. If no longer serviceable replace as an assembly complete with integral bearings.

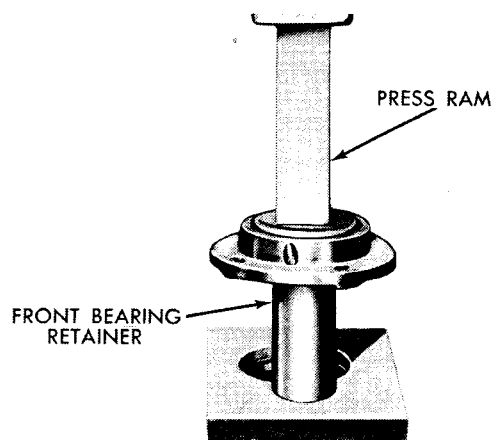


Fig. 7—Installing Seal in Bearing Retainer

Drive Pinion and Bearing Retainer

- (1) Position drive pinion in arbor press (Fig. 6).
- (2) Place a wood block on pinion gear and press into bearing until it contacts bearing inner race.
- (3) Coat roller bearings with light film of grease to hold rollers in place and insert in pocket of drive pinion gear.
- (4) Install washer and snap ring.
- (5) Press a new seal into place in bearing retainer, make sure lip of seal is toward mounting surface.
- (6) Press bearing race into retainer (Fig. 7).

Cover and Shift Forks (Fig. 5 and 8)

- (1) Assemble spring on reverse gear plunger and hold it in reverse shift gate. Compress it in gate and install retaining clip.
- (2) Enter reverse shift rail in cover and place detent spring and ball in position. Depress ball and slide rail over it.
- (3) Install gate and fork on rail. Install a new roll pin in gate and in fork.
- (4) Place reverse fork in neutral position.
- (5) Install the two interlock plungers in their bores.
- (6) Insert the interlock pin in the third and fourth speed shift rail. Install rail in the same manner as reverse shift rail.
- (7) Install first and second speed shift rail in the same manner making sure the interlock plunger is in place.
- (8) Check interlocks by shifting reverse shift rail into reverse position. It should not be possible to shift the other shift rails when this rail is shifted.
- (9) If shift lever is to be installed at this point lubricate spherical ball seat and place cap in place.
- (10) Install back-up switch (if used).
- (11) Install new expansion plugs in bores of rail holes. Install rail interlock hole plug.

INSTALLING SUBASSEMBLIES**Countershaft**

- (1) Press front roller bearing into case until cage is flush with front of case. Lubricate roller bearings with light coating of grease.
- (2) Place transmission with front of case facing down. If uncaged bearings are re-used, hold loose rollers in place in cap with light film of grease (not required with caged type).
- (3) Lower countershaft assembly into case placing thrust washer tangs in slots in case, and inserting front end of shaft into bearing.
- (4) Place roller thrust bearing and race on rear end of countershaft, holding in place with light coating of grease.
- (5) While holding gear assembly in alignment install rear bearing retainer gasket, retainer and bearing assembly. Install and tighten cap screws.

Reverse Idler Assembly

- (1) Position reverse gear and bearing assembly in case.
- (2) Align idler shaft so lock plate groove in shaft is in proper alignment to install lock plate.
- (3) Tap shaft into case far enough to start reverse gear.
- (4) While holding gear in position tap shaft through case and gear.
- (5) Install lock plate, washer and cap screw.
- (6) Make sure gear turns freely on shaft.

