

VW
TRANSAXLE
INSTRUCTIONS

CROWN MANUFACTURING CO., INC.
858 PRODUCTION PLACE, P.O. BOX 2860 NEWPORT BEACH, CA 92663, 714-642-7391

GENERAL INSTRUCTIONS FOR REBUILDING VW TUNNEL STYLE TRANSAXLES

If you are unfamiliar with the procedure of rebuilding transaxles, we suggest you read the instructions through before going back to study them step by step.

If your vehicle has the following chassis number, or later, it is not necessary to disassemble the transaxle for the #5012 BeCu washer and spacer kit as they will not fit. These transaxles have a helical spring in place of the original washer and spacer. Sedan: 118 258 722; Transporter: All '68 and on; Variant: 318 064 186.

Due to slight differences encountered from year to year which we cannot cover in detail, a VW Owners Service Manual for the specific year of the transaxle would be handy to have. By using these instructions and common sense, anyone should be able to learn how to rebuild a VW tunnel style transaxle. This information has been checked carefully, to the best of our ability, but due to the many variables involved in inspection of parts and their assembly, we can accept no responsibility as to the final results.

Removing the oil seal, rear wheel bearing and axle tube:

Take off axle shaft nut and remove brake drum.

Remove cover retaining screws, cover and oil seal.

Remove brake backing plate.

Remove outer spacer, gasket between spacer and ball bearing, washer, and cover gasket.

Remove nuts at axle tube retainer.

Remove rear wheel bearing and inner spacer by tapping on shock mount.

Remove rear axle tube retainer, gaskets and plastic packing (note gasket thickness).

Remove differential side gear locking ring with snapping pliers.

Remove differential side gear thrust washer and axle shaft.

Remove differential side gear and fulcrum plates from the differential housing.

Drive out the lock pin in the axle shaft bearing housing.

Loosen the dust sleeve.

REMOVING THE DIFFERENTIAL AND TRANSMISSION FROM THE CASE

Remove the gear shift housing.

Pry off the lock plates for the drive pinion and main shaft nuts.

Lock the transmission by engaging reverse and third or fourth gears.

Remove the drive pinion and main drive shaft nuts and take off the lock plates.

Remove the gear carrier stud nuts and take off the ground strap and retainer for the accelerator cable.

Turn the transmission case so that the left hand final drive cover faces up.

Remove the stud nuts from the left hand final drive cover.

Remove the final drive cover by tapping with a punch and/or hammer on the projections.

Press out the differential by hitting the right axle with a soft hammer or block of wood and hammer. Note the thickness and arrangement of the differential shims to facilitate replacement.

Loosen the retaining ring for reverse gear on the main drive shaft. Slide reverse gear rearward and slip the main drive shaft apart. (Picture #1)

Take off reverse gear and retaining ring and remove the rear main shaft towards the rear. Do not worry about the oil seal. Always plan to replace it.

Remove the right hand final drive cover.

Pry up the lock plates attaching the drive pinion ball bearing retainer and remove the screws. (Picture #1)

Push the transmission out of the case with the Trans-A-Jig removal tool. Note the thickness and placement of the pinion shims. (Picture #2)

Remove the woodruff key and take the reverse gear shaft and thrust washer out of the transmission case only if the gear or bearing is damaged, and remove the screw which secures the spacer sleeve for the reverse gear shaft needle bearings and drive out the bearings with a drift or socket.

Remove the screw which secures the needle bearing on the main drive shaft and drive out the needle bearing with a drift only if the race on the shaft shows evidence of wear.

Examine the ball bearing of the left and right final drive covers, and remove if they are to be replaced.

Remove the clutch release bearing.

DISASSEMBLY OF GEAR CARRIER

Remove reverse selector fork and reverse sliding gear from reverse lever.

Remove the shims from the drive pinion ball bearing. Note the thickness and placement of the shims.

Place the gear carrier in a vice equipped with soft faces. Loosen the locking screws of the first/second and third/fourth selector forks and remove the selector fork for first/second gears.

Withdraw the selector shaft for third/fourth gears out of the selector fork.

Place a rubber band or string around the operating sleeve of first/second gear and main drive shaft.

Press the transmission from the gear carrier carefully to avoid tilting which could damage the gear or needle bearing in the gear carrier (Picture #3).

Remove the screw that secures the drive pinion needle bearing and press out the needle bearing only if the inner race condition indicates replacement.

Press or tap out the bearing to the main drive shaft.

Place the gear carrier in a soft jawed vice and remove the screw on the reverse lever guide.

Withdraw the selector shaft for first and second gears.

Withdraw the selector shaft for third and fourth gears.

Remove plunger and detent balls.

Remove springs with a small screwdriver. Stretch to 1-1/8" to 1-3/16" before replacing.

