



## Gearbox Disassembly

One of my near term goals is to pull the gearbox on my TR250 so that I can deal with a sticky clutch. The gearbox is whining when in neutral so I don't want to put it back in without repairing it. I have a spare TR250 gearbox, also with an A type overdrive. I had planned to use the spare in a '70 TR6 that is a future project. So, I decided I'd get the spare gearbox all fixed up and put it in the TR250 when repairing the clutch. I can then repair the whining gearbox later for use in the '70 TR6 project.

Unfortunately, when I opened the spare gearbox I found gears with a few teeth missing. I opened up the non-overdrive gearbox from the '70 TR6 and found gears with all the teeth present. I then decided to rebuild the '70 gearbox and replace the rear shaft with the rear shaft from the spare gearbox. I will then have a good gearbox ready to accept the A type overdrive. (The only difference between an overdrive gearbox and a non-over drive gearbox is the length on the main shaft and the presence of the gearbox extension in place of the overdrive unit.)

The most difficult part of rebuilding a gearbox is taking it apart. The maintenance manual leaves most the hard parts to the reader, so much so that I think it's written by an engineer or an English major, neither who have ever disassembled a gearbox. The following describes a practical way to disassemble a gearbox. I tried to use the same parts nomenclature as used in The Roadster Factory Parts Catalogue. The catalogue shows all parts and how the parts fit together. The catalogue should be used to supplement the following description.

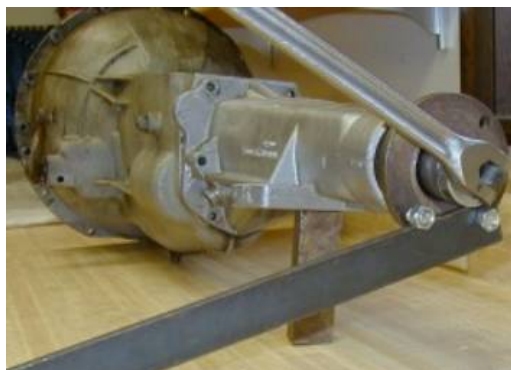
The first problem is removing the pin in the clutch-operating fork so that the clutch-operating shaft can be removed. In most cases this pin is broken or breaks when it is unscrewed leaving part of the pin in the fork thus preventing the removal of the shaft. One technique to remove the remaining part of the pin is described in the August 2000 Newsletter (available on the website if you can't find your copy).

The next job is to remove the gearbox extension. The instructions from the manual are as follows:

1. *Drive the vehicle onto a ramp and raise the ramp.*
2. *Remove the exhaust intermediate pipes, silencer and tail pipes.*
3. *Remove the propeller shaft 47.15.01.*
4. *Using tool RG421 to retain the drive flange, unscrew and remove the nut and washer.*
5. *Remove the drive flange.*
6. *Unscrew and remove the peg bolt and washer.*
7. *Withdraw the speedometer drive cable and pinion assembly.*
8. *Using a ramp jack, support the gearbox and remove the rear mounting platform attachment bolts and nuts.*
9. *Remove the two mounting bolts and nuts. Swing the steady strap forward and clear of the rear extension.*
10. *Raise the gearbox and remove the mounting. Lower the gearbox.*
11. *Place a drip tray under the gearbox.*
12. *Unscrew and remove the bolts.*
13. *Withdraw the extension housing, thrust washer and gasket.*

Steps 1, 2, 3, 8, 9, 10 & 11 apply if the gearbox is still in the car. My gearbox has been drained, degreased and is setting on the workbench.

Number 4 is the first step I have to do. I have no ideal what a RG421 tool is. I made a **Flange Retaining Tool** (something to keep the drive flange from turning when the mainshaft nut is removed) by drilling a 3/8 inch hole in the end of a 1/4 inch by 1 1/4 inch flat steel bar and loosely attaching it to the flange with a 3/8 inch bolt and using a second bolt to keep the flange from turning as shown in the following photo. (This bar also serves as a **Flywheel Retaining Tool** where it is attached to the flywheel with a clutch plate bolt.)



After the mainshaft nut is removed, the drive flange can be removed by tapping it lightly with a small hammer if it is too snug to slide off.

The next step is to remove the peg bolt holding the speedometer gear bearing ---- no big deal. Next one must remove the speedometer gear bearing with gear. This bearing is an aluminum cylinder threaded on the end for attachment of the speedometer cable. The first instinct is to grab the end with a pair of pliers and pull. Bad idea --- that will only smash the treads so that it will be impossible to attach a speedometer cable. In most cases that won't be a problem since most speedometer cables are broken anyway. For those who want a working speedometer, the bearing can be removed undamaged using the following procedure. First, attach a speedometer cable. Next, use a large screwdriver with the tip positioned against the front lip of the cable nut to pry out the bearing. See next photo.