Mainshaft and Drive Pinion

- (1) Lower rear end of pre-assembled mainshaft into case holding first speed gear on shaft and maneuver shaft through rear bearing opening.
- (2) With shaft assembly moved to rear of case be sure third and fourth speed synchronizer and pre-selected shims remain in position.
- (3) Install roller type thrusting bearing.
- (4) Place a wood block in between front of case and front of main shaft.
- (5) Install rear bearing on mainshaft by carefully driving bearing onto shaft and into case (snap ring flush against case) using a suitable sleeve against inner race of bearing.
- (6) Install drive pinion shaft and bearing assembly making sure pilot rollers remain in place.
- (7) Install spacer and speedometer gear.
- (8) Install rear bearing retainer and gasket.
- (9) Place drive pinion bearing retainer over pinion shaft without gasket.
- (10) Hold retainer tight against bearing and measure clearance between retainer and case with a feeler gauge. **End play in step (11) and (12) below allows for normal heat expansion of parts during operation, preventing seizure and damage to bearings, gears, synchronizers and shafts.**
- (11) Install a gasket shim pack .010-.015 inch thicker than measured clearance between retainer and case to obtain the required 0.007 to 0.017 inch pinion shaft end play. After front retainer bolts are tightened, recheck end play.
- (12) Check the synchronizer end play clearance (.050 to .070) after all mainshaft components are in position and properly tightened. Two sets of equal feeler gauges are used to measure this clearance, (Fig. 3). Care should be used to keep gauges as close as possible to both sides of the mainshaft for best results. **In some cases, it may be necessary to disassemble mainshaft again and change the thickness of the shims to keep the end play clearance within the specified (.050 to .070).** Shims are available in two thicknesses.
- (13) Install speedometer drive pinion. "Refer to Speedometer Pinion Gear Chart in Specifications."