Disassembly of the drive pinion:

Press out inner race of needle bearing and fourth gear and remove fourth gear woodruff key. (Picture #4)

Remove the spacer sleeve, concave washer shims and concave washers. Note: These should be replaced with Crown #5012 BeCu washers and spacers. Chassis with these numbers have helical springs instead of washers and spacers. sedan - 118 258 722, transporter - all 1968 on, variant - 318 064 186. Do not combine the helical spring and the washers.

Remove second and third gears including needle cage and synchronizer stop ring for second gear. Note: Do not mix synchronizer rings from first, second, third, and fourth!

Remove the clutch gear for first and second gears including the shifting plates, springs, and operating sleeve, and disassemble.

Remove the synchronizer stop ring, first gear and pinion bearing retainer.

Remove the first gear shims.

Remove the round nut with a chisel shaped brass or aluminum punch and hammer, or large pipe wrench, while holding the assembly in a soft jawed vise (Picture #5)

Remove the trust washer and needle cage for first gear.

Remove (press) the inner race of the needle bearing, the first gear thrust washer and the pinion bearing.

INSPECTION

Inspect the drive pinion for wear and damage. If necessary, replace the drive pinion and ring gear as a pair. Note that they have matching numbers.

Check the condition of the pinion bearing and needle bearing and replace, if necessary. If the drive pinion has to be replaced, the drive pinion and ring gear have to be re-adjusted.

Check gears for wear and damage and replace, if necessary. When a damaged gear is replaced, the matching gear must also be replaced. Worn and damaged first and second gears that are replaced also require replacement on the front main drive shaft.

Check all synchronizer components for wear. Clean the internal cone surface of the stop rings with a wire brush. Check the clearance between the stop ring face and the clutch teeth of the corresponding gear (normal clearance should be .043"). If the wear limit (.024") is reached, the stop ring should be replaced. Premature wear on the stop rings is due to poor condition of the clutch or to incorrect operation of the clutch. If a gear will not engage, even though the clutch is fully released, it may be that the slots in the stop ring are worn. Replace if there is any doubt.

ASSEMBLY

Before being pressed into position, the inner races of the pinion bearing and the needle bearing inner race for the first gear should be heated in a pot of oil on a hot plate or in the oven to a temperature of approximately 195°.

Slide one of the pinion bearing inner races on to the drive pinion.

Slide the bearing on to the drive pinion and then slide the second inner race on in such a manner that the bearing numbers indented in both races are exactly opposite to one another and at the same relative position on the shaft.

Slide first gear thrust washer and needle bearing inner race on to the drive pinion.

Press together all parts on the repair press or set with a soft drift and hammer.

Tighten the round nut with a torque wrench to 87 ft. lbs., or seat soundly with a drift and hammer or large pipe wrench. (Picture #5)

Install pinion bearing retainer plate.

Install shims for first gear. The end play (.004-.010") should be checked between the thrust washer and first gear after the clutch gear for first and second gears has been installed. Clearance toward the high side are preferred. (We prefer .008-.014 clearance for racing where high temperatures are to be encountered. We have found no adverse effects from lots of clearance).

Place first speed stop ring on the cone surface of the gear. The synchronizer stop rings for the first and second gears are not always interchangeable.

Assemble the synchro unit for first and second gears. Slide the operating on the clutch gear so that its shifting plate slots are in line with the slots the clutch gear. Put the shifting plates in position and install the two snap offset to one another. Make sure that the ends of each ring engage behind shifting plates.

Slide the assembled synchro unit onto the drive pinion. The longer hub portion should be toward the face of the drive pinion splines. Turn the first speed stop ring until the shifting plates engage the slots.

Install second speed stop ring with notches toward shifting plates. Install third gear and bearing and two concave washers (Crown #5012) nested with the large diameter touching third gear. Install the spacer. Helical spring arrangement is adjusted by means of varying thickness snap rings and should allow third gear to move about .005" to .010".

The Crown #5012 BeCu washers and spacer are pre-set and require no adjustment. Do not try to combine the Crown washers and the helical spring arrangement as the spring rate of one modifies the other and reduces the shock absorbing quality of either. Chassis numbers having the helical spring arrangement are: transporter - all 1968 and later, sedan - 118 258 722, variant - 318 064 186.

Insert the woodruff key for fourth gear into the drive pinion.

The fourth speed gear and needle bearing inner race should be heated in an oil bath to about 195° before being pressed into position (except for splined fourth gear in '68 and later models).

Slide the fourth gear on to the drive pinion with its wide shoulder facing the spacer sleeve or helical spring, depending on the type.

Press fourth speed gear and needle bearing inner race fully into place.

REBUILDING THE MAIN DRIVE SHAFT DISASSEMBLY

Remove thrust washer, fourth gear, needle cage and stop ring.

Remove fourth speed needle bearing inner race, third/fourth speed clutch gear, and third gear by supporting behind third gear and pressing the assembly off.

Remove third gear needle cage.

Disassemble synchro unit for third and fourth gears.

• Check all parts for wear.