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The next step (#12) is to remove the bolts and then (#13) withdraw the extension housing --- like it's ready to fall off. I don't know whom they're trying to kid; removing the extension requires that the rear bearing slide off the main shaft ---- not likely since the bearing is a force fit on the shaft. One method is to use a big hammer and try to pound the extension off. Big hammers and gears and bearings don't mix well. I instead made an **Extension Removal Tool** by welding ½ inch bolts perpendicular to the end of two threaded rods; making a center by turning a point on a 3/8 inch bolt; and drilling some holes in a ½ inch steel plate. The next photo shows the tool in use. The extension comes off easily as the nuts are tightened.



The next step is to remove the bolts at the front of the gearbox that retain the front cover (the thing the throw out bearing sleeve slides over) and the countershaft cover. See next photo. The covers can be pried off after the bolts have been removed.



The Wedglok screw that holds the retaining plate is removed next. The retaining plate fits in slots on the end of the countershaft and on the end of the reverse idler gear shaft. This screw is usually difficult to remove and requires a very large Phillips screwdriver and much torque. I positioned the gearbox on end to get good leverage on the screw as shown in the following photo.

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After the retaining plate is removed the countershaft can be removed to the rear by placing a long rod against the front of the countershaft and tapping gently with a small hammer as shown in the next two photos.



Once the countershaft is removed the countershaft gears drop to the bottom of the gearbox permitting the input shaft and main shaft to be removed.

The input shaft and front bearing are removed next through the front of the gearbox. One way to accomplish this is to lightly tap a long punch positioned against the outer race of the front bearing from the inside of the gearbox. Rather than doing this I decided to make an **Input Shaft Removal Tool** from scrap pipe, scarp angle, 3/8 inch bolts and 1/2 inch threaded rods. (I have about 25 pieces of threaded rod that were scraps from a church project about ten years ago. I hated to throw them away --- just knew that I'd find a use for them someday.) The next photo shows the tool in use. The tool is attached to the shaft by tightening the bolts that press against a narrow part of the shaft behind the splines. The input shaft is then pulled out as the rods are screwed in. The subsequent photo shows the tool holding the input shaft after removal.



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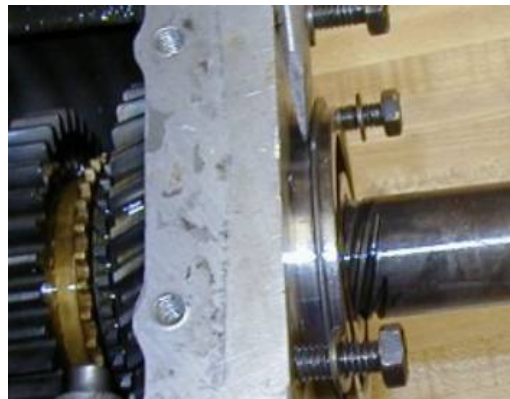


The next step is to remove the circlip on the main shaft to the rear of the center bearing using circlip pliers as shown in next photo.



The mainshaft must now be pressed forward and off the center bearing. One way to do this is to drive the shaft out of the bearing with a large hammer. Again, I prefer to not pound shafts, bearings and gears with a hammer. So, you guessed it, I made a **Mainshaft Removal Tool** using some scrap angle, the plate from the **Extension Removal Tool** and more of those 1/2 inch threaded rods.

The threaded rods of the tool are held to the back of the gearbox housing using bolts through the angles welded to the end of the rods as shown in the following photo. The bolts are those that normally attach the extension. The mainshaft is pressed forward as the nuts of the tool are tightened. It is only necessary to press the mainshaft forward about an inch to where the bearing is over a narrower part of the mainshaft. The bearing can then be pried out of the gearbox housing using a large screwdriver as shown in the subsequent photo.



Once the bearing is free from the case, it can be slid off the mainshaft. The mainshaft can then be tilted up at the front and together with the gears, removed through the top of the gearbox. Next, the reverse idler gear shaft and idler gear are removed. Finally, the countershaft gears can be slid out. The easiest way to do this is to position the gearbox front down on the workbench. Next, remove the rear countershaft thrust washer using a pair of needle nose pliers. Once this washer is removed there is enough clearance for the gears to slide out easily.

I stored shafts with the gears and washers still in position so that I will have no trouble determining which piece goes where. The next step of the project is to examine each part for wear, replace parts where required, and then reassemble everything. That's tomorrow's project and maybe a later note.