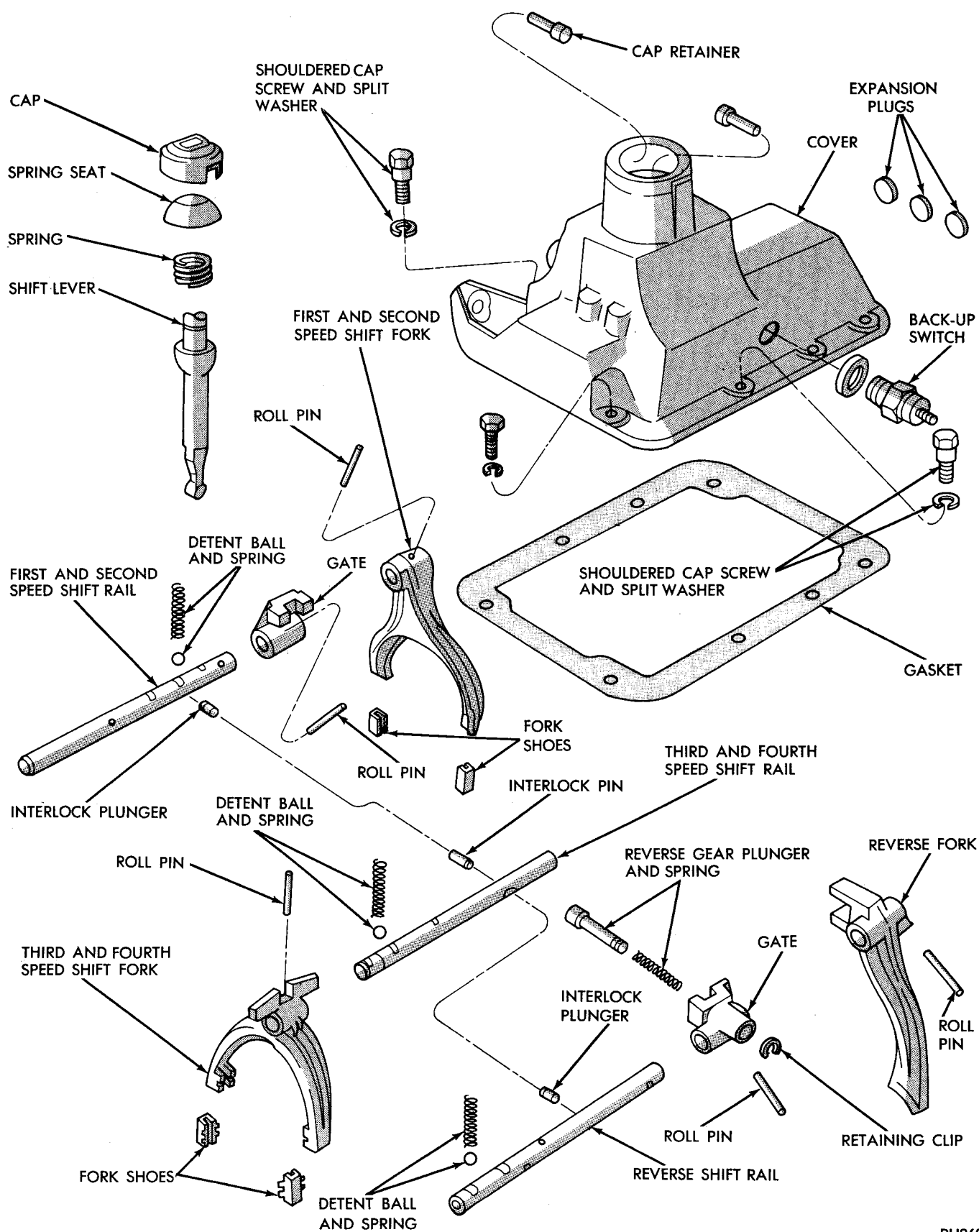


Fig. 8—Cover and Shift Fork (Exploded View)

(14) Install yoke flange, drum and brake assembly, (if used).

(15) Final tightening of nut may be performed on truck, however, place transmission into two gears at once to hold shaft for preliminary tightening.

(16) Shift gears and/or synchronizer into all speed positions and check for free rotation.

Cover

Before installing cover, take pressure type oil can and fill with transmission lubricant. Then, oil all exposed transmission parts to avoid damage at start up

after initial transmission fill.

(1) Move gears into neutral position.

(2) Lower cover with new gasket on case, over transmission.

(3) Carefully engage forks into proper gears and lower cover into place.

(4) Install one shouldered alignment screw and split washer in each second-from-front hole on each side of cover and try gears for free rotation by shifting gears through cover tower with a long screw-driver.

(5) Install remaining cover screws.

445 FOUR SPEED TRANSMISSION

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GENERAL INFORMATION

445 Four-Speed Transmission (Fig. 1)

The four-speed Model 445-D transmission is available as extra equipment on all light duty model trucks. It is a rugged, smooth, exceptionally easy shifting transmission. All gears are helical. The transmission is synchronized in all four forward speeds and a sliding helical reverse gear is mounted on the rear of the output shaft. The helical reverse idler gear is fixed and mounted on roller bearings. The mainshaft reverse gear slides into the fixed reverse idler gear and is prevented from jumping by a positive torque lock step in the mainshaft splines. A cross-sectional view of the Model 445-D transmission is shown in Figure 2.

The all-helical gear design of this transmission insures balanced thrust loads on the shafts and bearings in all gears. Countershaft thrust bearings are not required and overall bearing life is increased. The input shaft (drive gear) of the Model 445-D transmission is supported by an adjustable tapered roller bearing. The front of the output shaft is supported by a pilot bearing located in a pocket in the rear of the drive gear. The rear of the output shaft is supported by a tapered roller bearing. The countershaft is supported on high capacity roller bearings.

OPERATION

First Gear

When the transmission is shifted into first gear, the low-speed sliding clutch gear is moved rearward, locking the first speed gear to the mainshaft. In all

other shift positions, the first speed gear is free-running. In first gear, engine power is applied to the countershaft low-speed gear through the transmission input shaft or drive gear and to the mainshaft low-speed gear through the countershaft low-speed gear. There are no sliding gears in the model 445-D transmission at any forward speed. The first speed gear ratio is 4.56 to 1.