- check main drive shaft
- check reverse gear splines on the drive shaft
- check first and second gears
- check needle bearing surfaces
- plane front main drive shaft between two points and check contact surface of third gear needle bearing for run-out. Maximum run-out should not exceed .0006".
- check needle bearings and third and fourth gears for wear or damage and replace, if necessary.
- check all synchro components, clean stop rings, check stop ring clearances. Stop ring wear may indicate poor clutch condition.
- if a gear will not engage with the clutch fully released, check the alignment of the stop rings and check for worn slots.
- check fourth gear thrust washer and replace, if necessary.
- check main drive shaft where it fits into the pilot bushing
- check splines
- check oil seal seating surfaces for scores
- check reverse gear on main drive shaft

ASSEMBLY

Assemble the synchro unit for third and fourth gears. To reduce backlash between the clutch gear and the operating sleeve to a minimum, the operating sleeve and the clutch gear are paired and etched for identification. Put the shifting plates in position and install the two snap rings offset to each other. Make sure that the ends of each ring engage behind the shifting plates. To keep third gear from jumping out, the driving flanks of the teeth on the third gear side of the clutch gear are set back slightly.

Note: Both 3rd and 4th gears on the main shaft are an assembly of three parts each. The synchronizer cones have external teeth on them which engage the female teeth on the 3rd and 4th speed clutch gear in order to drive the 3rd and 4th gears. These two members are pressed together with a thin washer sandwiched in between. This press fit is all that drives your car in 3rd and 4th gear. If these gears slip, they usually remove the running clearance between all members on the main shaft. Overheating, galling and general destruction of the gear box are inevitable results.

We have found only one sure way of keeping these assemblies together under applications of lots of power. After the gears are clean and dry, they are pressed together so the washer will not move, and the two are tack welded together with four 1/4" to 3/8" long welds equally spaced around the two pressed together diameters. They should be heliarc welded with ".502" rod (.040 - .062 ϕ is easy to work with). Naturally, you should avoid overheating the parts. After the welding is complete, the excess material should be ground off flat to avoid interference and provide a smooth bearing surface.

Insert the woodruff key for the clutch gear in the main drive shaft and place third gear synchronizer stop ring on the cone of the gear.

Press the third/fourth clutch gear into position (third gear side has an internal chamfer). The identifying number "4" on the clutch gear must be toward fourth gear. The third gear is lifted slightly and turned until the stop ring engages in the shifting plates. Check end play with a feeler gage between second gear or the main shaft and third gear (.010 - .015").

Press fourth gear needle bearing inner race into position.

Assemble fourth needle cage, fourth gear and thrust washer (use later washer with oil grooves).

Check end play by holding fourth gear thrust washer against bearing race. Check between it and fourth gear with a feeler gage (.010 - .015").

REBUILDING THE DIFFERENTIAL

DISASSEMBLY

Place the differential in a holding fixture.

Remove the screws holding the lock wire and ring gear.

Lift off ring gear.

Remove the headed over end of the retaining pin with a grinder before driving out to avoid cracking the differential housing.

Drive out the differential pinion shaft with a drift and remove differential pinions.

ASSEMBLY

Check the concave differential pinion contact surfaces in the differential housing for damage and wear. Replace differential housing, if necessary.

Crown #5059 "Beef-A-Diff" installed at this point doubles the strength of the spider gears.

Peen the lock pin for the differential pinion shaft.

Check the ring gear for wear and damage, and replace the ring gear and drive pinion as a pair, if necessary. Note that they have matching numbers.

Keep the contact surfaces of the differential housing and ring gear absolutely clean to insure uniform backlash.

Tighten the ring gear attaching screws with a torque wrench to 43 ft. lbs.

Insert the lock wire so that there is a clockwise tension on the attaching screws when the wire ends are twisted.

ADJUSTMENT OF RING GEAR AND DRIVE PINION

Quiet operation and minimum wear of the final drive depend on the proper adjustment of the ring and pinion. Drive pinions and ring gears are machined in pairs during production and carefully inspected to insure correct tooth contact and silent meshing in both turning directions. Each gear set is given a matching number and replacements must be made in pairs. Replacing the ring and pinion usually necessitates a readjustment of the transmission. Silent operation is obtained by adjusting the pinion endwise with the ring gear lifted out of the fully engaged position to insure that the backlash is within the prescribed limits of .0067" to .0098".

Re-adjustment of the ring gear is usually all that is necessary if the differential housing, a final drive cover or a differential bearing have been replaced. If parts have been replaced in the rear axle, the ring and pinion may need to be readjusted. If the transmission case or the gear set itself have been replaced, the ring and pinion must be adjusted.

Adjustment of the ring and pinion is done to make sure that the vehicle operates quietly. Shims need to be installed between the ball bearing and the contact surface of the pinion at the transmission case. In the process of disassembly, thickness and location of shims should have been carefully noted. The ring gear should be adjusted to give the prescribed backlash. The thickness of the shims for the differential housing should be noted. Both of the final drive covers should be installed with a pre-load of .0055". After determining the thickness of the shims, a pre-load of .0028" must be taken into consideration.

Parts should be handled carefully and kept clean during all assembly work to insure correct results.

GEAR CARRIER ASSEMBLY

Check the detent springs and replace, if necessary. The free length of the detent springs should be 1-1/8" to 1-3/16".

The detent springs should be inserted through the holes for the selector shafts. Since the top halves of the detent springs are without bushings, the detent springs for first and second and reverse gears can be installed more easily by inserting them into the top halves first.

Install selector shaft (reverse) including the reverse lever and the reverse lever guide if previously removed.

Install selector shafts for first and second and for third and fourth gears, taking care not to omit the two interlock plungers. Check for proper interlocking by engaging a gear. The selector shaft next to the one used must be locked. When engaging first or second gears, the two other selector shafts should be locked.

Check needle bearing for drive pinion and ball bearing for main drive shaft and replace, if necessary. Secure the drive pinion needle bearing after it has been installed in the gear carrier.

Place the gear carrier on a support and press the main drive shaft ball bearing into position.

Check the selector forks for wear. The clearance around the selector forks should be .004 - .012". Replace worn parts.

Check the main drive shaft and drive pinion.

Press the transmission into the gear carrier. The selector fork for the third and fourth gears should be positioned in the operating sleeve before this. When pressing, the drive pinion should be lifted slightly and care taken that the selector fork for third/fourth gears does not become jammed on the selector shaft. Fully insert the selector shaft into the fork before this. When pressing the transmission into place, place a rubber band or string around the operating sleeve for the first and second gears and the main shaft so that the main drive shaft and drive pinion are held together. (An alternate method involved placing gear assemblies into the gear carrier and then installing a main shaft ball bearing.)

Install the first/second selector fork.

Attach reverse gear selector fork with reverse sliding gear on to reverse lever.

Adjust selector forks.

ADJUSTMENT OF SELECTOR FORKS

The adjustment of the selector forks can best be carried out properly with the help of the Crown "Trans-A-Jig". Since the adjustment of the first/second and reverse selector forks changes with the adjustment of the drive pinion, the drive pinion adjustments must be done first. Nuts for the drive pinion must be tightened to the recommended torque.

Place transmission with drive pinion shims and gasket for gear carrier on the "Trans-A-Jig" and attach the gear carrier with four screws.

Tighten the drive pinion ball bearing retainer with two screws diagonally opposed to each other to 36 ft. lbs.

Push the crank of the "Trans-A-Jig" onto the splines of the main drive shaft so that the main drive shaft is locked by the crank handle. Engage first or second gear.

Tighten the main drive shaft with a torque wrench to 87 ft. lbs. (Picture #6).

Tighten the drive pinion nut to 87 ft. lbs. Bend tabs of locks over.

Attach the gear shift housing and the shifting handle. This will insure a proper seating of the main drive shaft ball bearing in the gear carrier.

Set the selector forks for first/second and third/fourth gears so that the forks move freely in the operating sleeve, not only in neutral position but also when the different gears are engaged. Turn gears with the crank to centralize the gear train between checks. (Transaxles seeing an opposite input rotation should be slightly loaded toward second and fourth). (Picture #7)

Set the reverse gear selector fork so that the reverse sliding gear is in the middle between the operating sleeve and second gear of the main drive shaft with the second gear engaged, and engages properly in the reverse gear on the drive pinion when the reverse gear is engaged.

The locking screws of the selector forks should be tightened with a torque wrench to 18 ft. lbs. Tighten the reverse lever guide to 14 ft. lbs.

Remove the transmission from the fixture.

INSTALLING THE DIFFERENTIAL AND TRANSMISSION

Clean and inspect the transmission case and final drive covers for damage. Replace damaged parts.

The starter motor armature bush should be checked for wear and replaced, if necessary.

Check the clutch operating shaft bushes for wear and replace, if necessary. The clutch operating shaft should be checked at every transmission repair for free movement, and high temperature grease should be applied, if necessary.

Check all bearings before installing, and replace, if necessary.

Insert needle bearings for reverse gear shaft and spacer sleeve and fasten.

Install main drive shaft needle bearing with a drift and fasten.

Install reverse gear shaft with the thrust washer and drive gear. Check the snap ring for proper tension. Do not forget the woodruff key.

Place the drive pinion shims over the ball bearing and screw two engine mounting studs (4") into the ball bearing retainer. This prevents the retainer ring from turning when installing the transmission (Picture #8).

Push the reverse selector fork and sliding gear on to the reverse lever and engage reverse gear.

Insert the transmission into the transmission case. Use a rubber hammer to position the pinion correctly in the bearing seat. Use a new gear carrier gasket.

Tighten the ball bearing retainer screws with a torque wrench to 36 ft. lbs. Use new lock plates. Use only 10 K screws.