Second Gear

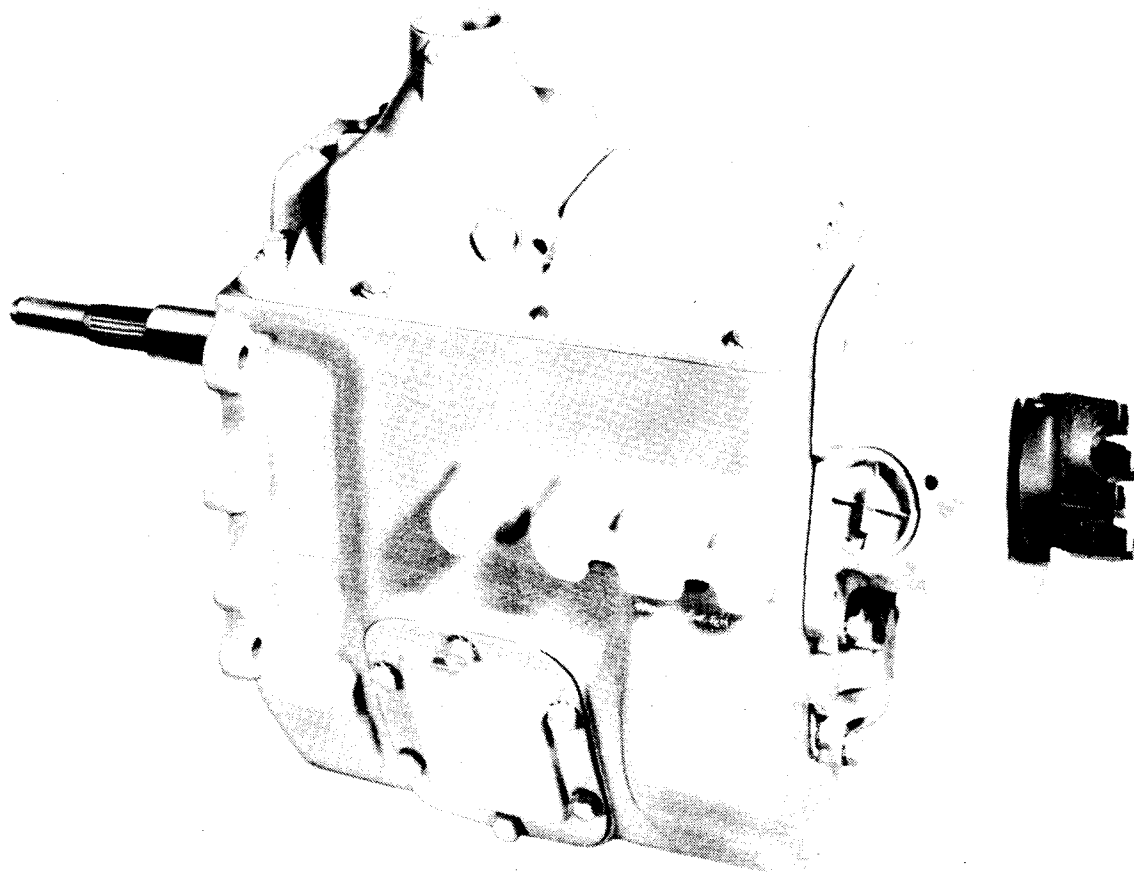
When the transmission is shifted into second, the low-speed shift fork moves forward and the low-speed sliding clutch gear pushes against the synchronizer and locks the second-speed gear to the mainshaft. Engine power is applied to the countershaft through the drive gear and from the second-speed gear on the countershaft to the mainshaft second-speed gear. The mainshaft second-speed gear is free-running in all other shift positions. In second gear, the transmission ratio is 2.28 to 1.

Third Gear

When the transmission is shifted to third gear, the shift fork moves the third-fourth speed sliding clutch gear rearward and locks the third-speed gear to the output shaft. In all other shift positions, the third-speed gear is free-running. In third gear, engine power is applied through the drive gear to the countershaft and from the countershaft third-speed gear to the mainshaft third-speed gear. The transmission gear ratio in third gear is 1.31 to 1.

Fourth Gear

When the 445-D transmission is shifted into fourth



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Fig. 1—Model 445D 4 Speed Transmission

gear, the third-fourth speed sliding clutch gear is moved forward, locking the input shaft to the output shaft. Engine power is applied directly from the transmission drive gear to the mainshaft. The drive gear also drives the countershaft which in turn drives the free running forward gears on the mainshaft. The transmission output shaft turns at engine speed when the transmission is in fourth gear.

Reverse

When the shift lever is moved to reverse, the mainshaft sliding reverse gear is moved forward into contact with the reverse idler gear which is driven by the low-speed gear on the countershaft. Note that the reverse idler is **not** shifted, but remains in contact with the countershaft low-speed gear constantly. Input to output ratio in reverse is 5.65 to 1.

SERVICE PROCEDURES

TRANSMISSION REMOVAL

The Model 445-D transmission has a case extension which is supported by an additional crossmember which must be removed before the transmission can be dropped. The transmission should be firmly supported by transmission jack before beginning transmission removal procedures.

(1) Shift transmission into gear with the shift lever. Install Engine Support Fixture, Tool C-3487, with a 1" x 4" wooden block across front springs to support rear of engine.

(2) Disconnect universal joint and push drive line out of the way or remove it. The yoke nut may be loosened at this time to facilitate removal when the transmission is in a work stand.

(3) Disconnect speedometer cable and back-up light

wire at the transmission. Remove rear extension insulator bolts. Remove cross-member bolts (Fig. 3). Remove cross-member.

(4) Remove shift lever retainer by pressing it down, rotating it counter clockwise and releasing it.

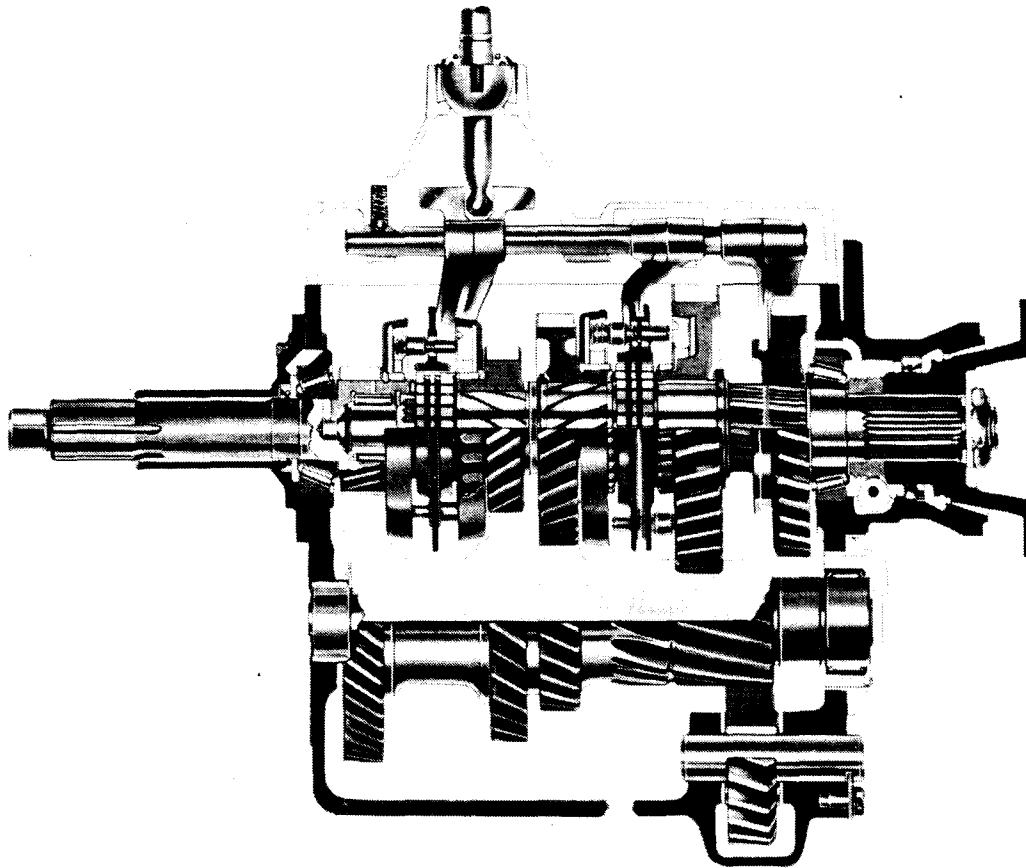
(5) Remove shift lever and springs and washers.