Apply oil to the lip of the oil seal before installing the rear half of the main drive shaft. Screw both halves of the drive shaft together. Back them off until the splines for the reverse gear are in line. Both halves of the main drive shaft must not be screwed tightly together. Make sure that the pretension of the reverse gear snap ring is correct.

Press the ball bearings into the left and right final drive covers. Press on outside race only.

Install the right final drive cover and use a new gasket or "O" ring, depending on the type of seal used. Tighten the nuts with a torque wrench to 18 ft. lbs.

Install the differential in the transmission case. Make sure that the shims are inserted correctly.

Tighten the gear carrier stud nuts to 14 ft. lbs.

Block the transmission by engaging both the reverse and third and fourth gears.

INSTALLING THE REAR AXLE TUBE AND SHAFT

Clean the axle tube retainer and axle tube retainer seat on the final drive cover.

Check the dust sleeve for damage and replace, if necessary.

Check the axle shaft, differential side gear and thrust washer for wear or damage and replace, if necessary.

Check the rear axle shaft for run-out at the ball bearing seat. If the run-out exceeds .002", straighten the rear axle shaft in cold condition or replace it.

Check the fitting clearance of the rear axle shaft/fulcrum plates/differential side gear. In case of excessive clearance (.0096") install larger fulcrum plates or replace the worn parts.

Install the differential side gear, axle shaft and thrust washer in the differential housing and insert the lock ring.

The rear axle tube should be fitted without end play by selecting an axle tube retainer gasket of appropriate thickness. Do not exceed .008" end play. Tighten axle tube retainer nuts to 14 ft. lbs of torque.

Do not tighten the dust sleeve clips before the rear axle is installed or the sleeves may become twisted and damaged.

INSTALLING THE OIL SEAL AND REAR WHEEL BEARING

Check the ball bearing and replace if worn or damaged.

Replace the two gaskets. (o-rings).

Check the oil seal. It is a good idea to replace it anyway, worn appearing or not. (They are cheap.)

The outer spacer must be clean and free of rust, scores and cracks. It should be lightly coated with oil.

Replace the cover so that the oil drip nose points down.