(6) Remove screws holding transmission to the clutch bell housing. Roll transmission jack rearwards until transmission drive gear clears clutch bell housing. Lower jack and remove transmission from beneath truck.

DISASSEMBLY OF TRANSMISSION (Fig. 4)

(1) Place transmission in a holding fixture or work stand. Drain lubricant.

(2) Shift transmission gears into neutral. Remove



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Fig. 2—Model 445D Cross Sectional View

gearshift cover attaching bolts. Note that the two bolts opposite the tower are shouldered to properly position cover and are provided with lockwashers. Be sure that the alignment bolts are correctly located and tightened first during cover installation. Lift cover straight up to remove (Fig. 5).

(3) Lock transmission in two gears at once and remove mainshaft nut and yoke (1-1/8 inch socket.)

(4) Loosen and remove extension housing attaching bolts (9/16 inch). Remove mainshaft rear extension housing and speedometer drive pinion.

Drive Pinion

(1) Remove attaching bolts from drive pinion front bearing retainer (1/2 inch) and pull off bearing retainer and gasket.

(2) Rotate drive pinion gear to align pinion gear flat with countershaft drive gear teeth. Remove drive pinion gear and tapered roller bearing from transmission (Fig. 6).

Mainshaft

(1) Remove thrust bearing.

(2) Push mainshaft assembly to rear of transmission and tilt front of mainshaft up (Fig. 7).

(3) Remove mainshaft assembly from transmission case.

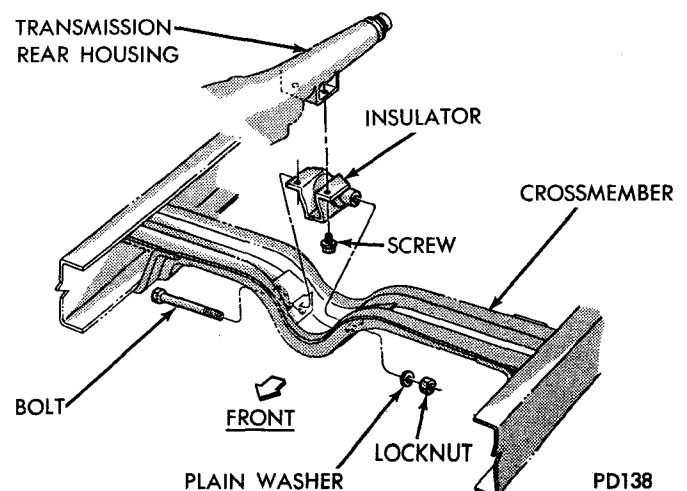
Reverse Idler Gear

(1) Remove reverse idler lock screw and lock plate.

(2) Install Tool C-603 and pull idler shaft from case.

(3) Lift out reverse idler gear.