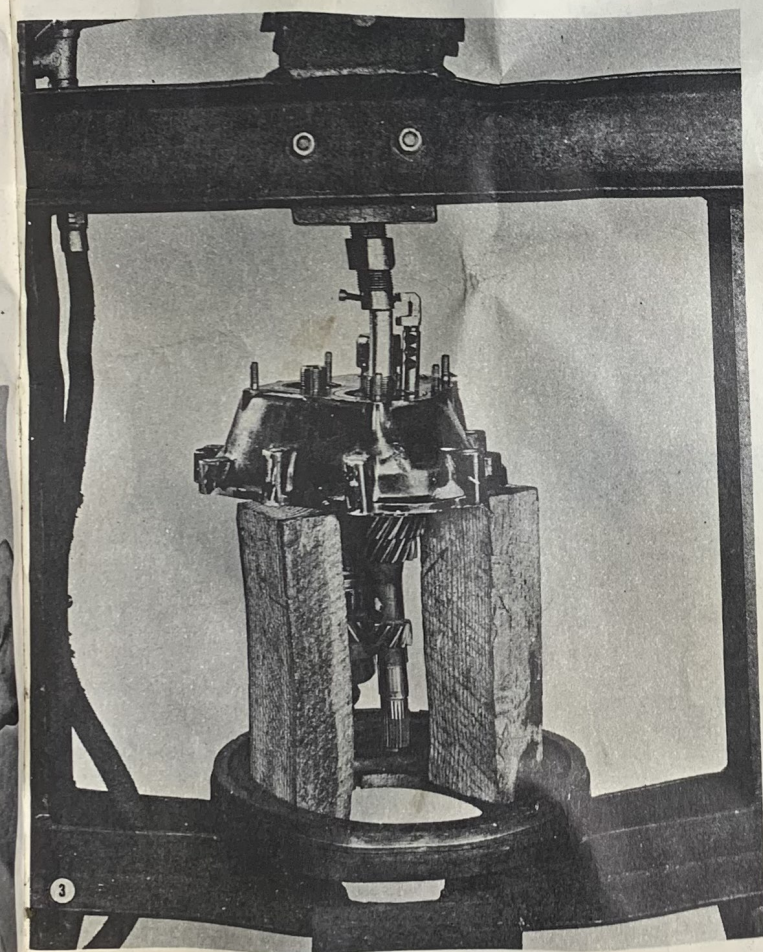
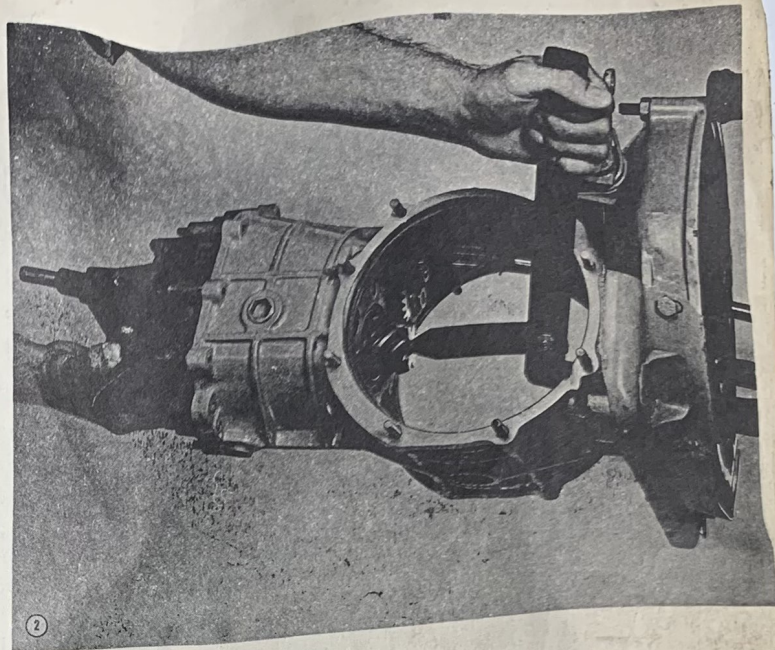
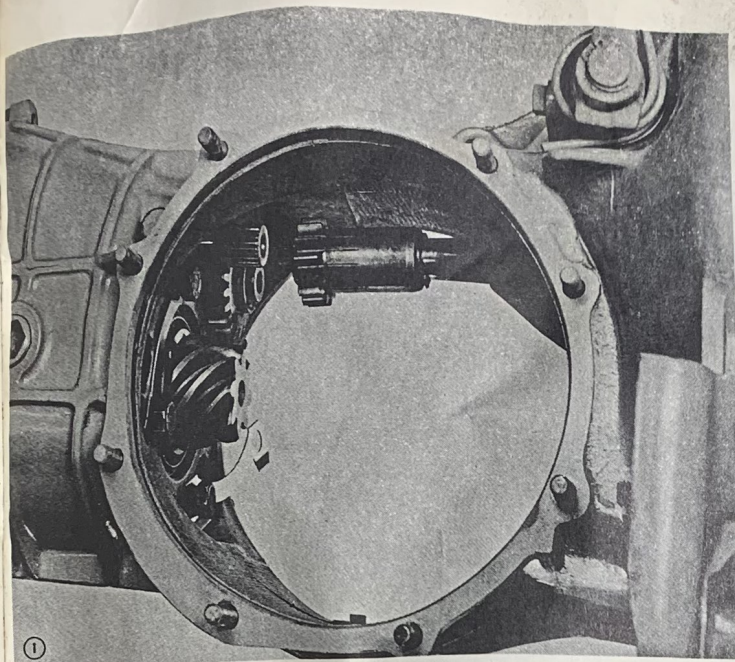
Clean the oil deflector before installing it. Be sure that the oil drip tube bearing tightly against the brake drum to prevent oiling the brake shoes.

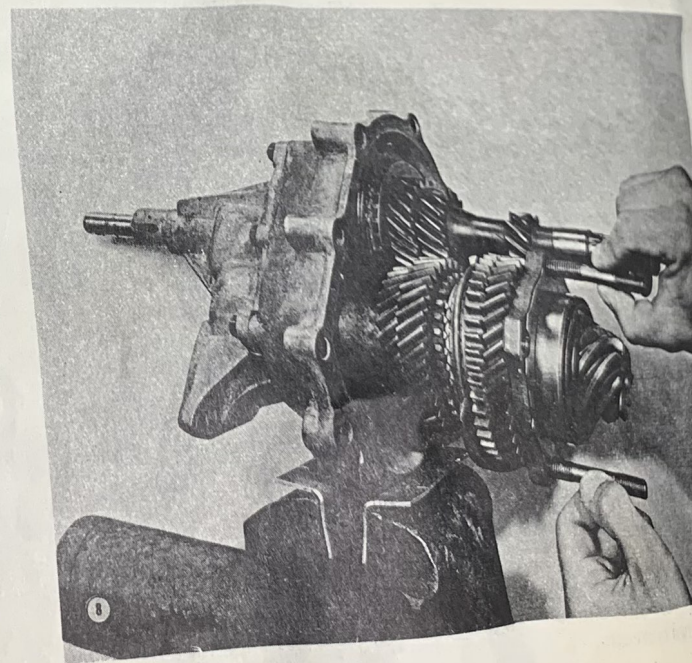
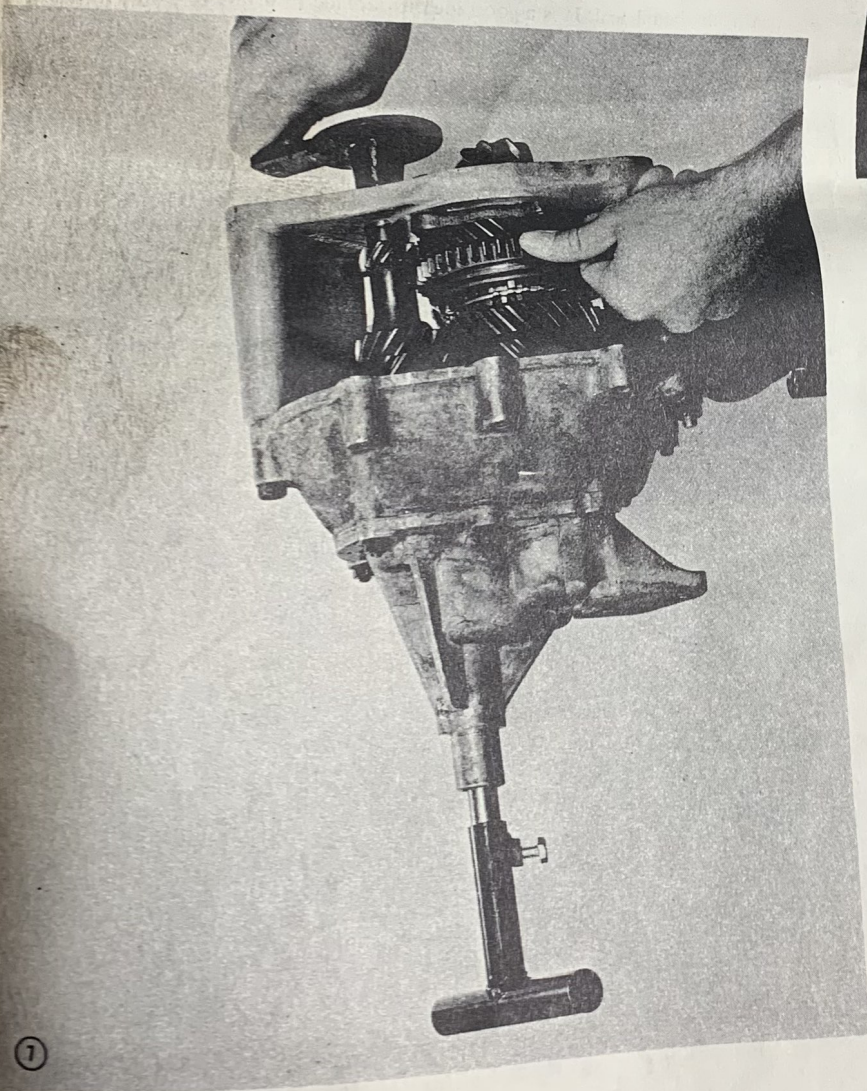
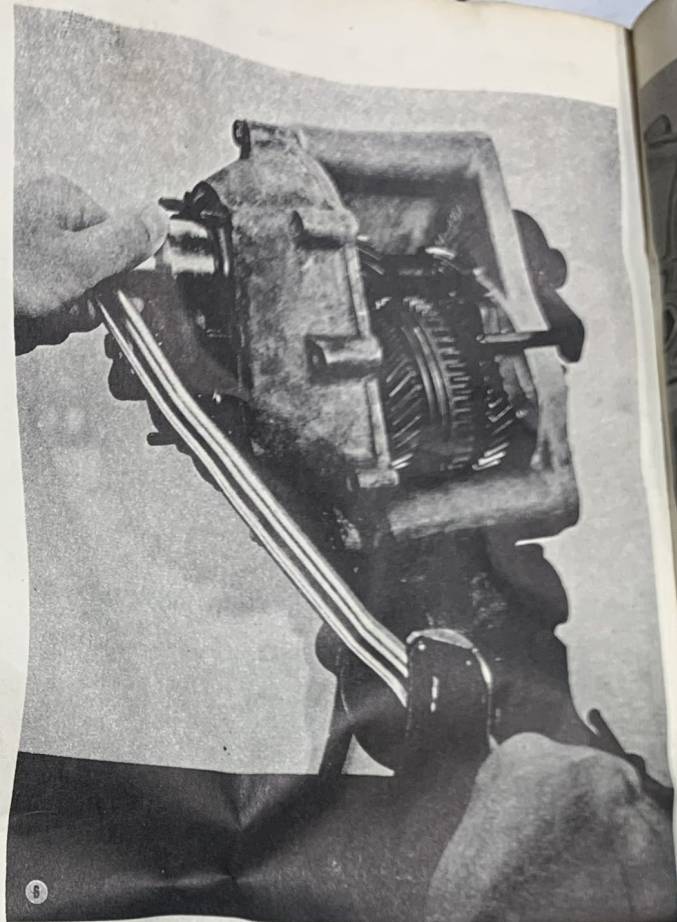
Check the splines in the brake drum hub. If they are worn, replace the drum.

Torque the rear axle shaft nut to 217 ft. lbs., and fasten with a cotter pin.