NOTE: If Tool C-603 is not available, the reverse idler shaft may be driven out the rear of the case with a hammer and a brass drift. **DO NOT ATTEMPT TO DRIVE IDLER SHAFT FORWARD!** It is a should-



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Fig. 3—Transmission and Rear Engine Support

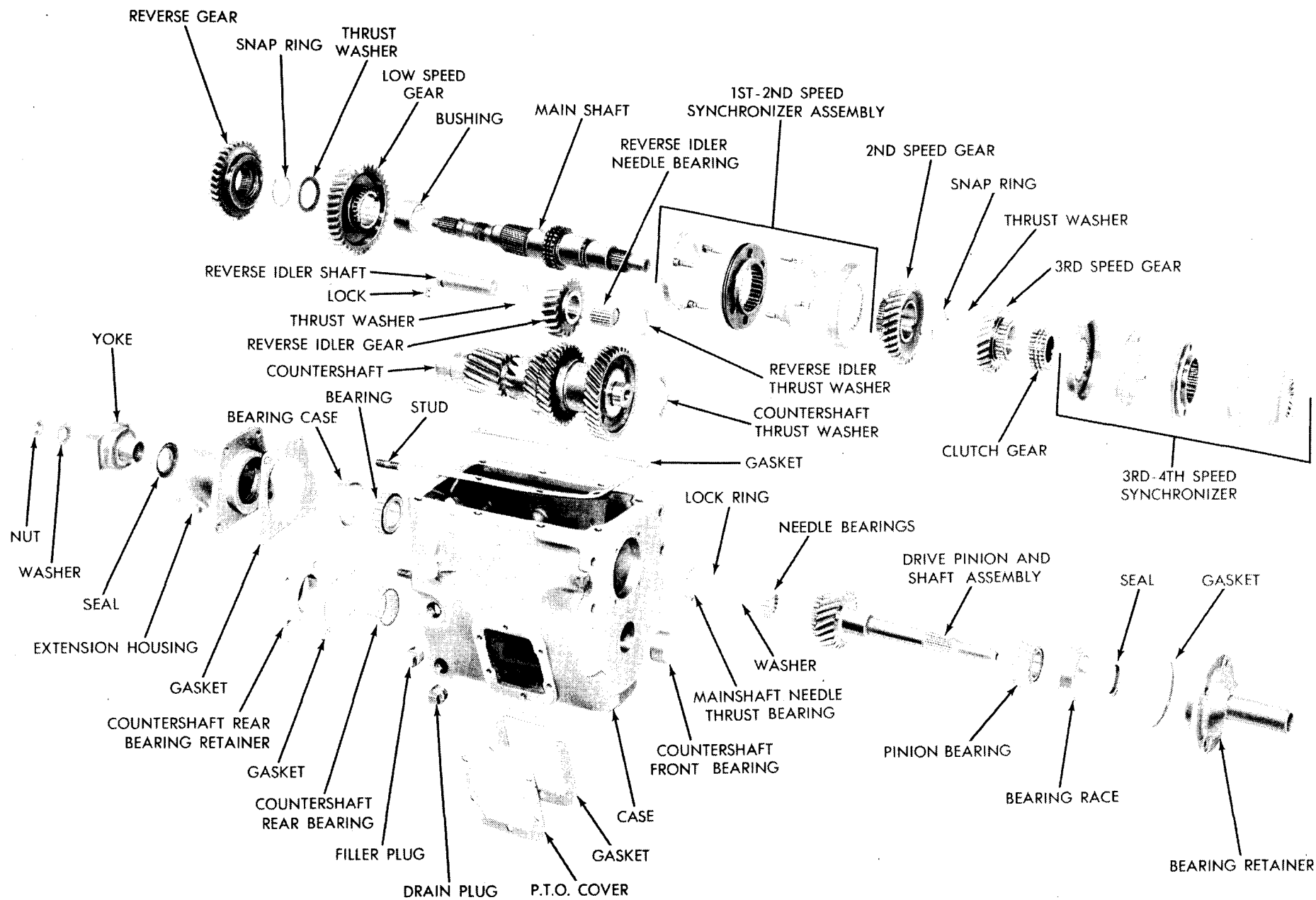


Fig. 4-445 Transmission Exploded View