Fill the transmission with 5½ US pints of transmission oil.

Bleed and adjust the brakes.

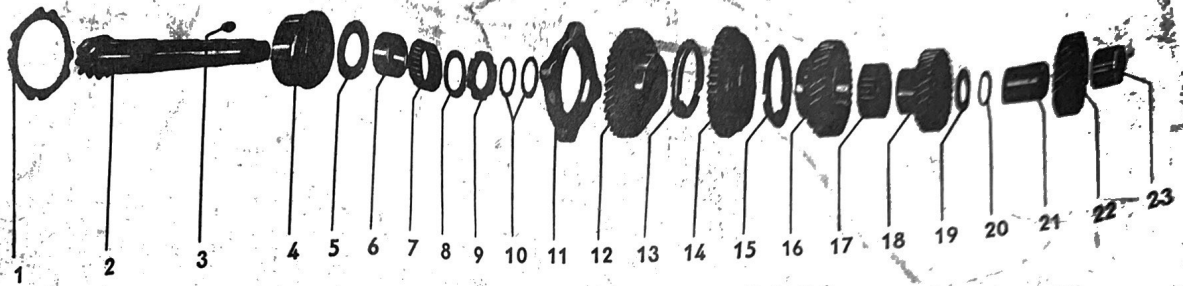




7

9

8

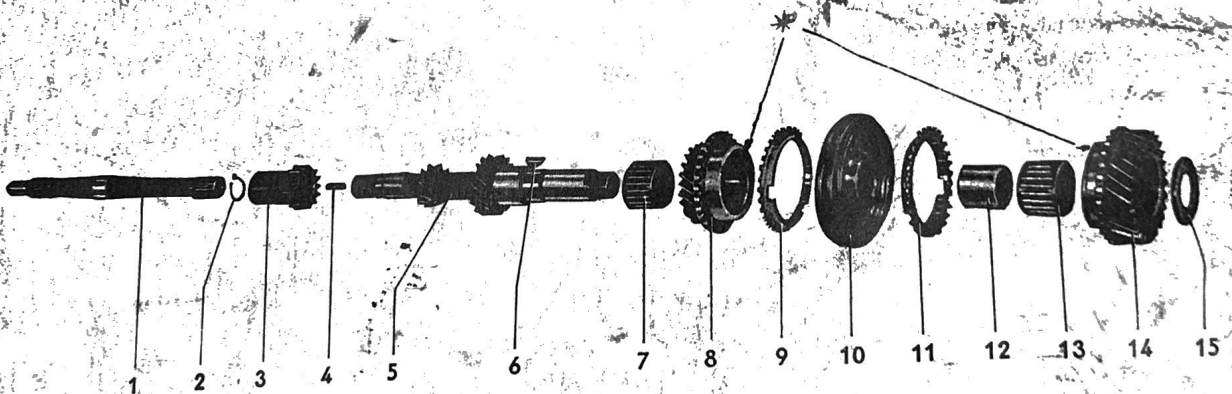


- 1 - Shim
- 2 - Drive Pinion
- 3 - Woodruff key for 4th gear
- 4 - Ball bearing
- 5 - Thrust washer for 1st gear
- 6 - Needle bearing inner race (1st gear)
- 7 - Needle cage (1st gear)
- 8 - Thrust washer for needle bearing (1st gear)
- 9 - Round nut
- 10 - Shims, end play 1st gear
- 11 - Ball bearing retainer
- 12 - 1st gear

- 13 - Synchronizer stop ring (1st gear)
- 14 - Clutch gear for 1st and 2nd gears, and reverse gear
- 15 - Synchronizer stop ring (2nd gear)
- 16 - 2nd gear
- 17 - Needle cage (2nd gear)
- 18 - 3rd gear
- 19 - Concave washer
- 20 - Shims for concave washer
- 21 - Spacer sleeve
- 22 - 4th gear
- 23 - Inner race, needle bearing in gear carrier

Exploded view of the pinion shaft assembly.

Note: Replace #19, 20 and 21 with Crown #5012, especially if the transaxle is running in reverse direction.



- 1 - Main drive shaft rear half
- 2 - Snap ring for reverse gear
- 3 - Reverse gear on drive shaft
- 4 - Stud
- 5 - Main drive shaft front half

- 6 - Woodruff key for clutch gear
- 7 - Needle cage (3rd gear)
- 8 - 3rd gear
- 9 - Synchronizer stop ring (3rd gear)
- 10 - Clutch gear (3rd and 4th speeds)

- 11 - Synchronizer stop ring (4th gear)
- 12 - Needle bearing inner race (4th gear)
- 13 - Needle cage (4th gear)
- 14 - 4th gear
- 15 - Thrust washer (4th gear)

Exploded view of main shaft assembly.

Note: Third and fourth gear assemblies should be heliarc welded together where the clutch gear presses on to the drive gear, if the engine has lots of power.